淡江大學教育與未來設計學系未來學碩士班

指導教授： 陳國華 博士

有機食物未來：有機農業和食物系統的因果層次分析

Futures of Organic Food: A Causal Layered Analysis of Agroecology and Food Systems

研究生：愛德華 撰

中華民國 111 年 6 月

論文名稱：有機食物未來：有機農業和食物系統的因果層次分析 頁數：129

校系(所)組別：淡江大學教育與未來設計學系未來學碩士班

畢業時間及提要別：110 學年度第 2 學期　　碩士　學位論文提要

研究生：愛德華　　指導教授：陳國華 博士

論文提要內容：

隨著有越來越多人類生活在城市地區，預計到 2050 年全球人口將達到 100 億，研究全球糧食系統的不同方法來養活世界，並解決不斷上升的貧困和飢餓率，已經成為一個急需探索的領域。但如何追求和實現這些目標的問題，對未來糧食系統採取“生態農業”方法的倡導者認為，未來的農業可以運用文化衍生的智慧和祖傳知識為導向，這些智慧和祖傳知識是經過幾代人在農業中的反複試驗和對地球自然過程的理解而積累起來的。而另一方面，“機械/技術驅動”方法的倡導者則認為，養活世界的解決方案應該來自技術“創新”，例如使用轉基因技術、室內/垂直農業和細胞基底的蛋白質替代品，以及以不會對動物造成傷害的道德性採購。這些不同的願景不僅在未來可以和應該在“哪裡”生產食物方面出現分歧，而且在“應該”如何生產食物的問題上也出現了越來越大的分歧。這些問題導致了“農村”和“城市”、“技術”和“農業生態”、“現代”和“傳統”、“利潤驅動”和“需求驅動”之間的一系列二分法。

本論文主要針對未來糧食系統的農業生態方法和基於技術的方法之間進行比較分析。為了解農業生態學文化衍生實踐及其對全球糧食系統未來的潛在願景，於印度北部農村社區的 Navdanya 農場進行民族誌未來研究，對城市食品生產中的新興技術進行分析，以了解技術驅動的未來願景。再使用因果層次分析進行檢核，以探索為這些不同的方法和對糧食系統未來的願景提供信息的基本隱喻。然後使用情節分析來檢查實施這些不同的糧食未來可能產生的問題，並反映在不同條件下糧食系統未來可能發生的情況。

關鍵字：因果層次分析、情節分析、有機農業、食物系統

Title of Thesis：Futures of Organic Food : A Causal Layered Analysis of Agroecology and Food Systems Total pages: 129

Key word: Causal Layered Analysis, Scenarios Organic Farming, Food Systems

Name of Institute: Master's Program in Future's Studies, Department of Education and Futures Design, Tamkang University

Graduate date: June 2022 Degree conferred: Master

Name of student: Edward James Niedbalski 愛德華 Advisor:Kuo-Hua Chen 陳國華 博士

Abstract:
As humanity will increasingly be living in urban areas in the future and global population is expected to reach ten billion by 2050, the need for examining different approaches to global food systems to feed the world and addressing rising rates of poverty and hunger has become an area in critical need of exploration. But this brings with it the issues of 'how' these goals should be pursued and achieved. Advocates of 'Agroecological' approaches to the future of food systems believe that farming in the future can be guided by the culturally-derived wisdom and ancestral knowledge accumulated through generations of trial and error in farming and understanding natural processes of the Earth. While on the other side, advocates of 'Mechanistic/'Technology-driven' approaches believe that the solutions to feeding the world should come from technological 'innovations', such as the use on GMO technologies, indoor/vertical farming, and cell-based protein 'replacements', sourced 'ethically' without harm to animals. These differing visions present not only a divergence in 'where' food can and should be produced in the future, it make apparent a growing divergence in the question of how food 'should be' produced. These questions give rise to a series of dichotomies between 'rural and urban', 'Technological' and 'Agroecological', 'Modern' and 'Traditional', 'Profit-driven and 'Needs-Driven'.

This thesis has been prepared as a comparative analysis between Agroecological approaches and Technology-based approaches to the future of food systems. Ethnographic Futures Research was conducted at the Navdanya Farm in a rural community in north India as the basis for understanding the culturally-derived practices of

Agroecology, and its potential visions for the future of global food systems. An analysis of emerging technologies in urban food production was conducted for providing an understanding of tech-driven visions of the future. These findings are examined using Causal Layered Analysis, to explore the foundational metaphors which inform these divergent approaches and visions to the future of food systems. Scenario Analysis is then used to examine possible futures which may arise from the implementation of these different visions of food futures, and reflect what might be possible for the future of food systems under different conditions.

Table of Contents

Preface: Where the journey begins: The long road into a possible future

The Path to Navdanya

The journey to the Navdanya farm began after about ten days in India, spent on the usual tourist trail and ticking of the check list of places to see; after all, a likely once-in-a-lifetime trip to India ought to include a trip to Agra, Jaipur, the Red Fort, the Taj Mahal, and of course, Delhi. The heat and humidity were impossible to get 'used to', just a 'new normal' to adjust to, a constant sheet of sweat was a part of the experience. The hustle and crowded streets of the big cites had been just about enough for me, and the journey to the countryside for a month on a farm was a welcome prospect.

The train journey was a long, and was set to be an uncomfortable as well; the randomness of seating assignments when booking saw me—not a particularly small guy—up against the window, seated next to the largest man I saw the entire five weeks I was in India. After 40 minutes into the scheduled six hour trip to Dehradun (which was more like eight and a half), I went and sat in the space between connecting cars, and sat on top of a portable ice chest which was carrying ice cream the entire rest of the way to Dehradun.

The farm itself was such a refreshing place to be, especially after the constant bombardment of endless noise from the overcrowded streets of Delhi. The smell of nature and the melodic muezzin calls from the local mosques that would chime in at unison made for a relaxing reminder of the passing of slow time on the farm. The opportunity to live on the Navdanya farm and to learn about Agroecology directly from Dr. Shiva and other local and international experts was one of the most unique opportunities of my life, and a life experience which was unforgettable. Meeting Dr. Shiva was the real life chance to meet a long-time personal hero, and it was worth the seventeen years on being a fan of her work to come all the way to India to be able to be filled with just a fraction of her wisdom, insights, and foresight for the future of Agroecological food systems and the invaluable perspectives of local indigenous community. They have true potential for achieving a sustainable, prosperous, and equitable future with the approaches they promote for how local and global food systems can be, and it is one which deserved to be shared equitably, exactly in keeping with the philosophy of Navdanya's perspective protecting access to 'the commons' of ancestral knowledge, land use, and the natural wisdom of the seed. May the seeds of that wisdom be spread across the world, for a better future.

Where did the journey really begin?

I grew up in a community in transition. The neighbourhood of my youth was very much a rural one, particularly in my early years. My own house was less than five years old when my family moved in, and I was less than a year old. There were only about nine or ten houses on the entire street all the way back to the farm at the end, the family farm whose name that street bears to this day. All around behind my home and across the street was farmland, with the outer edges of the local, multi-generational family orchard connecting just 2 backyards away, and a direct line of sight to Three Mile Island nuclear power plant, just five miles away— well within what would have been the exclusion zone had it gone into a Chernobyl-level meltdown; my hometown on the outskirts of the greater Harrisburg area nearly became 'Pripyat' even before it did, when I was just four months old. Despite the threat of imminent nuclear meltdown looming Simpsons-esque on the southern sky, It was always a quiet, middle class American neighbourhood to grow up, mostly still leaning in the direction of 'rural' during my first decade, as the line between rural and suburban slowly began to blur. And yet, growing up well within what literally would have been the blast radius of what was nearly the world's first full nuclear meltdown—twenty minutes away from it in fact, as has since been confirmed-- gave a someone ominous feeling of impending and potential doom which embodies the extreme 'downside' of technological advancement; the possible answer to the question no one wants to ask about what can happen when the promises of technology go wrong—very wrong. The contrast of seeing the farmers'

fields stretch out in every direction, only to be met with the eye-drawing sight of those gloomy, grey towers in the distance represented the starkest of contrasts between the natural and man-made worlds; the since decommissioned 'dark towers' with no lights and no smoke coming from them a reminder of 'The Accident'. The automatic presumption that technology and all of its promise of 'solutions' for improving human life were something inherently preferable were easily questioned, and the coming 'development' of the area brought as much a sense of 'encroachment' as it did 'improvement'.

Oppenheimer's warning

It was with great irony years later I learned that Oppenheimer's well-known 'quote', "Now I am become Death, the Destroyer of Worlds", was in fact him quoting from the Hindu Bhagavad Gita; an irony not lost on me, having later become a follower of Dr. Vandana Shiva's work, and having spent time in India at the Navdanya farm, which included discussions of Hindu/Indian religion and mythology. The ability to split the atom, harnessing its great power for the good of humanity was in reality a secondary discovery-- a happy but incidental coincidence of its original purpose and intent—to destroy. Inherent in humanity's quest to become Gods-- to be able to shape, create, and control the world—is also contained the implicit ability to destroy it. Destruction is an inevitable aspect of creation, or 're'creation; that which was must be destroyed, so the 'new' can come. All human 'development' or acts or 'creation', whether it is clearing forest to plant crops, turning over farmland to build houses, or tearing down homes to build skyscrapers and metros and shopping malls and parking lots, contained within those acts is the seed and necessity of destruction in order to creation something else. This was something I implicitly understood even as a child, although I was many years removed from being able to articulate in a coherent and expressible way.

Dichotomies: the emergence of different paths

There is also notable expression of this impulse for power and control apparent in many visions of how the food systems of the future are being reimagined. The human desire to create and exert control, deeply ingrained but still distinctly visible within the pursuit of technology-driven answers to creating food systems and shifting the actual physical food sources of the future. New technologies such as lab-grown protein replacements, robotic farming, vertical/indoor farming systems, and gene-editing seek to achieve and exercise that direct control over every step of what had always been the provenance of the natural world and natural processes, right down to the genetic level. The push to take control over the very processes by which food is grown and created also represents a desire to move the focal point and physical places of where food is produced, and brings with it a range of emergent dichotomies. In a most basic sense, the shifts seek to move food production from 'outdoor' to 'indoor'. But more deeply, there are other emergent dichotomies of growing significance which begin to surface upon examination, which will be explored within this thesis.

Growing up in a time of change

Seeing local farmland as a child, the very places where food 'comes from', being transformed into something else, into places that no longer produce food, prompted me as a child to ask my parents: "where will people get food if they don't grow food there anymore"? Gradually, from about age six, some of the wheat fields behind the house got sold and 'developed' turned into houses on the standard half-acre plot which is the stuff of the 'American Dream' of the house in 'The burbs with the white picket fence, bringing new friends and neighbors along with it. By the time I was nearly ten, the land across the street, which has also been farm land all the back to the hill and woods had also been 'developed', more than doubling the size and number of houses in the neighbourhood of my youth. But the farm at the end is still there to this day, as well as the connecting orchard. There always remained that sense of the rural, that connection right down the street of the rural community my home had once been. The July corn from the local orchard and the Amish farmers' market, from the area of my mother's childhood home (a small farming community) is still something I dream about when I'm away for long periods, backyard BBQ and the garden we had in the side yard are the very taste and essence of good from memories from home.

Change was a part of my experience growing up. Not just in the sense of physical maturation and the obvious changes of growth and development from child to adolescent to adult. The pull of the future, pushed on by the progress of the present and dragged in pace by the weight of the past were all vaguely tangible, if somewhat elusive and difficult to capture in their essence; 'home' was changing around me, moving in the inevitable direction of the future, in ways that it has taken years of reflection and perspective to even begin to understand. Many years later in my early adult life, having spent a dozen years living in a rural village in Ireland, on the absolute outer reaches of the Dublin commuter belt that straddled the line between the 'Greater Dublin area' and the Irish 'Midlands', I was again witness to a similar process. I watched Irish farmland gradually transform into apartments, houses and yards, 'developed' from rural to semi-urban, the 'village' I lived in became a 'town' in that time. My last two years there, I resided in a new apartment complex on top of a new shopping center, which had still been a patch of forest and rather small but putrid bog land during my first two years there. Even my previous Master's thesis work was connected to that process of change, my work focused on Polish migrant workers in the Irish construction industry—the very hands which brought that change and transition from rural to urbanization to the country.

Entering the Future

Coming from a place which had been distinctly rural and witnessing it gradually change in the direction of the urban had both a progressive as well as melancholy tone to it. Farming had been something my mother had done as a child, her own childhood home just forty minutes away still borders local Amish and Mennonite communities and my neighbors at the end of the road were and still are farmers. My parents' best 'couple friends' were dairy farmers, their own

son born within a week of myself. Seeing the process of urbanization slowly but visibly change the rural places I have lived and hold close to my heart, both home and later my university town in Ireland, had shaped, informed, and underpinned my interest in the Social Sciences upon entering university. Cultural Anthropology along with Philosophy were my subjects for my undergraduate degree, a natural set of choices considering my interest in people, the processes of change, and without really being aware of it at the time, uncertainty and the future. Upon discovering 'The Future'—that is, the world of Futures Studies as an academic subject and as something that only the crazy/brave pursue, and the lucky/smart can make a living at—the first formulation for what I would pursue as my thesis topic quickly began to emerge. The 'seeds' of my interests in the processes of rural to urban, of 'organic' to 'mechanistic', of past to future having long ago been planted in my past, soon to grow into my own future research for this thesis. The images of the future of where food 'comes from' are an integral part of the research, and of my interest in the topic had its genesis in seeing the processes of urbanization and the shift from agricultural use of land and having an intimate personal connection to rural farm communities.

Chapter 1 Introduction: Sustainable Food Futures-- Traditional Organic Methods vs. Science-Based, Technocratic Solutions

Where we are today?

The world today stands at a unique and unprecedented crossroads, a point in the history of humanity whose scale and scope have never been rivalled, which can and undoubtedly will affect the future of everyone on Earth: a global population of nearly 10 billion people by the year 2050. Humans in most parts of the world are living longer, healthier lives than ever before. Birth rates have grown in the global south and infant mortality in those same regions has dramatically declined; improved access to healthcare and advances in medical technology are allowing people from all parts of the world live longer, healthier, and better lives than at any point in human history. Preventable diseases are being cured and treated, allowing humanity to have longer lifespans than ever before; general quality of life has risen across the board, thanks to improved sanitation, healthcare, and numerous technological advancements. And the most basic of those resources, that upon which all others depend for human health and wellbeing, is food. How and where food is produced, transported, and the local and global systems which it depends, are all of primary concern for the future of humanity and the planet. New technologies related to the production of food have brought with them the embedded promise of new ways to address the growing food needs arising from population growth, balancing the give-and-take of rural population decline and rising urban centers and megacities, combatting global climate change, and improving human dietary intake in all settings. Yet, an emerging issue has accompanied the shift towards and an apparent growing dependence upon these improvements in human quality of life have come at a cost, particularly impacting the way we deal with producing

and transporting food, under the comparatively recent shift towards mass production and focus on producing key commoditized crops: we are using natural resources at an unprecedented—and ultimately unsustainable-- rate, with the added irony of expending tremendous amounts of resources to expressly produce other resources.

Where are we going to be in the future?

Arguably, the production of and access to food is among the most pressing concerns for the future of humanity. In light of unprecedented growth in global population and increased demand for higher levels of natural resource consumption, the problem of how to feed more people than have ever lived on Planet Earth at any one time in truly sustainable way present a mounting challenge. Meeting growing levels of demand and consumer-based lifestyles revolving around what foods we eat and how it is produced, both in attempting to meet sustainable Development Goals of eliminated global hunger as well as improving overall nutrition and quality diets for the world's most food vulnerable are also becoming more important to food consumers. What is also an emerging issue among those with an interest in the future of food rests in examining gradual changes in what is socially acceptable ways to produce food, and what is increasingly controversial debate over what is considered ethical regard what food is consumed and where it is sourced. The directions this emerging dichotomy to the approaches to food futures are the central question of this work.

Different Directions of the Future of Food; a Fork in the Road?

From eye-catching headlines in newspapers, industry journals, technology websites and publications, to much more in-depth academic sources about the 'future of food', the focus of the majority of mainstream narratives designed to address the world's growing food needs rests almost exclusively on finding or inventing the most 'modern', 'scientific', and 'technologically-based' solutions. The leading trends, approaches, and 'innovations' for producing more food and refining the systems through which they are produced and transported are hinged on 'quick', 'efficient', 'high-tech', 'modern'; the myth of the future of food for this approach is rooted in the strong and direct involvement and intervention of technology into the processes of producing food. These changes reflect the recent shift of the majority of humanity now residing in urban areas and cities, and arguably the shift in mentality which accompanies it. As more people move to cities from rural areas, there has been an emerging shift in focus regarding 'where' the future will take place, and the issue of where food is produced has become intertwined with those larger visions of the future.

The focus and prominent visions within much of the contemporary discourse of food futures almost exclusively rest on the food production and consumption needs of urban communities and cities. As the majority of the world's population is no longer living in rural areas, with urban populations estimated to keep rising, the needs of urban dwellers have taken

precedent in the development of much contemporary research as well as the presumed priority in how and for whom food will be produced. This new focus comes despite the fact that both paradoxically and ironically, many of these new approaches tend to overlook the needs of not only those rural communities who actually produce the majority of the world's food, but beg the question of whether rural communities have a 'place' in the future at all. These visions of a future of technology-driven food production appear to come at the express exclusion of those same people who are most vulnerable to changes in global food markets, fluctuations in production models, crop blights, droughts, climate disasters, and changes in the whims of urban consumers: the rural poor in developing nations. What then of the future of rural communities, and what of the larger issue of global hunger, when so many of those suffering from extreme hunger are those who live in rural communities? What changes will these disruptions potentially have on global food systems?

The future promise of emerging technologies

These potential answers to the present and future issues of food production and food systems are often characterized as resting solely upon promises of the newest trends in 'cutting edge' research, with their dazzling promises of a technologically-guided future, the yet-to-be-realized visions of science fiction dreams. From reducing harm to animals in factory farms and the dramatic cuts in greenhouse gases by producing meat grown in labs (https://www.wired.com), or in the building of 'Vertical farms' and city-grown produce—imagined as rooftop greenhouses producing vegetables and produce at the top of every city high rise (https://interestingengineering.com). And of course, the much-lauded promise of robots and other Artificial Intelligence creations tasked with and designed to monitor, pollinate (without pollinators), grow (without soil), and harvest commodity crops without direct human interaction, able to almost completely eliminate the need for human labor outside of oversight of the technology (https://www.wired.co.uk). 'Aquaponics' habitats are designed to produce both vegetables and fish for human consumption in a sustainable, closed system (www.theaquaponicsource.com).

Is 'New Tech' all it's cracked-up to be?

What often fails to make the headlines of these miraculous technological solutions to building the food systems of the future are the high external inputs required to run them. Trading one problem for another in the attempt at creating progress in what is often a zero-sum game is the downside of the technological progress. Many of these new 'solutions' come with their own inherent sets of problems. The factory farming model on which much contemporary industrialized, commoditized agriculture has been based since the 1950's has a heavy reliance on inputs in the form of petro-chemical based herbicides, pesticides, and fertilizers, which has been proven not only to have negative health impacts on the rural communities exposed to them. The

voices, desires, and visions of the future of rural communities and food producers, those who create and oversee the very foundations of global food systems, are lost in the hype; rural communities go widely unheard amidst the chorus of tech-based, urban-focused futures visions of global food systems.

Who's NOT at the discussion table?

These and other developments and potential disruptors all represent novel and innovative solutions to at least some aspects of the problems facing the future of food systems, both local and global in scope and scale. These technology-based solutions, however, have a tendency to exclude, by design, or the de-facto situation of rural areas being underdeveloped in their infrastructure. While some progress and programs have sought to be more inclusive of the rural poor in what has been dubbed 'digital agriculture' by the FAO, and seen the founding of development projects supporting 'agriprenuership' (FAO 2019), there is still the implicit, underlying belief embedded within these approaches which assumes that these are the 'only' or 'preferred' ways for progression towards a sustainable food future.

And yet, these approaches certainly do not stand as the only solutions to the problem; seldom do simpler, more basic answers seem possible. The fact that most of the world's food production—and thus by extension, the basis of most global food systems-- are run by small-scale, local farmers, who often have little to no access to the technology-based approaches advocated and touted by those with an interest in the 'technification' of the future of food production and food systems. Traditional, small-scale farming has largely become disregarded or overlooked in many modern discussions of the future of food as a useful approach to the creation of sustainable food futures to such a degree, that it can arguably be considered in and of itself an 'alternative future' within the context of the wider discussion possible futures for creating sustainable food systems. And even the attempts to bring digital technologies to rural communities—while having a 'democratizing' effect for socio-economic inequalities and deficiencies—can be also be seen inherently undermining and invasive in its underlying premise, in that it seeks to impose technologically based approaches upon rural communities, and force the underpinning logic of technological approaches and solutions upon those communities as well.

Statement of Purpose:

This thesis intends to explore futures visions of the Navdanya organization and their concept of agroecological farming as the basis for and representative example of a possible future of regional and global food systems. Through the lens of Ethnographic Research Futures (EFR), a futures vision demonstrating the potential for rural/agricultural communities to have a voice in their own future will be developed, in the hope that it can stand as a representative case

study for visions of possible futures of global food systems in many rural settings, and represent a return to traditional agriculture as a viable path for achieving sustainability in agriculture. Causal Layered Analysis (CLA) will be employed to conduct a comparative analysis between conceptions of possible food systems futures as envisioned by the Navdanya organization in rural India, and those of more dominant, technology-driven and Western-based visions for the future of food production and food systems. Scenario Analysis will then be applied to these diverging visions, to explore the possibility of discovering commonalities of purpose, and compatibilities of the intended means and methods for producing the world's food and running global food systems in sustainable, healthy ways.

A matter of perspective and framing: Rural and Urban communities

The differences between perspectives of rural communities in developing nations and Western perspectives on possible futures of global food systems will be explored by examining diverging narratives in how food systems are conceived of, both in terms of their origins and purposes, as well as their potentials and future directions. Comparing these narratives and approaches will lay the groundwork for exploring how their differing visions for the future of global food systems compete with each other for attention in mainstream discourses, how these visions contrast with each other vis-à-vis their views on whose needs are best served in their differing approaches, and ultimately, how they could possibly be reconciled, allowing for a hybrid vision of the future of food systems to emerge. The hope in this thesis is to employ CLA to explore the differing visions of these two conceptions of food systems, and employing them to construct/develop scenarios which might allow for reconciliation between these differing visions, leading to actualized futures which are beneficial and viewed as preferable from numerous perspectives.

Defining Food Systems: contrasting definitions

A necessary first step in the exploration of this topic is to examine understandings and varying definitions of what a 'food system' is, and to come to a working definition of the concept which will suit the purposes of this thesis. A 'Food System', as it is defined by the FAO, "encompasses the ecosystems and all of the activities required for the production, processing, transportation and consumption of food, including the inputs needed and outputs generated by each of these activities. Within this system, value chains are composed of the full range of farms and enterprises and their value-adding activities, which produce agricultural raw materials and transform them into food products that are sold to final consumers and disposed of after use" (FAO 2017a:57, 2014a).

The International Food Policy Research Institute defines a Food System as:

"Food systems are the sum of actors and interactions along the food value chain—from input supply and production of crops, livestock, fish, and other agricultural commodities to transportation, processing, retailing, wholesaling, and preparation of foods to consumption and disposal. Food systems also include the enabling policy environments and cultural norms around food. Ideal food systems would be nutrition-, health-, and safety-driven, productive and efficient (and thus able to deliver affordable food), environmentally sustainable and climate-smart, and inclusive" (ifpri.org).

These definitions of food systems incorporates the widest possible definition of all aspects that play a part in creating the means by which food is produced, distributed, and sold. This definition is reflective of the more dominant Western-based worldviews of the purpose and function of food systems: it is a system of "value chains", requiring 'inputs' and 'outputs', 'adding value', 'consumption', 'disposal', 'production/processing', and using 'raw materials' to produce the commodity we call 'food'.

The above definitions of food systems has become the accepted standard for most Western-based international organizations and experts, and typically serves as the widely accepted definition for public discourse on the issue. The specific language used to describe what a food system is and what it does illustrates the mechanical, industrialized conception of its functioning which forms the epistemological basis for the now dominant Western worldviews of food systems, and sets the tone for discussing the futures of food systems. While this has become the dominant worldview of food systems in Western discourses, it is an important and often overlooked fact that there are other, competing, and significantly different worldviews which exist in other parts of the world about what food systems are, and what they can be. And most importantly, they have different visions of the potential futures for global food systems. Many of the discussions in mainstream discourse tend to overlook, exclude, or is whole or partially unaware of the existence of these different perspectives and visions, and also tends to preclude even the possibility that other, non-Western/Capitalist, non-tech-driven visions could lead to viable future outcomes for global food systems. Such narrow definitions of foods systems are often the opposite of how many rural communities see their futures. The presumption of superiority of Western/Capitalist over non-Western/non-Capitalist visions is often forcefully imposed from external sources, and/or marginalizes non-Western futures visions in their value and the possibility for envisioning viable food systems.

Example of alternative Food System Futures: Definining Agroecology

Agroecology is a futures vision of how food is produced, informed by traditional farming practices and principles; it seeks to be inclusive of natural patterns in nature, incorporating farming with the local environment and natural growth patterns and cycles of indigenous plant

life, and respecting the natural, harmonious balance that can exist between them. The FAO has compiled a list of different organizations' definitions of Agroecology. Some of them will be highlighted to create a useful definition for the purposes of this work. They have constructed a framework of ten key elements on agroecology, derived from common principles, which include a combination of bio-physical and socio-economic elements grounded in the three pillars of sustainable development – the social, the economic and the environmental. Different elements may come into play in various configurations, with a strong blend of social, economic and environmental aspects. The United Stated Department of Agriculture (USDA) defines Agroecology as:

"Agroecology can be defined broadly or narrowly. Loosely defined, agroecology often incorporates ideas about a more environmentally and socially sensitive approach to agriculture, one that focuses not only on production, but also on the ecological sustainability of the productive system. This definition implies a number of features about society and production that go well beyond the limits of the agricultural field. At its most narrow, agroecology refers to the study of purely ecological phenomena within the crop field, such as predator/prey relations, or crop/weed competition" (USDA.gov, 2007).

"Agroecology is a way of life and the language of Nature that we learn as her children. It is not a mere set of technologies or production practices. It cannot be implemented the same way in all territories. Rather it is based on principles that, while they may be similar across the diversity of our territories, can and are practiced in many different ways, with each sector contributing their own colors of their local reality and culture, while always respecting Mother Earth and our common, shared values.

The production practices of agroecology (such as intercropping, traditional fishing and mobile pastoralism, integrating crops, trees, livestock and fish, manuring, compost, local seeds and animal breeds, etc.) are based on ecological principles like building life in the soil, recycling nutrients, the dynamic management of biodiversity and energy conservation at all scales. Agroecology drastically reduces our use of externally-purchased inputs that must be bought from industry. There is no use of agro-toxines, artificial hormones, GMOs or other dangerous new technologies in agroecology" (foodsovereignty.org, 2015).

Agroecology in India: the Work of Vandana Shiva

Despite its dominance in mainstream discourses, there are other visions for how food systems can function, and what their futures could be. The key example which will be discussed in this thesis and which served as the basis of the fieldwork undertaken for this study is that presented by Dr. Vandana Shiva. Dr. Shiva is a leading expert, author, and advocate for rural

and agricultural communities, as well as for creating an intellectual space in modern discussions for non-Western food systems. Her organization, Navdanya, has been a leading voice in promoting and speaking on behalf of rural communities against the patenting of seeds and indigenous crop varieties in India, and the advocacy and promotion of 'Agroecology' as a foundational approach to creating sustainable food systems into the future.

Vandana Shiva has said of the need for the widespread use of agroecology in modern agriculture and food systems:

"Traditional agriculture and organic farming have their roots in several strands of knowledge, which are collectively recognized as the emerging knowledge paradigm of agroecology. Agroecology takes into account the interconnectedness of life and the complex processes that take place within nature. The time-tested agroecological knowledge of centuries, evolved in diverse ecosystems and cultures, is now being reinforced by the latest findings in modern science. There is new scientific knowledge in epigenetics about the interaction between genes and the environment, new knowledge of the ecological services provided by biodiversity and ecosystems, and a scientific recognition of the fact that the Earth is living. These are all contributing to the emergence of agroecology as a widely recognized scientific paradigm" (Shiva, 2016a:20).

"I realised that the industrial-colonising West was based on a mechanical mind, a monoculture of the mind. Building on my training and my Himalayan upbringing, I started to cultivate the biodiversity of the mind, and regenerate biodiversity on our farms and [of our] food. I have realised over four decades of research and action that most farmers of the world are women. They grow food as nourishment, not as commodities. They grow food for health, not disease. Through wars and famines, through floods and droughts, they have kept alive the memory of their seeds and foods" (BBC Travel, 2021).

The viewpoints of Dr. Shiva and these other definitions of agroecology represent an interesting duality between contemporary visions of food systems, representing what is arguably an inversion of what has historically been the dominant worldview on food and food systems, dating back to the ancient creation of organized agriculture. The widely divergent use of the language used to describe food systems according to agroecological perspectives is significant. 'Environmental', 'sustainable', 'socially sensitive', 'ecological', 'local, 'soil', 'intercropping', 'tradition(al)', 'biodiversity', 'organic', 'nourishment', 'health'; the divergence in much of the key words and language for definitions of the key principle functioning and the purpose of food systems under the paradigm and narrative of agroecology reflect a significant gap between the divergent conceptions of food systems.

Can the 'old' become 'new' again?

What was once the 'new' approach to producing food, represented by the introduction and implementation of industrialized agriculture and the widespread use of petro-chemical inputs in the form of pesticides and herbicides, have become, in a historically contextual blink of an eye of less than one-hundred years, the presumed 'normal', 'standard', 'default' model of producing food. And the latest technological innovations such as lab-grown meats, indoor/vertical farming, insect proteins, and prohibitive costs and peer-pressure based efforts to shame and disincentivize the consumption of animals and promote vegetarian/vegan lifestyles as more 'sustainable'/'ethical'. In this, it can be said that traditional farming methodologies and the structural foundations of all food systems have seemingly been inverted, and are presented as an 'alternative' to the newly dominant 'normal'. The 12,000+ year history of organized agriculture, now seen as an 'alternative' view of food futures to the now more often heard narratives of technological 'fixes' to all things under the sun—or under the indoor hydroponic growing lamp.

These definitions stand as starting from the widest possible definitions of the conceptualization of food systems and narrowing down to specific examples and contexts—namely, the visions of sustainable food systems of the future as envisioned by the agroecological approach as advocated by Dr. Shiva, on one side, and the technology-driven visions of tech start-ups, agribusiness, and tunnel-visioned futurists on the other. But food systems are susceptible to a host of external factors, be they natural (climate change/global warming), or human-derived change (industrial/farming waste disposal, deforestation, pollution, etc). Consumer demand and expectations also play a more significant role in the modern world. As lifestyles in many parts of the world become more 'middle class' and cosmopolitan in their manifestations and average incomes increase, consumer tastes and expectations increase as well. In light of these factors, a way must be found for creating a clean, sustainable, just and fair way to build and maintain the global food system, which can serve the interests and food needs of people in all regions of the world equally and sustainably. But what way or ways can this come into being? And what expectations should people have when it comes to the type and quality of the food they will be able to access in the future?

The Need for Futures Research on Food and Food systems

The Future of Food is an important and expanding topic within the field of Futures Studies, as well as a major current and emerging issue in light of population growth, urbanization trends, and consumer demand for all sectors of government, businesses, and individuals across the globe. The continued and expanding access to safe, healthy food is 'Goal #2' of the 2030 Millennium Development goals for the eradication of global hunger, whose stated aim is to "End hunger, achieve food security and improved nutrition and promote sustainable agriculture" (UN.org/development), but current trends in food security and hunger levels are unfortunately

showing signs of expansion rather than contraction, as there has been a noted increase in terms of both percentages as well as the absolute number. The FAO's 2018 'The State of Food Security and Nutrition in the World' report noted that the number of undernourished people in the world is now estimated to have increased from around 804 million in 2016 to almost 821 million (one of every nine people in the world) in 2017 (FAO 2018a:2-3). The simple fact is that we are all dependent of the continued safe and efficient functioning of food systems; we all eat food, and we are all dependent upon the continued ability to produce, access, and distribute it for our most basic biological existence. Everyone on Earth, regardless of who they are or where they are from, regardless of what their financial, living, or external circumstances are, is dependent upon the continued existence of the systems of production and distribution of food, be it through self-production, or through local, regional, international, and/or global supply chains. The creation and maintenance of a sustainable food system or systems is essential not merely for attaining the goal #2 of the Millennium Development goal of eliminating hunger, but will also help to address numerous other MDP goals, which can arguably include goals #1, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, and 15.

Food Production and Distribution Systems: Key Issues for the Future of Agriculture

Equality of access to food in the future

If one of the key problems of the modern age is poor and/or unequal access to food, will access to the production and distribution chains of food become easier or perhaps even more difficult, if the global system of commodity crop vs. subsistence production and the channels of production and distribution do not also undergo equally profound future 'breakthroughs' and 'innovations'? And, are such 'breakthroughs' and 'innovations' truly necessary for feeding a growing global population? As global populations become more and more urbanized and rural populations continue to be among the world's poorest communities, despite these estimated 1.5 billion smallholder households producing the majority of the world's food (over 80%) at present, particularly in the developing world-- (FAO.org/news; FAO 2012), what can be done to level the playing field for rural communities and promote sustainable models of agriculture, and to address rural poverty and inequality? In trying to address the current and rising challenges related to food, be it in producing, transporting, and distribution, and in direct relation the challenges of population growth and urbanization, what ways can the issue of the future of food be addressed? Is there a singular 'preferred future' for the whole planet in the approaches proposed by advocated of tech-based solutions? And conversely, is there the potential for creating sustainable, organic, small-scale farming to truly meet the growing food needs of a future planet estimated to have over 10 billion people by 2050?

Technological 'Innovations' in food production—a Used Future?

While new, innovative approaches undoubtedly have merit, validity, and hold great potential for addressing the planet's growing food needs, it must be noted that all of these approaches speak of potential futures which are based on the premise that 'innovation' and 'progress' can and will presumably only be made through specific means, namely technological interventions in and over the natural processes of growing food. Measures of the efficacy seek to transform the meaning of food systems into something that produces and delivers food with the cold efficiency of the market; the purpose of food reduced to a pure commodity item, with the biological need of it for sustenance being secondary or even incidental.

The underpinning logic which creates the epistemological foundations of many of these visions of a sustainable food future is derived from a highly mechanistic, Capitalist-derived vision of the future. Similar to visions of the future of work (which agriculture certainly is a form of), technology, innovation, and Artificial Intelligence (A.I.) are all hailed as the 'solution' for current and emerging issues across the board. However, it has been argued that these high-tech futures visions still in themselves, despite their 'futuristic' fetishizing of new technologies, still in themselves constitute a 'used future'. Jose Ramos has stated in a recent article that: "This view (of work) is based on real trends and developments in science, technology and industry, but it is still a used future because it does not challenge the techno-deterministic nature of these visions (e.g. the 'singularity') and the way in which it excludes important aspects of social and ecological wellbeing" (Ramos, 2019).

Questioning the (presumptuous) future

This thesis will proceed with a similar premise, that certain avenues of 'progress' for the future of food and sustainable food systems and dominant narratives are primarily 'techno-deterministic' in nature, and thus can also be argued to constitute a 'used future'. Much of the discussions and experts are singularly focused on a techno-deterministic set of goals and methods, using the logic and language of free market Capitalism: the increased 'efficiency' and yields of commodity crop production. But a central question in this discourse seems to go unasked, which is the key issue this thesis intends to explore: Is this the only way into a future of sustainable agriculture, truly capable of feeding a growing population with ever-expanding needs and consumption patterns? Is it the 'only' way? Or even the best way? Or is something else possible? The argument will be made that there are other ways forward into a truly sustainable future of food, which does not hinge solely on humanities (in)ability to 'invent' their way out of their self-induced problems. An easier way forward, guided by the traditional knowledge of thousands of years of trial and error is traditional agriculture and refreshed under the modern understanding of it offered by agroecology may represent a more viable and sustainable path into sustainable food futures.

While technology-based/focused solutions for addressing the issues of global hunger and sustainable agriculture methodologies are important and even necessary concepts for advancing human knowledge and trying to produce enough food for all, they are not the only possible solutions for achieving those goals. Certain voices in the discussion of food futures have no platform or outlet in which to join the discussion, therefore this study seeks to include these voices in the discussion of food futures as an essential element in demonstrating that these technology-driven solutions are not the only solutions to the issue. The poor and rural communities of the world rarely see their voices heard in wider discussion on the topic, and are often marginalized or paid minimal lip service within the context of discussions on their own futures, be they agricultural, social, or economic.

Chapter 3: Theory and Methodology of Food Systems Futures

Making Methodological and Theoretical sense of the Future

Creating a viable theoretical and methodological frame for this thesis has presented a particular set of challenges. This thesis intends to explore these diverging concepts as a comparative analysis using data collected in fieldwork in India through the lens of Ethnographic Research Futures as a basis, and proceed with the construction of a 'Causal Layered Analysis' (CLA) and build a Scenario Analysis as described in the work of Sohail Inayatullah and the 'Manoa School' under Jim Dator to unpack the potential uses of non-dominant approaches to food futures. Ultimately, this thesis endeavours to understand the deeper worldviews and myth-level underpinnings of these variant approaches to the deepest roots of the meanings of food systems, and use the transformative power of CLA and Scenarios to explore new ways which can shape the future of food systems towards one which hold the maximum potential to be both sustainable and equitable for all.

As one of the few voices whose work and efforts have gained limited attention in Western circles, Dr. Shiva's work stands as a primary-- if often lone-- example of what the future of food, agriculture and food systems can be outside of a Western/Capitalist, technologically-driven paradigm. This thesis will model and compare the differing conceptions of the technologically-based, Western/Capitalist conceptions of purposes of farming and food systems and compare it with that of Navdanya's approach to agriculture and food systems based on their conception of Agroecology. This thesis will produce a CLA study comparing and contrasting these widely varying approaches to the same issue, and proceed with a scenario analysis to examine possible futures within the context of results demonstrated in the CLA. It is the goal within the scope of this thesis to outline and address the potential solutions and central

differences in the worldviews and metaphors utilized by the both sides of this apparently emergent dichotomy between approaches and understandings of food production and agricultural systems and practices as understood by advocates of organic approaches to agricultural futures and advocates of technological/scientific solutions to the future challenges of creating and maintaining sustainable food systems.

In doing so, raising questions about these emergent and seemingly dominant, and even non-inclusive discussions of possible food futures, and undertaking a comparative analysis between these two separate paradigms using CLA and Scenarios, examining their underlying worldviews and metaphors which underpin their understandings of their role in global food production systems, is the primary goal of this thesis. It is also a central the goal of this thesis to demonstrate through CLA and Scenarios that there are/can be 'alternative futures' to the emerging and seemingly dominant, technology-based approaches and solutions which are given voice over countless others, despite the majority of farmers globally being small-scale, local producers of food. This thesis intends to challenge the dominant narratives both within the futures community and the wider discussion on the future of food, as well as give voice to the possible futures proposed by advocates of traditional, organic farming, and hopefully demonstrate that such a future is not only going to be a likely reality for countless numbers of people in rural communities throughout the world, but that such an approach can be a viable 'solution' to the overall issues of global agriculture and rising world hunger. And within the examination, it is the hope that an emergent 'middle way', a blending of beliefs and methods from both approaches, might be key in creating a truly sustainable food system for the future of the planet, as all human beings are 'stakeholders' in the future of food and food systems.

The issues of food production and having access to the sale and distribution of food have always been a core concern for humanity throughout its past, present, and indeed will continue to be into the future. The 'invention' or 'discovery' of settled agriculture—and more specifically, the heavy significance marked by the most important invention in agriculture, the invention of the plough—are often considered to be the starting point for modern civilization. The transition from 'hunter/gatherer' living patterns into sedentary, organized agriculture has been tremendously important historical markers in the development of modern civilization, the invention of the plough chief among them (Dove, 2014; N.D.; Harford, 2017). Being able to reliably (re)produce food allowed humanity to shift from a hunter-gatherer lifestyle to sedentary living, which in turn spawned the birth of civilization as we conceive of it today. This further allowed for the rise of divisions and specialization of labor, where some could branch out beyond working directly for their own subsistence, allowing some to specialize in agriculture, and others to develop other skills and professions. (Pryor,1985; Division of Labor in Society: Definition, Theorists & Examples, 2015)

Research Question and framing of the research:

This thesis intends to explore the future of food and food systems by conducting a comparative analysis of the worldviews and foundational metaphors between two main diverging approaches to its production and the systems in which it is produced. One side of the analysis intends to examine the potential impact that 'futuristic', technology-based, and mechanistic approaches to the future of producing food and creating food systems, and explore the underlying conceptual foundations and purposes of modern approaches to food systems. The other side of the analysis, in-turn, will explore the foundational basis of traditional/agroecological methods of agriculture and food systems, which still exist in rural communities, and to understand the potential they have still hold for creating sustainable global food systems. Numerous dichotomies have arisen in the approaches and the underlying purposes of food systems, which have evolved beyond being about producing food, or the reproduction of cultural practices and beliefs which are central to numerous rural agricultural communities; modern technological approaches to food systems have become a source of commodity and data production, not merely a way to produce food, but to produce income and information by means of the additional values added by the creation of them, outside and above the production of food as a natural resource. Causal Layered Analysis and Scenarios will be used as Futures methods to explore food systems futures from both diverging approaches, with the intention of seeking and identifying approaches to creating sustainable futures for food production and food systems which utilize methods and will impact how it can address hunger and malnutrition. The other is to compare how current conventional farming hopes to address the same problem. Some of the key dichotomies noted in this thesis are:

Urban/Rural

Technology/Agriculture

Mechanistic/Holistic

Purposes of Food and Food Systems—Generating Data & commodities/Creating and sustaining life

Another intention of this thesis is to examine what is often the most overlooked aspect of farming and food system futures discussions in both the context of Futures Studies as well as the more general discussion on the topic: what will be the role and impact of and on the small-scale farmers of the world, whose labor in fact constitutes the majority global food production. This thesis will make the argument that while these technology-based solutions for addressing the issues of global hunger in the future are important, necessary concepts for advancing human

knowledge and trying to sustainably produce enough food for all, these are not the only solutions to the issue. This thesis intends to give voice to the poor and rural communities of the world, and to understand their approaches to addressing the problems facing the world related to global hunger, food productions, and sustainable food systems, and particularly, to acknowledge their contributions to the providing the basis for all current global food systems. Dr. Vandana Shiva, whose work stands as a leading and internationally known and respected voice and advocate for small scale farmers, indigenous peoples, and the rural poor, has served as a basis of exploration of global food system futures for this thesis. The future of food and sustainable food systems which Dr. Shiva and her internationally-recognized organization, Navdanya, have set an important example of what the future of food and food systems can be outside of a Western, technologically-driven paradigm.

It is also the intent of this thesis to explore these differing conceptions of the possible Futures of Food using a combination of ethnographic research methodology (Participant Observation), which included using Textor's 'Ethnographic Futures Research' (EFR), as well as specific futures research methods, most notably 'Causal Layered Analysis' (CLA) as described and developed in the work of Sohail Inayatullah and other scholars. Scenario Analysis will also be used to develop possible futures based upon the combination of field work and a comparative analysis of technological advancements in food production designed as potential use in future scenarios designed to create sustainable food systems in the future.

Building a Comparative Analysis

This thesis will model and compare the various developments of technologically-based, Western conceptualizations and narratives of technological advancements in food production and compare it with that of Navdanya's advocated approaches and narratives to food production by promoting traditional, organic agriculture. A CLA has been produced which studies, compares and contrasts these widely varying approaches to the same issue, followed by scenarios developed from possible implementation(s) of various combinations of methods and policies relevant to developing sustainable food systems. This comparative analysis will be framed in light of facts, figures, and futures estimates and projections pertaining to environmental change, public health, and perhaps most centrally, global population growth and urbanization trends, in order to create a fuller understanding of the present and future challenges which stand in place of the creation and implementation of sustainable food systems. This thesis will attempt to create a parallel analysis between urban and rural-dwelling peoples, as it will be argued that both will have different possible, probable and preferable pathways and outcomes in their respective futures regarding their levels of access to food and its production.

Methodology and Theory: Ethnography Futures Research, Causal Layered Analysis, and Scenarios

Introducing the approaches to research

The research conducted for the completion of this project and degree required a multi-faceted, multi-pronged approach, combining several distinct research methods hailing from various disciplines and incorporating a variety of epistemological frameworks. It has been the intention in the research and writing process of this thesis to produce a comparative analysis of the various approaches to food production and/or agricultural systems which exist now, are currently under development, or will be developed and/or implemented in the future, and to understand, speculate on, and to project their potential applications and value for creating or potentially creating a sustainable, global food/agricultural system for the future of Earth and humanity.

The research process consisted of utilizing three key methods, combined in such a way as to hopefully have produced a cogent and coherent narrative and fair analysis of the various approaches which were researched within the context of this study. A primary goal of this research has been to find an understanding of the possible futures presented by these various approaches for creating sustainable food/agricultural systems futures, and to create a forward-looking futures vision which explore the implications and possibilities for the implementation and use of these visions into a coherent strategy which could have positive impacts for both regional and global food systems.

These methods will be introduced individually, and then in will be discussed and shown why they were used in conjunction for the creation of this work, and an outline of their use value in presenting the arguments, and discuss why they were the preferred methods utilized for the creation of this study and comparative analysis presented in this thesis. Each of these methods was selected for their individual merits, uses, and ability to contribute something significant and unique to this research. For the overall purposes of this research, they were specifically used in combination together, as it is intended that in their combined use, they may find a new level of understanding the ways in which existing methodologies within the realm of the social sciences alone may be unable to produce.

Ethnography/Participant Observation

As a holder of a prior master's degree in the subject of Cultural Anthropology, ethnographic research and fieldwork was very much in the forte of this researcher, and thus it was incorporated as an integral part of the research topic and overall conception of this thesis. It afforded the unique opportunity to meet and study with a long-time personal 'hero', Dr. Vandana Shiva. Participant Observation—a hallmark of the discipline and the standard for conducting ethnographic research within the discipline—was the primary framework for conducting at least part of the overall research for this thesis, specifically, the fieldwork conducted for examining and learning about 'Agroecology' and organic farming futures in India. Participant observation and the concept of ethnographic fieldwork provided a useful 'way in', and a practically-based

starting point for entering research based on the specific futures conceptions of a specific set of people. Fieldwork in India, focusing on one particular group/organization with a specific approach to the future of food and agriculture and their constituent systems, served as the grounding, both literal and conceptual, for how this thesis has taken shape.

Defining Participant Observation

Social Science research methodologies have been practiced with a variety of criteria, priorities, approaches, and concerns in mind. Participant observation serves as a qualitative method for conducting ethnography and social science research has become a key method utilized within the disciplines of Anthropology and Sociology as well as other areas of academia, and is a method which has the ability to produce valuable findings in numerous other areas of research. And yet, participant observation is a method with broad and often-debated definitions and purposes. Dr. Barbara Kawulich notes that:

Participant observation, for many years, has been a hallmark of both anthropological and sociological studies. In recent years, the field of education has seen an increase in the number of qualitative studies that include participant observation as a way to collect information. Qualitative methods of data collection, such as interviewing, observation, and document analysis, have been included under the umbrella term of "ethnographic methods" in recent years (2005).

This conceptualization of participant observation presented by Dr. Kawulich represents a usefully expanded, more inclusive definition of both the types of research for which participant observation can be utilized, and the specific uses of those methods in producing academic work pertaining to the social sciences. The openness and flexibility of the application of research methodology which can be characterized as 'participant observation' allows for a more open-ended and widely-ranged set of research settings, subjects, and uses for it as a key method in conducting qualitative research. The field work conducted for this thesis was intended to be conducted under this more open conceptualization of participant observation.

Other social scientists have defined participant observation in slightly varied terms, all adding their own conceptions of what its value is for the research process, and what types of information it is capable of gleaming from the research subjects and setting being observed. Marshall and Rossman (1989) have defined participant observation as "the systematic description of events, behaviors, and artifacts in the social setting chosen for study" (1989:79). Schensul, Schensul, and LeCompte define participant observation as "the process of learning through exposure to or involvement in the day-to-day or routine activities of participants in the researcher setting" (1999:91). Fine describes his 'peopled ethnography' concept as a means to "explore the organized routines of behavior" (2003:41), which is part of the overall process of

participant observation, which he argues should include field notes and interviews, as well as vignettes of the research setting.

Participant observation is intended to be as 'hands-on' as possible, while intending for the presence and the participation of the researcher to be as minimally disruptive as possible to the people and the settings being observed. The hope is that living and participating in the 'normal life' of the people and setting being observed will give the researcher insight and access to information that might otherwise be difficult or impossible to otherwise receive. Living in India on an organic farm made sense as a way to take part in and observe the lived-present and hoped-for future of Agroecology, and the promise it holds for creating a sustainable future of food for all.

Textor's Anticipatory Anthropology and Ethnographic Futures Research

Another unique addition to the applications of participant observation which proved to be highly useful for this thesis has been made by Anthropologist Robert Textor, a student of highly regarded (and controversial) Anthropologist Margaret Meade, and a self-styled 'futurist'. Textor has created and proposed the use of an adapted form of participant observation/ethnography, specifically designed for conducting futures-oriented research, utilizing culturally-derived data for uncovering and understanding culturally-specific futures visions. He argues that by combining aspects from ethnography into futures research, that new ways of understanding culturally-specific futures visions and conceptions can be realized, granting unique insights into how the future is envisioned by specific ethnic groups. He has called this method 'Ethnographic Futures Research', and says of it:

Just as the cultural anthropologist conventionally uses ethnography to study an extant culture, so the cultural futures researcher uses EFR (Ethnographic Futures Research) to elicit from members of an extant social group their images and preferences (cognitions and values) with respect to possible or probable future cultures for their social group. (Textor,1980: 10).

EFR in this thesis

EFR as a research method represents an innovative blend of disciplines, one which has been tremendously useful in conceptualizing and conducting part of this research. It is unknown if the research contained herein exactly fits or constitutes the definition or specific purpose(s) of EFR which Textor intended; an argument can be made that the majority of information and the understandings of the futures visions of agriculture and sustainable food systems in India and the rest of the developing world and rural communities expressed during research by Dr. Shiva and the Navdanya Organization's conception of Agroecology fits the working definition of EFR. As research was derived from time spent at the Navdanya farm as well as her numerous books, articles, and interviews on the subject or the future of farming and food systems, this thesis

constitutes at least some type the expanded definition of participant observation research as outlined by Kawulich as well as meeting Textor's definition of EFR.

The argument can be made that the discussions which were witnessed and experienced by this researcher during field research constitute a culturally-specific vision for the future of agriculture and food systems. To this point, it can be said that this thesis specifically constitutes a comparative analysis of a culturally-specific, culturally-derived futures vision on one side—that being the Agroecological approach to the future of food and food systems—and on the other, the more generalized approaches to the future of food and food systems characterized by technological input and innovations that focus on the new, urbanized realities embodied by the fact that the majority of humanity now lives in urban areas and fewer are directly involved in rural agriculture to make their living. These are the key trends in urbanization and food production which will continue into the next half century that will shape how humanity consumes and produces food (FAO Stats book 2019, FAO 2017b, FAO 2018).

Multiple approaches to fieldwork: Combining Methodologies

It was the original intention for this thesis to undertake fieldwork as a form of ethnographic research conducted through participant observation, with the research purpose being to derive a sense of the specific futures vision(s) of Dr. Vandana Shiva and the Navdanya Organization for agricultural and food systems, thus resulting in research which is at least partially consistent with the goals of Textor's EFR concept. And similar to the participant-based research conducted by Candy and Kornet with marginalized communities and environmental activists in Canada's Lake Huron region (although not as extensive), in which EFR-specific interviews and discussions they conducted in an effort to uncover and express concepts pertaining to 'Experiential Futures' (2019:4-5), the research conducted for this thesis in India included a similar element of directly introducing futures thinking and methods to research subjects/participants, in that a 'mini CLA workshop' was conducted with other participants in the Agroecology course at the Navdanya farm.

It is unclear if the research conducted in the fieldwork segment of this thesis as it was undertaken specifically or perfectly fits within the definitions set out by Textor about what constitutes 'EFR' style research, or if it meets the same level of centrality or primary focus in the overall thesis research as the use of EFR as conducted by Candy and Kornet (2019) for their work does. Nevertheless, the important contribution and development of Textor's EFR and the example of its use in multidisciplinary research settings shows that there can be efficient uses of ethnographically-based research methodologies and the utilization of culturally-specific research settings for use in conducting futures-based fieldwork/research. It was with this goal in mind that this field research was conducted, and it is intended to provide a grounded and 'real'

dimension to the visions of the future for rural farming communities in rural north India. It is hoped that this desire and expectation of a prosperous futures vision for Indian agricultural communities can also serve as generalized, representative futures vision for rural communities in various parts of the world, so they can, in a way, be 'given voice' in the future of food and food systems.

A flexible frame for researching the future

These various definitions of what participant observation is, what it can be, and what it is intended for, have provided a useful and flexible framework in which to conduct field research as key component for completing part of this thesis. The primary emphasis and focus of attention in participant observation-based research seems to be of the 'setting' and observation of 'routine behavior', as well as trying to make observations which aim for objectivity, all while trying to be as minimally disruptive to the lives of those under observation. But just as important is to attempt to maintain a sense of objectivity in the undertaking of research, while also trying to create and maintain trust with the people you interact with as a researcher. Even if true objectivity is an impossible undertaking, it stands as an idealized goal for conducting research in the realm of human social sciences.

The field work and participant observation for this thesis was conducted with these ideals about objectivity in mind. Research was conducted within the context of the established curriculum and settings established by the Navdanya Organization for participants to learn directly about organic farming in India, as well as from expert guest speakers hailing from many parts of the world, in order to share their knowledge and experience in agroecology and organic farming and numerous directly associated subjects (permaculture, seed saving, plant breeding, soil biology, insect pollinators, etc.), as they are practiced in those locations and contexts. The combined settings and learning opportunities of both classroom with Phd's and leading academics, combined with direct, hands-on experience out in the fields, working side-by-side with local farmers was designed to maximize the value of the overall experience for the participants.

The fieldwork conducted in India is intended to be presented in combination with perspectives and inputs from more generalized sources and contexts on organic, small-scale, and agroecological approaches and methodologies for producing the world's food. The various worldviews informing the purposes and functions of food systems from these perspectives, and the farmers and farming communities who provide the primary bases for all local and global food systems, is intended within this thesis to provide a central (although not exclusive) example of differing, even contrasting perspectives to more modern, more dominant perspectives, worldviews, and discussions on the future of food systems, and the approaches to providing the planet with sustainable sources of food.

The many faces of Agroecology

Sifting through its varied definitions, Agroecology is generally held to be the pursuit of creating a sustainable, 'green' agricultural/food system capable of meeting the food needs of the entire planet into the foreseeable and preferably long-term future, which will hopefully achieve and maintain a 'balance' with nature. The FAO has amassed a "framework of 10 elements on agroecology (which) is derived from the common principles articulated for agroecology, including a combination of bio-physical and socio-economic elements that are grounded in the three pillars of sustainable development – the social, the economic and the environmental." They further claim that "different elements may come into play in various configurations, with a strong blend of social, economic and environmental aspects" (fao.org./agroecology). The FAO also provides an additional list of 19 definitions of agroecology from a variety of sources, providing openness and flexibility in the ways it can be understood and applied in a variety of contexts (fao.org./agroecology).

The Agroecology Fund

The Agreocology fund (AEF), an international organization which "aims to support viable food systems, promote the economic well-being and human rights of small farmers and their communities, and mitigate climate change through low input agriculture featuring sustainable soil and water use" (agroecologyfund.org). The AEF seeks to create and maintain link between organizations and movements that advance agroecological solutions locally, regionally and globally. They define Agroecology as farming that "centers on food production that makes the best use of nature's goods and services while not damaging these resources. Farming thrives when it works with local ecosystems, for example, improving soil and plant quality through available biomass and biodiversity, rather than battling nature with chemical inputs. Agroecological farmers seek to improve food yields for balanced nutrition, strengthen fair markets for their produce, enhance healthy ecosystems, and build on ancestral knowledge and customs" (Agroecologyfund.org).

Agroecology in Practice in India-- Navdanya

The Navdanya Organization, as part of their learning programs available for approved participants, offers several positions and opportunities to come to their farm and learn about their philosophy and practices as they pertain to 'Agroecology', The Navdaya Organization also puts forward their own definition and understanding of what agroecology is, stating on their website that: "Agroecology is (the) holistic study of agro-ecosystems, including all environmental and human elements that focuses on the form, dynamics and functions of their inter- and intra-relationships. It can also be defined as: an ecological approach to agriculture that views

agricultural areas as ecosystems, and is concerned with the ecological impact of agricultural practices" (navdanya.org).

This definition of agroecology provided by Navdanya was the most important one for understanding the practices, methods, and underlying beliefs about food and food systems in some parts of India, particularly in seeing these agricultural principles as a living practice at the Navdanya farm. As part of the course attended in India for field research of this thesis, learning about agroecology was right in the title of the course. The Navdanya 'Bija Veedyapeeth' (Earth University) farm, as well as it being available for year-round learning and internships, is a place at which the principles of agroecology are demonstrating in real, living practice. In this way, the philosophy, worldviews, and deep metaphors and underpinning beliefs and ideology which are the basis for agroecology in India are brought to light. The agroecology concept as expressed by the Navdanya organization constitutes the modern vision and version and continuation of these ancient practices, and the belief system which underpins them.

Participant Observation at Navdanya: Being a Bijak

Research on the Navdanya farm was conducted by assuming the role of 'Bijak', which translates from Hindi as 'a sower of seeds' (Navdanya.org). This role has been designed by the Navdanya Organization specifically as a kind of 'hands-on learning and participant observation experience', available for people who have come specifically for the 'A-Z of Agroecology' course, as well as for those conducting research about organic farming for academic purposes, or those who come to learn for the personal experience and opportunity to learn about organic farming practices directly from the local people. This experience as a Bijak and time on the farm served as the participant observation/field work for the pursuit of this thesis.

In keeping with the general themes presented by participant observation as a research method, much of the additional background information used as the basis for the exploration of organic farming methodologies and practices in the developing world and specifically in India were directly inspired by the extensive writing on the subject by Dr. Shiva. Her numerous books, speeches, and public activism in promoting organic farming and seed sharing/saving programs and efforts in representing the interests of small-scale farmers and farming communities made the opportunity to go to India and learn from her directly and conducting research that were unique research and learning opportunities. The entire team at Navdanya Bija Vidyapeeth Earth University (Navdanyainternational.org) made the time and the experience there both educational and enlightening. The farm consisted of both experts with advanced academic degrees in their

respective fields, as well as local 'peasant' farmers, all of whom were knowledgeable and hard-working, and willing to share their knowledge and experience with participants.

A Personal Note about Research in India

Although the 'square peg' that was represented as the time and research in India may not 'fit' perfectly into the 'round hole' that the discipline of Anthropology might consider an ideal ethnographic/participant observation experience, it was the loose, general approach used while conducting research there at the Navdanya farm in Northern India. I characterize my time in India as 'field work' and 'participant observation' for the fact that the 'A-Z of Agroecology' course I attended in India is specifically hosted and designed for providing such an experience to its participants, without having a sense of being forced or contrived, or concocted for attracting tourists. Guest speakers, events, and practical learning of the key concepts of organic agriculture were the central elements of the course, and those farming practices and the specifics about how they are practiced by local farmers in the Uttarakhand region of India in accordance with local tradition were the primary things that myself as a 'Bijak' and a researcher was able to participate in and observe.

The knowledge, understandings, and specific practices as they relate to agriculture are a deeply ingrained and embedded aspect within the local cultural knowledge, understanding, and observed practices of farming in that specific region of India. The opportunity to live, learn about, and to directly participate in and observe about the farming practices with the local people in the area was a unique and unforgettable experience, and the learning and participation observations I was able to undertake whilst at the Navdanya farm, under the tutelage of Dr. Shiva, were the foundation stone of my arguments for the validity of a vision for a global future based on the modern interpretations of ancient agricultural practice and the cultural-derived logic, beliefs and practices which are their epistemological basis, create a place in the modern food system paradigm where organic agriculture and small-scale farm production can be argued to be a viable and real possibility to addressing the food needs of billions in the future.

Sharing the Narrative Space: Creating a place for Agroecology in the pantheon of the Future of Food and Food Systems

'The Future' of food and Agriculture, as it appears to be discussed in many sources, ranging from the academic, NGO's, and think-tank-produced works, to the type of articles written by journalists for tech magazines and websites, the presence of subsistence and peasant farmers as people with a both a place and a stake in the future of food and food systems, often lack direct input from those same people, and seems to simultaneously minimize if not completely overlook their undeniable and fundamental role as the basis of all global food

systems. Nor does agroecology receive as much attention as a viable, credible, and highly sustainable approach to addressing the food needs of the planet into the future. In both the focus and production of much of these bodies of work, there seems to be a conspicuous absence in both the discussion and the public's awareness of the fact that these people too will inevitably have a future, but will likely continue to play a central role in the production of food and food systems. It is these futures which this thesis hopes to explore and give voice to, and to contrast these visions with the approaches to creating sustainable agricultural futures which garner more attention in academic, scientific, and media outlets.

The role of culturally-derived metaphors in agriculture: Hinduism

Even less focus in much of the literature is the role of myth and worldview in agriculture and food systems, and the ideologies which led to the practice of organized farming in early human societies. The beliefs which underpin the principles of agroecology in India are still driven and guided by culturally-derived practices deeply rooted in the precepts of Hinduism, which believe in maintaining balance between agricultural lands used and shaped by humans and the natural environments from which they are taken. Maintaining respect for traditional agriculture and the natural environment and the religious and culturally-based practices and beliefs they spring from is something which seems far-removed from modern iterations of industrial and laboratory-based food production methodologies; the robes of the holy man and the dirt-caked sandals of the rural farmer have been replaced by the white lab coats and sanitary shoe covers of the scientist, clipboard in hand, his 'sermon' the latest readings and 'data' derived from the latest plantings and harvests, not 'knowledge' passed down through the generations for the purpose of sustaining life through creating healthy, organic, nutritious food.

The split between what can be arguably be considered as the underlying purpose of producing food in the form of organized agriculture—to sustain human life—has been subsumed into something else, something which has overstepped the original purpose and intention, twisting it into a for-profit business while retaining the veneer of feeding humanity as its primary purpose. This divide illustrates a long-growing rift underlying the purpose of food systems, and the emphasis which each gets has diverged between subsistence food production and producing food-as-commodity profit-making.

This dichotomy can be further examined using Causal Layered Analysis, the primary Futures method which was utilized for the purposes of this thesis. Through examining the language used around these divergent approaches to agriculture and food systems, the difference of purpose becomes apparent. An outline of CLA and its usefulness on this analysis of language and deeper meanings behind the divergence of purposes behind food and food systems, and hopefully in conclusion, find a common space for these approaches to their inherent and ultimately immutable purpose: producing and providing food for sustaining human life. The comparative analysis between these technological and agroecological approaches to agriculture, food production and the development and maintenance of food systems, is the primary goal of

this thesis, and the exploration of these developments through the lens of CLA will uncover the deeper meanings and fundamental changes implicated by technological innovations which stand to fundamentally change humanities relationship to food and food systems.

Causal Layered Analysis (CLA)

Personal note:

Very shortly after starting my degree in the area of Futures Studies, it was the similarities with Anthropological and cultural knowledge, insight, and the search for understanding culturally-based beliefs and practices which initially attracted me to Causal Layered Analysis.

Why CLA?

The insights and understandings that CLA seeks to draw out from its deeper 'Myth/Metaphor' level—drawn directly from the exact type of underlying cultural beliefs and practices which are of primary interest to Anthropologists and social science researchers—made CLA the ideal Futures-based research method to utilize during the course of this thesis, particularly for research which is at least partially based on or inclusive of ethnographic fieldwork. An outline of both this writers own understanding of CLA and what other academics and scholars have discussed in relation to the uses of CLA will demonstrate why it was deemed the most valuable and sensible method to use in the conducting of this research. And ultimately, to use and demonstrate it in relation to the opposing (?) worldviews and metaphors hypothesized to make-up the two key approaches and conceptions examined in this research about the possible futures of agriculture and of local, regional, and global food systems.

CLA—Sohail Inayatullah

Sohail Inayatullah, the creator of CLA, opens his description of the method as being "a theory of knowledge and a methodology for creating more-effective policies and strategies" (Inayatullah, 2014:26). Its use value as a critical Futures method rests upon the methods' ability to allow for the re-conceptualizing, challenging, and reimagining the future by unpacking and challenging our beliefs and assumptions about it, and particularly by challenging and discarding what he describes as 'used futures' (2008, 2017). Prof. Inayatullah says of CLA that:

"As a method, CLA's utility lies not so much in predicting the future as in creating transformative spaces for the analysis and the creation of alternative futures. CLA also proves useful in developing policies and strategies that are more robust, efficient, and effective as well as deeper, more long-term and inclusive" (Inayatullah, 2017:3).

CLA has seen increased usage in recent years as a key method utilized by numerous businesses, governments, cities planners, NGO's, and numerous types of organizations around the world. Prof. Inayatullah's extensive list of organizations which he has worked with discussing CLA and the Six Pillars approach to Futures Studies is extensive, showing the usefulness and positive impact that these methods can have on reimagining the future for NGO's, governmental agencies, and business clientele in the business world (metafuture.org).

What is CLA and how does it work? The Four Levels of CLA

The structuring of CLA is based on conceptualizing four operative levels of understanding for making an analysis of any issue under discussion/examination. Each constituent 'layer' represents a different level of 'conceptual depth', or stage of thinking about a particular issue, which allows for these aspects to be at first separated from each other for differentiating of the constituent elements, compared and individually examined, and then seemingly 'put back together' in a way which allows for issues to be conceived of differently, and opens the possibility for a reimagining of the paradigm; it is in the spaces in-between where change can find its way into the public imaginary.

The 'Litany' level is often described by Inayatullah and others who use the method as a 'newspaper headline'; a surface level understanding about a topic, and often best expressed in as short and succinct a way as an actual newspaper headline. The Litany serves as the outward, external, public, and generally 'known' conceptualization of an issue, and perhaps the 'consensus' on how an issue is viewed within a specific social or other context (Inayatullah 2004, 2008, 2017 Schwandt).

The next level, the 'System' level, starts to look slightly deeper into the issue, raising important questions and pointing out the issues which underpin the surface level description provided in the Litany. This level engages the topic at the political and technical levels, and often involves discussion on questions that relate to policies of governments and other civil and social institutions and special interest groups. Laws and official authority and political power often reside at this level. The Systems level can also be thought of as the 'functional level' of CLA; it is the space where real world decisions are made, and is the arena of public life and civil engagement. (Inayatullah, 2004, 2008, 2017) (REFERENCES HERE)

The third level, the 'Worldview' level, begins to address more engaging and in-depth topics and discussions, dealing with cultural beliefs and values, which both inform and formulate not only people's behaviors, but the very things which shape those behaviors and beliefs. Framing and embedding of issues are determined at this level, and the examination of beliefs and values becomes possible as emergent discourses come to light. (Inayatullah, 2004, 2008, 2017).

The deepest level of CLA, the 'Myth/Metaphor' level, is often expressed and/or understood in exactly that way: a symbolically 'deep' metaphor or derived myth from it which informs all other levels above it. It is often an archetypal, representative metaphor that holds strong and paradigm-shaping significance and meaning to a specific group of people, and represents signs and symbols which inform the logic and beliefs of those who are a part of that group. It is this level where significant change can be imagined, and the most important level at which real change and its mere possibility can be conceived, formulated, and the first place it can be implemented (Inayatullah, 2004, 2008, 2017; MacGill, 2015).

Futurists on CLA

CLA has become a well-known and widely utilized method within Futures Studies as an academic discipline and beyond. People from the corporate world, Law enforcement agencies, and NGO's have all seen the benefits of gaining what Prof. Inayatullah calls 'futures literacy'. The use of CLA and the 'Six-Pillars' of futures methods and envisioning (Inyatullah, 2008) have useful applications in nearly any area of business or academic pursuit. The insights granted from CLA can be of tremendous benefit, as it grants a unique insight into understanding the basic assumptions which shape the issue being examined. CLA holds transformative power in how it allows, as a method for understanding change and how it can be implemented, for a multi-layered analysis at the various levels of engagement. This feature allows for an adaptability and ease of access which makes CLA a method which holds universal applicability and understanding, and allows for assumptions often considered universal to be questioned, and to problematize assumptions about the future, so they can be critically analyzed (Inayatullah, 2007).

Richard Slaughter has stated that CLA "provides a richer account of what is being studied than the more common empiricist or predictive orientation which merely 'skims the surface'. But because mastery of the different layers calls for critical and hermeneutic skills that originate in the humanities, some futures practitioners may find the method challenging at first" (Slaughter, 1997:6). Slaughter argues here that CLA is most suitable and adaptable for humanities-based disciplines, due to the difficulties faced by those with different educational backgrounds in adapting to the method in disciplines without a background in humanities-related subjects. This can make the initial task of engagement with it more difficult for some people or disciplines, but with some effort, can be understood by those willing to engage in critical analysis about their own assumptions about the present and the future.

CLA is one of the primary methods which can be described as falling within the scope of 'Critical futures' theories, as Slaughter characterizes it, which in an initial sense seems to present a challenge to the status-quo of the business classes, but can more correctly be said to challenge dominant paradigms, rather than the established order. If a wider understanding can be adopted,

inclusive of paradigm-challenging ideas and concepts, then the value of this 'systems thinking' approach can come to the surface (Slaughter, 1997:6-7).

Victor MacGill gives a succinct outline of CLA, saying that:

"Causal Layered Analysis (Inayatullah, 2003b) is a proven futures tool used to help us understand and act in any situation. It is used in tandem with other futures techniques to create robust processes for exploring future opportunities (Inayatullah, 2008). By exploring the four layers in any situation, we can break from the temptation to only analyse from one perspective which can only yield a partial understanding of what is being examined. CLA is not simply comprised of four separate categories, rather, the layers are dynamically interconnected and overlapping to enable vertical movement between the layers and horizontal movement within the same layer" (McGill 2015:56).

MacGill further says of the uses and importance of CLA that "the post-structuralist foundation of CLA is constantly seeking to problematize existing structures, generate alternative perspectives, and is ever mindful of who is excluded from power…" and thus that the best use of CLA is in understanding "how the myth/metaphor layer can become distorted within a particular group or society and thus become a part of the dynamics of oppression" (MacGill 2015:56). This thesis endeavors to do the same problematizing of existing power structures, by exploring the perspectives on food and food futures of those who are often excluded or merely given minimal attention in mainstream discourses on the subject.

Why CLA works for this thesis

These reflections on the value of CLA as a research method in the realm of Futures Studies and beyond stand as supporting evidence for the reasons that flexibility in application inherent in CLA for examining different levels and aspects of a topic have made it an ideal method for serving as the primary Futures research method for this thesis. The FAO has noted that to achieve Sustainable Development Goals (SDG's), "we must embrace innovation while also drawing on traditional practices and the time-tested agricultural methods of indigenous peoples" (FAO, 2019). The use of CLA in combination with ethnographic fieldwork conducted in a rural indigenous community and specifically the application of EFR methodology for examining the future of agriculture and food systems, makes CLA an ideal method for unpacking the deeper meanings of culturally-derived narratives about food and food systems, and provides important insights into what indigenous/rural communities can contribute towards meeting those SDG's. Examining the meanings and deep myths and metaphors which illustrate and create the narratives and diversity of approaches employed to address the current and future problems faced by agricultural populations/ producers and food systems give a human face to the impacts of emerging issues which impact how food is produced and how food systems function, such as

local and global population growth, increasing urbanization, and rural population decline, illuminate humanities' continuously changing relationship with food systems.

The decision to use CLA was an important choice as a key method in pursuit of this thesis, as it stands as a versatile, adaptive, and reactive method, easily used in conjunction with other methods, and easily woven within a tapestry of methods for more in-depth analysis. CLA allows for a level of creativity and insight which many other methods do not. The transformative potential inherent in the structuring and openness of CLA allows for the finding of new understandings and granting exposure for meanings embedded within a topic. CLA is ideal for carrying out the comparative analysis around which this thesis is based, and works in direct conjunction with the development and use of Scenarios, which have also been utilized for this thesis. The overall analysis in this thesis is between two key approaches to creating sustainable food systems, each with worldviews that can be characterized as somewhat oppositional to the other in their approaches to producing food and the purposes which they exist. Underpinning metaphor-level beliefs about the purpose, guiding principles of, and ultimately, control over them. Contained within that comparative analysis is the worldviews and metaphors which will be scrutinized, examined, and compared, in efforts to unpack the logic which informs the wider discussions and seemingly opposing positions as embodied by the 'Ageoecological/Holistic' and 'Mechanistic/Tech-driven' identified in the course of this research to creating sustainable global food systems futures.

The Elephant in the research room: Power relations in popular discourses on the future of food systems

A hope embedded within the making and original conception-- if not the explicit intention of this thesis-- has been to avoid losing specific focus on the methods which can produce the best outcomes for the future of food and food systems, regardless of their approach. But also within this thesis has been the attempt to at least partially expose, examine, and question the power relationships that exist between these two narratives and the embedded interests which advocate for these seemingly oppositional approaches to the future of food and food systems. The use of CLA in this endeavor intends to (at least partially) expose the power relationships which creates an apparent 'imbalance' pertaining to general discussions in media and even within futurist circles, and among 'expert' opinion on the future of food and food systems. General discussion on the topic seems to allow for a 'louder' voicing to those that advocate technology-driven solutions for food futures.

Addressing this imbalance in competing narratives of the future of food and food systems was one of the deciding factors for establishing the basis of fieldwork for this thesis with the work of Dr. Vandana Shiva's advocacy of Agroecology, one of the leading voices for what

might, paradoxically, be characterized as 'alternative' approaches to the future of food and food systems, despite its ancient origins. The paradox arises from the fact that Dr. Shiva advocates for a return to, or the reincorporation of, traditional, ancient agricultural practices into modern food production, emphasizing harmony with nature and systemic sustainability in the production and distribution of food. Despite it being the traditional, time-tested methodology for human agriculture for much of the entire history of organized agriculture, it has, in the modern conversation and current paradigm, been characterized as the 'alternative' approach to farming and food production, as technology-based approaches are given first priority in discussing 'the future' of food and food systems.

This thesis endeavors to give equal footing, credence, and 'voice' to advocates and practitioners of food and food systems experts on approaches which do not conform to the technology-based, mechanistic approaches to the issue, which are the typically dominant ones in most discussions and representations of the topic.

Scenarios

In expanding the concepts addressed during the research of this thesis, and as an insightful extension of the work of Prof. Inayatullah's '6 Pillars' of Futures Studies concept (2008), the development of futures scenarios have been employed to draw out and explore further, deeper, and more meaningful understandings of possible futures for the world and its systemic relationship to producing and procuring food. Scenarios will be presented as a means by which to explore the differing, divergent, yet cyclically related bonds of urban and rural residents of the Earth in the future.

Experts on Scenarios

On establishing the usefulness of scenarios as a key futures method which expands upon the insights given to us through the use of CLA, an overview of expert opinions on their use in futures studies and foresight will be made here. Pierre Wack has stated that "Scenario analysis is a disciplined way to think about the future. It demands above all an understanding of the forces that drive the system, rather than a reliance on forecasts" (Wack, 1984, p.83). This drive to understand, as Wack put it, "the forces that drive the system", is precisely where the key usefulness of scenarios for futures studies resides. Futurists make use of the imaginative ways in which futures visions can become manifested as a potential reality, and how envisioning the future in this way can open the imagination to new possibilities yet to be conceived of.

Prof. Inayatullah's insights and 6-Pillars and CLA approaches offer useful historical background and cultural context for the creation of useful and insightful futures scenarios. Prof. Inayatullah states that "Scenarios are the tool par excellence of futures studies. They open up the present, contour the range of uncertainty, offer alternatives, and even, better predict" (2008: 15). He also notes the specific contribution and specific iteration of Jim Dator to scenarios, those being his description of what he calls "scenario archetypes" (2008:16, Dator, 1979). Dator's scenario archetypes have been utilized in this thesis as a means to describe sometimes conflicting, often –times complimentary, and always simultaneous futures scenarios for urban and rural communities. The quadrants have been formulated using slightly different terms by different scholars and futurists to describe each of them, but the precepts and formulation are essentially the same in each description, and serve the same function in the formulation of the constituent scenarios they represent.

Scenarios in this thesis

For the purposes of this thesis, a parallel set of scenarios have been developed for cites/urban areas and rural communities. This is an important and meaningful distinction to make, as global populations have shifted to the majority of people living in cities, and yet the majority of the planet's food is still (and necessarily) produced by rural communities. Separate and parallel scenarios will give the opportunity for exploration into how this relationship between rural and urban will undoubtedly change in the future, particularly in light of numerous technological developments in food production methodologies. But for the purposes of staying to-form, the scenarios for each 'setting' will be presented together within the classic four-scenarios framework, as the localized but connected halves of each envisioned possible future.

This thesis has incorporated the use of scenarios as a means by which to breathe life into the concepts presented and discussed, and which are realistic, probable futures visions for the future of food and food systems. Creating relatable and hopefully realistic scenarios, which are easily understood and imaginable for those for whom will be living that envisioned future is an important aspect of the use of scenario analysis. The four archetypal scenarios based on the concepts put forth by Dator and others are referred to as: 'Continued Growth', 'Steady State', 'Limits and Discipline', and 'Transformation'. These four archetypal scenarios allow for the development of formulated futures visions which could be considered likely to occur in specific circumstances, based on the criteria and assumptions contained within each hypothesized scenario, as it conforms to the built-in 'shaping' of the quadrant. This 'quadrant' approach to conceiving of and presenting scenarios allows for a broad (but manageable) spectrum of future possibilities to be conceived and discussed as they pertain to a specific subject. Each scenario imposes an assumption about the future of the topic in question; essentially, it is a built-in 'limit' to what might occur in the future. This quadrant approach in scenarios allows for an examination of what can be considered to be the 'Best Case', 'Worst' Case', 'Probable Case',

and ‘Preferable Case’. The intention of scenarios divided, presented, and conceived of in this way is intended to create a limited but broad enough range of scenarios which can be compared and contrasted between each other, and presume a divergence from a common starting point. Presuming that certain decisions are made or courses of action take place from that starting point, each quadrant of a scenario is shaped based upon them.

Defining Scenario Quadrants

These quadrants, as defined by Dator (2009), Inayatullah (2008), Schultz (2001), and Fergnani and Jackson (2019), are typically divided into the following categories:

1. Continuation/Continued Growth: Essentially, the ‘Business as Usual’ approach to the future; this future is based on the dominant assumptions of the time, utilizing the conventional approaches and beliefs of the current paradigm. Futures visions derived from this quadrant are based in a rather static model of the world. Changes are presumed to be incremental and non-disruptive.

2. Collapse: Seemingly the inevitable conclusion to the Continued Growth model. Too many contradictions and expectations collide to bring about an end to the paradigm.

3. Discipline/Steady State: This future seeks to find a balance and control (economic?) growth; it endeavors to create a fairer and more equal, just society, measuring human values against the over-use or heavy reliance on technology

4. Transformation: Systemic and transcendent change occurs, at either the spiritual and human values or consciousness level, radical technological shifts, and economic liberation brought on by changing social conditions.

Dator’s formulation of archetypal scenarios and the later interpretations of it discussed by other scholars served as the basis for numerous works in the area of Futures Studies, and it has been applied for use in this thesis for exploring possible scenarios and futures as they relate to the future of food and food systems for both urban and rural settings.

Scenarios in Food and Food Systems Futures

For this thesis, a total of eight different scenarios have been developed, based upon the possible outcomes which could result from developing the four quadrants for the two divergent approaches proposed for the creation of sustainable food systems in either urban or rural settings, or, the ‘Agroecological/Holistic’ vs. the ‘Mechanistic/Tech-driven’. Four have been developed with a focus on rural community needs and values, while the other four have been developed based on approaches which center on cities or megacities and more densely concentrated,

urbanized environments and populations. These scenarios intend to separately explore the two primary visions of the future of food systems under analysis in this thesis, namely the 'Holistic' and 'Mechanistic' approaches to creating sustainable food systems futures, will provide the basis for the four scenarios produced for each area. Within the scenarios, an attempt is made to explore the possibilities which could result from 'hybrid' approaches to addressing the future development of food systems in both rural and urban areas; that is, the scenarios developed will attempt to reflect the most realistic futures for agricultural and food system futures, which in all likelihood will be a 'mixed bag' approach to producing food and maintaining and creating sustainable food systems.

The future is not something that will happen in a laboratory, a thought exercise, a corporate boardroom, a think-tank strategy meeting, a weekend seminar, nor in a Master's thesis. The future will be a real, lived-in reality; it will be a place where real lives are affected and shaped by policies, choices, circumstances at or beyond the control of individuals and organizations, and subject to the winds of change, the drag of embedded interests, and the draw of preferred outcomes. The future of food and food systems is indeed an area of universal interest and importance for all of humanity. The scenarios presented within this thesis attempt to paint a realistic and easily imaginable set possible futures which are relatable and believable, and simultaneously endeavor to open minds and envision new potential avenues for creating sustainable food futures for all, regardless of rural or urban setting, socio-economical means or circumstances, or status.

Searching for realism and imagination in Scenarios

For maintaining a semblance of realism and probability in the scenarios, the assumption is built-in that the more preferable scenarios are those which seek to create and/or maintain some sense of balance between urban and rural communities and the food systems which each support the functioning of the other. The ultimate goal of creating these preferred scenarios is to imaginatively envision fully sustainable food systems, in regards to their environmental and energy resource impacts. Additionally, the exploration of non-preferable scenarios intends to shed light on the possible outcomes of poor strategy, planning, policy, or implementation of steps intended to improve regional and global food systems, and fail to create or maintain cohesion between rural and urban food systems. The overall premise which is sought in this exploration assumes that balance is preferable, as it is highly unlikely that cities and urban areas would ever reach total self-reliance and sustainability in their food needs without some degree of co-operation and/or reliance upon the other (cities will likely remain dependent upon rural communities for natural resources, rural communities will remain dependent upon cites for financial support), and the socio-economic dependencies and mutually-beneficial relationship which they have had since the dawn of city living and the earliest days of human civilization.

What can Scenarios tell us about the future of Food Systems?

In conceiving of the scenarios produced within this thesis, no presumption of mutual exclusivity of approaches or solutions was intended in their creation; if anything, they have been presumed to have a great deal of flexibility and potential benefit for both rural and urban settings, as urban and rural environments historically have had, and will likely continue to have, a mutually beneficial relationship. While there are some potential solutions which undoubtedly will have true use value in only one setting or another-- such as vertical farms only being (potentially) viable or necessary in urban settings, others will have potential uses anywhere they may be applied or implemented. Organic farming methodologies, such as the planting of mutually dependent/beneficial plant varieties which promote soil health, can be certainly be utilized in urban or rural settings. Other emerging technologies, such as data-mining and robotic monitoring and/or planting/harvesting systems, soil health analysis, and mixed-crop farming, can also be used in any setting for which it can be adapted and utilized for the optimization of plant growth and production.

The hope in the scenarios produced here were that they were conceived of and created with the underlying premise that the best paths towards creating and actualizing sustainable food systems in either rural or urban settings futures is likely not an 'either/or' approach; ideas and solutions originating in the 'agroecological/holistic' or the 'mechanistic/tech-driven' worldviews can and likely will have central roles in the creation of viable, sustainable food systems. Real solutions will likely arise from a 'hybrid' approach to solving these problems, not merely from orthodox, conventional, traditional, technological, new, or 'pure' approaches. The scenarios developed here are intended to, in at least some capacity, to reflect the possibilities of blended approaches derived from these seemingly dichotomous worldviews. Scenarios are designed to allow for real world solutions to surface through critical examination of possible futures.

Limitations of the research

Fieldwork and specific contextual/culturally-derived information for it was concentrated on the rare research opportunity presented by attending the Navdanya Agroecology course hosted by Dr. Shiva in northern India. Due to the constraints of time, funding, and general scope and scale of this thesis, the remainder of the information examined for the purposes of this thesis and the comparative analysis it attempts to make were based on having conducted trend scanning and reviewing literature relevant to the most prominent, headline-generating advances in technology-based solutions to addressing the problems relevant to the future of food and the world's growing food and consumption needs, in order to gain a relevant overview of the wide range of approaches and developments pertaining to the future of food and food systems. A review of statistics and analysis of other pertinent facts and developments of issues related to and/or having relevance and potential impact on food systems are included in this work. These areas include a look at urbanization, global population growth, and the rise of megacities. These topics are briefly addressed, due to their direct and indirect impact on how they affect food

systems, and the varying impacts they have on how people access food provided by those food systems.

Specifically, this thesis should be read and understood as having a primary focus on the futures visions of non-dominant voices in the wider discussion of farming and agricultural systems futures. The viewpoints and arguments of Dr. Vandana Shiva and the Navdanya organization in favor of agroecological (the 'argroecological/holistic' side of the dichotomy) approaches to creating sustainable food systems are a key voice for those who are often excluded from more mainstream discussions on the future of food and food systems. The goal within the comparative analysis through the use of scenarios is to build a framework for conceiving of new, possible futures and 'blended' methods for future progress, as it is likely that any truly progressive change to food systems which can achieve sustainability will be reached through combinations of agroecological as well as technological design, innovation, and implementation.

Given adequate time and resources, the comparative analysis within this thesis would have intended to include additional fieldwork incorporated into the study, specifically, to have presented a more complete and comprehensive comparative analysis between the opposing sides of the dichotomy between what is characterized here as 'mechanistic' and 'holistic' approaches to the possible futures of food production and food systems. This would have preferably been accomplished thorough conducting additional field site visits, face-to-face or electronically-mediated interviews with leading experts in creating, developing, and marketing some (if not in all) of the key research areas being discussed in this thesis on the 'tech-based' approaches, such as robotic farming, vertical farming, lab-grown proteins and protein-replacement products, and/or aquaponic systems, among other leading research and innovations. As it stands, the research into these technological innovations, for the purposes of this thesis, have necessarily been limited to a cursory analysis of their development and future potential and current limitations for addressing the world's food needs based on relevant literature reviews and online resources discussing the use and implementation of these innovations into modern and future food production systems.

The primary points intended to be conveyed in the comparative analysis is in the differing worldviews and myth/metaphors in use and which exist between what has been characterized in this thesis as the 'Agroecological/Holistic' and 'Mechanistic/Tech-driven' approaches to creating sustainable food systems. It is the aspects which come to light at this level of CLA. There are numerous useful and telling dichotomies embedded within this comparative analysis, several of which are intended to be discussed with varying degrees of detail. One of these is the question of what it is that each approach hopes to 'make', or to 'generate' from its endeavors, a question which is becoming more prominent in futures-related discourse on food and food systems: What is the production of food and the creation and maintenance of food systems supposed to be about, aside from its most obvious primary role of providing sustenance? Are agriculture and food systems about gaining, 'creating', and passing on 'knowledge' about how to derive life-giving and sustenance from the Earth? Or, has the food system and agricultural itself changed into

'producing' something more commoditized and sought after: is the undertaking of agriculture now to be about 'generating' data, information, and by extension in a capitalist economic system, control, profit, and trademarked technologies?

Chapter 4 Literature Review

The divine gifts of Agricultural knowledge: Hindu Religion and India

The birth of modern organized agriculture and the creation stories and mythologies of countless cultures across the world feature some aspect of agriculture and the ability of humanity to grow/produce food as being a gift derived from or given directly to them by the Gods; the gift of bestowed knowledge which underpins all human social action, and allows for life itself to be sustained, and thus, sustain the culture who received this divine gift of agricultural knowledge and abilities has the ability to sustain and reproduce itself. Within the historical and cultural contexts of India, the ancient scriptures of Hinduism provide the basis for food and agriculture as a divine gift from the Gods, and that gift of food comes from the Earth (isha.sadhguru.org, faithinfood.wordpress.com, independentsciencenews.org). Sadhguru has stated that:

"Transforming mud into food is agriculture. Human beings discovered this phenomenal process by observing plant life and harnessing it" (isha.sadhguru.org). Dr. Shiva notes that "Food is life. Food holds the contributions of all beings that make the food web, and it holds the potential of maintaining and regenerating the web of life. Food also holds the potential for health and disease, depending on how it was grown and processed. Food is therefore the living currency of the web of life" (independentsciencenews.org).

This culturally and religiously-derived set of practices and beliefs is still deeply embedded in the rural Indian community where field work took place, and informs much of what makes up Navdanya and Dr. Shiva's vision of sustainable agroecological practices.

Cauvin on the Mytho-historical origins of Agriculture

The work of French academic Jacques Cauvin has been highly influential in modern discussions of the historical and cultural origins of modern agriculture. In a review by multiple scholars on Cauvin's most influential and well-known work on the topic, 'The Birth of The Gods and The Origins of Agriculture' (2000), numerous scholars have praised Cauvin's work for its insights into the 'restructuring of the human mentality' that occurred between the thirteenth and the tenth millennium B.C., which Cauvin argued were expressed through newly emergent, religious ideas and symbols (2000:105).

Cauvin states that his own theory on the earliest development of agriculture "highlights the importance of cognitive factors, and the socio-cultural changes which result therefrom, as the principal motivation for the Neolithic Revolution" (2000:106). Cauvin makes the argument that there were 'cognitive changes' in human thought and organizing principles which led to the eventual creation of what he argues was not only the emergence of 'agriculture', but an 'agricultural economy' (2000). As organized agriculture emerged in the Fertile Crescent region in the Tigris and Euphrates river valleys in the 9th millennium B.C., Cauvin argues that these changes were due more specifically to social causes and factors, more so than merely economic ones. A "reordering of symbolic material", as Cauvin characterizes it—essentially, the emergence of organizing principles and human thought at a philosophical level. Anthropologist Ian Hodder notes the rise of the importance of the symbolic meanings derived from the birth of agriculture is linked to the birth of divinities. Hodder states that "the increased intervention in the environment associated with agriculture implies a human agency that is derived from envisaging the power of personal divinities. To be more specific, Cauvin sees it as very important that the 'Revolution of Symbols' occurs before the first agricultural communities" (2000:108).

This outlines the key idea underlying Cauvin's theory: that there is a religiously-inspired, underlying epistemological 'level' which underpins all of organized agriculture as we have come to know it; a 'myth/metaphor' level of agriculture which has been the foundation stone upon which all of modern civilization has rested and been built. Cauvin and commentators on his key works argue that this particular period in human history—approximately 12,000-9,000 B.C.-- the starting point of the 'Neolithic Age' which saw the emergence of organized religions, as a necessary pre-condition for taking 'control' and exercising power over the natural world. It is in the act of exerting and exercising control and power over nature which Hodder argues allow humans to externalize themselves from simply being a part of nature, but being both part of the natural world as well as having the ability to wield power over it (2000).

"Neolithic images are of supreme beings and they suggest a new psychology of the human being dominated by a divine personified force which looks down. The bull is seen as representing a masculine anthropomorphic god, and by confronting this, man's virility becomes productive and civilizing (p.124). Humans thus could see themselves as separate from external reality (p.209) and then act upon it so as to transform and domesticate. The revolution in action (the domestication of plants) results from the 'Revolution of Symbols'. The symbolic shift to the woman/bull system occurred before cattle were dominant in the middle Euphrates. The initial change was 'a purely mental development' (p.32). Hence the title of the book: it was the birth of divinities in human form that created the agency and the alienated sense of self (p.209) that are necessary for agriculture" (2000:108).

The 'Revolution of Symbols' discussed and argued by Cauvin, most notably his insights into the anthropomorphization of the divine, holds that this constituted a necessary human mental development, referred to as a 'psycho-cultural' development in human thought (2000). This development is held by Cauvin as the change which allowed for the earliest formations of organized agricultural practices as divinely gifted and inspired abilities which humanity can take part in. Myths and creation stories derived from religious doctrine create powerful metaphors which reference and represent 'creation', 'power', 'divine gifts', and 'knowledge' have been a dominant feature of the agricultural past and underpinned the foundation of the world's earliest emergent food systems. Modern agriculture in rural northern India still holds many of these traditions and culturally-derived practices. In this sense, the 'ancient' is still a modern practice, still holding a place in the contemporary world, and will have a place in the future as well.

The 'Ancient' is still 'Modern': the continuation of traditional agriculture

In many rural farming communities across the world, religious and culturally-rooted links to farming and food production are still maintained. Certain metaphors reflecting these ideas and beliefs were present in discussion of the history of Indian agriculture at the Navdanya farm in India, and are some of the main talking points of Dr. Shiva on agroecology as practiced in modern India today. A central metaphor which exists in much of the discussion of farming and agriculture as defined by Dr. Shiva and the Navdanya organization is that of the 'Sacred Feminine', and the central role and feminine aspects of farming as outlined in the 'Ecofeminism' concept (field notes, Sept 2017). In numerous rural communities around the world, farming is and has long been viewed as 'women's work', in that 43% of farmers in rural communities in developing countries are women (FAO, 2011). Shiva stated in a recent interview that "they've (women) ruled the world by serving the Earth, by protecting their communities. That's another kind of rule. Because the rule of the patriarch is a rule over; the rule of women is supporting and with. Women are co-creators with nature." (Pasanen, 2019).

Rural farming undoubtedly has a feminine aspect to it. This can be demonstrated to be a wholly modern, contemporary example of rural/agricultural communities in Northern India noted during field research for this work, and undoubtedly for many other parts of the world as well. The relationship with the land, with farming as a living, and agricultural production as part of a larger system still exists in the modern era; and is not something relegated solely to the historical past. Rural communities around the world still keep the practices and traditions derived from indigenous knowledge which have been passed down for generations, with women being the key 'transmitters' of culturally-derived knowledge (Kumar, 2016; Merotto, Sabido, & Békési, 2021).

Can lessons from the past become the guiding principles of the future?

It is the gifts of Earthly and divine knowledge, of the reproduction cycles of the natural world, of the seed and its inherent creative, life-producing potential. The ability to (re)produce food is in itself the ability to (re)produce civilization itself; it is the foundation stone upon which all other aspects of agriculture and civilization have been built. This creative power and ability has long been a knowledge viewed as something held under human stewardship via some form of 'divine contract'; humanities' role within the natural world was to nurture and take care of it (stewardship), just as much as it was within the purview of humanity to take nature under its control, and for its own ends. This is the point where a divergence has occurred: attitudes and approaches to agriculture informed by modern, tech-driven methods have seen the changing of views over where power over nature rests, and more foundationally, the role of humanity within it. We have gone from being 'within' that natural order into to projecting and situating ourselves 'above' it. Some are no longer content to be the stewards of nature; they intend and presume to be its master. This is the crack in the foundation of visions of what agriculture can be, and what it was. As concrete wastelands replace the natural landscapes of the Earth, nature is blocked out, an out-of-place and out-of-context aberration in such a landscape; the dandelion growing out of a crack in the concrete, sprayed with petrochemical herbicides for the mere fact that it proves that life finds a way, no matter how human blunders at exerting control over it.

However, this is not the only way forward into sustainable food futures, despite the implicit obviousness the prognosticators of technocratic visions of the future would tell the story. Religiously-based, culturally-derived approaches to farming and agriculture deeply rooted in the past, are imbued with strong futures visions for how to address current and pending issues related to food production and security. It is the intention of this thesis to demonstrate that non-Western approaches to farming and agricultural production which are not rooted in technological innovation and invention not only will have a future, but are just as much rooted within modern worldviews and ideologies as any other, and have similar—if not more—potential to offer real, viable solutions to the emerging issues of feeding a growing global population and addressing increasing levels of consumer demand for higher quality and a wider variety of foods.

Rising Dichotomies: Mechanistic vs. Holistic Worldviews and Metaphors (West vs. The Rest?)

'Modern commodity' or 'divine gift'?

The advent of what some might characterize as 'modern' agriculture—perhaps more accurately described as 'industrialized' agriculture—can be argued to represent a conceptual breaking point and separation of the link between land as sacred/divine gift to a commoditized object, used for the production of other commodities. While in rather stark contrast, the modern, Western discussion of food and food futures does not include much discussion about this feminine, mythological past, nor the implications it holds for our relationship with food and

nature into the future. Most discussions on the future of food—both internal as well as external to the futures studies academic and professional community-- are predicated and framed around the belief that scientific 'breakthroughs', new 'technology', and 'innovations' will be the 'only way(s)' to achieve a future without hunger. But therein lays both an assumption and an unasked—as well as unanswered—question: embedded within all of these technological marvels and the promises they pre-emptively make about their potential to eradicate hunger in the face of a growing global population, no one seems to be asking: Who will be the primary beneficiaries of these promised innovations and technologies—and perhaps as importantly—who will not? And moreover, perhaps the most salient question(s) of all: Whose future(s) are being conceived of in these technology-based futures visions? Is this truly the only future path for ensuring equal, sustainable, and quality food to the entire planet's growing population?

Relationship with the Earth and Land: Ownership vs. Stewardship

The exploration of opposing worldviews has been a key area to the research in this thesis. One of the overarching themes conveyed throughout this examination of varied approaches to addressing the future of food and food systems has been to examine and come to an understanding of the intellectual, cultural, and even spiritual understandings in which each approach is embedded. This approach seeks an understanding of the metaphors and myths which underpin them. It is obvious that Western, technology-based approaches have significantly moved away from the ideas and metaphors of both our ancient ancestors as well as many modern peoples throughout the world who still hold onto the ideals and practices handed down from generations of farmers going back to the dawn of organized agriculture. The language and the understanding of what traditional, indigenous, agricultural knowledge is and from where it is derived have gone from a 'divine gift' in traditional narratives into one in which 'The Gods' have been replaced within the technocratic narrative. Traditional knowledge is usurped and humanity itself can be said to have taken the place of 'God' in the narrative of creation and in 'gifting' of life itself through the (re)productive act of agriculture. The religious and mythological origins of agriculture and its associated knowledge of it as a gift bestowed upon humanity from the divine have been replaced by the proliferation and 'creation' of genetically modified and patented hybrids; modern science has written its own 'creation myth', one where the significance it once held for cultures around the world are now talking about 'stakeholders', 'producers' and 'consumers' are the nameless, faceless characters in their story. In seeking to re-write genetic codes, there is a more deeply implied attempt to re-write the stories behind the origins of agriculture, and along with it, the meaning food has beyond its mere status as a commodity to be produced, purchased, and consumed for sustenance.

'Farmers' vs. 'Scientists'—producing knowledge and food? Or producing commodities, data, and profits?

In numerous images of the entire discussion and presentation of the future of food, and particularly who is creating or living in these imagined futures, a strong dichotomy becomes clear: there difference often has racial, sexual, class and structural differences, as well as raising the much needed question of WHO are the people with 'knowledge' and/or 'expertise' in farming and agricultural futures? There are several emerging dichotomies here:

Caucasian/Dark skinned

'Scientist'/'Businessman'/'Entrepreneurs' vs. 'Farmers'—White guys in lab coats (indoors) vs. peasants (mostly female) in the fields (outdoors)

Growing food vs. Producing products/profits

Passing on Wisdom and Knowledge vs. Generating/gathering data

The Future of Food, Agriculture, and the Problems of World Hunger and Health: Facts, figures, Speculations and Solutions for feeding a growing world population

Key Trends Affecting Food Systems: Population Growth, Undernourishment, and Obesity

In attempting to understand the problems which are pertinent to the future of food systems and the continued production and secure access to safe and hopefully sustainable sources of food into the future, some facts and figures are a needed as a starting point, particularly related to the key issues which affect global food production. Population growth, urbanization, rural and urban poverty, climate change, and rates of obesity and malnourishment do to starvation and inadequate food intake all have a known impact on human health, and all have their own set of long-term implications and impacts on the future of food.

Many mainstream arguments and some expert voices in the discussion consider the central issue threatening food security to be population growth. The alarmists among some experts regarding the future of food production and food system have issued dire warnings that expected food demand in light of estimated population growth and growing consumer demand in developing economies will see a significant increase in global hunger, and that severe food shortages may be upon us as soon as the year 2023 (Sohngen, 2017; FAO, 2009). And considering current reports on global malnourishment and undernourishment, their fears may not be totally unwarranted. Sara Menker, founder of agricultural data tech company Gro Intelligence, argues that the actual time the planet will begin to run short of food is not measured in mass and weight, as the FAO measures, but based on the nutritional value dietary choices and preferences

which consumers in the developing world are beginning to make, most notably the increased demand and consumption of red meats, which are known for having higher associated production costs and carbon footprint (Dahir, 2017).

The increased projections of consumption of all meats up to 2050 has been a known and growing concern in relation to the amount of agricultural land and production which goes into producing feed (ourworldindata.org; Alexandratos & Bruinsma, 2012), and estimates of arable land usage and the rates of global production and consumption up to the year 2050 predict that a 70% global, overall increase in production levels will be required to continue to feed the world at the estimated rates of demand and consumption. The need for exports of other staples, such as cereals, sugars, and oils to developing nations, is all estimated to have significant increases to meet the predicted demands of 2050 (ourworldindata.org). 90% of the growth in crop production globally (80% in developing countries) is expected to come from higher yields and increased cropping intensity, with the remainder coming from land expansion. Arable land would expand by some 70 million ha (or less then 5%), with the expansion in developing countries by about 120 million ha (or 12%) being offset by a decline of some 50 million ha (or 8%) in the developed countries. Almost all of the land expansion in developing countries would take place in sub-Saharan Africa and Latin America (Goldberg, et al, 2021).

Questioning the dominant Narrative(s): Are Global Food Systems in Crisis?

It can be stated that one of the most pressing questions for food systems looking forward towards the future is: Is the world truly running out of food? And based on current projections and estimates of global population increases, urban growth, and global climate change, is a future of mass starvation and widespread famine inevitable, if not for major shifts and innovations in global food systems and production methods? Are some of the projections and estimates accurate in the supposition that the global food system needs to adapt and grow in the ways that technocratic proponents espouse to be able to feed 10 billion people by 2050? These are indeed highly complex problems, but is this an overly simplistic argument to assume that technology is the only way out of them? The continued productivity of the global food system is certainly a growing concern for protecting planet-wide human health to ensure the adequate production of food to protect against possible famines, food shortages, and mass-starvations and the social upheavals and unrest which could result of a collapse in the food system, or its inability to meet human food needs into the future.

There are numerous contributing, concurrent, and interlinked factors affecting the productivity of food systems which must be discussed together for an accurate overview not only of the current state of food production, but for mapping and imagining how things are likely to change in the future, both in the short and long term. The following issues of human health

(hunger and obesity), population growth, Demographic changes (Urbanization and rural flight), poverty levels, global climate change, natural disasters, automation, and technological advancement all stand to have an impact on the future of food and food systems. An outline of these contributing factors will be provided as a basis for the following examination of the future of global food systems and the alternative visions for it.

Health, Hunger, and Obesity in a Growing World

According to the FAO, 821 million people—1 out of 9 of global population—was malnourished in 2017 (FAO 2018b:ix). Both undernourishment and obesity are signalling a reversal of positive trends; resources from forests and fisheries, as well as from agriculture, are being consumed at far beyond sustainable rates, and 'business as usual' can no longer be the approach we use for producing and distributing food. And yet in a world where some argue that there will not be enough food for everyone, we currently have a situation where in fact, there is not enough for some, but far too much for others. Rates of overweight and obesity have tripled since 1975, with 1.9 billion adults and 39 million in the age 5-19 group being in these categories (WHO, 2021). The fact that there is a health and food-related epidemic of both extreme rates of malnourishment in some parts of the world and extreme rates of obesity in others represents a uniquely paradoxical aspect of the growing issues affecting the food system and global health.

These facts are a source of worry and contention about future developments and ways to address the issues. The U.N. estimates that the world's population will reach approximately 9.8 billion by 2050, and about 11.2 billion by 2100, according their "medium variant" projections (U.N. Pop 2017:1). While planetary population growth rates are expected to slow overall and regional populations (Europe, China) will gradually decline, the total population will continue to increase due to higher birth rates, lower infant mortality, and longer life expectancies in Africa and south Asia (FAO, 2018: 8-9). Both the ways and the places where the majority of people are living and where food is grown are areas where attention must be paid regarding food security. As populations expand, contract, and stabilize according to region, the food security and production of those same regions is not assured to be matching the needs of local peoples, particularly those from poorer regions, as well as places more likely to be affected by climate change and natural disasters.

Urbanization and the Demographics of the Future—Changing lifestyle demands and the shift from Rural to Urban population centers

The year 2007 saw a shift which fundamentally changed how humanity as a species lives and organizes itself, marking what could be characterized as a long foreseen—and finally realized-- achievement of a milestone of human civilization. This milestone was in the demographic and geographic shift in how—and specifically, where-- the majority of humanity lives. This was the year which saw the majority of people on Earth now residing in cities and urban areas, and it is a trend which has and will continue to have profound effects on how we live, work, and of course, how we produce and consume food. The trend of urbanization shifted to a majority of humanity living in cities and urban areas in 2008, with certain regions already having an urban population concentration of up to 70% in North America, Europe, Latin America, and the Caribbean (PRB 2007:10). In 2018, the global urban population has already risen to 55%, (U.N. 2018:1). Projections into the future estimate that this will grow to 68% by 2050, with the majority of that growth being in Asia and Africa (U.N.org Pop. 2018). As the global population becomes progressively more urbanized, and with the often rapid and increasing rates of urbanization specifically seen in developing nations, the world—particularly the global south-- is faced with the potential for both increased rates of hunger and continued poverty, which for many, merely shifts from being rural to urban. The FAO has reported that "Young rural people faced with the prospect of a life of grinding poverty may see few other alternatives than to migrate, at the risk of becoming only marginally better off as they may outnumber available jobs in urban settings" (FAO 2017a:v).

The global economic system is pushing more and more people from rural areas, which are the key areas globally for the vast majority of food production, and thus the foundation stones of all food systems. Fewer people directly involved with food production in rural areas can be argued to eventually lead to shortages in food production, and perhaps in major disruptions of food regional and even global food systems.

These shifts in where and how people are living will undoubtedly have an increasingly profound effect on the relationship between humanity and on production and consumption patterns and food systems into the future. As 'rural flight' has become a rising global phenomenon, numerous rural regions are facing labor shortages, while urban areas often have more and more inward migration (FAO, 2016). Comprehensive steps are needed to address rural poverty, and as economic development since the 1990's has shown, there has been an increase in the standard of living which has seen 1.6 billion of its inhabitants living above the relative poverty line, demonstrating that rural development has been, and will continue to be, essential to eradicating hunger and poverty (FAO 2017b:xi). As people become more separated from the places where food is produced, there is a developing and widening gap between urban and rural development. As increasing incomes and quality of living standards (middle class lifestyles and consumption levels) become available to more people, a unique set of demands is placed on regional and global food system, one which many experts have proclaimed to be unsustainable

without serious considerations and adjustments to how to produce, transport, store, and consume food, and what and how much we consume (FAO, 2015).

Urbanization—Poverty and hunger

Satterthwaite, McGranahan, and Tacoli have examined the issue of Urbanization and its implications for the future of farming and global food systems. The declining ratio of food producers to consumers is becoming an emerging issue within the context of global food production. As urban populations continue to grow, particularly with the rise of so-called 'Mega- Cities', defined as metropolitan areas with ten million or more people living in them (worldatlas.com), the U.N. estimates are projecting an increase of a billion global urban dwellers between 2010 and 2025, while growth in rural populations will remain relatively flat. These changes in where people are living also directly correlates to a reduced number of food producers as more people move to urban areas in search of the services, lifestyle, and preferred, higher-payment employment in services unrelated to food production, as well as ageing populations preferences for remaining closer to medical and other services which ate typically better in urban centers (2008:2909-10).

Under-nutrition is a growing concern in concentrated population areas, even as the types of foods in demand in middle and high income countries is increasingly energy-intensive to produce and generates more greenhouse gas emissions (2008:2809). The shift towards urbanization has been an essential step and a necessary component of economic advancement, be it globally, regionally, or for individual countries. While higher life-expectancy, better services and infrastructure, higher incomes and living standards, urbanization also has its downside. Heavy concentrations of people in many parts of the world have led to high infant mortality, highly localized unemployment, overcrowding, poor sanitation, racial and gender discrimination, slums and squats in many developing nations.

Poverty and the social problems which often accompany it can become concentrated and magnified in urbanized environments, just as much as the positive aspects of urbanization are often used as the 'measuring stick' of a nations advancement and social progress, as urban areas are often the seats of both financial and political capital, as well as becoming key social and cultural centers, as a sense of cosmopolitanism permeates more deeply into the national identities of city-dwellers begin to identify themselves more closely with the offerings of city life, gradually drifting from the values, beliefs, and ways of thinking associated with their rural past. In developing nations, government policies, infrastructural development, and overall public services often lag behind the rapidly growing and shifting needs of the newly urbanized populace, seeing the rise of slums, higher infectious disease rates, higher pollution, and urban poverty (worldpopulationhistory.com). The issue of the adequate production and access to food is a key

and growing concern related to the rise of mega-cities in the future, as urbanization and urbanized living becomes the standard for more and more people.

It appears to be an easy conclusion to assume that globally, urbanization will continue, and most estimates project that it will (un.org, 2018)—but it is not so easy to predict how it will develop and where, as there cannot be said to be a distinct and predictable pattern that is globally or regionally applicable. Different countries will urbanize in their own unique ways and at their own pace. But it can be assumed, so Satterthwaite and his co-writers argue, that "it would be expected that in nations with successful economies and rapid urbanization, there will be rising demands for meat, dairy products, vegetable oils and 'luxury' foods, and this implies more energy-intensive production and, for many nations, more imports" (2008:2814-2815). But on the other end of the spectrum of urbanization, income and development there can also be said that there is much less change in how people purchase and produce food. There are numerous areas of the world where urbanization has failed to allow for an improvement of access to adequate food or caloric intake and nutritional needs.

Poverty in rural areas

The World Bank estimated that in 2010, 78% of those considered extremely poor were living in rural areas (Olinto et al., 2013), and it has been noted that this type of concentration is common across geographic regions, despite differences in overall poverty rates (FAO, 2015a). Across all LMIC, a person living in a rural area is almost three times more likely to live in extreme poverty than someone living in an urban area (World Bank, 2013). This relative deprivation among rural dwellers is reflected in a wide range of socio-economic welfare indicators, particularly as seen in the lack of employment and income-earning opportunities in pre-dominantly agricultural communities. A given example is that of child malnutrition (measured by the prevalence of underweight in children under five years of age), which is worse in rural areas in virtually every country for which data are available (FAO, 2015a; FAO 2018:19).

"These disadvantages in rural areas are well understood in view of the almost worldwide process of structural transformation that has occurred over the past 30 years, which has led to a decrease of the relative contribution of agriculture to GDP. In many instances, this process has led to a reduction in the number of people engaged in agriculture, contributing significantly to urbanization (see Figure 1.9 a,b). At the same time, however, demographic dynamics are expected to result in a spike in the number of young people who will join the ranks of the labour force, particularly in rural areas. The pressure will be enormous for some regions, such as SSA and South Asia, where jobs are likely to be scarce. Without sufficient employment opportunities, this population trend may lead to faster rates of outmigration and urbanization, and possibly to conflicts (FAO, 2017a)." (FAOb 2018:19).

Increases and improvements in global diets and calorie intake— how will the increase in demand and a majority urban population affect food production and consumption? Can the Millennium Development Goals be met?

One of the simultaneously positive and negative consequences of increased urbanization is an improvement of the diets of people in 'Low to Middle income countries' (LMIC) and the ever-increasing consumption of calories and livestock-based and resource-intensive food sources in 'High Income countries' (HIC) (Drewnowski, et. al., 2020). This shift has seen a global decrease in hunger and under-nutrition, and an increase in lifestyle-related consumption patterns and habits for people in LMIC's. This is a positive and important trend, as emerging economies in poorer countries are able to have an increased caloric intake per-person and to diversify their population's diets. A diversified diet with higher protein intake is an essential part of addressing global hunger.

As lifestyle demands increase and a wider variety of foods become available to-- and expected by-- consumers to be available for import to a larger number of people globally, it must travel greater distances from 'farm-to-fork', which places greater stress on farmers and producers of food, and by extension, on the entire food system. The types of foods which are mass-produced for many parts of the world are of a different type and quality as they previously were. The world has simultaneously seen the paradoxical rise of parallel trends in food consumption, such as what have often been deemed as 'super foods' for Western markets/consumers, despite there being no set criteria to define the term, other than it referring to food with known or assumed health benefits, and is as much a marketing tactic as anything (livescience.com, healthline.com).

Diets—healthy and unhealthy

So-called 'super foods', which are praised for their health benefits and taste, are on the rise at the same time as processed snack foods, junk foods and fast foods are cheaper and more readily available and heavily marketed and consumed than ever before (Hill, 2018). While some sources of consumer demand have prompted some fast food chains to offer healthier options on their menus, recent research has speculated that fast food is actually becoming more unhealthy overall in the last thirty years (medicalnewstoday.com). While this is an emerging trend among some food vendors to offer some healthier options, fast food and junk foods are fuelling obesity and poor health globally, with food allergies and nutrient deficiencies attributed to increased fast food consumption (Cohut, 2019; Sushma, 2019). Thus many countries are simultaneously seeing an increase in both severe malnourishment and obesity in those same countries among poorer population groups. The 'healthy foods' trend seems to co-exist right alongside increasing rates of child and adult obesity.

Highly-processed foods, on the other hand, which are designed for longer shelf life and quick preparation, typically are high in added sugars, fats, and salt. These lower-cost food are increasingly found to be directly associated with higher levels of poverty and rates of obesity. This has been combined with a decline in intake of fruits, vegetables, and dietary fibres, and a moving away from more traditional and diverse dietary sources, particularly roots, tubers, and cereals. This "nutrition transition", which represents a major shift in how and what people across the world are eating, has highly problematic implications for human health, and for the pressure it places on food systems. A shift towards sedentary lifestyles has led to the rapidly growing rates of obesity among both adults and children, and is have becoming a particular concern in HIC's, with growing rates of diabetes and diet-related medical conditions on the rise. The increasing rates of cancers and of other serious medical conditions, as well as numerous medical conditions which are considered preventable, can be attributed to the shift towards urbanization and Western, urban lifestyle choices. Despite these improvements in the lives on large demographics, many of the Millennium Development goals have not been met in many key areas (FAO 2018c).

Income inequality and inequitable distribution/access to food resources—the true cause of global hunger?

Dr. Shiva stated in the first private session we had with her at the Navdanya farm in September 2017 that the issue of global hunger is not about inadequate levels of food being produced globally; rather, the issue at-hand is one of inequitable distribution of food, and the commoditized production and distribution models which it follows. Dr. Shiva stated that global food production currently produces enough food to feed a total global population of 14 billion people—double current population levels. The true issue behind global hunger is a complicated matter of unequal access to food, not specifically or exclusively an inability to produce 'enough'. The issue of global hunger and the extremes of inequality are also noted by the FAO and confirm Dr. Shiva's statement:

"Globally, food systems produce enough food for everybody, but not everybody has enough purchasing power to obtain sufficient food. This gives rise to the most extreme form of inequality, that occurring between those who have access to enough food and those who are forced to go hungry" (FAOa 2018:14).

Satterthwaite et. al also note the impact of urbanization on hunger and access to food, stating that "hundreds of millions of urban dwellers face under-nutrition today, although this is far more related to their lack of income than to a lack of capacity to produce food. There is a very large urban population worldwide with incomes so low that their health and nutritional status are at risk from any staple food price rise—as became evident with the rising hunger

among urban populations after the food price rises in 2007 and the first half of 2008" (Satterthwaite, 2008:2,809).

The question still stands about what approach would be considered the best or most appropriate for addressing the issue of food systems of the future, while at the same time, raising the parallel issue of inequality, which inevitably affects people's ability (particularly the poor) to produce, purchase, or access food, or land upon which to grow/produce their own. Within these questions, we can see a rising dichotomy of voices weighing in on not only how enough food can be produced for the global population of the future, but also, what is the purpose and primary function of the global and regional food systems: is it to produce enough food for people to eat and live in a healthy, nutritious, and sustainable way? Or is it to generate profits for international food corporations by producing commodity crops for sale and export in global markets? These approaches appear to have significantly divergent purposes. The question of the central purposes and interests which are served by each of these apparently opposing approaches to food and food systems, and their methodologies and implications for the future of food production on a regional and global scale are urgent concerns for the planet, as the opposing presumed purposes of creating food vs. creating profits represented in the emerging dichotomy must find common ground and reconcile on some level, if the will be hope to eliminate global hunger in the future.

The Global Food System and Commodity Production Economy: Is Capitalist Commodity Production and distribution of food the way into a sustainable future?

While it is one thing to conceive of and manifest new and innovative ways to 'grow', produce', or 'create' food, it is quite something else to redesign the seemingly pre-determined (and predetermining) pathways of food production, consumption, sale and distribution which is a pre-supposed and seemingly inescapable aspect of the Capitalism and the for-profit framework within which food systems exist today. Much of what makes up much of the modern global 'food system' exists today as a means by which to sell and transport food, as much if not more so than it is to physically produce it. Yet in many ways, it is exactly that which many of the emerging food production models hope to achieve: a system by which food is produced in a most 'efficient' way, which minimizes costs while maximizing profits. As the overall costs of food production within a Capitalist food system are coming to be calculated more frequently by input/output metrics of production and consumption costs, ranging from the amounts of water needed to produce crops, costs of seeds, herbicides, pesticides and fertilizers, cost of labor, etc., to the more often-cited, well-known, and useful term 'food miles', which is a key indicator in determining the overall 'carbon footprint' of the food production process—as well as an indicator of the actual, overall financial costs of producing food in this way.

A food mile is defined as "a unit used to measure the distance that a food product travels from where it is produced to where it is sold or consumed" (dictionary.com). Simply put, it is the transportation and other associated costs (storage, packaging, and/or refrigeration) associated with getting food from where it is produced to where it is sold and/or consumed. Reducing food miles and similar associated costs is a central element in many recent trends and futures-focused developments in food production. Increased urbanization and city living for most of humanity—a trend which is set to continue—(worldpopulationhistory.com) combined with the reduction in rural populations, which by extension means fewer people working in rural-based agriculture, is also a significant factor in the desire to 'relocate' or develop significant food producing capacities into urban areas. These combined factors do raise the question of the need for a shift in food production models, and the most efficient way to accomplish this is to move the food production to where people live—in to cities and urban areas. It is here that the discussion of urban planning and technological innovations begin to take root and become most relevant to the discussion of food system futures—but the needs of rural communities must also be considered in this process of upheaval, relocation, and the endless quest for profits; true sustainability in food systems of the future must be rooted in an understanding that rural communities will continue to exist, and must have a voice in creating the food systems of the future, if ending global hunger and achieving true sustainability are to ever stand a chance of being achieved.

Futures Thinking and its contribution to addressing the world's food crisis

Embedded within all of these technological developments and innovations for the future of food and agriculture we can see the deeply ingrained logic, mechanisms, and worldviews indicative of the late-stage Capitalist paradigm; buried beneath the drive for evermore technological 'solutions' as the only presumed way to move towards the future, we can see revealed the heavily burdened, truncated, held back, and significantly slowed down vision which these 'used futures' produce, as they dictated by the powerful lobby of the petrochemical industry giants and the mass-produced commodity crop production model and those who profit from it, which is reflective of what is taken as 'standard/best practice' for optimum farming techniques and practices in many parts of the world. The U.S. and Europe have been instrumental in implementing these policies and standards of practice, particularly guided by those corporations with vested interests in the future of agriculture. Large companies like Monsanto have made great efforts at patenting and genetically modifying life and living plant organisms, and the very processes by which it replicates itself. This is the definition of what Dr. Shiva refers to as 'Biopiracy' (Shiva, 2012). Large corporate interests and high-profile billionaires are buying huge tracts of agricultural land, backing and investing in new agritech industries, and seeking to assert 'guidance' (if not outright and direct control) over the direction which food and food systems will function in the future. The promise of ever-increasing technological advancements and a world continuously micromanaged by technical processes,

monitoring, assessment, and efficiency have shaped this worldview, and are underpinned by powerful metaphors of the desire to exert dominance over nature and natural processes.

Those who resist these neo-colonial incursions into traditional farming methods, and see nothing 'natural' in the process of seeking dominance over nature, find their voices drowned out by more dominant approaches and actors, or are systematically excluded from the conversation of how food system of the world can—or 'should'-- be. Technology-based approaches to the future of farming and achieving the (hopefully) universally desirable and preferred future of sustainable global agriculture, capable of feeding the entirety of the planet and eliminating human hunger across the world, dominates the thinking of many when it comes to determining preferred agricultural methodologies.

What possible futures are there?

And yet a key question in the discussion seems to go almost completely unasked: Are these the only possible futures for the farming and food production, and for achieving the ultimate goal of a sustainable agricultural system? Have dominant worldviews and the selectively chosen paradigms of modernity limited our choices, narrowed our perspectives, and made us over-emphasize and exaggerate the promises of technology? The apparent preference in the discussion for the 'technological' over the 'biological' seems to allow for a one particular worldview to prevail over others, leaving the possibility of it being considered a viable possible future excluded from the conversation. This mirrors the social, economic, and political exclusion which the poor and marginalized worldwide endure. Dominant and powerful voices from equally powerful actors and their socio-economic interests often shape and direct the narrative, and thus, essentially control the entire paradigm.

Opening a space for new possibilities

How can futurists create a space for new or excluded ideas, discussions, narratives, and methodologies which do not 'fit-in' with the tech-heavy proposals and solutions which constitute the majority of the approaches to the future of food and food and agriculture? Finding a place in this future for the small-scale peasant farmers of the world seems a far cry from the hyper-futuristic, tech-based solutions and scenarios and currently dominant commodity crop production models which grab headlines and promise a future free from hunger and the ravages of climate change and natural disasters. Despite these mostly promising images of the future, the present reality forms a rather different picture. The facts are that even right now, the majority of the world is fed by small-scale farmers, with the FAO citing that "family farmers" currently produce at least 56% of global agricultural output (FAO: 2014a), with variations determined regionally. Even in the United States, 84% of agriculture is done on family farms. It has been noted elsewhere by Dr. Shiva and other sources that between 70-73% of the world's food are in fact produced by small, family-owned/operated farms (Chandrasekhar, 2015).

Stereotypes of the rural poor

The perception of the small-scale peasant farmers of poorer regions of the world as being those who in fact already currently do feed the majority of the world's people—and will likely be able to do so into the future-- stands in rather stark contrast to what in discussed in corporate boardrooms, university departments, and research laboratories, and indeed, by futurists and their prestigious academic journals. In a world both physically far away as they are logically far-removed from this on-the-ground reality, the power relations embedded in the narrative are made visible at these rare moments; and who gets to have a voice in the discussion and a 'seat at the table' regarding the future is something worth considering when addressing a topic as vital as the future of food production and security. Farming is not merely about the production of food; it is about the sustainability of life itself. Intertwined within this ability to produce food and sustain life is also the ability—which creates the desire among some-- to control it. The rise of concepts of 'ownership' over things which have previously been considered part of the human or intellectual 'commons' has crept in gradually, introducing concepts such as 'Intellectual Property Rights', thus making human knowledge over the ability to guide and control food—and life—a reduce them to privatizable and commodifiable 'assets' to be controlled and restricted from common use, and for the common good.

Chapter 5: Research. Future Trends and Developments—An Analysis of the Future Impacts of new technological approaches to Food Futures and those of Agroecology

Exploring 'Alternative' Food Futures Approaches: the approaches of Science and Technology

In discussing the Future of farming and agriculture, it is an important to frame the discussion around other developing and observable trends not only in direct reference to the physical production of food, but just as importantly, where it is produced. Where and how the majority of the world's population lives and what those urbanization trends indicate for the future is that potentially tremendous shifts are coming and are required in the physical roots of food systems of the future. Research and analysis of recent trends and developments in the areas of agricultural alternatives and different food production methods have produced very promising and useful possibilities for changing the way the world produces food and feeds its people.

Some argue that these developments are crucial for the future of food and agriculture and offer detailed plans and strategies on how to address these emerging issues. The often-cited claim is repeatedly made that there will be inadequate food production via conventional farming methods by 2050, due to an increased global population of up to nearly ten billion, as well as increased consumer/lifestyle demand for more diverse foods and higher per-person consumption of food eventually exceeding current levels. This in turn has prompted everyone from

credentialed experts in food systems developing detailed, multi-approach plans for addressing the future of food systems and other approaches such as expansion of genetic engineering research and synthetic biology (Waite, Hanson & Ranganathan, 2019; Vickers, 2019) to eccentric and opinionated tech and airline billionaires wishing to impose their college-dropout inspired dystopian ideologies upon us, telling the world 'what must be done' to save the world from disaster and starvation, as some of them are simultaneously buying up large sections of agricultural land through their 'charitable' foundations and working to patent all the technological 'fixes' and everything else along the way, and make a substantial profit from it all in the meantime by totally unconvincing coincidence (Miley, 2017; Malkan, 2021). Emerging technologies have been in the works by a myriad of sources which hope to address these future challenges, and several of the leading, trending approaches and technologies in this area will be examined and analysed, to create a contrast with the organic/agroecological food movement as promoted by Dr. Shiva and practiced in Northern India, for the purposes of a creating balanced perspective.

Following is an overview of the two leading major developments in urban-focused food production (vertical/indoor agriculture and animal and/or plant-based protein replacements), and assessment of their viability for achieving preferred futures for the production of sustainable, healthy food sources, particularly for newly emerging urban populations. They are examined here for their potential future benefit and viability to the global food system, with discussion of the potential benefits as well as current and future challenges within each innovation. For the purposes of length, the comparative analysis has been limited to these two, as they are the most discussed and currently most viable developments in food production

Gardens in the Sky: The Promise and Limitations of Urban Agriculture, Controlled Environment Agriculture & Vertical Farming

'Vertical Farming'; essentially, the production of food in vertically stacked, indoor greenhouses and/or warehouses, is in the early stages of limited implementation in some cities around the world (Jacob, 2017), and has the potential to viably producing certain types of crops, particularly leafy greens (lightsciencetech.com). Vertical farming is arguably the most well-known and futures-oriented food production model of what is more widely referred to as 'Controlled Environment Agriculture' (Mattson, N.D.). The common mode of implementation of nearly every vertical farming platform/model has been that of indoor farming, with some limited implementation of rooftop farming as well. These have been modelled primarily in urban areas, with the primary goal to bring food growing to where the majority of people will reside in the future, which is cities and urban areas. The hope in bringing vertical farming methodologies of some crop varieties into cites and urban areas is in reducing external resource inputs related to storage and transport costs of food; essentially, to greatly reduce the problems of food spoilage during transportation, and minimizing or even eliminating 'food miles'.

Understandings and definitions

Having some cross-over elements in common with Controlled Environment Agriculture, vertical farms, peri-urban farms, and roof top farming are among the most commonly known and the most currently implemented early methodologies of what is more widely referred to as 'Urban Agriculture' (Rangarajan & Riordan, 2019). Some futures conceptions of this possibility envision the top floors and rooftops of every urban high-rise having its own vertical farming gardens, producing food for residents of the buildings and for local communities with the surplus (ecofriend.com). There have been numerous start-ups in several locations around the world doing highly innovative and interesting work in this promising field. From technological innovations which include 'dirtless'/'soiless' plant growth, the possibility of significantly reduced water usage in plant growth and maintenance, protection from adverse weather conditions more organic crops and less pesticide use (Leblanc, 2020), transportable modular farming units, conveyor belt systems, hydraulic platform systems, and moving levels and platforms which rotate the crops to optimize light exposure, water/moisture intake, and optimize plant exposure to preferred temperatures. Some of these companies are already claiming they can produce both higher yields and faster crop growth rates than conventional methods (Adams, 2017).

The promise of Vertical Farming/Indoor Agriculture

The potential applications and production yields for vertical indoor farming systems is certainly significant. One of the key arguments in favour of widespread implementation of vertical farming is reduced external inputs, such as 'food miles', the measure of how long/far food must travel from 'farm-to-fork' (Harris, 2022). Food which travels less distance, the arguments is made, will reduce the amount of money, labor, and resources necessary to process, package, store, and transport the food. The possibility to drastically reduce (or in some cases eliminate) the need for any form of vehicular transportation in the conveyance of food from production site to the market or kitchen table is significant. However, there are other important considerations which still must be addressed in the long-term if vertical/indoor farming and other types of urban agriculture are ever going to reach levels of productivity and efficiency which will make them both financially viable and environmentally sustainable.

Limitations: questions of Environmental Impact, external energy inputs, long-term sustainability

Under current technological limitations, only some types of crops can be effectively grown in vertical farming conditions, both in terms of input costs and in regards to what crops can effectively be grown in indoor conditions. Certain crop varieties, typically those with deep root systems, cannot be effectively grown outside of soil (Piechowiak, N.D.). Many companies are focusing on the production of 'leafy greens' in their vertical farms, as they pose fewer obstacles to growing viable crop yields and can be grown without soil. Despite the savings in money and resources in some areas of expenditure, which have been the primary indicators for

the long-term viability of the current and expanded role and utilizations of vertical farming in the future, the cost of other 'inputs' also currently make it far more expensive to produce food in vertical farms than it does using conventional methods (Michael, 2017). The electricity costs for the electric/artificial lighting, even in using high-quality, long-lasting LED lighting, is more expensive than utilizing nature's most generous of natural resources—the sun—to grow and produce crops. Dr. Jonathan Foley notes the irony in proposals to make indoor farms carbon neutral by utilizing renewable solar energy, stating that: "These indoor "farms" would use solar panels to harvest naturally occurring sunlight, and convert it into electricity, so that they can power…artificial sunlight? In other words, they're trying to use the sun to replace the sun" Foley, 2018). It is a salient point to make in demonstrating that much of the technological innovations for farming are in essence attempts at reinventing the wheel, and over making it significantly more complicated while they are doing so.

Crops without 'dirt'?

'Dirtless'/'soiless' systems also must provide nutrient substitutes for the growth and sustenance of the crops, something nature provides for free, particularly when soil health is well maintained in holding a balance of beneficial microbes and micronutrients (Miller, 2019). Plants draw nutrients from the anaerobic bacteria and chemical and elemental compounds present in healthy soil. The need for substitute natural sources with artificial sources of the prerequisite nutrients for crops to grow could be a contributing factor in the whether or not vertical farming will be viewed as a viable long-term alternative or contributing source of agricultural production. Additionally, questions about the potential lack of nutritional content in plants grown without utilizing soil may pose a troubling question regarding the health benefits of consuming crops grown in this way (Miller, 2018).

Current trends and Visions of the future: The green-topped city skyline

The concept of building 'Plantscrapers' (Furness, 2017) in the future—inner-city high-rises with the entire top floors being dedicated to vertical indoor farm and/or rooftop crop production—are an image of the future which is strongly advocated and envisioned by those who believe in the possibilities presented by vertical farming, Urban Agriculture, and Controlled Environment Agriculture methodologies for what cities might look like, and how these new food systems would function in urban spaces. Green rooftops are a current trend also seeing continued growth and indicate proliferation of movement in this direction, with some cities around the world mandating a minimum percentage of green rooftop spaces to help improve air quality and making cityscapes more green (Petrass, 2022). Inventive designs incorporating both 'the green and the gray' of the rural and the urban of the push and need for more urban agriculture can be seen in the design of Plantagon's 'World Food Building' design concept, intended to be a functioning model of a city-based Plantscraper (Rogers, 2017; Plantagon.com). Whether or not technological developments can be made which can overcome the notable and currently unavoidable hurdles in the form of large start-up costs of construction, equipment,

maintenance, training and staffing, and massive external energy inputs of Urban and/or Controlled Environment Agriculture models of food systems based in the cities of the future remain to be seen, but hold the promise of at least a partial solution to positively impacting the growing food needs of expanding urban populations in the future.

A Futures vision of the Paris skyline. Petrass, 2022.

Lab-grown meats & Protein alternative: Bioreactor or Soy Burgers for dinner tonight

Sometimes also referred to as 'clean' or 'ethical' meats, also 'in-vitro' meats, 'cultivated meats', and even 'alt-proteins', the potential uses for lab-based/grown protein replacements for beef, chicken, pork, fish, or other meat products is a tremendous one, with noted market growth and a proliferation of companies focus on this space and countries making investments in the technology (Griffin, 2019; Figueiras, 2021). The market for plant-based alternatives to animal products and for meats/proteins sourced from animal cells and grown in large vats referred to as 'bioreactors', as opposed to the traditional or commercial farm-raised animals has the potential for significant disruptions in both the markets and production methods of meat products across the industry.

Leading developments in 'Alt-Meats'

There are two key approaches to the issue as illustrated by a cursory examination of some of the leading start-ups in the race to put lab-grown proteins on every table. These are: 1. Meats/proteins derived and grown from living animal cells taken in-culture, and 2. 'Meat-replacement' proteins which are wholly derived from plant-based protein sources. For the purposes of the overall discussion, the term 'lab-based proteins' will be intended to encompass both of these particular approaches; as they essentially have the same goal and end-point with only slightly different approaches, i.e., comparing conventional animal-based meat (ABM) vs. cell-based meat (CBM) vs. plant-based meat (PBM). The discussion of them will not make further distinctions between these two new approaches, as both ultimately seek to reduce and/or eventually eliminate the consumption of conventional animal protein sources and factory farm models of meat production (Rubio, Xiang, & Kaplan, 2020).

The growing market for protein alternatives

According to many news headlines of recent years, there are no less than a dozen companies working towards being the first to have a 'clean meat' product on supermarket shelves by the end of 2018 (Carrington,2018). Another more recent source from 2021 names at least twenty six companies who have entered the industry, and 2021 marked a 5 billion U.S. Dollar level of investment in alternative proteins (Fusaro, 2021; Nunes, 2021), demonstrating a genuine interest in making lab-based replacement proteins a viable and commercially successful option to address the world's constantly growing demand for consuming animal proteins. Interest has been 'cultivated' within the technology and start-up sectors interested in the future of food, and several major conventional meat companies have also invested in this new venture, most notably Tyson Meats and Cargill. Lab-grown protein companies have also seen a six-fold increase in investment from 2020 to 2021 (Carrington, 2021).

What's in a name? Debating what 'meat' is and the social impact of the ethics and consumer choices in alternative proteins

The debate over what to call various 'protein replacement' products has already been a hotly debated issue between proponents or laboratory-produced sources and many in the conventional livestock industries. There have been back and forth spats and even lawsuits and proposed legislation over the definition of 'meat' itself, and what distinctions between what is considered 'real' meat or not should be made regarding labelling of such products on grocery store shelves (Pampuro, 2019), often resorting in emotive name-calling and implicit pokes at the opposite sides arguments and products. Proponents of conventional meats have often referred to lab-based proteins as 'fake meat' (Akhtar, 2016), and numerous lawsuits around the world have already taken place which have sought (successfully in some cases) to prevent lab-grown proteins from being called or labelled as 'meat' in grocery stores (Nicholson, 2018; Oatman,

2018). The conventional meat industry has begun to take the steps it deems necessary to protect itself from what it perceives as an encroachment upon its business as usual approach.

The morality of meat

A significant aspect of the debate current is the moralistic, emotive, and explicitly judgemental language used by many who hold strong opinions on one side or the other. There is an implicit back-handed slap against conventional meat production when referring to lab-grown proteins as 'clean' meat; it leaves the often unspoken but resoundingly clear intimation that conventionally-produced meats are inherently 'dirty', which by extension includes those who produce, sell, and consume these products as also carrying the moral stain insinuated in the label. Some proponents of conventionally sourced meats from animals have not only lobbied to prevent it from being called 'meat', they have referred to lab-produced proteins as 'Frankenmeats', characterizing them as 'unnatural' and 'synthetic' (Coolidge, 2018; Shiva, 2022). The emotive arguments from both sides have personal undertones woven into them; farmers, meat packers and processors, and those invested in the industry as it currently exists see their opponents in the argument seeking to undermine their livings, and impose upon them a 'meatless future' informed by vegan/vegetarian ideologies and ideals. Those who argue for major changes in the amount of meat consumed and produced globally or hope to see an end to the consumption of animal products see the shift away from conventionally produced meats as the only way to avoid environmental catastrophe and achieve true sustainability in food systems and avoid hunger in the future. Advocates of agroecological perspectives also weigh in on the topic, making the argument that it is possible to move away from factory farming of livestock animals with a "less but better" philosophy for meat production and consumption (Sahlin, et al, 2022), and sustainably and at-scale switch to agroecological farming, which includes the livestock raised on pastoral lands which would not be suitable for other uses, thereby making the best and most sustainable use of the land, at a fraction of the cost and far more sustainably than either factory farming or lab-grown proteins can offer (Morrison, 2019).

Environmental Impacts

There is some evidence that indicates the widespread implementation and switch-over to producing and consuming lab-grown proteins has the potential to drastically reduce the environmental impact and footprint caused by the mass-production model of the factory farming industrial system. The UNEP cites that livestock production and grains grown as animal feed account for approximately 32% of total planetary methane gas emissions, noting that population growth, economic development, and urban migration are drivers of the unprecedented demand for consumption of animal proteins, which is predicted to grow further as global population approaching 10 billion by 2050 (UNEP, 2021). Even a partial switch-over to lab-grown proteins and plant-based alternatives could have a tremendously positive environmental and health impact with regard to Greenhouse gas emissions via the reduction in land and crop usage dedicated solely to the purpose of producing animal feed and reduced antibiotics, as there is also a

projected doubling of meat consumption levels by 2050 (Latimer, 2021; Newton & Blaustein-Rejto, 2021).

Setbacks and limitations of current technology

However, other studies have suggested that switching to lab-grown meats may have other often overlooked and glossed over serious potential drawbacks which may prove difficult or impossible to overcome with existing technologies. A major study conducted by researchers at Oxford concluded that overall climate impact of cultured meat vs. cattle hinge on the type of emissions each approach produces, and the overall long-term impacts of each. The study notes that under current technological limitations and production methods for lab-based proteins, even accounting for likely improvements in the overall technology and production process, far more damaging and excessing Co2 emissions will have a far greater cumulative, long-term effect than that of methane, which is the main 'culprit' gas emission fixated upon by the advocates of a widespread switch to lab-based protein sources (Lynch & Pierrehumbert, 2019). Another recent study examining the environmental, nutritional, and potential sustainability of five different meat alternatives concluded that there remain widespread expectations and a reliance upon technological breakthroughs which have yet to be achieved, which come at the expense and disregard of other currently existent and viable alternatives, and rely on bringing about significant shifts in consumer behaviors, expectations, and consumption patterns. They note that

"The most sustainable alternative(s) suffer from relative neglect while many resources (attention, money, human resources, scientific capacity) are spent on technologically challenging and societally complex options with a lower sustainability potential. The focus on high-tech alternatives such as cultured meat, highly processed PBMA and algae may stem from deep-seated assumptions about the feasibility and desirability of high levels of control over production and intellectual property, and on highly integrated models of industrial organisation" (Van Der Weele, et al, 2019.

<u>The Meat Market of the Future—the 'Mixed Bag' Approach Scenario:</u>

Envisioning the market place of the future regarding the sourcing of meats and proteins is a particularly interesting area for speculation. Opinions have a tendency to be somewhat polarized, as the many of the leading voices tend to have vested interests or an ideological stake in the future of one type or source of proteins versus another. The issue is no doubt an emotive one; discussions tend to be heavily one-sided, with those who are 'pro' one side or the other claiming that in the future, their preferred approach to proteins will be totally replaced by the other. And as noted above, there have been specific efforts already taken as pre-emptive measure in some areas in the form of lobbying efforts to protect the current meat-farming industry from the encroachment of lab-grown protein by demanding that lab-grown protein not be allowed to call their products 'meat'.

Those who are invested in the industry have very obvious biases, and many appear to be taking an 'either/or' approach to the future of protein sources for the ever-expanding market, despite some scepticism that the future market for 'alt meats' might be over-hyped (Campisi, 2022). But the realities of the future of meats/proteins will likely (and hopefully) be much more of a 'mixed-bag'; a blending and a meeting of personal tastes and preferences for all sides being catered to by producers and suppliers of all sources of proteins, be they ABM, CBM, or PBM. Just as the market and producers/suppliers have risen to the challenge of meeting the demand of vegetarian and vegan products and lifestyle-based consumer food choices, so too will the protein industries on both sides of the spectrum likely rise to meet the demands of a variety of personal tastes and preferences. Whatever separate labelling guidelines are agreed upon and implemented, it is reasonable to envision products which cater to the tastes and preferences of all as both preferable for consumers as well as producers and suppliers. A balance and parity of market share and competition between all sources and producers can be easily envisioned, leaving neither producers nor consumers with the feeling that they have 'no choice' in what they choose to consume for dinner. Choice and variety for consumers will remain highly important, which may also be increasingly difficult if present trends of market consolidations and buy-outs in the meat industry continue; many of the same companies involved in conventional meat-packing and production are the same companies heavily investing in and/or funding alt-proteins/clean meats companies and research, such as JBS, Cargill, Tyson, and National Beef controlling over 50% of the chicken, pork, and beef markets in the United States, something advocacy groups, farmers, and The National Farmers Union see as a troubling development which undermines both the interests of farmers and consumers (Held, 2021; Cudmore, 2022). Additionally, Tyson and JBS have begun to diversify and expand into also providing plant-based alt meat products. This could lead to even further market consolidation in the future, as the larger companies can out-compete and eventually swallow-up the competition, buying out competitors and simply keeping the name of what was once a competing product (Smith, 2019; Hirtzer, Shanker, & Batista, 2021).

A trip to the meats aisle at your local grocery shop in the near future could see the products from both lab-grown and farm-raised products on the shelves, side-by-side, with plant-based alternatives close by. Each will have clear labels, specifying its source and how it came to be there in the shop shelf. Regardless of whether the lab-grown product will be allowed to bear the label of 'meat' is a point that remains to be seen, but both products will have equal shelf space and advertising available to them. Labelling that clarifies source and production method can be seen not as one side or another attempting to 'misrepresent' what they are selling, but merely as an indicator for the discerning consumer to have the ability to remain fully informed about their own choices of what to buy and eat. Just as milk is sold on the same shelves right next to the soy 'milk' and other milk alternatives, each product will be there with the required labelling, allowing customers to make the choices they want according to their own preferences, tastes, and ethical/moral stances as it pertains to protein sourcing.

Who gets to have a future? Shaping and sharing narrative space in the future of food systems

The future of agriculture appears very different depending on the particular 'footing' of the observer, and the perspectives of those who support and/or advocate for one side or the other. Lab-coated 'experts' in cities and laboratories, financial investors in three-piece suits in corporate boardrooms in high-rise office buildings certainly have an urban-centered vision of the future, with food being a high priority among those visions. Food grown indoors in labs and under artificial growing lights in fully controlled conditions is the goal, a future where food is fully under the dominion (and dominance) of humanity, where doubt, loss of control, and the external world can no longer interfere. This type of future seems to be the preferred one for advocates of the technology-driven, mechanistic worldview. But what are the preferred futures for those who believe in an entirely different approach to food, farming, and agricultural futures? What if we looked at the visions of the future for how the vast majority of humanity and of rural farming communities outside of the city limits see the future of food and food systems? Can an inclusive future be envisioned that not only includes rural communities as fully active participants in their own future, but also the authors of their own narratives and visions? Can the urban technology-advocating 'experts', scientists and industrialists come to see rural farmers and communities as more than mere unfortunate 'victims' of circumstance and adjust their views of them to be more than mere 'tag-alongs' or collateral damage of the tech-driven future they see as inevitable, and make it possible for rural communities to have a voice in the types of futures which they would find preferable? And, can the rural and urban, the Agroecological and the Tech-based visions of the future of global food systems find common ground, and recognize that their differing vision of 'how to get there' both share the same goal of being able to provide quality food for all of humanity?

This thesis will now discuss the original fieldwork conducted at the Navdanya Bija Peeth Biodiversity and Conservation Farm in rural north India. The experiences there and specific learning about the principles of Agroecology as a modern vision of what the future of food systems, based on ancient principles and thousands of years of lived practice, are taken as a representative example of the visions for a sustainable future of food and food systems can be from the perspectives of rural and/or indigenous communities.

Experiences on the Navdanya Farm: Fieldwork

Field research was conducted for this thesis, as previously noted, at the Navdanya Bija Veedyapeeth in northern India. The farm is located approximately 45 minutes north of the city of Dehradun, in the state of Uttarakhand. Time spent as a 'bijak', or 'seed keeper', while participating in the 'A-Z of Agroecology' training course was the basis of the fieldwork part of this thesis. The research was done through the lens of anthropology/ethnography, specifically with the Ethnographic Futures Research perspective. These observations function as the basis upon which a Causal Layered Analysis of the future of food and food systems will be constructed, with the specific farming methods, systems of producing food, the worldview of Agroecology and Navdanya, and the Myths and metaphors rooted in Hindu religion and Indian cultural beliefs constituting the representative levels of the CLA. This CLA of Navdanya will serve as the representative example for the comparative analysis between technology-driven visions of the future or food and food systems, and the modern viewpoints of practitioners and advocates for the use of and return to ancient, traditional farming methods, and how they can be a viable alternative to a sustainable food future.

Fieldwork as Ethnographic Futures Research: Time at the Navdanya Farm

As discussed earlier, part of this thesis has been conducted as ethnographic fieldwork to form the basis of the comparative analysis between visions of the futures of food systems. This fieldwork has been conducted through the lens of 'Ethnographic Futures Research' (EFR) as developed by Textor (1980), and expanded upon by Sauyaq & Gordan (2020) to work with indigenous communities in developing sustainability indicators. The choice of EFR as a methodology for observation and understanding allows for an examining of culturally-specific perspectives of the future creates a space where these visions can emerge during the course of ethnographic research.

This section of the research chapter will outline the ethnographic research conducted at the Navdanya Farm, as an example of a north Indian rural/agricultural community, through the perspective of EFR. This has been done in order to examine specific culturally-derived viewpoints of potential futures of food production and food systems, as advocated and understood under the rubric of Agroecology as it is envisioned and practiced by Vandana Shiva and the Navdanya organization. The intention is to form an understanding of its practice in the

present, and also understand the specific visions of how it might be practiced in the future both in India and elsewhere. Most importantly, it is intended to act as a guide for how alternative visions of food systems futures might stand as a challenge to dominant, Western and technology-driven narratives and worldviews of the future of food.

This section will discuss reflections from field notes taken during ethnographic research via participation in the 'A-Z of Agroecology' course at the Navdanya Farm. Descriptions of daily life, responsibilities, classes, and learning that took place there all were intended to make Agroecology a lived experience, showing it as a viable means of sustainably producing food in the contemporary world, derived from the ancient practices of farming as it has been practiced since the early Indus Valley civilization, and to also show that its modern practitioners also have a scientific basis for making an argument that Agroecology can be viably utilized to bring about . This work hopes to demonstrate how farming and food systems function in the worldview of the Navdanya organization and Dr. Vandana Shiva, and the local farmers of northern India. It is the intention of this chapter to illustrate the lived experience of Agroecology as methodology for farming and agriculture, but also a philosophical approach to a potential futures vision of the future of establishing sustainable farming and food systems regionally and globally.

Traveling to and arriving at the farm and first impressions

Field notes: August 31: "Got up early to go to the train, and again was lied to by the taxi driver (I think the fifth time since being in Delhi), who told me the metro wasn't operating to get to the train station. But, I wasn't in the mood, so I paid the quadruple-white-guy-price for the train station, and began the long journey to Dehradun. After getting my seat next to the largest man I have seen my entire time in India, I adjourned myself to sitting on a cooler in the connection area between cars for the remainder of the journey, which turned into 8+ hours. Didn't get my pre-paid meal… Arrived there at the station, and met another person who was obviously on the way to the same place as me. Her name is Jesse, she's an American woman in her late 20's, and we agreed to get share a taxi to the farm. We arrived about 50 minutes later, greeted by the office manager, and shown to the rooms. Got settled in and had afternoon chai, then a nice first dinner. Got to take a quick walk around the grounds around the office. It's a really pleasant place, I'm looking forward to the course and the time here."

Facts about The Navdanya Farm

The Navdanya farm encompasses a total of 52 acres of total land, including mango and lemon orchards, farmland, a seed bank, a medicinal herb garden, a soil laboratory, and accommodations for the Navdanya community (Navdanya.org). The farm was started in 1994 in the Doon Valley at Ramgarh Village, about an hour's drive north of Dehradun City. The 'Earth University' (Bija Vidyapeeth, Hindi for 'Seed Learning Center') was established in 2001 as a center for learning about the tenants of Agroecology and biodiversity, based on the preservation of ancient practices of traditional farming methods and the ideology of farming in India. The ethos of Earth University is strongly anchored in Gandhian philosophy, advocating nonviolence towards all sentient beings and the Earth, as well as promoting living cultures and living economies in the face of a collapsing, unsustainable global environment (Navdanya.org).

First day of A-Z of Agroecology Course and Opening Ceremony

Dr. Shiva and the key organizers officially open the A-Z of Agroecology Course

Field notes: September 1: “We had the first day today, starting the day and the course with an opening ceremony of the main organizers, and a keynote speech from Dr. Shiva. We were organized into two main groups for which of the two gardens and ‘shramdaan’ duties will be divided. The mood seems up-beat, and meeting the other participants has been refreshing. I met my roommate today, a Frenchman and naturalized U.S. citizen who has been living and working in New York City for over twenty years. We dove right into things, having an additional talk in the afternoon with Dr. Shiva, as well as with several of the other founders of the Navdanya farm.”

The Navdanya farm office and dining hall during a late monsoon season rain.

Journal entry, September 2: “The rain here is pretty heavy when it comes! We’re here in the tail end of the rainy season in north India I’m told, so it’s likely that we’ll have days like this during the time here in the farm. The rain seems to come in heavy and go again just as fast; it was pouring rain the morning, and then the sun came out in the early afternoon, producing a particularly steamy, ‘outdoor sauna’ day… There’s going to plenty of sweat during my time here!”

Living quarters on the farm

Farm Living

Most of the time at the Navdanya farm was spent there in the fields around the main living quarters and buildings in the middle of the property. The property starts following a winding, loose-stone path through the mango orchard, after tuning off the road leading to the local village. One section of the living quarters, including where I stayed, was located right among the mango trees, to the right of the stone path. The other side was home to the main office, dining hall, public meeting rooms, more accommodation rooms, and the fields of conservation crops and local varieties we most often worked with. I arrived the day before the first official day of the course.

The Navdanya farm grows over six hundred varieties of rice, and maintains seeds for over one other varieties of rice. Thousands of other seeds and crops are maintained and saved at the Navdanya Farm, as well as in their one-hundred and twenty-five regional seed banks.

The office and courtyard at the Navdanya Farm.

Daily Routine at the Navdanya Farm

Performing Shramdaan and daily routines

The time on the farm was set into routines and a pre-set schedule, split between learning practical farming skills and techniques of Agroecology directly out in the field, classroom time for lectures with international experts as well as local farmers, performing public service, referred to as 'shramdaan', and meals times and optional talks, free time, and events in the evenings. Each morning started with optional yoga or guided meditation class at 7am (neither of which I ever attended), followed by breakfast at 8am. 'Morning Circle' and announcements began at 9am, where group activities, an inspirational quote, and the daily schedule and other announcements were discussed.

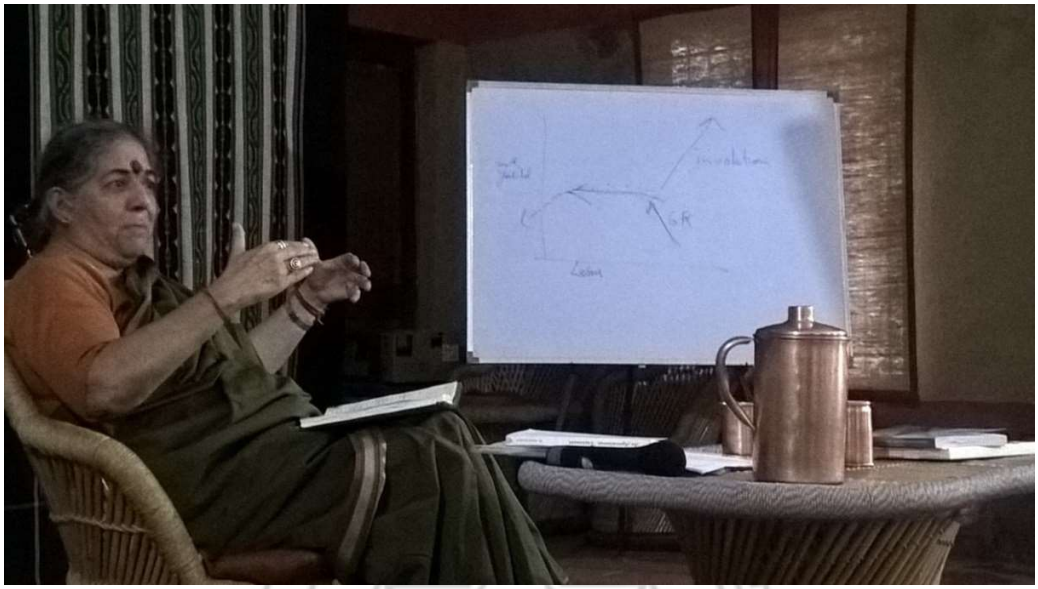
After morning meeting, each respective group would either attend their learning garden, or perform their shramdaan. Shramdaan duties were divided into several responsibilities, including: 1. sweeping the paths and walkways 2. Trash collection 3. Assisting with food preparation 4. Cleaning the dining hall 5. Cleaning public toilets. Shramdaan was always something which I enjoyed doing. The Gandhi-inspired philosophy behind it, the concept of making a contribution and providing public service of all who are part of the community, be it long or short term, was an appealing concept. The unity and shared responsibility of public service created an inspiring sense of community and camaraderie between the residents of the farm who were partaking in the agroecology course. Shramdaan was also a group activity, and was once which typically involved at least one partner to perform each activity. This created unique moments of bonding which allowed for the participants to get to know each other better.

The opposite group will spend that time working in their garden, working side-by-side with the farmers of Navdanya, benefitting from their tutelage and knowledge, and years of experience as farmers practicing traditional Indian agroecology. The gardens allowed for the participants to do a bit of real work, to see how farming works as a hands-on experience for learning about agroecology and traditional organic farming methodologies.

On a typical day, after shramdaan and garden time, the morning session of classroom talks would begin. The first session would go until lunch time, followed by a short rest, then the afternoon classroom session. Afternoon chai followed the afternoon classroom session, followed by free time. This time was often spent by many from the group playing volleyball, going to the local village market, resting, playing music, or doing additional voluntary tasks around the farm.

Dinner would be promptly served at the same time every day, and like the other meals of the day, was a reflection of the local food and cuisine grown right on the farm. The evenings typically had an activity session. These were often watching movies or documentaries related to organic farming and agroecology, had evening classroom times, if a guest speaker was only scheduled to be there for a short time, or for the participants themselves to hold a talk on a topic of their choice. I myself ran a presentation and short seminar on CLA. By the end of the last session, most people are ready for bed. Most people were sleeping by 10 or 11pm.

Classroom time with global and local food systems & Agroecology experts



Field journal, September 2:

"We had 2 sessions with Dr. Shiva today, and watched the documentary 'Bullshit' in the evening, featuring Dr. Shiva, being followed by a Swedish documentary film team back in 2003-04. Dr. Shiva talked at length about the early days and formation of Navdanya, the numerous successful lawsuits (and current one related to mustard seed) they've engaged in to protect Indian agricultural traditions and seeds (like Basmati rice) from international agribusinesses attempts to undermine traditional farming and steal the rights to use heirloom seeds through the use of patent laws. There was also a good discussion on the global history of 'Agroecology', and how it is conceived of as the modern iteration of traditional farming methods are both the symbol and the living embodiment of cultural and agricultural traditions. These traditions stand in opposition to the 'Bio-imperialism' practiced in the modern agribusiness industry, which sees seeds, crops, and life-sustaining agriculture as merely tradable commodities whose only 'value' is determined by international markets. The worldview of traditional farming represented by the concept of Agroecology described by Dr. Shiva stands as a perfect example of how modern farming can still be conducted in keeping with ancient traditions, and stand as a contrast to what has become the tech-based 'dominant narrative' is such a comparatively short period of time. Tech-driven 'solutions' using petrochemicals have been around for about 70 years; traditional farming has been around for about 12,000 years. It's worth keeping that in perspective."

Knowledge directly from the experts

The classroom time with guest speakers and time in the field with the experts were some of the most valuable learning experiences at the Navdanya farm, and were featured as the centre pieces of the course. Experts in a wide variety of fields related to farming and agriculture were invited in to speak and give presentations. Areas of expertise that these people had were in the areas of: seed-keeping, animal handling, health and nutrition, insect management (pest control and pollinators) soil health, plant breeding, farm design, vegetarianism, and included numerous sessions with Dr. Shiva, the fight against the agribusiness giants and their attempt to misappropriate indigenous knowledge, patent heirloom seeds, and their pushing of pesticides and herbicides to go along with their genetically modified seeds. Below will highlight some of the experts and their specific areas of expertise that were kind enough to impart their knowledge about the many aspects of modern farming in rural and indigenous communities, and share their time and insights, all of which are in support of a futures-oriented vision for Agroecology. Together they formulate a vision and premise upon which the CLA and scenarios for this thesis has been based.

Av Singh

Ethical Animal handing practices

Av Singh is an expert in animal ethical handling practices and design of sustainable farms, farming lifestyles advocacy, and the legalization of marijuana in Canada, for medicinal, commercial, and 'personal' uses. Topics we focused on in our time with Dr. Singh also included animal evolution, animal handling practices, species biology, & ethical meat production and consumption.

Field journal, September 4:

"We had a great session with Av today. He's a great guy and really knows his stuff. He's a personal acquaintance and colleague of renowned innovator in animal handling practices Temple Grandin, is an expert in human animal handling practices in his own right, and a leading expert on organic farming, farm layout and design, crop combinations, as well as an advocate for the growing and legalization of marijuana for all purposes of use. He's definitely 'cool', as they say! His concepts of farm designing are really interesting, he will run a special class later about the concept of optimized farm design for sustainable green living. I like his concepts and his ideas, he really shows that sustainable living based on agroecological principles and concepts. You can see a true possibility for sustainable futures in his ideas."

Chris and Marilyn Kennedy

Soil Health: Microscopic Ecosystems essential for life

Field journal entry, September 11:

"Today we had our discussion on seeds with Chris and Marilyn. They do really great work back in the U.S. (Cleveland) on seed saving and sharing, and setting up local seed collectives. We learned some basics of plant and seed biology—monocots and dicots, self-pollinating and 'out-breeding' plants. We also learned about 'rogueing'—pulling poorly growing and/or diseased plants to keep them producing seeds, as they will pass on diseases and poor traits. They discussed what 'heirloom' seeds are, and their importance in maintaining biodiversity in the plants we consume. They also talked about why/how hybrid seeds aren't always genetically viable. And we also discussed the tremendous importance of soil health, the microscopic ecosystems upon which all plant life—and therefore all life on Earth—depends."

Soil health and biology was an interesting thing to learn about while at the farm. Chris and Marilyn Kennedy are among the world's few remaining experts who specialize specifically in soil health and the microscopic bacteria and organisms which are essential for healthy soil and plant growth. Healthy soil, teeming with life, is the most necessary and basic starting point for all agriculture and nature; without healthy micro biomes, literally nothing would grow in the soil. Much of their professional work and advocacy focuses on the detrimental effects of chemical pesticides and herbicides on soil health. Few working researchers and academics have any expert level knowledge in this area, or specific focus on this most important aspect of natural biology. Their own organization, 'the Hummingbird Project', seeks to promote 'ecological regeneration' and empowering communities to seek resilience by reconnecting people to the natural world by promoting sustainable practices.

Insect management and biology

Journal entry, September 8: “In the afternoon, we got a chance to go out in the back field where the cows are and look at some plant and insect species. We learned about pollinators, as that was the specific area of her research. We got to see some insects right there flying around and landing on the crops, learn about their behavior, and the importance of preserving their habitats and reducing harm to them, since they’re so important to maintaining plant life through pollination.”

Learning about important insect species was another unique part of the time on the farm. Dr. Bhatt paid a visit to the Navdanya to teach the group about the importance of pollinators, as well as pest insects and how to manage them. Insects make up a key part of the food system, as there are many foods which simply cannot grow and reproduce without the cross-pollination of specific insect species. Knowing the difference between harmful and helpful insect species can make the difference between a failed crop and a successful one. The noted impact on insects and thus also agriculture through the widespread use of herbicides and pesticides in commercial farming. The phenomenon of ‘colony collapse disorder’ linked to the use of neonicotinoids classification pesticides has been shown to be a leading cause of the disorder in multiple scientific studies (VanEngelsdorp, 2009; Spector, 2014; Leska, 2021).

Health and nutrition

Dr. Anna Pawar

Field Notes, September 22:

"Today we had an excellent session on health and nutrition, particularly focusing on dietary intake. Dr. Anna Pawar, M.D., a practicing doctor here in her native Indian, dropped a bombshell that the hippies in the course weren't prepared to hear: that meat should be a part of their regular diet! This definitely shocked many of them; their high-minded, Western-based, idealized visions of their lifestyle choices and the incorrect presumptions that they are based in or justified by 'Eastern' beliefs saw their arrogant sensibilities of being vegan/vegetarian living being challenged by medical facts. Having a diet that includes animal proteins contradicted everything they've convinced themselves of about 'healthy eating and living', and it coming to their by way of an Indian woman wasn't something they were ready to hear. I couldn't wipe the smile off my face all day."

Field notes, September 23:

"We met again for another session with Dr. Mira Shiva, today discussing the issues of malnutrition and micronutrient deficiencies in India and other parts of the developing world. Nutrition information in many parts of the world are not designed in ways which are truly beneficial to the promotion and maintenance of sufficient dietary and health requirements of most people, and continuing malnutrition has increased the prevalence of childhood stunting and wasting. Much the current mass-production models of food systems focus on mono-cropping, which have been shown to diminish the nutritional content of foods over the last 70 years. Reintroducing a diverse range of traditional, local crop varieties can effectively help reverse

wasting, general malnutrition, and reverse the trend of nutrition loss in mono-cropping production models."

Dr. Mira Shiva

The importance of health and nutrition are among the main reasons the vitality and robustness of food systems are of such significance to discussions of food and food systems futures. A firm focus on the future and working towards creating (or re-attaining) long-term sustainability in food production and ensuring quality and diversity of food was a constant theme discussed throughout the time at the Navdanya farm, and was a key component of the work of every speaker and expert who joined us there. Long-term studies have shown that the overall

nutritional content of major staple food products has been in decline for at least seventy years, with the increased use of petro-chemical fertilizers and pesticides, demand for ever-increasing yields, mono-crop production models, the decline of the health and nutrient content of soils, and the selective breeding for achieving that end have been the cumulative causes of the loss of nutrient in major staple foods in many parts of the world where studies on it have been conducted (Davis, et. al, 2004; Davis, 2009; Ebner, 2021). Restoring biodiversity in agriculture is the foundational building block of agroecology, as Navdanya and other proponents advocate.

It was interesting to note that while they do practice vegetarianism on the farm itself, only offering vegetarian cuisine (milk is consumed there, no eggs) during the course, Navdanya as an organization is philosophically open to accepting and hosting experts who express differing ethical viewpoints about the consumption of animal products. Many experts argue that consuming meat raised from animals can indeed be produced and consumed sustainably, including some featured speakers at Navdanya (Av Singh, Dr. Pawar), as part of a healthy diet and lifestyle. Within the context of possible futures, an argument can be made that consumption of animal and animal products can remain consistent with the ethical, traditional, and spiritual contexts of Agroecological food production and consumption. By contrast, there are industry-funded expert opinions which hold that meat production and consumption, often the first example given by proponents of technology-focused approaches, that meat and protein consumption is both unsustainable and not in keeping with certain values-based assumptions woven into much of the talking points of their narratives. Numerous arguments of this type pertaining to the future of food hinge specifically on the issue of the production and consumption of animal and animal-derived products. The emphasis is placed on shifts towards mass producing animal proteins or plant-based replacements under laboratory conditions and away from the 'factory farming' model for both ethical and environmental reasons, and along with it promote a shifting of tastes towards prefer plant-based alternatives and/or 'replacement' products. This is despite the fact that the entire argument of its potential long-term sustainability is premised upon the assumption that yet-to-exist energy source breakthroughs will happen in the meantime, while (conveniently) forgetting to mention the estimated one trillion dollars of infrastructure investment to scale alt-protein sources to meet expected demands, while also overlooking the short-term financial bonanza which is the current rush claiming patent of intellectual property rights and intentional failure to disclose any potential negative health effects for consumers (Schweizer, 2022).

Plant Breeding

Dr. Ceccarelli

Field notes, September 14:

"We had a full, but really great day with Dr. Ceccarelli for both sessions today. The general topics were on the uniformity of major industrial agriculture and the overuse/overemphasis on pesticides and herbicides, and how they grow resistant to them. The second talk was on the Evolution of Plant Breeding. Again, a wonderful man, and his true human touch to all that he has done and all that he has encountered is an amazing site, and stands as a testament to what a gentleman he truly is, and the inspiring work he has done in so many parts of the world that are in need. I got to have a few great conversations with him over the next days, and I look forward to seeing more of his fantastic work. We went out to the field in the afternoon after the formal talk was over, to look at some crops and discuss the 'selective pollination' technique he discussed. This is the technique where you choose the plants you'd like to breed by selecting and covering the 'male' sections of one plant, and the 'female' sections of another, with a plastic bag overnight. You then take the bag which was coving the 'male' parts and put it over the plant with the covered 'female' parts, to ensure pollination only occurs between these two plants. You can then grow your preferred strain of that plant from the seeds which it will produce. It was very interesting to learn these specific techniques for plant breeding, since they are undoubtedly adapted from thousands of years of farmers finding through countless generations of trial and error, and finding what works best."

The concept of plant breeding harkens back to ancient traditions of agriculture practiced all over the world, as well as its modern embodiment within Agroecology. Selectively cross-

pollinating healthy crops to produce viable seeds and pass on the preferred qualities of the species to the next generation has been the way that what were once merely assorted plant species have been selectively bred into the staple crop species which have become the crops that feed the entire world. The further development and scientific research into this area have shown that it is a viable means by which the goals of reducing pesticide and herbicide use, reducing greenhouse gas emissions, preserving land, water, biodiversity, and sustainable agriculture can be achieved (Barker, 2021).

Agroecology and activism: The struggle against GMO's seed patenting and technology

Journal entry, September 12: "We had 2 excellent sessions today with Dr. Shiva. The first one was about 'intellectual property rights' and seeds; we discussed at length the things which Monsanto does and have attempted to do, only to be thwarted in their efforts by Navdanya after lengthy legal challenges, which all boils down to STEALING from people and suing everyone that even makes a peep about it. In the afternoon we discussed similar issues to the morning, starting with and outlining the history of seed laws. We learned about how foreign companies have come to India with the intent of patenting traditional organic seeds and restricting the sale and access to them, and how laws have been written by agri-food industry lobbyists to protect the monopoly-building endeavors of these corporation giants in their attempts to put the small farmers of the world out of business, or at least force them to be unwilling customers in their closed-loop system of needing to buy their seeds, their pesticides and herbicides, or get sued

when nearly inevitable cross-contamination occurs from neighboring fields. Navdanya advocates against these invasive and unsustainable practices perpetuated by the tech-driven corporations and their profit-making worldview."

Patenting the Future: Bayer/Monsanto

This thesis has endeavoured to maintain as much academic objectivity as it is possible, while also lending the discerning reader with enough markers of the authors' obvious biases in regard to the debate between Agroecological approaches to food system futures, and the techno-determinist methods promoted by others. But a discussion of the work of Dr. Shiva and the Navdanya organization cannot be complete without a brief discussion of their struggles against one company in particular: Bayer/Monsanto. Bayer/Monsanto, the company which brought the world 'Agent Orange' (exposure to which this writer's father receives a partial disability payment for due to his exposure to that dangerous substance from his military pension for service in Vietnam in 1968), has long been a company which has very much represented the tech-driven, mechanized visions of the future of food. Their seed patenting, production and sale of herbicides, pesticides, seeds, and of course, GMO gene-editing technologies represent the steps that many on this side of the dichotomy believe and argue are the preferred if not 'only ways' to achieve future sustainability in food systems.

A less-flattering but entirely (and unfortunately) factual aspect of their business model has been their widespread use of patent laws and intellectual property infringement as a means to sue small farmers has been well documented. A fellow farm attendee, Jodi, has been both attendee and course manager at the Navdanya farm for several years running. Her own academic work back in Canada has focused on the harmful effects of the main ingredient in Monsanto's primary herbicide product, glyphosate, on both humans and ecosystems. She had also documented their use of lawsuits which they almost invariably win against farmers for 'patent infringement' with hundreds of both in and out of court settlements around the world when farms which are intentionally not using any Monsanto products of any kind, but neighbour those which do, who have found themselves subsequently sued when the inevitable cross-contamination of the fully natural processes of cross-pollination between neighbouring fields occur, a policy which is de-facto making any semblance of traditional farming increasingly and eventually impossible to perform (Harris, 2013; Hunt, 2016; Peschard, 2019; Mattera, 2020; Southern Exposure Seed Exchange, 2020).

As much as it is the aim of this study to show alternative visions of the future of food and food systems, and without delving into the long, detailed, and highly convincing arguments made against the entirety of their approach and intended methods to their visions of food system futures, it must still be noted that Monsanto's behaviour as a company has (rightfully) earned them the deserved reputation of the world's most 'Evil' company, and their rare and ham-fisted,

failed attempts to 'engage' with the public and convince them of their allegedly good will and intentions towards the forced customers they try to force farmers to be (Sheets, 2013; Hamilton, 2013) . As 'well-intentioned' as the individuals who work there may be, in that they likely see the work they do as a means by which—or have convinced themselves that theirs is the only means-- to 'solve the problems' of the food issues of the future, an overall assessment of the companies behaviour towards farmers cannot possibly go without raising some eyebrows, even among the most ardent defenders of the company and the army of lawyers and public relations experts they employ to defend them and their practices, and as dismissively as they attempt to dismiss the overwhelming evidence of the harm caused by their products, even in the face of high-profile lawsuits where the company was found guilty of selling products with known carcinogens and losing multiple appeals of the ruling against them pertaining to over 100,000 separate lawsuits and settlements of over $11billion (Reuters, 2021; Miller, 2022). While they are unlikely to be the cackling comic book super-villains they are often deservedly caricatured as, their practices, scientific approaches, and most notably their business model have put them in a position where they appear to be trying to shape, control, and ultimately own the future of food by patenting it; a real-life 'Lexcorp', mirroring Superman's archenemy in his quest for control and power through ownership.

A future where the most fundamental and elemental aspect of what it means to engage in agriculture, which is to plant seeds, harvest their crops, and save seeds for the next planting—literally the definition and essence of what farming itself is—will essentially and eventually become an illegal act, if Monsanto's vision of the future of food and food systems remains unchallenged. The late-stage Capitalist worldview of farming and agriculture, if allowed to follow the market-based logic of Monsanto/Bayer's business model, will lead to a future where farmers have become little more than the 'unskilled' workers that they are seen to be by those who would seek to impose such a model upon them; the 'button-pushers' of food production, rather than the wise and uniquely skilled workers they are. Instead of the food growing experts which they in fact already are, they will be the repetitive task-performing, low-wage, industrialized workforce that Capitalism would see them become; the lowest cogs in the wheels of industrialized food production, whose knowledge has been subverted, patented, and 'owned' by a faceless Western corporation. Neo-colonialism, repackaged for the 21st century. This vision of the future appears to be a preferred one for the mechanistic, techno-determinist, Capitalist proponents represented among the ranks of those who seek to own, patent, and subvert traditional knowledge and food systems. That is, unless the extractive 'tribute' paid in the form of royalties, percentages of profits from crop sales (Bhardwaj, 2019 Peschard, 2019) , and of the inability to save and plant seeds in the future will not be allowed to continue, and unless a way can be found to reconcile the hopefully matching desire to sustainably feed the world in the future, if not the means by which to achieve that shared goal.

Forgotten Foods

Field Notes, September 22: "We had another 2 great sessions today with Dr. Shiva. In the morning we heard about her activism going back to the 1970's. In the afternoon, we learned about the importance of 'forgotten foods'. Pulses and millets, with amaranth being a prime example, has a long tradition of use in traditional Indian mix-cropping. Pulses are a natural source of soil nitrogen, providing not only a staple crop with multiple uses in traditional cuisine, but also providing the nitrogen deposited in the soil needed for other crops to flourish. Taking pulses out of global agriculture and diets in favour of monocropping has seen the rise in the imposed need for petro-chemical based nitrogen fertilizers to be purchased, when simply reintroducing them into our farms and dinner plates could reduce—if not eliminate—the need for artificial nitrogen fertilizers in many parts of the world."

'Forgotten foods', such as pulses and millets, were still very much a part of the local diet in rural northern India. They were sold in the local markets (as depicted in the above photo), as well as being produced at the Navdanya Farm. Dr. Shiva discusses in many of her writings and her talks held on the farm the importance of preserving these forgotten foods through local seed saving and sharing initiatives, but also advocates for their reintroduction into modern diets across the world (Shiva, 2016b). Traditional, pre-industrialized agriculture featured far more localized varieties of foods in people's diets. But significant loss of biodiversity by the prevalence and preference of monocropping which measure 'yields per-acre' over Navdanya's vision of 'health per-acre' across the world during the 20th century has seen the typical diet of what was once thousands of varieties of crop species be reduced to merely a handful of three species of rice,

wheat, and maize accounting for 50% of global caloric intake. Re-diversifying global diets to include local, seasonal, traditional crops can vastly improve health, biodiversity can be re-established, and the mechanistic paradigm can be reversed, and agroecology can lead the way towards a sustainable food future (Shiva, 2016a; Shiva & Leverink, 2018) Commoditized production models in food systems which favour a limited varieties of crops for reasons of uniformity, efficiency, and the maximization of yields and profits have significantly reduced the types and varieties of foods people consume since the early 20th century. This has increased the occurrences of food allergies, reduced the overall nutritional content of the shrinking varieties of foods that are most commonly grown and eaten, and required more pesticides, herbicides, and fertilizers to grow non-native/local crop varieties (Adams, 2013; Quinton, 2018; Bottemiller-Evich, 2020).

Development in Rural communities: farming collectives

Visit to the local Women's Farm Co-op

Field journal, September 26: "This afternoon we went out of the farm, and walked about 15 minutes over to the meeting place of a local women's farming collective. There, we were introduced to a group of about 12-15 women who participate together in farming their individual family lands collectively. They described for us the functioning of their collective, how they rotate, plan and coordinate planting, harvesting, and the crops on their farms, so that they can work together on each farm at particular planting and harvesting times. Their method of collective farming, using all local, organic seeds and crop varieties, make them a true example of the living practice of Agroecology. They have a collective strategy of what to grow on each farm and when to do everything, allowing all the heavy work to be done together in a way that

the timing works out so all can be there to help the others at key times. Foods grown on each farm are shared collectively between the members, and so are the profits for the bountiful harvests they get for the crops sold in the open market."

One of the many unique encounters during the time at the farm was meeting the local all-women's farming co-op group. We spend some time with them one afternoon, and learned about their collective farming practices. All these women have husbands who work regular jobs outside the home, and the women work as an organized collective together on each other's farms. They often organize the crops each plants as well as planting and harvest times. This way, they can match the timing of when the crops of each are ready, and they can work in-turn on each other's farms for these important times during the important points in the farming process. They also share with each other the harvested crops, so each family takes a portion of the crops harvested from each farm. Crops produced beyond the needs of each family are then sold in local markets, and the profits are shared collectively between the families. This allows for larger amounts of crops to be produced collectively, and for profits to be shared in order to fund the needs of the families involved. Already, two of the families in the collective had been able to build new houses on their own land with the profits gained from participation in the collective. It is a true example of what can be achieved when food systems are designed from their roots to be localized so they can address the needs of the farmers who produce the food, who can then work collectively to get a good market price for the organic, local varieties of food they produce, and build sustainable food systems which benefit them. The only people who 'lose' are those who would seek to sell these people seeds they are not allowed to save, and who would have them grown genetically-modified crops for sale on international markets have a world away.

Practical Field Learning

Journal entry September 9: “We had a session with Dr. Koppula, and we got to go out and make some homemade, all organic pesticide/herbicide/fungicide with him! We learned how to make a vermiwash that can be for preparing for planting and after plant growth, for use as an herbicide and pesticide. These are some of the traditional, ancient methods still used in rural India for thousands of years of agriculture for combatting pests and disease. It’s cheap and effective, and impossible for western agribusiness to patent. There are some things which cannot be stolen or misappropriated, like traditional knowledge and wisdom.”

Several of the activities undertaken out in the field were presented by either guest speakers, or the farmers who lived and worked full-time at the Bija Veedyapeeth Biodiversity conservation farm. From learning about seed saving and selection, how to make vermiwash and fertilizers, plant biology, insect management, plant harvesting, soil health, nearly every conceivable aspect of farming and food production had a practical field teaching session attached with it. This knowledge serves as the bedrock upon which the epistemological foundations of global food systems are built. Numerous studies have shown the effectiveness of the use of vermiwashes in agriculture as a sustainable, preferable means of promoting and maintaining soil health, reducing the presence of pests, achieving measurably better plant growth and crop yields, and promote and maintain micronutrient content of the soil and the crops grown in it, with greater effectiveness and none of the demonstrable harm to the soils micro biome which are known to be caused by the use of chemical fertilizers (Gilll, et al, 2018; Verma, et al, 2018; Gudeta, et al, 2021).

Journal entry, September 11:

"In the afternoon we went out in the fields with Dr. Nagi G. to learn about seed planting and harvesting, discussing techniques for how, when, and which seeds to harvest. Good seeds will begin to consistently produce good yields with a high degree of uniformity in the size and quality of the crops. We also discussed the importance of the plants to have at least 30% female flowers on them to maintain long term viability. We also learned about the seed preparation and preservation techniques using cow wiz and dung!"

Local experts and farmers who have been with Navdanya for many years shared their knowledge with us throughout the time at the farm. They were happy to pass on to us the benefits of their own extensive experience, and share the wisdom of generations of farming and ancestral knowledge. The preservation, harvesting, and preparation of seeds were among the most important lessons taught to us while on the farm. Knowing how to select seeds from the crops chosen for their positive growth and best characteristics, the ways to know when and how to harvest those seeds, and how to preserve them for planting in the next season represent the accumulated knowledge and experience of thousands of years of wisdom brought by countless generations of tried, tested, and perfected methods for preserving seeds.

Working in the Knowledge Garden

Field notes, Sept. 4: “Finally, we got to go out in the field! My group was assigned the ‘Knowledge Garden’ for our own, so we began clearing individualized sections of our own to work with. The guide told us that there will be room for each of us to experiment with growing crops (I believe of our own choosing) to see what grows well in combination with each other. I’m thinking of trying some things for 3 out of 4 of the crops which complement each other and grow well together, but also adding an ‘X’ factor crop, just to see how it fares along with the others; hopefully it won’t kill the entire crop!!”

Time spent working in the Gyan (‘Knowledge’) garden was easily among my favourite moments at the Navdanya farm. Shaping the land, planting crops, watching them grow, tending the seedlings as they sprouted; these were hardworking, sweat-inducing moments, and I was happy for them. There is a pride in physical labor that is difficult to match in other, more ephemeral and abstract accomplishments; the tangibility of seeing crops grow from the earth is the real reward, and evokes images of the lived realities of farmers and farm workers across the world, planting and harvesting the life-sustaining foods that feed humanity. The desire to work hard and gain hands-on experience at farming and plant biology was among the primary areas of personal interest for me in undertaking the research. Seeing the very foundations of food systems, the farms and small land holders where the majority of the world’s crops are grown, and being able to see how it is done and participate in some small way was worth the trip.

The image of lab-coated men, clipboards in-hand, working in sterile, tightly monitored and artificially controlled indoor environments seems the farthest thing imaginable from the realities of producing food in rural communities. There is a sense of authenticity in the experience and the connection with the land that is undeniable in the direct experience of working in the fields, feeling the dirt under your fingernails, feeling the sun on your back.

Food on the farm

September 14.

“Emanuel and I went out to dinner this evening, and I got to have MEAT—that, and several other delicious dishes! I had no idea that India food was sooooo good, after having almost nothing but ‘Vegetarian Survival Slop’ (V.S.S.), which is what I’ve dubbed the endlessly repetitive food served on the farm. I’ll definitely be going there again soon!”

The food served on the farm was produced by the full-time cooks employed by the Navdanya Trust. Essentially all the ingredients in the food was produced right there on the farm, with only the milk coming in by daily delivery. While always fresh, and completely vegetarian, the food menu service did seem rather repetitive. Dahl seemed to be on the menu essentially every day, often for lunch and dinner. But the food was an example of what diverse, local, seasonal, and fresh food can be, and a representative example for how foods can become re-localized.

Overall Impressions, Futures possibilities for Organic Food systems and rural communities and farmers

The Nadanya farm gives the impression of being a place well rooted in the ancient traditions of Indian farming; the wisdom embedded in the place itself and the knowledge of the local farmers was awe-inspiring. There was no 'modern' farming equipment to be found on the Navdanya farm; despite this, there was a thriving community and amazing output of crops on the farm, and tremendous biodiversity being preserved for the future. This was and is every bit as 'modern' of a place and method of food production as any laboratory producing cell-based proteins or GMO crops, vertical farming projects in large cities, or robotically-monitored farms. Despite the lack of 'high-tech' methods, a thriving and bright future seems possible in the ancient cultural and agricultural practices utilized there. Time spent in rural communities paints a much different portrait of the potential futures of food and food systems than those originating from or produced in academia, think tanks, research institutes, and significantly different than those originating from the various segments of the agribusiness sector. Visions of a future where 'innovations' and tech-driven 'improvements' to farming and food systems tend to miss the point and purpose food systems as envisioned and embodied by rural communities who still practice in their ancient traditions—or at least—are making an apparently different path to the only mutually agreed endpoints of both approaches: providing safe, healthy, and abundant food for the whole planet. The Navdanya organization stands as an example of a modern farming format informed by a tradition based not only in ancient practices, but one underpinned by a different

set of core metaphors about the purposes of food and agriculture, the environment, and the roles which nature and humanity play for each other.

In this vision, there was also a promise for the future, and an important narrative which, despite being a lived reality for so many, is also a story which remains largely untold in discussions of the future. The future of food systems and farming, and moreover, of where people live and how humanity addresses and meets its food needs now and into the future are at stake, and every human on Earth is therefore a 'stakeholder' in the outcome. The Navdanya farm, nestled there in a rural village in Northern India with the Himalayan foothills in sight, is not unlike countless others in rural communities across the globe, particularly in developing countries. This is what the future of farming and the foundations of food systems not only can look like, it is what they are, and are likely to continue to be for a significant portion of humanity into the future.

Small farm and rural communities feed the world

FAO (2014c) statistics show the majority of farms across the world are run by small land holders; 70%-80% of the world's farm land and produce 80% of the world's food. These small scale family farms produce higher yields per-hectare than larger farms, and manage to produce the majority of the world's food, as they have from the beginning of organized agriculture. And they are still managing to do it on less than a quarter of the planet's farmland, the majority being women, all while losing more land to bigger industrial farms (grain.com, 2014). People in rural communities feed not only themselves, but the rest of the world as well. As that fact is contrasted with the facts that the majority of humanity now lives in cities and urbanized areas and the global population is projected to reach 10 billion+ by 2050, the continued support of rural, food-producing communities will be an essential element of food system security into the future. As promising as many of the technology-based innovations in food production might be, and as much promise as they hold for the future of food, the realities of their potential have yet to be realized. For as much potential as these developments have for streamlining of regional food systems and enabling more localized production in urban areas and drastically reducing 'food miles' and related transportation and refrigeration and storage costs, the levels of efficiency needed to cost-effectively localize food production into urban areas where large populations will be more and more concentrated in the future will remain daunting, short of yet to manifest breakthroughs in energy efficiency. Despite the tremendous potential of recent breakthroughs, these developing methods and technologies cannot and will have enormous difficulties in meeting or beating the 'efficiency' or 'output' in the yields of a farmer growing food with nothing more than dirt, sunlight, and hand-held tools, organic seeds, and the wisdom, foresight, and ancestral knowledge that guide them.

Chapter 6: Analysis

Food systems: Towards an understanding of divergent futures narratives and visions

Perhaps the most valuable lesson learned while in India was that it allowed for a most basic understanding about exactly 'food systems' are to be formulated. What their functional bases are and where they are physically 'rooted' in the world was the first part of that understanding. But there is certainly another aspect to food systems, not merely their physical dimensions or 'routes' which can be noted on a map, or traced on their long and winding paths from the proverbial 'farms to forks'. But there is a deeper dimension to food systems which remains largely unexplored, one which is seen from the corner of the eye, but almost intentionally NOT focused on in so many modern contexts and discussions; it fades into the background, an ephemeral thought, lost if not verbalized, evading capture remaining undefined. Agricultural communities form the basis of all global food systems, whose metaphorical leaves and vines stretch out across all corners of the world. Coming to an understanding about what role they play in human societies and global civilization can help to bring about an understanding of where they may be headed in the future. Humanity has essentially only been able to evolve as far as the accompanying food systems that support it have allowed. And it is in this where the evasiveness of the desire for some to see the food systems of the future 'evolve' or change into something unrecognizable is worth examining.

The participant observation experience in India gave the impression that there is still a connection rural communities have to the global food system which cities and urbanized areas simply do not have. There is a primal, direct, and immediate connection rural farmers have, via their engage on a daily basis with the production of food, and are responsible for maintaining the foundations of local and global food systems that cannot be matched in urban areas. Urban living and lifestyles, now being the more prevalent lifestyle globally, as the shift of the world's population has tipped into the majority living in cities and urban areas at a currently estimated 55% (Ritchie & Roser, 2019) and projections of up to 68% by 2050 (un.org) have lost this intimate connection with the food they eat and the 'far end' of the food system; they exist as food 'consumers' only, not as food producers, or in any way engaged with the food they eat, aside from being consumers (literal and economic). In this, the type of culturally and religiously based myths and metaphors that inform visions of the future are still a direct part of the lived experience of people in north India where field work was conducted, as well as rural communities across the world, have lost their importance and significance for urban peoples. Emerging in their place are new futures metaphors of science and technology, the power of 'creation' and life having become under the purview of humanity.

A divergence in narratives, myths and informative metaphors for farming and food systems has been long in emerging, and it can be argued that the industrialization of food

production was the most significant and first—but certainly not the last—step in very slowly unfolding process, whose pace has quickened dramatically with the introduction of new technologies in producing food. Steam powered farm equipment and mass-produced mono-cropping models gradually took over the key processes of farming. 'The Green Revolution' of the post-WWII era was arguably the next significant step in the creation of this new narrative, as it further severed the ties of community and farmers from the important connections to the land they oversee as farmers, and metaphors and signifiers which formed the foundational beliefs about the purpose of food systems. This process had a particularly strong impact on agriculture and farming in India (Shiva, 2010). Indoor, soil-less, genetically modified, and lab-grown foods are the next step in that process.

The essence of Ethnographic research futures truly was captured at the Navdanya farm. The visions of Navdanya reflect the viewpoints of rural communities in rural India and their perspectives on the future, with Agroecology a key and emerging concept for creating viable and sustainable food systems.

The Historical Precedent of traditional/Agroecological food Sustainability in the Future

The discussion of food futures often focuses on specific types of futures as preferred, often rooted in the belief that these are the most 'sustainable' visions for the how we will produce food. While these dominant visions so often focus on the perceived benefits of developing and increasing technological innovations are the preferred—or the only way forward, the example of 10,000 years of successes in sustainable agriculture go almost completely overlooked for the tremendous achievement that it has been: Over ten millennia of successfully feeding and sustaining the majority of human life on Earth since the beginning of recorded history.

It could be that simply fewer and fewer people have an interest in undertaking the often difficult, physically intensive type of work that farming inherently is and remains, despite numerous technological innovations designed to make it easier to perform and with far fewer people. Even with the advent of early steam-powered plows, harvesters, tractors, and various other forms of automation introduced into agriculture since the early Industrial Revolution, farming has always had a physically intense, 'dirty' aspect to it. This was the same set of inventions which allowed for further diversification of human labor, allowing more and more people to leave behind a life lived in the countryside of waking up before dawn, toiling in the dirt, and feeling the intensity of the summer sun on their backs. This desire to 'leave behind' a way of life, a place, and a rural lifestyle represents in the minds of many people an aspect of our collective past which we have 'evolved' beyond (or at least desire to), and move towards something perceived as 'more advanced', something which represents 'the future'. It is in this where the modern, futuristic image of the lab-coated 'food scientist' both clashes with—but also mirrors—the 'peasant farmer'.

Trading 'the dirt', the unpredictable weather, and natural elements of the outdoors for the comfort and sterile cleanliness of the laboratory in the megacity of the future seems for some the next big and obvious step in the 'natural' progression in the physical 'places' where food is grown. So too has it seemed a 'natural' step to utilize the new methodologies, tools, technologies, and the associated sets of knowledge and expertise which go along with them. The 'food scientist' is likely a university-educated 'expert' in their own field, having worked for years building a highly credentialed set of educational and professional accomplishments and personal accolades while building their career. As much as a 'natural' progression as it may seem to view technological advancement as the obvious 'higher' step in a pre-Boasian view of social/cultural evolution, modern, currently existent cultures cannot be seen as inherently 'less evolved' simply due to their geo-physical locality, nor due to their consumption and uptake of technological 'innovations'.

While the 'peasant' seems, from the outside perspective of the city-dweller, who has possibly never seen a farm except in movies and television let alone been to one, to somehow possess very little, there is far more to the upbringing of the peasant than meets the outsider's eye. But the peasant has been in a position to receive millennia of ancestral wisdom as a built-in feature of their upbringing. Children from rural communities who have grown up with the responsibilities of contributing to the family farm and related work that goes with it inherit an education and set of knowledge which has contained within the wisdom, the foresight, and countless trial-and-errors which have come along with the processes of discovery of the most efficient and sustainable practices in traditional organic agriculture which have existed and gradually and 'organically' evolved since the beginning of organized agriculture. While the accomplishments of the individual and their forward looking visions seek to move into some vision of 'the future', they might do well to look back to the rural communities, to their generations of knowledge, wisdom, and sustainable practices, to take note of what they are simultaneously leaving behind.

Addressing emerging issues of food systems: is one way 'better' than another?

The decline in the nutritional content of foods over the previous seventy years are noted by Dr. Shiva as being not merely a coincidence, but are a direct consequence of switching to so-called 'high-yield varieties' of seeds well as petro-chemical fertilizers introduced during the post-WWII 'Green Revolution', where petro-chemicals developed for use in war were repurposed as fertilizers, herbicides and pesticides (Shiva, 2010). The attempts to address and hopefully reverse this alarming trend and to continue producing food high in nutritional content are primary drivers for both major approaches discussed in this thesis and a central concern for all proposed food futures.

Both Agroecological as well as technology-driven approaches to how food will be produced in the future seek to ensure that healthy, nutritiously adequate food, including animal proteins, can continue to be produced and consumed ethically and sustainably. What stands as

the primary arguments between advocates of traditional/agroecological on one side and modern technology-based approaches to food systems on the other rests primarily in how to achieve these goals, particularly on the consumption of animal proteins, and in addressing the ethical implications contained within each approach, and which can ultimately be achieved sustainably. Proponents of each approach claim that their preferred methods are both safe and ethical, and capable of producing healthy food for the entire planet into the future. The Navdanya farm is strongly rooted in the argument that agroecological approaches to food production and farming can (again or continue) to serve as the basis for global food systems. However, voices advocating for traditional methods of farming find themselves drowned out by the chorus of those singing from the deep-pocketed advocates of technological approaches. Giving voice to those who go unheard in this discussion, rural farmers and communities, showing their perspectives, desires, and shared goals of creating sustainable food systems has been the chief endeavour of this work, in the hopes that viable solutions which address the needs, desires, and visions of both approaches can be achieved for all.

Constructing an emerging CLA from the story of Navdanya and Agroecological approaches to food system futures

From the experience on the Navdanya farm, and directly experiencing the lived philosophy of Agroecology as a sustainable practice for the future of farming and reconnecting conceptions of deep meaning to food production and food systems, the patterns of what can be framed into the layers of a CLA begin to emerge. The time spent in India at the A-Z of Agroecology course, the levels of CLA can become more clearly seen in the philosophy of Navdanya, and their vision of the future of food and food systems begins to come out into a coherent, representative format for building a CLA of Agroecology. It has been the hope of this thesis to construct a CLA of Agroecology with the philosophy and practice of it as Navdanya and Dr. Shiva envision it for use as a representative case for one half of the dichotomy discussed earlier, as the working premise of this thesis is a comparative analysis between organic and holistic approaches to achieving sustainable food futures on one side, and technology-based and driven approaches on the other. It has been the hope that the CLA of Navdanya's vision of Agroecology can be a 'representative case study' for what a sustainable food future can look like from the perspective of an organic, holistic approach to achieving sustainable food futures. A CLA of Agroecology inspired by Navdanya as a representing a holistic approach to achieving preferred futures for farming and food systems will now be presented.

A CLA of Agroecology

Litany:

"Agroecology has the potential to create sustainable futures of farming and food systems"

The principles of Agroecology represent a real possibility for creating sustainable food systems of the future. Farming in the future can be done with the exact same approaches and methods which farming has had since the dawn or organized agriculture.

System:

"Local regions, governments, and international organizations adopt localized approaches to farming and food systems based on Agroecological principles."

As the concept of Agroecology take hold, producers, suppliers, governments, citizens, and various stakeholders involved in food production and supply chains begin to understand that it represents a 'return' to a more basic, simple model of farming, promoting and planting localized, seasonal varieties of crops. Agroecology can achieve true sustainability for the future of humanity for all of their food needs. Re-localizing and re-diversifying foods can address the pitfalls of for-profit commodity crop production models, greatly reduce imports/exports and related costs, and promote healthier, more diverse diets.

Worldview:

"Agroecology has become a leading and even preferred method of farming in the modern era. The best practices of the past which promote an 'environment first' worldview and applying it to the present and future trajectory of farming, more people are seeing this approach as the 'right way' to approach both regional and global farming and food systems design."

As the benefits of an agroecological approach to farming and food systems become more known, accepted, and proven as a viable approach to the future of farming, it eventually become 'the standard' (again) for how the future of food and food systems can be imagined. Agroecology represents a 'return' to a more 'natural' way of viewing farming and food production, and of humanity's connection to the land.

Myth/Metaphor:

"Back to basics"; "The future rests in the wisdom of the past"; "Back to The Future (of farming and food systems)".

Agroecology has the power to reconnect people with a natural viewpoint of how food is produced. Food has again come to be seen as having more significant origins than just 'coming from the grocery store'. The religious and culturally-derived concepts and mythologies behind the deeper meanings of food and farming to people around the world can be awakened,

reinvigorating the way people conceive of and interact with the natural world. While the majority of people will not be returning to an agrarian lifestyle or growing the majority of their own food like in the historic past, people will again become connected to the natural systems which feed them and their communities.

CLA of Mechanistic/Techno-determinist Futures of Food Systems

Those who see a future divergent from that of the historic past and precedent set forth from over 10,000 years of organized human agriculture have a distinctly different vision of the preferred futures of food and food systems. Some see a future where the connections to the past can be left behind, removing most of the elemental connections of farming and food from much of its natural past. Seeds, crops, 'meat', the entire production process of food itself can be 'removed' from the unknowns and uncertainties of nature and of the outer world, extracted from the outdoors, hidden from the elements, and out from under the skies, away from where the Gods are watching, with their jealous gaze.

Litany:

As global population grows, people move to cities/urban areas away from rural areas; climate change is becoming more extreme, technological innovations are needed to address global hunger and increasing food needs and demand for higher quality consumer-driven food products.

Human civilization has been on a long trajectory towards the recent and historic moment where the 'counter' has switched over to the majority of people living in rural areas and communities over to cities and urban areas. Now that humanity has 'arrived' in the newly urban future, the need for rethinking and redesigning food systems has arisen. New methods, technologies, and thinking about what food is, where it is produced, and how it comes to our plates has to be conceived and achieved for a sustainable food future suitable for the new majority of humanity.

System:

Corporations, research groups, and think tanks create and invest in 'Agri-Tech solutions' to growing food needs centered in urban areas. Systems of growing food will be restructured to serve the needs and interests of cities and urban populations. Logistics and production of food will shift to urban regions in the name of environmental sustainability and serving majority interests and populations.

Governmental policies fund and promote research into new technologies undertaken by companies, universities, and research groups going into full support of finding the next big

‘solutions in Agri-Tech’, with a new focus on urban designs and centralized locations for food production. The systemic aim is to make mega-cities and urban areas as self-sufficient and self-sustaining as possible, in the hopes that food systems can be localized, thus reducing or eliminating the need for food imports and long distance logistics for providing adequate food for the residence of the city. National governments shift some of their national food policies and decision-making powers over to city and regional governments, as food systems become more and more centralized and rooted inside of cities. Rural communities capitalize on the chance to re-diversify and localize their own food systems, as mega-cities prefer their lab-grown proteins and indoor-grown greens over organically produced, natural foods.

Worldview:

‘Technological innovations’ are the preferred (or only) way to solve the growing food needs of the world; maximizing ‘efficiency’, and financial profits for those with an interest in those technologies as a built-in consequence of introducing these changes. New-age trends and attitudes about ‘Ethical consumption’ are emergent and promoted by ‘experts’ and social elites, seeking to displace/replace the moral, ethical, and physical ‘roots’ of global food production and food systems. The physical and moral ‘dirtiness’ of producing food will replaced with ‘clean’ versions and conceptions of food produced in laboratories and factories.

Techno-determinist, mechanized worldviews have become the dominant narrative(s) in the mega-cities of the future. The YouTube and ‘social’ media virtual-signaling crowd have become the celebrity’s du-jour, the de-facto spokespeople for new-age lifestyles of why you should stop eating animal proteins (unless they are lab-grown), consume locally-produced, indoor-grown foods, and embrace all things technological. Ethics and discussions about them dominate the debate between approaches to food and food sources, with those who still have a preference for animal proteins sourced directly from animals seen as ‘backwards’, not ‘with it’, ‘unsophisticated’, or participants in an inherently exploitative, unsustainable system of factory-farmed animals and commodity-driven mono-crops. Those who are not actively showing their loyalty to the new ethics are deemed the ‘peasants’ of the time, whether they live in the city or are still living in the countryside, the new ‘outer edges’ of human civilization to the self-absorbed city-chic lifestyle promoter. Removing animals, risk, and all things ‘external’ are seen as the highest aspirations of the new-age lifestyle promoter, and represent the new ethos promoted by the advocates of techno-determinist futures.

Myth/Metaphor:

‘Trans-Food’ for the ‘Transhuman’. ‘Food’ minus nature; ‘Beyond Food; Beyond Animals, Beyond nature’; Mastery over nature via technology allows humanity to remove/replace nature to gain power and control over its processes. The ‘dirt’ and dirtiness of food can be removed from creating food. Food itself can be sanitized and controlled, and the uncertainty inherent in nature is gone. Food itself can be changed to fit a new vision of humanity removed from nature;

just as civilization has moved from rural to urban as a process of social 'evolution', making food can also evolve beyond the natural processes of the Earth.

Becoming God-Size. The new myth level for the preferred relationship which humanity will have with food and food systems is transcendence. The last piece of the puzzle in humanity transcending its limits and connection to nature is by overcoming the last pieces of what can be characterized as the limitations of technology being overcome. A humanity removed from nature is a humanity which has overcome its limits imposed by the nature, by the Gods. A humanity which can overcome nature and its limits can overthrow its own Gods, to become God-like in the ability to control its own nature, and to impose its own boundaries and limits on morality, determining what is 'right' and 'good'. The transcended human will dictate its way to design the world, and the social mores and ethics which will constitute the new order.

Scenarios: What possible food systems futures may emerge?

The scenarios developed for this thesis have sought to reflect the possibility that the 'rural' and the 'urban' dichotomy, in at least some of the scenarios, have grown distinctly separate from each other. As the physical distance between shrinking rural communities and ever-growing

mega-cities and urban areas expand, so too, perhaps even more so, does the sense of 'connection' between them grow even wider: a crack which became a gap, a gap which became a chasm, a chasm which becomes an abyss. The developed scenarios will be presented here still without the four scenarios framework of Dator, but will have separate aspects within them which will address what is happening in both urban and rural settings, with further discussion about how these separate settings, despite the cracks, gaps, chasms, and rifts, still will retain a relationship with each other, no matter how separate and/or strained, and will hopefully be able to overcome them.

Business as Usual:

Continuation: Cities become 'mega'-- and so does the cost of food

Population growth, urbanization and growth of megacities up to 2050 stay on projection; overcrowding, low wages, high cost of living persist, with food more expensive than ever. The promise of technological 'breakthroughs' don't quite manage to live up to the early hype, and can't 'replace' conventionally-grown crops or protein sources to keep up with either consumer demands nor with providing adequate dietary needs. High energy input costs for lab-based proteins and vertical/indoor farms mean that the costs are passed on to consumers. Highly processed foods are still the only cheap, readily available food sources for most people who live in megacities; obesity and other diet/health related ailments continue to increase, which represent another social and economic cost, as health care costs increase in response to decrease levels of good health.

Cash for Commodities: 'farming as business investment' in rural communities

Fewer and fewer varieties of crops are produced in large amounts; the focus on producing 'food as commodities' for sale and profit on ever-enlarging factory-farms, produced for the benefit of global markets rather than for regional/local need or focusing on the production of local crop varieties. The types and varieties of crops produced for global commodity production shrinks even more, further reducing biodiversity in rural areas. The cost of production keeps on the steady increase, under-cutting wages and profits for small farmers, who increasingly find themselves bought-out by farm consolidation by large corporations. High profile billionaires continue the trend of buying up large tracts of farm and rural land. Biodiversity becomes even further reduced as small-scale farmers switch to fewer varieties of commodity crops for production to stay financially solvent.

The chasm gets wider and deeper: rural and urban become increasingly antagonistic

The relationship between urban and rural communities keeps declining. As Megacities grow, and more and more young people grow up in a majority urbanized world, the cityscape seems the only 'right' place to be. The 'fly-over America' concept spreads throughout the world, as rural areas are increasingly seen as the 'dead spaces' that exist between the 'islands of civilization' which cities are perceived to be. As rural populations continue to shrink, the rate of inward migration flows from rural to urban increase. Poverty rates among rural-born, city-bound migrants remain high, and so does discrimination against them. The further loss of needed labor in rural areas for agriculture drives the need for further mechanization and industrial-model agriculture. The inability to make urban-based food technologies cost-effective at the scale needed to adequate meet food demand and dietary need keeps costs high, making urban living increasingly difficult for the many who live in cities, particularly rural-born migrants, who face discrimination, low wages, and poor health.

Limits and Discipline:

The 'Hybrid' Food Economy—Food from everywhere and diversification/specialization of plant varieties

Urbanized production of food becomes a reality– with some technological and economic limits. Only some Tech-based solutions are cost-effective enough to be widely implemented; leafy greens and some lab-based proteins are produced in cities, as they can be produced at scale and health and quality standards can be met. Root vegetables and other specific meat products must still be transported into urban areas to meet food needs. Modest improvements is social systems and slightly more equitable distribution of wealth and resources via progressive taxation and social demand to establish minimum living standards for all city residents see a moderate reduction in comparative poverty rates; access to adequate food for most urban-dwellers sees some positive change.

Fair prices for Farming Communities: Sustainability and Green Economy

Some improvements in market conditions allow small-scale farmers to get a greater share of profit from the sale of their produce on regional and global markets. Limits are set and enforced on 'billionaire buyouts' and corporate consolidations of farm/agricultural land, Demand for local varieties of foods begins trending, allowing for more diverse, local crops to be grown, which in-turn need less external inputs than imported varieties of non-local crops grown for commodity production/export. The cost of logistics and processing see moderate decreases due to innovations in storage and transport. Demand for non-factory farmed, ethically-raised, free range and open-grazing livestock see moderate reductions in the amount of land needed to produce animal feed, allowing some land to returned to nature or other agricultural uses, allowing greater biodiversity in rural agriculture to return on some level.

Bridging the gap between rural and urban: 'Authenticity' of rurally-produced foods prized in megacities

A mutual appreciation and respect for the 'authentic' foods grown in farms begins to take root in cities. While on any given day, your typical city resident can go to the grocery shop, corner restaurant, or local 'burger joint' and get themselves a locally-produced 'burger', with either plant-based or cell-based 'burgers' side-by-side on the menu, accompanied by side dishes produced locally from roof-top and indoor vertical farms, occasionally, something 'special' and 'authentic' is what is desired. High-end restaurants and grocery shops cater to a clientele who like to treat themselves on special occasions to a meal raised from all-organic, ethically raised/produced, country-farmed foods. Specific farms and farmers are named on labels in grocery shops and mentioned by restaurant staff to patrons as the source of their foods. Fairer prices for farmers, along with specialized demand for their produce create a growth in appreciation between the urban and the rural resident. Costs remain somewhat high for this, thus it's a 'special occasion' type of treat for most urban residents to eat that way. Rural farmers are able to maintain a modest living for themselves, and can begin to produce more food for themselves and reintroduce greater biodiversity and traditional crops, as a smaller proportion of what they produce is grown for commodity production and international markets.

Collapse

Worst Case Scenario: The Endless Slum; Over-crowding in Mega-Cities and systemic collapse

Food becomes even more of a scare, fought over commodity. The natural energy resources used to grow food in cities are depleted, as none of major promised, energy source 'breakthroughs' needed to produce food in cities at-scale to meet human needs are ever realized. Desperately over-crowded cities become wall-off 'zones', resources are kept under armed guards. There is no way to transport enough food into cities from remote rural areas, and the few shipments that come in are subject to raids by starving gangs or citizens, all while the shipments are brought in for the benefit of wealthy elites. Billionaires still dine on caviar and drink from stockpiled champagnes and high-end wines, musing at the chaos unfolding around them, as their presumed 'escape plans' should things 'get ugly' see them out of harm's way—unless they don't exactly go as planned, and they find themselves at the receiving end of 'mob justice'. People try to grow what they can on rooftops, but raiding and theft are rampant.

Agribusiness: The new 'Absentee English Landlord' of rural communities: The Irish Famine gone global

Rural communities see the rise of neo-feudalism in the form of corporate ownership of land, leading to the widespread dispossession of small-holders. Billionaires and large corporations have come to monopolize land ownership in rural areas, as they have come to

dominate land and property in both urban and rural settings. As the wealthy have previously proclaimed to the masses from the security of their private gatherings in Swiss mountain villages, in the guise of pseudo-enlightened benevolence, that people (except for them, of course) will 'own nothing'; what they were wrong about was the people being 'happy about it'. Seed patents and 'intellectual property rights' make the task of avoiding 'cross contamination' in the natural pollination process of crops impossible, seeing virtually every small holder sued into dispossession of his own land due to 'infringement' of 'intellectual property'. Rural communities have no choices but to work for below-subsistence wages as share-croppers on land that used to be theirs, or attempt to immigrate to ever-growing megacities.

Seasons in the Abyss: The descent into chaos

As the over-crowded, over-populated megacities see significant numbers of people seek refuge in rural areas in an attempt to stave off starvation and social disorder, widespread panic and disorder take hold. The neo-feudal absentee landlords in the countryside, who are the landlords, CEO's, and shareholders of the same faceless mega-corporations who own everything in the cities cannot absorb in any significant way the newly arrived 'reverse immigrants', creating a no-win situation for people attempting to move from city-to-country or country-to-city in order to improve their situation, or retain any sense of 'normal life'. Little to no sense of 'balance', 'order', or 'stability' can be achieved either in or between rural and urban settings or communities. People from cities and rural communities find themselves as refugees en-masse, wherever they go. Some manage to survive on the hinterlands of semi-habitable regions, hoping to wait-out the impending apocalypse waiting for those who remain trapped on the sinking ship that was modern human civilization with 'Captain Capitalism' at its helm.

Transformation:

The 'hanging gardens of Utopia': Transcendence 'Beyond Food'

The technocratic dreams of the urban elite become realized and implemented. They have been able to create a place without hunger, a world without risk or harm; that which was once 'natural' has become completely under the dominion of humanity. Food can be 'ethically' produced without harm to animals– all proteins are lab-grown. Technological breakthroughs in energy resources and indoor farming allow for a highly diverse, nutritious array of foods to be locally and sustainably produced in every city. A.I. monitoring systems maintain perfect growing conditions for all crops, and robotic harvesting has essentially eliminated the need for direct human labor in any step of the farming process. All these systems require are skilled 'technicians' to oversee the proper functioning of the technology. Growing conditions for virtually any type of food can be copied and controlled; Helsinki can cost-effectively grow its own coffee beans and mangoes. 'Food miles' can be measured in 'city blocks', virtually

eliminating the need for long-haul logistics, greatly reducing related pollution and energy consumption.

Rise of the 'Farmer as Food Growing Expert'

Farmers and those who live in rural communities are no longer seen as 'peasants'; they are seen as the keepers and teachers of agricultural knowledge, and the wisdom and foresight on how to manage it. Their expertise is recognized for the tremendous social, cultural, and economic value they hold, and they receive the gratitude of the world, and the fair share of the commonwealth they deserve. Agroecology has opened a path back to restoring a balance with the natural world, proving that sustainable agriculture is possible based on traditional farming methods. Scientific research is realigned to find ways to improve and contribute to agricultural knowledge, in alignment with the guiding principles of Agroecology. Humanity (re)learns how to find a balance with nature, without seeking to control it, patent it, or own it. 'The Commons' are once again assured to be used for the benefit and prosperity of all humanity.

Reconciling diverging visions of a preferred future: Is patching the cracks possible?

Finding common ground for building bridges of reconciliation and mutually desired outcomes for the seemingly divergent preferred futures of each approach to creating sustainable food systems has been a key challenge of writing this thesis. One approach champions the victory of 'man over nature'; the other seeks to see humanity reconcile its 'place' within it. Speculating as to whether each vision can exist simultaneously, in a 'separate but equal' state would seem one way that things could be envisioned; another would be for some sort of 'reconciliation' between the two, a merging of a fusion 'hybrid', but the philosophical differences between them might make for difficulties in getting advocates of one to accept the principles and approaches of the other. It is difficult to speculate if the future will be an 'either/or' for sustainable food systems, or if one or each approach can be achieved independently of the other. A hope could be that both can be achieved, and people can have the free choice of which path, lifestyle, and philosophy fits in with their particular beliefs and worldviews.

Conclusions of the research and analysis of food and food systems of the future: What do food systems seek to 'do'?

Seeking "Food Knowledge" or "Food Data"?

One of the fundamental questions about what food systems 'do' and what is derived from them have been central to the exploration of this thesis. The inclusion in this discussion of the emergent dichotomy of the perpetuation of farming/agricultural 'Knowledge' vs. the creation,

gathering, and monetization of 'Data' as the informing metaphor of agriculture and food systems is a natural extension from the 'Agroecological'/'Holistic' vs. 'Mechanistic/Tech-driven' approaches, growing out from the deeper roots of agriculture, incorporating and emphasizing the modern in comparison to the traditional, asking the fundamental question about what and whose interests are served under each vision of food and food systems and those involved in them serve in the modern world, and whom and what it will serve in the future. This exploration has sought to speculate on and understand what the end-purpose is for these diverging visions of food and food systems beyond the most obvious question of producing food. These approaches have evolved over time, and certainly the Mechanistic approach is a logical (and arguably was a necessary step) in advancing human civilization and human population growth in the short period of time which it did. A brief discussion and analysis exploring the historical shifts from Holistic to Mechanistic worldviews of agriculture, and how this split grew due to increased population growth, urbanization, and the impact of the Industrial Revolution.

Population growth and the 'modernization' of agriculture in the Industrial Revolution

Industrialization of the late 19th century allowed for an escape of Malthusian population cycles which limited human population growth by allowing for technological improvements to be adapted for use in the agricultural sector (Zhou, 2019). These industry-based improvements in farming methodologies dramatically increased efficiency, intensification, and concentration of agricultural yields; the same amount of land was quickly able to produce significantly more food than previously (ourworldindata.org). More land became open to other uses besides farming, allowing for land to be developed into the quickly-expanding borders of cities and urbanized areas, and leading to swift urban population growth.

These changes impacted not only how people live, but the expectations they have about access to food, and their lifestyle choices. Shifts in how the majority of humanity lives and makes a living, moving from primarily agricultural/rural to industrial/urban, was one of the greatest acts of 'distancing' which saw the majority of humanity no longer having direct involvement in the making and processing of their own food. The dramatically increased yields of food and expansion and efficiency of transport methods, high-level production of commoditized agricultural goods allowed for an explosion of the human population and urbanization and expanding cities, and at an unprecedented rate of increase. Global population stood at approximately one billion in the beginning of the 18th century, and grew to 7.7 billion in 2020 (ourworldindata.org), to an estimated 10 billion by 2050 (un.org).

The speed and efficiency which food could now be produced and safely transported long distances fundamentally changed the nature of the relationship that much of humanity has to food and to food systems. The argument can be made that it was at this point that a significant shift began, creating a 'fracture point', a 'rupture' in the core metaphors which people in rapidly

industrializing regions employed to describe their relationship to food and food systems. As industrialization advanced, people moved to cities in even larger numbers, and the logic of industrialization took hold, as numerous new professions in manufacturing were created, leaving behind the countryside and working in the fields working in agriculture (Rafferty, n.d.). The language of 'efficiency' and 'commodities', numbers and statistics, production and transport capacities, deadlines, quotas, likely made the gradual progression to becoming the prevalent language used about food systems during this time; this was the 'Logic', as well as the 'Myth' of Capitalism, replacing value systems and beliefs, gradually reshaping human relationships, power structures, and institutions to its will (Bhambra, 2007; Edsforth, 2012).

While food production, transportation, access and security have always undoubtedly been a concern for rulers, governments, and people in all sectors of society in all historical contexts, the dominant language and metaphor of mechanistic 'production' of commodities and 'efficiency' of production and transportation processes pertaining to food since the Industrial Revolution have come to prominence over the older conceptions of 'knowledge' about nature to achieve the 'creation' of food through natural systems, direct connection, and more harmonious relationship with the land. Rural communities have gradually become more and more marginalized, their lifestyles, worldviews, beliefs and practices, and influence have been undermined and replaced in many parts of the world. Despite the decline in prestige and respect, rural communities and small landholders still produce the vast majority of the world's food, and are the basis of every food system and supply chain on Earth. These mark some of the steps that allowed mechanistic metaphors and concepts of complete control over nature as it eventually came to be the primary paradigm for discussing food futures.

Chapter 7. Conclusions for The Future of Food systems: what have we learned?

This thesis has sought to use Ethnographic Futures Research, Causal Layered Analysis, and Scenarios together as a means to create a comparative analysis between emergent and divergent visions of the future of food production and food systems. EFR has served as the epistemological basis for field research conducted in India at the Navadaya farm under the tutelage of Dr. Vandana Shiva to gain insights into the potential of Agroecology as a guiding vision for the future of food systems. The research conducted there served as the basis for constructing a representative example for a CLA of Agroecology, for its potential applicability for global food systems. This was contrasted with a CLA of Tech-driven methods and new technologies, specifically protein replacements and indoor/vertical agriculture models, based on an analysis of their current development, and potential for future applicability in large-scale food production. The emerging metaphors of the contrasting CLA's illustrate the different

preferences, beliefs, trajectories, and visions for how the future of food systems should be shaped according to each path towards hopefully creating a sustainable future for food systems. Scenarios were then created to explore the possible iterations and permutations that can shape the food futures of rural and urban communities under different conditions. This has intended to allow for a space to open for the discussion of achieving preferred futures, and hopefully a most just and equitable world system for addressing the challenges presented by rapidly growing urban areas, global population, and shifting beliefs on ethical consumption.

It has been hoped that despite the fact that there is an imbalance in the fieldwork conducted for the purposes of this thesis (as noted, due to constraints of time and scope), that the overall comparative analysis conducted within it has adequately explored the emerging dichotomy between Agroecological and Tech-driven visions of the future of food systems. This imbalance resulting from the limitations of scope and time has hopefully not stood as a hindrance to the overall analysis nor undermined the exploration of the overall research question. While part of this work has intended to give voice to the 'cultured' and 'cultural' origins and basis for traditional (and still utilized) agricultural practices and beliefs or people in rural communities in the use of EFR which align with Agroecology—specifically, those based in local practice in northern India—it also has hoped to examine its views towards the future of food systems in the Indian and other rural community contexts as they could be in the future. CLA has endeavored to shine light upon and bring meaningful insights into the metaphors which shape the underlying beliefs which serve as the drivers for each of these two primary approaches to addressing global food needs of the future. The scenarios developed in the analysis have sought to explore the possibilities which arise from the changes—or lack of change—to food systems under different conditions and settings (urban and rural), to addressing the food needs of the future. Exploring these scenarios for what they can tell us about how the future could be under different conditions is the futurists' attempt to create a space where an ideal set of futures for planet-wide food and food systems can be imagined and explored.

At the same time, it is hoped that the approaches discussed under the Mechanistic worldview are also framed and viewed as 'cultured' and 'cultural' in their premise and intentions, in that they reflect at least some of the positive the values and beliefs of contemporary Western societies and worldviews, and do ultimately share the same collective goal: that of creating a globally sustainable food system, which can effectively address and alleviate global malnutrition and hunger, and achieve the U.N. sustainable development goals of feeding the world and addressing global poverty, which is a primary driver of hunger. While a key goal of this thesis has been to give voice to viewpoints and approaches to food production and food systems of rural communities and from non-technology driven approaches and perspectives for the future, it is hoped that a balanced view can be presented as well, without insinuation or assumption that modern, western-based 'Mechanistic' approaches are 'wrong' immoral, or without merit. The desire to create sustainable food systems is presumed to be as valid and sincere in their approach

and intention from both sides of the Mechanistic'/'Holistic' dichotomy, and equal validity and potential is granted for them both, and the desires for a sustainable food future which underpin them can be argued to have the same roots as traditional, Holistic ones, merely that the metaphors have diverged drastically, but hopefully not irreconcilably. The transformed narratives and myths discussed in the scenarios have attempted to find grounds upon which to start a dialogue of reconciliation between the seemingly divergent approaches into viable, imaginable possibilities for realizing sustainability of food systems in the future.

In as much as technological innovations in food production and system creation and maintenance tends to dominate discussions of the future of sustainable food and food systems within Western discussions and contexts, this tends to come at the specific exclusion of other voices in the endeavor to achieve a future of sustainable agriculture and totally alleviate malnutrition and hunger. This exclusion also tends to presume the preeminence and implements an automatic that technology-based approaches are not only preferable, but the only viable possibilities for achieving sustainability of food production and systems. This exclusion tends to entail both the perspective and voices of rural communities, but presumes to speak for them in a paternalist, neo-imperialist 'father knows best' manner. And most egregiously, the worldviews and underpinning metaphors of rural communities, and the values and culturally significant symbols embodied in them, often seem to have little voice in the overall discussion.

Most major aspects of human society/social development, it has been argued in this thesis, is that much of the current discussion is not only almost exclusively 'Western-focused' and driven by a Capitalist ethos, in that it addressed almost exclusively the issues of food and food production in and for affluent countries and regions, their current and futures needs, desires, and values, but that it seemingly overlooks (or intentionally ignores or glosses over) those of less affluent regions and countries of the world, and disregards their wishes and potential solutions to bringing about a future without global hunger. By conducting futures-based, ethnographic-style research as an epistemological basis for this thesis, it was the intention of the writing to provide a uniquely inclusive and more well-rounded and balanced discussion of food futures, as well as a 'tip of the hat' to the mythological/historical origins of organized agriculture. As the fieldwork for this thesis was conducted in India, under the purview of attending a course designed to teach participants about hands-on agricultural methodologies as Agroecology as it is promoted by Dr. Shiva, the discussion of food system futures and the focus on India specifically and the experience of agriculture in India in a rural community, remind me of the parallels in my own upbringing in a rural setting. India has seen the gradual encroachment of 'technology' brought in under the guise of providing seeds, fertilizers, pesticides and herbicides, in a 'Revolution' labeled as 'green', all in the attempt to turn technologies originally intended for destruction towards constructive uses.

The chemicals companies whose products were designed to kill people during the World Wars are the same companies in the post-war period and up to today which promote and sell chemical and technological 'solutions' to address human needs in India and around the world, the same companies that created the chemicals used to execute people in Nazi extermination camps and destroy jungles in Vietnam have re-packaged their products and re-branded themselves as 'innovators' in food science and production (Shiva, 2016c). So too has been my own experience. The nuclear power plant of Three Mile Island is within direct line of sight from my childhood home; I grew up within the blast radius of a technology of destruction-turned towards positive use. The almost incidental discovery after-the-fact that this inherently destructive 'innovation' could be instead used to 'create' something positive and useful to humanity was perhaps seen an act of contrition and fortunate and cathartic coincidence for those who invented 'the bomb'.

Although Oppenheimer never publicly showed regret for his role in creating the atomic bomb, his quoting from the Bhagavad Gita reflects a profound awareness of the fact that the world would never be the same after its invention and use (Temperton, 2017). It was perhaps in the later uses of atomic/nuclear technology which happened later in his lifetime that Oppenheimer was able to reconcile himself with his actions, and reflect upon the story from which his infamous quote was taken. Perhaps Oppenheimer saw the invention of the bomb as his doing his 'Dharma', his 'sacred duty', not unlike Arjuna the warrior in the Bhagavad Gita. That his invention was later turned towards more constructive application may have granted him enough peace in his mind, that he did something 'bad' for the 'greater good', so as to never have to reconcile himself with the guilt of the death his invention had wrought.

As my neighborhood slowly transformed in front of my eyes, with the ominous shadow of Oppenheimer's invention and what the promise—as well as the threats of the unknowns of 'technology', always looming from just over the hill overseeing all-- that darkened tower stood as a reminder of the darkness technology can also bring, despite its literal and metaphorical intention of bringing light and enlightenment to the world. Perhaps technology cannot always bring the god-like 'control' we seek to exert and wield over nature; but the God-like potential of the inherent destructiveness contained within it remains an inseparable part of technological innovation. Rural communities and their differing approaches to agriculture can be seen as an exercise in reserved skepticism of technology, and the double-edged 'promises' often inherent in its applications; without denying its potential to provide benefits to the creation and maintaining of food systems, their visions for the future are shaped by a trust in nature, without the desire to have control over it. Living in commune with the natural world instead of masters over it seems the preferred way for many, and is reflected strongly in the philosophy of Agreocology.

These shifts in 'where & how' the majority of humanity now live and will in the future stands to potentially change humanities relationship and interactions with the natural world. in fundamental ways the relationship which the rapidly expanding majority of humanity not only made their primary living and populations slowly moved into urban areas, but had the secondary

effect of changing the nature of their relationship to the Earth itself. Humanity is re-examining its conception of 'dominion' over the Earth, with 'domination vs. stewardship' being a central metaphor for examination of our relationship to the natural world (Lane, 2011). At the same time as these technological changes were taking place and allowing for the rapid increase in human population, it must also be speculated that there was a perceptible shift in worldviews and metaphors which accompanied it, at least in Western industrialized nations. As technological 'solutions' to age-old issues faced in food production and systems, the perceptions of humanity as a 'part' of nature and the natural world, a member of the natural community, which implied balance and membership, and with it, responsibilities—had gradually become one of domination and control, represented in the embrace of technology's ability to provide humanity with the illusion of control over it; but with the very real ability to destroy it.

Reliance on the favorable conditions of often uncontrollable forces of nature associated with agriculture since its inception (droughts, flooding, harmful pests) are no longer a of direct or immediate concern for most people (perhaps with the exception of occasional prices fluctuations), since their livelihoods were no longer directly involved in producing their own food. Visions of the future of food from many key innovations would presume to 'solve' these issues in their design and inception; vertical farms in city skyscrapers will grow a variety of crops, monitored by sophisticated computer systems in climate-controlled conditions, under artificial lighting, with the crops being fed 'nutrient solution' instead of deriving it from the Earth. Genetically modified crops, pesticides, and seeds, allegedly designed to improve yields, resist pests (despite highly suspicious and mixed results), and even robotic monitoring and tending of crops in the fields would function not only as means to grow food, but simultaneously 'weed out' the uncertainty inherent in the natural world. In this, much of the socio-spiritual connections between the natural world, have become disconnected from the direct, lived experience of most of humanity. Built into the logic of these is the assumption that nature no longer something which can be 'guided' by the hand of Man, but something that can be 'controlled', right down to its genetic level. This illustrates an attempt at reframing of the ancient relationship which humanity has with nature.

It is a particular irony that the mechanization and commodification of food and food systems, and the subsequent shifts away from more traditional and holistic viewpoints of the relationship of humanity to its food sources was born out of the desire to improve the level of access that people had to food. The reasons, intentions, and ultimate purposes that underlie the motivation to produce food have diverged to the point that it has arguably created its own dichotomous and contrasting worldviews and metaphors with each of them independently seeking to define what sustainable food and food systems will be like in the future. What should be kept in mind is that technological innovations hold promise, positive potential, and the desires of those who advocate them, on a basic level, are as sincere, meaningful, and forthright as any—they desire to create a world without hunger. But in follow one path, are we simply trading one

set of problems for another? But it must be understood that for many, a skepticism for new technology and its 'innovations' often come at a price. What price we are willing to pay as a race-- whose survival is dependent upon our chosen paths—remains a question for our collective future.

References

Adams, C. (Jun. 4, 2013). ‘Allergies to Monoculture Food Crops Growing’. Waking Times. https://www.wakingtimes.com/allergies-to-monoculture-food-crops-growing/

Adams, P. (Oct. 24, 2017). ‘What will it really take for vertical farms to succeed?’. The Counter.org. https://thecounter.org/vertical-farms-scale-profit/

‘Agritechture’. (N.D.). Plantagon International Feeding the City. Building the future. https://www.plantagon.com/

Akhatar, K. Sept. 16, 2016), ‘A burger by any other name: What do we call lab-grown meat?’. CBC News. https://www.cbc.ca/news/science/a-burger-by-any-other-name-what-do-we-call-lab-grown-meat-1.3764100

Alexandratos, N. and J. Bruinsma. 2012. ‘World agriculture towards 2030/2050: the 2012 revision’. ESA Working paper No. 12-03. Rome, FAO. https://www.fao.org/3/ap106e/ap106e.pdf

Barker, M. (May 17, 2021). ‘Plant breeding 'vital for sustainable agriculture'’. Euro Fruit. https://www.fruitnet.com/eurofruit/plant-breeding-vital-for-sustainable-agriculture/185239.article

‘Bayer loses third appeals case over glyphosate weedkiller’. (Aug. 11, 2021). Reuters. https://www.reuters.com/business/healthcare-pharmaceuticals/bayer-loses-third-appeals-case-over-glyphosate-weedkiller-2021-08-10/

Bhambra, G.K. (2007). Myths of Industrial Capitalism — The Industrial Revolution. In: Rethinking Modernity. Palgrave Macmillan, London. https://doi.org/10.1057/9780230206410_7

Bhardwaj, M. (Feb. 12, 2019). ‘Exclusive: Monsanto wins arbitration ruling over royalties from Indian seed company’. Reuters. https://www.reuters.com/article/india-monsanto-idINKCN1Q01YP

‘Bija Vidyapeeth-- Earth University’. (N.D.) Navdanya International. https://navdanyainternational.org/what-we-do/earth-university/

Campisi, V. (Apr. 20, 2022). ‘Analysis: Is the Alt-Protein Movement Overhyped?’ The Food Institute. https://foodinstitute.com/focus/analysis-is-the-alt-protein-movement-overhyped/

Candy, S. Kornet, K. ‘Turning Foresight Inside Out: An Introduction to Ethnographic Experiential Futures’. Journal of Futures Studies, March 2019, 23(3): 3–22 DOI:10.6531/JFS.201903_23(3).0002.

Carrington, D. (Apr. 30, 2018). 'The new food: meet the startups racing to reinvent the meal'. The Guardian.com. https://www.theguardian.com/environment/2018/apr/30/lab-grown-meat-how-a-bunch-of-geeks-scared-the-meat-industry

Carrington, D. (May 11, 2021). 'Lab-grown meat firms attract sixfold increase in investment'. The Guardian.com. https://www.theguardian.com/environment/2021/may/11/lab-grown-meat-companies-swallow-record-investments

Cauvin, J. Hodder, I. Rollefson, G. Bar-Yosef, O. and Watkins, T. 2001. Review of 'The Birth of the Gods and the Origins of Agriculture' by Jacques Cauvin, Translated by Trevor Watkins (New Studies in Archaeology). Cambridge Archaeological Journal 11, no. 01:105-121. doi:10.1017/S0959774301000063 https://dash.harvard.edu/bitstream/handle/1/12220716/s095977430100063a.pdf?sequence=1

Chandrasekhar, A. (May 15, 2015). 'Interview with Vandana Shiva: Why small farms are key to feeding the world'. Culture for Peace News Network. https://cpnn-world.org/new/?p=2727

Cohut, M. (Mar. 2, 2019). 'Has fast food become worse for our health in the past 30 years?'. Medical News Today. https://www.medicalnewstoday.com/articles/324589

Coolidge, W. (Nov. 28, 2018). 'Franken Meats and the Rise of Cellular Agriculture'. https://www.openpasturemeats.com/blog/2018/11/28/franken-meats-and-the-rise-of-cellular-agriculture

Cudmore, D. (Jun. 2, 2022). 'Lab Grown Meat Stocks to Invest In: Public Companies'. Vegfaqs. https://vegfaqs.com/lab-grown-meat-companies-to-invest-in/

Dahir, A.L. (Aug 30, 2017). 'The world could run out of food two decades earlier than thought'. Quartz. https://qz.com/africa/1064653/the-world-could-run-out-of-food-two-decades-earlier-than-thought/

Dator, J. (Nov, 2009). 'Alternative Futures at The Manoa School'. Journal of Futures Studies, November 2009, 14(2): 1 – 18. https://jfsdigital.org/wp-content/uploads/2014/01/142-A01.pdf

Dator's Four Futures. (N.D.) Foresight University. https://www.foresightguide.com/dator-four-futures/

Davis, D.R., Epp M.D, Riordan H.D. 'Changes in USDA food composition data for 43 garden crops, 1950 to 1999'. J Am Coll Nutr. 2004 Dec;23(6):669-82. https://doi.org/10.1080/07315724.2004.10719409

Davis, D. R. (2009). 'Declining Fruit and Vegetable Nutrient Composition: What Is the Evidence?'. American Society for Horticultural Science. 44(1), 15-19. https://doi.org/10.21273/HORTSCI.44.1.15

Declaration of the International Forum for Agroecology, Feb 27, 2015. 'International Planning Committee for Food Sovereignty'. https://www.foodsovereignty.org/forum-agroecology-nyeleni-2015-2/

Division of Labor in Society: Definition, Theorists & Examples. (2015, June 19). Retrieved from https://study.com/academy/lesson/division-of-labor-text-lessons-test.html.

Dove, L. '5 Farming Technologies That Changed the World'. (N.D.). Science: How Stuff Works. https://science.howstuffworks.com/environmental/green-science/5-farming-technologies-changed-world.htm#pt1

Drewnowski, A. Monterrosa E.C. de Pee S, Frongillo, E.A. Vandevijvere, S. 'Shaping Physical, Economic, and Policy Components of the Food Environment to Create Sustainable Healthy Diets'. Food and Nutrition Bulletin. 2020;41(2_suppl):74S-86S. https://doi.org/10.1177%2F0379572120945904

'Earth University (Bija Vidyapeeth) Visitor's Guide'. Navdanya International. https://dokumen.tips/download/link/download-visitor-guide-to-navdanya

Ebner, M. (Apr. 30, 2021). 'How to Combat Nutritional Decline of Fruits and Vegetables'. Ebylife.com. https://www.ebylife.com/blog1/how-to-combat-the-nutritional-decline-of-fruits-and-vegetables

Edsforth, R. (Feb, 2012). 'On the Definition of Capitalism and Its Implications for the Current Global Political-Economic Crisis'. http://www.culturaldiplomacy.org/academy/content/pdf/participant-papers/2012-02-unccd/On_the_Definition_of_Capitalism_-_Prof_Ronald_Edsforth.pdf

Evich, H. Bottemiller. (Sep. 13, 2017). 'The great nutrient collapse'. Politico. https://www.politico.com/agenda/story/2017/09/13/food-nutrients-carbon-dioxide-000511/

'Faith in Food'. (N.D.) https://faithinfood.wordpress.com/spirituality-food/hinduism/

FAO. (N.D.) 'Agroecology Knowledge Hub'. Agroecology Definitions. https://www.fao.org/agroecology/knowledge/definitions/en/

FAO. (2011). 'The State of Food & Agriculture: Women in Agriculture—Closing the Gender gap for Development'. https://www.fao.org/3/i2050e/i2050e.pdf

FAO. (2012). 'Small Holders and Family Farmers' Factsheet. https://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/Factsheet_SMALLHOLDERS.pdf

FAO. Oct 16, 2014a. 'Putting family farmers first to eradicate hunger'. https://www.fao.org/news/story/en/item/260535/icode/

FAO. Neven, David. 2014b. Developing sustainable food value chains – Guiding principles'. Rome. https://www.fao.org/3/i3953e/i3953e.pdf

FAO. (2014c). 'The State of Food and Agriculture: Innovation in family farming'. https://www.fao.org/3/i4040e/i4040e.pdf

FAO. (2015). 'Food in an Urbanised World: The Role of City Region Food Systems in resilience and Sustainable Development'. https://www.fao.org/fileadmin/templates/FCIT/documents/Food_in_an_Urbanised_World_Report_DRAFT_February_2015.pdf

FAO. (2016). 'Migration, Agriculture and Rural Development: Addressing the root causes of migration and harnessing its potential for development'. https://www.fao.org/3/i6064e/i6064e.pdf

FAO. (2017a). 'The State of Food & Agriculture: Leveraging Food Systems for Inclusive Rural Transformation'. https://www.fao.org/3/i7658e/i7658e.pdf

FAO. (2017b). 'The Future of Food and Agriculture – Trends and challenges'. Rome. https://www.fao.org/3/i6583e/i6583e.pdf

FAO, IFAD, UNICEF, WFP and WHO. 2018. 'The State of Food Security and Nutrition in the World 2018'. Building climate resilience for food security and nutrition'. Rome, FAO. Licence: CC BY-NC-SA 3.0 IGO. https://www.fao.org/3/I9553EN/i9553en.pdf

FAOa. 2018. 'The Future of Food and Agriculture – Alternative pathways to 2050'. Rome. 224 pp. Licence: CC BY-NC-SA 3.0 IGO. https://www.fao.org/3/I8429EN/i8429en.pdf

FAOb. 2018. The State of Food and Agriculture 2018. Migration, agriculture and rural development. Rome. Licence: CC BY-NC-SA 3.0 IGO. https://www.fao.org/3/I9549EN/i9549en.pdf

FAO. 2019. 'World Food and Agriculture – Statistical pocketbook 2019'. Rome. https://www.fao.org/3/ca6463en/ca6463en.pdf?utm_content=bufferbc29e&utm_medium=social&utm_source=linkedin.com&utm_campaign=buffer

FAO/Benedetti, A. (Dec. 11, 2019). 'Transforming food and agricultural systems: a challenge we must face together'. FAO. https://www.fao.org/fao-stories/article/en/c/1254608/?utm_content=buffer752bc&utm_medium=social&utm_source=linkedin.com&utm_campaign=buffer

Fergnani, A, Jackson, M. Extracting scenario archetypes: A quantitative text analysis of documents about the future. Futures & Foresight Science. 2019; 1:e17. https://doi.org/10.1002/ffo2.17

Fine, G. A. (2003). Towards a peopled ethnography: Developing theory from group life. Ethnography, 4(1), 41–60. http://www.jstor.org/stable/24047801

Figueiras, S. (Jan. 5, 2021). 'Top 13 Alt Protein Trends: Our 2021 Industry Predictions'. Green Queen. https://www.greenqueen.com.hk/top-13-alt-protein-trends-our-2021-industry-predictions/

Foley, J. (Aug. 2, 2018). 'No, Vertical Farms Won't Feed the World'. https://globalecoguy.org/no-vertical-farms-wont-feed-the-world-5313e3e961c0

'Food Mile'. Dictionary.com. https://www.dictionary.com/browse/food-mile

Furness, D. (Dec 24, 2017). 'Before 'plantscrapers' can grow food in the city, they'll need to grow money'. Digital Trends.com https://www.digitaltrends.com/cool-tech/platangon-wants-to-feed-cities-with-towering-plantscrapers/

Fusaro, D. (May 6, 2021). 'Cultured Meat is Growing in Popularity'. Food Processing. https://www.foodprocessing.com/articles/2021/cultured-meat/

Gilll, K. Sandhu, S. Kalmodiya, T. Mor, M. Singh, M. (2018). 'Vermiwash and its uses in Agriculture: An Article'. Journal of Emerging Technologies and Innovative Research. December 2018, Volume 5, Issue 12. https://www.jetir.org/papers/JETIRDT06174.pdf

'Global Meat Consumption, World, 1962 to 2050'. Ourworldindata.org. https://ourworldindata.org/grapher/global-meat-projections-to-2050?time=1962..latest

Goldberg, A. Robin, A. Zollmann, M. Traugott, H. Palatnik, I, Alvaro. (2021). 'Macroalgal Biorefineries for the Blue Economy'. World Scientific Publishing Co. https://books.google.com.tw/books?id=RJgJEAAAQBAJ&printsec=frontcover#v=onepage&q&f=false

Gordon, H. Sauyaq, J. Datta, R. (2022) Indigenous Communities Defining and Utilising Self-determination as an Individual and Collective Capability. Journal of Human Development and Capabilities 23:2, pages 182-205. https://doi.org/10.1080/1088937X.2021.1881647

Griffin, M. (Jan. 5, 2019). 'Aleph Farms serves up the world's first lab grown steak'. https://www.fanaticalfuturist.com/2019/01/aleph-farms-serves-up-the-worlds-first-lab-grown-steak/

Gudeta, K. Julka, J.M. Kumar, A. Bhagat, A. Kumari, A. (Mar. 2021). 'Vermiwash: An agent of disease and pest control in soil, a review'. Heliyon. Volume 7, Issue 3, March 2021. https://doi.org/10.1016/j.heliyon.2021.e06434

Hamilton, G. (Nov. 8, 2013). ''Most evil corporation' Monsanto opens up and offers rare opportunity for its opponents to engage it'. National Post.

https://nationalpost.com/news/canada/most-evil-corporation-monsanto-opens-up-and-offers-rare-opportunity-for-its-opponents-to-engage-it

Harford, T. (Nov. 27, 2017). 'How the plough made the modern economy possible'. Bbc.com. https://www.bbc.com/news/business-41903076

Harris, L. (Mar. 23, 2022). 'What are Food Miles?' EcoWatch.com. https://www.ecowatch.com/food-miles-supply-transportation.html

Harris, P. (Feb. 13, 2013). 'Monsanto Has Been Suing Small Farmers To Protect Its Seed Patents'. Business Insider.com. https://www.businessinsider.com/monsanto-has-been-suing-small-famers-to-protect-its-seed-patents-2013-2

Held, L. (Jul. 14, 2021). 'Just a Few Companies Control the Meat Industry. Can a New Approach to Monopolies Level the Playing Field?' Civil Eats. https://civileats.com/2021/07/14/just-a-few-companies-control-the-meat-industry-can-a-new-approach-to-monopolies-level-the-playing-field/

Hill, A. (Jul. 9, 2018). '16 Superfoods That Are Worthy of the Title'. Health Line.com. https://www.healthline.com/nutrition/true-superfoods

Hirtzer, M. Shanker, D. Batista, F. (May 3, 2021). 'Meat giant Tyson Foods enters the competitive plant-based market again—this time with a line of vegan meat products'. Fortune.com. https://fortune.com/2021/05/03/tyson-plant-based-meat-beyond-meat-impossible-foods-vegan/

'Hungry for land: small farmers feed the world with less than a quarter of all farmland'. (May 28, 2014). Grain.org. https://grain.org/article/entries/4929-hungry-for-land-small-farmers-feed-the-world-with-less-than-a-quarter-of-all-farmland#sdfootnote6sym

Hunt, T. (Apr 20, 2016). 'Monsanto'. Ethical Consumer. https://www.ethicalconsumer.org/home-garden/monsanto

Inayatullah, S. (2004). Causal layered analysis: Theory, historical context, and case studies. The causal layered analysis reader: Theory and case studies of an integrative and transformative methodology. 1-52. https://www.researchgate.net/publication/303143254_Causal_layered_analysis_Theory_historical_context_and_case_studies

Inayatullah, S. (2007). 'Questioning the Future: Methods and Tools for Organizational and Societal Transformation'. http://www.metafuture.org/library1/FuturesStudies/The-Study-of-the-Future-questioning_the_future_ch_1-2007.pdf

Inayatullah, S. (2008). Six pillars: 'Futures thinking for transforming'. Foresight, 10, 4-21. https://doi.org/10.1108/14636680810855991

Inayatullah, S. (Apr. 1, 2017). ‘Causal Layered Analysis: A Four-Level Approach to Alternative Futures’. 1-21. Futuribles. https://www.futuribles.com/en/group/prospective-and-strategic-foresight-toolbox/document/causal-layered-analysis/

International Food Policy Research Institute. ‘Food Systems’. N.D. https://www.ifpri.org/topic/food-systems

‘Is lab-grown meat really meat? The legal battle has already begun’. April 18, 2018). Verdict.co.uk. https://www.verdict.co.uk/lab-grown-meat-really-meat-let-legal-battle-begin/

Jacob, A. (Oct. 12, 2017). ‘Are Vertical Farms the Way of the Future?’. Ordermentum.com. https://www.ordermentum.com/blog/are-vertical-farms-the-way-of-the-future

‘Judge Sides With Monsanto: Ridicules Farmers' Right to Grow Food’. (N.D.). Southern Exposure Seed Exchange. https://www.southernexposure.com/judge-sides-with-monsanto-ridicules-farmers-right-to-grow-food/

Kawulich, B. (2005). Participant Observation as a Data Collection Method [81 paragraphs]. Forum Qualitative Sozialforschung / Forum: Qualitative Social Research, 6(2), Art. 43, http://nbn-resolving.de/urn:nbn:de:0114-fqs0502430 https://www.qualitative-research.net/index.php/fqs/article/view/466/996

Kumar, D. (March-April, 2016). ‘New Agro Technology and Traditional Agricultural Knowledge: Some Anthropological Reflection from Tribal India’. Asian Journal of Research in Social Science and Humanities. https://www.academia.edu/24230215/New_Agro_Technology_and_Traditional_Agricultural_Knowledge_Some_Anthropological_Reflection_from_Tribal_India

Lane, J. (April 21, 2011). 'Dominion over all the earth': exploitation or stewardship?’. https://www.csmonitor.com/Commentary/A-Christian-Science-Perspective/2011/0421/Dominion-over-all-the-earth-exploitation-or-stewardship

Latimer, E. (Mar. 26, 2021). ‘Our Sustainable Future: Lab-grown meat’. Impakter. https://impakter.com/our-sustainable-future-lab-grown-meat/

LeBlanc, R. (Dec. 16, 2020.) ‘What You Should Know About Vertical Farming: Is It the Future of Agriculture?’. The Balance Small Business. https://www.thebalancesmb.com/what-you-should-know-about-vertical-farming-4144786

Leska, A. Nowak, A. Nowak, I. Górczyńska, A. ‘Effects of Insecticides and Microbiological Contaminants on Apis mellifera Health’. Molecules. 2021 Aug 22;26(16):5080. PMID: 34443668; PMCID: PMC8398688. DOI: https://doi.org/10.3390/molecules26165080

Lynch, J. and Pierrehumbert, R. (Feb, 2019) ‘Climate Impacts of Cultured Meat and Beef Cattle’. Frontiers in Sustainable Food Systems. 3:5. https://doi.org/10.3389/fsufs.2019.00005

MacGill, V. 'Unravelling the Myth/Metaphor Layer in Causal Layered Analysis'. Journal of Futures Studies, September 2015, 20(1): 55-68. https://jfsdigital.org/wp-content/uploads/2015/09/4.pdf

Malkin, S. (June 17,2021). 'Bill Gates has radical plans to change our food. What's on the menu?'. Local Futures. https://www.localfutures.org/bill-gates-has-radical-plans-to-change-our-food-whats-on-the-menu/

Marshall, C., & Rossman, G. B. (1989). Designing Qualitative Research. Newbury Park, CA: Sage Press.

Mattera, P. (Sept 26, 2020). 'Monsanto: Corporate Rap Sheet'. Corporate Research Project. https://www.corp-research.org/monsanto

Mattson, N. (N.D.). 'Controlled Environment Agriculture'. Cornell College of Agriculture and Life Sciences. https://cea.cals.cornell.edu/about-cea/

Meretto, T. Sabido, L. Békési, E. (May 9, 2021). 'Why the role of mothers is pivotal in transmitting culture?'. Heritage Education Network Belize. https://www.heritagebelize.org/blog/why-the-role-of-mothers-is-pivotal-in-transmitting-culture

Metafuture. (N.D.) Previous Speeches, Workshops and Research Reports. https://www.metafuture.org/coursestraining/previous-speeches-workshops-and-research-reports/

'Methane emissions are driving climate change. Here's how to reduce them.' (Aug. 20, 2021). UN Environment Programme. https://www.unep.org/news-and-stories/story/methane-emissions-are-driving-climate-change-heres-how-reduce-them

Michael, C. (Feb 20, 2017). '9 Reasons Why Vertical Farms Fail'. https://university.upstartfarmers.com/blog/9-reasons-why-vertical-farms-fail

Miley, J. (Oct 3, 2017). 'Richard Branson Thinks, By 2050, We Will No Longer Need to Kill Any Animals for Meat'. Interesting Engineering. https://interestingengineering.com/science/richard-branson-thinks-by-2050-we-will-no-longer-need-to-kill-any-animals-for-meat

Miller, A. (April 5, 2018). 'Vertical farming and hydroponics on the spectrum of sustainability'. Sustainable Food Trust. https://sustainablefoodtrust.org/news-views/vertical-farming-sustainability/

Miller, A. (Dec. 10, 2019). 'What's the Problem with Soil-Less Agriculture?'. Resilience.org. https://www.resilience.org/stories/2019-12-10/whats-the-problem-with-soil-less-agriculture/

Miller, Robert V. (Jul. 21, 2022). ‘Monsanto Roundup Lawsuit Update’. Lawsuit Information Center Blog. https://www.lawsuit-information-center.com/roundup-mdl-judge-question-10-billion-settlement-proposal.html

Morrison, O. (Oct. 11, 2019). ‘Agroecological farming, not cultured meat, is key to a sustainable future, says campaigner’. Food Navigator. https://www.foodnavigator.com/Article/2019/10/11/Agroecological-farming-not-cultured-meat-is-key-to-a-sustainable-future-says-campaigner

Newton, P and Blaustein-Rejto, D. (2021) ‘Social and Economic Opportunities and Challenges of Plant-Based and Cultured Meat for Rural Producers in the US’. Frontiers in Sustainable Food Systems 5:624270. https://doi.org/10.3389/fsufs.2021.624270

Nicholson, R. (Apr. 22, 2018). ‘Jean-Baptiste Moreau gets one over on ‘fake meat’’. The Guardian.com. https://www.theguardian.com/commentisfree/2018/apr/22/jean-baptiste-moreau-gets-one-over-on-fake-meat-veganism

Nunes, K. (Mar. 2. 2022). ‘Alternative protein investments reached $5 billion in 2021’. Food Business News. https://www.foodbusinessnews.net/articles/20824-alternative-protein-investments-reached-5-billion-in-2021

Oatman, M. (May 19, 2018). ‘Missouri Is Making It Illegal To Call This “Meat”’. Mother Jones. https://www.motherjones.com/food/2018/05/missouri-meat-fake-lab-grown-plant-based-pork-beef/

‘Obesity and Overweight: Key Facts’. (June 9, 2021). World Health Organization. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

Olinto, P. & Beegle, K. Sobrado, C. & Uematsu, H. (2013). The State of the Poor: Where Are The Poor, Where Is Extreme Poverty Harder to End, and What Is the Current Profile of the World’s Poor?. World Bank Economic Premise. https://www.researchgate.net/publication/289469850_The_State_of_the_Poor_Where_Are_The_Poor_Where_Is_Extreme_Poverty_Harder_to_End_and_What_Is_the_Current_Profile_of_the_World%27s_Poor

Pampuro, A. Apr, 26, 2019. ‘The Beef Over What to Call Lab Meat Is Starting to Sizzle’. Court House News Service. https://www.courthousenews.com/the-beef-over-what-to-call-lab-meat-starting-to-sizzle/

Pasanen, M. (May 3, 2019). ‘Vandana Shiva Talks Poison Cartel, Farmers' Rights and Ecofeminism’. Vermont’s Independent Voice Seven Days. https://www.sevendaysvt.com/BiteClub/archives/2019/05/03/vandana-shiva-talks-poison-cartel-farmers-rights-and-ecofeminism

Peschard, K. (Oct. 31, 2019). 'Monsanto wins $7.7b lawsuit in Brazil – but farmers' fight to stop its 'amoral' royalty system will continue'. The Conversation.com. https://theconversation.com/monsanto-wins-7-7b-lawsuit-in-brazil-but-farmers-fight-to-stop-its-amoral-royalty-system-will-continue-125471

Petrass, R.M. (June 30, 2022). 'France mandates green roofs – time for Oz to look at the pacesetters'. The Fifth Estate. https://thefifthestate.com.au/urbanism/planning/france-mandates-green-roofs-time-for-oz-to-look-at-the-pacesetters/

Piechowiak, M. (N.D.). 'Why Is Vertical Farming Bad: 9 Disadvantages'. Vertical Farming Planet.com. https://verticalfarmingplanet.com/why-is-vertical-farming-bad-9-disadvantages/

Pryor, F. L. (1985). The Invention of the Plow. Comparative Studies in Society and History, 27(4), 727–743. http://www.jstor.org/stable/178600

Quinton, A. (Aug. 8, 2018). 'Can We Grow Food Without Fertiliser?'. Technology Networks Applied Sciences. https://www.technologynetworks.com/applied-sciences/news/can-we-grow-food-without-fertiliser-307317

Rafferty, J. P. (N. D.). 'The Rise of the Machines: Pros and Cons of the Industrial Revolution'. Encyclopedia Britannica. https://www.britannica.com/story/the-rise-of-the-machines-pros-and-cons-of-the-industrial-revolution

Ramos, J. (Aug 19, 2019). 'The Future of Work'. https://goodmenproject.com/featured-content/the-future-of-work/

Rangarajan, A., & Riordan, M. (2019). 'The Promise of Urban Agriculture: National Study of Commercial Farming in Urban Areas'. Washington, DC: United States Department of Agriculture/Agricultural Marketing Service and Cornell University Small Farms Program. https://smallfarms.cornell.edu/wp-content/uploads/2022/06/Promise-of-Urban-Ag_Full_102919.pdf

Resare Sahlin, K., Carolus, J., von Greyerz, K. et al. Delivering "less but better" meat in practice—a case study of a farm in agroecological transition. Agronomy for Sustainable Development 42, 24 (2022). https://doi.org/10.1007/s13593-021-00737-5

Ritchie, H. Roser, M. (Nov. 2021). 'Urbanization'. Our World in Data. https://ourworldindata.org/urbanization

Rodgers, S. (Sept. 6, 2021). 'This 'Plantscaper' Could Provide 500 Metric Tons of Organic Food'. Interesting Engineering.com. https://interestingengineering.com/science/this-plantscaper-could-provide-500-metric-tons-of-organic-food

Roser M. Ritchie, H. Ortiz-Ospina, E. (2013) 'World Population Growth. OurWorldInData.org. https://ourworldindata.org/world-population-growth

Rowling, M. (Feb. 19, 2019). ‘Lab-grown steak could be worse for climate than flatulent cattle: scientists’. Reuters. https://www.reuters.com/article/us-global-climatechange-food-science-idUSKCN1Q81LK

Rubio, N.R., Xiang, N. & Kaplan, D.L. ‘Plant-based and cell-based approaches to meat production’. Nature Communications 11, 6276 (2020). https://doi.org/10.1038/s41467-020-20061-y

Satterthwaite, D. McGranahan, G. Tacoli, C. (2010). ‘Urbanization and its implications for food and farming’. Philosophical Transactions of the Royal Society, 365, 2809–2820. doi:10.1098/rstb.2010.0136

Schensul, S.L., Schensul, J. J., & LeCompte. M. D. (1999). ‘Essential ethnographic methods’. Walnut Creek: Altamira Press.

Schultz, W. (Dec, 2001). ‘Scenario Archetypes: A Map of Basic Structures’. http://www.infinitefutures.com/essays/prez/scenarch/sld001.htm

Schweizer, E. (Apr 19, 2022). ‘Why ‘Alt-Protein’ Won’t Save The Planet’. Forbes.com. https://www.forbes.com/sites/errolschweizer/2022/04/19/why-alt-protein-wont-save-the-planet/?sh=482c9586210c

Sheets, Connor A. (Jun. 10, 2013). ‘Monsanto Named 2013's 'Most Evil Corporation' In New Poll’. International Business Times. https://www.ibtimes.com/monsanto-named-2013s-most-evil-corporation-new-poll-1300217

Shiva, V. (2010). ‘Violence of The Green Revolution’. Natraj Publishers, Dehradun.

Shiva, V. (2012). ‘Biopiracy: The plunder of nature and knowledge’. Natraj Publishers, Dehradun.

Shiva, V. (2016a). ‘Who Really Feeds the World? The Failures of agribusiness and the Promise of Agroecology’. ISBN 978-1-62317-063-9 (ebook). North Atlantic Books, Berkeley, California, USA. www.northatlanticbooks.com.

Shiva, V. (Jan 27, 2016b). ‘The pulse of life’. The Asian Age. https://www.asianage.com/columnists/pulse-life-681

Shiva, V. (Sep. 14, 2016c). ‘Monsanto and the Poisonous Cartel of GMOs in India’. Common Dreams. https://www.commondreams.org/views/2016/09/14/monsanto-and-poisonous-cartel-gmos-india

Shiva, V. Leverink, J. (Feb. 26, 2018) ‘Seed Freedom and the Future of Farming’. https://www.cadtm.org/spip.php?page=imprimer&id_article=15873

Shiva, V. (June 18, 2019). ‘Fake Food, Fake Meat: Big Food’s Desperate Attempt to Further the Industrialisation of Food’. Independent Science News. https://www.independentsciencenews.org/health/fake-food-fake-meat-big-foods-desperate-attempt-to-further-industrialisation-food/?fbclid=IwAR2qwsgzrz_S5cNmD6bbka5oi27dElshFcZj123u5yBt3s0CpZw9V77hVto

Shiva, V. (2022). ‘The Corporate Push for Synthetic Foods: False Solutions that Endanger our Health and Damage the Planet’. Navdanya International. https://navdanyainternational.org/wp-content/uploads/2022/04/The-Corporate-Push-for-Synthetic-Foods-Rev3.pdf

Slaughter, R. (1997). ‘Developing and Applying Strategic Foresight’. https://www.ams-forschungsnetzwerk.at/downloadpub/2002slaughter_Strategic_Foresight.pdf

Sohngen, T. (Aug 31, 2017). ‘The World Could Run Out of Food by 2023, Study Says’. Globalcitizen.org. https://www.globalcitizen.org/en/content/world-running-out-of-food-by-2023/

Spector, D. (May 14, 2014). ‘Scientists May Have Finally Pinpointed What's Killing All The Honeybees’. Business Insider. https://www.businessinsider.com/harvard-study-links-pesticides-to-colony-collapse-disorder-2014-5?r=US&IR=T

Sushma, M. (Mar. 5, 2019). ‘The rise and rise of the fast food industry’. https://www.downtoearth.org.in/news/food/the-rise-and-rise-of-the-fast-food-industry-63452

Temperton, J. (Aug. 8, 2017). ‘'Now I am become Death, the destroyer of worlds'. The story of Oppenheimer's infamous quote’. Wired.co.uk. https://www.wired.co.uk/article/manhattan-project-robert-oppenheimer

Textor, R.B. (1980). ‘A Handbook on Ethnographic Futures Research’. Third Edition, Version A. https://stacks.stanford.edu/file/druid:yd731zg5499/SC1190_A_Handbook_on_Ethnographic_Futures_Research.pdf

‘The Future of Indian Farming’. Sept 15, 2018. https://isha.sadhguru.org/us/en/wisdom/article/future-indian-farming?fbclid=IwAR0cAKr9HA20x8W7Cth-Z6TxLhYmxkED-o-12onR7QgNwMzs_4thdRuqln0

‘The Good, the Bad and the Ugly about Vertical Farming’. (N.D.). Ecofriend.com https://ecofriend.com/the-good-the-bad-and-the-ugly-about-vertical-farming.html

Trendov, N. M., Varas, S. & Zeng, M. 2019. Digital technologies in agriculture and rural areas – Status report. Rome. Licence: cc by-nc-sa 3.0 igo. https://www.fao.org/3/ca4985en/ca4985en.pdf?utm_content=buffer10e85&utm_medium=social&utm_source=linkedin.com&utm_campaign=buffer#page=7&zoom=auto,-107,846

United Nations, Department of Economic and Social Affairs, Population Division (2017). World Population Prospects 2017 – Data Booklet (ST/ESA/SER.A/401). https://population.un.org/wpp/Publications/Files/WPP2017_DataBooklet.pdf

United States Department of Agriculture. 2007. 'Sustainable Agriculture: Definitions and Terms. Related Terms'. https://www.nal.usda.gov/legacy/afsic/sustainable-agriculture-definitions-and-terms-related-terms#term1

'Urbanization and the Megacity' (N.D.). World Population History. https://worldpopulationhistory.org/urbanization-and-the-megacity/

'Vandana Shiva on Why the food we eat matters'. Jan. 28, 2021. Bbc Travel. https://www.bbc.com/travel/article/20210127-vandana-shiva-on-why-the-food-we-eat-matters

Van der Weele, C. Feindt, P. Jan van der Goot, A. van Mierlo, B. van Boekel, M. (2019). 'Meat alternatives: an integrative comparison.' Trends in Food Science & Technology, Volume 88. https://doi.org/10.1016/j.tifs.2019.04.018

Van Engelsdorp D, Evans JD, Saegerman C, Mullin C, Haubruge E, Nguyen BK, et al. (2009) 'Colony Collapse Disorder: A Descriptive Study'. PLoS ONE 4(8): e6481. https://doi.org/10.1371/journal.pone.0006481

Varghese, S. 'How small robots may kill the tractor and make farming efficient'. Nov. 11, 2018. Wired.com. https://www.wired.co.uk/article/farming-robots-small-robot-company-tractors

Verma, S. Babu, A. Patel, A. Singh, S. Pradhan, S. Verma, S. Singh, J. Singh, R. (2018). 'Significance of vermiwash on crop production: A review'. Journal of Pharmacognosy and Phytochemistry 2018; 7(2): 297-30. https://www.phytojournal.com/archives/2018/vol7issue2/PartE/7-1-13-247.pdf

Vickers, C. (Nov. 20, 2019). 'To feed the world in 2050 we need to build the plants that evolution didn't'. The Conversation.com. https://theconversation.com/to-feed-the-world-in-2050-we-need-to-build-the-plants-that-evolution-didnt-127316

Vyas, K. '13 Vertical Farming Innovations That Could Revolutionize Agriculture'. Interestingengineering.com. https://interestingengineering.com/13-vertical-farming-innovations-that-could-revolutionize-agriculture

Wack, P. (1984). Scenarios: The Gentle Art of Re-perceiving, Harvard Business School Working Paper 9-785-042, December 1984.

Waite, R. Hanson, C. Ranganthan, J. (July, 2019). 'Creating a Sustainable Food Future: A Menu of Solutions to feed nearly 10 Billion People by 2050'. World Resources Institute. https://research.wri.org/sites/default/files/2019-07/WRR_Food_Full_Report_0.pdf

Wanjek, C. (Mar. 19, 2019). ‘What are Superfoods?’. Live Science. https://www.livescience.com/34693-superfoods.html

‘What can be grown in a vertical farm?’ (N.D.) Light Science Technologies. https://lightsciencetech.com/what-can-be-grown-in-a-vertical-farm/

‘What is Agroecology?’ (N.D.) Agroecology Fund. https://www.agroecologyfund.org/what-is-agroecology

‘What is Agroecology?’ (N.D.) Navdanya International. https://navdanyainternational.org/key-issues/agroecology/

‘What is Aquaponics?’ (N.D.) https://www.theaquaponicsource.com/what-is-aquaponics/

‘Working for social change through ecological regeneration and community empowerment.’ https://www.hummingbirdproject.org/

Zhou, H. (2019): Population growth and industrialization. Published in: Economic Inquiry , Vol. 47, No. 2 (April 2009): pp. 249-265. https://doi.org/10.1111/j.1465-7295.2008.00151.x

#Envision2030 Goal 2: Zero Hunger (N.D.). Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture. https://www.un.org/development/desa/disabilities/envision2030-goal2.html

‘68% of the world population projected to live in urban areas by 2050, says UN’. (May 16, 2018). United Nations Department of Economic and Social Affairs.