Urban Agriculture

A Participatory, Primer Course
Part 1b: Production Systems

2017-18 Urban Ag Certificate Course

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Ag/Natural Resources Extension Agent
UF/IFAS Extension Sarasota County
Urban Ag Production Systems
Urban Ag Production Systems

Urban Ag Production Systems

Production Techniques

- Starting small
  - Tremendous amounts of vacant urban space

- Developing markets
  - Tremendous opportunities in niche markets

- Farming in urban soils
  - A system to match any soils

https://www.slideshare.net/edwinmarty/southern-sawg-what-is-urban-farming-2014
In-ground Raised beds

- **Advantages**
  - Low cost and easy to build with correct equipment
  - Improve drainage, aeration and concentration of fertility

- **Challenges**
  - Time consuming to build without proper equipment
  - Lose some planting area to pathways and bed shoulder
  - Soil must be tested!
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Farming In-Ground

Biointensive (i.e., “Double digging”) Farming

Watch video at http://youtube.com/watch?v=jx9pM9tPOWM&feature=related

Seven features of Jeavons’ Biointensive:
- Permanent double-dug beds
- Compost for soil fertility
- Hexagonal close-packed planting
- Companion planting in time & space
- Carbon-efficient crops
- Calorie-efficient crops
- Open-pollinated seeds

http://www.growbiointensive.org/
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- Farming In-Ground
- Permaculture Farming

Videos available at https://www.youtube.com/playlist?list=PLEgB--CmfB1V5hKTRS1xyPjpts3F4cpwl
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Wood/ Metal raised beds

- **Advantages**
  - Improve drainage, aeration and concentration of fertility
  - Easy to harvest
  - Match aesthetics of site

- **Challenges**
  - Time consuming/expensive to build.
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Cinderblock raised beds

- Advantages
  - Excellent drainage, aeration and concentration of fertility
  - Much easier harvest and maintenance

- Challenges
  - Time consuming/expensive to build w/o proper equipment
  - Lose some planting area to width of cinder block
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Container gardening

- **Advantages**
  - Excellent drainage and concentration of fertility
  - Easy to harvest and maintain
  - Can get pots for free

- **Challenges**
  - Need greenhouse or covering
  - Must be watered frequently

[https://www.slideshare.net/edwinmarty/southern-sawg-what-is-urban-farming-2014](https://www.slideshare.net/edwinmarty/southern-sawg-what-is-urban-farming-2014)
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Greenhouses/ Hothouses

- **Advantages**
  - Increases season
  - Control moisture level in soil

- **Challenges**
  - Expensive to build and maintain
  - Must be watered frequently
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Edible Landscaping

https://www.slideshare.net/GreenDrinksChina/urban-farming-trends
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Rooftop Farming

- Where: Manhattan Warehouse Rooftop
- Size: 6,000 square feet.

On the shoreline of the East River and with a sweeping view of the Manhattan skyline, Eagle Street Rooftop Farm is a green roof organic vegetable farm.

https://www.slideshare.net/GreenDrinksChina/urban-farming-trends

https://www.slideshare.net/GreenDrinksChina/urban-farming-trends
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Use Urban Farming Technologies to Supplement Traditional Farming – Agricultural Revolution

- Hydroponics
- Vertical Farming
- Aquaponics

https://www.slideshare.net/ReneHubbard/technology-in-urban-farming-techniques
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‘Living Walls’ Hydroponics

A freestanding central greenhouse serving as a growing and retailing area (pick your own)

http://www.urbangardensweb.com/2013/01/05/urban-vertical-farm-and-pick-it-yourself-market/
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Here Are Some Short Videos of Vertical Farms

• An urban farming aquaponics project – see http://pittsburgh.cbslocal.com/2016/10/12/aquaponics-lab-debuts-in-pittsburgh-as-urban-farming-project/

• An urban vertical farm that uses no soil and 95% less water compared to conventional farming – see https://www.youtube.com/watch?v=-tvJtUHnmU
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Diversified Small Scale Farm Example

https://www.slideshare.net/RobSmart5/concept-of-urban-farming
Urban Ag Production Systems

“Growing Power - A Model for Urban Agriculture in Milwaukee”

- A short video of a large scale urban farm that integrates vegetables, herbs, fruit and aquaculture production

See this video at https://www.youtube.com/watch?v=vs7BG4IH3m4
### Table 7: Production Practices and Structures Used on Urban Farms, 2013 National Survey of Urban Farms

<table>
<thead>
<tr>
<th>Practices/Structures</th>
<th>Frequency</th>
<th>Percent of Respondents</th>
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<td>Raised beds</td>
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<td>Hydroponics</td>
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<td>Rooftop farming</td>
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</table>
2013 National Survey of Urban Ag Commercial Farms Profile

“Production Risks”

2013 National Survey of Urban Ag Commercial Farms Profile

“Other Challenges”

Crop Production
General Planning Steps

✓ Use planting guide for information
  - vegetables & cultivars suited to Florida gardens
  - planting distances and depths
  - planting dates by areas and hardiness
  - days to harvest and expected yields

✓ Design the urban farm to meet your food production goals (fresh, canning, selling, etc)

✓ Select a location of good, well-drained soil with adequate water supply/quality and sunlight
Crop Production
General Planning Steps (Cont.)

✔ Soil preparation with amendments
  ▪ Compost/organic matter for soil life
  ▪ liming and minerals additions according to soil tests

✔ Irrigate according to crop needs
  ▪ use best management practices
  ▪ learn critical growth stages
Crop Production
General Planning Steps (Cont.)

✔ Weed control
  ▪ shallow cultivation and hoeing of small weeds are advised due to soil weed seedbank
  ▪ use mulch to suppress weeds

✔ Insect & disease control
  ▪ plant resistant & disease/pest-free varieties
  ▪ practice integrated pest management (IPM)
Crop Production: Seasons

<table>
<thead>
<tr>
<th>Crop</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
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<td>Sweet Corn</td>
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<td>Watermelon</td>
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www.Florida-Agriculture.com
Crop Production Factors

Core Management Topic Areas:

- Location
- Season
  - Temperature
  - Photoperiod
- Water
- Soil
- Crops
- Pests
Location: Site Selection Factors

• Light (photoperiod) 
  ≥ 6 hours

• Proximity to Trees, Shrubs, & Buildings
  – Shade
  – Nutrient competition

• Air / Water Drainage
<table>
<thead>
<tr>
<th>Crop</th>
<th>Shade Notes</th>
<th>Growing Tips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arugula</td>
<td>At least three to four hours of sun per day.</td>
<td>Arugula welcomes shade, as this crop is prone to bolting as soon as the</td>
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<td></td>
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<td>weather turns warm if in full sun.</td>
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<tr>
<td>Asian greens</td>
<td>At least two hours of sun per day.</td>
<td>Asian greens such as bok choi (also spelled “pac choi” and “pak choi”),</td>
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<td>komatsuna and tatsoli will grow wonderfully with a couple hours of sun plus</td>
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<td></td>
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<td>some bright shade or ambient light.</td>
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<tr>
<td>Chard</td>
<td>If you grow chard mainly for its crisp stalks, you will need at least</td>
<td>Expect chard grown in partial shade to be quite a bit smaller than that</td>
</tr>
<tr>
<td></td>
<td>five hours of sun per day; if you grow it mainly for the tender baby</td>
<td>grown in full sun. Baby chard leaves are excellent cooked or served raw in</td>
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<td></td>
<td>leaves, three to four hours of sun per day will be enough.</td>
<td>salads.</td>
</tr>
<tr>
<td>Culinary herbs</td>
<td>At least three hours of sun per day.</td>
<td>While many culinary herbs need full sun, chives, cilantro, garlic chives,</td>
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<td>golden marjoram, lemon balm, mint, oregano and parsley will usually</td>
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<td>perform well in shadier gardens.</td>
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<tr>
<td>Kale</td>
<td>At least three to four hours of sun per day.</td>
<td>You’ll notice only a small reduction in growth if comparing kale grown in</td>
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<td>partial shade with kale grown in full sun.</td>
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<tr>
<td>Lettuce</td>
<td>At least three to four hours of sun per day.</td>
<td>Lettuce is perfect for shadier gardens because the shade protects it from</td>
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<td>the sun’s heat, preventing it from bolting as quickly. Often, the shade can</td>
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<td>buy a few more weeks of harvesting time that you’d get from lettuce grown</td>
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<td>in full sun.</td>
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<tr>
<td>Mesclun</td>
<td>One of the best crops for shady gardens. Grows in as little as two hours</td>
<td>The delicate leaves of this salad mix can be harvested in about four weeks,</td>
</tr>
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<td>of sun per day and handles dappled shade well.</td>
<td>and as long as you leave the roots intact, you should be able to get at</td>
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<td>least three good harvests before you have to replant.</td>
</tr>
<tr>
<td>Mustard greens</td>
<td>At least three hours of sun per day for baby mustard greens.</td>
<td>Mustard grown for baby greens is best-suited for shady gardens.</td>
</tr>
<tr>
<td>Peas and beans</td>
<td>At least four to five hours of sun.</td>
<td>If growing these crops in partial shade, getting a good harvest will take</td>
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<td>longer. Try bush and dwarf varieties rather than pole varieties.</td>
</tr>
<tr>
<td>Root vegetables</td>
<td>At least four to five hours of sun per day for decent production.</td>
<td>Beets, carrots, potatoes, radishes and turnips will do OK in partial shade,</td>
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<td>but you’ll have to wait longer for a full crop. The more light you have,</td>
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<td>the faster they’ll mature. Alternatively, you can harvest baby carrots or</td>
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<td>small new potatoes for a gourmet treat that would cost an arm and a leg at</td>
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<tr>
<td>Scallions</td>
<td>At least three hours of sun per day.</td>
<td>a grocery store.</td>
</tr>
<tr>
<td>Spinach</td>
<td>At least three to four hours of sun per day.</td>
<td>This crop does well in partial shade throughout the growing season.</td>
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<td>Spinach welcomes shade, as it bolts easily if in full sun. If you grow it</td>
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<td>specifically to harvest as baby spinach, you’ll be able to harvest for quite</td>
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<td>a while as long as you continue to harvest the outmost leaves of each plant.</td>
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</tbody>
</table>

http://www.motherearthnews.com/organic-gardening/shade-tolerant-vegetables-zm0z1zst0.aspx#axzz3AxtpQr5y
Location: Temperature Differences

*Home Site Example*

- **Warmest areas**
- **Coldest area**
- **Moderately warm area**

- **South**
- **West**
- **East**
- **North**
Location: Air/Water Drainage

- Low-lying areas are subject to unseasonable frosts & water-logged soils.
- South-facing slopes warm more quickly.
- Wind protection is desirable in ‘wind tunnel’ situations:
  - Prevents physical damage to plants.
  - Reduces water loss.
  - Preserves heat that may be lost through transpiration.
Temperatures: Growing Zones

- USDA Plant Hardiness Zone Map
Temperature: Crop Requirements

- **Cool season crops**
  - Develop best <50°F
  - Tolerate frost.
  - Quality deteriorates under warm conditions.
  - Peas, spinach, cole crops

- **Warm season crops**
  - Develop best at temps >50°F.
  - Killed by frost.
  - Beans, tomatoes, peppers, eggplant, sweet corn, cucurbits.
Temperatures: Growing Zones

2012 USDA Plant Hardiness Zone Map

We are here

http://centralfloridagardening.com/page/2/
Temperature: Growing Zones

UF/IFAS Vegetable Planting Guide

http://edis.ifas.ufl.edu/pdffiles/VH/VH02100.pdf
http://centralfloridagardening.com/page/2/
Temperature: Growing Zones

- **AHS Heat Zone Map**

http://www.ahs.org/gardening-resources/gardening-maps/heat-zone-map
Temperature: Growing Zones

- AHS Heat Zone Map

We are here

http://www.nettally.com/skinnerd/zone2.htm
Photoperiod: Effects on Crop Growth

• Increasing or decreasing day length affects
  – Flower initiation
  – Bulbing & tuber development

• Short day plants:
  – Sweet potato

• Long day plants flower when light exceeds a certain number of hours.
  – Lettuce
  – Spinach
  – Radish

• Day neutral plants – flowering not related to light
  – Cucumber
  – Beans
  – Peas
  – Peppers
Water: Average Rainfall

Average Annual Precipitation

Florida

Legend (in inches)
- Under 50
- 50 to 52
- 52 to 54
- 54 to 56
- 56 to 58
- 58 to 60
- 60 to 62
- 62 to 64
- 64 to 66
- 66 to 68
- Above 68

We are here...
Water: Seasonal Crop Usage

- Florida Automated Weather Network Resource
  - Evapotranspiration data
  - Freeze warnings
  - Temperature data and forecasts
## Water: Seasonal and Growth Crop Stage Use Comparison

Average water use for **CABBAGE** in inches/day.

<table>
<thead>
<tr>
<th>Month</th>
<th>Small plants</th>
<th>Growing plants</th>
<th>Head development</th>
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<tbody>
<tr>
<td>Aug</td>
<td>0.05</td>
<td>0.07</td>
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<td>Sep</td>
<td>0.04</td>
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<td>May</td>
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Approximate weeks after planting

- Aug: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
- Sep: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
- Oct: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
- Nov: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
- Dec: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
- Jan: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
- Feb: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
- Mar: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
- Apr: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
- May: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Water: Quality

Southern Water Use Caution Area
Salt Water Intrusion

Soils: Types & Distribution Map

We are here
Overview of Florida Soils

- Very diverse array – sands, mucks, marl, and rock-plowed
- ALL used in horticulture
- Represent contrasting media for plant propagation
- Marked differences even among sandy soils
- Seven soil orders occur here

1. Spodosols: Well-expressed Bh
2. Entisols: Only A, E, Bw, or C Within 2 meters depth
3. Ultisols: Bt or Btg with low base status
4. Histosols: ≥12% organic C to ≥40 cm depth
5. Alfisols: Bt or Btg with high base status
6. Mollisols: Thick dark A horizon with high base status throughout profile
Urban soils range from slightly disturbed to completely man-made. Sand, gravel & clay are mined and used as important materials for many purposes, such as constructing foundations, leveling, filling, shaping, draining & compacting building sites. Urban soils present unique challenges to horticulturalists, landscape architects, engineers and urban planners.
Crops: Types

- A wide variety of foods can be grown in SW Florida
- You need to be aware of limitations
  - Varieties
  - Diseases
  - Insects
  - Climate
  - Soil
Crops: Vegetable Categories for SW Florida

- **Temperate**
  - Broccoli

- **Subtropical**
  - Sweet Potato

- **Tropical**
  - Amaranth
Crops: Fruit Categories for SW Florida

- **Temperate**
  - Nectarine
  - Muscadine Grape

- **Subtropical**
  - Guava
  - Lychee

- **Tropical**
  - Mango
  - Sapodilla

http://trec.ifas.ufl.edu/fruitscapes/
Crops: Herb Categories for SW Florida

- **Temperate**
  - Comfrey

- **Subtropical**
  - Sweet Basil

- **Tropical**
  - Chinese Chives
Crops: Edible, Native & Cut Flowers

• Expand your crop list to include flowers
  – Sunflower
  – Celosia
  – Zinnia
  – Snapdragon
  – Nasturtium
  – Sweet pea
  – Coreopsis
  – Black-eyed Susan

http://solutionsforyourlife.ufl.edu/lawn-and-garden/flowering-plants/

http://gardeningsolutions.ifas.ufl.edu/plants/ornamentals/edible-flowers.html
Crops: Edible Natives for SW Florida

Elderberry

Red Mulberry

Plum Flatwoods

American Persimmon

http://gardeningsolutions.ifas.ufl.edu/plants/ornamentals/native-plants.html

http://nbbd.com/edibleplants/
2013 National Survey of Urban Ag Commercial Farms Profile

“Crops”

Crop Production: Diversification - Benefits -

• Increased resource efficiency
  – nutrients, water, space, equipment, etc

• Crop synergisms
  – e.g., enhanced pest and disease control

• Expanded growing and harvest seasons

• Exploit profitable niche markets

• Reduced risks of production

• Promote local ag economic development

• Enhanced agroecosystem sustainability
Crop Production: Diversification - Challenges -

- Market development. Expect to conduct substantial research.
- Information on varietal performance, best management practices and post-harvest handling and storage may be hard to find.
- Seed selection may be limited and plant establishment may be difficult.
- Pest management information for alternative crops may not be available.
- A need to modify or replace equipment. Consider that hand labor may occasionally be the only viable option.
Crop Production: Diversification

- Challenges -

- Harvesting, post-harvest handling and storage considerations, with possible additional costs.

- Locating local businesses and infrastructure for handling, transporting, processing, storing and marketing.

- Price swings for alternative crops.

- Contracts. Sometimes contracts are not available for alternative crops every year – or at all.
Crop Production: Diversified Production Examples

Strip Cropping of Vegetables

Permaculture

http://www.basicknowledge101.com/subjects/permaculture.html
Crop Production: Urban Agroecology

Concept of “Hierarchical Scale”

Crop diversification can be applied at various scales.
Crop Production: Urban Agroecology

Concept of “Succession”

**Early Stages**

1. Bare soil

2. Annual monoculture

3. Annual polyculture

4. Polyculture of mixed annuals and short-lived perennials

5. Annual/perennial polyculture with tree seedlings

6. Agroforestry

**Late Stages**

7. Tree crop agroecosystem

Example Techniques:
- agroforestry,
- interplanting
- rotational cropping

✓ Mimick natural ecosystems for enhanced stability.
THANK YOU . . .

That’s all Folks!
WAIT ! Preparations for Next Class

• Read ‘Start a Farm in the City: Change Your Community by Growing What You Eat’ – see https://attra.ncat.org/attra-pub/download.php?id=21

• Watch the short video “Urban agroecology” – see https://www.youtube.com/watch?v=ODo_d69xd0Y

• Download free manual “Building a Sustainable Business” - see http://www.sare.org/Learning-Center/Books/Building-a-Sustainable-Business
  – read pp. 19-25 and complete Task One
  – read pp. 97-103 and complete Task Three
Crops: Variety Information

✓ EDIS Publications – see http://edis.ifas.ufl.edu/

✓ UF/IFAS Research & Education Centers: Food Crop Trials Reports & Publications – see http://solutionsforyourlife.ufl.edu/map/index.html
Crops: UF/IFAS Online Newsletters

• “Vegetarian Newsletter”
  – A Vegetable Crops Extension Publication by UF Horticultural Sciences Department
  – See http://hos.ufl.edu/newsletters/vegetarian

• “Extension Berry/Vegetable Times”
  – By UF/IFAS Gulf Coast Research and Education Center at Balm - see http://strawberry.ifas.ufl.edu/BerryTimes/BVTTNewsletters.htm

• “South Florida Vegetable Pest and Disease Hotline”
  – By Hendry County Extension Office
  – See http://hendry.ifas.ufl.edu/agriculture/sw_fl_pest_hotline/index.shtml
UF/IFAS Crop Production Guides

• Vegetable Production Handbook – see http://edis.ifas.ufl.edu/topic_vph

• Florida Vegetable Gardening Guide – see http://edis.ifas.ufl.edu/pdffiles/vh/vh02100.pdf

• Organic Vegetable Gardening in FL – see http://edis.ifas.ufl.edu/hs1215

• Edible Landscaping – see http://edis.ifas.ufl.edu/ep146


• Manual of Minor Vegetables – see http://edis.ifas.ufl.edu/topic_minor_vegetables

• Aquaponics – see http://orange.ifas.ufl.edu/uf_workshop/pdffiles/HS125200.pdf

• Hydroponics – see http://smallfarms.ifas.ufl.edu/crops/hydroponics/index.html
Crops: Variety Seed Sources

- **Seed Company Examples**
  - **SE USA Region**
  - **USA Region**
    - Seed Savers Exchange ([http://www.seedsavers.org/](http://www.seedsavers.org/))
References and Resources

- ATTRA. Urban and Community Agriculture – see https://attra.ncat.org/attra-pub/local_food/urban_ag.html
- Cornell Small Farms Program. Rooftop Gardening – see http://smallfarms.cornell.edu/2017/05/02/13-roof-top-gardening/
- eXtension. Urban Agriculture – see http://articles.extension.org/pages/71005/urban-agriculture
References and Resources

- International Network for Urban Agriculture – see https://www.inuag.org/
- Johns Hopkins Center For A Livable Future.
  - Food Policy Networks– see http://www.foodpolicynetworks.org/
References and Resources

- RUAF Foundation – Urban Agriculture Distance Learning Course – see http://www.ruaf.org/distance-learning-courses
- UNESCO. Sustainable Agriculture: Teaching and Learning for a Sustainable Future – see http://www.unesco.org/education/tlsf/mods/theme_c/mod15.html
- Urban Agroecology – see http://www.urban-agroecology.org/
Video/Webinar/Podcasts Resources

• Agroecology In Action. Urban Agroecology – see https://www.youtube.com/watch?v=ODo_d69xd0Y

• ATTRA.
  • Managing Risks on an Urban Farm – see https://www.youtube.com/watch?v=dkX5YSDXxY0&feature=youtu.be

• Audiopedia. What Is Agroecology? – see https://www.youtube.com/watch?v=hqRt7Yviyro


• Couple Thinkers. Kimbal Musk: Can real food feed the world? – see https://www.youtube.com/watch?v=ILbs8SHnHZM
Video/Webinar/Podcasts Resources

• Food Abundance. Urban Agroecology: 6,000 lbs of food on 1/10th acre - Urban Homestead - Urban Permaculture – see https://www.youtube.com/watch?v=NCmTJkZy0rM

• Olivier de Schutter: What is agroecological farming? And why should it be upscaled? – see https://www.youtube.com/watch?v=938PECAJ920

• PBS. Urban Farming: America Revealed – see https://www.youtube.com/watch?v=kEPs3Ta-6eg

• Prairie Farm Report. See How Urban Farming Works – see https://www.youtube.com/watch?v=FoJCUAXQBmE

• Permaculture Urban Farming – see https://www.youtube.com/playlist?list=PLEgB--CmfB1V5hKTRS1xyPjpts3F4cpwl

• Sustainable Farming through Agroecology – see https://www.youtube.com/watch?v=ObffHbRuJgc
Video/Webinar/Podcast Resources

• Mother Earth News Podcasts. Writing Urban Ag Policy – see https://www.motherearthnews.com/podcast/urban-ag-policy-zepz1711zcbru

• NPR. Stories of Urban Farming – see https://www.frontiersin.org/files/Articles/218353/fpls-07-01386-HTML-r2/image_m/fpls-07-01386-g001.jpg

  - The urban agriculture revolution | David Gingera – see https://www.youtube.com/watch?v=oH1fcCiaT20

• The Good Stuff. Why We Should Be Urban Farming – see https://www.youtube.com/watch?v=XaEkJ5Vv3Zg

• Urban Agriculture Podcasts – see http://www.microbe.tv/urbanag/

• Why is agroecology the solution to hunger and food security – see https://www.youtube.com/watch?v=2yFvD8wuLmU