CONSOLIDATED THESIS RESEARCH NOTES AND CONTENT-BASED TYPOLOGY

Notes:

1. Topics about CPULs are all from Viljoen's book, 'CPULs'*
2. UA – urban agriculture
3. Entries may appear in multiple topics
4. Book titles are underlined
5. An entry without a page number is on the same page as the preceding entry
6. Entries to be used

TOPICS

Important terms and concepts

CPULs

Chapter 3

- Embodied energy

Chapter 11

- Community garden
- City farm
- Organoponicos

Chapter 12

- Composting

Cities Feeding People

Chapter 5

- Cooperatives

Agropolis

Chapter 1

- 'Reciprocal urbanization'

Chapter 7

- Vermiculture

Cities Farming for the Future

Chapter 6

- Community-based urban agriculture (CBUA)

Chapter 9

- Ecological sanitation

Chapter 11

- Horticulture
- Hydroponics
- Organoponics

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- Permaculture

***Definition and description of Continuous Productive Urban Landscapes**

Chapter 2

- productive urban landscapes + continuous landscapes [11]
- city-traversing open spaces connecting urban to rural area
- supports various activities
- overlaid onto the city, connecting existing and newly reclaimed open spaces
- productive as recreational space, access routes, green lungs, etc.
    - more importantly, provides space for urban agriculture (inner and peri-urban)
- designed for pedestrians, bicycles, engine-less and emergency vehicles
- connect different types of urban agriculture; addition of agricultural fields [12]

Chapter 14

- 3 important aspects of CPULs: [109]
    1. Spaciousness – size and sense of openness [109-110]
    2. Occupation – number if users, financial turnover; long-term benefits (contribution to health, social interaction, etc.) [110]
    3. Ecology – exposure of people to nature, environmental delight [122]

Chapter 24

- Size of productive urban landscapes is not as important as the connectivity it has to other PULs [240]
- The goal of CPULs is to connect the different PULs in the urban fabric

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***Viability and benefits of CPULs**

Chapter 2

- localized production and consumption [12]
    - less energy and environmental impact than current Western food production
- environmentally, sociologically, and economically productive [15]
- requires land, open space
    - CPULs will need to compete with other land uses
    - can be introduced anywhere in the city, in site-specific adaptations
    - can take advantage of existing areas and spaces that abound: car parks, malls, brownfields, etc. [15-16]
- reclamation of used areas may require relocation of interrupted activities [16]

Chapter 3

- local production and consumption of products greatly reduces transportation needs, as well as processing and packaging [29-30]

Chapter 4

- sustainability in cities could be achieved by aiming for closed-loop nutrient systems and energy efficiency [38-39]
    - wastewater use in UA could be implemented

Chapter 24

- CPULs will improve closeness of urban life to the processes of nature through the personal experience of seasonal and agricultural progression [246]

Chapter 25

- Two types of economic return from land-use are the direct benefits from employment and business growth; and long-term benefits from reduced environmental impact and damage mitigation costs [253]

***Open spaces and comparisons with CPULs**

Chapter 14

- a variety of open urban space types already exist in most European cities; these include urban squares, urban parks, urban riverfronts, urban stages, and urban forests [109]
    - there are, however, no urban fields yet
- comparisons of CPULs with other existing open urban spaces [113-121]
    1. size (4th/8) [113]
        - flat or undulating, 1.5-10 ha, in big-city context
    2. local interactions (2nd/8)
        - encounters between residents, tourists/local visitors, passers-by, and/or workers/traders; meeting place
    3. variety of occupation (2nd/8) 115]
        - walk, cycle, shortcut, talk, see, sit, learn, meet, eat, play, party, engage, work, produce, earn
    4. sense of openness (4th/8)
        - reducing: external buildings and traffic' increasing: topography, two sides open to views and moves
    5. economic return from ground-use (1st/8) [117]
        - financial return from trading/selling grown produce; financial benefit from composting, retaining seeds; self-usage of grown produce, lifestyle and short-distance economy; local employer
    6. inner-city movement (4th/8)
        - some entrances/exits, new connections between existing roads/paths and between different inner-city areas; improved site access
    7. persistent visual stimulation (2nd/8) [119]
        - tree seasons, seasonal and changing vegetation, passing pedestrians and cyclists, visitors, workers
    8. urban nature (2nd/8)
        - young individual fruit trees and bushes, vegetable, herb, fruit, flower, grain beds or fields, lawn surfaces, water, gravel
    9. variety of occupants (4th/8) [121]
        - private and professional residents, passers-by, workers, visitors, all social and ethnic backgrounds mainly locals; all ages, but mainly adults
    10. environmental delight (2nd/8)
        - reducing: possible road traffic; increasing: openness abundance of seasonally changing vegetation; rich soil; visible ecological cycles

The definition, description, and nature of urban agriculture

CPULs

Chapter 4

- UA has increased due to the problems associated with urbanization [35]
- Involves the growing of plants, raising of animals, production of tree seedlings and ornamental plants and flowers
- UA is an important part of the city in some countries like Russia, China, and Cuba [36]
    - It is encouraged and done in a large scale

Chapter 9

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- In the 'North', it is practiced to reduce environmental degradation, whereas in the 'South', it is done as a form of subsistence—for survival [66]
- Top motives for UA in the South: [68]
    1. Production for home consumption
    2. Income enhancement (or expenditure substitution)
    3. Response to economic crisis
    4. High prices of market produce
- Other motives include employment, food security, culture and religion, and recreation (particularly in the North) [68-69]

Cities Feeding People

Foreword

- Growing of food crops and food trees, plus raising of animals considered edible locally [x]

Chapter 1

- UA is an adaptive practice that develops according to urban conditions, allowing it to pop-up in a variety of areas and to offer specialized products [21]
- It isn't exclusively a subsistence activitiy; UA classification ranges from food security to market-oriented (Maxwell, 1993b) [22]

Agropolis

Introduction

- Ua according to Mougeot (2000, p. 10): growth and distribution of food and nonfood products in and on the fringe (intra- and peri-urban, respectively) of the city [2]
- Driving forces of ua: [3]
    1. Food security
        - Urban poor have difficulty accessing food from the formal food supply system of the city
        - In cases of short urban-rural distance, food is accessed from rural areas; in long urban-rural distance, self-provisioning for food is more depended upon (both cases are concerned with access to food by the poor)
        - Importation affects food supply in cities; drop in importation may incite ua
        - Exportation also lessens food supply due to crop selection; and sometimes leaves lower quality food supplies (imports) for the city, while higher quality food supplies (exports) are shipped to strong-currency consumer markets [4]
        - Currency devaluation, job cuts, and elimination of basic needs subsidy encourage ua
        - 800 million people (1/3 of urban families) were engaged in ua in the early 1990s, and supplied 1/3 of all food consumed in cities (UNDP, 1996)
        - There is an association between ua and street and market vending of fresh and processed food in many cities [7]
        - Zimbabwe, Uganda, Kenya, and Haiti: ua practitioners have lower food insecurity and more savings for other food otherwise unaffordable (comparing ua practicing and non-practicing poor households)
    2. More decent and productive urban livelihoods
        - Ua for income and savings generation [8]
        - Market value of a produce is directly proportional to its contribution to household income
        - Savings from buying less food

- Income and savings from ua can allow women to invest in other home-based income-generating activities
- Opportunities for youth employment [11]
- Impoverished middle-class are competing against the poor for resources
- There is a lack of recognition and support for poor ua practitioners, obscuring their potential to acquire greater benefits from ua

Cities Farming for the Future

Introduction

- What distinguishes ua from rural is its close connection to the urban area in terms of input, output, effects, and dependency, rather than just its location [2]
- 3 policy dimensions of ua (policy directions based on ua type): [10-11]
  1. Social (Inclusive City)
     - Concerned with ua for subsistence
     - Savings on food and health expenditures plus income from sale of surplus
  2. Economic (Productive City)
     - Market-oriented ua; small-scale and family-based, or large-scale and entrepreneurial associations-based
     - Food and non-food products
     - Involved with other ua-related enterprises
     - High profitability, higher externalities
  3. Ecological (Environmental Healthy City)
     - Multifunctional ua
     - Food provision, income generation, waste cycling, recreation, urban greening, water storage, etc.
     - Adoption of agro-ecological production methods, connect with eco-sanitation and decentralized sustainable waste management, parks planning and management

Chapter 2

- Ua involves many stakeholders, including both public and private organizations and institutions (government, NGOs, academic institutions, producers, etc.) [21-22]

Chapter 7

- Urban agricultural system types:
  1. Subsistence home intra-urban farmers (intra- and peri-urban)
  2. Family-type commercial farmers (i & p)
  3. Urban and peri-urban agricultural entrepreneurs (i & p)
  4. Multi-cropping peri-urban farmers (peri-urban) [175]
     - See Table 7.1 for details [176-177]

Chapter 10

- There are different ways to classify urban agriculture systems: based on space (intra/peri-urban), production objectives (subsistence/semi-commercial/entrepreneurial), on predominance of crops or livestock, and size of holdings [282]

Benefits of/associated with urban agriculture and agriculture in general

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CPULs

Chapter 3

- agriculture allows nations to be self-sufficient [20]

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- UA offers 3 environmental benefits: biodiversity preservation, waste management, and energy efficiency [21]
- organic agriculture can greatly reduce greenhouse gas emissions [25]
- local production and consumption of products greatly reduces transportation needs, as well as processing and packaging [29-30]

Chapter 4

- acknowledgement for UA is growing; it contributes to food security, nutrition, poverty alleviation, and economic development [35]
- sustainability in cities could be achieved by aiming for closed-loop nutrient systems and energy efficiency [38-39]
    - wastewater use in UA could be implemented

Chapter 8

- UA brings socio-cultural benefits such as unity, crime prevention and reduction, and reduction of discrimination [57]
- UA also contributes economically by providing products and services, education, training of useful skills that can be used to score job opportunities, and supporting poor communities in terms of food security [57-59] RATIONALE
- UA offers health benefits in the form of a good diet as a result of healthful products and accessibility to these; exercise; and mental health [59-60]

Chapter 9

- 3 economic benefits of UA [66]
    1. Employment, income generation, and enterprise development
    2. National agriculture sector and food supply (urban)
    3. Land-use economics
- UA contributes a considerable amount of food in many cities and countries (see Table 9.1, p. 67)
- Some advantages of UA include cheap labor (except for those in the North; Jakarta, Havana, and Shanghai which support their UA practitioners), adaptability to market demands, reduced operational costs (transport, storage, etc.), ability to supply special and niche produce [70-71]
- Macro-economic effects of UA: improved food security, lower food prices, employment, contributions to related industries [73]

Cities Feeding People

Chapter 1

- UA provides an opportunity to make use of native plant species [21]

Chapter 5 (Addis Ababa, Ethiopia)

- If given enough support, ua can be an employment-generating activity [96]
- The potential from waste-recycling brought by ua would benefit the environment and could increase employment opportunities as well [100] RATIONALE
- Ua could reduce the need for food importation and aid, as well as contribute to exportation, given more time

Chapter 6

- Ua has more economic returns aside from food savings and employment generation; it also adds value to land by preventing pests, thieves, dumping, squatting, etc. [109]
    - Ua also supplies food to institutions and businesses [111]

Agropolis

Introduction

- Income and savings from ua can allow women to invest in other home-based income-generating activities [8]
- Opportunities for youth employment [11]
- Plants can beautify the city, cool its climate, curb erosion, and absorb air pollution and odors [12]

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- Waste management could be improved by ua:
    - Lots used for crops and livestock discourage dumping, squatting, and hideouts of delinquents and thieves
    - Decontamination of polluted soils and waters
    - Human waste as compost*, wastewater as irrigation (*see 'Ecological Sanitation Closing the Loop', UA Magazine vol. 1, no. 3, March. Pp 35-37. Esrey and Andersson, 2001)

Agriculture in the City

Chapter 3

- Benefits of ua to Havana and Cuba: [47]
    - Food availability, particularly fresh vegetables [48]
    - Guaranteed organic products
    - City greening
    - Reduction/elimination of dumping grounds
    - Mitigation of unsanitary city conditions
    - Promotion of agricultural culture
    - Job generation (around 100,000)
    - Involvement of many actors from diverse backgrounds
    - Introduction to and understanding of other scales of agriculture [49]

Cities Farming for the Future

Introduction

- Ua's benefits include: [3-5]
    - Improved access to food, food security
    - Improved nutrition and health
    - Income from sale of products, savings from self-provision of food
    - Creates enterprises for agricultural input and downstream processes (processing, packaging, marketing, etc.) RATIONALE
    - Social inclusion of marginalized groups
    - Urban environmental management (solid and liquid waste recycling, city greening, micro-climate improvement, biodiversity preservation, reduction of embodied energy of food)

Current issues relevant to agriculture

CPULs

Chapter 3

- unchecked global trade can overwhelm local production efforts, in effect increasing dependency on importation [20]
- industrial agriculture has negatively affected rural areas and has increased the distance between producers and consumers [21]
- industrial agriculture relies heavily on chemicals, and focuses on only a few species of crops
    - this is an effect of the dominance of a few large scale supermarkets favoring mass-produced goods [21-22]
- seasonal food is being marketed as available year-round, inciting demand, and therefore putting a strain on production and increasing embodied energy [28]
    - adhering to seasonal production will decrease the need for transnational transportation and heavy greenhouse use, both sources of emissions

Chapter 4

- modern agriculture takes up a lot of land, particularly forest land, to provide food for the growing meat industry [34]
- nutrients are being diverted from the land to the sea; practically nothing comes back to the land
    - this is caused by the sewage system
    - this creates the need for artificial fertilizers

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Chapter 5

- long-distance food distribution driven by a culture of importation and exportation causes greater stress on the environment [41]
- biodiversity is stunted by producing only a select variety of crops suited for current food distribution systems
    - this leads to increasing pesticide use
- countries export crops but import the same type [42]
- transportation from both producers (particularly air freight) and consumers contributes a lot to greenhouse emissions
- industrial UA involves the 3Ps: processing, pesticides, and packaging; all of which contribute to greater food miles and waste output [42-44]
- aside from having negative effects on the environment and health, the food miles chain also compromises the growth of local economies, as little money stays in the area [44-45]
    - money returns to wherever the food came from
- various factors drive the food miles: cheap fuel and transport, middlemen (transporters, processers, retailers, etc.) international policies, and consumer ignorance [45-46]
    - the issues around food miles could be addressed with the effort of both individuals and government [46-47]

Chapter 8

- 3 categories of obstacles to UA: regulatory, economic, and technical [60]
- despite increased interest in UA worldwide, there has been a lack of formal action and implementation regarding the integration of UA into current land-use policies [60-61]
    - there is a lack of awareness and knowledge about the implications of UA to land-use regulation [61]
- UA competes with other land-uses with higher financial return [62]
    - This may be why it is not prioritized or desired as much (insight mine; not in the book)
- some technical obstacles for UA include soil contamination
    - proper evaluation of conditions on sites must be done to identify viable areas for UA

Chapter 9

- it is hard to accurately determine the income and employment contributions of UA due to complex factors and the variety of cases per city/country [66]

Cities Feeding People

Chapter 6

- there is a lack of comparative longitudinal studies between farming and non-farming households [107]

Agropolis

Introduction

- Urban poor have difficulty accessing food from the formal food supply system of the city [3]
- Exportation also lessens food supply due to crop selection; and sometimes leaves lower quality food supplies (imports) for the city, while higher quality food supplies (exports) are shipped to strong-currency consumer markets [4]
- There is a lack of recognition and support for poor ua practitioners, obscuring their potential to acquire greater benefits from ua [11]

Agriculture in the City

Chapter 3

- Weaknesses in ua-urban environment relationship [50]
    1. Lack of harmony between productive and constructed space; isolation of areas from each other;

consideration for areas surrounding productive space is needed
2. Insufficient research on effects of placing ua in city (ex. contamination of crops by motor emissions)
3. Need to increase efficiency of ua aspects (yields, trade mechanisms, management systems) [50-51]
4. Ua should be distinguished from rural agriculture due to different conditions and contexts; ua requires its own conceptual framework [51]
5. Little attention given to obtaining and storing water within production units for irrigation [52]
6. Organic matter used comes directly from sugar processing centers, livestock facilities (requiring transport) instead of tapping into community organic waste and promoting recycling and the use of local resources
7. Information and training focus only on production function disregarding other areas of potential improvement
8. (skip)
9. Practitioners with no assurance of permanent access to their tended land think about the short-term (maximizing capital), disregarding sustainability [53]

Cities Farming for the Future

Introduction

- Ua's liabilities include: [3-5]
  - Crop contamination from polluted water, road emissions, agrochemicals
  - Diseases from improper animal keeping

Chapter 8

- Urban centers in developing countries are unable to meet demands for public services such as sanitation due to accelerated urbanization ABSTRACT

Viability and requirements of UA

CPULs

Chapter 4

- sustainability in cities could be achieved by aiming for closed-loop nutrient systems and energy efficiency [38-39]
  - wastewater use in UA could be implemented

Chapter 8

- 3 categories of obstacles to UA: regulatory, economic, and technical [60]
- some technical obstacles for UA include soil contamination [62]
  - proper evaluation of conditions on sites must be done to identify viable areas for UA

Chapter 9

- factors that determine net flow of income of households involved in UA (Nugent, 2000): [69]
  1. farming effort
  2. availability and cost of basic inputs
  3. yields
  4. market access
  5. ability to store
  6. transport
  7. process and preserve
  8. prices
- access to land is an important aspect of UA
  - often times, land-use with higher opportunity costs are prioritized [70]
- Some advantages of UA include cheap labor (except for those in the North; Jakarta, Havana, and Shanghai which support their UA practitioners), adaptability to market demands, reduced operational costs (transport, storage, etc.), ability to supply special and niche produce [70-71]

- Small scale UA is relatively easy to start as long as there is land [71]
- Some obstacles include: land access and security, labor scarcity, underdeveloped skills, competition with imports and complex downstream activities (processing, packaging, etc.)
- Purchase of food by the statutory sector (hospitals, prison, schools, etc.) could be a boost to UA [73]

Chapter 11

- Local authorities' support is an important thing when it comes to establishing community-led projects [86-87]
    - This may come in the form of financial aid, land provision, or policies

Chapter 17

- Selection criteria for UA land (Provincial Group for Urban Agriculture in Cienfuegos) [151]
    1. Empty sites
    2. Sites must not have been used for any other purpose
    3. Site must be included in long-term plan by municipality to integrate agriculture with physical, health, and water resource planning
    4. Water and electricity must be available on the site; low-impact cultivation
    5. Proximity to consumers to reduce transport needs
    6. All of the above must be met for a site to be designated for UA
    - Planning guidance for UA is decided locally
- If site soil is contaminated, raised beds of imported soil supplemented by compost are used

Cities Feeding People

Foreword

- Urban food production is vital for income and consumption in East Africa [xi]

Chapter 1

- Urban food insecurity is becoming an issue, and UA is playing an important role in mitigating it particularly for the urban poor [23-24] RATIONALE

Chapter 5 (Addis Ababa, Ethiopia)

- Ua is motivated by the need to feed families and provide additional income [93]
- Determination, ability, and willingness to cultivate urban land is as important a factor as land and water availability when it comes to ua
- If given enough support, ua can be an employment-generating activity [96]
- Full-time and part-time employment has been provided by the combined household strategy to involved households
    - It also offers jobs for unprivileged sections (women, illiterate, etc.)
- Consumption of their produce allows households to save an average of 10-20% of their income [97]
- According to Ganapathy, 6 m^2 is adequate to provide all vegetables needed by a family of 4 [99]
- The potential from waste-recycling brought by ua would benefit the environment and could increase employment opportunities as well [100]
- Ua could reduce the need for food importation and aid, as well as contribute to exportation, given more time
- Legalization of cooperatives would allow greater productivity [101]
- Modernization of agricultural production would require support of government through relevant agencies to aid in training and advice provision to urban farmers
- Urban land tax could also be adjusted appropriately to urban farmers' productivity and paying capability

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- Incentives could be given to farmers who exceed expected production, thus encouraging higher yields at least at par with private lots [101-102]
- Ua should be taken into consideration when designating land-use; it could be allocated to underused or inappropriately used land, after careful assessment of the needs of the population [102]
- "the efforts of urban planners and city governments should centre on responding to the needs and views of residents and on improving the inhabitants' quality of life." [103]

Chapter 6

- Ua requires more organizational precision than rural agriculture, and must employ techniques and technologies suited to small areas of production (stall feeding, hydroponics, etc.) [108]
    - Food-crop selection is also important
- Costs and benefits of ua both as a land-use and an industry must be studied [109]
    - Horticultural farms were 10-20 times more profitable than staple-crop farms of equal size
- Ua has more economic returns aside from food savings and employment generation; it also adds value to land by preventing pests, thieves, dumping, squatting, etc.
    - Ua also supplies food to institutions and businesses [111]
- Access to land is more important than availability of land

Agropolis

Introduction

- Ua is an acceptable, affordable, and effective tool for sustainable urbanization [12] RATIONALE
- Capital-intensive and small-area ua: fruit trees, medicinal and ornamentals, silkworms, mushrooms, catfish, small stall-fed livestock
    - Can thrive in city cores

Chapter 6

- it is important to be careful when it comes to omitting or ignoring certain forms of ua, as this could lead to an eventual disappearance of the practices; it is also important (if not the most important) to consider the realities and needs of ua practitioners themselves, for they're the ones sustaining ua [177]

Chapter 7

- "ua is a powerful tool for engaging urban inhabitants with limited resources and for initiating local development processes" [199]

Agriculture in the City

Chapter 3

- Higher yields, fewer producers/ha, and higher production/producer = more efficient [38]
- Efficiency in descending order: (1) field workers (fresh vegetable greenhouses?); (2) urban community gardens; (3) intensive-cultivation gardens; (4) high-yield urban gardens; (5) state farms; (6) plot [39]
- Support for ua production: [40]
    1. Organic matter production centers
        - Collect, process, and distribute organic matter to all ua production modes in the city
    2. Agricultural information offices [41]
        - Provides technical assistance and facilities, information dissemination and meetings with producers
    3. Seedling greenhouses [42]
        - Provides seedlings (mainly vegetables, some fruit trees) [43]
        - Requires financial and irrigation support

Chapter 4

- Considerations for improving water sustainability of ua [62]
    1. Development of techniques to reduce irrigation needs
    2. Use of low-water consumption irrigation systems
    3. Water reuse for irrigation
    4. Promotion of and education about water conservation

Cities Farming for the Future

Introduction

- Ua complements rural agriculture and contributes to the efficiency of natural food systems [2]
- Urban populations are increasing worldwide, particularly in developing countries, due to natural urban population growth and rural-urban migration [7]
    - RATIONALE
        - This is accompanied by increased urban poverty and food insecurity, as cities fail to cope with increasing populations; there are problems in employment generation, basic services provision, etc.
- Inclusion of the urban poor in the planning process is important for proper situation analysis, priority identification, and implementation [12]
- Multi-stakeholder Policy Making and Action Planning on ua
    - See Quito-Ecuador, Rosario-Argentina, and Dar Es Salaam-Tanzania
    - Ua or urban food policy platform is established with all indirect and direct stakeholders in production and consumption; multi-stakeholder forum is held for: definition of problem, agenda setting, and identification of priorities, etc.
- Strategies for the development of safe and sustainable ua: [12-13]
    - Creating conducive policy environment and formal acceptance of ua as a land use
    - Improving access to vacant open urban spaces
    - Enhancing productivity and economic viability of ua by providing training, technical advice, and credit
    - Encouraging establishment of and supporting urban farmer organizations
    - Preventing/reducing health and environmental risks of ua
- Other intervention areas to increase productivity and economic viability of ua: [15]
    - Enhance access to inputs (organic wastes, irrigation water, animal feeds, and related facilities)
    - Enhance access to credit facilities
    - Linking farmers to different markets (city markets, schools, feeding programs, etc.) and creation of food preservation and storage facilities (canning, pickling, etc.)

Chapter 2

- Involving the various stakeholders in project development, policy and planning allows better decision making, implementation, credibility, and reach [22]
- Multi-stakeholder processes on ua:
    - Allows stakeholders to cooperate with each other to improve situations that affect them through dialogue, negotiation, learning, decision making, and collective action [23]
- Ua can offer more than food production in industrial countries [43]

Chapter 3

- Land access is one of the main concerns of urban farmers; suggestions to help in this matter include: [78]

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    - Organize awareness campaigns on the procedure for acquisition of land deeds
    - Facilitate access to finance for agricultural producers
    - Encourage formation of cooperatives by producers
    - Improve individual access to land
    - Sensitize consumer associations on quality control of ua production
    - Improve capability of municipal authorities in land administration
- See Xiaotangshan town [80]

Chapter 4

- Different schemes of financial support to ua producers include: [118]
    1. Financial grants
        - For extremely poor beneficiaries unable to raise their own capital through formal or informal systems; this, however, may lead to complacency on the producer's part
    2. Loan
        - Has long-term sustainability; suitable for middle and high-income earners; motivates people to work hard to be able to pay loans
    3. Input supports
        - Tractors, seeds, fertilizers, etc. maybe given to farmers incapable of affording them; effective in getting people started
    4. Tax incentives
        - Useful in attracting major investors to agriculture and manufacturing; effective in generating income and employment
    5. Cooperatives
        - Can motivate people to delve in ua; government, donor agencies, and NGOs prefer lending to cooperatives than to individuals

Chapter 7

- To reliably measure urban farmers' incomes, a typology of urban farmers and traders should be created to account for the different factors involved; a monthly observation of incomes is ideal; comparison with other similar level jobs and with budget for basic needs is also important [179-180]

Chapter 10

- the urban environment allows two aspects of intensification of urban agriculture: the use of vertical space, and the use of urban organic wastes for soil or animal nutrition [282]

Embodied energy

CPULs

Chapter 3

- embodied energy of food is high, almost as much as that of a household and a car combined (in a study by Brenda and Robert Vale) [23]
    - this is despite low greenhouse gas emissions from agriculture which is due to the exclusion of the other processes such as transportation, processing, packaging, production of fertilizers, etc. associated with industrial agriculture when calculating agricultural emissions [25]
- there has also been an increase on the energy ratios of food (ratio of energy acquired from consuming the food and energy input to produce the food) [26]
- seasonal food is being marketed as available year-round, inciting demand, and therefore putting a strain on production and increasing embodied energy [28]

- adhering to seasonal production will decrease the need for transnational transportation and heavy greenhouse use, both sources of emissions

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Horticulture

Cities Farming for the Future

Chapter 11

- urban and peri-urban horticulture (UPH) involves the growing of edible and ornamental crops such as vegetables, cereals, flowers, ornamental trees, aromatic vegetables, and mushrooms [316]
  - short-cycle crops are preferred in cities; long-cycle (ex. orchards) in peri-urban areas *see Table 11.1 for plants cultivated (p. 317)
- UPH supplies fresh food, contributes to economic (income generation), social (labor), cultural, living environment (open spaces and greening), environmental (recycling) and security (food and natural risks)
- UPH provides a huge part of the vegetable supplies to urban markets [318]
- Factors influencing urban horticulture: [319]
  1. Access to natural resources and labor [320]
     - Access to land is crucial to ua development; in developing countries, it is difficult to acquire and hold on to lands; small sizes of available land also negatively affect practice, leading to not so ideal techniques
     - There are numerous sources of water in and around cities, urban horticulture (uh) is flexible when it comes to sourcing water; the use of wastewater provides nutrients aside from water, lessening fertilizer expenses
     - Uh is often a part time job combined with other livelihoods; this may affect available labor in times of need [320-321]
  2. Environmental pollution [321]
     - The urban environment contains numerous forms of pollutants threatening ua and uh

     A. Heavy metals – mainly brought to the soil by water and solid wastes contaminated by industry; metals include lead, cadmium, chromium, zinc, copper, nickel, mercury, manganese, selenium and arsenic; these can affect plant physiology and growth, as well as human health (carcinogenic and mutagenic effects); air pollution also affects plants [321-322]
        - The location of uh operations must be carefully considered. Being careful to avoid industrial areas

     B. Pesticide residues and fertilizers [322]
        - Pesticide residue can be found in contaminated plants, soil, and water; these pesticides can endanger producer and consumer health

     C. Biological contaminants
        - These come from the reuse of solid and liquid wastes and may bring diseases to both producers and consumers

- Composting significantly reduces health risks from solid wastes, but use of human excreta and untreated wastewater in production increases risk [322-323]

3. Pollution by horticultural practices [323]
    - Horticultural practice may also impact the environment and people, particularly in the crowded urban environment
    - Pesticide and nitrates (cause health problems for children and pregnant women; eutrophication)
    - *see Box 11.1 for recommendations [324]

- Agronomic techniques [325]

1. Irrigation
    - In developing countries, the watering can is the most common method of irrigation; although labor-intensive, it allows precise quantities of water to be fed to the plants [326]
    - Drip irrigation saves water by 10-20% compared to overhead irrigation; it commonly requires filters, pumps, and a pressure regulator (often not affordable by low-income farmers); the system can be adjusted and modified to suits needs and capabilities of farmers
2. Fertilization [327]
    A. Organic fertilizers
        - Contain most of the needed nutrients and improve soil structure
        - Come from organic wastes: poultry or livestock manure, composted vegetable wastes or other urban wastes
        - Poses health and environmental risks
        - Solid organic fertilizers release nutrients (especially nitrogen) slowly, whereas liquid counterparts release more quickly

    B. Inorganic fertilizers
        - Easier to use and allows for application of proper dosage of nutrients
        - Risks include over-application and contamination of soils and water by nitrates and phosphates

3. Pesticides
    - Use of chemical pesticides has increased due to easy access and technical information
    - They, however, bring 3 risks: consumer health risks, environmental pollution (mainly water sources), and risks for users

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Hydroponics/other growing methods

<u>Cities Farming for the Future</u>

Chapter 11

- Cultivation of crops without soil; requires less space, labor, external inputs, and time; but also needs proper management and usually higher investments [329]

- Allows for the control of plant nutrients uptake, reduction of accumulation of soil toxins, and soil-borne diseases [329-330]
- Water, nutrients, and oxygen must be balanced with plants' needs; other factors to be monitored are temperature, humidity, CO_2 levels, light intensity, ventilation, and plant's genetic make-up [330]
- Rainwater is a good water source thanks to its low ionic strength, microorganism and algal densities
- Well controlled hydroponics has superior productivity over traditional systems
- Special hydroponic techniques have been developed for small spaces, and are easier to understand as they are simplified *read more: "Simplified hydroponic as an appropriate technology to implement food security in ua", 'Practical Hydroponics and Greenhouses 76' pp 1-6 (Caldeyro-Stajano, 2004)
- Hydroponics with floaters (polystyrene) mitigates algal growth [331]
    - Large volume of nutritive solution, no water loss, minimal evaporation, and multi-crop-cycle use of solution; needs little maintenance and expenses
- Organoponics makes use of organic substrata to replace unavailable chemical inputs; organic substrata can come from compost, feces, etc.; this is suited to low-fertility soils
- Green buildings are also being established; plants are cultivated on rooftops mainly, and contribute to the thermal performance of the building [331-332]
- Permaculture is the creation of a symbiotic system putting plants, trees, and livestock together [332]
- A number of organic (bio-intensive) production techniques are practiced in Addis Ababa [342]
    - Biodynamic French Intensive Method
        - Combines German biodynamic techniques and French intensive techniques
        - 3 principles:
            1. Minimize space between plants to reduce weed growth and conserve soil moisture
            2. Use 60 cm deep, raised planting beds with loose soil for aeration, moisture, warmth, and sufficient organic nutrients
            3. Feed the soil with organic fertilizer and natural pest control
    - FAITH garden method
        - Bottomless baskets are placed on top of a hole (30 cm diameter x 30 cm depth) where kitchen and garden wastes are thrown [343]
        - Vegetables are then planted about 20 cm away from the hole, allowing their roots to soak in the nutrients from the waste; this method produces fertilizer, conserves water, and protects plants
    - Barrel garden
        - Requires a 200-liter barrel, a corrugated iron sheet, soil mixture (preferably 2 parts soil to 1 part aged manure/compost to 1 part sand), and manure tea
        - The barrel is covered with horizontal slits (hammer upper lips inwards, lower lips outwards) about 12 cm; allow 15 and 20 cm horizontal and vertical spacing, respectively, between slits; leave barrel top open while the bottom is

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perforated with about 10 holes
        - Place rolled corrugated sheet in the barrel center, fill with sand, fill space between barrel and sheet with soil mixture
        - Plant vegetables or fruits in made slits
        - Regular watering is done through sand in the middle; apply manure tea weekly on same spot
        - Advised to place barrel on gravel for better aeration and drainage
    - Trench garden
        - Requires seed potatoes, aged manure, and mulching material
        - Dig a hole 30 cm deep, 30 cm wide, and 6 m long; crack soil at the trench bottom about 30 cm for better aeration and drainage
        - Plant seed potatoes 30 cm apart; fill trench with aged manure
        - After 2 months, each potato plant will yield 1-2 tubers weekly for 2 months; repeat process after duration
    - Natural fertilization, pest control, and waste management [344]
        - Natural fertilization makes use of organic fertilizers that could be manure-based, legume-based, or biomass-based; and additives such as wood ash, egg shells, etc.
        - Natural pest control involves using healthy plants and soil; beneficial animals like ladybirds, mantises, wasps, birds, lizards, etc.; and natural pesticides such as pepper, tobacco, pyrethrum, etc.
        - Water efficiency activities include: harvesting water during seasons of abundance (ex. roof water harvesting, artificial lakes); water conservation by mulching, shading, etc.; water recycling and reuse

Hydroponics from the Home Gardener

Chapter 1

- Hydroponics: "The art of cultivating plant life in a nutrient-water solution whose roots are supported by a substance other than soil." [1]
- Hydroponics gardening offers freshness and high nutritional value of vegetables and plants grown
- Not labor-intensive (tilling, raking, weed pulling, etc.) [3]
- Perfect for those without time and space for full-time soil gardening
- Hydroponic plants grow faster and yield greater than soil garden plants
- Plants absorb inorganic material (chemicals) traditionally provided by the soil after breaking down organic material; this process is skipped in hydroponics [5]
- Plant growth involves osmosis (roots) and photosynthesis (leaves); osmosis takes up nutrients, while photosynthesis (through light and atmosphere) transforms the nutrients to plant tissue
- Inorganic fertilizer hurts the soil by disrupting the microorganisms' actions in the soil [6]
    - These fertilizers also eventually end up in natural bodies of water, causing eutrophication
    - Hydroponics addresses these issues
- Hydroponics enables off-season and year-round gardening [7]

Chapter 2

- 4 approaches to hydroponic gardening: [10]
    1. Growing outdoors

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2. Growing indoors
3. Combination of outdoor and indoor, year-round garden
4. Growing in a greenhouse
    - Whatever approach is taken, what's important is that all growth requirements are present; environmental factors need to be duplicated indoors

- Main objectives of a hydroponic system: support the plant's root system and supply nutrients and aeration to plants [11]
- Aggregates serve to support the roots and aerate them; almost any material could be used, but the lighter and more porous, the better [12]
    - Some examples are perlite, vermiculite, lava stones, broken tiles, and haydite (expanded oil shale); pieces should be about 3/8 in. for ideal aeration and moisture retention [12-13]
- 3 basic types of automatic, labor-saving feeding and drainage systems: [13]
    1. Drip from above
    2. Flood and drain (sub-irrigation)
    3. Constant flow
    - Type 3 is preferred due to constant flow of nutrients and almost immediate drainage [13]
    - Type 1 makes the surface of the aggregate moist and prone to algal growth [14]
    - Type 2 can also lead to algal growth and can move the seeds around too much with water rise and recession

Chapter 3

- Basic elements that should be present in nutrients: [31]
    - Nitrogen: plant cells building
    - Phosphorus: flowers, roots, healthy roots
    - Potassium: energy assimilation by plant cells
    - Sulfur: assists in plant energy production; boosts phosphorus' effect
    - Iron: chlorophyll production
    - Manganese: nitrogen absorption; energy transference process
    - Zinc: energy transference process
    - Copper: chlorophyll
    - Boron: required in minute amounts
    - Magnesium: chlorophyll component; phosphorus distribution in plant
    - Calcium: root growth; potassium absorption
    - Chlorine: photosynthesis
    - Molybdenum: assists in some chemical reactions
- Water oversaturated with nutrients (salts) will cause plant to dehydrate [32]

Chapter 5

- 3 main factors to consider are light, temperature, and humidity [49]

Chapter 7

- Almost any plant or vegetable will grow hydroponically [69]

Chapter 11

- Tomatoes are perfect for outdoor hydroponics; flavorful and high potential yield [113]
- Place system on a table or stand when growing outdoors to avoid insect infestation [114]

Livestock keeping

<u>Cities Farming for the Future</u>

Chapter 12

- Livestock keeping, although a historical and traditional practice, is not officially recognized in many countries, making it hard for research, policy, and development

agencies to identify and address risks and potentials in the urban context [350]

- Urban livestock systems could be categorized in a number of ways: urban conditions (inner cities, fringes, garden cities, etc.); type of enterprise (subsistence, commercial, etc.); production objective (food/income, drought, status, etc.); type of animals (rabbits, pigs, dairy-cows, etc.); stakeholders (consumers, producers, housewives, etc.) *see Table 12.2 [354]
- Positive and/or negative aspects of animal keeping *see table 12.5 [357]
    - Positive (or negative)
        - Produce (healthy) food
        - Use waste/clean or scavenge the environment
        - Provide income and emotional value
        - Status, savings, tradition
        - Dung for garden
        - Draught
    - Negative (or positive)
        - Dung and urine disposal problems
        - Disease risk
        - Theft
        - Zoonoses/hygiene
        - Nuisance
        - Much work
- Livestock keeping in cities is seen as a backward practice and associated with diseases and nuisance
    - This can be considered unfair treatment, because it ignores other urban realities that cause similar problems
- Problems with urban livestock increase with high concentrations of animals and people [358]
- Livestock may be a nuisance to neighbors (odors, noise), clog sewage systems, cause traffic problems, and/or contaminate water sources
- The future of good urban livestock practices lies in knowing how and why it occurs, and its potential in the future
- Important issues about livestock keeping that are often overlooked *see Table 12.6 for topics of importance (p. 360)
    1. Food security and poverty, energy and CO_2, biodiversity and scale [359]
        - Small-scale systems do better compared to industrial operations [360]
        - These systems provide food security through nutrients and income, and produce affordable food close to the market where it is needed
        - Small scales require less energy than larger ones, and make better use of local leftovers
    2. Public health and emerging zoonotic diseases [361]
        - Disease can be transmitted from animals to people by contact, animal product consumption, or disease carriers (insects)
        - Zoonoses can be viral, bacterial, or parasitic
        - Health problems can be attributed to inadequate public health and veterinary infrastructure; in addition to these, high costs of veterinary services, lack of health risks information, and lack of testing facilities contribute to the problem [362]
    3. Public administration and policy
        - Approaches to urban livestock that are non-linear and consider various factors (disease, population density, community organization) should be encouraged
        - Accept and regulate a sector that fulfils urban residents' needs
        - Educators, administrators, and policy makers are key to

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rediscovering its opportunities

- 'ville-jardn' is a 19th century concept about combining urban and rural aspects in a city; lots surrounded green spaces (unproductive, hence viewed as luxurious) with employment nearby [364]
- 'Schreber-gardens' in Germany illustrate Schreber's 1864 idea of introducing green spaces in industrial areas, making them 'productive' gardens; these gardens support multiple uses such as being places for contemplation, recreation, social use, or food provision

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Aquaculture

Cities Farming for the Future

Chapter 13

- Aquaculture is the farming or culture of aquatic organisms such as fish, mollusks, crustaceans, and aquatic plants [383]
    - Involves human intervention in the rearing process (FAO, 1995)
- Coche proposed an aquaculture systems typology that identifies 3 categories: extensive, semi-intensive, and intensive
    - *see Table 13.1 (p. 389) for comparisons
    - *Read: Coche, A.G. 1982, Cage culture of Tilapias. Pp. 205-246. In: Pullin and Lowe-McConell (Eds.), 'Biology and Culture of Tilapias', Metro Manila, Philippines. International Centre for Living Aquatic Research Management
    1. Extensive urban aquaculture [384]
        - Fish are stocked in reservoirs and large urban water bodies, then harvested once they have grown
        - Due to the open nature of the water bodies used, many different users share the water, and conflicting interests are unavoidable; this also makes it difficult to properly monitor and control conditions in the water [385]
        - Cages and pens may aid in securing sections of the water body, but this may cause conflicts and be out of reach of poorer practitioners
        - Wastewater diverted to the used water bodies improve production but also pose a number of risks to the environment and public health
    2. Semi-intensive urban aquaculture
        - Pond-based, allowing greater control of production
        - Land lease-holders, cooperatives, fishermen groups, and the government are operators of fisheries [386]
        - Aquatic vegetable production in semi-intensive and intensive systems contribute a significant amount of produce in SEA; most of these are done in flooded fields
        - Aquatic vegetable production may cost lower and return higher than fish production; vegetables tend to be more tolerant of pollution than fish [386-387]
        - Combination of wastewater treatment and aquaculture already exists, and shows great potential *Read: Mara, D.D., et al. 1993. "A rational approach to the design of wastewater-fed fishponds. 'Water Research' 27 (12): 1797-1799 [387]
    3. Intensive urban aquaculture

        - Requires less land than semi-intensive, but requires greater investment
        - Allows operators greater control over operations; inputs; and public, animal, and environmental health hazards [387-388]
        - Due to high costs, these systems are constrained to producing high value and specialized products [388]
        - Products include eel, see bass, shrimp, and tilapia (EU and NA)
- Benefits of urban aquaculture include: [389]
    - Food security and meeting market demand
    - Employment and income
    - Resource recovery, reuse of solid and liquid wastes [390]
        - Subsidization of water treatment by earnings from urban aquaculture
    - Household and community health benefits
        - Water sanitation
- Constraints to urban aquaculture (extensive and semi-intensive) [391]
    - Urbanization; competition for land, land insecurity
    - Labor migration to higher-paying jobs
    - Competition for markets; access to more distant sources of produce
    - Changing access patterns for inputs; inadequate access to wastewater [392]
    - Contamination of surface water resources with domestic and industrial pollution
    - Public health concerns
    - Changing social expectations and perceptions; perceptions of operators, consumers, and society influence the success of urban aquaculture systems [394]
    - Management constraints; no control over some factors and problems

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Case studies, existing examples, and current state of agricultural practice/CPULs

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CPULs

Chapter 4

- in Davis, California, a 'permaculture' suburb was developed [37]
    - houses had built-in vegetable plots and orchards
- Adelaide, Australia was able to achieve successful UA irrigation with wastewater [38-39]

Chapter 24

- LeisurESCAPE study [Plate 6 (between pp. 250 & 251)]
    - Tries to apply CPUL in London
    - Outside London – Thames – Outside London
    - Connects existing patches of open land
    - Host a variety of activities including pedestrian and bike transit, as well as recreational ones
    - Laid out mainly on existing roads [Plate 7]
        - Transformed into UA sites

Cities Feeding People

Chapter 1

- Ua in Asia has seen advancements and promotion during the late 20th century, with its practice integrated into the urban lifestyle, and intensified and commercialized [4]
- Outside Asia, in other developing nations, UA has grown due to many factors including rapid urbanization, rising unemployment, disrupted rural food production and supply lines to cities [5]

- A large number of households in developing countries devote their income to food alone [9-10]
    - In 5 surveyed developing countries, urban households paid 10-30% more for food than their rural counterparts [11]

Chapter 2 (Dar es Salaam)

- In Dar es Salaam (at least in the 3 wards studied), women make up the majority of ua practitioners [30]
- Top 3 occupations of ua practitioners in Dar es Salaam: small business or trade owner, professional, and cultivator (urban farmer) [42]
- Top categories in terms of importance of urban farmers according to their perception (Dar es Salaam): crop and livestock (mixed), crop, and livestock farmers [44]

Chapter 3 (Kampala)

- Roughly 30% of households in Kampala are involved in UA [49]
- Staple crops are the dominant produce (cassava, sweet potato, beans, etc.), while poultry is also common for meat and eggs
- 4 major categories of household logic in Kampala UA: [53-56]
    1. Commercial production
        - Products include coffee and vanilla beans, but are largely poultry and livestock [53-54]
        - Capital for commercial production is almost always acquired from other sources of income besides ua [54]
    2. Urban food self-sufficiency
        - Practiced by long-time and well established households
        - Requires access to significant amount of land
        - Land is not owned by the ua practitioners
        - Surplus is sometimes sold
        - Some food is still gotten from external sources
    3. Food security [55]
        - Commonly practiced in the case where a household member has acquired access to land by whatever means
        - This practice is not the sole and primary source of food for the household, but rather a supplementary one that also serves as a safety net against food shortage
        - Allows income to be used for matters besides food [56]
    4. No other means
        - For low-income, food-insecure, and land-insecure households
        - Subsistence on often “squatted” (illegally used) land
        - Although already insufficient for their own consumption, the products are sold to compensate for other expenses

Chapter 4 (Kenya)

- Pre-industrialized cities of the world included ua [70-71]
    - Westernized urbanization displaced ua from the cities because it was uncompetitive against other land uses
- Western influence on Kenya has led to the disregard of ua as a legitimate urban activity [70]
- The urban poor in Kenya are not considered in nutrition support efforts and programs [80]
- 40% of urban farmers depend on ua to survive
- A lot of urban households don’t have access to land for food production; this contributes to the lack of food security, and emphasizes ua’s importance in meeting nutritional requirements

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- Despite its importance to urban households (particularly the poor), ua has been excluded in planning, with little support from authorities [83]

Chapter 5 (Addis Ababa, Ethiopia)

- Addis Ababa in Ethipoia is relatively self-sufficient when it comes to vegetable production, but relies on other sources for its staple foods [86-87]
- UA in Ethiopia is a traditional practice, but products are more oriented to self-consumption than sale [87]
    - Its contribution to satisfying people's basic needs is considerable despite little contribution to the urban economy
- 5 cooperatives operate in Addis Ababa, making use of rivers and streams within the city for irrigation [88]
    - These cooperatives practice intensive farming to contribute to the local market and leave a little for household consumption
- Ua usually came later in the evolution of livelihood practices of low-income urban farmer households, which begins with informal service sector, then tenancy and wage farm labor, state-land occupation, and finally, producers' cooperative [92]
- Ua is motivated by the need to feed families and provide additional income [93]
- Cooperative-used lands are largely used as communal plots, with a little portion designated as private lots for all members
    - Women and children worked on the private lots, while women household heads worked on both cooperative and private lots, as well as domestic duties; women worked more than men [93-94]
- Revenues are distributed to member households [94]
- Extended families are desired due to increased manpower, sharing of vegetable production skills to relatives, and self-insurance of the household (help from relatives in times of need?)
- Cooperative formation was a voluntary act by members, motivated by the idea of independency and improved survival [95]
- Shares from the cooperative are distributed according to a point system in performed tasks
- Cooperatives have made united communities with members that act together to discuss and solve problems
    - Cooperatives, however, are not legally recognized, resulting in little support from the government, and sub-optimal productivity; for example, cooperatives may not build permanent structures on the land used (despite paying tax)
- Income acquired from ua was above 50% of that of the population of Addis Ababa [96]
- Households involved in cooperatives consumed a minimum of 10% of vegetables from their private lots; they opted to sell the rest of the produce for additional money to be used on other foodstuffs and basic needs [96-97]
- Consumption of their produce allows households to save an average of 10-20% of their income [97]
- Income from sold produce and shares from the cooperative have improved the socioeconomic conditions of the households
- Cooperative (Mekanissa, Furi, and Saris Producers' Cooperative) is able to provide a considerable portion of vegetable needs of Addis Ababa [98]
    - They provide fresh produce and convenient service to the residents; low-income households also benefit from the cheaper produce and proximity, avoiding extra transportation expenses [98-99]
- Communal plots yielded significantly less than private plots in cooperatives [99]

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- According to Ganapathy, 6 m^2 is adequate to provide all vegetables needed by a family of 4

Agropolis

Chapter 1 (Namibia)

- Despite high unemployment due to rapid urbanization brought about by rural-urban migration, food insecurity is less than in previous years (in Windhoek City) [33]
    - This could be attributed to greater mobility of migrants between rural and urban areas, allowing easier transportation of goods
- Ua is not commonly practiced in Windhoek, but when it is, it saves households about 60 Namibia dollars (~8 USD in 2003) which is a considerable amount of money [37]
- Livestock keeping is even more scarce due to strict policies [37-38]
    - Ua is not the primary source of food for poor households, instead, rural-urban food transfers because of less than ideal conditions and support for ua [38]
- 2/3 of the studied sample of households received food from relatives or friends about 2-6 times per year
    - Food sent by rural dwellers were predominantly acquired through farming or foraging; the frequency of sending food was also reliant on visitors or trips to the urban areas [39]
    - For majority of the urban sample, food from the rural areas was important to their food security
- It is common for households facing economic stress and food scarcity to send children or adults to rural relatives because they're unable to be supported in the urban area [40-41]
- Urban households reciprocate the aid given to them by rural households by remitting income to relatives [42]
    - Urban and rural systems are interdependent [43]
    - 'reciprocal urbanization' [44]

Chapter 3 (Cote d'Ivoire)

- Traditionally a meat-importing nation due to less than ideal conditions for livestock keeping [89]
- Cattle have a sociological rather than economic function [90]
- Cattle aren't used economically because of lacking animal husbandry skills and traditional/cultural prohibition of cattle keeping [93]
    - Foreigners are therefore hired to herd cattle
    - Cows not milked or sold
- Small ruminants, however, are kept near households and used in production, economic, and social systems, especially by women
    - Goats and sheep
- Determinants of livestock adoption in the Khorogo survey include: [96-97]
    - Age – older people are more likely to keep livestock
    - Gender – women are much more likely to tend to livestock
    - Education – less educated
    - Nationality (ethnicity) – foreigners
    - Wife's primary occupation - no work outside home
    - Income – less wealthy
    - Years of experience in farming – mixed; experienced in farming not necessarily important
- To improve national self-reliance on meat supply and food security, urban livestock should be seen as an asset in terms of the economy and food security; animal feed should be made available and its production encouraged; women should be given support as they are the dominant keepers of small ruminants, in the form of accessibility to feedstuff, medicine, and markets [100]

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Chapter 7 (Rosario, Argentina)

- ua was started by the government in 1989, a time of socio-economic problems, as a response to the food crisis [187]
    - Pro-Huerta Programme (Promoting gardens programme) by the National Institute of Agricultural Technology
- Vermiculture is a viable technology for organic waste processing at a small to medium scale [194]
    - It is of low cost and simple handling, easily acquirable by those with little financial resources
- Vermiculture was able to increase the quantity and weight of fruits of tested tomato plants
- Medicinal plants were used to produce products such as creams, lotions, and ointments with the participation of the municipal health centre and Community Gardens Department; the sharing of the knowledge to other neighborhoods was recommended by doctors from the health centre to produce more products [195]
- Vermiculture training raised waste management awareness, led the community to form a working group, and led them to propose various activities such as processing organic waste and recycling plastic
- Ua has had a positive effect on the community in terms of productivity (self-consumption and commercialization), social development of the community, economic growth (income and employment), and environmental aspects (agroecological techniques, environmental training) [199]
- "ua is a powerful tool for engaging urban inhabitants with limited resources and for initiating local development processes"

Cities Farming for the Future

Introduction

- Cuba, Argentina, and Brazil have huge government support for ua [5]

Chapter 2

- Bieslandse, Bovenpolder, Netherlands
    - A farmer, Jan Duijndan, coordinated with a planner and other planners to create a multifunctional area integrating organic ua and nature development (a water meadow with fluctuating groundwater level, a reed bed and marshy woodland) [42]
        - Ua can offer more than food production in industrial countries [43]
        - This requires integration of policies between different parties including government and other organizations
- Rosario, Argentina [44]
    - About 35% of the municipal area was vacant or partially vacant land
        - This can be converted to ua
    - Workshops with urban gardeners and officials were held to discuss variables to be used in selecting vacant spaces based on "suitability" and "accessibility"; succeeding workshops were held to gain more information about the vacant land, producers, and opportunities [45]
        - The proposals were then shared to relevant municipal departments [46]
    - Finally, the action plan includes activities to convert vacant land for productive use, to improve soil; and the institutionalization of land access policies

Chapter 7

- PROVE – Small Agricultural Production Verticalisation Programme (Brazil) [201-203]
    - Went through 11 stages
        1. Motivating institutions – acquiring support from stakeholders

2. Providing incentives – inviting socially-marginalized individuals and groups to participate
3. Ensuring credit lines – financial support
4. Specific sanitary legislation and laws – evaluation and revision of laws
5. Building small agro-industrial facilities
6. Training
7. Inputs – sale of inputs to farmers
8. Publicity and marketing – creation of a quality seal
9. Trading the products
10. Inspection and control – periodical product inspection
11. Follow-up

Cuba

CPULs

Chapter 17

- Organoponicos populares (urban community garden) [153]
  - High-yield and commercially run
  - Most conspicuous form of UA in Cuba
  - Smallest cultivated area is 500 m^2
  - Raised beds to separate crop soil from contaminated soil, and to control compost applications; this also makes it easier for workers to work, as it allows less bending when working [154]
- The municipality of Rodas supports and encourages UA practice by the locals [188]
  - 'Programa Especial De Desarrollo de la Agricultura Urbana' provides an advisory team to help Rodas' farmers
  - Vets and horticulturalists guide farmers on proper practice
  - Farmers are supplied with organic fertilizer and given opportunities for cattle and chicken farming; 10 chickens and a rooster are given to families
  - Schools, medical centres, and homes for the aged are partnered with UA sites for healthy eating programmes
  - Rodas aims to be able to produce and export surplus
- Havana's UA is supported by the government and an independent foundation, Fundacion Antonio Nunez Jimenez De la Naturaleza Y El Hombre
  - The foundation promotes urban ecology with the backdrop of environmental and social sustainability
  - It provides workshops and networking to promote permaculture and organic agriculture
  - Although Havana is still not self-sufficient (as of 2005), the government provides plenty of land to interested individuals and groups (who are then asked to plant certain crops); it also allows UA expansion into parks [189]
    - Land value and ownership in the future evoke concern from the residents, but as long as UA's benefits are understood, it is likely to continue
- UA in residential areas (particularly in the studied settlement Consejo Popular Camilo Cienfuegos) is either intensive and commercial, for private consumption, or privately practiced (independent from government)
  - The former two are aided by elected local representatives who then report to the agricultural administrators and provincial planners to mediate between the two parties [189-190]

    - Land is given to individuals and groups who volunteer to participate in UA [190]
    - UA in agriculture has been organic as a result of necessity rather than deliberate effort, as artificial pesticides and fertilizers were hard to come by [191]
        - Nevertheless, various organic methods have developed to counter insect pests; composting has also increased greatly due to increased production by dedicated sites

Agropolis

Chapter 6 (Havana, Cuba)

- Ua in Cuba began (or became important) during the 1989 post-Soviet economic crisis [153]
- Ua efforts in Cuba have contributed significantly to the reduction of food insecurity and environmental degradation [154]
- Havana is the center of Cuban ua, being the base of most ua research, decision-making, and support networks
- The government has been supportive of ua by providing lands to be used as garden lots in usufruct, promoting research, disseminating knowledge through agricultural delegates to every level of government, and provision of affordable agricultural input to urban farmers
- While the commercially-oriented ua (organoponicos) has expanded greatly, the small-scale ua (parcelas) for self-consumption has decreased
    - This is largely attributed to Cuba's economic recovery and the shift of some farmers to commercial food production, but some instances could be associated with the conversion of lots to non-agricultural functions as a result of the idea of a "proper" city the urban population has [155]
- The decline of small-scale self-provisioning practice is an important issue because the contributions of commercial ua are still not accessible or affordable enough to poorer populations [155-156]
    - An increase in large-scale intensive ua is not necessarily equal with universal access or enhanced food security for all groups [156]
- The discourses and practices of ua professionals (involved with official planning, support, and regulating of in Havana) and small-scale, self-provisioning producers differ from each other [163]
- Ua professionals studied are concerned with managing ua as a formal and institutional activity
    - Their actions may sometimes inadvertently disenfranchise some ua producers
- Livestock keeping was considered a special case of ua rather than a common part of it; ua professionals underreported instances of livestock keeping, thus affecting its visibility to other professionals when it comes to policy making [164]
    - This underreporting suggests intentional motives by professionals to exclude animal raising in formal ua practice; conscious molding of the direction of ua
- Women's involvement is downplayed by professionals
    - Partly because of established gender roles where men dominate agriculture, and the low priority given to small-scale production where women's involvement may be higher [165]
- Ua professionals do not consider the traditional practice of ua that existed before the economic crisis; they also believed that food security has stabilized and that ua must be transferred to the outskirts
    - This, of course, is a mindset that doesn't consider the importance of

ua in the city for small-scale producers

- the Urban Planning sector sees it more appropriate to place food production in the urban periphery, while maintaining an ornamental-oriented ua in the city core [166]
    - this view is partly founded on the idea that food production is large scale and extensive, and a bias on anti-food production (subjective) within the urban environment
- in contrast to the Urban Planning Sector, the Ministry of Agriculture (MINAGRI) refers to food production when speaking about ua [168]
    - they emphasize the food security aspect of ua
    - however, when considering sites for ua, they don't look at their relation with the surrounding urban environment; but this is beginning to change with more recognition of the multi-dimensionality of the city
- the high regard of MINAGRI for small-scale ua is supported by its efforts of placing Tiendas Consultorias Agropecuarias (TCA) in centrally located municipalities to provide agricultural inputs, services, and educational material for food production [169]
    - however, organoponicos are still considered with greater importance, being managed by the ministry; this, again, underlines the bias of institutions against small-scale producers [169-170]
- producers are more concerned with practical problems than definitions and claims about ua's novelty; also, they acknowledge the existence of ua before the 1989 crisis [171]
- small-scale practitioners use their ingenuity to sustain ua in less than ideal areas, highlighting the difference between their and the professionals' standard
- the practice of the common folk highlights the problem of ignoring reality on the ground (by the authorities), restricting the potential use of space and hampering the provision of all practitioners' needs [173]
- farmers who worked on self-owned land were more concerned with providing for the family; while those given usufruct rights, in addition to providing for the family, also acknowledged their part in contributing to the community
- many farmers didn't feel a sense of belonging to the community, instead, they saw ua as a refuge from the outside
- producers recognized the contribution of ua to their diet, and the savings acquired from the practice
- considering that households still can't afford food even from organoponicos, the importance of small-scale ua in improving the food security of practicing households is realized [174]
- despite the importance of animal husbandry in satisfying the protein needs of most Cubans, there is little support given by the government; support could come in the form of fodder or cages
- aside from providing food to producers' households, ua also provides pleasure and recreational value; the spaces used for ua are also considered an extension of the home, a representation of individual and family identities [174-175]
- it is important to be careful when it comes to omitting or ignoring certain forms of ua, as this could lead to an eventual disappearance of the practices; it is also important (if not the most important) to consider the realities and needs of ua practitioners themselves, for they're the ones sustaining ua [177]

Agriculture in the City

Introduction

- Cuba has traditionally relied on imported food to compensate for sugar cane production, which took up 30% of Cuba's arable land [3]

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- Cuba's 'special period', a time of economic crisis in the 1990s led to the decrease of the people's nutritional intake, as well as the disruption of government projects and services [3-4]
    - This pushed Cuba to find solutions, ua being one of them, and being an important component in restoring the basic nutritional requirements of the people [4-5]

Chapter 3

- The Cuban government was the major initiator of ua in 1989 by providing state-owned lands (vacant) to be used for ua for free; providing technical assistance and training; selling seeds and common tools; and building high-yield urban gardens [24]
    1. This was supplemented by the civil society organizations' support and collaboration with the government
- Direct forms of production of ua: [26]
    1. State farms for producers' consumption
        - Vacant lots outside of the city were given freely to workers to be farmed for self-provision on the conditions that no trees would be cut, no permanent structures built, and facilities blend with the landscape (lots were usually greater than 1 ha)
        - Surplus was sold among workers, to surrounding populations, or given to institutions (daycare, homes for the elderly, etc.) [27]
    2. Community gardens [30]
        - Available spaces in the city usually less than 1,500 m^2 used for direct consumption-oriented production
        - Called (a) plots or (b) intensive-cultivation gardens; (a) plots were usually less than 1,000 m^2 and worked by one person or family, while (b) intensive-cultivation gardens were on average between 1,000 m^2 and 3,000 m^2 worked by one or more families; both were either state-owned or private [31]
    3. Urban community gardens [32]
        - Land between 2,000 m^2 and 5,000 m^2 not suitable for direct agricultural use allocated to groups supported by specialized institutions
        - Raised beds are commonly employed due to poor soil quality in worked areas [34]
    4. High-yield urban gardens/Organoponico de Alto Rendimiento (OAR)
        - Plots greater than 1 ha and not commonly suited for ua
        - Specialized institutions were necessary to manage the requirements of these enterprises
        - Products are dedicated to the population
        - Size of each plot has decreased for purposes of efficiency and manageability [35]
    5. Fresh vegetable greenhouses [36]
        - Intended for high-yield fresh vegetable production and production of off-season crops marketed mainly to the tourism sector
        - Employed in areas with experienced farmers of fresh vegetables
- See pictured graphs pp.37-39 (in cp camera)
- Efficiency in descending order: (1) field workers (fresh vegetable greenhouses?); (2) urban community gardens; (3) intensive-cultivation gardens; (4) high-yield urban gardens; (5) state farms; (6) plot [39]

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- Support for ua production: [40]
    1. Organic matter production centers
        - Collect, process, and distribute organic matter to all ua production modes in the city
    2. Agricultural information offices [41]
        - Provides technical assistance and facilities, information dissemination and meetings with producers
    3. Seedling greenhouses [42]
        - Provides seedlings (mainly vegetables, some fruit trees) [43]
        - Requires financial and irrigation support
- Partnership modes among producers:
    1. Farmer groups
        - Started to share experiences and to find better self-managing capabilities
        - Not officially recognized (legally incorporated) [44]
    2. Agriculture-livestock production cooperatives and credit and service cooperatives [45]
        - Farmers join their lands and collectively manage the operation
        - CCS are legally incorporated and adhere to self-drafted by-laws
        - Legal procedures are simplified; options to facilitate sale of their products on their own premises or agri-livestock markets; priority in receiving agricultural input [46]
    3. Basic units for cooperative production
        - Legally incorporated and adhere to conditions given by government to work on freely given land [47]
- Benefits of ua to Havana and Cuba:
    - Food availability, particularly fresh vegetables [48]
    - Guaranteed organic products
    - City greening
    - Reduction/elimination of dumping grounds
    - Mitigation of unsanitary city conditions
    - Promotion of agricultural culture
    - Job generation (around 100,000)
    - Involvement of many actors from diverse backgrounds
    - Introduction to and understanding of other scales of agriculture [49]
- Weaknesses in ua-urban environment relationship [50]
    1. Lack of harmony between productive and constructed space; isolation of areas from each other; consideration for areas surrounding productive space is needed
    2. Insufficient research on effects of placing ua in city (ex. contamination of crops by motor emissions)
    3. Need to increase efficiency of ua aspects (yields, trade mechanisms, management systems) [50-51]
    4. Ua should be distinguished from rural agriculture due to different conditions and contexts; ua requires its own conceptual framework [51]
    5. Little attention given to obtaining and storing water within production units for irrigation [52]
    6. Organic matter used comes directly from sugar processing centers, livestock facilities (requiring transport) instead of tapping into community organic waste and promoting recycling and the use of local resources
    7. Information and training focus only on production function disregarding other areas of potential improvement
    8. (skip)
    9. Practitioners with no assurance of permanent access to their tended

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land think about the short-term (maximizing capital), disregarding sustainability [53]

Chapter 4

- Water used for irrigation of urban gardens and intensive cultivation gardens (total number of units in %) [61]
    - Water supply network system for the population – 38%
    - Wells – 29%
    - Reservoirs, dams, and mini-reservoirs – 28%
    - More than one source – 4%
    - Pipes (containers) – 1%
- Considerations for improving water sustainability of ua [62]
    - Development of techniques to reduce irrigation needs
    - Use of low-water consumption irrigation systems
    - Water reuse for irrigation
    - Promotion of and education about water conservation

Chapter 6 (see Parque Metropolitano de la Hebena Project)

Chapter 8

- The government of Havana established a provincial working commission tasked with developing ua with the following objectives: [161]
    - To set out main working lines for development
    - To define conditions to justify agricultural use of urban spaces
    - To create mechanisms to transfer responsibilities to grassroots bodies through a direct operations activity
- A workshop involving government and experts was held to address the issue of further institutionalizing ua to insert it into land management [165]
    - Questions were addressed (only most important points listed here):

1. Why insert ua into land management system? [166]
    - Ua is a significant and productive activity yielding positive results in Cuba
    - Ua should be linked with other urban components, should be controlled
2. What would be the basis for stating that ua should or must be regarded as an urban function? [167]
    - Ua should be regarded as a permanent function
3. As an urban function, where does the development and enhancement of ua begin?
    - The primary actors are the government and community, both having specific roles and gaining mutual benefits [168]
4. As an urban function, at what work scale should ua be undertaken and on what bases?
    - Large and medium scale in the city [169]
5. With what urban components might ua bring about a mutually beneficial relationship?
    - Tourism, housing, industry, education, community economy, water, energy, recycling, other (green mass, health) [169-170]
6. How can ua be included in the land management process? [171]

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- In the Cuban case, to include it in the Green System (under agricultural production) [172]

Cities Farming for the Future

Chapter 6

- Project 'Patio Comunitario', Havana [167]
  - Created in 1998, promotes permaculture designs [168-169]
  - Activities include: household food production in small domestic spaces (balconies, courtyards, etc.); domestic waste recycling into compost, feed, and planting receptacles; environmental education and community training, particularly of the youth; and healthy food fairs held every last Saturday of the month where vegetable dishes are prepared and lectures are held, among other activities

Chapter 7

- Subsistence farmers produce food for their own consumption, while family-type commercial farmers grow food mainly for income and opt to go for high-value and short-cycle crops (eg. Leafy vegetables) [176-177]
- Ua entrepreneurs operate at a larger scale than family-type commercial farmers, and employ salaried labor; meanwhile, multi-cropping peri-urban farmers are similar to rural farmers but differ in terms of markets, sources of incomes, level of intensification, and specialization [178]
- Most commercial farmers come from a non-agricultural background and have resources to operate commercially, but it is also possible to progress from subsistence farming to commercial with savings (read Keralta, et al., 'Urban irrigation methods…' 2003), municipal support, technical skill development, and credit provision [179]

Community gardens and city farms

CPULs

Chapter 11

- Community gardens and city farms are local, community-driven projects sometimes aided by local authorities [83]
  - Lots of volunteer work
- Benefits in terms of social participation [83-84]
  - Establishment of community-managed green space
  - Skills development of individuals
  - Building of social networks
  - Fostering public pride in the community
  - Community participation
- Community development contributions of community gardens and city farms: [84-85]
  - More green space
  - Formal and informal education opportunities
  - Food growing and animal care education
  - School involvement
  - Play and sport facilities
  - Help for people with special needs and backgrounds
  - Community business opportunities
- Local authorities' support is an important thing when it comes to establishing community-led projects [86-87]
  - This may come in the form of financial aid, land provision, or policies

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Organoponicos

CPULs

Chapter 17

- Organoponicos populares (urban community garden) [153]
    - High-yield and commercially run
    - Most conspicuous form of UA in Cuba
    - Smallest cultivated area is 500 m^2
    - Raised beds to separate crop soil from contaminated soil, and to control compost applications; this also makes it easier for workers to work, as it allows less bending when working [154]
- Nursery houses are located either within or outside UA sites, and provide seeds and plants
- Access paths and support buildings surprisingly take up considerable space within organoponicos
- Organoponicos are composed of alternating strips of paths (65 cm) and raised beds (120 cm) [158]
    - Dig 30 cm deep below beds and fill with rocks for drainage; surround beds with 20 cm high retaining walls then fill to the brim with soil
- Materials used for retaining walls of plant beds varied from site to site; bed edging was either loosely installed or permanent; all were made from recycled materials
- UA sites are fenced in a variety of ways, depending on the site
- Crops planted in 10 studied organoponicos: [161-179]
    - Avocado pears
    - Furrows for beans
    - Pumpkins (3)
    - Banana tree (2)
    - Aloe Vera (2)
    - Peas
    - Fennel
    - Radish
    - Beans (5)
    - Medicinal crops
    - Hibiscus (2)
    - Parsley
    - Chives (3)
    - Chilies
    - Herbs
    - Tomatoes (8)
    - Cabbage (2)
    - Onions (5)
    - Lettuce (7)
    - Maize (2)
    - Leeks
    - Rocket
    - Peppers
    - Aubergines (3)
    - Cauliflower
    - Carrots (2)
    - Okra beans (2)
    - Coriander (2)
    - Irises
    - Poppies
    - Daisies
    - Beet root
    - Potatoes
    - Garlic
    - Mint
    - Spinach
    - Citrus trees
- Planting bed wall materials in the studied organoponicos [180-183]
    - Concrete test cores
    - Precast concrete slabs (pcs)/steel rebars
    - Pcs/hollow blocks
    - Hollow terracotta bricks
    - Pcs/terracotta bricks
    - In situ concrete walls
    - Pcs/concrete blocks
    - Pcs/ in situ concrete corner
    - Plastic ‘grow’ bags
    - Rough cast concrete slabs
    - Pcs/steel stool logs
    - Natural stones
    - Interlocking terracotta roof tiles
    - Stone and crushed concrete
    - Precast concrete beam/concrete blocks
    - Rough cast concrete/in situ concrete
    - Precast concrete/ in situ concrete
    - Terracotta roof tiles
    - Crushed concrete and brick
    - Rubber tyres
    - Lime washed stones

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- Crushed concrete
- Precast concrete columns

Community-based urban agriculture

Cities Farming for the Future

- Community-based urban agriculture (CBUA) [146-147]
  - Social organization that focuses on creating stronger urban communities [146]
  - Vehicle for a more grassroots form of community development granting a sense of accomplishment, inclusion, and dignity to its practitioners [147]
- CBUA can be distinguished from other forms of proactive ua such as: (1) subsistence farming; (2) entrepreneurial, market-oriented; (3) leisure or recreational gardening
  - CBUA focuses intentionally on building communities through social interaction and cooperative operation of urban agriculture
- Community supported agriculture (CSA) [148]
  - Farmer sells "shares" to investors who pay at the start of the growing season; investors receive a steady supply of the harvest
  - Creates a relationship between farmer and consumer, as well as encourages stakeholders to participate in farm work
- CBUA allows community members to get their food directly, without going through the formal economy; social ties allow for transactions through barter, for example
  - This brings about savings and food security, and allows allocating resources to other family needs; communities are able to achieve community goals through this way
- 7 dimensions of community capital found within CBUA activities [151-155]

1. Human capital [151]
   - Health, education, skills of individuals involved
   - CBUA improves a community's food security and nutrition; activities also serve to educate and train participants
2. Social capital
   - Strength of groups and networks, linking of different groups
   - Urban farming allows communities to have social cohesion and interaction
   - CBUA is distinguished by its potential to generate groups able to manage their projects
   - See Aspen farms (USA)
3. Political capital [153]
   - Nature of group organization, relationship to government authorities
4. Cultural capital
   - CBUA allows communities to produce their traditional cultural products and tap into their heritage
5. Economic capital
   - Ua serves as a stable source of income for practitioners [154]
   - While beneficial to individuals, CBUA can also benefit entire communities, offering many opportunities for community-run economic activities
6. Built capital
   - Ua creates infrastructure that benefit individual practitioners and communities alike
7. Natural capital [155]
   - CBUA employs sustainable project management such as composting and solid wastes and wastewater reuse; this is

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accompanied by education of the community

- Development continuum (see image) [162]
    - Step-by-step development continuum for community-based agriculture
    - Identify phases of farming projects: survival, subsistence, livelihood, and commercial; allowing participants to know in which stage they are and want to progress to

Edge development

CPULs

Chapter 17

- Thick edge – separates public and private space while accommodating different occupations (ex. play, picnics, etc.) [184]
- Dual nature edge – building on UA site's edge offers two views: urban and rural [185]
- Thin edge – a wall between UA and a building serves to simultaneously separate and join the two areas; the wall provides two sides: urban and rural [186]
- Topographical edge – the landscape and ground surrounding UA sites offer different heights of view into the UA site (higher, same, or lower level) [187]

Composting

CPULs

Chapter 12

- Composting options include on-site: home composting, community composting, and on-farm composting; centralized composting: open-air systems, in-vessel [90]
- Compost contains nutrients and microbes, and improves the structure and health of the soil [92]
- Compost supply should be taken advantage of, as it is more than enough to provide for both domestic, park, and agriculture use

Agropolis

Chapter 7 (Rosario, Argentina)

- Vermiculture is a viable technology for organic waste processing at a small to medium scale [194]
    - It is of low cost and simple handling, easily acquirable by those with little financial resources
- Vermiculture was able to increase the quantity and weight of fruits of tested tomato plants
- Vermiculture training raised waste management awareness, led the community to form a working group, and led them to propose various activities such as processing organic waste and recycling [195]

Cities Farming for the Future

Chapter 8

- Urban waste could be solid or liquid, organic or inorganic, recyclable or non-recyclable [210]
- Biodegradable wastes make up a considerable portion of urban waste
    - The high content of organic matter holds opportunities for composting [211]
- Common forms of organic waste: solid waste; horticultural and agricultural; agro-industrial; and sludge and bio-solid
- Landfills, incineration, and recycling or reuse are ways to manage solid waste [212]
- Developing nations lack properly engineered landfills and incinerators
    - Common waste disposal involves unregulated landfills and open dumps
- Agenda 21 provides a waste management hierarchy:
    - Minimizing wastes

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    - Maximizing environmentally sound waste reuse and recycling
    - Promoting environmentally sound waste disposal and treatment
    - Extending waste service coverage
- *read more on Integrated Waste Management (IWM)
- Composting involves decomposers (microorganisms, fungi, invertebrates) to break down organic waste materials into compost used for various purposes like gardening, landscaping, and farming
- Large scale centralized composting proved to be unsuccessful due to costs and energy demand of transporting organic wastes to centralized sites [212-213]
    - Application in developing countries has also been ineffective as a result of lacking operation know-how and limited resources, most of which are focused on waste collection and safe disposal [213]
- Composting of organic wastes as close to the source as possible is the ideal practice, be it decentralized on-site (for commercial organic waste) or on-plot (for domestic organic waste)
- Benefits of organic waste recycling include reduction of waste transported to landfills, production of soil amendment, flexibility of application at different scales, optimal climate of developing countries for composting, etc. [214-215]
- Constraints of organic waste recycling include lack of vision and marketing plans for compost, lack of finances to cover processing, transportation, and application costs [215]
    - Poor coordination between institutions and stakeholders also hinders composting projects; as well as poor study of relevant factors such as transport costs, uses, demand, etc. [216]
- Factors to be considered include facility type, optimal number, capacity, and location of compost stations per city; it's also critical to identify possible composting methods as well as supply and demand
- Composting could be aerobic, anaerobic, or an alternation of the two; anaerobic is not preferred for ua due to strong odors and inability to destroy harmful pathogens
- Factors affecting biological decomposition: (these 6 entries taken from nutrient recycling loop) [219]
    - Carbon-nitrogen ratio
    - Moisture content
    - Oxygen supply, aeration
    - Particle size
    - pH
    - temperature
    - turning frequency
    - microorganisms and invertebrates
    - control of pathogens
    - degree of decomposition
    - Nitrogen conservation
- Technology to be employed for aerobic composting depends on location of facility, available capital, waste type and amount
- Two types of systems (aerobic):
    1. Open systems
        - Windrow, pile or heap composting (material piled up in heaps called windrows)
        - Bin composting (material contained on 3 or 4 sides)
        - Trench and pit composting (heaps contained partly or fully under soil)
    2. Closed "in-vessel"/"reactor" systems
        - Static or movable closed structures
- Aerobic composting could last from a few weeks to 3-4 months
- Effective microorganisms (EM) and vermiculture are emerging trends that accelerate the composting process; vermiculture uses worms to digest organic waste into humus, and in some cases modify soil structure [220]
- Vermiculture is suited to ua because of its applicability in different settings and scales

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- Health concerns from the recycling of urban waste include the presence of pathogens and heavy metals, respiratory problems from dust and gases, and injuries from stray sharp fragments [222]
- Safety precautions can be employed to minimize health hazards: compost workers should be equipped with gear such as masks, gloves, and boots; they should be trained to safely handling wastes; washing and first aid facilities must be provided; and final compost must be inspected for presence of pathogens
- Chemical contamination may occur when organic waste is stored with other wastes that contain chemicals
    - There is, however, little evidence of crop contamination through compost [223]
- Composting is hindered in developing countries by the following:
    - Insufficient technical know-how to produce quality compost
    - Lack of markets and marketing strategies and skills
    - Ignoring externalities such as reduced soil erosion, reduced water pollution, and avoided disposal costs
    - Lack of government support for decentralized composting
- More research is needed on the following areas:
    - Proper segregation methods at the source or sorting procedures
    - Marketing strategies and institutional framework
    - Regulatory frameworks and realistic standards for compost use
- Urban organic waste recycling brings ecological advantages and energy efficiency [224]
    - The supply in urban centers must be taken advantage of
- See Figure 8.5 for detailed questions to guide compost stations [227]

Nutrient Recycling Loop

<u>Cities Farming for the Future</u>

Chapter 8

- The Nutrient Recycling Loop involves the different stages and elements of the composting system and shows their relationship with each other (Drechsel, et al., 2002) [216]
    - The goal is that each stage and element in the process is accounted for through studies/assessment
    - It begins with "Urban Consumption and Waste Generation", then moves on to "Waste Processing", then to "Compost Demand"; linking the demand and processing segments is an economic analysis of "Economic Viability, Marketability and Distribution"; the final element is the "Legal, Institutional and Communal setting" present throughout the cycle
        - See Figure 8.3 for diagram [217]

1. The supply of organic waste
    - Supply studies should focus on types, amounts, quality, current and possible uses, value and availability of organic wastes for composting
    - The availability of composting is not an issue; in fact, agriculture currently cannot absorb all compost supplies (Tessier, A. 2004) [217-218]
2. The demand for waste-derived compost [218]
    - Identification and characterization of potential users is needed while considering their willingness (and ability) to pay (WTP)

        - Landscape designers and real estate developers are expected to be sources of major demand from expanding cities; the latter were shown to be willing to pay higher for compost, something to consider
        - Farmers seek compost for its growth enhancing effect and soil amelioration
    3. The process of waste composting (go to Composting for details)
    4. Economics of waste composting
        - Economic analysis links the supply, demand, and process of composting, showing the viability of a compost station
        - An analysis was done in Accura, and showed that the cost of building and operating compost facilities is much lower than that of incineration and landfills
    5. Legal, institutional, and communal settings
        - These factors affect the establishment and maintenance of compost stations, and dictate the roles and contributions of various stakeholders
        - This also involves environmental and sanitation bylaws and policies, as well as public awareness and perceptions of authorities about composting

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Composting case studies

Cities Farming for the Future

Chapter 8

- Marilao, Philippines [230]
    - Marilao was faced with the problem of increasing waste and decreasing land; to address this, the lgu decided to cooperate with the community and NGOs
        - They decided to acquire existing organic wastes (almost 50%) from the landfill, and to start a segregation initiative at the household level, which proved successful, and expanded to other areas [231]
    - The NURTURE (Networking for Urban Renewal Through Urban Ecology) Plan was established to address growing demand for compost and related information [232]
    - The Marilao case shows the importance of political will in mobilizing NGOs and the community for a common cause [233]
- Kumasi, Ghana [234]
    - Container composting methods were tried in Kumasi
        - Container composting is appropriate for urban and peri-urban agriculture, which are practiced in close proximity to settlements; advantages include protection of organic material from external elements, low odor emissions, etc.
        - See Table 8.2 for advantages and disadvantages
    - Containers can be constructed from various materials; space required is about 1.5-2 m^2 per household, with additional working space around [235]
    - Fundamental design principles include:
        - Pile compost directly on ground soil for drainage and microbial contact from soil [236]

        - Provide means of aeration in container walls
        - Use covers to close containers at night and regulate compost during the day
    - Initially, the experiment was a success with growing participation; however, gradually, motivation waned; this changed when training and support in entrepreneurial skills related to compost marketing was provided
        - Composting programmes success depends more on intensive care and know-how of the individual than composting method or container
    - Container composting in Kumasi was implemented successfully as a result of commitment of the stakeholders to see through all stages of the program and provide constant support and training to the locals [236-237]
- Nairobi, Kenya [238]
    - Community-based organizations (CBOs)/self-help groups practice composting mainly to generate income and secure self-employment, but also to contribute to environmental management of the wastes problem
    - Different types of organic waste are used, but result to poorer quality compost than cattle manure; this is mainly due to a lack of training or application of formal training skills in some cases, and the lack of space [239]
    - Marketing of compost is not successful due to high prices only big businesses and farms could afford, and lack of transparency regarding the compost source
        - Farmers also part of the CBOs were mainly the only buyers of the compost

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Wastewater

Cities Farming for the Future

Chapter 9

- Continuing rise in population, particularly in cities, have 2 effects: [244]
    1. Increase in wastewater produced as a consequence of greater volumes of water diverted to cities
    2. Increase in urban demand for food
    - These trends will make wastewater recycling much more of a reality in the future of farming
- Despite a large part of freshwater dedicated to agriculture (70%) currently, the increasing competition with other sectors will make water even scarcer for agriculture [245]
    - Water reuse will gain greater viability as these changes occur
- Cities are not able to cope with the increasing volume of wastewater [246]
- Water treatment is expensive, so most of the wastewater is let go to natural water bodies
- Van der Hoek (2004) has developed a typology of wastewater uses; it provides 3 categories: [247]
    1. Direct use and application of untreated wastewater from a sewage system onto land
    2. Direct use of treated wastewater channeled to a particular area for irrigation
    3. Indirect use of wastewater that has been diverted into a natural body of water
    - See Figure 9.2 for diagram of typology [248]
- Wastewater use for irrigation already contributes to a lot of agricultural

production, particularly in Pakistan, India, Vietnam, China, Mexico, and Jordan; its use covers large tracts of agricultural land

- Wastewater users come from a variety of backgrounds and have various motives for wastewater use for irrigation: [249]
    - Only available water in sufficient quantities in dry areas
    - Available year round, even outside the rainy season
    - Inexpensive source of water and nutrients; allows for less use of fertilizers, and greater crop yields resulting to bigger earnings
    - Proximity to fields, easy to channel/transport
- Wastewater reuse contributes to health by irrigating crops and livestock feed, both important aspects of livelihood—important for income and access to food [250]
- The use of wastewater for agriculture puts workers, their families, nearby residents, and consumers at risk of negative health impacts:
    - Direct contact with wastewater makes one more vulnerable to helminth infection (roundworm, whipworm, and hookworm)
    - Consuming crops irrigated with wastewater raw can lead to various diseases such as cholera, typhoid, dysentery, etc.
    - Municipal and industrial wastewater contain harmful chemical pollutants
    - *see Box 1 (p. 251)
- Strategies for managing health risks provided by "Guidelines for Wastewater Use in Agriculture" (from draft WHO report 2005):
    1. Wastewater treatment
        - Secondary treated water must be supplemented by tertiary treatment (disinfection) or retained in a maturation pond for five more days [251]
        - *read examples: "Prevention today, solutions tomorrow…" 'Urban Agriculture Magazine No. 8' pp. 37-38 (Calizaya); "Wastewater-fed Fisheries…" 'Urban Agriculture Magazine No. 10' p. 37 (Mukherjee)
    2. Choice of irrigation techniques [252]
        - Provide 50-100 m buffer zones from houses or roads for sprinklers/spray irrigation
        - Bubbler/drip/trickle irrigation offers the best health protection, although expensive
    3. Crop selection
        - Non-edible crops or crops cooked before eating are safe to be wastewater irrigated
        - Crops close to the ground should be kept away
    4. Human exposure control
        - Employ appropriate irrigation techniques such as bed and furrow cultivation
        - Protective wear for workers (gloves and boots); sanitation facilities
        - Use clean water in markets to wash produce; thorough washing and cooking of products
- Farmers employ strategies to maintain or increase yields and income, and to lower health risks: mixing or alternating use of water and wastewater (which increases yield while decreasing pest attacks), and switching to crops more suited to wastewater irrigation [252-253]
- Ecological sanitation makes use of and optimizes human excreta by extracting nutrients from them (which add up to exactly what amount of nutrients his or her food needs) [253]
    - Urine can be separated from feces and diluted with water to serve as fertilizer

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    - Feces, once desiccated (dried out), are free from pathogens and odor, and can then be used as a soil conditioner
    - Excess greywater can be used for irrigation and aquifer recharge
- It is important to consider the perceptions of farmers who carry out activities related to wastewater irrigated crops about wastewater
    - This is to identify their needs
- It is important to educate the various involved groups about wastewater farming to reduce the health risks associated with the practice (see Fig. 9.3) [255]
- The success of the livelihoods of urban farmers and wastewater users depends on multi-stakeholder communication and cooperation
- Middle Eastern and North African countries [264]
    - To address the increasing water scarcity brought about by population growth and urbanization in the region, some countries have begun using treated domestic wastewater for industry, for certain municipal uses like flushing and irrigating green spaces, but more importantly, urban and peri-urban agriculture (UPA)
    - Advantages of using treated wastewater include:
        - Conservation of high quality and expensive fresh water for drinking
        - Preservation and protection of existing fresh water sources, the environment, and public health; it also allows aquifer recharge
        - Managed properly, treated wastewater can be superior to fresh water for agriculture; there is stable supply, nitrogen and phosphorous for higher yields (less fertilizer needs)
    - Israel, Tunisia, and Jordan, aside from treating wastewater like their neighboring countries, practice wastewater treatment and reuse (WWTR) as a part of water management and environmental protection strategies
        - Wastewater reuse in these countries is planned at the national level, and done with coordinating agencies [265]
    - A project in Jordan by IDRC's research partners involved the reuse of greywater for plant irrigation
        - Greywater is harvested at the local level and diverted through minor plumbing modifications and natural filters
        - 25 houses were included in the initial phase, but more households followed suit after the success of the project [265-266]
        - The Inter-Islamic Network on Water Resources Development and Management (INWRDAM) further developed the original design, working on the filters and environmentally –friendly dishwashing liquid that prevents soil salination [266]

Additional readings

CPULs

'Urban Agriculture: Food, Jobs and Sustainable Cities' (Jac Smit) [57]

Cities Feeding People

FAO hydroponics manual (Marulanda and Izquierdo, 1993) [106]

Schilter, 1991 [109]

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Agropolis

'Optimizing use of vacant space for urban agriculture through participatory planning processes' (Dubbeling, 2004) [12]

Read case study

- Municipality of Rosario, Argentina: multifunctional use of green areas combining recreation, education, and food production; see also Ecuador and Peru [12]

'Ecological Sanitation Closing the Loop', UA Magazine vol. 1, no. 3, March. Pp 35-37 (Esrey and Andersson, 2001) [12]

Quito Declaration [13]

Cities Farming for the Future

See Xiaotangshan town [80]

Civic agriculture (Thomas Lyson, 2004) [147]

Aspen farms (Spirn, 1998) [151]

Farming Inside Cities (Jerry Kaufman, et al.) [171]

Entrepreneurial Community Gardens (David Campbell, et al.) [171]

'The status of vegetable consumption…' (Potutan, et al., 1999) [177]

'Urban Agriculture in Cagayan De Oro…' (Potutan, et al., 2000) [177]

Integrated Waste Management [212]

"Prevention today, solutions tomorrow…" 'Urban Agriculture Magazine No. 8' pp. 37-38 (Calizaya) [251]

"Wastewater-fed Fisheries…" 'Urban Agriculture Magazine No. 10' p. 37 (Mukherjee) [251]

Urban Agriculture – A Step-by-Step Guide To Successful Container Gardening in the City (Undan, et al. 2002) [298]

Coche, A.G. 1982, Cage culture of Tilapias. Pp. 205-246. In: Pullin and Lowe-McConell (Eds.), 'Biology and Culture of Tilapias', Metro Manila, Philippines. International Centre for Living Aquatic Research Management [383]

Mara, D.D., et al. 1993. "A rational approach to the design of wastewater-fed fishponds. 'Water Research' 27 (12): 1797-1799 [387]

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