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Sustainable Development Through Urban Agriculture

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Sustainable Development

Through Urban Agriculture

by

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A dissertation submitted in partial fulfilment
of the requirements for the degree of
Doctor of Philosophy
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Social Capital, Planetary Boundaries, Stormwater BMPs

DEDICATION

To my late Mom, Ely Maria Rivera Weaver, who was diagnosed with stage three ovarian cancer in 1997. It was as a result of this diagnosis that I raced back to my alma mater, the University of South Florida, to meet with Dr. Heidi Kay in the College of Public Health as she had attended Chemistry One with me during freshman year. I was soon researching the scientific alternatives for my mother's cancer fight, which ended on January 24th, 1999. And to my late 2nd Dad, Harold E. Aldrich, who got me to take this academic endeavour seriously, sadly, he succumbed to cancer as well.

Thanks also to my son, Christopher Alan Weaver, whose passion for, and demonstrated professional success in, teaching architecture help me understand my own inspiration to teach. And most of all, deep appreciation to my wife Kimberly Therese Finn, who found me along the way and helped me to stay grounded to complete this work.

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I greatly appreciate the time and effort that my doctoral committee, my co-committee advisors, and the many committee members both past and present invested in my pursuit. My Major Professor: Dr. Kalanithy Vairavamoorthy, signed-on to chair my research the first day he arrived at USF to run the new Patel School of Global Sustainability. My Co-Major Professor: Dr. Mahmood H. Nachabe, accepted my application as the Graduate Advisor in the Civil Engineering Department and agreed to Co-Advise with Dr. Vairavamoorthy. Dr. Michael W. Fountain, first suggested I obtain an MBA in December 2004. Dr. John M. Jermier, first hired me as his Editorial Assistant for *Organization & Environment* in May of 2006. And Dr. Ali Yalcin, worked with Dr. Vairavamoorthy and I as the Patel School of Global Sustainability became the Patel College of Global Sustainability.

As a non-traditional student, I presented a formidable challenge to them all, but was graced with their patience and determination to keep me focused. Further, I never would have made it without my three “brothers in the same fight”: Dr. John M. Jermier, for his friendship, understanding, mentorship, and steadfast support; Dr. Richard Berman for pushing me through the last hours, and Dr. Peter Stiling for guiding me to “let it go” and to move on to the next challenge ahead.

Further, gratitude goes to my peers, professors, and staff in each The College of Business, The College of Public Health, The College of Engineering, and The Patel College of Global Sustainability. Collectively, they provided me with the community support, teaching opportunities, as well as the research and graduate assistantship positions that helped to pay for the majority of this program.

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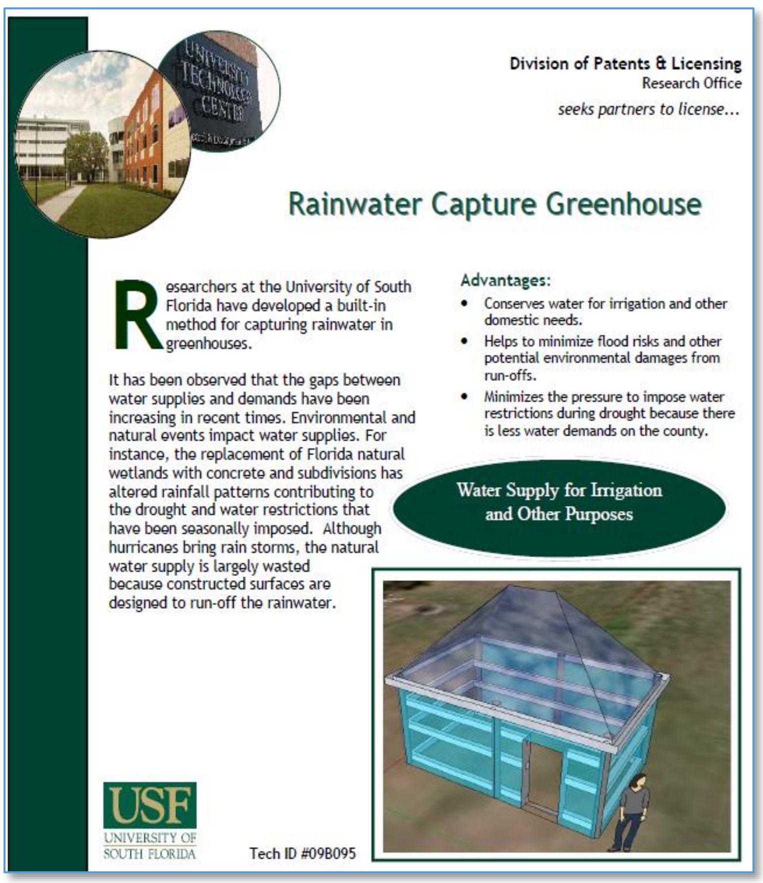
ABSTRACT

This document includes three completed publications to represent Urban Agriculture as a ideal solution to meet the UN Sustainable Development Goals. The first publication (Weaver, 2017a) provided in Chapter Two examines the stormwater Best Management Practices (BMPs) modelling parameters for the current EPA Stormwater Management Model (SWMM) as the first step to developing Urban Agriculture BMPs. The second publication (Weaver, 2015) provided in Chapter Three highlights how many high-rated scholars have identified agriculture as a critical driver for the planetary systems impacts we find with community development. The third publication (Weaver, 2017b) provided in Chapter Four breaks down a completely new definition for Urban Agriculture, as the foundational works disagree on meaning, resulting in an ambiguous definition. Together, these publications encourage engineers to model Urban Agriculture options for new green infrastructure (Weaver, 2017a), distinct from the Planetary Systems impacts of other contemporary options (Weaver, 2015), with a greater understanding of the social capital to engage stakeholders in meeting the UN Sustainable Development Goals (Weaver, 2017b).

CHAPTER 1: INTRODUCTION

This research started with the objective to complete a comprehensive comparison of Urban Agriculture (UA) with the existing stormwater Best Management Practices (BMP) at the Florida Aquarium demonstration site. My research postulated that UA is potentially the ideal BMP, which each resident can support and expand independently. However, the UA entrepreneurial patent explored for this engagement: The Rainwater Capture Greenhouse as shown in Figure 1.1, was proven to be unattainable, as similar systems had been patented previously.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Rainwater Capture Greenhouse

Researchers at the University of South Florida have developed a built-in method for capturing rainwater in greenhouses.

It has been observed that the gaps between water supplies and demands have been increasing in recent times. Environmental and natural events impact water supplies. For instance, the replacement of Florida natural wetlands with concrete and subdivisions has altered rainfall patterns contributing to the drought and water restrictions that have been seasonally imposed. Although hurricanes bring rain storms, the natural water supply is largely wasted because constructed surfaces are designed to run-off the rainwater.

Advantages:

- Conserves water for irrigation and other domestic needs.
- Helps to minimize flood risks and other potential environmental damages from run-offs.
- Minimizes the pressure to impose water restrictions during drought because there is less water demands on the county.

Water Supply for Irrigation and Other Purposes

USF
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Tech ID #09B095

Figure 1.1 The rainwater capture greenhouse

Therefore, the remainder of this document will outline the related objectives which were successfully completed. This effort resulted in the completion of three separate publications for different journals as outlined in Table 1.1. This chapter will introduce these three publications, provide a brief description of each, and then discuss the related aspects fundamental to the development of Urban Agriculture as a means to reach the UN Sustainable Development Goals.

Table 1.1 Journal publications included in this work*

Chapter	Title	Publisher	Date Approved
Two	Parameters sensitivities for sustainable urban infrastructure.	*Municipal Engineer* (Weaver 2017a)	February 02, 2017
Three	Sustainable development: for people or profit?	*Suburban Sustainability* (Weaver, 2015)	February 04, 2015
Four	*Urban agriculture defined for sustainable development.*	*Land Use Policy* (Weaver, 2017b)	Under Review

*All the journal publishers allowed reprinting of these articles for this doctoral dissertation submission. Each separate permission statement can be found in the Appendix A.

Urban Agriculture is a very common aspect of human development, heralding the beginning of civilization itself. Similarly, Industrial Agriculture has evolved to become a fundamental component of our modern societies. Critical to all forms of agriculture are water use and rainfall. For example, Urban Agriculture (UA) may use only rainfall, or collect and recycle stormwater runoff to support innovative urban plant production. Furthermore, Industrial Agriculture may also use rainfall supplemented with irrigation technologies, which may result in runoff. My work begins by examining these fundamental aspects and their differences to clarify key problems and encourage supporting specific solutions.

To begin, any modern urban development and the expansion of agriculture into new areas, infrastructure-modeling software technologies are used to simulate the required water flows. Chapter Two examines one of the major stormwater simulation programs from the Environmental Protection Agency (EPA) entitled SWMM, or the StormWater Management

Model, which was developed in the 1970s. SWMM simulates the rainfall and the resulting stormwater from land and constructed surfaces utilizing a dynamic hydrology-hydraulic water quality simulation model. That this water flows through existing and projected green infrastructure areas is one of the critical elements, which may encourage different agriculture technologies.

The first objective published (Weaver, 2017a), provided in Chapter Two, examines the stormwater Best Management Practices (BMPs) modelling parameters for use in the current EPA SWMM program as the first step to developing Urban Agriculture BMPs. Thus, Chapter Two finds that there exists a considerable literature gap in the availability of suitable parameters for developing models and designs for these new green infrastructure techniques. Thus, the publication completed a sensitivity analysis of SWMM parameters required for selected green infrastructure designs. This analysis shows a strong indication of the sensitivity relationships between parameters to enable engineers, designers, and planners to simulate green urban infrastructure at other locations. Future research is required to establish more detailed parameters for each type of UA beyond this analysis. The significant results completed, however, encourage future modelling of important green infrastructure installations to support the UN Sustainable Development Goals.

To support further development of these green infrastructure installations, the second objective evaluates the planetary impacts as reported in Chapter Three (Weaver, 2015). Herein the compiled research examines the primary drivers for many of the planetary system impacts. The research presents the impacts related to Climate Change and the nine Planetary Boundaries as found in the top-tier journals published recently and examined by scientists (Weaver, 2014). Significant differences exist between various aspects of agriculture, resulting in a great disparity in the knowledge published separating the versions of agriculture. This work explores this inconsistency in depth, highlighting how top-ranked scholars have evaluated these critical impacts in top-ranked journal publications.

The major gaps in the literature prevent governments, landuse administrators, planners, and engineers from understanding or adequately supporting new innovative alternatives. Having examined this literature, detailed examples of the existing problems are provided regarding the six critical areas impacted, including: biodiversity loss, nitrogen and phosphorus cycles, change in land use, water pollution, water use and chemical pollution. Thus, Chapter Three (Weaver, 2015) compiled this critical research to suggest that Urban Agriculture might be a suitable alternative. There has been a great deal of scholarly work establishing the Planetary Boundaries, therefore the Planetary Boundary Framework is used for this review. This analysis compiles many scientifically exemplary impacts from top-tier journals. Further, this work concludes by introducing significant science published to show how propaganda and multinational investments disregard Urban Agriculture as an alternative food production means. However, the science is not clear about what Urban Agriculture represents separately from the other systems. The cloud of propaganda and lobbyist efforts maintain government support for new industries to replace native and indigenous Urban Agriculture methods, which have remained within the Planetary Boundaries for thousands of years. Chapter Four expands on this Planetary Boundary Framework to include the Sensemaking Framework for establishing a new definition for Urban Agriculture to resolve this.

The final effort completed in the present work Chapter Four (Weaver, 2017b), establishes an Urban Agriculture definition clearly distinct from rural and industrial agriculture. This analysis began with four decades of Urban Agriculture literature pulled from multiple databases to ensure complete coverage of the discipline. The peer-reviewed publications were parsed into a dataset of 337 articles from 2000 to 2013 representing 90% of the total available English research. Grounded Theory was combined with Sensemaking to examine this data in a unique way. My interpretation of "sensemaking", based on Karl Weick, encouraged an open mind for observing data in terms of the Planetary Framework and the Systems Theory, to enable more holistic universal cues to be observed. This allowed me to be engaged with the actual circumstances experienced during the research process. What new relationships were observed in the new data? What other higher order relationships can be attributed to these observations? The experience to resolve this problem required direct empirical analysis of the published evidence obtained from USF Library in Tampa, Florida, linked to new understanding of the study of Capital.

Chapter Four brings together the key findings on Urban Agriculture found to be based primarily on Social Capital, separate from the Manufactured Capital and Financial Capital that dominate Industrial Agriculture. Engineers and other community development professionals can now better understand how the differences in agriculture, highlighted herein, better support the UN Sustainable Development Goals.

Finally, Chapter Five represents how the completed research supported the concurrent examination of published works which were organized around the three critical literature gaps for supporting Urban Agriculture. The SWMM model parameters allowing engineers to develop suitable green infrastructure design, are outlined in Chapter Two. Next, Chapter Three reviews the impacts from agriculture through the Planetary Boundary Framework to suggest new green infrastructure alternatives beyond the propaganda and miss-information of lobbyists. Chapter Four combines Sensemaking experiences and the literature issues of Capital to bring holistic perspectives of the Planetary Boundary Framework and Systems Theory. This resulted in the science supporting a new definition of Urban Agriculture beyond the current paradigms. Herein, I argue that the United Nations Sustainable Development Goals can be easily achieved when the planning community understands the full definition of Urban Agriculture through this Planetary Boundary Framework and System Thinking. The data based analysis of this study recommends the Appreciative Inquiry approach with the Community Capitals Framework. This integrated framework can direct stakeholders to establish new policies to achieve this next evolutionary stage of the Anthropocene to reach the United Nations Sustainable Development Goals through social capital. I think it is important to identify this new definition to understand the opportunities made available from the onset of Sustainable Development stepping beyond the propaganda of multinational lobbyists.

CHAPTER 2: PARAMETERS SENSITIVITIES FOR SUSTAINABLE URBAN INFRASTRUCTURE[1]

2.1 Introduction

This paper outlines the proper use of the EPA Stormwater Management Model (SWMM) developing parameter values for professionals to model BMPs, LIDs, and other green infrastructures. Green infrastructure uses natural processes such as infiltration and evapotranspiration to reduce stormwater impacts to adjacent water bodies. Low Impact Development (LID) mitigates stormwater sources through the use of technology and infrastructure such as rain barrels, permeable pavements, grassed swales, green rooftops and other BMPs. Similarly, EPA defines BMPs as "Best Management Practices" to include:

> Schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of "waters of the United States." BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage (The National Pollutant Discharge Elimination System. Code of Federal Regulations, 40 CFR 122.2).

The literature details the current uses, and identifies the critical gaps in the data for adequate parameter development to model LIDs and BMPs, See Figure 2.1. The SWMM

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1 This chapter was published in Weaver, E. R. R., & M. H. Nachabe. 2017. Parameters sensitivities for sustainable urban infrastructure *Proceedings of the Institution of Civil Engineers - Municipal Engineer*. Ahead of Print, pp. 1–10. Published online: March 3, 2017 http://dx.doi.org/10.1680/jmuen.16.00021 Permission is included in Appendix A.

program development is discussed followed by a brief introduction to the sensitivity processes used. This is further expanded in the following Section 2.3. Methods and Materials.

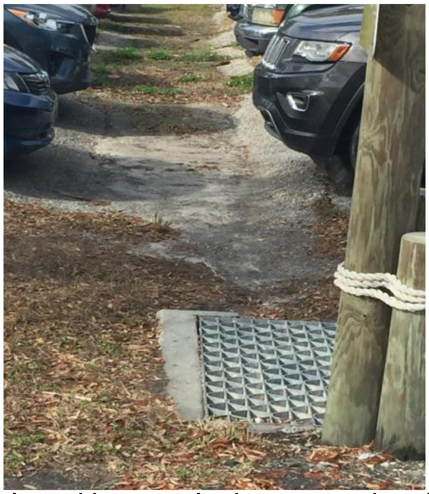

Figure 2.1 Asphalt parking swale demonstrating the typical construction configuration for commercial parking lots (Rushton & Hastings, 2001)

The EPA Stormwater Management Model (SWMM) has been used internationally to evaluate the dynamic rainfall-runoff effects of urban areas since 1971 (Rossman, 2015). The current SWMM version allows LID and BMP simulations to represent urban quality and quantity impacts to adjacent water bodies. To reduce these impacts, communities invest in sustainable urban infrastructures, such as stormwater BMPs, LIDs, and other urban green infrastructures to reduce stormwater runoff impacts.

Significant efforts have contributed to developing models and tools to evaluate these more sustainable urban infrastructures. The literature currently has a great disparity in the development of model parameters regarding sustainable urban infrastructure. To resolve this, ten years of BMP sampling data has been compiled to support this sensitivity analysis of EPA SWMM 5.1.011. This current study determines the model parameterization relationships for selected LID features for use by others in future site development. The preliminary results indicate that the derived model parameters are sufficient to support the configuration of sustainable urban infrastructure as shown for the Florida Aquarium in Tampa, Florida.

2.2 LIDs and BMPs to Reduce TMDLs

Many communities are investing substantially in sustainable urban infrastructure systems to reduce non-point pollution loading as required to meet TMDL requirements (Barrett, 2015; Breuste, Artmann, Li, & Xie, 2015; Koppenjan & Enserink, 2009; Minsker et al., 2015). Thus, considerable research efforts have explored sustainable urban infrastructure systems, such as Low Impact Developments (LID; Barrett, 2015; Jia, Yao, & Shaw, 2013; Niemczynowicz, 1994; Zhang, Hamlett, Reed, & Tang, 2013), stormwater Best Management Practices (BMP; Field, Brown, & Vilkelis, 1994; J. H. Lee & Bang, 2000; Muthukrishnan & Field, 2004; Steffen, Jensen, Pomeroy, & Burian, 2013; Wanielista & Yousef, 1986), and other Green Infrastructure technologies (GI, Barrett, 2015; Breuste et al., 2015; Karvazy & Webster, 2015).

Barrett (2015) noted that the recent 2015 Houston conference continued to promote LIDs accelerating their use by improving understanding and informing practitioners, see Figure 2.2. The planning and construction of these sustainable urban infrastructure technologies requires modelling of their impacts for proper design and community support. This present sensitivity analysis focuses on the EPA SWMM version 5.1.011 program. Many BMPs have already been modelled by SWMM (Burns et al., 2015; Gülbaz & Kazezyilmaz-Alhan, 2014; Steffen et al., 2013; Van der Sterren et al., 2014; Zhang et al., 2013).

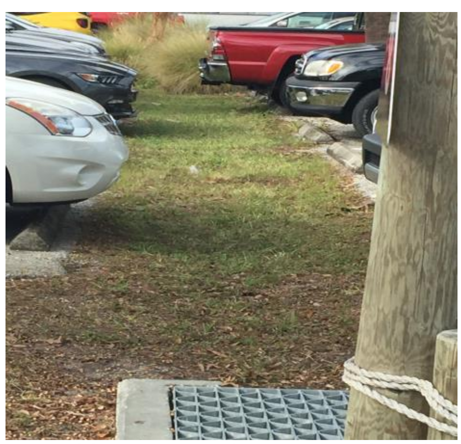

Figure 2.2 Grass parking swale demonstrating the LID construction configuration to filter parking lot stormwater (picture used with permission from Rushton & Hastings, 2001)

For example, Gülbaz and Kazezyilmaz-Alhan (2014) found when modelling 5% of Low Impact Development (LID) areas in EPA SWMM resulted in the stormwater runoff reduced by 13%. Van der Sterren et al. (2014) reported that small-scale household rainwater capture systems could be adequately modelled with XP-SWMM. Similarly, Burns et al. (2015) confirmed that small scale neighbourhood rainwater collection tanks coupled with infiltration swales are effective for reducing the overall flood area by 40%, see Figure 2.3 Typical Swale Cross Section.

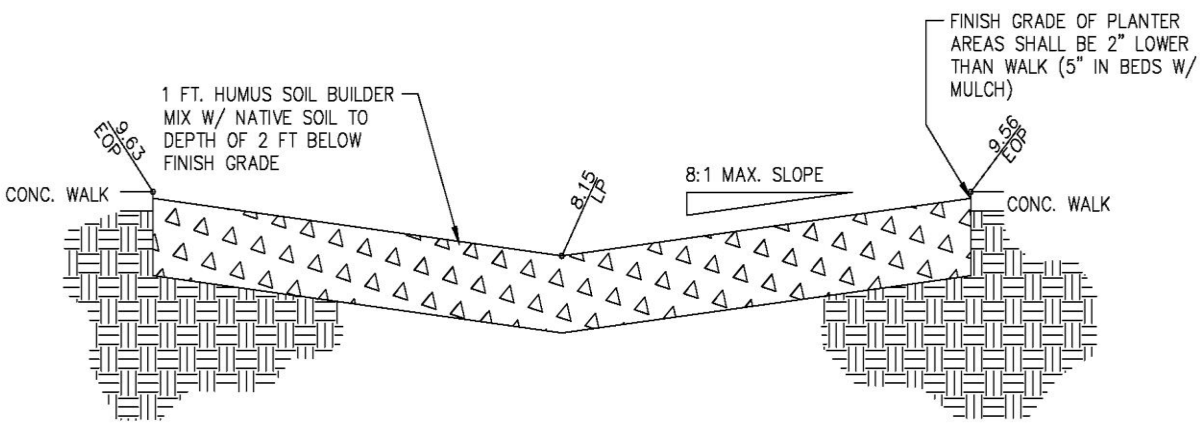

Figure 2.3 Typical swale cross section used throughout the site (picture used with permission from Rushton & Hastings, 2001)

However, Fletcher et al. (2013) suggested that the software modelling technologies for estimating water balances and pollutants is poor. Hamel et al. (2013) agree that the sustainable infrastructure infiltration modelling efforts are limited with the "fundamental research gaps in catchment modelling" (p. 208). Model parameter development is necessary for accurate modelling of BMPs. Jacobson (2011) further defined how a sensitivity analyses was still necessary for understanding how calibration parameters affect software modelling technologies.

Many authors have completed model sensitivity analyses for priority parameter identification (Barco et al., 2008; Krebs et al., 2013; Lee et al., 2014; Song et al., 2015; Zaghloul, 1983). These methods help define which model parameters have the highest impact on the final model outcomes. For example, Lee et al. (2014) found that for pervious pavement installations of sustainable urban infrastructure the horizontal exfiltration was the critical parameter for simulation of the hydrologic performance. Krebs et al. (2013) determined that the vital parameters in the sensitivity analysis of closed conduit flow SWMM simulations are the Manning's n coefficients and the impervious depression storage. However, many of these studies are missing measured site data. The present analysis will examine long-term samples data sensitivities of the infiltration swales added to EPA SWMM Version 5.1.011 (Rossman, 2015).

Song et al. (2015) claimed that no particular sensitivity analysis is better than any other, while using multiple methods at the same time is advantageous. Rosa et al., (2015) confirm that suitable catchment data is necessary for proper calibrations for LID modelling, as most cases are missing this data. Chow et al., (2012) used EPA SWMM version 5.0 to determine that the runoff depth and peak flow are sensitive to urban catchment parameters. Zhang (2014) similarly used SWMM Version 5.1.006. Rosa et al. (2015) recommended that more detailed Green-Ampt parameters in the SWMM manual would support better calibration efforts. Finally, these recent publications also conclude that a long-term data analysis is missing from the published literature. The following analysis will use a common sensitivity analysis method to examine long-term data collected over ten years to resolve these issues.

2.3 Methods and Materials

A long-term BMP analysis is critical to engineering and landuse administrator's support of sustainable urban infrastructure systems. This BMP analysis will give planners confidence in the technologies to encourage greater community support. The modelling of the configuration parameters developed for the Florida Aquarium, see Figure 2.4, support BMP analysis for implementation in urban construction.

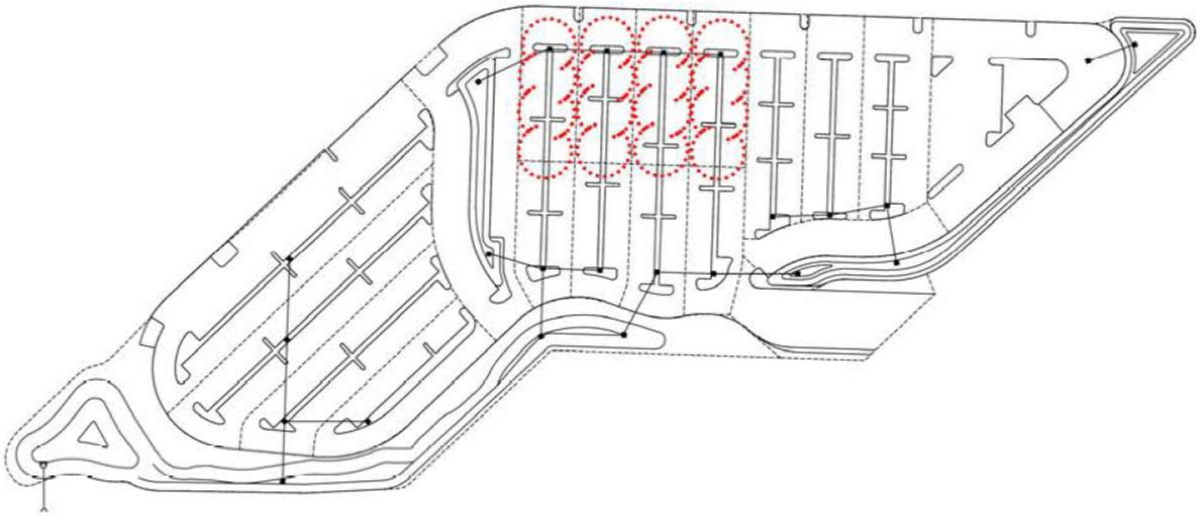

Figure 2.4 Florida Aquarium study area with parking lot drainage swale locations clouded in dotted area (picture used with permission from Rushton & Hastings, 2001)

This analysis will include values such as conductivity, suction head, initial deficit, impervious roughness, pervious roughness, impervious slope, pervious slope, percent zero impervious, percent impervious, drainage width, basin slope, and basin curb length collected from construction in 1995 to 2005 (Burns, Fletcher, Walsh, Ladson, & Hart, 2014; Rossman, 2010). The Florida Aquarium parking lot included specific designs to test many BMPs, where sampling was completed for over 10 years (Rushton & Hastings, 2001). The required data for this analysis was obtained from the public records archives at the Southwest Florida Water Management District (SWFWMD) and the Florida Department of Environmental Protection (FDEP).

2.3.1 Study Area

The site for the Florida Aquarium included many BMP pilot tests in the parking lot designed by Ekistics Design Studio, Urban Landscape Architects. This included the different parking lot materials of pavement, concrete, and pervious paving, both with and without vegetative swales (Figures 2.1 and 2.2 as located in Figure 2.5). SWFWMD and FDEP funded the installation of monitoring equipment to be supplemented by grab samples tested in their labs. A total of 59 rain events were recorded ranging from 0.25 inches to 3 inches (Rushton &

Hastings, 2001). Each separate basin had data collected individually to evaluate the difference between the installed BMPs.

The subsequent data analysis will support the use of model parameters for simulation of BMPs in other locations. Additionally, model parameters are compared to determine key BMP features that support selective flow reductions. Thus, the proposed analysis simulates a selected sample of the site layout, as shown in Figure 2.5 Model Area, and develops the parameters for BMP configuration. The completed system analysis allows detailed comparison of the existing BMPs used in the industry to publish the important results and submit the findings to industry professionals for future model simulations of new site improvements seeking to support BMP installations.

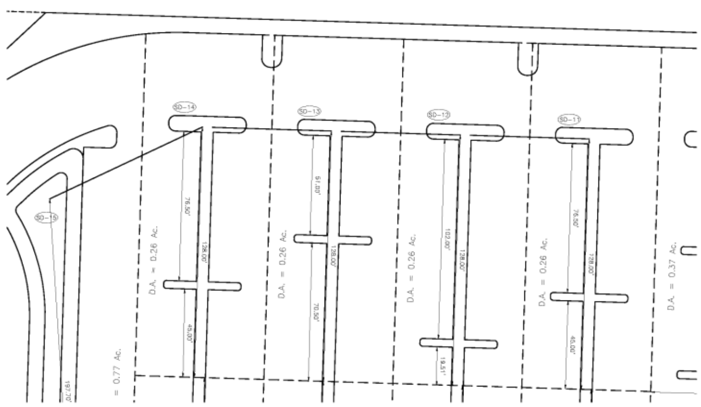

Figure 2.5 Model area of the parking lot is shown to include four separate swale designs (picture used with permission from Rushton & Hastings, 2001)

2.3.2 SWMM Calibration

As shown in Figure 2.5, the parking lot model for this BMP analysis includes four main subcatchments representative of the entire site. The SWMM data parameters for these subcatchments begin with the measures that are site specific to the areas modelled. The flows through each of the systems identified were collected onsite for over 10 years. For this calibration selected storms were run to match the maximum flows observed on site. Each system diagrammed on site includes the basin outline, the basin node which outfalls to the system nodes as listed in Table 2.1. The system node represent the beginning of the swale configuration also noted in Table 2.1 by the numbered links and the Model Layout (Figure 2.5).

Table 2.1 System calibration configuration

LID/BMP Config.	System	Links
Asphalt w/ swale	node43	35
Asphalt w/o swale	node14	36
Perv. Cement w/ swale	node16	37
Perm. Paving w/ swale	node15	38

The swales each end at the SD nodes which represent the stormwater structures discharging to the drainage pipes connected to the outfall pond at SD-15. Thus, the Simulated versus Observed data provided in Figure 2.6, is looking at the maximum flows through the links numbers to the SD structures which are the critical points for the analysis. All reported analyses are addressing these same structure points. Thus, each of these SD structures represents the final outfall of the different BMP configurations used in the Low Impact Development configuration.

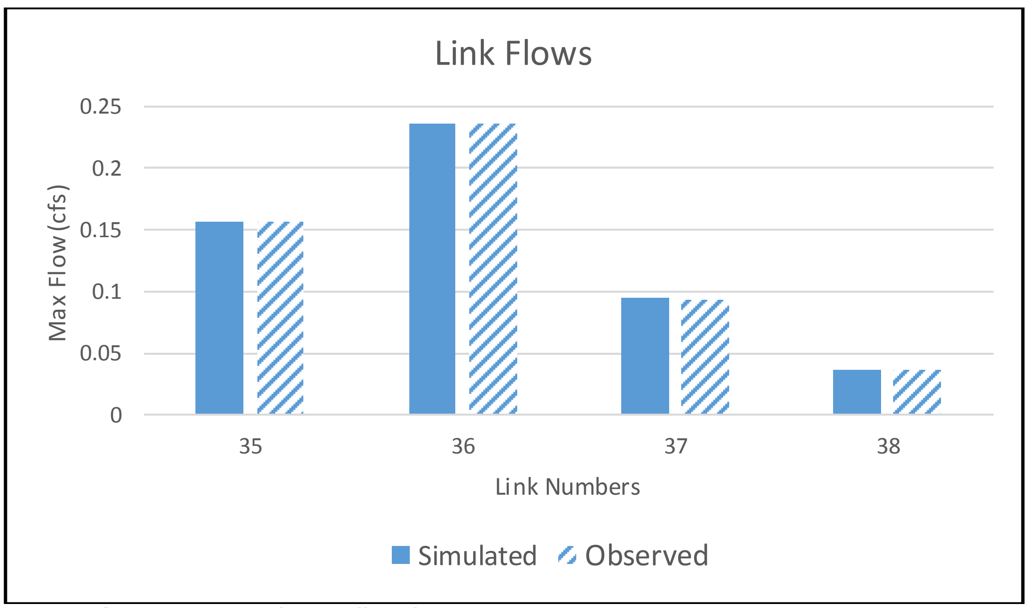

Figure 2.6 Model calibration

The simulated flows were calibrated to the observed flow as noted in Figure 2.6. The first BMP studied, Link 35, was the parking lot with a grassed swale (see Figure 2.2). Link 36 is the same sized parking lot, but without the grassed swale (see Figure 2.1). The difference between these designs indicates a 34% increase in flows as noted in Figure 2.6. This shows the effectiveness of adding the grassed swale to lower the flows. Additionally, Link 37 includes pervious cement and a grassed swale, which decreased the stormwater runoff by 60% over the asphalt alone in Link 36. Using the permeable paving with a grassed swale, as indicated by Link 38, reduced the flow nearly 85% over the asphalt design of Link 36.

This is a substantial reduction of stormwater leaving this parking area. In this last configuration a substantial amount of stormwater is soaking into the permeable pavement and the grassed swales. This LID design change will reduce the pipe and pond sizes required to remove and attenuate the excess stormwater derived from paving a parking lot resulting in a significant construction cost reduction. Figure 2.6 shows the differences between the different BMP designs at this location. Examining the differences between these designs allows a clear understanding of the parameterization used in the SWMM stormwater software. However, as indicated in the ten years of data collected at the Florida Aquarium, this permeability rate decreased over time because of the silting of the voids in the permeable pavement (critical data supporting site maintenance requirement for a future study).

2.3.3 SWMM Parameterization

For this analysis, the Florida Aquarium site data, see Table 2.2, was obtained from the original permit files and verified with site visits and reviews with project design staff at Ekistics Design Studios. For the sensitivity analysis these variables were all kept constant as designed and installed at the Florida Aquarium site.

Table 2.2 Subcatchment site properties*

Name	Description of subcatchment site properties
OutiD	Name of node or subcatchment that receives runoff from subcatchment
Area	Area of subcatchment (acres or hectares)
%Imperv	Percent imperviousness of subcatchment

Table 2.2 (Continued)

Width	Characteristic width of subcatchment (ft or meters)
Slope	Subcatchment slope (percent)
Clength	Total curb length (any length units)
Spack	Name of snow pack object (from [SNOWPACKS] section) that characterizes snow accumulation and melting over the subcatchment

*(adopted from Rossman, 2010)

The Subcatchment Site Data in Table 2.2 introduces the first set of properties to simulate the LID configuration at the Florida Aquarium. According to the SWMM manual, subcatchment characteristic width (see Table 2.2) is a calibration parameter that should be adjusted to improve agreement between observed and predicted runoff volume and peak flow. It is defined as the characteristic width of the overland flow path for sheet flow runoff and an initial estimate is obtained by dividing the area of a subcatchment by the average maximum overland flow length (Rossman, 2010). This was completed in the previous section. The additional parameters required for the subcatchments area are listed in Table 2.3 were modified for the sensitivity analysis.

Table 2.3 Subareas site parameters*

Name	Description of subareas data parameter
Nimp	Manning's n for overland flow over the impervious sub-area
Nperv	Manning's n for overland flow over the pervious sub-area
Sperv	Depression storage for pervious sub-area (inches or mm)
%Zero	Percent of impervious area with no depression storage
RouteTo	Use impervious if pervious area runoff runs onto impervious area, pervious if impervious runoff runs onto pervious area, or outlet if both areas drain to the subcatchment's outlet (default = outlet)
%Rted	Percent of runoff routed from one type of area to another (default = l00).

*(adopted from Rossman, 2010)

In this case, the parameters that were part of the sensitivity analysis are listed in Table 2.4 with the appropriate referenced range of values derived from the literature as noted.

Table 2.4 Subareas parameter ranges used in sensitivity analysis*

Nimp	Nperv	SImp (in)	Spev (in)
0.01 - 0.015 (McCuen, 1996)	0.13 - 0.4 (McCuen, 1996)	0.1 - 0.5 (Jones, 1992)	0.1 - 0.5 (Jones, 1992)

*(adopted from Rossman, 2010)

Another set of subcatchment parameters to be analysed are listed in Table 2.5, these are providing for the Green-Ampt infiltration calculations completed for subareas in the simulation (including the referenced parameter ranges for the sandy urban soils at this site location).

Table 2.5 Swale infiltrations parameter ranges used in sensitivity analysis*

Parameter	Description	Values
Suction	Soil capillary suction (in).	1.93 - 9.0
Ksat	Soil saturated hydraulic conductivity (in/hr)	0.2 – 4.74
InitDef	Initial soil moisture deficit (volume of voids / total volume)	0.2 - 0.375

*(Rawls et al., 1983; Rossman, 2010)

The primary set of parameters specific for a BMP are defined in SWMM as the LID Surface Layers associated with a swale. The values from the Florida Aquarium construction plans are entered in the SWMM data fields as depicted in Figure 2.7.

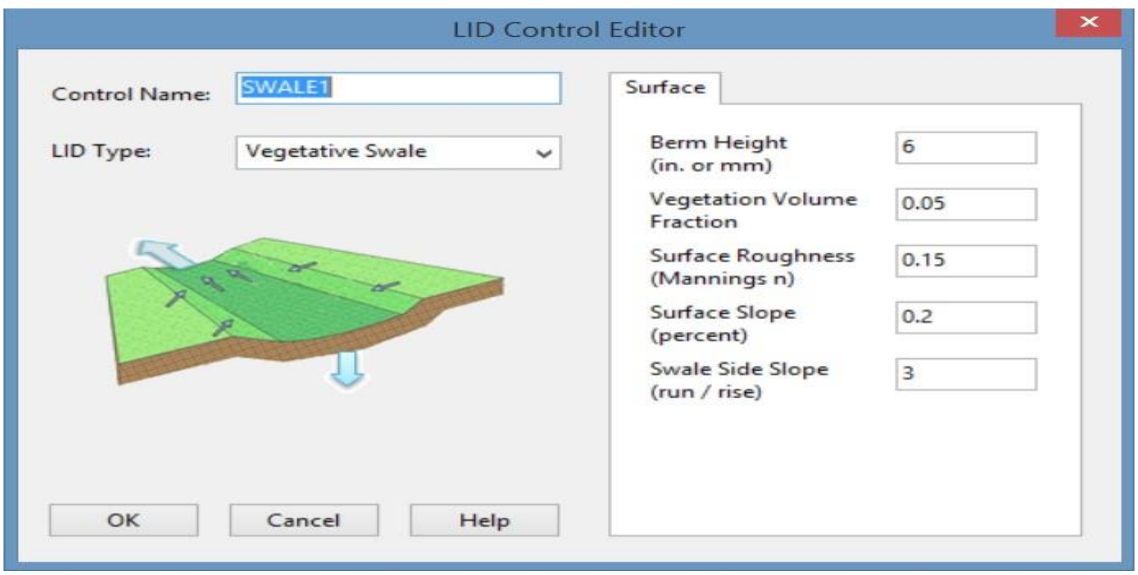

Figure 2.7 LID swale layers for vegetative swale for data entry into SWMM (adopted from SWMM 5.1.011 [Computer software]. Cincinnati, OH, U.S. EPA).

These parameters are defined in Table 2.6 with a suitable range of values referenced from the literature.

Table 2.6 Parameters for swale layers as shown from SWMM in Figure 2.7*

Parameter	Description	Values
StorHt	When confining walls or berms are present, this is the maximum depth to which water can pond above the surface of the unit before overflow occurs (in inches or mm). For LIDs that experience overland flow it is the height of any surface depression storage. For swales, it is the height of its trapezoidal cross section (in).	6 - 8
VegFrac	Fraction of the area above the surface that is filled with vegetation (%).	0.0 - 0.2
Rough	Manning's n for overland flow over the surface of porous pavement or a vegetative swale. Use 0 for other types of LIDs.	0.13 - 0.4
Slope	Slope of porous pavement surface or vegetative swale (%). Use 0 for other types of LIDs.	0.1 - 2
X slope	Slope (run over rise) of the side walls of a vegetative swale's cross section. Use 0 for other types of LIDs.	3:1 – 5:1

*(adopted from McCuen, 1996; Rossman, 2010)

2.3.4 Sensitivity Analysis

Rosa et al. (2015) recommended adjustment of the value by 50% as the calibration methods used by Jewell et al. (1978). Meeting these conditions, each parameter is adjusted to calculate the associated sensitivity of the results compared to the original model data. However, these procedures were not used whenever the suitable range of values for the proposed parameter did allow for a 50% change. For example, in Table 2.6 the swale cross section slope (X slope) onsite is 4:1. To examine the sensitivity of this parameter the revised parameter only has a range of 3:1 – 5:1, or only a 25% adjustment for examining this parameter sensitivity, which is less that the 50% recommended by Rosa et al. (2015).

Furthermore, Rosa et al. (2015) also recommended the sensitivity analysis methods published by James and Burges (1982). This technique determines sensitivity (S) as the change of the model results (R) over the change of the parameter (P). Thus:

S = dR/dP

Similarly, Relative Sensitivity (Sr) as derived by James and Burges (1982) is:

Sr = (dR/dP)(P/R)

These sensitivity calculations for the parameters discussed in Section 3.2 were completed. To enable easier comparisons the percentage change of the original value along with the sensitivity values were also reviewed. The previous data in Table 2.6 of Parameters for swales resulted in Table 2.7 for the sensitivity values. The first set of values (% dP = change in parameter; S = Sensitivity; Sr = Relative Sensitivity) represent the (P1 to P2) calculation while the second set of values represent the (P1 to P3) calculation. Each parameter change is carried out for all four swale BMPs studied to support comparison.

Table 2.7 Swale parameter sensitivities

StorHt	P1	P2	% dP	S	Sr	P3	% dP	S	Sr
Perm. Paving w/	6	5	-17%	0.48	11.7%	8	33%	-0.17	-4.3%
Perv. Cement w/	6			0.14	4.1%			-0.12	-3.7%
Asphalt w/o swale	6			0.06	2.4%			-0.05	-1.8%
Asphalt w/ swale	6			0.06	7.3%			-0.04	-4.8%
VegFrac									
Perm. Paving w/	0.05	0	-	0.60	0.1%	0.2	300%	-0.07	0.0%
Perv. Cement w/	0.05			0.00	0.0%			-0.33	-0.1%
Asphalt w/o swale	0.05			0.00	0.0%			0.00	0.0%
Asphalt w/ swale	0.05			0.20	0.2%			-0.07	-0.1%
Rough									
Perm. Paving w/	0.15	0.13	-13%	2.00	1.2%	0.4	167%	-2.08	-1.3%
Perv. Cement w/	0.15			1.50	1.1%			-1.92	-1.4%
Asphalt w/o swale	0.15			.50	0.5%			-0.60	-0.6%
Asphalt w/ swale	0.15			1.00	3.0%			-0.80	-2.4%
Slope									
Perm. Paving w/	0.2	0.1	-50%	1.10	0.9%	2	900%	0.21	0.2%
Perv. Cement w/	0.2			0.40	0.4%			0.07	0.1%
Asphalt w/o swale	0.2			0.30	0.4%			0.03	0.0%
Asphalt w/ swale	0.2			0.20	0.8%			0.02	0.1%
Xslope									
Perm. Paving w/	4	3	-25%	0.26	4.2%	5	25%	0.27	4.4%
Perv. Cement w/	4			0.13	2.6%			0.11	2.2%
Asphalt w/o swale	4			0.06	1.6%			0.03	0.8%
Asphalt w/ swale	4			0.05	4.0%			0.04	3.2%

2.4 Results

The results of this analysis indicate the sensitivity of the different BMP drainage systems under analysis. In this analysis, each swale has the same size and configuration allowing for detailed review of the parameters specific for the LID design. These adjustments of parameters resulted in effects across the system. For example, the StorHt represents the storage height available for ponding in the systems. Thus, the reduction of the StorHt parameter by one foot increased the permeable paving w/ swale design flow by Sr = 11.7% while the asphalt w/o swale only increase by 2.4%. This is completely reasonable and expected as less depth retaining the stormwater will increase flow because of lower storage and also because of lower permeable area outflows, while the pavement only areas have the lower storage. Similarly, reducing the VegFrac has a zero effect on the asphalt w/o the swale but increases outflows elsewhere. Other changes of parameters show similar changes for the flows in each BMP design. Reviewing these values similarly reveals the relationships of different parameters for improving LID systems. Further, the swale modification can have even more significant changes to the outfall flow rates. However, these parameter changes can have significant cost implication. For example, changing the soil conductivity (Ksat in Table 2.8) from sand (Ksat = 4.74) to loam (Ksat = 0.2) requires excavating the existing sand and replacing it with purchases loam soil.

Table 2.8 Infiltrations parameter sensitivity analysis

Ksat	P1	P2	% dP	S	Sr	P2	% dP	S	Sr
Perm. Paving w/	4.74	0.2	-96%	-0.90	-	2	-58%	-0.68	-
Perv. Cement w/	4.74			-0.61	-			-0.43	-
Asphalt w/o swale	4.74			-0.31	-9.6%			-0.21	-6.6%
Asphalt w/ swale	4.74			-0.21	-			-0.14	-
Suction									
Perm. Paving w/	1.93	5	159%	-5.62	-	9	366%	-0.07	-0.6%
Perv. Cement w/	1.93			-4.58	-			-0.05	-0.4%
Asphalt w/o swale	1.93			-3.20	-			-0.02	-0.2%
Asphalt w/ swale	1.93			-0.48	-			-0.02	-0.7%

Table 2.8 (Continued)

InitDef									
Perm. Paving w/	0.37	0.2	-	1.77	2.7%	0.4	7%	-0.40	-0.6%
Perv. Cement w/	0.37			0.80	1.5%			-0.40	-0.7%
Asphalt w/o	0.37			0.46	1.1%			-0.40	-1.0%
Asphalt w/ swale	0.37			0.23	1.7%			-0.80	-6.0%
Nimp									
Perm. Paving w/	0.01	0.01	-	10.00	0.5%	0.012	-8%	14.00	7.4%
Perv. Cement w/	0.01			26.67	1.7%			20.00	1.3%
Asphalt w/o	0.01			3.33	0.3%			0.00	0.0%
Asphalt w/ swale	0.01			16.67	4.4%			20.00	5.2%
Nimp									
Perm. Paving w/	0.01	0.014	8%	-70.00	-3.7%	0.015	15%	-20.00	-1.1%
Perv. Cement w/	0.01			-20.00	-1.3%			-35.00	-2.2%
Asphalt w/o	0.01			0.00	0.0%			-20.00	-1.7%
Asphalt w/ swale	0.01			-20.00	-5.2%			-5.00	-1.3%
Simp									
Perm. Paving w/	0.1	0.2	100%	-2.10	-	0.4	300%	-1.97	-
Perv. Cement w/	0.1			-1.20	-			-1.30	-
Asphalt w/o swale	0.1			-0.90	-			-0.93	-
Asphalt w/ swale	0.1			-0.30	-			-0.30	-
Spev									
Perm. Paving w/	0.2	0.1	-50%	-0.10	-	0.4	100%	0.00	0.0
Perv. Cement w/	0.2			0.00	0.0			0.05	0.0
Asphalt w/o swale	0.2			0.00	0.0			0.05	0.1
Asphalt w/ swale	0.2			0.00	0.0			0.00	0.0

2.5 Discussion

Each parameter listed in Tables 2.3 and 2.6 were adjusted to evaluate the sensitivity to changes within the suitable range for the parameters at the Florida Aquarium site. As another more specific example, the cross-sections slopes on the existing site are at 4:1, while this data review indicates the steeper slopes will result in a higher flow rate. The data indicates that at 4:1 side slopes during the storm event results indicated that the swale carries about 1.08 cfs to the outfall structure. With the 25% change in the side slopes this swale flows increased to 1.09 cfs. This simple calculation shows the significance of this sensitivity analysis, since adjusting 128 feet of swale from the 4:1 slope to a 3:1 slope in Florida will require a significant investment to ensure adequate slope stabilization, changing from hydroseeding to sodding, see Table 2.9.

Table 2.9 Florida swale grass requirements*

Establishment Technique Conditions	Conditions
1.a. Hydroseeding	1. Slopes less than 5%. 2. Velocity less than 3 feet (1 m) per second.
1.b. Establishing Bermuda grass	1. Majority of drainage can be diverted away from channel by sprigging during germination and establishment. 2. Erosion-resistant soil.
2. Seeding with straw mulch and jute mesh or erosion netting	1 . Slopes less than 5%. 2. Velocity less than 5 feet (1.5 m) per second. 3. Majority of drainage cannot be diverted from channel during germination and establishment. 4. Moderately erodible soil.
3. Sodding	1. Slopes greater than 5%. 2. Velocity between 5 and 6 feet (1.5 to 1.8 m) per second. 3. Majority of drainage cannot be diverted away from channel during germination and establishment. 4. Highly erodible soil.

*(adopted from DeWiest & Livingston, 2008)

Sodding can cost as much as $1-2/sf while hydroseeding can be as cheap as $0.07-0.15 /sf making the additional 0.01cfs of flow in this example very expensive which is important for choosing which parameters are suitable for changing in different LID configurations..

Understanding these fundamental limitations for modelling will simplify future analyses and calibrations, as does this completed sensitivity analysis. A future SWMM user must first examine the results provided to note where the changes and variabilities are reasonable. Thus, the distribution of sensitivity measures provided in Table 2.7 and 2.8 supports understanding of the parameter changes for quicker calibration. Finally, Tables 2.1-2.5 provide many parameters from the SWMM manual, but also include additional references to other suitable sources as requested by Rosa et al. (2015).

2.6 Conclusion

The results of this analysis indicated that the new EPA SWMM 5.1.011 more closely simulates the sustainable urban infrastructure components. The current model configuration provides a great deal of flexibility to allow users to focus on the specific measures that are suitable for reducing the impacts to the receiving waters. These preliminary results indicate that model parameters are sufficient to support the configuration of sustainable urban infrastructure at the Florida Aquarium in Tampa, Florida. This analysis provides a strong indication of the sensitivity relationships of parameters allowing engineers, designers, and planners to simulate sustainable urban infrastructure at other locations. The physical properties of swale vegetation, including the volume fraction and associated manning's show the greatest impacts while changes in the slopes and storage might be more costly and have limited results.

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CHAPTER 3: SUSTAINABLE DEVELOPMENT: FOR PEOPLE OR PROFIT?[2]

3.1 Introduction

Sustainability has made steady progress, according to the 2000 United Nations Conference on Sustainable Development (RIO+20), since 1987 when the Brundtland Commission released its "Report of the World Commission on the Environment and Development: Our Common Future." This work included agreements by world leaders to address human impact on the environment (United Nations, 1992a), climate change, desertification and biodiversity (United Nations, 1992b), policy implementation plans (United Nations, 2002), and food production (G8 Summit, 2009). However, these policies did not translate into action, leading scientists prior to the first Earth Summit in 1992 to request global political leaders to commit to actions beyond additional policy agreements, and discussions to address environmental degradation.[3]

Research defined how environmental degradation continues to impact planetary systems (Rockström et al., 2009a). Again, before the June 2012 Rio+20 Earth Summit, scientists made recommendations to the world's political leaders for decisive actions against the environmental degradation problems (Biermann et al., 2012; UNEP, 2012; Hansen, Sato, & Ruedy; 2012, Barnosky et al., 2012). Here we show that although scientists consistently "cry wolf" for enforced environmental regulations and critical actions, the politicians have their own agenda and thus do not listen to scientists' recommendations (Hansen et al., 2012).

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2 This chapter was published in Weaver, E. R. R. (2015). Sustainable Development for People or Profit? *Suburban Sustainability*, 3(1), 2. Retrieved from http://scholarcommons.usf.edu/subsust/vol3/iss1/2 Permission is included in Appendix A.

3 Statement by the Royal Society and National Academy of Sciences (1992), Union of Concerned Scientists (1992), Watson (1992), Holden (1992), Stem (1993), Hansen et al. (1991).

Building a sustainable alternative is required before any population can comprehend and undertake the required actions to support Earth's carrying capacity into the 22nd Century, according to Leach et al. (2012). Leach argues that we find that the "status quo" (IAASTD, 2009) paradigm of industrial agriculture systems is the primary factor impacting our planet's ecosystem. Population support for new agricultural alternatives must begin with recognizing that this "status quo" (IAASTD, 2009) is about corporations and politicians maintaining their profits, not sustaining the planet, supporting the Earth's carrying capacity, or creating sustainable food security for any population.[4] "Business as usual is no longer an option" (IAASTD, 2009).

Thus, here we show the major threat to sustainable agricultural systems and the Earth's carrying capacity is not only global warming, water shortages, and biodiversity loss; the existing sustainable agricultural systems are threatened most by industrial agriculture and the associated corporate land grabs (Cotula & Vermeulen, 2009; ETC Group, 2009; Gall, 2003a, b; Ayres, 2004), toxic over spray (Horrigan, Lawrence, & Walker, 2002; Carson, 1962; Davidson, Shaffer, & Jennings 2002; Jamison et al., 2006; Lindley, 1976) and GMO drift (IAASTD, 2009; Horrigan, Lawrence, & Walker, 2002).

3.2 Unsustainable Industrial Agriculture

Industrial agriculture is the primary reason for human-provoked planetary impacts. Unsustainable industrial agricultural systems impact all the planetary systems defined by Rockström et al. (2009a) in research at the Stockholm Resilience Centre. Industry's unrelenting environmental degradation has impacted the Planetary Boundaries and threatens Earth's carrying capacity (Cohen, 1995) for fundamental sustenance of all human populations. As shown in Figure 3.1, the original work of Rockström et al. (2009b) was so profound that it was highlighted in the top tier journal Nature. Similarly, articles to support this current debate were compiled from comparable top tier journals and references derived therein. The next section

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4 Monsanto Company. "Improving Agriculture" entry. Company website. 2002-2013. Retrieved Sunday, 12/16/2012. http://www.monsanto.com/improvingagriculture/pages/our-role.aspx

details the increased human-provoked impacts resulting from industrial agriculture in seven of these nine planetary systems studied in top tier journals.

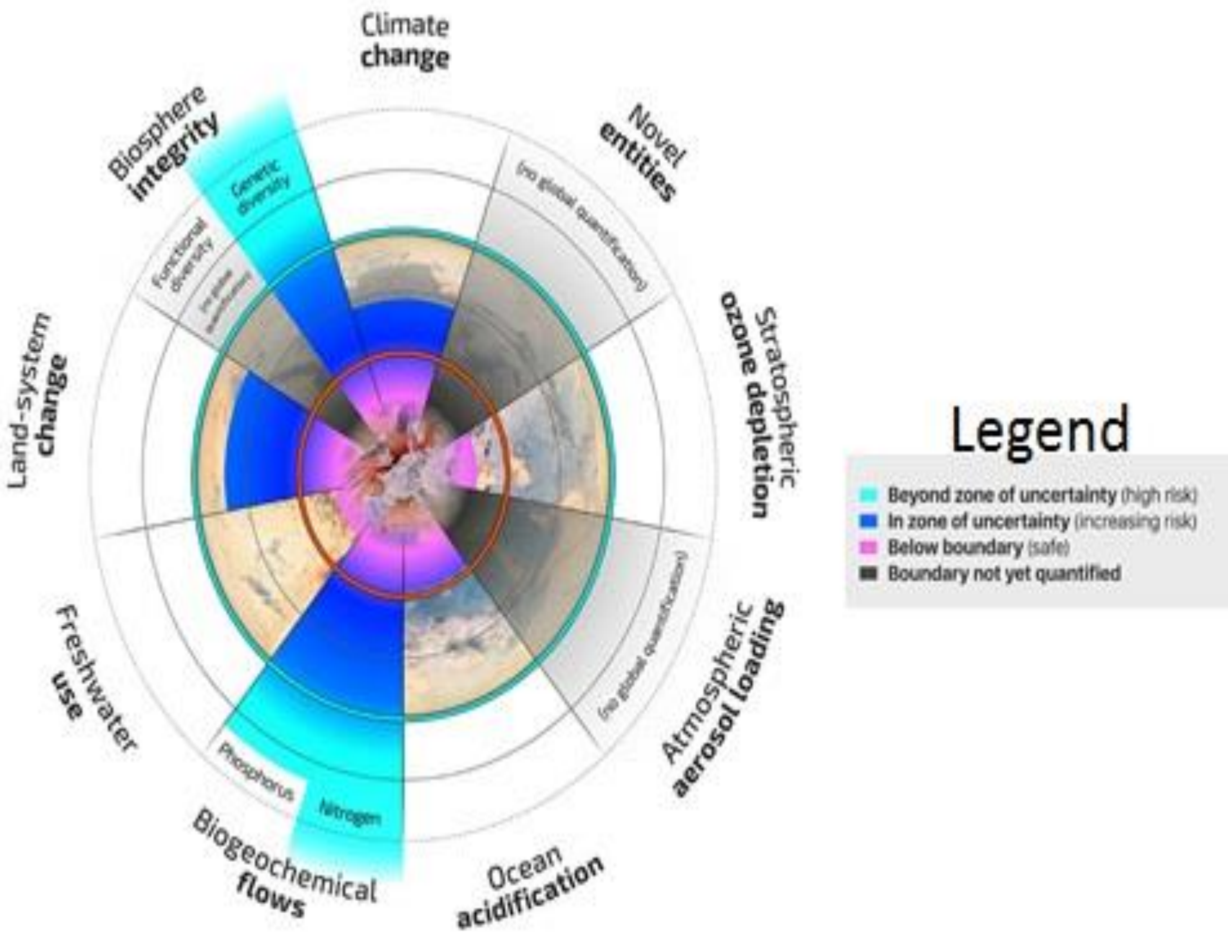

Figure 3.1 Planetary boundaries. The "safe operating space" indicated by the red circle for maintaining the planet's environment is based on nine critical system thresholds for Earth's sustainability. The blue identified areas exceed these scientifically determined limits (Felix Pharand-Deschenes, www.globaia.org, www.anthropocene.info, used with permission).

3.2.1 Biodiversity Loss

The current industrial agricultural system causes loss of biodiversity according to Altieri (1999), Tscharntke et al. (2005), Chapin III et al. (2000), Ehrlich and Wilson (1991), and Davidson, Shaffer, & Jennings (2002). Tscharntke et al. explain that industrial agriculture is a major threat to biodiversity globally, since such large areas of landscape are impacted by agriculture and further note that, as agrochemical use increased after World War II in Europe, cereal yields also increased, but with the simultaneous decline of bird populations. For example, Hole et al. (2005) and Krebs et al. (1999) noted that industrial agricultural is the "principal cause of the widespread declines in European farmland bird populations (e.g. Donald et al., 2001a; Krebs et al., 1999) and reductions in abundance and diversity of a host of plant and invertebrate taxa (e.g. Donald, 1998; Preston et al., 2002; Wilson et al., 1999) over the past four decades" (p. 114).

Davidson, Shaffer, and Jennings (2002) found that four out of five California amphibians were impacted by upwind agricultural uses of agrochemicals, causing population declines as "exposure to pesticides may weaken immune systems, increasing susceptibility to disease" (p. 1599). Ehrlich and Wilson (1991) reviewed three primary reasons to support biodiversity, beginning with the obvious: aesthetic and ethical reasons as a fundamental moral responsibility, then moving on to the considerable economic benefits that include industrial products, food, and medicines derived from biodiversity. Thirdly, and most critical, they point to the ecosystem services of biodiversity that maintain the oxygen composition of the atmosphere, biodegrade materials to create soils, and support other functions fundamental for food production.

MacDonald and Nierenberg (2003) estimated that a healthy global ecosystem provides services such as insects that pollinate crops, and healthy, soil-cleansed water that help to avoid costs to society of nearly $61 trillion. Chapin III et al. (2000) state that the current extinction rates are nearly 100-1,000 times greater now than before people became dominant on Earth. They give further detail about how interaction of species supports key resources within the environment that are important for a sustained planet (Figure 3.2).

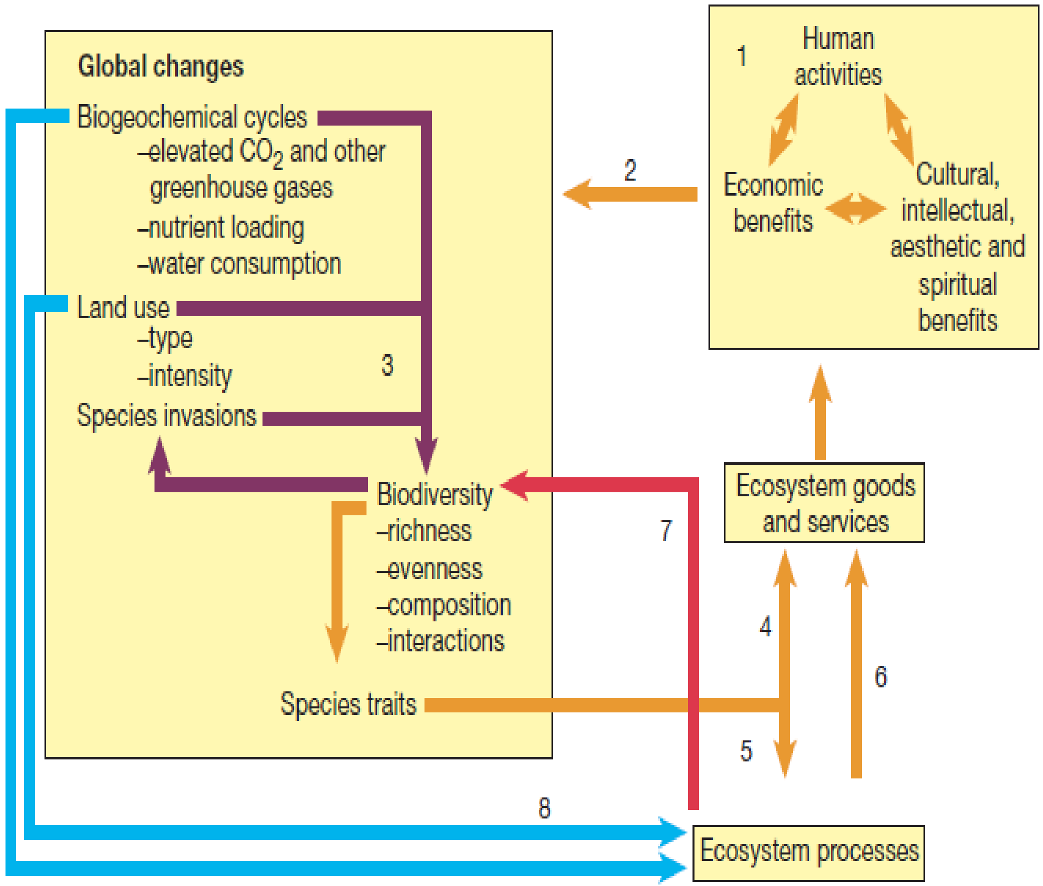

Figure 3.2 The role of biodiversity in global change**.** "Human activities that are motivated by economic, cultural, intellectual, aesthetic and spiritual goals (1) are now causing environmental and ecological changes of global significance (2). By a variety of mechanisms, these global changes contribute to changing biodiversity, and changing biodiversity feeds back on susceptibility to species invasions (3, purple arrows; see text). Changes in biodiversity, through changes in species traits, can have direct consequences for ecosystem services and, as a result, human economic and social activities (4). In addition, changes in biodiversity can influence ecosystem processes (5). Altered ecosystem processes can thereby influence ecosystem services that benefit humanity (6) and feedback to further alter biodiversity (7, red arrow). Global changes may also directly affect ecosystem processes (8, blue arrows). Depending on the circumstances, the direct effects of global change may be either stronger or weaker than effects mediated by changes in diversity. We argue that the costs of loss of biotic diversity, although traditionally considered to be 'outside the box' of human welfare, must be recognized in our accounting of the costs and benefits of human activities" (Quoted in Chapin, et al., 2002. Used with permission).

Similarly, Renner (2012) estimates that "52 percent of commercial fish stocks are fully exploited, about 20 percent are overexploited, and 8 percent are depleted" (p. 5). Further, Myers and Worm (2003) noted that the "status quo" in industrialized fishing has consumed 90%

of the global large predatory fish, while similar studies have identified a multitude of fisheries that have been overexploited or collapsed (see Table 3.1). For example, MacDonald and Nierenberg (2003) noted "over fishing caused the collapse of cod stocks off Canada's coast in the early 1990s, it threw 30,000 people out of work and decimated the economies of 700 communities in Newfoundland" (p. 42). Of critical concern in more recent research, Worm et al. (2006) estimated all currently harvested species will similarly collapse by 2048, further reducing Earth's carrying capacity as supported by Table 3.1.

Table 3.1 Collapsed fisheries*

Authors	Concern areas	Journal
AH Altieri, MD Bertness, TC Coverdale, NC Herrmann (2012)	collapse of a growing number of shallow-water marine ecosystem	*Ecology*, 93(6), p. 1402–1410
TR Johnson, JA Wilson, C Cleaver (2012)	collapse of the Sea Urchin Fishery in Maine, USA	*Ecology and Society*, 17(2), p. 15.
W Li (2012)	fishery collapse with two periods analysis in Dong Jiang Lake	*Journal of Agricultural Science*, 4(7), p. 172
Henderson, Peter A.; Plenty, Shaun J.; Newton, Lyn C.; et al. (2012)	collapse of European eel (Anguilla anguilla) in the Bristol Channel	*Journal of the Marine Biological Association*, 92(4), p. 843-85
Zwolinski, Juan P.; Demer, David A. (2012)	forecasts a collapse of the sardine stock	Proceedings of the National Academy of Sciences, 109(11), p. 4175-4180
Downing, Andrea S.; van Nes, Egbert H.; Janse, Jan H.; et al. (2012)	collapse and reorganization of a food web of Mwanza Gulf, Lake Victoria	*Ecological Applications*, 22(1), p. 229-23
Chapman, Demian D.; Simpfendorfer, Colin A.; Wiley, Tonya R.; et al. (2012)	collapse in a critically endangered marine fish: the Smalltooth Sawfish (Pristis pectinata)	*Journal of Heredity*, 102(6), p. 643-652

*World of Knowledge database search for the topic "collapse & fish" yielded 243 articles. This table represents a random sample of these articles, all completed by different authors and from different journals in various locations.

3.2.2 Nitrogen and Phosphorus Cycles

The "status quo" of industrialized agriculture includes fertilizers as a major culprit in global warming and water body eutrophication (Fedoroff et al., 2010; Bennett, Carpenter, & Caraco, 2001; Arbuckle & Downing, 2001; Bright, 2003). For example, Arbuckle and Downing (2001) completed a detailed study of agricultural lands in Iowa including 113 lakes to find significant nitrogen and phosphorus concentrations associated with row crop industrial agriculture practices. Bennett, Carpenter, and Caraco (2001) estimated that Earth's water systems have 75% greater amounts of phosphorus than in the preindustrial times. This over enrichment results in eutrophication causing algae blooms, which deplete oxygen, kill fish, reduce biodiversity, and increase toxins making water undrinkable. He continued this analysis to state that "clearly, P [phosphorus] is accumulating in Earth's surface soils, primarily in agricultural areas" (Bennett, Carpenter, & Caraco, 2001, p. 231). More specifically, Fedoroff et al. (2010) noted that "nitrogenous compounds in fertilizers are major contributors to waterway eutrophication and greenhouse gas emissions" (p. 833). Bright (2003) estimates that people have doubled the release of nitrogen to nearly 350 million tons per year while phosphorus delivery is 3.7 times the natural rate of 13 million tons per year.

3.2.3 Change in Land Use

Industrial agriculture impacts on land use, be it from deforestation or typical agricultural practices, have significantly increased the loss of soil (Pimentel et al., 1995; Montgomery, 2007; Brown, 2011a; Turner & Rabalais, 2003). Montgomery (2007) detailed how the global data confirms the fact that agricultural practices result in twice as much soil loss from erosion than from soil production. Turner and Rabalais (2003) referred to the work of the Iowa State Planning Commission in 1948 (cited in Prince, 1997) stating that "disturbance of the state's prairie had caused the loss of 192,643 metric tons per km2 of soil and that 40% of Iowa had lost 50% to 75% of its surface soil" (p. 566).

More specifically, they stated that agriculture as late as 1780: "On this continent, the cheap and unlimited land[,] promoted a widespread attitude that land could be used, exhausted, or destroyed as the case may be, and then abandoned for new land" (Turner & Rabalais, 2003, p. 566). This practice is fundamental to the ways that multinational industrial processes create profits through exploitation of the global commons. Brown (2011a) argues that the health of the population cannot be separated from the health of the soil and specifically quantifies this, claiming that "for each inch of topsoil lost, wheat and corn yields declined by close to 6%" (p. 26). Pimentel et al. (1995) took this one step further with an analysis of corn farming expenses, breaking it down to the economic and energy costs required by the agricultural industry to replace the loss of soils (see Table 3.2), which converts to a total of $27 billion per year in the US alone.

Table 3.2 Estimated annual costs (per hectare) of soil and water loss*

Factors	Annual quantities lost	Cost of replacement (dollars)	Energetic costs (10^3 kcal)	Yield loss after 20 years of erosion (%)
Water runoff	75 mm	30	700	7
Nitrogen	50 kg		500	
Phosphorus	2 kg	100	3	8
Potassium	410 kg		260	
Soil depth	1.4 mm	16	-	7
Organic matter	2 tons	-	-	4
Water holding capacity	0.1 mm	-	-	2
Soil biota	-	-	-	1
Total on-site		146	1460	20
Total off-site		50	100	
Grand total		196	1560	

*These values are from conventional corn, assuming the current water and wind erosion rate of 17 tons ha-1 year-1 over the long term (20 years). Adopted from Pimentel, D., Harvey, C., Resosudarmo, P., Sinclair, K., Kurz, D., McNair, M., . . . Blair, R. "Environmental and economic costs of soil erosion and conservation benefits." 1995. *Science*, 267(5201), p.1119. (Used with permission).

Further, Brown (2011b) provides extensive details about the global impacts of industrial agriculture on Earth's carrying capacity. This includes a specific review of the impacts on the soil, air, and waters of Earth. For example, the issues of soil erosion and desertification have reached critical proportions internationally, where "desertification now affects 25 percent of Earth's land area. And it threatens the livelihoods of more than 1 billion people - the families of farmers and herders in roughly 100 countries" (Brown 2011b, p. 37). The plant life of Earth protects the soil from wind and water erosion, while the increase of industrial agriculture techniques of meat herd over-grazing, crop area over-plowing, and forest clear-cutting remove this important plant life leaving the soil bare for erosion and further desertification.

3.2.4 Water Pollution

Industrial agriculture is a major cause of the world's water pollution (Turner & Rabalais 2003; Mallin, 2000; Kennedy & Worcester 2004; Kirby, 2010; MacDonald, 2012; Mikhail, 2012; Horrigan, Lawrence, & Walker, 2002). Factory farms now concentrate manure in adjacent lagoons. This changed the ecological manure, which supported previous generations' family farms, into toxic waste, impacting water supplies. Research in this area has shown that "US animal factories yield 100 times more waste than all US human sewage plants" (Kirby, 2010). For example, on June 22, 1995 25 million gallons of swine waste leaked into the New River, on July 3, nine million gallons of poultry waste spilled into Limestone Creek, and on August 8 of the same year, one million gallons of swine waste into Harris Creek, NC. All of this occurred before hurricanes Fran and Bonnie flooded these areas the following year (Mallin, 2000). Kennedy and Worcester (2004) details this tragedy of Concentrated Animal Feeding Operation in North Carolina by finding that "there are many studies that show that factory farms have a devastating impact on rural economies and quality of life. There is not a single empirical study showing net benefits to rural communities" (p. 51). They continue explaining below:

> Pig factories produce far more manure than is needed to fertilize the fields around them. The costs of properly treating and disposing of this waste make factory farming uncompetitive for traditional farms - unless they violate numerous environmental laws. Because factory meat producers must break the law in order to survive, the industry's business plan relies on the assumption that pork factories will be able to evade prosecution by improperly influencing government officials (Kennedy & Worcester 2004, p. 52) The industry routinely uses bullying lawyers and illegal intimidation, threats, harassment and violence to terrorize and silence its critics (p. 53).

Kirby (2010) also noted, "Human sewage is treated to kill pathogens but animal waste is not. Hog manure has 10-to-100 times more pathogens than human waste." Similarly, China's livestock generates 2.7 billion tons of manure (MacDonald, 2012). Further, fertilizer and pesticides applied to farming areas leach into groundwater and surface waters (Mikhail, 2012). Turner and Rabalais (2003) summarize the many studies, which define the agricultural application of fertilizer to be the primary source of increased nutrient loadings in major rivers and estuary systems. Their review of the 1,151,000 square mile Mississippi River Basin, which drains the 14 state industrial agriculture region of the US "breadbasket," had 40% of the rivers listed as "impaired" by EPA in 2000. The river impact resulted in a nearly 8,000 square mile dead zone in the Gulf of Mexico. Further, this impact resulted from exceeding a tipping point mentioned earlier by Rockström et al. (2009b) such that "when the atomic ratio of silicate to nitrate falls below 1:1, the food web off the Mississippi River seems to switch from a diatom based ecosystem to another ecosystem state that may be less desirable" (Turner & Rabalais, 2003, p. 570). Further, Horrigan, Lawrence, and Walker (2002) accounts that the EPA "has blamed current farming practices for 70% of the pollution in the nation's rivers and streams. The agency reports that runoff of chemicals, silt, and animal waste from U.S. farmland has polluted more than 173,000 miles of waterways" (p. 447). Additionally, Frommel et al. (2012) claimed that "Ocean acidification, caused by increasing atmospheric concentrations of CO2, is one of the most critical anthropogenic threats to marine life" (p. 42).

3.2.5 Water Use

Industrial agriculture contributes significantly to global water shortages (Gleick, 2000; Mikhail 2012; Horrigan, Lawrence, & Walker, 2002). Mikhail (2012) estimated that 70% of global freshwater is used for agriculture, dropping water tables, and causing saltwater intrusion. Horrigan, Lawrence, and Walker (2002) had determined that one-third of the agricultural food production came from irrigated lands as depicted in Figure 3.3.

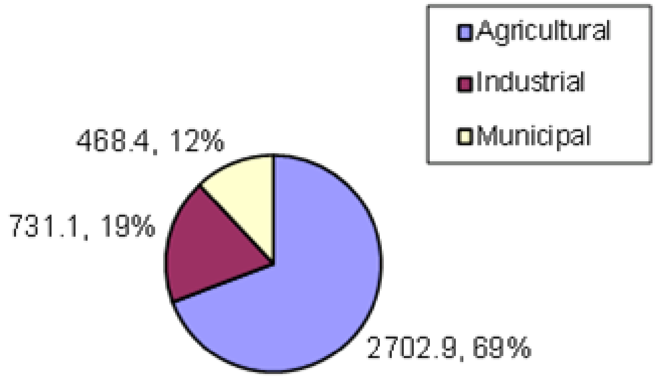

Figure 3.3 Global water use by industry (10^9 m3/yr). Data compiled from values, Food and Agriculture Organization of the United Nations (FAO). Website accessed on 10/05/2015 http://www.fao.org/nr/water/aquastat/main/index.stm.

Gleick (2000) estimated this water was used to irrigate nearly 267 million hectares in 2000, nearly seven times as much as in 1900 as depicted in Figure 3.4. However, he also noted that nearly 40% of this water is lost through leaky pipes and overspray.

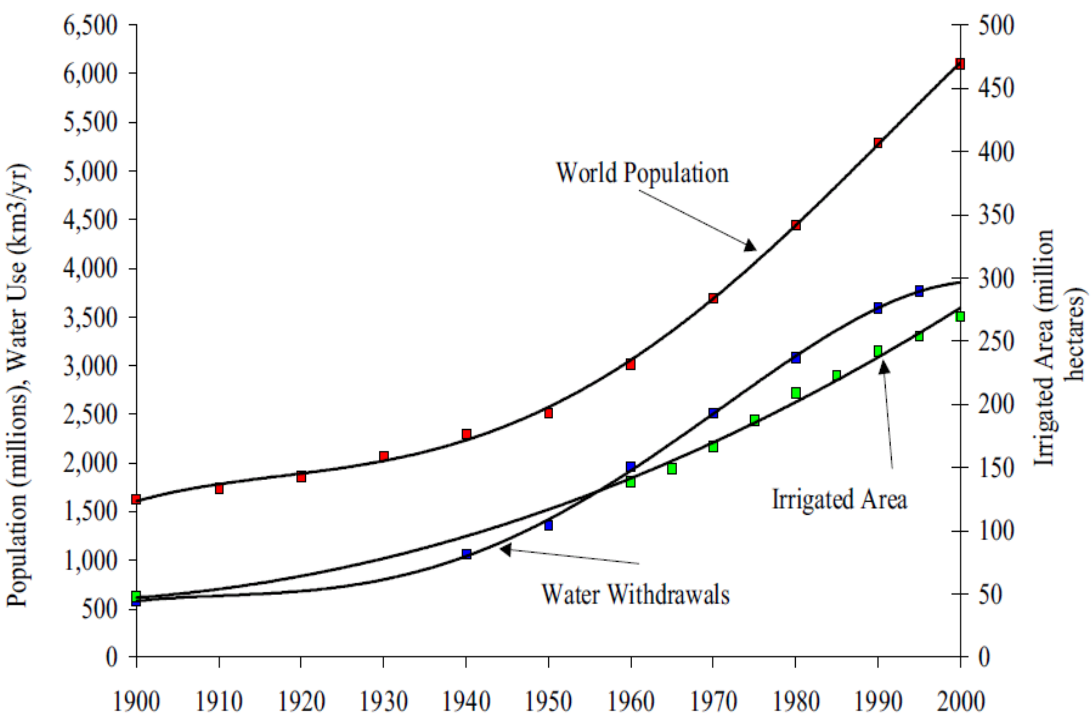

Figure 3.4 World populations, water use and irrigation areas. Adopted from Gleick, P. H. 2000. "The changing water paradigm: a look at twenty-first century water resources development." *Water International*, 25(1), p.128 (used with permission).

3.2.6 Chemical Pollution

Beyond water pollutions mentioned earlier, GMO and industrial marine agriculture result in significant impacts, including water pollution, benthic pollution, herbicides, antibiotics, and other pesticide chemicals accumulating in the ecosystems (Klinger & Naylor, 2012; McGinn, 2002; Spinks, 2011). McGinn (2002) noted "farmers worldwide will apply something on the order of 2.5 million tons of pesticides, the over whelming majority of which are synthetic organic chemicals that are orders of magnitude more toxic than 50 years ago" (p. 77). Horrigan, Lawrence and Walker (2002) estimated this impact is closer to 3 million tons per year, including herbicides, insecticides, and fungicides; only 0.1% of these chemicals are effective for crops, while 99.9% impact the surrounding environment. Benbrook, (2012) determined that in the US alone, the planting of GMO crops, promoted with claims it would "decrease the overall use of herbicides,"[5] has resulted in a 527 million pound increase in herbicides from 1996-2011. He further estimated that the new 2,4-D GMO brands proposed for USDA approval to avert the new herbicide resistant super-weeds will result in another 50% increase in herbicide use. Simultaneously, since 2002 the multinational industrial agriculture company Monsanto has had a 1,047% increase in stock values.[6]

Elsewhere, the multinational industrial agriculture development in India has impacted the carrying capacity there, including hundreds of suicides related to GMO expansions. The "government statistics estimate that as many as 250,000 farmers have committed suicide after failed cotton harvests left them saddled with debt" (Spinks, 2011). The official Minister of Environment and Forests, Jairam Ramesh, introduced an indefinite moratorium on Bt brinjal, in February 2010 (Jayaraman, 2010). These were significant steps to address the continued civil

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5 Existing website quote "Their use on Roundup Ready crops has allowed farmers to conserve fuel, reduce tillage and decrease the overall use of herbicides." Monsanto Company, "Agricultural Herbicides." Web. 2015. Retrieved 12/16/2012 http://www.monsanto.com/products/Pages/agricultural-herbicides.aspx

6 Open price: 8.73, Date: 11/29/2002 to Open: 91.83, Date: 11/29/2012. Monsanto Company, "Stock Performance" entry. Web. 2015. Retrieved 12/16/2012. http://www.monsanto.com/investors/Pages/stock-performance.aspx

violations and public outcry against the multinational industrial agriculture "status quo" expansion in India.

However, the multinational lobby responded by changing the laws to circumvent this decision through the Biotechnology Regulatory Authority of India Bill, 2011 (BRAI, Bill No 54, 2011). One researcher described this new bill, promoted by the industrial agriculture lobby, as an attempt to "ensure that India becomes a safe haven for large firms to run their tests and sell their [GMO] products" (Tanmay, 2011, p. 13). This position coincides with the evaluation by the Coalition for a GM-Free India who reported that the BRAI Bill had the wrong mandate of promoting [GMO] corporations into self-regulators (Coalition for a GM-Free India, 2012). Subsequently, the Indian government filed a lawsuit against Mahyco-Monsanto Biotech Limited for their "'unlawful' attempt to obtain and modify the indigenous crop brinjal" to suspend the "status quo" industrial agriculture expansion into India and end these critical impacts on the Earth's carrying capacity (Spinks, 2011, p. 1).

Industrialized agricultural systems also include the mining and processing of fertilizers, which are a major culprit in climate change and water body eutrophication (Arbuckle & Downing, 2001; Bennett, Carpenter, & Caraco, 2001; Bright, 2003; Fedoroff et al., 2010). Thus, unsustainable industrial agricultural systems impact nearly all the planet's systems defined by Rockström et al. (2009a).

3.3 Unsustainable Policy Development

Despite the call for decisive actions, the Rio+20 Conference was a missed opportunity, where "[d]ismal grades dominate Nature's report cards on the Rio treaties" (Tollefson & Gilbert, 2012). Gisbert Glaser, senior advisor at the International Council for Science (ICSU), claimed the world's political leaders would only continue " 'development as usual,' rather than [take] action on the scale that the scientific evidence now demands" (Irwin, 2012). The final 49-page document, The Future We Want (United Nations, 2012), signed at the Rio+20 Conference, only delayed real action to maintain the "status quo" of existing industrial agriculture systems. Calls for small numbers of focused targets on sustainability development goals or any changes of the "economic playing field" (Griggs et al., 2013) are still falling on deaf ears.

The failure of the Rio+20 is better understood by comparing it to the success of the May, 2012 G8 Camp David Summit, which resulted in the New Alliance for Food Security and Nutrition (Office of the Press Secretary, 2012). The G8 Summit created a new partnership to support the multinational industrial agriculture expansion into Africa (see Figure 3.5), while none of these key global leaders attended the Rio+20 conference the following month.

Figure 3.5 Conference room during the G8 Summit at Camp David. Prime Minister David Cameron of the United Kingdom, President Barack Obama, Chancellor Angela Merkel of Germany, José Manuel Barroso, President of the European Commission, and others watch the overtime shootout of the Chelsea vs. Bayern Munich Champions League final, in the Laurel Cabin conference room during the G8 Summit at Camp David, Md., May 19, 2012 (Official White House Photo by Pete Souza).

The G8 action confirms political leaders' desire to support the "status quo," as according to Holt, Gimenez and Shattuck, (2011), "corporations dominate the government agencies and multilateral organizations that make and enforce the regime's rules, regulations, and projects for trade, labor, property, and technology" (p. 92). Further, scientists have noted the major political players and global food governance groups enforce the "status quo" and are "bureaucratic, slow to act and lack foresight" (von Braun, 2010, p. 548) with regards to any change.

3.3.1 Unsustainable Corporate Entanglement

The public response to the G8 deal was non-existent while the public outcry after the closing of the 2012 Rio Summit addressed the lack of action. For example, the Centre for Environment and Development put forth the "Peoples' Sustainability Treaties" seeking to "transcend the parochial concerns of a corporate-capitalistic globalization" (Zoysa, 2012). Similarly, the People's Action at the Earth Summit (Rio Occupy Working Groups, 2012) requested the ending of the "corporate capture of the UN." The partnerships between private corporations and national officials continue to compromise the needs of the environment and the general population much as the G8 May 2012 deal only guaranteed multinational industrial agriculture development into Africa.

Dr. James Hansen, the retired Director of the NASA Goddard Institute for Space Studies in New York City, was more direct about the lack of political progress during a presentation to young people:

> How is it possible that large human-driven climate change is unfolding virtually unimpeded, despite scientific understanding of likely consequences? Would not governments – presumably instituted for the protection of all citizens – have stepped in to safeguard the future of young people? A strong case can be made that the absence of effective leadership in most nations is related to the undue sway of special financial interests on government policies aided by pervasive public relations efforts by organizations that profit from the public's addiction to fossil fuels and wish to perpetuate that dependence (Hansen et al., 2012, p. 17).

Multinational corporations have invested in significant land and technological equipment to produce a profit and will maintain this initial capital investment as long as it continues to profit (Piketty & Goldhammer, 2014). Climate change is one planetary system now better understood by global politicians and populations. On January 24, 2014, the UN Secretary-General Ban Ki-moon stated, "We need large injections of public capital for the rapid development of low-carbon infrastructure" (O'Reilly, Paper, & Marx, 2012). These concerns stem from the latest Intergovernmental Panel on Climate Change (IPCC) scientific report which stated: "Warming of the climate system is unequivocal" (IPCC, 2013, p. 62). However, multinational investment continues to support old technologies such as oil refineries (Klein, 2014) and other capital intensive industries to maintain tremendous profits (Piketty & Saez, 2014), similar to investments in the machinery of industrial agriculture (Vallianatos, 2014). There is no need to explore solar or other new, healthier technologies (Marmot, 2014), while these old investments are still profitable (Stehr, 2014).

Correspondingly, global energy industries currently have coal, oil, and gas reserves for creating 2,795 gigatons of carbon dioxide emissions. Planetary simulation models indicate that the Earth's atmosphere can remain within a reasonable two degree change with only 565 gigatons of carbon dioxide by the mid-21st century (McKibben, 2012). This is a planetary boundary limit defined by scientists, not by the banks or anyone with influence over multinational energy corporations and their profits. Thus, multinationals will continue to maximize profits at any cost, similar to NAFTA destroying subsistence farming in Mexico (Klein, 2001), the western expansion's destruction of the indigenous people of Pine Ridge, South Dakota (Moyers & Hedges, 2012). Clearly, the "class exploitation, imperialism, war, and ecological devastation are not mere unrelated accidents of history but interrelated, intrinsic features of capitalist development" as noted by Foster (2007, p. 2). Similarly, as Ghoshal (2005) surmised, industry intends to reduce Earth's carrying capacity through:

> […] ruthlessly hard-driving, strictly top-down, command-and-control focused, shareholder-value-obsessed, win-at-any-cost business leader of which Scott Paper's "Chainsaw" Al Dunlap and Tyco's Dennis Kozlowski are only the most extreme examples. This is what Isaiah Berlin implied when he wrote about absurdities in theory leading to dehumanization (p. 85).

The unsustainable industrial agriculture "status quo" systems are based on importing agro-chemicals, machinery, and technologies to prioritize profits in support of multinational corporations at the expense of the environment, rural communities, indigenous farmer knowledge, and biodiversity (Foster, 2007; Altieri, 1999; Alkon & Norgaard, 2009; Altieri, 2009; Kerr, 2012; Altieri, Letourneau, & Davis, 1983). The New Green Revolution proposed at the May, 2012 G8 Camp David Summit with the Alliance for Food Security and Nutrition (Office of the Press Secretary, 2012) seeks only to continue this industrial expansion of the "status quo," now including patented seeds with further immeasurable impacts on Earth’s carrying capacity (Klein, 2001; Howard, 2009). However, GM crops tended to have no increased yields beyond the traditional breeding, improved irrigation, and indigenous agricultural practices (Gurian-Sherman, 2009). These crops create significant issues, and as Horrigan, Lawrence, and Walker (2002) found "in the Philippines, Indonesia, and some other developing countries, more than 80% of farmers now plant modern rice varieties. In Indonesia, this led to the recent extinction of 1,500 local rice varieties in just 15 years" (p. 448).

3.3.2 Unsustainable Population Pressures

The world population is likely to be over 10 billion by 2050 (Keilman, 2001; Pearce, 2011). To exacerbate this issue further, after 2005 this world population has become more urban than rural, where more people are migrating into cities and urban areas as depicted in Figure 3.6.

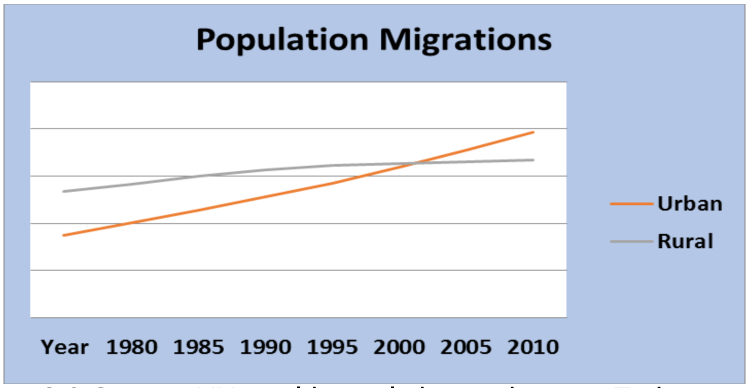

Figure 3.6 Current UN world population estimates. Estimates of the urban and rural population by age and sex, 1980-2015. Website accessed on 10/05/2015 http://esa.un.org/unpd/wpp/Excel-Data/population.htm.

This increasing urban population is of serious concern, while the accompanying natural resource consumption and waste generation in urban areas is critical. Urban populations are expected to increase most rapidly in the less economically developed regions of the world. For example, in India the average population growth rate of 1.3% per year is higher than most regions in the world. Further, the urban population in India is growing at 2.5% per year. More critically, Chandrasekhar and Ghosh (2014) have noted that "The ratio of urban to rural consumption rose from 1.79 in 1983 to 1.96 in 2009-10, with the most rapid widening of the gap coming after 2004-05" (p. 2). This disparity is demonstrated in Figure 3.7, indicating the precarious issue is the excessive consumption in these expanding urban areas.

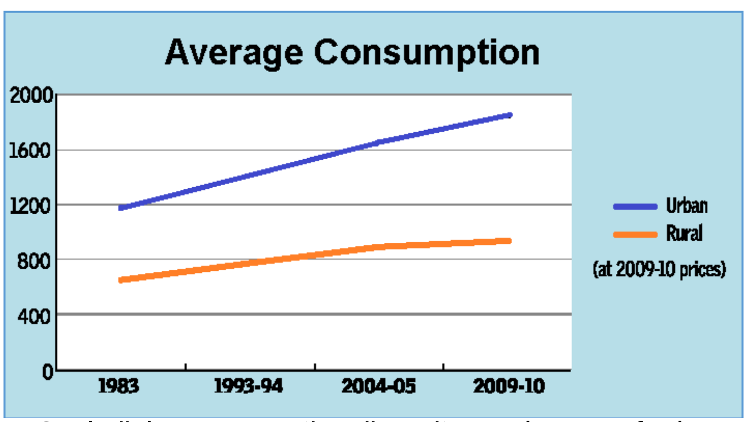

Figure 3.7 India's consumption disparity. Estimates of urban and rural population consumption are adopted from Chandrasekhar, C.P., & Ghosh, J. (2014). Consumption inequality in India. *The Hindu Business Line*. http://www.thehindubusinessline.com/opinion/columns/c-p-chandrasekhar/consumption-inequality-in-india/article3569657.ece

These high rates of natural resource consumption and waste generation forced critical environmental impacts to the forefront of scientific discourse. The Rockström et al. (2009b) treatise states that (if continued) these current environmental impacts to the "Earth System could destabilize critical biophysical systems and trigger abrupt environmental changes that would be catastrophic for humans" (p. 2). Government regulations and global treaties have proven ineffective in reducing the environmental impacts of industrial agriculture as the planetary impacts outlined above indicate.

3.4 Sustainable Solutions

"Fixing the dysfunctional food system - in any sustainable sense - requires regime change" (Holt, Gimenez, & Shattuck, 2011, p. 93). Considerable sustainable agricultural systems have continued on Earth for thousands of years, essentially right under our collective noses. Altieri (1989) stated "Agroecology has emerged as a scientific approach used to study, diagnose and propose alternative low-input management of Agroecosystems. Solving the sustainability problem of agriculture is the primary aim of Agroecology" (p. 27). Altieri (1999) notes that contrary to industrial agriculture, biodiversity through agroecological systems can expand soil fertility, protect crops (without agrochemicals), and increase productivity naturally. Agroecological scientists have been investigating and researching the sustainable indigenous systems throughout Earth (Altieri, Funes-Monzote, & Petersen, 2012). This coincides with more recent calls from Leach et al. (2012) where the "fundamental challenge remains in more effectively connecting local, grassroots innovation capacity with the global parameters set by Planetary Boundaries."

As mentioned earlier, the multinational industrial agriculture model tried to obtain and modify the indigenous crop brinjal in India, resulting in lawsuits (Abdelgawad, 2012). However, with the recent G8 Alliances, these same multinational corporations have been given free reign over vast areas of Africa to continue the same exploitive practices that ultimately degrade environmental resources, impoverish the native populations, and destroy existing indigenous practices and knowledge in return for quarterly profits to stockholders as discussed in India. This clearly demonstrates the "explicit denial of any role of moral or ethical considerations in the practice of management" (Ghoshal, 2005, p. 79) by these multinational corporations.

We have seen how the multinational corporate lobby ensures (Sheets, 2013) that the international regulatory focus is on providing monopoly support for creating exorbitant profits, such as Monsanto's 1,047% increase in stock values.[4] Thus, future research must focus on building a sustainable grassroots effort as recommended by Leach et al. (2012) combined with the agroecological sustainable knowledge as outlined by Altieri, Funes-Monzote, and Petersen (2012) to support an ideal solution contrary to industrial agriculture.

3.5 Urban Agriculture as Sustainable Agriculture

Urban agriculture, shared amongst indigenous populations globally, is commonly understood as agriculture in urban areas. One underlying cause of urban agriculture is the global population increase. As indigenous people become displaced, they populate shantytowns adjacent to cities. Increasingly, these displaced people revert to agricultural traditions and create more urban agriculture (Altieri, 2002). Thus, today urban agriculture has become a vital set of practices both for industrialized societies and for supporting food security in less developed countries and for urban refugees (Altieri, 2009). Thus, urban agriculture represents a grassroots alternative to industrial agriculture.

As mentioned previously with agroecology, many scientists (biologists, geologists, ecologists) and technical policy analysts (engineers, public administrators, and planners) have conducted systematic studies of urban agriculture and have developed rich descriptions of urban agriculture phenomena (Altieri, 2005; De Schutter, 2010; Rosset 2011). This work has produced numerous theoretical statements, quantitative and qualitative empirical studies, literature reviews, and conceptual critiques. Therefore, the next critical step in the development of the industry of urban agriculture is to establish scholarly research to determine the critical components for expanding and supporting urban agriculture as a sustainable development alternative in rapidly developing urban areas (De Schutter, 2014).

3.6 Conclusion

Urban agriculture as a sustainable grassroots alternative could replace industrial agriculture (Piketty & Saez, 2014). This action could create a paradigm shift to easily attainable healthy organic foods within an urban food desert. Such a system could be supported by a local community food cooperative linked to other local farmers, creating a suitable market (Donnell, 2014). The local schooling facilities and community service institutions could be engaged to support community outreach for further development (De Schutter, 2014). This results in an alternative urban agriculture paradigm (Teka, Van Rompaey, & Poesen, 2013), which as noted by Ghoshal (2005, p. 87) "Thomas Kuhn (1962) was right in arguing that mere disconfirmation or challenge never dislodges a dominant paradigm; only a better alternative does." Critical questions future research must address include: How well can urban agriculture effectively reduce industrial agriculture? What measures for urban agriculture can be developed? How can urban residents be encouraged to support urban agriculture? How can urban agriculture bring a paradigm shift?

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CHAPTER 4: URBAN AGRICULTURE DEFINED FOR SUSTAINABLE DEVELOPMENT[7]

4.1 Introduction

Scholarly research describes the ways that human activity threatens the Earth's planetary systems (Hamilton, 2016; Rockstrom et al., 2009; Steffen et al., 2015) and degrades the Earth's carrying capacity (Cohen, 1995; Ostrom, 2009). A major cause of many human-provoked planetary impacts have been directly attributed to the global scale of industrial agriculture (Atiyah, 1992; IAASTD, 2009; Mastny, 2015; Starke, 2013; Weaver, 2015). However, these published facts regarding industrial agriculture impacts on planetary systems are currently overlooked by popular media, similar to the way that climate change science was previously overlooked due to propaganda and the industry's financial influence over governments (Hansen et al., 2012; McKibben, 2012). An examination of the complete issue of industrial agriculture including food waste, cow manure/methane, import and export freight, fertilizer, and pesticide production demonstrated that industrial agriculture is the primary culprit in climate change impacts (IPCC, 2014; Weaver, 2014). Many scholars have determined that such "business as usual" policies for industrial agriculture are unsustainable (Beuchelt & Virchow, 2012; IAASTD, 2009). We suggest that Urban Agriculture (UA) can significantly reduce planetary impacts through engaged stakeholders and knowledgeable leaders stepping beyond the industrial puppeted bureaucrats.

Urban Agriculture may be able to replace industrial agriculture through sustainable policy support. However, a comprehensive definition of UA does not exist. Further, measuring and reviewing UA through the industrial terms of commodities is woefully inadequate as each UA

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7 This chapter was published in Weaver, E.R.R. Viewpoint: Urban agriculture defined for sustainable develop (2017) *Land Use Policy*: (currently under review) Permission is included in Appendix A.

application is completely unique based on social context and local environments (Huang & Drescher, 2015; Prové, Dessein, & Krom, 2016). Thus, UA must be examined based on local conditions and stakeholders. As determined herein, Urban Agriculture can replace industrial agriculture through sustainability policy development by Land Use Administrators.

We developed a comprehensive UA definition using Grounded Theory and sensemaking (Meadows, 2008; Weick, 1995) to evaluate the complete system. Kuhn (1962) noted the only way to escape the existing destructive paradigm is to engage in a better alternative. Land Use Administrators can achieve the necessary paradigm change by using this definition to create new UA policies supporting traditional, organic, or other sustainable community supported systems as many scholars have recommended (Altieri & Koohafkan, 2008; De Schutter, 2010; Rosset, 2011). Additionally, the indigenous knowledge and experience with UA has been found to reduce other climate change impacts and bio-diversity losses (Altieri & Toledo, 2011; Mistry & Berardi, 2016). Accordingly, utilizing this knowledge and new UA definition will allow Land Use Administrators to remain within the Planetary Boundary limits while introducing "Systems Thinking" into communities to help attain the new UN Sustainable Development Goals (United Nations, 2015). Such a practice will benefit the commons utilizing the developing knowledge of Planetary Boundaries and limits (Ostrom, Burger, Field, Norgaard, & Policansky, 1999; Steffen et al., 2015) combined with increased attention to the local social capital (Gallaher, Kerr, Njenga, Karanja, & WinklerPrins, 2013; McIvor & Hale, 2015). We believe this growing understanding of these relationships will enable UA leaders to meet the UN Sustainable Development Goals (United Nations, 2015), similar to understanding of the integrated policies used to meet the human health sustainable goals as noted by Whitmee et al. (2015). Specifically, UA must address UN Sustainable Development Goal 2:

> Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture . .
> 2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers . . .

> 2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices . . .

However, the controversy regarding the UA definition and measures continues with the new UN Sustainable Development Goals for planetary governance and urban policies (Barnosky et al., 2014; Foley et al., 2011; Fraser et al., 2016; G. Glaser, 2012; Griggs et al., 2013; Grimm et al., 2008; Hák, Janoušková, & Moldan, 2016; Parris & Kates, 2003; Whiteman, Walker, & Perego, 2012; Whitmee et al., 2015). Additionally, many scholars have examined the sustainable development options created through UA (Mawois, Aubry, & Le Bail, 2011; McClintock, 2014; Pretty & Bharucha, 2014; Provė et al., 2016; Specht et al., 2013; Zasada, 2011). These distinctions encourage arguments about the one-size fits-all definition of UA for policy development (Arku, Mkandawire, Aguda, & Kuuire, 2012). Nevertheless, the leading UA scholars disagree on the key concepts that found UA. Urban Agriculture, as defined by Smit's foundational work (Smit, Nasr, & Ratta, 1996) remains a narrow approach, while Mougeot (2000) claims an empirical investigation is required to bring UA into "conceptual maturity." The lack of a clear UA definition creates an intellectual gap, inhibiting scholars from designing new policies for reaching the UN Sustainable Development Goals. This paper will clarify the disparity between these two foundational authors.

Contemporary literature demonstrates the discrepancy about UA key concepts, as these disagreeing foundational authors (Mougeot, 2000; Smit et al., 1996) are the most commonly cited in this body of literature (see Table 4.1). This disparity is discussed by Arku et al. (2012) who claimed a definition does not exist. Furthermore, Stewart et al. (2013) express that this literature gap creates incongruent methods of determining UA measures. More recently, reviewing ten cities in Canada, Huang and Drescher (2015) confirm that each application of UA is distinctive. However, Specht et al. (2013) noted definitions have been developing over decades, while Provė et al. (2016) reconfirmed that the multitude of definitions vary from the broad ecosystem concepts (Mougeot, 2000), to the narrow commercial concepts (Smit et al., 1996). Recently, Opitz, Berges, Piorr, and Krikser (2015) simply stated that the definitions were still vague. Consequently, there is a critical need to establish a uniform definition of UA for the development of important policies to support the Sustainable Development Goals.

Table 4.1 Most commonly cited foundational works*

Author	Title	Publisher	Citation Count
Smit, J., Nasr, J., & Ratta, A. (1996, 2001)	*Urban Agriculture: food, jobs and sustainable cities.*	United Nations Development Program	482
Mougeot, Luc JA. (2000)	*Urban Agriculture: definition, presence, potentials and risks.*	RUAF Resource Centres on Urban Agriculture and Food Security	437

*Urban Agriculture Food, Jobs and Sustainable Cities originally published in 1996 was revised in 2001. This citation analysis was conducted using Google Scholar to search for "Urban Agriculture" January 13, 2017.

According to Reynolds (1971) clarity on the key concepts is necessary for scholars to agree on a definition. Mougeot (2000) concludes that "the urban ecosystemic link of UA throughout its entire conceptual framework remains to be fully developed. Its conceptualisation currently offers a generic definition and some indications of its distinctive traits. A de-codification of this definition is needed to help us identify its distinctiveness, in both theoretical and operational terms" (p 13, italics added). Dr. Mougeot further states that Urban Agriculture still requires scholarly "de-codification" (personal communication, October 28, 2013):

> By de-codifying a concept, I meant dismembering it into its constructs or building blocks, which themselves need to translate into typologies or categorisations and observable indicators in order to recognise these. What are the essential traits (and the more localised adaptations) of Urban Agriculture?

This paper will resolve this issue by establishing UA’s key concepts in order to create a comprehensive definition. In the next section, we outline the procedures used for this analysis followed by a detailed review of the results. This is a novel contribution to the science of UA, which is necessary to support this important green infrastructure in order to meet the UN Sustainable Development Goals.

4.2 De-Codification Requirements

One approach to de-codification is the use of Grounded Theory Methods to advance a clear direction for sustainable development policy through Urban Agriculture (UA). This method practices analytical induction of case studies, examples, and experiential text data to create coded categories of recorded words and phrases which identify the established relationship patterns for a new comprehensive definition. Grounded Theory was introduced by Glaser and Strauss (1967) and was advanced by Green, Kao, and Larsen (2010) and Adolph, Hall., and Kruchten (2011). Grounded Theory is a well-established systematic method for developing key concepts for a definition based on textual analysis of surveys and other written data.

Scholars from many disciplines use Grounded Theory Methods to expand research, concepts, and definitions (Alkon & Mares, 2012; Bohnet, Roberts, Harding, & Haug, 2011; Dewaelheyns, Kerselaers, & Rogge, 2016; Green et al., 2010; Nastran, 2015; Phelps & Horman, 2009). Within the engineering discipline, Green et al. (2010) employed Grounded Theory to demonstrate knowledge coproduction for new construction management research. Within the land use policy discipline, Bohnet et al. (2011) executed this method to determine stakeholder typologies for designing cattle landuse management policies in Australia. Further, Nastran (2015) used Grounded Theory to link key concepts from stakeholder perceptions to understand park management policies for Slovenia. Finally, within the software engineering discipline, Adolph et al. (2011) evaluated the social practices of software developers utilizing Grounded Theory to create powerful conclusions for new research in this area. Thus, Grounded Theory has near universal application for concept and research development across science fields.

The present work extends the Grounded Theory approach by concentrating only on literature. Dewaelheyns et al. (2016) determined the way that management publications and related articles developed policies for garden governance through Grounded Theory. Similarly, Green et al. (2010) employed Grounded Theory with relevant construction management literature to examine empirical evidence in order to direct future research. Additionally, Green et al. (2010) stepped beyond the perceived limitations of Grounded Theory (Glaser & Strauss, 1967), claiming theory development required the "coproduction" techniques incorporating published academic works and practitioner interviews simultaneously for sensemaking (Weick, 1995). Meaningful sensemaking requires being fully present in the experience and using what is observed in the present as a data source for a complete evaluation. This ideal is used where the researcher experiences are as valid as the coded data to determine conclusions. Each textual phrase is considered in the broadest possible context, reviewing the complete dataset to engage all stakeholders and the natural sciences. This application coincides with related works recommending context specific policy development to fill the conceptual gap (Alkon & Mares, 2012; Prové et al., 2016). Thus, our theory development through sensemaking techniques utilizes systems thinking within the Planetary Boundaries Framework for reaching the UN Sustainable Development Goals.

4.3 Methods

In this paper, we determine a comprehensive definition of Urban Agriculture (UA) by completing a de-codification of the key concepts in a literature dataset from 1980 to 2013. Although Mougeot (2000) called for a decoded definition of UA fifteen years ago, this has not been done. The goal is to clarify the definitional concepts of UA to advance research beyond the foundational disparity. We collected UA literature from the available English scholarly publications. Next, utilizing the Grounded Theory methods, we developed key concepts and categories of UA to defend a comprehensive definition. The professional community must have a single definition for scientific progress (Reynolds, 1971). Accordingly, this section details how Grounded Theory was used to identify the key concepts of UA, the core categories, and ultimately the knowledge that links these categories to a new comprehensive definition.

4.3.1 Literature Data Collection

The University of South Florida Library was searched to collect over three decades of Urban Agriculture articles between January 1, 1980 and December 31, 2013. This included three databases: Engineering Village, Web of Knowledge, and ABI/INFORM Complete to check and verify the complete coverage of the available articles. Each source was searched using "Urban Agriculture" and "Urban Farming" within the title, abstract, or keywords. The resulting dataset of nearly 500 articles is diagrammed in Figure 4.1.

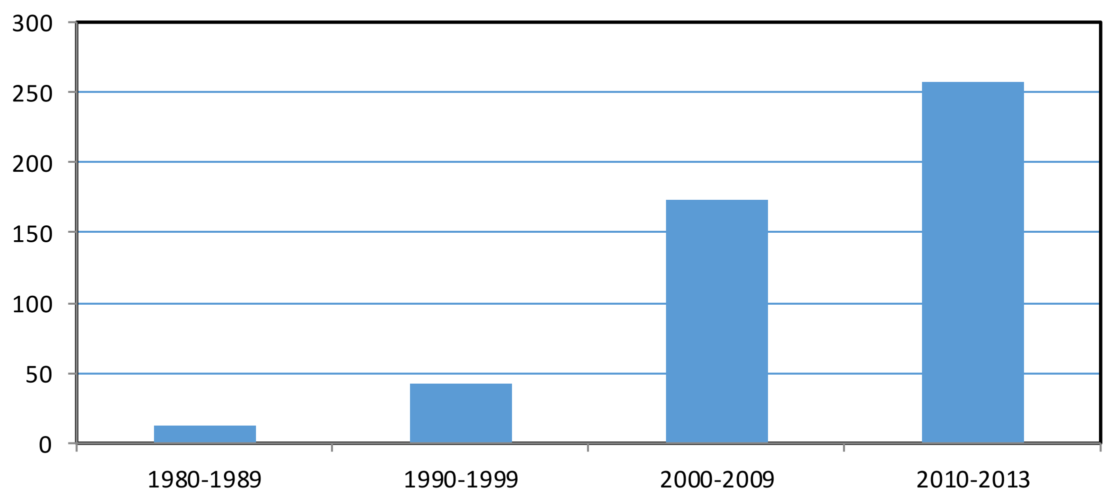

Figure 4.1 Primary urban agriculture data search represents the total count for each decade of the articles collected. Engineering Village, Web of Knowledge, and ABI/INFORM Complete were searched and compiled to result in nearly 500 peer-reviewed articles published between January 1, 1980 and December 31, 2013 (see supplemental data for complete listing).

The exclusion criteria began with removing all duplicates, book reviews, commentaries, and editorial works from the initial search. This focused the inclusion criteria on the theoretical, empirical, literature reviews, and other scientific studies which represent the current knowledge in this field. Another exclusion was to limit the publications to dates after the foundational sources beginning with Mougeot (2000, see Table 4.1). This resulted in a dataset of literature published in the period 2000 to 2013. The final parsing of the Urban Agriculture literature, shown in Figure 4.1, identified the completed analysis data set of 337 unique, scholarly publications; nearly 90% of all publications we found on Urban Agriculture.

4.3.2 Limitations

The use of English only literature is a critical limit, since the foundational author Luc Mougeot is a French Canadian. All publications were found in PDF format with all text converted by an optical character reader to allow the query and selection procedures afforded by the Atlas.ti software used in this analysis. Additionally, significant Urban Agriculture research has been completed in both Asia and Africa, where additional works in this field exist in different languages that were not included, which represents a further limit of this analysis.

4.3.3 Grounded Theory

The Grounded Theory de-codification process for coding the literature is illustrated in Figure 4.2. Within this section, *italic* terms are the key actions labelled in Figure 4.2 (eg. the next phrase has "concepts" in italic indicating that *concepts* located in Figure 4.2 adjacent to the circled A is a result of Open Coding as shown). We completed Grounded Theory through (A) Open Coding to determine key *concepts*, (B) Selective Coding to determine *categories*, and finally (C) Theoretical Coding which relates the *core categories* to develop the *theory* (Glaser & Holton, 2004). Similarly, *memos* were written about the relationships that arose as more concepts are linked into existing categories (Adolph et al., 2011). This analysis method yields multiple sensemaking (Weick, 1995) opportunities to add memos for revealing the new definition. Adolph et al. (2011) claimed, "Theoretical coding conceptualizes how substantive codes relate to each other as hypotheses" (p. 502). Memos record theoretical representations discovered through data analysis processes (Glaser, 2007). Thus, memos result from the personal induction process of discovering relationships as the culminating step of the process as written to describe the experience of the researcher.

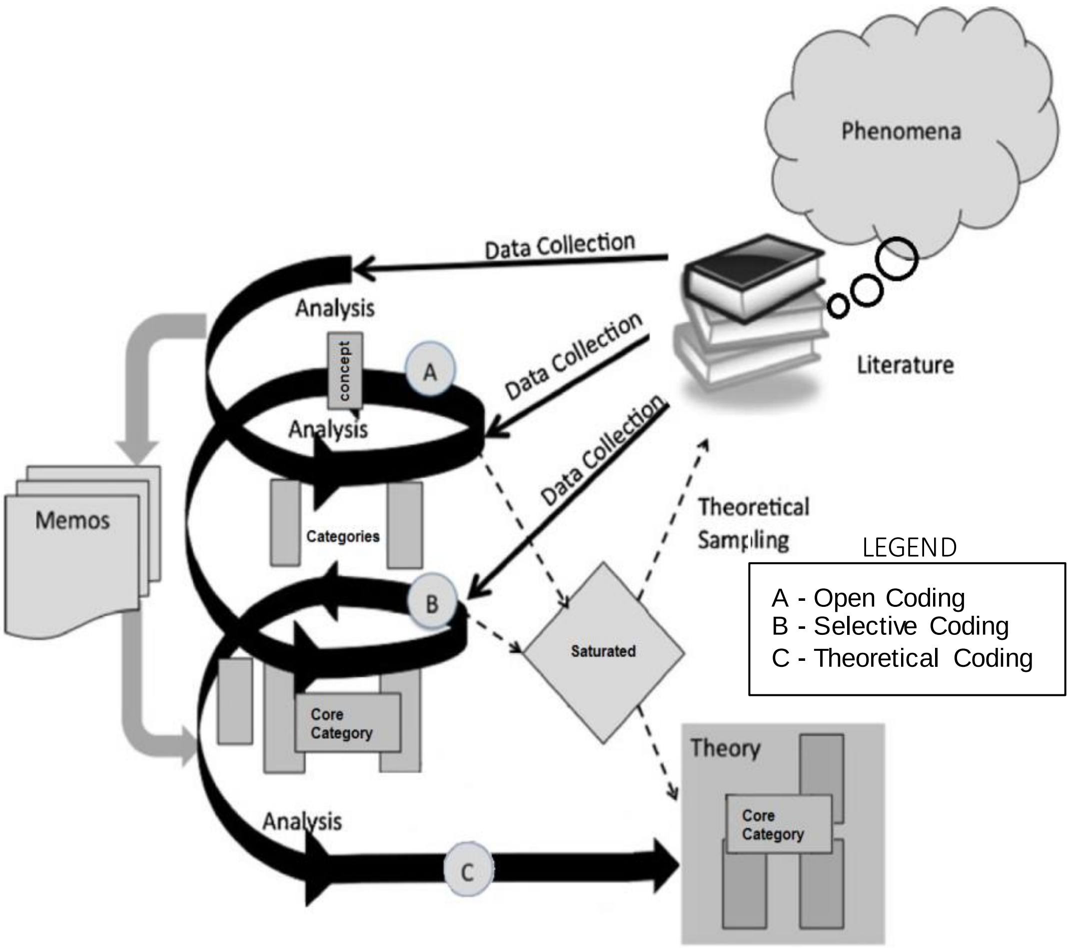

Figure 4.2 Grounded theory de-codification process with terms written above appear in *italics* in this section to support understanding of the description. This image is adopted and modified from Adolph, S., Hall, W., & Kruchten, P. (2011). Using Grounded Theory to study the experience of software development. *Empirical Software Engineering*, 16(4), 487-513.

The *data collection* process begins the initial Open Coding *analysis*. Atlas.ti software was used for this analysis (indicated by the spirals in the diagram). Atlas.ti is a qualitative research software program used to code text phrases within selected datasets (Friese, 2011). Atlas.ti selects each textual phrase based on a required term, allowing the researchers to code the selected phrases into categories. Similarly, Nastran (2015) used Atlas.ti software to establish a theory on stakeholder participation for park development. We selected only article definitional phrases setting the UA context to determine the key concepts used. We continued this analysis until the results were saturated, where new data searches net no new knowledge

(O'Reilly, Paper, & Marx, 2012). These diagrammed spirals in Figure 4.2 represent the "constant comparative method," as noted by Glaser and Strauss (1967). The constant comparison analysis are repeated cycles of Atlas.ti coding, finding key concepts throughout the dataset for each new keyword and repeating through the dataset as necessary. Thus, the Auto-coding tool of Atlas.ti was repeated throughout all the dataset for each new keyword to create the categories. Auto-coding is the Atlas.ti tool allowing the authors to review each phrase individually before coding and proceeding to the next selected phrase. Further, this diagram demonstrates the triangulation of multiple data collections as done by Dewaelheyns et al. (2016). In the present study, the repetitive data collection triangulates to the key concepts used in the literature to represent Urban Agriculture.

4.4 Results

The Grounded Theory process in Figure 4.2 illustrated how each analysis spiral was completed. As noted, for each iteration we selected new information from the dataset to support constant comparison. This repetition further enabled the System Thinking approach with our professional reflection (ie, sensemaking) over the suitability of each phrase coded (Meadows, 2008). We also recorded sensemaking memos of important discoveries using Atlas.ti software. The following sections explain the Open Coding, Selective Coding, and Theoretical Coding results completed to de-code Urban Agriculture as indicated by the tabular results included herein.

4.4.1 Open Coding

Open Coding (as shown as (A) in Figure 4.2) enabled us to break down the Urban Agriculture definitions provided by the foundational works in Table 4.1. As noted in Table 4.2, each of these phrases contained the five core elements identified by Smit, Nasr, and Ratta (2001). These "pre-established concepts" allowed us to build the theory as recommended by Strauss and Corbin (1998).

Table 4.2 Foundational works' concepts

Code	Key concepts
Locations	Area, on land, in water, urban, peri-urban, intra-urban
Activities	Produces, processes, markets, distributes, grows, services, raises, processes human and material resources reusing natural resources and urban wastes
Legalities	Town, city, metropolis
Stages	Yield a diversity of crops and livestock including non-food and food products
Scale	Based on daily demand

The key concepts listed above were selected, sorted, and copied directly from the foundational works definitions (Mougeot, 2000; Smit et al., 2001). These initial codes listed are the core elements for definitions identified by Smit et al. (2001). Additional key concepts were devised through the Auto-coding tool within Atlas.ti, until the data results indicated complete saturation.

The foundational works coding resulted in 45 additional definitional sentences, and provided 11 additional keywords for finding definitions in the coding process of the complete dataset (see Table 4.3 for examples, the supplemental materials provide the complete dataset results).

Table 4.3 Codes developed in open coding process

Code	Additional keyword	Example
Locations	Acre	A low-income entrepreneurial farmer practices intensive, raised-bed monocropping of spinach on a 1-acre stretch along the roadside, in partnership with four or five other farmers (Smit et al., 2001, p. 12, ch 4).
Activities	Compost	Lewcock (1995) found in Kano, Nigeria, that periurban farms are a traditional informal and growing market for large quantities of minimally composted waste; he also found that these producers lacked knowledge on the safety of waste materials for use as fertilizer or stock feed (Mougeot, 2000).
Legalities	Regulations	In Havana, Singapore, and Beijing, land use and other regulations specify the types of crops/products that can be produced in various parts of the city (Smit et al., 2001, p. 22, ch 4).

The keywords listed in Table 4.2 were Open Coded (as shown as (A) in Figure 4.2) using the Auto-coding tool from Atlas.ti. These exemplify the phrases to support the key concepts of the definition found in the foundational works. Each new phrase, which added a keyword, resulted in repeating the Auto-code process until reaching saturation.

Each term coded was completed through the entire dataset at one time to avoid comparison bias. Other scholars have noted biases and the problems resulting from different skill levels of researchers (Strauss & Corbin, 1998). Each Open Code search for one concept was carried out until saturation was completed. The tedious, time consuming, one-at-a-time process was discovered to be more efficient to avoid comparison bias resulting from fatigue. We completed this process of analysis for each code through the 337 publications.

4.4.2 Selective Coding

We completed Selective Coding simultaneously with Open Coding through the complete dataset (as shown as (B) in Figure 4.2). Careful category discernment is necessary for definition emergence. Through this process, some activity codes came up more often. This time, beyond the keywords, we are comparing new coded sentences to previous sentences to provide greater refinement and deeper understanding of the data set (Glaser, 1978, 2002, 2013; Glaser & Holton, 2004; O'Reilly et al., 2012; Suddaby, 2006). This process of Selective Coding supports the second element of the Grounded Theory as Glaser and Strauss (1967) noted "the second rule of the constant comparative method is: stop coding and record a memo on your ideas. This rule is designed to tap the initial freshness of the analyst's theoretical notions and to relieve the conflict in his thoughts" (p. 107).

For example, "Waste," in Table 4.2 "Activities" category, occurred more often than other Activities. To explore this further, a new category to review the Waste Codes separately was created. This is the technique known as Selective Coding to selectively search for data to fill out the Waste Category (Stern, 2007). Also Corbin and Strauss (1990, p. 14) noted that "Selective Coding is the process by which all categories are unified around a 'core' category, and categories that need further explication are filled-in with descriptive detail." Similarly, several other codes were examined to create new categories and scrutinize the emergent relationships they represented. To provide more robust sampling of this experience, Table 4.4 lists other

Selective Coding exercises with brief descriptions about the process and results in each circumstance.

Table 4.4 Categories derived through selective coding

Category		Description
Core Categories	define, location, activity, legal	These are the primary categories expanded from the foundational works.
Resultant Categories	benefits, BMP, economic, entrep*	Beyond waste reduction and food production, several authors discussed educational and social benefits from Urban Agriculture. Economic and stormwater BMP categories were additional benefits separated to gain insight into the theory, including entrepreneurship as a subset of economic benefits.
Scholarly & Research Categories	Mougeot, Smit	Creating codes for the foundational authors allowed deeper analysis with Atlas.ti to find how many publications used their definitions as well as how common these citations occurred. The Atlas.ti Software provides operators for Boolean, Semantic, and Proximity coding to examine relationships between codes.
	cases, research, stakeholder, theory, neo-liberal, issue, transport	These additional categories were developed to separate the data sources for understanding the relationships better. For example, to determine the waste content discussed earlier, a new category was created as Research to determine how often waste was included as part of Urban Agriculture. Similar analyses were completed regarding case studies, stakeholders, theory development (including neo-liberal theories), and transportation.

The central codes identified became category names through this Selective Coding process (as shown as (B) in Figure 4.2). As noted above the “entrep*” term used in Atlas.ti Auto-coding selected all conjugations: entrepreneur, entrepreneurship, entrepreneurial, etc. to support a deeper analysis of these terms used by scholars for definitions in the dataset.

Selective Coding resulted in the core categories (Corbin & Strauss, 1990). This tedious exercise did not always result in new details for the final Theoretical Coding process. For example, separating the neo-liberal theory was an unworkable exploration as this found very few publications indicating this term was an outlier concept.

4.4.3 Theoretical Coding

The Theoretical Coding (as shown as (C) in Figure 4.2) for Grounded Theory steps beyond the codes and categories to see all the parts at once as required by System Thinking

(Meadows, 2008). This is understanding the scientific truth generated by investigating the consensus of the observations (Suddaby, 2006). Further, we have represented that the core categories listed in Table 4.2 resulted in the derived categories listed in Table 4.4. Each category emerged through our sensemaking from multiple Atlas.ti comparisons to establish "frameworks, mutual understanding, and patterning" (Weick, 1995). The Theoretical Coding began with reviewing the many memos written throughout the process. As Suddaby (2006) observed the "empirical 'reality' is seen as the ongoing interpretation of meaning produced by individuals engaged in a common project of observation" (p. 633). For the Theoretical Coding we reviewed these memos written to interpret meaning throughout the process (Suddaby, 2006). Table 4.5 outlines memos describing the Emergent Relationships we discovered from the Table 4.2 Core Categories.

Table 4.5 Foundational memos

Concept	Category	Emergent Relationship
Areas, allotments, state, city, town, suburb, neighborhood	Locations	Man-made measures
Production, market, cultivate, harvest, compost, hydroponics, aquaponics	Activities	Human actions and skills based on education and experience
Regulations, permits, zoning, policies, laws, codes, rules	Legalities	Community organizational constructs
Fruit, vegetable, calf, chick, yearling, adult, seed, seedling sprout, plant, waste	Stages	Man-made names for stages of growth and decomposition
Level, quantity, measure	Scale	Man-made measure of growth

The memos completed during Atlas.ti Auto-coding represented higher conceptual levels as Emergent Relationships to classify these core categories found in the foundational works (as shown as (C) in Figure 4.2). The Emergent Relationships listed support the theoretical conceptual definition of Urban Agriculture fundamental to Sustainable Development.

Table 4.6 Emergent categories

Table 4.4 Keywords	Keywords Breakdown	Emergent Relationships
Benefits	Stormwater BMP, economic development, entrepreneurship	Man-made structures, both physical and conceptual
Cases, research, theory	Conceptual structure and publications	Man-made conceptual structures

The memos completed during Atlas.ti (as shown as (C) in Figure 4.2). These memo emerged from the organic relationships identified from Table 4.4 data.

Table 4.5 outlines the Emergent Relationships representing a higher order of abstraction found through the sensemaking memos addressing all the parts of the system. Similarly, Table 4.6 details the Emerging Relationships that we identified from derived categories in Table 4.4. The codes and categories form a framework to measure and regulate Urban Agriculture (see Appendix B for examples). The higher order Emergent Relationships listed in Table 4.5 and 4.6 imply that the new UA definition must also be a higher order concept beyond the simplistic industrial measures of field areas, produce weights, and head counts. These simplistic measures are site specific, while the needed new definition must be uniform beyond the local environment and site specific measures. We know already UA is: growing plants, animals, food, and related by-products in an urban location, determined by the local environment (Mougeot, 2000; Smit et al., 2001). Exploring these higher order concepts revealed in the Emergent Relationships will lead to the new UA definition.

4.5 Discussion

We developed key concepts from the foundational works with Grounded Theory and then expanded these with the complete dataset of 337 publications from 2000-2013 (see supplemental materials for complete article listing). As noted each phrase was evaluated through constant comparison to the foundational works to include the complete system based on the Planetary Boundary Framework. The primary codes from definitional phrases determined the categories to be tested, resulting in the Common Categories listed in Table 4.7.

Table 4.7 Result summary

Key Concept			Primary Codes	Tested Category	Common Category
agriculture	hydroponic	proximity	activity	activity	activity
acre	hypothesis	purpose	agriculture	benefits	benefits
activity	input	purpose	define	BMP	entrepreneur
aquaponic	law	quantity	legality	cases	issue
area	level	regulation	location	define	legality
cash	locate	represent	scale	economic	location
codes	Location	result	stages	entrepreneur	waste
compost	measure	rule	urban	issue	
conclusions	methods	scale		legal	
define	NGO	stage		location	
demonstrates	output	study		Mougeot	
entrepreneur	permit	Theory		neo-liberal	
evaluate	plot	UA		research	
explores	policy	UPA		Smit	
food	presents	Urban		stakeholder	
fruit	product	vegetable		theory	
goals	production	waste		transport	
government	profit	zoning		waste	

The key concepts resulted in the primary codes to find the final common categories represented here (see supplementary materials for details). Throughout this process memos noted how these categories highlighted Emergent Relationships to support a comprehensive UA definition.

At this point in the analysis, we stepped beyond this Grounded Theory Method by engaging more with the lighter tools of sensemaking (Weick, 1999) to intuit the direct association of the Emergent Relationships from the Common Categories in Table 4.7. We found that the concepts used most often in association with UA in this dataset were all related to the higher-level concepts of capital. This coincides with another scholar who recommended the sustainable development measures be based on the forms of capital (G. Glaser, 2012). Capital is a higher-level concept, as listed in Figure 4.3, which we determined readily supports the UN Sustainable Development Goals reaching the higher levels required by the Planetary Boundary Framework.

Natural capital is the stock of natural resources that provide goods and services to society. It is necessary to maintain life on Earth and human well-being.
Human capital comprises people's health, knowledge, education, skills, and motivations. Enhancing human capital is central to a flourishing life and wellbeing.
Social capital concerns intangible assets associated with formal and informal networks, trust, shared values and norms required for enhancing the quality and quantity of societal interactions. Social capital facilitates coordination and cooperation for mutual benefit.
Manufactured capital refers to fixed physical assets, which contribute to the production process of goods and services - e.g. tools, machines, infrastructures, buildings, and other built capital.
Financial capital is a virtual mechanism our society uses to trade other forms of capital (natural, human, social, and manufactured), so it has no value by itself but in each particular social context. It refers to the savings, credits, and money used for investing in the maintenance and enhancement of other capital assets

Figure 4.3 Five forms of capital (adopted from and discussed by Palomo et al. 2016; from the work of Goodwin, 2003; Palomo, Felipe-Lucia, Bennett, Martín-López, & Pascual, 2016).

Evaluating the Emergent Relationships listed earlier in Tables 4.5 and 4.6 through System Theory and the Planetary Boundaries Framework inspired us to consider these higher order concepts of capital as noted in Figure 4.3. To examine this idea further the capital concepts in Figure 4.3 were combined with the Common Categories shown in Table 4.7 to create Table 4.8. Thus, interpreting the code and category data provided in Table 4.7 through this integrated systems lens including the Emergent Relationships determined the key Foundational Theory based on capital.

Table 4.8 Relationship determinations

Common Category	Emergent Relationship	Foundational Theory
Activity	Human actions and skills	Human capital
Benefits	Community constructs	Social capital
Entrepreneur	Man-made growth measure	Social capital
Issue	Man-made measures	Social capital
Legality	Conceptual structures	Social capital
Location	Natural physical structure	Natural capital
Waste	Man-made physical structure	Manufactured capital

The final core categories and memo analysis yield the emergent definition based on the foundational theory of the various forms of capital.

We continued with the sensemaking process by staying present with this dataset, and explored how other authors addressed capital. For example, Robinson and Carson (2015) discussed community capital in their recent review, including the ways that different capitals fit together. Therein the Community Capitals Framework is considered to be a community assessment and development tool addressing seven forms of capital: natural, built, financial, political, social, cultural, and human (e.g. Ellis & Freeman 2005; Minkler, Vásquez, Tajik & Petersen 2008; Nelson, Kokic, Crimp, Meinke & Howden 2010; Flora & Flora 2008). Similar to the sensemaking work we have completed here, Flora, Flora, and Gasteyer (2015) identified the Appreciative Inquiry approach of acknowledging the present assets for building community capital from "what is there and what is working" (p. 450). This parallels the Systems Thinking and sensemaking approach used herein, as we considered the Planetary Boundaries Framework and remained present with the data to review and link to the higher-level concepts of capital.

Further, to examine these new relationships more closely, we created a content analysis for each category. A content analysis determines the frequency of the codes in each category. As noted in Figure 4.4, this content analysis of the 337 selected publications on UA indicated that 154 (or 46%) of the article UA definitions addressed legal land tenure issues most common for land administration, while 156 addressed benefit issues. The most common definitional categories found were similarly reviewed to determine the total counts found in the dataset shown in Figure 4.4.

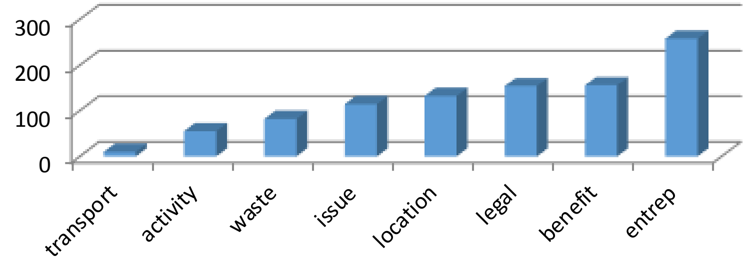

Figure 4.4 Common codes found through the complete dataset of 337 articles

Noted in Figure 4.4, the entrepreneurship code (abbreviated to “entrep” for presentation clarity) has the highest count (258) within all the coded phrases. This inspires new questions. How does entrepreneurship fit the Emergent Relationships listed in Table 4.8? Where does entrepreneurship fit into these categorized relationships?

We recognized that these five capital designations are present at different levels in all forms of agriculture. However, we further observed that a different form of capital more substantially facilitates each configuration of agriculture. Rural agriculture is primarily based on family traditions and hard labor associated with human capital (Altieri & Koohafkan, 2008; De Schutter, 2010; Rosset, 2011). Industrial agriculture is primarily based on manufactured and financial capital (IAASTD, 2009; Starke, 2013; Weaver, 2015). Lastly, UA is shown most often through the social capital as the results listed in Table 4.8 represent, which is necessary for entrepreneurship as most often coded herein (see Figure 4.4 counts). Thus, we conclude that the UA dataset indicates the most common elements for creating UA are social capital through entrepreneurship.

Our results are consistent with the policy literature. A recent American Planning Association (APA) guide recommends that planners organize stakeholders to start Community and Regional Food Plans (American Planning Association, 2007). Stakeholders engaged with community plans encourage stronger community networks increasing social capital as recently noted by McIvor and Hale (2015). Further, these local planning efforts are critical as research has shown UA entrepreneurship with adequate policies encourages food security (Gallaher et al., 2013; Kimberley Hodgson, Campbell, & Bailkey, 2011). Additionally, this entrepreneurial expansion based on cooperative social capital has been recommended in recent work from Mougeot (2015). Mougeot (2015) confirms the social capital network of local institutional support is necessary for sustainable development of UA. Further, to reach the UN Sustainable Development Goals, Ostrom et al. (1999) found that when local entrepreneurs are given autonomy they tend to create their own policies and restrictions for increased sustainability of the commons contrary to industrial agriculture which tends to destroy the environment (IAASTD, 2009; IPCC, 2014; Weaver, 2014).

Additionally, our dataset included examples of how UA entrepreneurs will succeed with policies that reinforce social capital. For example, the way that entrepreneurs create innovative "small-scale sharecropping" was reported in Portland, OR (Lovell, 2010). Similarly, Brown and Jameton (2000) found that UA entrepreneurs increase health, food security, and extra income with proper policies. APA further noted that UA strengthens sustainable growth and city resilience (Hodgson et al., 2011). Thus, professionals can expand UA for sustainable development by encouraging social capital investment in UA entrepreneurship.

4.6 Conclusion

The purpose of this work is to define UA beyond the industrial propaganda used to support the status quo. The planning community already supports UA (American Planning Association, 2007; Dewaelheyns et al., 2016; K. Hodgson, 2012; Kimberley Hodgson et al., 2011; Vásquez-Moreno & Córdova, 2013). Our current analysis increases knowledge with a comprehensive definition of UA. Understanding the key concepts of UA, and the preferred methods of increasing social capital through entrepreneurship enables planners to better engage local community stakeholders to support UA. UA is a social construct supported mainly by engaged community entrepreneurs, not a commodity controlled by industry with measures focused on farmed areas, delivered pounds, and slaughtered headcounts. This additional clarity encourages a "bottom-up entrepreneurial approach" to reach the UN Sustainable Development Goals. We must recognize the professional responsibility to direct UA with proper policies to achieve this next evolutionary stage of the Anthropocene through sustainable development:

> *Urban Agriculture is entrepreneurship: growing plants, animals, food, and related by-products in an urban location dependent on the local environment and engaged social capital.*

This increased knowledge and understanding of these newly integrated UA concepts allow professionals to develop new policies for UA based on local conditions (Prové et al., 2016). The measurement and structural components must include Planetary Boundary Thinking and engaging stakeholders specifically to encourage deep democracy in each individual community (McIvor & Hale, 2015). We recommend the Appreciative Inquiry approach with Community Capitals Framework (CCF) (Flora et al., 2015; Robinson & Carson, 2015) for this implementation. This agrees with Prové et al. (2016) who recommended a city specific context for policy development. The CCF can begin engaging stakeholders with the key plan topics as the American Planning Association (APA) listed in Appendix B (Kimberley Hodgson et al., 2011) using the sample Community Garden Ordinance provided in Appendix C.

This comprehensive UA definition is fundamental to the Sustainable Development Goals, beyond the "business as usual" industrial agriculture model (IAASTD, 2009) and beyond the inadequate industrial models (Mistry & Berardi, 2016) promoted by industrial sponsored bureaucrats. Professionals now have a clear definition of UA for creating innovative policies to support UA as sustainable development. The key issue now is whether the UN Sustainable Development Goals will expand this effort or allow industries to continue to stand in the way as noted by Hansen et al. (2012) and Weaver (2015). Future research can replicate this data analysis and expand the queries through the supplemental data provided. Further, examining how stakeholders can better understand their local environment and engage in their community is noted in this video with the 3-priorities of Education, Planning and Voting for Understanding UA: https://youtu.be/HuoekmfFdNw.

4.7 References

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CHAPTER 5: CONCLUSION

The world population is likely to be over 10 billion by 2050. To further exacerbate this population issue, since 2005 the world population has become more urban than rural; by the mid-21st century the urban population is expected to double, seriously impacting the already unsustainable urban infrastructure systems. Resulting from this urban expansion, governments, land administrators, and engineers are pressed to change landuse and development policies to improve food security, through the sustainable development now afforded by Urban Agriculture. As a result of this completed research, professionals can now step beyond the "status quo" paradigm of industrial agriculture systems, which are the primary cause for the environmental degradation assessed using the Planetary Boundary Framework (Weaver, 2015). Thus, political support of landuse policies for new agriculture must begin with recognizing that the "status quo" is about multinational corporations maintaining their profits. This is not sustaining the planet, supporting the Earth's carrying capacity or creating sustainable food security for any population.

Researchers agree that Urban Agriculture is a more sustainable alternative to feed increasing global populations. Urban Agriculture, contrary to business as usual, is often an organic system based on agroecological techniques. Dr. Altieri; Professor of Agroecology at UC Berkeley's Department of Environmental Science, Policy, and Management; has done extensive research into the clash of the paradigms between the industrial agriculture and Agroecology, where the later uses 20% of the land to produce 60% of the global food production. Altieri (1999) also notes that contrary to industrial agriculture, biodiversity through agroecological systems can expand soil fertility, protect crops, and increase productivity naturally to create a sustainable system, without any harmful chemicals. These more diverse systems are also resilient, where agroecological techniques recover after disasters quicker than the monoculture areas of industry. These more socially just, economically feasible and environmentally sound techniques focus on the dialog of wisdom between existing farmers to promote Social Capital and resiliency. According to Altieri (1989), "Agroecology has emerged as a scientific approach used to study, diagnose and propose alternative low-input management of Agroecosystems. Solving the sustainability problem of agriculture is the primary aim of Agroecology" (p. 27).

Thus, the completed UA definition herein based on Social Capital (Weaver, 2017b) encourages practitioners to recognize UA as a viable alternative beyond the multinational propaganda and lobbyists efforts to support the “status quo.” The 34th Session of the UN Human Rights Council in January 2017 again maintained that “the pesticide industry is dominated by a few transnational corporations that wield extraordinary power over global agrochemical research, legislative initiatives and regulatory agendas” (Elver & Tuncak, 2017a, para 51). Their propaganda and political influence as noted herein, where G8 officials missed Rio+20 (Weaver, 2015) was also rebuked in the January Human Rights Council Session as the “assertion promoted by the agrochemical industry that pesticides are necessary to achieve food security is not only inaccurate, but dangerously misleading” (Elver & Tuncak, 2017a, para 91).

Further, the March 7, 2017 UN Human Rights Council further requested a new global treaty to reduce the use of dangerous pesticides as the “aggressive, unethical marketing tactics ... remain unchallenged, and huge sums [are] spent by the powerful chemical industry to influence policymakers.” In final confirmation of the efforts completed herein “The Special Rapporteur on Food highlights developments in [A]groecology, which replaces chemicals with biology, saying its approaches are capable of delivering sufficient yields to feed and nourish the entire world population, without undermining the rights of future generations to adequate food and health” (Elver & Tuncak, 2017b). Again repeating and updating the critical issues outlined herein (Weaver, 2015) as quoted from Dr. James Hansen et al., (2012) and Ghoshal (2005).

The research completed herein supports the expansion of UA for achieving the Sustainable Development Goals beyond the industrial puppeted "burrocrats" (aka bureaucrat, pronounced burro-crat as in burro, a small donkey and the Greek suffix –kratia or kratos, meaning "power" or "rule." Burrocrats: "jackass rules").

5.1 References

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APPENDIX A: JOURNAL COPYRIGHT MATERIALS

This appendix lists the acceptance letters from the three journal articles included. Each letter is followed by the Impact Factor page found for the selected journal and then the permissions statements regarding reprints for doctoral dissertations and other private uses, by the authors, as provided by each journal publisher. Each set of files attached is provided in the order they are listed in the chapters.

A.1 Approval for Chapter 2

A.1.1 Acceptance Letter from Gene W Seabolt, *Municipal Engineer*

Weaver, Eric

From:	em.muen.0.50f817.5d1e930c@editorialmanager.com on behalf of Municipal Engineer <em@editorialmanager.com>
Sent:	Thursday, February 02, 2017 9:21 AM
To:	Weaver, Eric
Subject:	Your paper has been accepted by Municipal Engineer

Article number: MUEN-D-16-00021R2
Title: Parameters sensitivities for sustainable urban infrastructure
Municipal Engineer

Dear Mr Eric Weaver,

I am pleased to tell you that your above article has been accepted for publication in Municipal Engineer.

The title and abstract of all accepted articles are subject to editing by the Proceedings of ICE Editor Simon Fullalove, to ensure that our wide readership finds them both accessible and easy to follow.

You will be contacted in due course by our Production department with your proofs, for approval. When you receive your proofs for checking, please limit your changes to only correcting errors, updating out-of-date information or substituting photographs.

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Regards,

Gene W Seabolt
Journals Editor
Municipal Engineer

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A.1.2 Journal Citation Reports Extract Dated 7/19/2016

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PROCEEDINGS OF THE INSTITUTION OF CIVIL ENGINEERS-MUNICIPAL ENGINEER

ISSN: 0965-0903

ICE PUBLISHING
INST CIVIL ENGINEERS, 1 GREAT GEORGE ST, WESTMINSTER SW1P 3AA, ENGLAND
ENGLAND

Go to Journal Table of Contents   Go to Ulrich's

Titles
ISO: Proc. Inst
JCR Abbrev: I

Categories
ENGINEERI

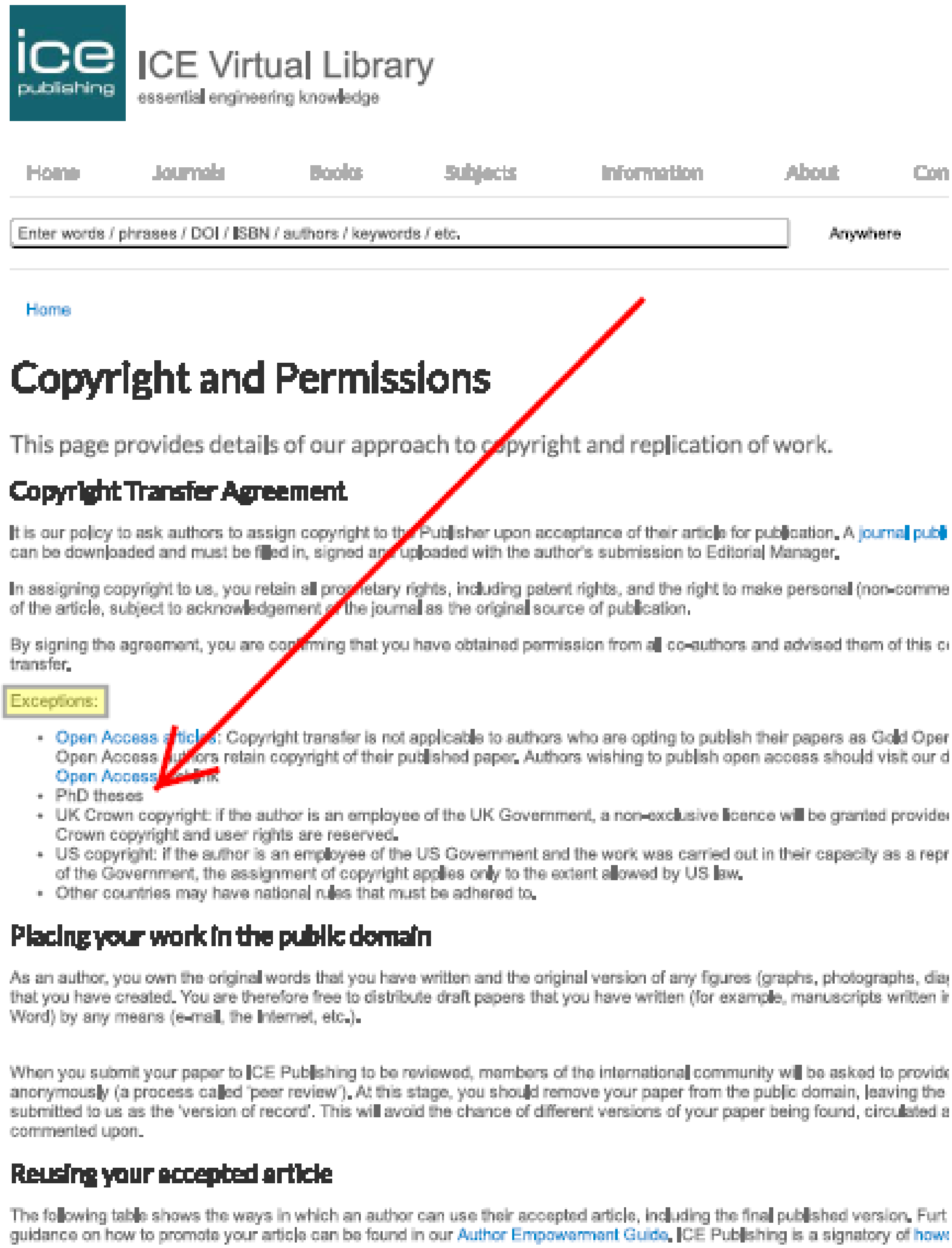
Languages
ENGLISH

4 Issues/Year;

Key Indicators

Year	Total Cites Graph	Journal Impact Factor Graph	Impact Factor Without Journal Self Cites Graph	5 Year Impact Factor Graph	Immediacy Index Graph	Citable Items Graph	Cited Half-Life Graph	Citing Half-Life Graph	Eigenfactor Score Graph	Article Influence Score Graph	% Articles in Citable Items Graph
2015	159	0.275	0.156	0.326	0.630	27	7.7	7.2	0.00022	0.104	100.00
2014	125	0.148	0.092	0.237	0.792	24	6.8	6.8	0.00019	0.079	95.83
2013	125	0.241	0.172	0.284	0.778	27	5.6	6.3	0.00030	0.117	100.00
2012	110	0.254	0.079	0.237	0.815	27	4.8	5.5	0.00016	0.058	100.00
2011	122	0.209	0.104	0.271	1.161	31	3.8	6.3	0.00017	0.059	100.00
2010	122	0.462	0.261	0.323	1.031	32	2.9	5.6	0.00028	0.090	100.00
2009	110	0.224	0.103	0.236	1.086	35	3.7	5.7	0.00031	0.091	100.00
2008	40	0.138	0.138	0.108	0.100	30	Not A...	5.8	0.00011	0.030	100.00
2007	32	0.103	0.044	0.148	0	28	Not A...	5.6	0.00020	0.048	100.00
2006	28	0.096	0.041	Not A...	0.033	30	Not A...	5.2	Not A...	Not A...	100.00
2005	21	0.099	0.070	Not A...	0.026	38	Not A...	5.3	Not A...	Not A...	100.00
2004	22	0.190	0.139	Not A...	0	35	Not A...	5.2	Not A...	Not A...	100.00
2003	11	0.069	0.045	Not A...	0	28	Not A...	5.1	Not A...	Not A...	100.00
2002	14	0.024	0	Not A...	0.047	43	Not A...	3.8	Not A...	Not A...	100.00
2001	11	0.031	0.015	Not A...	0	44	Not A...	4.2	Not A...	Not A...	100.00
2000	4	0.034	0	Not A	0	38	Not A	4.0	Not A	Not A	100.00

A.1.3 About Journal Publishing



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Activity	Subscriber content	G[illegible] op[illegible] ac[illegible]
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Share your article with a reasonable number (less than 50) of your colleagues and contacts, or a research collaboration network	Y	Y
Deposit the accepted version in a repository approved by your research-funding agency. Deposit the final version (PDF) in a repository approved by your research-funding agency, after the stipulated embargo period. Read our policy on Green open access and REF2020.	Y	Y
Directly include the full article in a second party mailing, forum or online scholarly collaboration network (e.g. Academia.edu)	N	Y
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Print a commercial number of copies (greater than 50). If you require more than 50 hardcopies, we offer a professional printing service	N	Y
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A.2 Approval for Chapter 3

A.2.1 Acceptance Letter from Robert Brinkmann, *Suburban Sustainability*

Weaver, Eric

From:	Robert Brinkmann <editor-subsust-1019-1597872 @scholarcommons.usf.edu>
Sent:	Wednesday, February 04, 2015 10:54 AM
To:	Weaver, Eric
Cc:	The Authors; The Editors
Subject:	MS #1019 - Suburban Sustainability

Dear Eric RR Weaver

Congratulations! After careful review, your article "Sustainable Development for People or Profit?" has been accepted into Suburban Sustainability. We look forward to publishing your article as soon as possible.

The reviewers provided some excellent points for revisions that you should consider prior to resubmission. In addition, we urge you to do a careful edit for language and to try to evaluate some of your sentences that include strong hyperbole. The reviewers noted that your language, in spots, was inappropriate for an academic paper. Nevertheless, we look forward to seeing the edited version.

When you are satisfied that your paper meets the journal's formatting requirements and is ready to publish, please upload your revision and be sure to also include a cover letter detailing the changes you have made. If you are satisfied with the article as it is, let me know that as well.

The current version of your submission is available here:
http://scholarcommons.usf.edu/cgi/preview.cgi?article=1019&context=subsust

You may also view the reviews and preview your submission on that page. To submit revisions, use the Revise Submission link on that page.

Please make sure that your paper adheres to the formatting requirements at
http://scholarcommons.usf.edu/subsust/styleguide.html

Thank you,

Robert Brinkmann
Editor

A.2.2 Scholar Commons Readership Reports

Weaver, Eric

From:	Scholar Commons notification system <noreply@bepress.com>
Sent:	Sunday, March 05, 2017 11:26 PM
To:	Weaver, Eric
Subject:	Your Latest Readership Report from Scholar Commons

readershipreport

From: Scholar Commons

Dear Author,

You had **3** new downloads in February 2017 across your **1** paper in Scholar Commons. Your current readership:

258 Total Downloads

VISIT MY DASHBOARD

Digital Commons Tip

A.2.3 Email Copyright and Permissions Ph.D. Thesis Exemptions

Weaver, Eric

From:	Boczar, Jason
Sent:	Wednesday, March 01, 2017 2:22 PM
To:	Schmidt, Leetta
Subject:	FW: Suburban Sustainability copyright and permissions question

Hi LeEtta,

Would this be an adequate record of permission for the student to use their article in their ETD?

All the best,
Jason

From: Robert Brinkmann <Robert.Brinkmann@hofstra.edu>
Date: Wednesday, March 1, 2017 at 1:51 PM
To: "Boczar, Jason" <jboczar@usf.edu>
Cc: "Johnston, Chelsea" <ctjohnston@usf.edu>
Subject: Re: Suburban Sustainability copyright and permissions question

Yes, they can use the materials Jason. Chelsea, if you could suggest some language, I would be grateful.
Cheers,

Bob Brinkmann
Vice Provost for Scholarship and Engagement
Associate Dean of Graduate Studies
Professor of Geology, Environment, and Sustainability
Hofstra University
West Library
130 Hofstra University
Hempstead, NY 11549
516-463-5400
robert.brinkmann@hofstra.edu

From: "Boczar, Jason" <jboczar@usf.edu>
Date: Tuesday, February 28, 2017 at 3:31 PM
To: Robert Brinkmann <Robert.Brinkmann@hofstra.edu>
Cc: Chelsea Johnston <ctjohnston@usf.edu>
Subject: Suburban Sustainability copyright and permissions question

Hi Robert,

I work with Scholar Commons, the host of Suburban Sustainability, and I recently received a question from a graduate student. They published an article in the journal and would like to use it in their dissertation. Does the journal permit using published articles in theses and dissertations?

Additionally, I was curious as to the copyright policy of the journal and I think that in keeping with the standard across Scholar Commons, it would be good to include some language about the copyright policy in the Policies section of the journal. I have CC'd Chelsea Johnston to help with this.

Thank you for your help!
All the best,
Jason

--
Jason Boczar
Digital Scholarship and Publishing Librarian
University of South Florida Libraries
4202 E. Fowler Ave. LIB 122
Tampa, FL 33620-5400
(813) 974-5505

Researcher Profile: http://works.bepress.com/jasonboczar
ORCiD: http://orcid.org/0000-0001-8575-2356

A.3 Approval for Chapter 4

A.3.1 Review Letter *Land Use Policy*

Weaver, Eric

From:	EviseSupport@elsevier.com
Sent:	Sunday, February 12, 2017 4:11 AM
To:	Weaver, Eric
Subject:	Your manuscript LUP_2017_129 has been sent for review

This message was sent automatically. Please do not reply.

Reference: LUP_2017_129
Title: Viewpoint: Urban agriculture defined for Sustainable Development
Journal: Land Use Policy

Dear Mr. weaver,

I am currently identifying and contacting reviewers who are acknowledged experts in the field. Since peer review is a voluntary service it can take time to find reviewers who are both qualified and available. While reviewers are being contacted, the status of your manuscript will appear in EVISE® as 'Reviewer Invited'.

Once a reviewer agrees to review your manuscript, the status will change to 'Under Review'. When I have received the required number of expert reviews, the status will change to 'Ready for Decision' while I evaluate the reviews before making a decision on your manuscript.

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Kind regards,

Land Use Policy

A.3.2 Journal Citation Reports Extract Dated 2/9/2017

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LAND USE POLICY

ISSN: 0264-8377

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ENGLAND

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Year	Total Cites Graph	Journal Impact Factor Graph	Impact Factor Without Journal Self Cites Graph	5 Year Impact Factor Graph	Immediacy Index Graph	Citable Items Graph	Cited Half-Life Graph	Citing Half-Life Graph	Eigenfactor Score Graph	Article Influence Score Graph	% Articles in Citable Items Graph
2015	4,736	2.768	2.141	3.253	0.604	326	4.7	7.7	0.00992	0.779	99.69
2014	3,728	2.631	2.136	3.095	0.646	246	4.9	7.9	0.01016	0.857	100.00
2013	2,936	3.134	2.474	3.314	0.764	297	4.5	7.9	0.00722	0.866	99.66
2012	2,020	2.346	2.125	2.631	0.758	91	4.4	7.7	0.00648	0.796	97.80
2011	1,721	2.292	2.066	2.561	0.489	88	4.2	7.8	0.00644	0.811	97.73
2010	1,365	2.070	1.716	2.360	0.725	120	4.1	7.3	0.00440	0.654	95.00
2009	1,011	2.355	1.934	2.536	0.479	117	5.1	8.1	0.00347	0.745	98.29
2008	700	1.821	1.714	2.089	0.320	50	4.6	7.3	0.00274	0.610	96.00
2007	488	1.213	0.977	1.613	0.263	57	4.6	7.6	0.00205	0.509	96.49
2006	379	1.581	1.467	Not A...	0.164	55	5.0	8.3	Not A...	Not A...	98.18
2005	236	1.035	0.877	Not A...	0.118	34	5.0	7.1	Not A...	Not A...	97.06
2004	242	0.768	0.553	Not A...	1.500	28	3.8	6.3	Not A...	Not A...	96.43
2003	138	0.636	0.509	Not A...	0.069	29	4.4	5.9	Not A...	Not A...	100.00
2002	114	0.603	0.586	Not A...	0.074	27	4.2	6.3	Not A...	Not A...	100.00
2001	109	0.623	0.490	Not A...	0.107	28	4.7	6.5	Not A...	Not A...	100.00

APPENDIX B: KEY TOPICS

community engagement
food waste and disposal
food literacy and education
food access and availability
food retail
food distribution
food processing
rural agriculture

health/nutrition education
community development
environmental stewardship
agricultural skills and knowledge
agricultural practices
financial assistance

water
land tenure
uncontaminated soil
growing space
farm animals
chickens
bees

orchards
share cropping
rooftop urban agriculture
commercial farms
commercial gardens
community gardens
vertical gardens
edible landscaping
victory gardens
private gardens

hydroponics
aeroponic
aquaponics

Adopted and modified from Hodgson, K., Campbell, M. C., & Bailkey, M. (2011). Urban agriculture: growing healthy, sustainable places. Washington, DC: American Planning Association.

APPENDIX C: URBAN AGRICULTURE ORDINANCE

This set of data was provided to the St. Petersburg City Council Public Services & Infrastructure (PS&I) Committee to successfully modify the city ordinance. The file includes all the research and supplemental attachments as provided June 10, 2013 to the St Petersburg Councilmembers.

C.1 Model City Ordinances

To: St. Petersburg City Council Public Services & Infrastructure (PS&I) Committee
From: Lauren M. Pusateri-Woods, Bon Secours St. Petersburg Health System and Diane Friel, Sustainable Urban Agriculture Coalition (SUAC) of St. Petersburg
Date: June 10, 2013
Subject: Urban Agriculture Ordinance
Dear Councilmembers,

It has come to our attention that the Public Services & Infrastructure (PS&I) Committee is considering changes to the Community Gardens Ordinance (Section 16.50.085). Many St. Petersburg residents desire to expand urban agriculture within the City limits and, in response, Councilman Nurse requested that the Planning Department investigate revising the Ordinance to allow for small scale urban farming in St. Petersburg. The City's lead as the first municipality in Pinellas to adopt a community gardens ordinance has inspired several other municipalities (e.g., Safety Harbor, Pinellas Park, and Dunedin) and the County to amend their land use regulations to allow community gardens in multiple zoning categories. The Sustainable Urban Agriculture Coalition (SUAC) and Bon Secours St. Petersburg (Bon Secours) applaud the City for its progressive actions to join the movement of US cities that are promoting and supporting urban agriculture!

The current regulations have helped to establish the urban agriculture movement in St .Petersburg, but they do not provide the framework to promote growing food locally to the extent that it could to become an economic stimulus, build lasting community bonds, aid in the reduction of local "food desserts", or improve overall nutrition and health. Therefore, we have prepared this memorandum to highlight some of the shortcomings in the City's current regulations, provide example ordinances, highlight the economic benefits that urban agriculture provides, and offer policy suggestions for the City to consider as it drafts amendments to the its Land Development Regulations and Comprehensive Plan. Furthermore, we are committed to work with the City's new Sustainability Council, once it is established, and pull together the best practices for urban agriculture in St. Petersburg. As approved and agreed by the City Council at its 6/6/13 meeting, establishing a Sustainability Council is a concrete step towards our community achieving the four E's: the Economy, the Environment, Social Equality and Efficiency and becoming resilient in the face of global climate change. Urban agriculture promotes these four goals and is an integral part of the sustainable living model.

Current Ordinance
Under the City of St. Petersburg's current code, there are three agricultural related uses, community gardens, commercial gardens and greenhouses, and nurseries. In addition, Chapter 4 of the City Code permits (to a limited extent) chickens, bees, and other animals. Establishing

a "community garden" requires a community garden permit while establishing a commercial garden is considered a special exception, as outlined in the Land Development Regulations Chapter 16, Section 16.50.085, and Section 16.10.020.1, respectively. There are many benefits associated with the City's current Land Development Regulations, for example, permitted community gardens may operate in any zoning district as long as they comply with the development standards of the zoning district, the general development standards, and the Ordinance itself. Furthermore, the current Community Gardens Ordinance does not specify a minimum or maximum lot size; in theory, any size garden is permitted as long as other development standards are met. Additionally, allowing commercial gardens within the City is a useful first step in creating economic opportunities associated with local food production. Although the current regulations are helpful in establishing the context for urban agricultural activities within the city limits, they limit the ability for a cohesive and functional urban agriculture movement.

As Councilman Nurse indicated in his request for the Mayor and City Council to consider changes to the Ordinance,

> *"When St. Petersburg passed the county's first community gardening ordinance, we did not consider that there might be an interest within a few years in creating gardens that would grow a sufficient crop to sell. Now, a number of organizations are considering establishing small urban farms as is done in a number of other cities including Tampa. These farms create jobs for young people in inner city neighborhoods and encourage healthy foods."*

The City did not anticipate the meteoric growth and interest in urban agriculture when the Ordinance was first approved in 2009. The current regulations provide a good start, but must be expanded on to promote growing food locally to the extent that it could to support the community. Most prohibitive is the language stating that "A community garden is not intended to be a commercial enterprise...The produce and horticultural plants grown in a community garden shall not be sold wholesale nor offered for sale on the premises. Surplus produce or plants may be sold off the premises." (Section 16.50.085.4.3). Another restriction is that the Ordinance prohibits "gas-powered equipment which is greater than 10 horsepower (Section 16.50.085.4.2). Finally, the overall definition of a community garden under Section 16.50.085.3 is restrictive in that it does not recognize the broad range of urban agriculture activities (for example, roof-top gardens, hydroponics, food forests, etc.), which the commercial garden and greenhouse definition does. Under this section, the Ordinance employs words that limit harvest for "personal consumption, enjoyment of friends and relatives, or donations to non-profit organizations" and only permits such community gardens on vacant land where no other uses may operate. This last restriction would eliminate community gardens on lands where businesses, such as restaurants, reside. It is also unclear as to how the Community Gardens Ordinance is applied to City-owned lands that are designated as Recreational/Open Space and/or Parks. We have heard rumor that, in general, the City Parks Department does not "allow" or encourage community gardens on properties they manage.

Amendments to Current Ordinance

The current regulations have helped to establish the urban agriculture movement in St. Petersburg, but in order for the benefits of the Movement to reach scale and have significant social, economic and health impacts, we suggest the following text and map amendments to the current Ordinance:

- Redefine community gardens to differentiate between commercial gardens (urban farms) by limiting community gardens size, use and generation of composting, and amount of produce allowed to be sold. A community garden should be limited to, for example to 25,000 sq ft. Community gardens should be limited to generating compost from on-site composting materials, and should not be allowed to sell composting materials, while urban farms would be allowed to generate compost materials from off-site materials, and should be allowed and sell compost off-site. The sale of produce from community gardens should be expanded to wholesale, but a limit on the amount of produce sold could be accomplished through limiting the sales revenue allowed to be generated. Urban farms would not be limited by the amount of sales revenue generated, and would be required to have a business license.

- To encourage the creation of urban farms as a large scale economic development tool, urban farms should receive incentives in the form of an urban agriculture tax incentive zone, similar to the idea of an Enterprise Zone. Further discussion of this tax incentive will be addressed in the economic development section of this document.

- Allow community gardens as a permitted use by right in all zoning categories, and expand the "outdoor sales, principal use gardens" category as a permitted use in several additional zoning categories such as retail and commercial categories, several institutional center categories, and both industrial zoning categories.

- Amend the commercial gardens and greenhouses (urban farms) permission from special exception to permitted use by right, and expand the use from the currently allowed industrial zone categories to several commercial corridors categories, several institutional center categories, both neighborhood planned unit zoning categories, and both retail center categories

- Create an Urban Agriculture Ordinance that protects the community's health by requiring any person or group who wishes to establish a community garden with plant beds that are not separated from the ground by a physical barrier and who are unable to confirm the historical use(s) of the property, to obtain a Phase I environmental site assessment to determine if any soil contamination exists. If it is determined, through a Phase I site assessment or through commonly gathered records or information, that the historical use of the property may be a potential environmental risk to the property, the applicant shall conduct all appropriate testing to determine the type and level of contamination, and conduct the appropriate remediation procedures to ensure that soil is suitable for gardening.

Numerous other community organizations and private entrepreneurs are clamoring to establish small-scale urban farms in the City limits and the City's current Comprehensive Plan, Land Development Regulations, and Future Land Use Plans are not set up to accommodate this rapidly expanding movement. St. Petersburg would be one of a growing number of cities in Florida to modify its zoning code to encourage the sale of produce from urban gardens and farms with passage of this Ordinance. We encourage the Mayor and City Council to amend the current Ordinance and approve a new Urban Agricultural Zoning Ordinance that would allow urban agriculture to the extent that it could provide the framework to promote a sustainable and resilient city. Several model city ordinances including the Ft. Lauderdale, Chicago, and San Francisco, which were referenced to create the above suggestions, have been included as **Attachment 1** of this document.

Economic Benefits and Urban Agriculture

In addition to the community-building and other positive social and health impacts, urban agriculture has led to sustainable economic benefits within cities across the United States by:

- Increasing green open space and the property values, including nearby home values and tax revenues near them,
- Revitalizing vacant arable and blighted land.
- Allowing residents to save money by growing and/or buying locally,
- Reducing the costs of health care through the health and environmental benefits of gardening and eating more produce
- Providing opportunities for supplemental income at the smaller community gardens and living wage opportunity through commercial farms
- Providing modeling ground and incubators for new, energy saving and environmentally sustainable technologies and creating new businesses that generate tax revenue,
- Providing job and skills training, particularly for youth, persons with a criminal record and those who are transitioning back into society.
- Increasing overall economic activities in local communities.

Although the urban agriculture movement has many economic benefits, it is often difficult for the movement to reach scale because of financial obstacles. One of the biggest obstacles to bringing urban agriculture to scale is access to land in St. Petersburg. Because Pinellas County is the most densely populated county in Florida, and St. Petersburg is the largest city in Pinellas, land supply tends to be limited, and costs of even vacant blighted property can be a challenge to acquisition for urban agriculture uses. To combat this issue and bring the benefits of urban agriculture to more residents, thus making the City of St. Petersburg more desirable, initial legislative tax incentives have significant impact in growing the urban agriculture movement.

As briefly discussed, urban agriculture zoning provides incentives to private landowners to make more land available for urban agriculture, while at the same time enabling them to do so at a lowered cost. Urban agriculture tax incentive zones will incentivize the use of private land for urban agriculture by reducing the assessed property tax rate in exchange for signing a contract with Pinellas County to place privately held land into urban agricultural use for 10 years. Should a landowner take action principally effecting a premature termination of enrollment in the program, the legislation will require them to pay back the tax benefits garnered from the program. This type of legislation has been used at the state-level in California (San Francisco Urban Agriculture.org **Attachment 2**).

Other tax incentives include City tax exemptions or reductions. For example, urban agriculture could receive City business certificate tax-exempt status for the first year of operation. Removing some of the financial hurdles to business start-up is key to developing urban agriculture as a sustainable economic development tool.

Comprehensive Urban Agriculture Policy

Progressive cities across the country have partnered with citizen advocacy groups and private businesses like SUAC and Bon Secours to promote urban agricultural initiatives. In particular, SUAC would like to see these partnerships formalized and encourages the City to embrace initiatives and binding language that encourages urban agriculture activities. Elements of the Comprehensive Plan should be update to include policy language supporting community gardens. Example goals, objectives and policies (GOPs) may contain language such as:

Goal/Objective:

Protect existing and establish new community gardens and urban farms as important community resources that build social connections; offer recreation, education, and economic development opportunities; and provide open space and a local food source.

Policies:

- Encourage the creation and operation of one community garden of no less than one acre for every 2,500 households. Identify neighborhoods that do not meet this standard and prioritize the establishment of new gardens in neighborhoods that are underserved and lack open space, grocery store access or healthy eating opportunities.

- Identify existing and potential community garden sites on public property, including parks; recreation and senior centers; public easements and right-of-ways; and surplus property, and give high priority to community gardens in appropriate locations.

- Encourage [or require] all affordable housing units to contain designated yard or other shared space for residents to garden.

- Encourage all [or some, such as multifamily residential, commercial, institutional or public] new construction to incorporate green roofs, edible landscaping, and encourage the use of existing roof space for community gardening.

- Create an Urban Agriculture Program within the [Parks and Recreation Department] to support existing and create additional community gardens.

- Increase support for community gardens through partnerships with other governmental agencies and private institutions including school district(s), neighborhood groups, senior centers, businesses, and civic and gardening organizations.

- Secure additional community garden sites through long-term leases or through the creation of garden sites as permanent public assets by the City, allow nonprofit organizations, and public or private institutions like universities, colleges, school districts, hospitals, and faith communities to lease sites from the City, or lease land owned by these entities to other public or private institutions.

- Encourage local law enforcement agencies to recognize the risk of vandalism of and theft from community gardens and provide appropriate surveillance and security to community gardens.

In addition to new GOPs and a revised Ordinance, SUAC and Bon Secours encourage the City to establish an Urban Agriculture Program (UAP) similar to the program started in San Francisco, California (see **Attachment 3**). The UAP should include one full-time equivalent position that would spend 100% of their time on Urban Agriculture and serve as a point person to coordinate closely with other City departments and organizations working on urban agriculture in the City, Pinellas County, neighboring communities, and the region as a whole.

As demonstrated through the policy suggestions above, successful urban agriculture programs are coordinated as part of a larger sustainable vision for a city. Two articles included under **Attachment 3** describe how urban agriculture policies fit under the umbrella of sustainability. The article published by *Resilience* highlights policies for a shareable city in relation to urban agriculture and an article from the *Sustainable Cities Institute* highlights how sustainability officers can promote urban agriculture through zoning.

No Better Time Then Now

In summary, we ask, if not now, then when? The collaborative call for urban agriculture is here. Healthcare advocates all over the nation and in St. Petersburg are joining with community gardeners, extension agencies, and faith-based organizations in city-wide coalitions, health organizations, and sustainability councils to maintain and expand urban food availability and improve access to nutritious food. Community economic development organizers, city planners, and environmentalists concerned with job creation and green businesses, sustainable cities and environmental concerns all see the potential for urban farming. A growing consumer desire for fresh, local food demands new markets for urban food production. Social ills of minority and low-income residents who are living in poverty and experience poor nutrition, and high unemployment necessitate the need for an innovative holistic solution that urban agriculture can provide. The City of St. Petersburg became the first *Green City* in Florida, and the Mayor and City Council have demonstrated their interest in becoming a more sustainable and resilient city. Now is the time to elevate the commitment to becoming green and capitalize on the great potential of food production in our urban area. As dozens of cities across the nation have realized and successfully demonstrated, the urban agriculture movement is not only necessary, but viable.

SUAC and Bon Secours are excited about the potential of amending the current Community Gardens Ordinance to broaden the current extent of community gardens, and actively promote and enable small-scale urban farms within City limits. We respectfully request that the City amend the Community Gardens Ordinance and consider the economic, social and health benefits of urban agriculture, the comprehensive urban agriculture policy suggestions, and allow St. Petersburg to continue to blaze the path to sustainable living.

C.1.1 City of Ft. Lauderdale Ordinance

ORDINANCE NO. C-12-

AN ORDINANCE AMENDING THE UNIFIED LAND DEVELOPMENT REGULATIONS OF THE CITY OF FORT LAUDERDALE, FLORIDA, PERMITTING URBAN FARMS AND COMMUNITY GARDENS BY CREATING SECTION 47-18.41, URBAN FARMS AND COMMUNITY GARDENS, ESTABLISHING REGULATIONS FOR URBAN FARMS AND COMMUNITY GARDENS; AMENDING ARTICLE II, ZONING DISTRICT REQUIREMENTS, TO PROVIDE FOR THE INCLUSION OF URBAN AGRICULTURE IN THE ZONING DISTRICT PERMITTED USE TABLES; AMENDING SECTION 47-20, PARKING AND LOADING REQUIREMENTS, TO PROVIDE FOR PARKING REQUIREMENTS; AMENDING SECTION 47-35 DEFINITIONS, TO PROVIDE DEFINITIONS; PROVIDING FOR SEVERABILITY; PROVIDING FOR REPEALER; PROVIDING FOR CODIFICATION; AND PROVIDING AN EFFECTIVE DATE.

WHEREAS, the City's Sustainability Action Plan encourages the establishment of zoning and sustainable agriculture policies that allow for sustainable agriculture land use through the City's Department of Sustainable Development; and

WHEREAS, on September 22, 2011 a public workshop was held by the City's Department of Sustainable Development to discuss the creation of an urban agriculture ordinance to further the goals of sustainability; and

WHEREAS, at its Conference meeting of November 15, 2011 the Commission directed staff for move forward with the creation of an urban agriculture ordinance; and

WHEREAS, the Planning and Zoning Board, at its meeting of May 16, 2012 (PZ Case No. 3-T-12), recommended approval of a proposed ordinance creating an urban agriculture ordinance; and

WHEREAS, the City Clerk notified the public of a public hearing to be held on Tuesday, June 19, 2012 and Tuesday, July 10 , 2012 at 6:00 o'clock P.M., in the City Commission Room, City Hall, Fort Lauderdale, Florida, for the purpose of hearing any objections which might be made to such ordinance; and

ORDINANCE NO. C-12-

WHEREAS, City Commission finds that locally grown and consumed produce has been shown to reduce the use of carbon-based fuels due to transportation over long distances and thereby reduces carbon emissions; and

WHEREAS, the implementation of an urban agriculture ordinance will restore agricultural business to the local economy and bring fresh produce to those areas where the population may not have the means to obtain fresh produce;

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COMMISSION OF THE CITY OF FORT LAUDERDALE, FLORIDA:

SECTION 1. That Section 47-18.41, Urban farm and community gardens, of the Unified Land Development Regulations ("ULDR") of the City of Fort Lauderdale, Florida, is hereby created to read as follows:

Sec. 47-18.41. Urban Farms and Community Gardens.

A. Purpose and Intent. The purpose of permitting Urban Farms and Community Gardens is to promote local food production for local consumption and promote the health, environmental and economic benefits of having such uses.

B. Permitted uses.

1. Urban Farm. Urban Farms shall be permitted in any zoning districts comprised of non-residential property when consistent with the City of Fort Lauderdale Comprehensive Plan.

2. Community gardens. Community gardens shall be permitted in all zoning districts when consistent with the City of Fort Lauderdale Comprehensive Plan.

a. One (1) sponsorship sign shall be permitted in a community garden subject to the following criteria:

i. signage shall not be visible from the public right-of-way;

ii. signs cannot exceed a maximum of ten (10) inches in width;

iii. signs cannot exceed a maximum of eight (8) inches in height; and

iv. signs may not be posted on higher than four (4) feet from grade.

C. Conditions for use.

1. Urban Farms may be permitted if the development site meets the minimum square footage required for development within the zoning district where the site is located.

2. Community Gardens may be permitted subject to the criteria herein.

D. Application. Approval of an Urban Farm or Community Garden shall be initiated by submittal of an application including the information provided in Section 47-24.1.F. In addition, the application shall include the following:

1. Management plan: A management plan shall be submitted to the department and shall include a drawing or sketch of the Urban Farm or Community Garden area. The following information shall be provided in the plan:

a. A narrative including the types of crop(s) to be grown, the hours of operation and the motorized equipment to be used as part of the operation. (Hours of operation shall be limited from dawn to dusk with no machinery operated before 7:00 a.m. seven (7) days a week); and

b. The number of persons to be involved in the operation; and

c. A list of chemicals, pesticides, fertilizers or any combination of same to be used; the frequency of use and the pests, diseases or plants they will be applied to; and

d. On site water source and a water management plan addressing run off to adjoining property, waterways or rights of way; and

e. A description of proposed rain-capture systems including size and location; and

f. Photograph of the proposed Urban Farm or Community Garden site; and

g. Urban Farms shall provide number of vehicles associated with the use and identification of permanent parking spaces on site; and

h. Description of composting activities including, location, size and means of containment; and

i. Complete description of any aspects of the operation that may generate noise or odor on site and that may impact neighboring residential property.

2. Urban Farm applications shall include a copy of a valid business tax license.

3. Community Gardens located on private property shall include a trespass affidavit from the property owner.

4. Community Gardens shall be required to perform an annual review of the approved management plan.

5. Proof of provision of a ten (10) day notice to adjacent property owners; such notice shall include a summary of the management plan.

E. Review Process.

1. Site Plan Level I. An application for a development permit for an Urban Farm one acre or less or a Community Garden no greater than the minimum lot size for development in the zoning district.

2. Site Plan Level I with a thirty (30) day Commission Request for Review (CRR). An application for a development permit for an Urban Farm greater than one acre or a Community Garden greater than the minimum lot size for development in the zoning district where located.

3. Approval of a Site Plan Level II development permit shall not be final until thirty (30) days after the preliminary DRC approval and then only if no motion is approved by the City Commission seeking to review the application pursuant to the process provided in Section 47-26A.2. of the ULDR.

F. Criteria.

1. The following criteria shall apply to the approval of an Urban Farm or Community Garden:

   a. The criteria applicable to a Site Plan Level I or Site Plan Level II development as applicable.

   b. The Urban Farm or Community Garden shall be compatible with, and preserve the character and integrity of adjacent neighborhoods and shall include improvements or modifications to mitigate adverse impacts such as noise, odor or other similar adverse effects.

   c. The application demonstrates how the proposed use meets all of the requirements and standards as provided in this Section 47-18.41 of the ULDR.

G. Standards.

1. The following standards shall apply as a condition to the approval of an Urban Farm or Community Garden:

   a. One utility or tool shed may be a permitted accessory structure if in compliance with Section 47-19.2 EE if in a residential zoned district or 47-19.FF. if in a non-residential zoned district. An additional utility or tool shed may be permitted for each addition acre for an Urban Farm and an additional minimum lot size for a Community Farm but there shall be a minimum 10 feet distance requirement between accessory structures.

   b. A cistern or other rain catching device may be permitted on site.

   c. Equipment.

      i. Urban Farms. Mechanical equipment used in the operation of an Urban Farm shall be limited to the following:

         (1) Riding/push mower designed for personal use;

(2) Handheld tillers or edgers that may be gas or electrically powered;

(3) Other handheld equipment designed for personal household use that create minimal impacts related to the operation of said equipment, including noise, odors, and vibration;

(4) Motor vehicles associated with the operations of an urban farm shall be limited to no more than two (2) with a gross vehicle weight of 10,000 pounds or less.

ii. Community Gardens.

(1) Push mowers designed for personal household use;

(2) Hand-held equipment designed for personal household use;

(3) Trucks (AASHTO "SU" design vehicle)

SECTION 2. That Section 47-20.2, Parking and loading zone requirements, of the ULDR of the City of Fort Lauderdale is hereby amended to read as follows:

Sec. 47-20.2. Parking and loading zone requirements.

...

TABLE 1. PARKING AND LOADING ZONE REQUIREMENTS

	Standard Requirements	
Use	*Parking Space Requirements*	*Loading Zone Requirements*
...		
Community Garden	0	1 Type I
...		
Urban Farm	1/4 employees	Type II

SECTION 3. That Section 47-35.1, Definitions, of the Unified Land Development Regulations (hereinafter referred to as "ULDR") of the City of Fort Lauderdale, Florida, is hereby amended to read as follows:

Sec. 47-35.1. Definitions.

Code: The Code of Ordinances of the City of Fort Lauderdale, Florida which includes Volumes I and II.

Community garden: An area of land managed and maintained to grow and harvest food crops and/or non-food ornamental crops, such as flowers, for use, consumption or donation by those maintaining the Community Garden. Community gardens may be divided into separate plots for cultivation by one or more individuals or may be farmed collectively by members of the group and may include common areas maintained and used by group members.

Truck sales: An establishment which provides for the sale of trailers, hauling trucks, dump trucks, concrete trucks and equipment and other similar heavy duty trucks.

Urban agriculture: May include the production, distribution and marketing of food and other products within the cores urban areas, comprising community and school gardens; backyard and rooftop horticulture; and other innovative food production methods that maximize production in a small area that may have the ability to supply urban farmers markets and community supported agriculture. Urban agriculture is a complex activity, addressing issues central to community food security, neighborhood development, environmental sustainability, land use planning and agricultural and food systems.

Urban farm: An area of land managed and maintained to grow and harvest food crops and/or non-food, ornamental crops, such as flowers, primarily for sale to local sellers and consumers. Local sellers or consumers shall be defined as sellers ultimately selling for consumers residing or doing business in Broward County, Florida.

SECTION 4. That Article II. Zoning District Requirements, of the ULDR of the City of Fort Lauderdale, Florida, is hereby amended to include the phrase "Urban Agriculture, (See Sec. 47-18.41)" as a district category in the respective "List of permitted and conditional uses" tables of every zoning district.

SECTION 5. That if any clause, section or other part of this Ordinance shall be held invalid or unconstitutional by any court of competent jurisdiction, the remainder of this Ordinance shall not be affected thereby, but shall remain in full force and effect.

SECTION 6. That all ordinances or parts of ordinances in conflict herewith, be and the same are hereby repealed.

SECTION 7. That this Ordinance shall be in full force and effect ten days from the date of final passage.

PASSED FIRST READING this the _____ day of __________, 2012.
PASSED SECOND READING this the _____ day of __________, 2012.

____
Mayor
JOHN P. "JACK" SEILER

ATTEST:

____
City Clerk
JONDA K. JOSEPH

L:\COMM2012\Ords\June 19th\Urban Agriculture Ordinace.doc

C.1.2 City of Chicago Ordinance

CHICAGO 09/09/2011 05:04 pm ET | Updated Nov 09, 2011

Chicago Urban Farming: City Council Approves New Ordinance

The Chicago City Council approved a zoning code amendment allowing for more widespread urban agriculture Thursday.

As WBEZ reports, the zoning code has expanded the size of community gardens to 25,000 feet, thus accommodating commercial farms within city limits. The ordinance also trims some of the red tape both farms and gardens face.

Mayor Rahm Emanuel lauded the amendment as a "job creator" that will also capitalize on otherwise vacant land.

"This policy is about taking land that we have here in the city of Chicago that is literally sitting fallow both as land as well as a revenue base or tax base and turning it into a job creator and a revenue creator. And there's great parts of the city where that exists," Emanuel said, as reported by WBEZ.

"The City worked with its sister agencies, urban agriculture experts and community members in an effort to help strengthen community ties and turn available empty lots into viable, productive urban green spaces," the mayor continued in a statement commending City Council for approving the ordinance.

The new rules will also allow for limited produce sales in residential areas, relax parking and fencing rules for larger urban farms and allow for aquaponics — sustainable, symbiotic food production systems — to be used, the *Chicago Tribune* reports.

Emanuel announced his support for the urban farming ordinance at the Iron Street Farm in Bridgeport in late July. Though the mayor's predecessor, Richard Daley, was nominally a proponent of urban farms, farmers say the ordinance he supported sought to place too many restrictions on how and where urban farms could be established. The ordinance approved Thursday by the City Council, under Emanuel's tenure, is considered to reverse that course.

Office of the Chicago City Clerk

O2011-6411

Office of the City Clerk

City Council Document Tracking Sheet

Meeting Date:	7/28/2011
Sponsor(s):	Mayor Emanuel
Type:	Ordinance
Title:	Amendment of Chapter 17-2 of Municipal Code regarding urban agriculture uses
Committee(s) Assignment:	Committee on Zoning, Landmarks and Building Standards

OFFICE OF THE MAYOR

CITY OF CHICAGO

RAHM EMANUEL
MAYOR

July 28, 2011

TO THE HONORABLE, THE CITY COUNCIL
OF THE CITY OF CHICAGO

Ladies and Gentlemen:

At the request of the Commissioner of Housing and Economic Development, together with Alderman Pawar, I transmit herewith an ordinance amending the Zoning Code regarding urban agriculture uses.

Your favorable consideration of this ordinance will be appreciated.

Very truly yours,

Mayor

ORDINANCE

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF CHICAGO:

SECTION 1. Section 17-2-0207 of the Chicago Zoning Ordinance, Title 17 of the Municipal Code of Chicago, is hereby amended by deleting the language stricken through and by inserting the language underscored, as follows:

17-2-0207 Use Table and Standards.

USE GROUP		Zoning Districts								Use Standard	Parking Standard
Use Category		RS	RS	RS	RT	RT	RM	RM	RM		
	Specific Use Type	1	2	3	3.5	4	4.5	5-5.5	6-6.5		
P= permitted by-right S = special use approval req'd PD = planned development approval req'd - = Not allowed											
(Omitted text is unaffected by this ordinance)											
PUBLIC AND CIVIC											
(Omitted text is unaffected by this ordinance)											
H. Parks and Recreation (except as more specifically regulated)		P	P	P	P	P	P	P	P		§ 17-10-0207-E
1.	Community Centers, Recreation Buildings and Similar Assembly Use	S	S	S	S	S	S	S	S		§ 17-10-0207-E
2.	Community Garden	P	P	P	P	P	P	P	P	§17-9-0103.5	§ 17-10-0207-E
(Omitted text is unaffected by this ordinance)											

SECTION 2. Section 17-3-0207 of the Chicago Zoning Ordinance, Title 17 of the Municipal Code of Chicago, is hereby amended by deleting the language stricken through and by inserting the language underscored, as follows:

17-3-0207 Use Table and Standards.

USE GROUP		Zoning Districts						Use Standard	Parking Standard
Use Category		B1	B2	B3	C1	C2	C3		
	Specific Use Type								
P= permitted by-right S = special use approval required PD = planned development approval required - = Not allowed									
(Omitted text is unaffected by this ordinance)									
PUBLIC AND CIVIC									
(Omitted text is unaffected by this ordinance)									
I. Parks and Recreation (except as more specifically regulated)		P	P	P	P	P	P		§ 17-10-0207-E
1.	Community Centers, Recreation Buildings and Similar Assembly Use	S	S	S	S	S	S		§ 17-10-0207-E

2.	Community Garden	P	P	P	P	P	P	§17-9-0103.5	§ 17-10-0207-E
(Omitted text is unaffected by this ordinance)									
W. Urban Farm									
1.	Indoor Operation	-	-	P	P	P	P	§17-9-0103.3	§ 17-10-0207-U
2.	Outdoor Operation	-	-	-	P	P	P	§17-9-0103.3	§ 17-10-0207-U
3.	Rooftop Operation	-	-	S	P	P	P	§17-9-0103.3	§ 17-10-0207-U
W X.	Communication Service Establishments	-	-	P	P	P	P		§ 17-10-0207-L
X Y. Construction Sales and Service									
1.	Building Material Sales	-	-	P	P	P	P		§ 17-10-0207-O
2.	Contractor/Construction Storage Yard	-	-	-	P	P	P		§ 17-10-0207-O
~~3.~~	~~Commercial Greenhouses~~	-	-	P	P	P	P		~~§ 17-10-0207-O~~
~~4.~~	~~Commercial Farm, Rooftop~~	-	-	S	P	P	P	~~§17-9-0103.3~~	~~§ 17-10-0207-E~~
(Omitted text is unaffected by this ordinance)									

SECTION 3. Section 17-4-0207 of the Chicago Zoning Ordinance, Title 17 of the Municipal Code of Chicago, is hereby amended by deleting the language stricken through and by inserting the language underscored, as follows:

17-4-0207 Use Table and Standards.

USE GROUP		Zoning Districts				Use Standard	Parking Standard
Use Category		DC	DX	DR	DS		
	Specific Use Type						
P= permitted by-right S = special use approval required PD = planned development approval required - = Not allowed							
(Omitted text is unaffected by this ordinance)							
PUBLIC AND CIVIC							
(Omitted text is unaffected by this ordinance)							
I. Parks and Recreation (except as more specifically regulated)		P	P	P	P		§ 17-10-0208
1.	Community Centers, Recreation Buildings and Similar Assembly Use	S	S	S	S		§ 17-10-0208
2.	Community Garden	P	P	P	P	§17-9-0103.5	§ 17-10-0208
(Omitted text is unaffected by this ordinance)							
COMMERCIAL							
(Omitted text is unaffected by this ordinance)							
W. Urban Farm							
1.	Indoor Operation	-	-	-	P	§17-9-0103.3	§ 17-10-0208
2.	Outdoor Operation	-	-	-	P	§17-9-0103.3	§ 17-10-0208
3.	Rooftop Operation	P	P	P	P	§17-9-0103.3	§ 17-10-0208

W X. Communication Service Establishments	P	P	-	P		§ 17-10-0208
X Y. Construction Sales and Service	-	-	-	P		§ 17-10-0208
1. Commercial Farm, Rooftop	P	P	P	P	§17-9-0103.3	§ 17-10-0208
Y Z. Drive-Through Facility	-	S	-	S	§ 17-9-0106	§ 17-10-0208
Z AA. Eating and Drinking Establishments (all, including Taverns)	P	P	-	P		§ 17-10-0208
AA BB. Entertainment and Spectator Sports (except as more specifically regulated)	P	P	-	P		
(Omitted text is unaffected by this ordinance)						
BB CC. Financial Services (except as more specifically regulated)	P	P	-	P		§ 17-10-0208
(Omitted text is unaffected by this ordinance)						
CC DD. Flea Market	-	-	-	S		§ 17-10-0208
DD EE. Food and Beverage Retail Sales (except as more specifically regulated)	P	P	-	P		§ 17-10-0208
(Omitted text is unaffected by this ordinance)						
EE FF. Fortune Telling Service	S	S	-	P		§ 17-10-0208
FF GG. Funeral and Interment Service						
(Omitted text is unaffected by this ordinance)						
GG HH. Gas Stations	-	S	-	S	§ 17-9-0109	§ 17-10-0208
HH II. Lodging						
(Omitted text is unaffected by this ordinance)						
II JJ. Medical Service	P	P	-	P		§ 17-10-0208
JJ KK. Office	P	P	-	P		§ 17-10-0208
KK LL. Parking, Non-Accessory						
(Omitted text is unaffected by this ordinance)						
LL MM. Personal Service	P	P	-	P		§ 17-10-0208
MM NN. Repair or Laundry Service, Consumer	P	P	-	P		§ 17-10-0208
NN OO. Residential Storage Warehouse	-	-	-	P		§ 17-10-0208
OO PP. Residential Support Services	-	-	P	-	§ 17-9-0114	None required
PP QQ. Retail Sales, General	P	P	-	P		§ 17-10-0208
QQ RR. Sports and Recreation, Participant						
(Omitted text is unaffected by this ordinance)						
RR SS. Valuable Objects Dealer	S	S	-	-		§ 17-10-0208
SS TT. Vehicle Sales and Service						
(Omitted text is unaffected by this ordinance)						
INDUSTRIAL						
TT UU. Manufacturing, Production and Industrial Services						
(Omitted text is unaffected by this ordinance)						
UU VV. Recycling Facilities						

(Omitted text is unaffected by this ordinance)						
~~WW~~ WW. Warehousing, Wholesaling and Freight Movement	-	P	-	P		§ 17-10-0208
OTHER						
~~WW~~ XX. Wireless Communication Facilities						
(Omitted text is unaffected by this ordinance)						

SECTION 4. Section 17-5-0207 of the Chicago Zoning Ordinance, Title 17 of the Municipal Code of Chicago, is hereby amended by deleting the language stricken through and by inserting the language underscored, as follows

17-5-0207 Use Table and Standards.

USE GROUP		District			Use Standard	Parking Standard
Use Category		M1	M2	M3		
	Specific Use Type					
P= permitted by-right S = special use approval required PD = planned development approval required - = Not allowed						
(Omitted text is unaffected by this ordinance)						
PUBLIC AND CIVIC						
(Omitted text is unaffected by this ordinance)						
I. Parks and Recreation (except as more specifically regulated)		P	P	P		§ 17-10-0207-E
1.	Community Centers, Recreation Buildings and Similar Assembly Use	-	-	-		
2.	Community Garden	-	-	-		
(Omitted text is unaffected by this ordinance)						
COMMERCIAL						
(Omitted text is unaffected by this ordinance)						
M. Urban Farm						
1.	Indoor Operation	P	P	P	§17-9-0103.3 Accessory sale of goods produced on site shall not exceed 3000 square feet	§ 17-10-0207-U
2.	Outdoor Operation	-	P	P	§17-9-0103.3 Accessory sale of goods produced on site shall not exceed 3000 square feet	§ 17-10-0207-U

3.	Rooftop Operation	P	P	P	§17-9-0103.3 Accessory sale of goods produced on site shall not exceed 3000 square feet	§ 17-10-0207-U
M N. Communication Service Establishments		P	P	P		§ 17-10-0207-L
N O. Construction Sales and Service						
1.	Building Material Sales	-	P	P	Customer-accessible retail sales areas may not exceed 20% of total floor area	§ 17-10-0207-O
2.	Contractor/Construction Storage Yard	-	P	P		§ 17-10-0207-O
~~3.~~	~~Commercial Greenhouses~~	-	P	P		~~§ 17-10-0207-O~~
~~4.~~	~~Commercial Farm, Rooftop~~	P	P	P	~~§17-9-0103.3~~	~~§ 17-10-0207-E~~
~~O~~ P. Drive-Through Facility		S	S	S	§ 17-9-0106	
P Q. Eating and Drinking Establishments						
(Omitted text is unaffected by this ordinance)						
Q R. Entertainment and Spectator Sports						
(Omitted text is unaffected by this ordinance)						
~~R~~ S. Financial Services (except as more specifically regulated)		P	P	P	Max GFA: 3,000 sq ft	§ 17-10-0207-L
(Omitted text is unaffected by this ordinance)						
~~S~~ T. Food and Beverage Retail Sales		P	P	P	Max GFA: 3,000 sq ft	§ 17-10-0207-M
~~T~~ U. Gas Stations		S	S	S	§ 17-9-0109	§ 17-10-0207-R
~~U~~ V. Medical Service		P	-	-		§ 17-10-0207-T
~~V~~ W. Office (except as more specifically regulated)		P	P	P	In M2 and M3, max GFA: 9,000 sq ft or accessory use to allowed industrial use	§ 17-10-0207-L
(Omitted text is unaffected by this ordinance)						
W X. Parking, Non-Accessory		S	S	S		
~~X~~ Y. Personal Service		P	P		Max GFA: 3,000 sq ft	§ 17-10-0207-M
~~Y~~ Z. Repair or Laundry Service, Consumer		P	P	P		§ 17-10-0207-N
~~Z~~ AA. Residential Storage Warehouse		P	P	P		§ 17-10-0207-Q
AA BB. Retail Sales, General		P	P	P	Accessory sales of goods produced on-site: not to exceed 20% of on-site GFA	§ 17-10-0207-M

BB CC. Sports and Recreation, Participant	S	S	S		§ 17-10-0207-M
CC DD. Vehicle Sales and Service					
(Omitted text is unaffected by this ordinance)					
INDUSTRIAL					
DD EE Manufacturing, Production and Industrial Service					
(Omitted text is unaffected by this ordinance)					
EE FF. Mining/Excavation	-	-	S	§ 17-9-0117.5*	§ 17-10-0207-U
FF GG. Recycling Facilities					
(Omitted text is unaffected by this ordinance)					
GG HH. Warehousing, Wholesaling and Freight Movement (except as more specifically regulated)	P	P	P		§ 17-10-0207-U
(Omitted text is unaffected by this ordinance)					
HH II. Waste-Related Use					
(Omitted text is unaffected by this ordinance)					
OTHER					
II JJ. Wireless Communication Facilities					
(Omitted text is unaffected by this ordinance)					

SECTION 5. Section 17-6-0203-E of the Chicago Zoning Ordinance, Title 17 of the Municipal Code of Chicago, is hereby amended by deleting the language stricken through and by inserting the language underscored, as follows:

17-6-0203-E Use Table

USE GROUP		Park/Open Space Facility Type				
Use Category		POS-1 Regional or Community Parks	POS-2 Neighborhood, Mini- and Play-lot Parks	POS-3 Open Space/ Natural Areas	POS-4 Cemeteries	Additional Standards
	Specific Use Type					
A = accessory P= permitted by-right S = special use approval required - = Not allowed						
(Omitted text is unaffected by this ordinance)						
PUBLIC AND CIVIC						
(Omitted text is unaffected by this ordinance)						
B. Parks and Recreation						
(Omitted text is unaffected by this ordinance)						
8	Community Garden	P	P	-	-	§17-9-0103.5
(Omitted text is unaffected by this ordinance)						

SECTION 6. Section 17-6-0403-F of the Chicago Zoning Ordinance, Title 17 of the Municipal Code of

Chicago, is hereby amended by deleting the language stricken through and by inserting the language underscored, as follows:

17-6-0403-F Use Table and Standards.

USE GROUP		PMD (Planned Manufacturing District)																				
Use Category		No. 1		No. 2		No. 3	No. 4		No. 5	No. 6	No. 7		No. 8	No. 9	No. 10	No. 11		No. 12	No. 13	No. 14	No. 15	Use Standard
	Specific Use Type	A	B	A	B		A	B			A	B				A	B					
P = permitted by right S = special use approval req'd PD = planned development approval req'd - = not allowed																						
(Omitted text is unaffected by this ordinance)																						
PUBLIC AND CIVIC																						
(Omitted text is unaffected by this ordinance)																						
I. Parks and Recreation (except as more specifically regulated)		S	S	S	S	S	S	S	S	S	S	P	S	S	S	S	P	S	S	S	-	
1.	Community Centers, Recreation Buildings and Similar Assembly Use	-	-	-	-	-	-	-	-	-	-	S	-	-	-	-	S	-	-	-	-	
2.	Community Garden	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
(Omitted text is unaffected by this ordinance)																						
COMMERCIAL																						
(Omitted text is unaffected by this ordinance)																						
M. Urban Farm																						
1.	Indoor Operation	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	§17-9-0103.1 Max GFA: 3000 sq ft for accessory sales of goods produced on site
2.	Outdoor Operation													P	P				P			§17-9-0103.1 Max GFA: 3000 sq ft for accessory sales of goods produced on site

3. Rooftop Operation	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	§17-9-0103.3. Max GFA: 5000 sq ft for accessory sales of goods produced on site
M N. Communication Service Establishments	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
(Omitted text is unaffected by this ordinance)																					
N O. Construction Sales and Service																					
3. Commercial Farm; Rooftop	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	§17-9-0103.3
O P. Drive-Through Facility	-	S	-	S	-	-	-	-	-	-	S	S	S	-	-	S	-	-	-	-	§ 17-9-0106
P Q. Eating and Drinking Establishments																					
(Omitted text is unaffected by this ordinance)																					
Q R. Entertainment and Spectator Sports																					
(Omitted text is unaffected by this ordinance)																					
R S. Financial Services (except as more specifically regulated)	-	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	-	-	Max GFA: 3,000 sq ft Max GFA: 6,000 sq. ft. in PMD #9 for lots which front on West North Avenue. No GFA limit in B subdistricts except PMD 4.
(Omitted text is unaffected by this ordinance)																					
S T. Food and Beverage Retail Sales	-	P	-	P	-	-	-	-	P	P	P	P	-	-	P	P	-	-	-	-	Max GFA: 3,000 sq ft. No GFA limit in PMD 8 for lots which abut South Halsted Stree north of Pershing Road and in B subdistricts except PMD 4.
T U. Gas Stations	S	S	S	S	S	S	S	S	P	P	S	P	S	S	S	S	S	S	-	S	§ 17-9-0109

~~U~~ V. Medical Service	P	P	P	P	P	P	P	P	-	S	P	P	-	S	P	P	P	P	-	P	Max GFA: 9,000 sq ft or reuse of existing building. No GFA limit in B subdistricts except PMD 4.
~~V~~ W. Office (except as more specifically regulated)	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P				Except in PMD 5, max GFA: 9,000 sq ft or reuse of existing building, or accessory to allowed industrial use. No GFA limit in B subdistricts except PMD 4.
(Omitted text is unaffected by this ordinance)																					
~~W~~ X. Parking, Non-Accessory	P	P	P	P	P	P	P	P	P	P	P	S	P	S	P	P	P	P	-	-	
~~X~~ Y. Personal Service	-	P	-	-	-	P	P	P	P	P	P	P	P	P	P	P	P	P	-	-	Max GFA: 3,000 sq ft. No GFA limit in B subdistricts except PMD 4.
~~Y~~ Z. Repair or Laundry Service, Consumer	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	-	-	Max GFA: 3,000 sq ft. No GFA limit in B subdistricts except PMD 4.
~~Z~~ AA. Residential Storage Warehouse	-	-	-	-	-	-	-	-	P	P	P	P	P	-	S	P	P	P	P	P	
~~AA~~ BB. Retail Sales, General	P	P	P	P	P	P	P	P	P	P	S	P	P	P	S	S	P				Max GFA: 3,000 sq ft for accessory sales of goods produced on-site: 20% of on-site GFA. No GFA limit or on-site production requirement in B subdistricts except PMD 4.
~~BB~~ CC. Sports and Recreation, Participant	-	S	-	S	-	S	-	S	-	S	P	-	-	-	-	P	-	-	-	-	

~~CC~~ DD. Schools, Elementary and High (non-boarding)	•	-	•	•	•	•	-	•	•	•	•	•	•	•	•	•	•	•	•	•	
~~DD~~ EE. Vehicle Sales and Service																					
(Omitted text is unaffected by this ordinance)																					
EE. ~~Reserved~~																					
(Omitted text is unaffected by this ordinance)																					

SECTION 7. Section 17-9-0100 of the Chicago Zoning Ordinance, Title 17 of the Municipal Code of Chicago, is hereby amended by deleting the language stricken through and by inserting the language underscored, as follows:

~~17-9-103.3 Commercial Farm, Rooftop.~~ **17-9-0103.3 Urban Farm.** *Urban farms* are subject to the following standards:

17-9-0103.3-A *Urban farms* shall be exempt from the landscaping and screening requirements of vehicular use areas of **17-11-0200**.

17-9-0103.3 B Parkway vegetation that is complementary to allowed activities and that is acceptable to the Department of Housing and Economic Development shall be allowed in lieu of the Parkway Tree requirements of **17-11-0100**.

17-9-0103.3-C Fencing and screening that is complementary to allowed activities and that is acceptable to the Department of Housing and Economic Development shall be allowed to comply with the requirements of **17-0-3-0304** and **17-5-0601**.

17-9-0103.3-D Composting is limited to only to the materials generated on site, and must comply with the standards of Section 7-28-715 of the Municipal Code.

(Omitted text is unaffected by this ordinance)

17-9-0103.5 Community Garden. *Community gardens* are subject to the following standards:

17-9-0103.5-A *Community gardens* shall not be larger than 25,000 square feet, except in POS districts. There is no size limit for community gardens in the POS1 and POS2 districts.

17-9-0103.5-B *Accessory buildings*, such as sheds, greenhouses, hoophouses or farmstands shall comply with the requirements of **17-9-0201-D**. Hoophouses or other fabric based shelters, which are not required to obtain a building permit shall not be considered accessory buildings. Hoophouses or other fabric based shelters shall be securely attached to the ground and designed and constructed to comply with appropriate standards in Title 13 of the Municipal Code of Chicago.

17-9-0103.5-C Composting is limited only to the materials generated on site, and must be used on site, and must otherwise comply with the standards of Section 7-28-715 of the Municipal Code.

17-9-0103.5-D Sales on site are limited to incidental sales of plants or produce generated on site.

(Omitted text is unaffected by this ordinance)

17-9-0201-D No *accessory buildings* may occupy more than 60% of the area of a required rear yard setback, except:

1. That an accessory garage building on a lot with a width of 25 feet or less may have an area of up to 480 square feet.
2. That the 60% coverage limit does not apply to accessory garage buildings in the RM5 thru RM 6.5 districts, when the garage is designed to provide an enclosed facility for required off- street parking.
3. That accessory community garden buildings such as sheds, greenhouses, hoophouses or farm stands may have an area of up to 575 square feet.

(Omitted text is unaffected by this ordinance)

SECTION 8. Section 17-10-0207 of the Chicago Zoning Ordinance, Title 17 of the Municipal Code of Chicago, is hereby amended by inserting the language underscored, as follows:

(Omitted text is unaffected by this ordinance)

17-10-0207-U Parking Group U. (Commercial Garden or Greenhouse, Electronic Data Storage Centers, Industrial)		
B, C, M dash 1, 1.5, 2, 3	1 space per 4 employees	1 per 10 auto spaces
B, C, M dash 5	None for first 35,000 square feet or 2 × lot area, whichever is greater, then 1.33 spaces per 1,000 square feet	

(Omitted text is unaffected by this ordinance)

SECTION 9. Section 17-17-0100 of the Chicago Zoning Ordinance, Title 17 of the Municipal Code of Chicago, is hereby amended by inserting the language underscored, as follows:

(Omitted text is unaffected by this ordinance)

17-17-0103-F **Parks and Recreation.** Recreational, social, or multi-purpose uses typically associated with public parks, public open spaces, public play fields, public or private golf courses, or public recreation areas or buildings.

1. Community Garden. A neighborhood-based development with the primary purpose of providing space for members of the community to grow plants for beautification, education, recreation, community distribution or personal use. Sites managed by public or civic entities, nonprofit

organizations or other community-based organizations that are responsible for maintenance and operations. Processing and storage of plants or plant products are prohibited on site. Gardening tools and supplies may be stored within an accessory building that is in compliance with Section 17-9-0103.5-B of the Municipal Code.

(Omitted text is unaffected by this ordinance)

17-17-0104-H Urban Farm. Growing, washing, packaging and storage of fruits, vegetables and other plant products for wholesale or retail sales.

1. Indoor Operation. All allowed activities must be conducted within completely enclosed buildings. Typical operations include greenhouses, vertical farming, hydroponic systems and aquaponic systems.
2. Outdoor Operation. Allowed activities are conducted in unenclosed areas or partially enclosed structures. May include indoor operations in conjunction with outdoor operations. Typical operations include growing beds, growing fields, hoophouses and orchards.
3. Rooftop Operation. All allowed activities occur on the roof of a principal building as a principal use or accessory use. Typical operations include growing beds and growing trays.

17-17-0104-HI Communications Service Establishments.

(Omitted text is unaffected by this ordinance)

17-17-0104-IJ Construction Sales and Services.

~~1. Commercial Farm, Rooftop. Growing, washing, packaging and storing of fruits, vegetables and other plant products on a rooftop for the purpose of wholesale or retail sales.~~

(Omitted text is unaffected by this ordinance)

17-17-0104-JK Eating and Drinking Establishments.

(Omitted text is unaffected by this ordinance)

17-17-0104-KL Entertainment and Spectator Sports.

(Omitted text is unaffected by this ordinance)

17-17-0104-LM Flea Market.

(Omitted text is unaffected by this ordinance)

17-17-0104-MN Financial Services.

(Omitted text is unaffected by this ordinance)

17-17-0104-NO Food and Beverage Retail Sales.

(Omitted text is unaffected by this ordinance)

17-17-0104-OP Fortune Telling Service.

C.1.3 City of San Francisco Ordinance Overview

Overview of San Francisco's Urban Agriculture Zoning Ordinance

San Francisco recently passed new rules regarding the locations and operations of gardens in the City. The Planning Code changes went into effect May 2011[a]. The law changes two things: 1) it clarifies where gardens of different types are allowed in the city, and 2) it allows gardeners to sell the produce grown from their gardens both on-site and off-site. Details about the new land-use categories and the rules of the ordinance are below. More information, including the text of the law, can be found at the SFUAA's website: www.sfuaa.org.

Home gardens: Home gardens, where food and/or horticultural products are grown solely for personal consumption, are not regulated by this ordinance and have no new rules.

New Categories and Rules for Gardens in San Francisco

Neighborhood Agriculture: gardens less than 1 acre in size
- Permitted in all zoning districts of the city

Large-Scale Urban Agriculture: gardens 1 acre or greater in size
- Permitted in Commercial; Industrial; and Production, Distribution, and Repair districts
- Only permitted with Conditional Use Authorization in all other zoning districts of the city

For both "Neighborhood Agriculture" and "Large Scale Agriculture" the following physical and operational standards must be followed:

(1) Compost areas must be setback at least 3 feet from dwelling units and decks;

(2) If the farmed area is enclosed by fencing, the fencing must be: (A) wood fencing, (B) ornamental fencing as defined by Planning Code Section 102.32, or (C) chain-link or woven wire fencing if over half of the fence area that borders a public right-of-way will be covered by plant material or other vegetative screening within three (3) years of the fence installation;

(3) Use of mechanized farm equipment is generally prohibited in residential districts; provided, however, that during the initial preparation of the land heavy equipment may be used to prepare the land for agriculture use. Landscaping equipment designed for household use shall be permitted;

(4) Farm equipment shall be enclosed or otherwise screened from sight;

(5) Sale of food and/or horticultural products from the use may occur between the hours of 6 a.m. and 8 p.m.;

[a] Specifically, the new rules were added by ordinance 66-11, File No. 101537, approved by the Board of Supervisors on April 20, 2011, and effective May 20, 2011. See also: San Francisco Planning Code Section 102.35 for the core text of the new rules.

(6) In all districts, sales, pick-ups, and donations of fresh food and horticultural products grown on-site are permitted. In every district *except* "Residential Districts", value-added products, where the primary ingredients are grown and produced on-site, are permitted.

Additionally, the Public Utilities Commission requires new gardens greater than 1,000 square feet to comply with existing water-efficiency regulations and submit information to the PUC regarding intended water use.

Permits from the Planning Department

Existing gardens:

- Existing gardens that already have permits do not need to apply for new permits unless they want to change their operations to take advantage of the new law.

For new gardens or gardens seeking an updated permit:

- Gardens that are "accessory uses" on a site (meaning generally that they are not the main use of a site, such as a backyard garden or a rooftop garden) do not require permits from the Planning Department. The rules must be followed, but no new permit is required.

- Gardens that are "principal uses" on a site (meaning generally that they are the main use of a site, such as a community garden, market garden, or urban farm) require a change-of-use permit from the Planning Department. This includes an application and fee of approximately $350 and can be obtained from the Planning Department's Planning Information Center.

Other permits

This factsheet focuses on the recent changes to the Planning Code and the rules and permits for gardens that are overseen by the Planning Department. If you plan to sell produce grown in your garden, you may also need business licenses, health permits, and/or agricultural permits, depending on your plans.

C.2 Economic Development Incentives

California Assembly-Local Government Committee Bill AB551

FAQ: Urban Agriculture Incentive Zones Legislation (AB 551)

What does AB551 do?

AB551 will incentivize the use of private land for urban agriculture. In exchange for signing a contract with a county to place privately held land into urban agricultural use for 10 years, private landowners will have their property assessed at a lower property tax rate based on its agricultural use rather than its market value.

Should a landowner take action principally effecting a premature termination of enrollment in the program, the legislation will require them to pay back the tax benefits garnered from the program.

How does AB551 work?

AB551 will permit counties to pass ordinances establishing "Urban Agriculture Incentive Zones" within their jurisdictional boundaries. Within the Incentive Zones, private property owners will be eligible to apply to enter a contract with the county restricting their privately owned undeveloped property to urban agricultural use in exchange for a revised tax assessment based on the agricultural use of the land. Counties may opt in to the program but will not be required to do so. Similarly, private landowner participation will be completely voluntary.

Why is AB551 important?

Urban agriculture provides many benefits to city residents including: education about fresh, healthy food and the effort it takes to produce it; environmental benefits for the city including modeling grounds for new, energy saving and environmentally sustainable technologies; community-building; vibrant green spaces and recreation; and a source of economic development including increased neighboring home values. One of the biggest obstacles to expanding the number of Californians who enjoy these benefits of urban agriculture is access to land--both its supply *and* cost in urban jurisdictions. This legislation provides an incentive to private landowners to make more land available for urban agriculture, while at the same time enabling them to do so at a lowered cost.

For commercial urban farms and gardens specifically, this legislation will help improve their financial viability by reducing the business cost of property taxes to a level that reflects the agricultural use of the property, rather than its potential residential or commercial uses. In rural areas of California, the state has worked to address the negative impact of property taxes on farm enterprises near urban areas through passage of the Williamson Act (California Land Conservation Act of 1965). This legislation uses a similar strategy but within urban areas.

How much will AB551 cost?

The legislation is targeted to apply to only a small number of parcels in any given county. The property most likely to be involved is privately-owned land that does not have near-term development potential because of unusual lot size, shape, location, ownership structure or other reasons. These vacant, potentially blighted properties can be dedicated exclusively to agricultural use with tremendous benefits for neighboring residents and communities. The difference in property tax assessment for an enrolled property will vary from property to property, and will be based upon accepted standards for property tax assessment.

C.3 Model Cities Policies and Programs

C.3.1 San Francisco's Urban Agriculture Program

OFFICE OF THE
CITY ADMINISTRATOR

Edwin M. Lee, Mayor
Naomi M. Kelly, City Administrator

To:	The Honorable David Chiu, President, Board of Supervisors
From:	Naomi M. Kelly, City Administrator
Re:	Urban Agriculture Recommendation
Date:	April 19, 2013
CC:	Mayor Edwin M. Lee Members, Board of Supervisors Phil Ginsburg, General Manager, Recreation and Park Department Interested Parties

Pursuant to Ordinance 162-12 the City Administrator convened community stakeholders and departmental representatives to engage in a strategic planning process for urban agriculture. The effort was designed to provide baseline data, as defined, on urban agriculture activities. The strategic plan is attached.

It is clear that San Franciscans and their City government support urban agriculture. The City spends $4.4 million on urban agriculture in the current year and we project City spending of $3.6 million next year. Thousands of San Franciscans are involved in local urban gardens on public and private land throughout our City.

My office convened four working group meetings and three community town halls attended by departmental representatives and community members. We conducted more than 30 one on one interviews with key public stakeholders. This effort has produced original research which will be shared with the City agency that takes responsibility for this program.

My recommendation is as follows:

1. **The Recreation and Park Department, San Francisco Public Utilities Commission, Department of Public Health and Department of the Environment should continue their leadership roles on urban agriculture.** Due to the unique constraints of the Charter and state law, it is impractical to establish an Urban Agriculture Program in one department with complete jurisdiction over all aspects of the urban agriculture area.

   The Recreation and Park Department has unique jurisdiction over its lands, the San Francisco Public Utilities Commission controls the water, wastewater and power enterprises and use of ratepayer funds, and the Agriculture Commissioner in the Health Department has state mandated authority. Therefore, it is advisable that these departments, along with the Department of the Environment,

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maintain their existing leadership roles in implementing urban agriculture programs and projects. Their existing programs, budgets and positions should remain at their respective departments.

2. **The Recreation and Park Department should be the lead agency for the Urban Agriculture Program.**
   Notwithstanding the limitations outlined above, the Recreation and Park Department is the most logical place to house an Urban Agriculture program that convenes multiple departments. My basis for this recommendation is as follows:

   (a) The Recreation and Park Department has Charter authority over its lands, meaning it can easily implement new and existing urban agriculture efforts.
   (b) The Recreation and Park Department has properties throughout all of San Francisco, assuring geographic equity in the program.
   (c) The Open Space Fund provides an ongoing, dedicated source of funding for the program.
   (d) Through its partnership with the San Francisco Parks Alliance, the Recreation and Park Department has experience working with community partners in the urban agriculture space.
   (e) Senior level management, up to and including the General Manager, express support for the program.

3. **San Francisco's public spending on Urban Agriculture is significant, and should be used to leverage new private investment.** Many City grant programs match public funds with private investment. Kaiser Permanente and other corporate funders have made community gardens a focus of their charitable giving. The San Francisco Foundation will also be making a new investment in this area. Given our existing public budget limitations and the robust funding urban agriculture currently enjoys, it is worth increasing private support for these programs.

I have appreciated the opportunity to work on this matter. My understanding is that the Recreation and Park Department will take the lead at the Board of Supervisors on presenting the proposal outlined in recommendation two. If you require further information, please contact Deputy City Administrator Linda Yeung or Bill Barnes, Project Manager, in the City Administrator's Office.

Edwin M. Lee, Mayor
Philip A. Ginsburg, General Manager

DATE: April 9, 2013

TO: Naomi M. Kelly
City Administrator

FROM: Phil Ginsburg, General Manager

THROUGH: Dawn Kamalanathan, Capital Program Manager

CC: Sarah Ballard, Director of Policy and Public Affairs

RE: Urban Agriculture Program Administration

The Recreation and Park Department (RPD) proposes that the newly created Urban Agriculture Program, per San Francisco Administrative Code Sections 53.1 through 53.4, be administered by the Recreation and Park Department as outlined below.

RPD was actively involved in the interdepartmental working group that crafted a preliminary strategic plan for meeting the goals of the Urban Agriculture ordinance. RPD has also run a Community Gardens Program for over twenty years, and currently manages 25 community garden sites, 9 DPW sites and 1 PUC site. The following areas of expertise that extend beyond the Community Gardens Program make RPD a strong candidate for accomplishing the work of the new citywide Urban Agriculture Program:

- Fundraising
- Close, productive working relationships with other city departments
- Successful volunteer recruitment and management
- Inclusive, comprehensive community processes
- Established "partnerships pathway" for working in collaboration

The Department proposes to take the lead on advancing the Urban Agriculture Program by dedicating one full time FTE staff member to the administration and advancement of San Francisco's Urban Agriculture Program. This dedicated staff person will work closely with RPD's Community Gardens Program Manager (25% FTE for 1 staff member (5261 classification)), who is funded through existing Open Space funding for RPD Community Gardens Program and who has been actively involved with the interdepartmental urban agriculture strategic planning working group.

(See Next Page)

Urban Agriculture Strategic Plan

Office of the City Administrator

Background: On July 10, 2012, the Board of Supervisors passed legislation on Urban Agriculture, which designated that the Mayor's Office and/or the Office of the City Administrator should produce several items related to Urban Agriculture.

Recommendation: After careful review, the Office of the City Administrator recommends that the City move the Urban Agriculture program formally to the Recreation and Park Department (RPD). RPD will employ one-full time FTE that will spend 100% of their time on Urban Agriculture. This person will coordinate closely with the other staff working on Urban Agriculture in the City, (most notably 50% of an FTE at the Department of Environment and 25% of an FTE at the Public Utilities Commission), and they will serve as one point of contact for the public on Urban Agriculture and as "Urban Agriculture experts". The Recreation and Park Department will use all of the information gathered by the Office of the City Administrator over the last several months to inform their "work plan" on Urban Agriculture over the next year.

Appendices: Attached to this document are several items that were requested as part of the strategic plan:

- **Appendix A:** List of All Urban Agriculture Programs
- **Appendix B:** Count of all Active Sites and their Coordinators
- **Appendix C:** Accounting of all City Funding and Resources (and full-time equivalent positions spending more than 10% of their time on Urban Ag).
- **Appendix D:** Audit of Rooftops of City Owned Buildings potentially suitable for Urban Agriculture
- **Appendix E:** Waiting Lists for Community Gardens – what do other localities do?
- **Appendix F:** Urban Agriculture Needs Assessment
- **Appendix G:** Department Specific Urban Agriculture Programs
- **Appendix H:** Streamlined Application Process

The Office of the City Administrator would like to formally thank everyone involved in this strategic planning process over the last several months.

The Urban Agriculture Program Coordinator, housed within RPD, will perform the following tasks:

1. Work in close coordination with an interdepartmental staff working group comprised of representatives from departments that were actively involved in developing a preliminary strategic plan (such as RPD, SF Environment, DPW, PUC, Planning, Real Estate);

2. Work in close coordination with community stakeholder groups(such as SPUR, SFUAA) and individuals;

3. Outline year 1 deliverables and refine the strategic plan to accomplish these deliverables; such as

   A. Identifying specific new sites and resource centers or "hubs" for urban agriculture, including specific budgets for each and opportunities for communal gardening;

   B. Refine the strategy to reduce the waiting list for San Francisco residents seeking access to a community garden plot and to optimize plot use;

   C. Expand the Department's recently improved Community Gardens Program website pages to be even more of a citywide resource;

4. Provide technical assistance to community gardening and urban agriculture organizations;

5. Develop and distribute materials and resources for urban agriculture;

6. Evaluate, at the close of year 1, whether more resources are needed, and make recommendations to the Board of Supervisors.

FY 2013 Budget (for one-time Addback from Supervisor David Chiu):

100% FTE for 1 staff member (3374 classification) for 1 full calendar year	$ 104,000
5% FTE for 1 RPD staff member (5261) to support work of 3374 Urban Agriculture Program Coordinator	+ $ 16,000
Identified Urban Agriculture Program Funding through Addback	$ 120,000

C.3.2 Resilience -- Policies for a Shareable City

Published on *Resilience* (http://www.resilience.org)

Policies for a shareable city #11: Urban agriculture

Published by Shareable on 2011-12-06
Original article: http://www.shareable.net/blog/policies-for-a-shareable-city-11-urban-agriculture **by Sustainable Economies Law Center**

Cities should be doing everything in their power to facilitate localized food production, and a key component of that is enabling urban agriculture and community gardening. Peak oil, the breakdown of our industrial food system, the high cost of sustainably produced food – these and other factors lend to an urgent need to use every plot of available city land for food growing.

Sharing is a critical component of urban food growing. First, food growing is labor intensive and requires that community members collaborate and share skills and knowledge. Sharing is also critical to land access; the people who will suffer the most from a food crisis are the urban poor who have less access to resources and tillable land. Much of the land that could be cultivated is owned by middle- or upper-class urban residents, private vacant lot owners, and government entities. A key question for cities is: how can the city incentivize the sharing of land resources to ensure that everyone is nourished?

Mike Lieberman in his New York City fire escape garden. Photo credit: Urban Organic Gardener.

Here are a few suggestions for ways that cities can adopt policies to facilitate the growth of urban agriculture and community food growing spaces:

1. **Offer property tax incentives for vacant private lots that are used for urban farming:** Cities should offer private land owners a property tax discount during years when an

otherwise empty lot is used for food growing. The Williamson Act in California already provides property tax incentives to preserve land as agricultural in rural areas, and a similar policy should be applied in urban areas. Generally, land has higher income earning potential when it is built up with strip malls and housing developments. But it doesn't always make sense to assess a property based on this potential value when the land is actually being used for a more modest activity, like agriculture. Even if a piece of land will eventually be developed, landowners should be rewarded for putting it to productive agricultural use in the meantime. Such a tax incentive could dramatically multiply the amount of available land for community gardening and urban farming.

2. **Conduct a land inventory and prioritize the use of city-owned land for urban farming:** Cities should conduct inventories of land available for urban food growing, and prioritize the use of public lands for food growing. In 2009, Mayor Gavin Newsom of San Francisco, California, asked the city "to conduct an audit of unused land – including empty lots, rooftops, windowsills, and median strips – that could be turned into community gardens or farms." (Yes, he even asked for a survey of windowsills!) In other cities, private groups have conducted such inventories. In Brooklyn, New York, an organization called 596 Acres has identified and created a map of 596 acres of vacant publicly owned land. In Oakland, California, geographer Nathan McClintock published a report and interactive map of public lots available for urban farming.

   Conducting land inventories for urban food growing is not a new idea. During WWI and WWII, to relieve burdens on the railroads and reduce demands for materials used in canning and processing, the U.S. government encouraged the cultivation of yards and unused plots of land. Up to 44 percent of the country's vegetables were produced by individuals and families in small "victory gardens" during WWII. Community organizers were sent out to survey available land for urban and suburban food growing. The National War Commission used the slogan "put the slacker lands to work," implying that any tillable lands not being used for food production were, basically, slacking off.

3. **Create definitions of "community gardening" and "personal gardening" in the zoning code and allow such activities in every city zone:** Many cities simply do not know where to fit community gardens into the zoning picture and, as a result, sometimes community gardens have had to jump through extensive legal hoops to get a permit for operating. Cities should recognize that individuals and communities that produce food for their own consumption or for charitable/educational purposes are providing a public good. Cities should create definitions of "community gardening" and "personal gardening" in the zoning code and specify that such uses are a permitted activity in every city zone. For example, community gardens in Oakland are now permitted in nearly every zoning except certain industrial zones.
4. **Create a simple permitting procedure and allow commercial food growing in every city zone:** The next logical step after enabling food growing throughout a city is to allow people to sell the veggies they grow. In some cities, urban farmers growing produce for sale have had to pay thousands of dollars to obtain conditional use permits. However, given the low margins of urban food production and the high social value of localized food systems, a city should require no more than a simple administrative use permit and charge no more than $100 or $200 in permit fees for someone wishing to engage in commercial food growing. For example, in Oakland, it is now possible to get a $40 home occupation permit to sell produce grown in one's backyard.

5. **Allow people to plant vegetables in sidewalk/parking strips:** It is often illegal for people to plant vegetables in the strip of land between a sidewalk and the street, or a permit is required to do any landscaping other than grass. Seattle, Washington, recently changed this law, allowing anyone to plant vegetables in the sidewalk strips in front of their homes. A sidewalk strip could become a micro-community garden for neighbors to enjoy together.
6. **And, for heaven's sake, allow people to plant vegetables in front yards:** Front yards are another ideal spot for community food growing, and cities should not fine and penalize people for planting front yard veggies. A Berkeley, California, resident was fined $4,500 for his front yard veggies, and an Oak Park, Michigan, resident was charged with a misdemeanor for planting a front yard veggie garden. An outright ban on front yard vegetables is bad policy. If a city is worried that front yard vegetable gardens could give the appearance of blight if neglected, the city should simply impose requirements that front yard vegetable gardens be reasonably well-kept and that a significant amount of dead plant material may not be left in the yard for too long.
7. **Subsidize water for urban farms and community gardens:** Water is typically subsidized for rural farmers, and the same should apply to urban farms. Cities should at least offer water discounts to organizations that designate land for publicly accessible community food gardens. Cities could also offer rebates and subsidies to urban farms that make use of recycled grey water or that capture and store rainwater that would otherwise drain to the sewer system. Such incentives could make water access more affordable to urban farms, while reducing the impact on the city's fresh water resources and stormwater run-off.
8. **Create reasonable policies for urban livestock raising:** The ability to raise one's own eggs, milk, and meat is critical to a more sustainable food system, since the majority of such products are currently produced by large-scale factory farms. Cities should give residents the right to raise their own livestock, within reasonable limits to ensure the wellbeing of animals and to ensure a low impact on surrounding neighbors. A group of students and faculty at the University of Oregon have produced a very helpful guide to Local Land Use Laws to Allow Urban Microlivestock which includes a sample ordinance for cities. Cities should also create guides and resources for urban livestock raisers, such as the helpful resource created by the Ontario Ministry of Agriculture.
9. **Exempt certain chicken coops and goat shelters from building and zoning permit requirements:** It can be unclear at what point a small chicken coop or goat shelter has become a "structure" or "building" subject to regulation and permitting requirements from the local building and planning departments. Most people build their own simple coops and shelters, and are sometimes surprised to learn that a local building department would have required a permit for such a building, or they may be surprised to learn that the planning department must approve the size and placement of the construction. Cities should define the size and placement of certain small chicken coops and goat shelters, such that residents can construct them without obtaining any permits.
10. **Limit the right of homeowners' associations to prevent home food production:** Currently, most homeowners associations have the right to make rules about how homeowners use their properties. Some homeowners' associations have been known to tell residents that they cannot keep chickens and bees, or that they cannot grow edible plants in their front yards. Although it would be preferable to make state laws to curtail homeowners' associations' powers in this regard, each city can also pass laws that allow people to grow and raise their own food as a right.

11. **De-pave paradise and put a tax on parking lots:** The City of Philadelphia imposes a tax on properties based on the size of impervious space on the property. This tax serves to prevent stormwater floods and incentivizes capture, storage, and percolation of rainwater. Because urban farms allow almost all rainwater to percolate, Philadelphia's tax system creates a huge incentive for property owners to replace paved spaces with urban gardens. Although most residences and commercial properties are required to provide some parking areas, such a tax would encourage property owners to at least remove any unnecessary pavement and replace it with gardens.

Community organizations partner to construct an urban vegetable garden in Ft. Myers, Florida. Photo credit: Gabriel Kamener. Used under Creative Commons license.

The Sustainable Economies Law Center has created a wiki Urban Agriculture Legal Resource Library to collect legal resources and sample ordinances. If you are interested in contributing to this library of resources, please contact Janelle Orsi.

Source URL: http://www.resilience.org/stories/2011-12-06/policies-shareable-city-11-urban-agriculture

C.3.3 Sustainable Cities Institute -- Promoting Urban Agriculture

SUSTAINABLE CITIES INSTITUTE
at the National League of Cities

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Home > Library > Reports & Guides > Promoting Urban Agriculture: Zoning

PROMOTING URBAN AGRICULTURE: ZONING

Local governments can use urban agriculture as a tool to address many financial, health, and environmental issues. For example, agriculture in and close to major cities can help the environment by, among other things, reducing the distances food travels. Community gardens can keep people active while providing them with natural, locally grown food. Municipal policies can help community gardeners make money by allowing them to sell excess produce. Moreover, community gardens can beautify neighborhoods and serve as a focal point that promotes resident interaction.

Sustainability Officers interested in promoting urban agriculture can refer to "Zoning for Urban Agriculture," an article prepared for the American Planning Association that provides a brief history of U.S. urban agriculture, as well as numerous examples of urban agriculture nonprofits, projects, policies, and ordinances/regulations. The authors of the article identify, and provide examples of, three roles that cities play to promote urban agriculture:

1. Including urban agriculture in the planning process as a component of land-use and food policy
2. Establishing programs and organizations
3. Creating urban agriculture zoning and permitting processes

While the authors provide a good overview of how a city can include urban agriculture in its planning process and promote urban agriculture with the help of nonprofits and community organizations, the article provides greater details on the zoning and permitting aspects of urban agriculture. In the article, the authors reference many nonprofits, markets, farms, government initiatives, plans, and ordinances. Links to most of the article's examples and references appear below, along with a brief description of the nonprofit, market, farm, government initiative, plan, or ordinance.

NONPROFITS, MARKETS, AND FARMS

Community GroundWorks at Troy Gardens - A 31-acre urban property in Madison, Wisconsin that "integrates mixed-income green-built housing, community gardens, an organic farm, and restored prairie and woodlands."

Dane County (Madison, Wisconsin) Farmers' Market on the Square - Market that only sells agriculturally-related items that are produced in Wisconsin.

Growing Home - Nonprofit organic agriculture business that provides employment opportunities/training for homeless and low-income people in Chicago.

Growing Power - Nonprofit that runs farms, provides training in growing methods, performs outreach for farmers and communities, and produces/distributes food.

NeighborSpace - An organization that helps communities protect their gardens/parks from development and works with public and private partners to expand Chicago's community-managed open space.

Nuestras Raices - An organization that helps the Puerto Rican community in Holyoke, Massachusetts maintain a connection to their culture through urban agriculture while establishing roots in their new community.

The Urban Farm at Stapleton - A Denver-area farm.

Zenger Farm - A Portland-area farm.

GOVERNMENT INITIATIVES

Madison, Wisconsin Community Development Block Grant - Information regarding Madison's use of CDBG funds to develop community gardens.

New York City Green Thumb Program - The New York City Department of Parks & Recreation's community gardening program.

Portland, Oregon Community Garden Program - The Portland Parks & Recreation's community gardening program.

Seattle P-Patch Community Gardening Program - A program run by Seattle's Department of Neighborhoods and P-Patch Trust, a local nonprofit, through which the Department of Neighborhoods manages 73 community gardens.

FOOD POLICY COUNCIL

Mayor Gavin Newsom's Executive Directive regarding Healthy and Sustainable Food for San Francisco - Outlines the City's commitment to health and sustainable food and creates a food policy council consisting of both public and private members.

Portland/Multnomah County Food Policy Council - A citizen-based urban agriculture/local food advisory council to the City of Portland and Multnomah County; the website contains regional reports and publications (e.g., the Diggable City Report, which is an inventory of Portland's land that is suited for agriculture).

PLANS AND ORDINANCES

Baltimore Sustainability Plan - Discusses sustainable local food systems and urban agriculture.

Boston Open Space Subdistricts - Section 33-8 establishes a community garden subdistrict.

Chattanooga Ordinance No. 11107 - Creates an urban agricultural zone that includes as permitted uses "[a]gricultural uses such as the growing of crops, dairying, grazing, the raising and maintaining of poultry and livestock, horticulture, viticulture, floriculture, forest, and woods."

Cleveland Zoning Code - Establishes an "Urban Garden District" as part of the Zoning Code to "ensure that urban garden areas are appropriately located and protected to meet needs" for the community.

Kansas City, Missouri, Climate Protection Plan - Contains recommendations to promote "residential neighborhood food production" and "metropolitan food production."

Milwaukee Zoning Ordinance - Permits the "raising of crops or livestock" in residential districts (see Subchapter 5 Residential Districts, Chapter 295-503 Uses).

Nashville Commercial and Non-Commercial Community Gardening Zoning Ordinance - Amends Title 17 of Nashville's zoning ordinance by allowing commercial and non-commercial community gardens as a Permitted use or a Special Exception use.

Portland (Oregon) Zoning Chapter 33.920 - Defines agriculture as including "activities that raise, produce, or keep plants or animals" (Code Sec. 33.920.500).

Sacramento Ordinance No. 2007-025 - Revises Sacramento's code by removing barriers to planting fruits and vegetables in residential front lawns.

City of Seattle Comprehensive Plan, January 2005 - Contains goal of having "one dedicated community garden for each 2,500 households" in an urban village.

ABOUT THE AUTHOR

Eric Weaver came to USF in 1983 when his father offered to pay for his degree in Engineering. He subsequently graduated from the College of Engineering in 1988 with experience using the Prime Medusa CAD system in the College. Beginning work at Delta Corporation (later purchased by AutoCAD) he designed the drainage systems of the fertilizer. plant in Gibsonton, Florida; following their acid spill of 1988. This project required that he beta-test the EPA Stormwater Management Model. All subsequent professional employment continued this engineering and computer synergism. Hillsborough County paid for his degree in Civil Engineering completed in 1998. He became self-employed as a Tampa SWMM Expert to spend more time with his two children, but as his kids grew up, he got bored with private consulting. In 2004, he followed Dr. Fountain's recommendation to return to USF for an MBA.

Eric's first courses explored the patent development of Dr. Heidi Kay for cancer treatments (https://www.google.com/patents/US7977381). However, it is the cancer testing itself that is the problem, since all life includes cancer cells, and it is only the focusing fear and anxiety on them, that enables these cells to grow uncontrollably. While it was in the Power and Control course within the MBA program that Dr. Nord recommended he pursue his own Ph.D. His inspiration and synergy with these professionals inspired him to step beyond the silos of academia to pursue his own ambitions, noted here. All for the love of Lord Jesus Christ, Amen.