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<td>D-06 Final reviews</td>
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PROJECT STATEMENT:
The three basic needs for human survival are water, air, and food. As the global population continues to increase, so does the demand being placed on the food and water resources. The scientist, Joel E. Cohen of Rockefeller University, an expert in demography, epidemiology and public health, says that the urban population will double by 2050. Such an increase will require a highly efficient system for food production and transportation within the growing urban environment. Vertical farming serves as a solution to meeting the demands of an ever-increasing global population.

To some, the concept of a vertical farm may seem inconceivable, but through the use of hydroponics and other highly efficient production and distribution systems, vertical farming can be financially viable.

PROJECT INTENT:
Clemson University’s graduate comprehensive Vertical Farm Studio will examine how such a project could be realized in Charleston, South Carolina. The studio was approached with the project when Clemson’s Institute of Applied Ecology received EPA funding to develop a design-feasibility studio to build a vertical farm in downtown Charleston. To begin the design process the studio will conduct research on the major topics of vertical farming as well as site specific research for the project in Charleston. In December of 2011 a series of design proposals will be presented and later exhibited for the public in Charleston.

GRANDMA SENTENCE:
“We will be designing a building that can grow food in a city.”
Three Programming Scenarios

1. Maximum Farm
   Devotes most space to food production.
   A giant machine or possibly an organism that produces food.

2. Mixed Use
   Part farm, part residential or office.
   Could be hybrid of industrial farm and residential farming.

3. Retrofit/Add-on
   Adds a layer of farm production to an existing building.
Our Site - a mix of all three?

1. Max Farm:
   We wish to demonstrate the maximum food production possible in a vertical farm.

2. Mixed Use:
   We have additional program elements, not necessary to a pure food production facility.

3. Retrofit:
   We propose to use the air space over the Meddin building, which could be considered retrofit.
Program (pending group input)

Industrial Food Production
  Grow Rooms
  Equipment/Material Storage
  Processing/Packaging
  Buffer Storage
  Shipping/Receiving
  Restrooms

Administration and Support
  Offices
  Restrooms
  Worker Amenities - Breakroom, Shower/Locker, Safe/dry bike storage

Research Lab Component
  Laboratories
  Seed Bank

Public Components
  Public Gardening
  Greenway
  Bike parking
  Retail - Farmers Market / Organic Café / Juice Bar / Store / Restrooms

General
  Mechanical / Storage
  Vertical circulation - (freight and people)
  ADA compliance and multiple egress routes
Program Details

**Industrial Food Production**

**Grow Rooms**
- maximum density food production.
- does it span entire level or hug the south facade?
- how is proper lighting achieved?

**Equipment/Material Storage**
- adjacent to grow rooms
- robots, hand tools, equipment.
- dirt, compost, plant food, fertilizers

**Processing/Packaging**
- where picked fruits are cleaned and packaged

**Buffer Storage**
- where packages wait for shipping

**Shipping/Receiving**
- what type of shipping? semi, box truck, bike?

**Restrooms**
Program Details

Administration and Support
   Offices
      - how many are needed?
      - occupancy still yet to be determined.
   Restrooms
   Worker Amenities
      - Breakroom
      - Showers/Lockers (since this is dirty work)
      - Safe/dry bike storage

Research Lab Component
   Laboratories
   Seed Bank
      - what type of spaces are these?
      - are they a requirement of the farm, or just part of our educational program?
Program Details

Public Components

Public Gardening
- should we provide community farm possibilities?

Greenway
- how to make it a part of our program?

Bike parking

Retail
- Farmers Market
- Organic Café/Juice Bar/Store w/ Restrooms

Public Education
- Classrooms? Auditorium? Training labs?
- Observation deck to see into industrial farm area.

General

Mechanical / Storage
Vertical circulation - (freight and people)
ADA compliance and multiple egress routes
Meddin Site - Available Space

1. Meddin Building - must stay: 7440 sq.ft.
2. Demo Building - rip it down: 4720 sq.ft.
Max Built Area, per Charleston code
- Code: min 30’, max 80’, 25’ setback after 55’
- Using 13’ floor spacing gives 6 stories.

Total Square Footage: roughly 100,000 sq.ft.
Circulation Space vs Program Space

Assuming 20% for circulation, structure, & mechanical.

Circulation, Structure, Mechanical: 20,000 sq.ft.

Available for Program: 80,000 sq.ft.
Vertical Farm Program vs Everything Else
Assuming we can fit everything else in 7000 sq.ft. “Everything Else” being programs not necessary to farm, which includes public education, retail, etc..

- Vertical Farm: 75,000 sq.ft.
- Non-Farm: 5,000 sq.ft.
- Circulation, Structure, Mechanical: 20,000 sq.ft.
**Vertical Farm - Fixed Space Needs**

Certain pieces of the farm program will be sized mostly the same regardless of farming output, such as administration.

- **Grow Space:** 73,000 sq.ft.
- **Admin Space:** 2,000 sq.ft.
- **Non-Farm:** 5,000 sq.ft.

Circulation, Structure, Mechanical: 20,000 sq.ft.
Vertical Farm - Relative Space Needs

The grow rooms will require a certain amount of space for support, which is a linear relation to the grow space. Let’s assume a small amount - only 5% of grow space.

- Grow Space: 70,000 sq.ft.
- Grow Support: 3,000 sq.ft.
- Admin Space: 2,000 sq.ft.
- Non-Farm: 5,000 sq.ft.
- Circulation, Structure, Mechanical: 20,000 sq.ft.
Farm Yield Analysis - Stacking
We must be able to predict the output of our farm. We should create a fine-tuned formula for this.

70,000 sq.ft.  \( \text{Plant Production in Sq.Ft.} \)
43,560 sq.ft./acre  \( \text{conversion} \)
1.6 acres  \( \text{Plant Production in Acres} \)

Acreage Times 4
For this site and program, we can get 1.6 acres from 4 tenths of an acre of land.
Yield Analysis - Hydroponics vs Traditional Dirt
Utilizing hydroponics or other non-traditional growing techniques, how much more plants can we get per volume?

1.6 acres  Plant Production in Sq.Ft.
\times 4  conversion ASSUMPTION
6.4 acres  Hydro Production in Acres

Acreage Times 16
By stacking multiple layers in each story, we get 16 times the output of the property size alone.
Yield Analysis - Annual Sales
Assuming 3 harvests per year for simplicity’s sake.
Using horizontal farm yield, while hydro numbers are needed!
Prices are not necessarily right.

<table>
<thead>
<tr>
<th>veggie</th>
<th>lbs/acre</th>
<th>lbs of food</th>
<th>sales/lb</th>
<th>total sales</th>
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<tr>
<td>carrots</td>
<td>19,400</td>
<td>124,702</td>
<td>$0.75</td>
<td>$93,000</td>
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<tr>
<td>cabbage</td>
<td>13,700</td>
<td>88,062</td>
<td>$0.33</td>
<td>$29,000</td>
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<tr>
<td>onions</td>
<td>19,800</td>
<td>127,273</td>
<td>$0.39</td>
<td>$49,000</td>
</tr>
</tbody>
</table>

Total Sales:  $171,000
PROBLEM... How to make this profitable?!?!?
One farmer tending 6 acres with this income could survive.
But this building costs a lot more than 6 acres of dirt.

Construction Costs:
Assume $100/sq.ft. × 100,000 sq.ft. = $10 million.
Monthly Mortgage Payment = $42,000
(assuming $5 million down, 6% interest, 5 year loan)
Program

73000 Industrial Food Production
   Grow Rooms
   Equipment/Material Storage
   Processing/Packaging
   Buffer Storage
   Shipping/Receiving
   Restrooms

1000 Administration and Support
   Offices
   Restrooms
   Worker Amenities - Breakroom, Shower/Locker, Safe/dry bike storage

1000 Research Lab Component
   Laboratories
   Seed Bank

5000 Public Components
   Public Gardening
   Greenway
   Bike parking
   Retail - Farmers Market / Organic Café / Juice Bar / Store / Restrooms

20000 General
   Mechanical / Storage
   Vertical circulation - (freight and people)
   ADA compliance and multiple egress routes
Charleston is the second largest city in the American state of South Carolina. It was made the county seat of Charleston County in 1901 when Charleston County was founded. The city’s original name was Charles Towne in 1670, and it moved to its present location (Oyster Point) from a location on the west bank of the Ashley River (Albemarle Point) in 1680. It adopted its present name in 1783. Charleston is included within the Charleston – North Charleston – Summerville metropolitan area and the Charleston-North Charleston urban area.
The city proper consists of six distinct areas: the Peninsula (Downtown), West Ashley, Johns Island, James Island, Daniel Island, and the Cainhoy Peninsula.
Geography
The city of Charleston is located just south of the mid-point of South Carolina’s coastline, at the confluence of the Ashley and Cooper rivers, which flow together into the Atlantic Ocean.
Charleston has a humid subtropical climate, with mild winters, hot, humid summers, and significant rainfall all year long. Summer is the wettest season; almost half of the annual rainfall occurs during the summer months in the form of thundershowers. Fall remains relatively warm through November. Winter is short and mild, and is characterized by occasional rain. Hurricanes are a major threat to the area during the summer and early fall, with several severe hurricanes hitting the area.
VERTICAL FARM

Charleston, SC, USA

Temperature: Daily High Daily Low

Precipitation
Humidity: No Data

Time of Day
Daylight

Sun path diagram
Geography
History
The first being of settlement (named Charles Town), was established by English settlers under William Style in 1670 on the west bank of the Ashley River, a few miles northwest of the present city.
As the relationship between the colonists and Britain deteriorated, Charleston became a focal point in the ensuing American Revolution. To help defend the city, the construction of Fort Sullivan was built on Sullivan’s Island in the harbor. After the British left the city’s name was officially changed to Charleston in 1783, naming it after King Charles II of England.
Charleston became even more prosperous in the plantation-dominated economy of the post-Revolutionary years. By 1820 Charleston's population had grown to 23,000, with a black majority.
The war had shattered the prosperity of the antebellum city. Industries slowly brought the city and its inhabitants back to a renewed vitality and growth in population.
Charleston languished economically for several decades in the 20th century, though the large military presence in the region helped to shore up the city's economy.
Contemporary era (1945–present)
Charleston garden Tradition
The term Charleston garden almost universally conveys a visual image of a small private garden enclosed by vine-covered walls and tastefully filled with a profusion of seasonal plants. Wrought-iron gates, old garden walls, antique brick, decorative fountains, statuary, benches, and piazzas are all characteristic features generally associated with a typical Charleston garden. While individual gardens will vary in detail and design, there exist certain basic elements to all Charleston gardens: integration of house and garden, maximum use of limited space, enclosure by protective walls, and a creative use of ornamental plants. These features have evolved over time and have been influenced by a variety of factors including climate, architecture, enclosure, and the city’s physical plan.
Another factor which greatly influenced the evolution of Charleston’s single house and integrated garden plan was the development of the city’s overall plan. With limited area in which to expand, high land costs, and the development of a multidirectional street layout, a very compact city plan evolved in 1779: “the streets from east to west extend from river to river... These streets are intersected by others, nearly at right angles, and throw the town into a number of squares with dwelling house on the front and offices, houses (dependencies) and little gardens behind.”

_Single house and City planning_

Charleston garden Tradition
The rectangular shape of the single house not only appropriately responded to Charleston’s climatic conditions but also readily fit it into the space allotted by the city’s dense urban plan. To maximize the layout, the long side of the house opposite the piazza was generally located directly on the lot line at the northern or eastern corner of the property in order to provide adequate space for a small side garden and service drive plus ample room at the rear of the property for slave quarters, kitchen, carriage house, stables, privy and well.
Located on the south or west side of the house to catch prevailing ocean breezes, piazzas serve as cool, outdoor living spaces overlooking small gardens.
Access from the street into a single house was provided by an outer door that opened onto a piazza, which traditionally overlooked a small side garden. The street door provided both an element of privacy and surprise. The real front door was located in the center of the piazza facing the garden. The piazza functioned as a transitional element between the house and garden which intimately combined.

Plan A and B depict typical layouts of Charleston house and garden plans. Plan C shows an expansion of the side garden to the rear of the property. This transition occurred during the early part of the twentieth century as the need for service yards gradually disappeared.
Site
All Items (Composite) 98.2

US Cities Baseline Index 100

92.3 104.2 98.9 101.5

Median Home Value

$205,600

$836

$392,900

$920

$571,000

$810

$162,000

$656

$101,500

$836

$392,900

$810
age demographics

POPULATION BY AGE

0-19 26.2%
20-24 26.2%
25-34 15.1%
35-54 27.2%
55-64 11.8%
65+ 11.4%

precedents
infrastructure
building skins
convertible systems
social justice
ecology
structure systems
FSP (Food Stamp) started in 1939
FIRST ATTEMPT AT FSP

Food Stamp Act of 1964
FIRST PERMANENT PROGRAM

Food Stamp Act of 1977
CHANGED ELIGIBILITY

ELECTRONIC BENEFIT TRANSFER

Farm Bill of 2002
BENEFITS AVAILABLE FOR ALIENS

SNAP [2008]
SUPPLEMENTAL NUTRITION ASSISTANCE PROGRAM

precedents
infrastructure
building skins
social justice
ecology
structure systems
ADVOCATES THE BENEFITS OF A LOCAL LIVING ECONOMY BY STRENGTHENING COMMUNITY SUPPORT OF OUR LOCAL INDEPENDENT BUSINESSES AND FARMERS.

TOP TEN REASONS TO EAT LOCAL

1. SUPPORTS LOCAL FARMERS
2. FRESHER & TASTIER
3. BETTER FOR THE ENVIRONMENT
4. SUPPORTS LOCAL ECONOMY
5. SUPPORTS SUSTAINABLE LAND USE
6. EATING SEASONALLY IS HEALTHIER
7. FREE RANGE MEAT TASTES BETTER
8. IT’S OUR HERITAGE!
9. GREAT DINNER CONVERSATION
10. BE THANKFUL FOR THE EARTH
Campaign is a grassroots campaign designed to educate Lowcountry residents to Think Local when they are considering where to make purchases, to Buy Local whenever possible and to Be Local by supporting businesses that keep our community unique.

**WHY BUY LOCAL?**

1. Keeps money in the Lowcountry
2. Embraces unique community
3. Fosters better service
4. Creates more jobs
5. Helps the environment
6. Supports community groups
7. Ensures you get what you want
8. Puts your tax dollars to good use
9. Shows the country you believe in the Low country

LOWCOUNTRYLOCALFIRST.ORG
proposed sustainable solutions neighborhood

DOWNTOWN PLAN

NURTURE INCLUSIVE, VIBRANT NEIGHBORHOODS

PURSUE ECONOMIC DIVERSITY

FOSTER SUSTAINABILITY

REINFORCE THE EXISTING URBAN STRUCTURE

RESPECT THE GRAIN, SCALE AND MIX OF THE PENINSULA'S URBAN FABRIC

ENSURE ARCHITECTURAL INTEGRITY

ENCOURAGE A BALANCED NETWORK FOR MOVEMENT

USE GROWTH STRATEGICALLY

MAINTAIN DOWNTOWN AS THE REGIONAL CENTER OF CULTURE AND COMMERCE

VERTICAL

FARMSTUDIO

precedents
infrastructure
building skins
convertible systems
social justice
ecology
structure systems
midtown development context

$150 MILLION PROJECT
PRIVATELY FUNDED
INCORPORATES EXISTING HISTORIC BUILDINGS
115 FEET TALL

"THERE'S NO WAY TO STOP INVESTORS FROM DRIVING UP THE PRICE OF THE NEARBY HOUSING... LONGTIME RESIDENTS THAT MIGHT NOT BE ABLE TO AFFORD TO STAY"  
REV. SIDNEY DAVIS
Waiting it out

Six major redevelopment projects in the Upper King Street area are on hold while developers wait for economic conditions to improve.

2009 - MIDTOWN’S GROUNDBREAKING PUSHED BACK TO 2010 BECAUSE OF BUDGET
EXPECTED TO REJUVENATE AREA LIKE CHARLESTON PLACE DID IN THE 1980S

2011 - ALL PROPERTIES IN MIDTOWN HAVE BEEN SOLD
There is a chart in Article 2, Lane Use Regulations, Part 3: Table of Permitted Uses that provides a detailed list of what programs you can have in each district.

**SEC. 54-230. - Purpose of Creating Districts**

In order to promote the economic and general welfare of the city and of the public generally, and to insure the harmonious, orderly and efficient growth and development of the municipality, it is deemed essential by the city council of the city that the qualities relating to the history of the city and a harmonious outward appearance of structures which preserve property values and attract tourist and residents alike be preserved; some of these qualities being the continued existence and preservation of historic areas and buildings; continued construction of buildings in the historic styles and a general harmony as to style, form, color, proportion, texture and material between buildings of historic design and those of more modern design; that such purpose is advanced through the preservation and protection of the old historic or architecturally worthy structures and quaint neighborhoods which impart a district aspect to the city and which serve as visible reminders of the historical and cultural heritage of the city, the state, and the nation.
Article 3 of BAR: Site Regulations

0. HEIGHT DISTRICT 80/30. IN THIS DISTRICT:

1. No structure, including appurtenant parts of a structure except for elevator penthouses, or mechanical penthouses, shall exceed a height of eighty (80) feet nor shall any structure fronting on any street be lower than the height of thirty (30) feet.

2. All portions of a structure above the fifty-five (55) foot level shall be set back at least twenty-five (25) feet from all street right-of-way lines.

3. Notwithstanding the above, no portion of a structure, which structure is within fifty (50) feet of an existing building rated “exceptional” (Group 1) or “excellent” (Group 2) on the Historic Architecture Inventory adopted by Section 54-235 shall exceed the height of such existing building unless approved by the Board of Architectural Review.

For a Laboratory, research facility there must be 1 off street parking spot for every 2 employees.

There are many other site regulations that should be considered such as tree protection requirements, parking regulations, loading zones, landscape buffer requirements, etc.
CHAPTER 6
TYPES OF CONSTRUCTION

SECTION 601
GENERAL

601.1 Scope. The provisions of this chapter shall control the classification of buildings as to type of construction.

SECTION 602
CONSTRUCTION CLASSIFICATION

602.1 General. Buildings and structures erected or to be erected, altered or extended in height or area shall be classified in one of the five construction types defined in Sections 602.2 through 602.5. The building elements shall have a fire-resistance rating not less than that specified in Table 602, and exterior walls shall have a fire-resistance rating not less than that specified in Table 602. Where required to have a fire-resistance rating by Table 601, building elements shall comply with the applicable provisions of Section 703.1. The provision of openings, ducts and air transfer openings in building elements shall not be required unless required by other provisions of this code.

602.2 Types I and II. Types I and II construction are those types of construction in which the building elements listed in Table 601 are of noncombustible materials, except as permitted in Section 605 and elsewhere in this code.

602.3 Type III. Type III construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code. Fire-resistant treated wood framing, complying with Section 2303.2, shall be permitted within exterior wall assemblies of a 2-hour rating or less.

602.4 Type IV. Type IV construction (Heavy Timber, HT) is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of solid or laminated wood without concealed spaces.
<table>
<thead>
<tr>
<th>Type of Construction</th>
<th>Type I</th>
<th>Type II</th>
<th>Type III</th>
<th>Type IV</th>
<th>Type V</th>
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</thead>
<tbody>
<tr>
<td>Height (feet)</td>
<td>UL</td>
<td>164</td>
<td>65</td>
<td>52</td>
<td>40</td>
</tr>
<tr>
<td>Stories (S)</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
</tbody>
</table>

**Table 501: Allowable Building Heights and Areas**

Building height limitations shown in feet above grade plane. Story limitations shown as stories above grade plane. Building area limitations shown in square feet, as determined by the definition of "Area, building," per story.
Sprinkler system

Article 504.2 of the IBC states that if an automatic sprinkler system you may increase the building height stated in Table 503 by 20 feet and the maximum stories can be increased by 1.

A great reference for the construction types to assist in reading the allowable building heights and areas in the Lecture Code 1 [slide 33] from Arch 874.

Occupancy Group B, F-2, U:
A sprinkler system is required throughout any building containing floors 55 ft or more above grade with an occupant load of 30 or more.

For most buildings the allowable exit distance is 200’ without a sprinkler system, and from 250’ to 300’ with a sprinkler system.
Excess Frontage

If more than 25% of the building perimeter fronts on a street or open space at least 20 ft wide that is accessible to firefighting vehicles, the tabulated area limitations below may be increased according to the following table.

\[ I = \left( \frac{F}{P} - 0.25 \right) \frac{W}{30} \]

- **I**: Area increase due to frontage.
- **F**: Building perimeter that fronts on a public way or open space having 20 feet (6096 mm) open minimum width (feet).
- **P**: Perimeter of entire building (feet).
- **W**: Width of public way or open space (feet) in accordance with Section 506.2.1.

Essentially, the more building that fronts a street that allows for emergency access, then the more square footage you are allowed to build on (by percentage per IBC code).
Mixed-use buildings

When two or more Occupancy Groups are combined in one building, the IBC allows these mixed uses to be treated as either nonseparated or Separated Occupancies.

When occupancies are Non-separated, there are no requirements for fire separation between them, and the allowable building height and area are determined for the whole structure by applying the requirements of the most restrictive occupancy throughout.

Separated Occupancies are segregated from one another by fire separations, which may consist of fire-resistant walls, fire doors, and other rated openings, and fire-resistant floor/ceiling assemblies.

Some combinations need not fully meet requirements of mixed-used occupancies: Assembly areas less than 750 sq. feet or with an occupant load of less than 50 may be considered part of any other occupancy within which they occur.
Vertical distribution of services for large buildings

**Occupancy Group B**
- Water closets:
  - First 50 occupants: 1 per 25
  - Remaining occupants: 1 per 50
- Lavatories:
  - First 80 occupants: 1 per 40
  - Remaining occupants: 1 per 80
- Drinking ftns: 1 per 100
- Bathrooms: None

**Occupancy Group F**
- Water closets: 1 per 100
- Lavatories: 1 per 100
- Drinking ftns: 1 per 400
- Bathrooms: Emergency showers and eyewash station may be required
Toilet facilities

A clear space of 30” by 48” is to be provided if the door swings into the room.

In buildings required to provide access for disabled persons, accessible routes must be provided to toilet and bathing facilities, and each facility must have at least one accessible fixture of each type.

Under most circumstances, separate toilet facilities are required for each sex. Separate facilities are not required for private facilities, for areas where the total occupant load is 15 or less, for employee facilities where 15 or fewer persons are employed.
Elevators

Accessible elevators should be installed along the accessible route. They should have a minimum size of 5’8 by 4’3. The minimum opening should be 3’.

Freight, service:
Capacity- 4000 to 6000 lb
Inside car dimensions- 8’-4” x 10’-0”
Inside shaft dimensions: 10’-10” x 10’-8”
### Egress

The maximum occupant load with 1 exit for B, F, and U are 50.

For most buildings, each floor with 500 or fewer occupants must have at least two independent exits. Floors with between 501 and 1000 occupants must have at least three such exits, and floors with more than 1000 occupants must have at least four.

The IBC requires egress doors to swing in the direction of egress travel.

§1004.2.1 Defines the requirements for the number of exits or exit access doorways.

Combines the requirement of several code sections and compares requirements for occupant load, number of exits and length of paths of egress travel.
Egress

1009.3 Stair treads and risers.
Stair riser heights shall be 7 inches maximum and 4 inches minimum. Stair tread depths shall be 11 inches minimum. The riser height shall be measured vertically between the leading edges of adjacent treads. The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread’s leading edge. Winder treads shall have a minimum tread depth of 11 inches measured at a right angle to the tread’s leading edge at a point 12 inches from the side where the treads are narrower and a minimum tread depth of 10 inches.
Egress

Defines the width of exit pathways, defined by the occupant load, the hazard of occupancy, and whether the building is sprinklered and whether the path is a stair.

Stairways must be at least 44” wide.

Any single flight of stairs may not exceed 12’ in vertical rise between floors and landings.

Stairways shall have a minimum headroom clearance of 80 inches measured vertically from a line connecting the edge of the nosings. Such headroom shall be continuous above the stairway to the point where the line intersects the landing below, one tread depth beyond the bottom riser. The minimum clearance shall be maintained the full width of the stairway and landing.
Handrails

Handrails have to be between 34” and 38” above the stair-tread nosing. Handrails must continue their slope for the depth of one tread beyond the bottom riser.

ADAAG requires an additional horizontal extension.

Intermediate handrails are required for stairs that are more than 60” each side. Handrail extensions are not required where the handrails are continuous between the flights.
South Carolina Department of Health and Environmental Control (SCDHEC):

is organized to provide the coordination of environmental permitting and regulatory communication with business, government, and the general public to help minimize the impact of growth on the state’s natural resources and environment.

Deals with waste management, pollution, air quality, etc.

- permitting
- licensing
- certification
- registration
- monitoring
- reporting
DHEC Office of Ocean and Coastal Resource Management (DHEC-OCRM):

protects and enhances the state’s coastal resources by preserving sensitive and fragile areas while promoting responsible development in the eight coastal counties of South Carolina.

DHEC-OCRM Program Goals and Objectives:

• Implement the Coastal Zone Management Program to manage wetland alterations, storm water and land disturbance activities, certify all federal and state permits and direct federal actions and all alterations of tidally influenced critical area lands, waters and beaches.
• Preserve sensitive natural, historic and cultural resources through regulatory oversight and guidance.
• Provide technical expertise to resolve complex coastal management issues.
• Encourage low impact and alternative development to preserve water quality and environmental integrity.

http://www.scdhec.gov/environment/ocrm
Sources for Codes and Zoning

BAR Charleston
http://www.charlestoncity.info/dept/content.aspx?nid=491

Charleston County Zoning

DHEC
http://www.scdhec.gov

OCRM
http://www.scdhec.gov/environment/ocrm

IBC 2009
the THEORY behind the CONCEPT of VERTICAL FARMING
what's all the hype about?
by 2050 the human population will increase by 3 billion and 80% of people will live in cities currently, traditional agriculture makes it difficult to achieve profitability, distances customers from their food and hurts the environment
The fact is that bad weather makes farming difficult, risky and uncertain. Millions of tons of valuable crops are lost to hurricanes, floods, long-term droughts, and monsoons every year. So what is the solution? How do we revolutionize the food system? A new kind of farming has to emerge.

- Urban farming
- Sky farming
- Vertical farming
THE URBAN FARM

Urban Farm Brooklyn, New York

Shenzhen & Hong Kong Biennale of Urbanism/Architecture

[Vertival Farm] concept + theory
community
history + context

[Vertival Farm] concept + theory
community
history + context

[Vertival Farm] concept + theory
community
history + context

[Vertival Farm] concept + theory
community
history + context
THE VERTICAL SOLUTION

HORIZONTAL VS. VERTICAL

The London City Farmhouse by Catrina Stewart

9 acres in a horizontal farm... equals 1 acre in a vertical farm...

27 vertical farm acres is equal to 243 horizontal farm acres
VERTICAL STACKING

COMMUNITY INTEGRATION

How can the vertical farm design target each of these groups within the community?

FARMING

COMMUNITY

What do we get out of it?

CROPS
FARMERS
MARKET
PEOPLE
EDUCATION
RETAILERS
RESTAURANTS

Harvest Green | Romses Architects
THE "U-PICK" SYSTEM
level of integration: high

THE FARMERS MARKET
level of integration: medium
THE EDUCATION LAB
level of integration: medium

THE EXPORT SYSTEM
level of integration: low

Singularity University | Agropolis

Eco-Laboratory | Weber-Thompson

Vertical Farm | Chris Jacobs

Vertical Farm | Lee Dongjin, Park Jinkyu, Lee Jeongwoo
VERTICAL FARMING FOR THE COMMUNITY
“Whereas community gardens are more about feeding individuals or families, urban farms feed the larger community.”

-Madalyn Painter
YOUR VICTORY GARDEN counts more than ever!

Winning the War One Seed at a Time
Growing Power Inc
small scale efforts
Teachers Teaching small scale efforts
Indoor Farming

Indoor Farming

precedent infrastructure building skins convertible systems social justice ecology structure systems

VERTICALFARMSTUDIO
Tactical Urbanism
Guerilla Farming
Bike-Based Business

Bike-Based Business
Large-scale Efforts
City Farms
Detroit is about to return to its roots.
“Urban farming is not just about food security. That’s part of it. But it’s also about growing minds and growing communities. Our next generation of farmers is not going to come from rural areas - they are going to come from cities. And we need to nourish that.”

-Will Allen
What does vertical farming mean for Charleston?

- restored ecosystems
- reduced transportation
- less hunger
High Quality Farmland + Low Development
High Quality Farmland + High Development
Urban Areas
2000 - 2010 population growth

Charleston 13%
Colleton 1.6%
Dorchester 41.6%
Berkeley 24.7%
Georgetown 7.8%
35% of vendors more than 20 miles from market

only 10% of vendors within 5 miles

average vendor travels 25 miles
FOOD DESERT
low income - low access

Poverty rate over 20%.

33% live over 1 mile away from supermarket.
Food Desert
USDA.gov
<table>
<thead>
<tr>
<th>Month</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor Farming</td>
<td>![Outdoor Farming Chart]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indoor Farming</td>
<td>![Indoor Farming Chart]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**LOWCOUNTRY PRODUCE AVAILABILITY**

- Arugula
- Asparagus
- Asian vegetables
- Basil
- Beans
- Beets
- Blackberries
- Blueberries
- Broccoli
- Brussels sprouts
- Butter beans
- Cabbage
- Cantaloupe
- Carrots
- Cauliflower
- Celery
- Chard
- Chinese cabbage
- Collards
- Corn
- Cucumbers
- Dill
- Eggplant
- Figs
- Garlic
- Gourds
- Green beans
- Green onion
- Kale
- Leeks
- Lettuce
- Mint
- Muscadine grapes
- Mustard
- New Zealand spinach
- Okra
- Onions
- Parsnip
- Peaches
- Pears
- Pecans
- Peas
- Peppers
- Plums
- Potatoes
- Pumpkin
- Radishes
- Rutabaga
- Spinach
- Summer squash
- Strawberries
- Tomatoes
- Turnips
- Watermelon
Peanut  Okra  Radish  Apples
Pecans  Green Onion  Peas
Corn  Tomatoes  Sweet Potatoes
Watermelons  Cucumbers  Leaks
Squash  Beans  Wheat
Peaches  Grapes  Oats
<table>
<thead>
<tr>
<th>Clean 15</th>
<th>Lowest in Pesticide</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Onions</td>
</tr>
<tr>
<td>2</td>
<td>Sweet Corn</td>
</tr>
<tr>
<td>3</td>
<td>Pineapples</td>
</tr>
<tr>
<td>4</td>
<td>Avocado</td>
</tr>
<tr>
<td>5</td>
<td>Asparagus</td>
</tr>
<tr>
<td>6</td>
<td>Sweet peas</td>
</tr>
<tr>
<td>7</td>
<td>Mangoes</td>
</tr>
<tr>
<td>8</td>
<td>Eggplant</td>
</tr>
<tr>
<td>9</td>
<td>Cantaloupe - domestic</td>
</tr>
<tr>
<td>10</td>
<td>Kiwi</td>
</tr>
<tr>
<td>11</td>
<td>Cabbage</td>
</tr>
<tr>
<td>12</td>
<td>Watermelon</td>
</tr>
<tr>
<td>13</td>
<td>Sweet potatoes</td>
</tr>
<tr>
<td>14</td>
<td>Grapefruit</td>
</tr>
<tr>
<td>15</td>
<td>Mushrooms</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dirty Dozen</th>
<th>Buy these organic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Apples</td>
</tr>
<tr>
<td>2</td>
<td>Celery</td>
</tr>
<tr>
<td>3</td>
<td>Strawberries</td>
</tr>
<tr>
<td>4</td>
<td>Peaches</td>
</tr>
<tr>
<td>5</td>
<td>Spinach</td>
</tr>
<tr>
<td>6</td>
<td>Nectarines - imported</td>
</tr>
<tr>
<td>7</td>
<td>Grapes - imported</td>
</tr>
<tr>
<td>8</td>
<td>Sweet bell peppers</td>
</tr>
<tr>
<td>9</td>
<td>Potatoes</td>
</tr>
<tr>
<td>10</td>
<td>Blueberries - domestic</td>
</tr>
<tr>
<td>11</td>
<td>Lettuce</td>
</tr>
<tr>
<td>12</td>
<td>Kale/collard greens</td>
</tr>
</tbody>
</table>
### Pesky Pesticides

A USDA survey found samples of various fresh fruits and vegetables contained pesticide residues at the following rates:

<table>
<thead>
<tr>
<th>Fruit/Item</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apples</td>
<td>98%</td>
</tr>
<tr>
<td>Grapes</td>
<td>97%</td>
</tr>
<tr>
<td>Strawberries</td>
<td>96%</td>
</tr>
<tr>
<td>Cilantro</td>
<td>94%</td>
</tr>
<tr>
<td>Potatoes</td>
<td>92%</td>
</tr>
<tr>
<td>Oranges</td>
<td>92%</td>
</tr>
<tr>
<td>Cucumbers</td>
<td>85%</td>
</tr>
<tr>
<td>Green onions</td>
<td>66%</td>
</tr>
<tr>
<td>Sweet potatoes</td>
<td>48%</td>
</tr>
<tr>
<td>Lettuce (organic)</td>
<td>20%</td>
</tr>
<tr>
<td>Asparagus</td>
<td>10%</td>
</tr>
<tr>
<td>Sweet corn</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

*After washed in water for 10 seconds*

Source: Department of Agriculture, Annual Summary for 2009 (published May 2011)
<table>
<thead>
<tr>
<th>Organism/Cause</th>
<th>Illness Description</th>
<th>Onset Time</th>
<th>Symptoms</th>
<th>Duration</th>
<th>Main Food Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E. coli</em> O157:H7</td>
<td>Hemorrhagic colitis</td>
<td>1-8 days</td>
<td>Severe</td>
<td>5-10 days</td>
<td>Undercooked beef (especially hamburger), unpasteurized milk and juice, raw fruits and vegetables</td>
</tr>
<tr>
<td><em>Hepatitis A</em></td>
<td>Hepatitis</td>
<td>28 days</td>
<td>Diarrhea, dark urine, jaundice, and flu-like symptoms, i.e., fever, headache, nausea, and abdominal pain</td>
<td>Variable, 2 weeks-3 months</td>
<td>Raw produce, contaminated drinking water, uncooked foods and cooked foods that are not reheated after contact with an infected food handler; shellfish from contaminated waters</td>
</tr>
<tr>
<td><em>Listeria monocytogenes</em></td>
<td>Listeriosis</td>
<td>9-48 hrs</td>
<td>Fever, muscle aches, and nausea or diarrhea. Pregnant women may have mild flu-like illness, and infection can lead to premature delivery or stillbirth. The elderly or immunocompromised patients may develop bacteremia or meningitis</td>
<td>Variable</td>
<td>Unpasteurized milk, soft cheese made with unpasteurized milk, ready-to-eat deli meats</td>
</tr>
<tr>
<td><em>Noroviruses</em></td>
<td>Variously called viral gastroenteritis, winter diarrhea, acute non-bacterial gastroenteritis, food poisoning, and food infection</td>
<td>12-48 hrs</td>
<td>Nausea, vomiting, abdominal cramping, diarrhea, fever, headache. Diarrhea is more prevalent in adults, vomiting more common in children</td>
<td>12-60 hrs</td>
<td>Raw produce, contaminated drinking water, uncooked foods and cooked foods that are not reheated after contact with an infected food handler; shellfish from contaminated waters</td>
</tr>
<tr>
<td><em>Salmonella</em></td>
<td>Salmonellosis</td>
<td>6-48 hours</td>
<td>Diarrhea, fever, abdominal cramps, vomiting</td>
<td>4-7 days</td>
<td>Eggs, poultry, meat, unpasteurized milk or juice, cheese, contaminated raw fruits and vegetables</td>
</tr>
<tr>
<td><em>Shigella</em></td>
<td>Shigellosis or Bacillary dysentery</td>
<td>4-7 days</td>
<td>Abdominal cramps, fever, and diarrhea. Stools may contain blood and mucus</td>
<td>24-48 hrs</td>
<td>Raw produce, contaminated drinking water, uncooked foods and cooked foods that are not reheated after contact with an infected food handler</td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>Staphylococcal food poisoning</td>
<td>1-6 hours</td>
<td>Sudden onset of severe nausea and vomiting. Abdominal cramps. Diarrhea and fever may be present</td>
<td>24-48 hours</td>
<td>Unrefrigerated or improperly refrigerated meats, potato and egg salads, cream pastries</td>
</tr>
<tr>
<td><em>Vibrio parahaemolyticus</em></td>
<td><em>V. parahaemolyticus</em> infection</td>
<td>4-96 hours</td>
<td>Watery (occasionally bloody) diarrhea, abdominal cramps, nausea, vomiting, fever</td>
<td>2-5 days</td>
<td>Undercooked or raw seafood, such as shellfish</td>
</tr>
<tr>
<td><em>Vibrio vulnificus</em></td>
<td><em>V. vulnificus</em> infection</td>
<td>1-7 days</td>
<td>Vomiting, diarrhea, abdominal pain, bloodborne infection. Fever, bleeding within the skin, ulcers requiring surgical removal. Can be fatal to persons with liver disease or weakened immune systems</td>
<td>2-8 days</td>
<td>Undercooked or raw seafood, such as shellfish (especially oysters)</td>
</tr>
</tbody>
</table>

For more information, contact: The U.S. Food and Drug Administration Center for Food Safety and Applied Nutrition Food Information Line at 1-888-SAFEFOOD (toll free), 10 AM to 4 PM ET, Monday through Friday. Or visit the FDA Web site at www.fda.gov.
Pesticides can contaminate all types of food.
What’s in Runoff Pollution?

- Bacteria
- Trash
- Heavy Metals
- Mercury
- Pesticides
- Fertilizers & Nutrients
- Sediment
- Motor Vehicle Fluids

Bacteria

Source: Raw sewage from failing septic systems, overflowing sewer lines, pet waste, farm animals and wildlife can all be sources of bacteria.

Effect: Stormwater contaminated from these sources can contain bacteria and viruses that may cause illnesses in people following swimming in contaminated lakes, rivers or the ocean. Illnesses may also occur after the consumption of raw or improperly cooked shellfish from these contaminated areas.

http://www.scdhec.gov
<table>
<thead>
<tr>
<th>Land Use</th>
<th>BOD</th>
<th>COD</th>
<th>TSS</th>
<th>TDS</th>
<th>TP</th>
<th>DP</th>
<th>TKN</th>
<th>NO2/NO3</th>
<th>Pb</th>
<th>Cu</th>
<th>Zn</th>
<th>Cd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest/Rural Open</td>
<td>3</td>
<td>27</td>
<td>51</td>
<td>415</td>
<td>0.11</td>
<td>0.03</td>
<td>0.94</td>
<td>0.80</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Urban</td>
<td>3</td>
<td>27</td>
<td>51</td>
<td>415</td>
<td>0.11</td>
<td>0.03</td>
<td>0.94</td>
<td>0.80</td>
<td>0.01</td>
<td>0.00</td>
<td>0.04</td>
<td>0.03</td>
</tr>
<tr>
<td>Agricultural/Pasture</td>
<td>3</td>
<td>53</td>
<td>145</td>
<td>415</td>
<td>0.37</td>
<td>0.09</td>
<td>1.92</td>
<td>4.06</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Low Density Residential</td>
<td>38</td>
<td>124</td>
<td>70</td>
<td>144</td>
<td>0.52</td>
<td>0.27</td>
<td>3.82</td>
<td>1.83</td>
<td>0.05</td>
<td>0.02</td>
<td>0.16</td>
<td>0.04</td>
</tr>
<tr>
<td>Medium Density Residential</td>
<td>38</td>
<td>124</td>
<td>70</td>
<td>144</td>
<td>0.52</td>
<td>0.27</td>
<td>3.82</td>
<td>1.83</td>
<td>0.18</td>
<td>0.04</td>
<td>0.18</td>
<td>0.04</td>
</tr>
<tr>
<td>High Density Residential</td>
<td>14</td>
<td>79</td>
<td>97</td>
<td>189</td>
<td>0.24</td>
<td>0.08</td>
<td>1.17</td>
<td>2.12</td>
<td>0.04</td>
<td>0.03</td>
<td>0.22</td>
<td>0.03</td>
</tr>
<tr>
<td>Commercial</td>
<td>21</td>
<td>80</td>
<td>77</td>
<td>294</td>
<td>0.33</td>
<td>0.17</td>
<td>1.74</td>
<td>1.23</td>
<td>0.04</td>
<td>0.03</td>
<td>0.16</td>
<td>0.03</td>
</tr>
<tr>
<td>Industrial</td>
<td>24</td>
<td>85</td>
<td>149</td>
<td>202</td>
<td>0.32</td>
<td>0.11</td>
<td>2.08</td>
<td>1.89</td>
<td>0.07</td>
<td>0.06</td>
<td>0.67</td>
<td>0.05</td>
</tr>
<tr>
<td>Highways</td>
<td>24</td>
<td>103</td>
<td>141</td>
<td>294</td>
<td>0.43</td>
<td>0.22</td>
<td>1.82</td>
<td>0.83</td>
<td>0.04</td>
<td>0.03</td>
<td>0.16</td>
<td>0.03</td>
</tr>
<tr>
<td>Water/Wetlands</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>12</td>
<td>0.08</td>
<td>0.04</td>
<td>0.79</td>
<td>0.59</td>
<td>0.01</td>
<td>0.00</td>
<td>0.03</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Adapted from NURP (1982), Homer et al. (1994), and Cove et al. (1994)

BOD = Biochemical Oxygen Demand  TKN = Total Kjeldahl Nitrogen
COD = Chemical Oxygen Demand    NO2/NO3 = Nitrates / Nitrites
TSS = Total Suspended Solids    Pb = Lead
TDS = Total Dissolved Solids    Cu = Copper
TP = Total Phosphorus           Zn = Zinc
DP = Dissolved Phosphorus       Cd = Cadmium

http://www.scdhec.gov
program introduction
building codes
concept + theory
community
history + context
tectonics
economics

GROWFOOD CAROLINA
GROWFOODCAROLINA.COM

CERTIFIED SOUTH CAROLINA
bakersarcesranch.com

Farm Fresh Food
lowcountrylocalfirst.org

LIMEHOUSE PRODUCE CO.
LimeHouseproduce.com
GREEN WALLS

HYDROPONICS

ENVIRONMENTAL CONTROLLERS

SUSTAINABLE ENERGY
precedent infrastructure building skins convertible systems social justice ecology structure systems
Dragonfly suggests therefore building a prototype of urban farm offering around a mixed programme and framing spaces which are vertically laid out in several floors and partly cultivated by its own inhabitants.
1. Title Graphic: Green Wall at the Solar Planetarium in Nagoya, Japan.


3. Green walls: 3a. Green Wall design | Greenworks. 3b. The Symbiotic Green Wall | Kooho Jung + Hayeon Kelly Choi. 3c. Green Wall design | Deesawat. 3d. Green Wall in Chicago


8. La Tour Vivante | SOA. http://www.ateliersoa.fr/verticalfarm_en/urban_farm.htm


What is Sustainability Community Infrastructure and asset based design as it pertains to vertical farming?

http://buildingsustainablelifestyles.wordpress.com
“Farming harnesses the efficiency of collectivity and community. Whether cultivating land, harvesting resources, extracting energy or delegating labor, farming reveals the interdependencies of a globalized world. Simultaneously, farming represents the local gesture, the productive landscape, and the alternative economy. The processes of farming are mutable, parametric, and efficient.”

- Bracket [On Farming]
In Iowa, the typical carrot traveled 1,600 miles from California.

Consumers spend 6-12% of food purchases to cover transportation costs.
Packing requirements for lettuce

THE FARM TO TABLE PLAN

Postmaster General Burleson has designated this office as an intermediary between the producer and the consumer, by which means it is hoped to reduce the cost of living and, at the same time, provide the consumer with a ready cash market. This entire plan is being worked out and conducted in the interest of the public welfare. In order that efforts in this direction may meet with the highest degree of success, the co-operation of both producer and consumer will be essential. In this connection, a careful reading should be given this paragraph and instructions complied with in every particular.

This office cannot furnish names of those having for sale contains to be used in shipping eggs and produce, but it is suggested that forms justing such containes for sale, communicate with the producers whose names appear on this list.

Inquiry Blank That May Be Used By Consumer

FROM FARM TO TABLE

VIA UNITED STATES PARCEL POST

TO.................................................................

POST OFFICE..............................................

STATE......................................................

Please send me information and lowest cash prices of the following:

doz.

eggs

lb.

pounds lard

lb.

pounds butter

lb.

honey

Farm products, poultry and other articles as follows:

NAME.....................................................

STREET and No........................................

POST OFFICE...........................................

STATE...................................................

Press of United States Post Office, Saint Louis, Missouri

Be Patriotic sign your country's pledge to save the food

US Food Administration
Farm-to-Market Road System

IMAGE: Iowa DOT

IMAGE: Wikipedia, Farm-to-Market Road
Tracking your food...
Where your food has been?

www.openideo.com/open/localfood/concepting/socialvore/

Organ-agriculture.org

Reason.com
### Pesky Pesticides

A USDA survey found samples of various fresh fruits and vegetables contained pesticide residues at the following rates:

<table>
<thead>
<tr>
<th>Produce</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apples</td>
<td>98%</td>
</tr>
<tr>
<td>Grapes</td>
<td>97%</td>
</tr>
<tr>
<td>Strawberries</td>
<td>96%</td>
</tr>
<tr>
<td>Cilantro</td>
<td>94%</td>
</tr>
<tr>
<td>Potatoes</td>
<td>92%</td>
</tr>
<tr>
<td>Oranges</td>
<td>92%</td>
</tr>
<tr>
<td>Cucumbers</td>
<td>85%</td>
</tr>
<tr>
<td>Green onions</td>
<td>66%</td>
</tr>
<tr>
<td>Sweet potatoes</td>
<td>48%</td>
</tr>
<tr>
<td>Lettuce (organic)</td>
<td>20%</td>
</tr>
<tr>
<td>Asparagus</td>
<td>10%</td>
</tr>
<tr>
<td>Sweet corn</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

*After washed in water for 10 seconds

Source: Department of Agriculture, Annual Summary for 2009 (published May 2011)
Green Carts
IMAGE: Queens Crap

Healthy Bodegas
IMAGE: nyc.gov

Health Bucks
IMAGE: nyc.gov

FRESH: Food Retail Expansion to Support Health
IMAGE: nycedc.com
Nashville Farmers’ Market
Initiatives:

http://notionscapital.wordpress.com/category/agriculture/

www.openideo.com/open/localfood/applause/?page=29
### Independent Family Farms

- Locally-owned
- Staying on the land

### Vitality of Rural Communities

- Stable employment opportunities
- Thriving main-street businesses
- Sustained/expanding social capital
- Diverse land-use
- Retention of young people in the community

### Entrepreneurship

- Locally-owned enterprises
- Value-added enterprises

### Leadership

- Farmers to train other farmers
- Adults to train youth
- Between farmers and technical advisors
- Between farmers and consumers
- Among rural residents
- Between/among rural residents and community leaders

### Collaboration

- Between farmers and technical advisors
- Between farmers and consumers
- Among rural residents
- Between/among rural residents and community leaders

### Trust

- Precedent
- Infrastructure
- Building skins
- Convertible systems
- Social justice
- Ecology
- Structure systems
Harvest of Ideas: Seeds for the Future

Increase Production
- Recruitment campaign for farmers
- Training
- Publication

Community Gardens
- Education
- Horticultural
- Community organizing
- PR campaign
- Gardening lessons
- Fellowship
- Hosting National Conf.

Backyard Gardens
- Interactive maps wiki
- Education curriculum
- "Grow local" compass
- Local policy around backyard gardening

Farm to School
- Solidify network
- 1st meeting this summer
- Integrate into school curriculum
- Local food procurement in schools
- Identify what's being purchased
- One produce of the month

Expand Cooking Skills
- Focus on family meal
- Incubation
- Target kids
- Reframed as culinary arts
- Target early adapters
- Target men
- Focus on growing season
- Family resource guide

Locally Purchasing
- Communication between farmers & purchasers
- Incorporate marketing
- Outreach to consumers
- From a cultural change plan
- Talking to outside decision-makers
- Mandates

Local Food in Commerce
- Refining message: it's the health of the local community
- Central online resource
- Real media campaign to drive consumers
- Local produce delivery - turnkey
- More media - especially online

Need:
- Media
- Money
- Movement that's already on theme
- Horizontal integration - thin community

Our Vision is Deepening - Education - elevator speech

Julie Stuart - Making Ideas Visible 2009

underserved neighborhoods
- Identify key partners
- Develop education/leadership development
- Community tool kit
- Advocacy assessment
- Establish action plan
- Coprojects

atlantalofood.com
10 FACTS ABOUT HUNGER IN AMERICA

Hunger is a real story. 1 in 6 Americans struggle with the reality of hunger and food insecurity. Many believe that hunger only affects certain areas of the country. That’s not true. It’s everywhere, affecting hard-working adults, children and seniors who cannot make ends meet. Let’s educate ourselves about the facts of hunger.

1. americans affected by hunger
   49 million

2. american children suffers from hunger
   17 million

3. increase in demand for hunger relief services
   36.00%

4. people relying on food banks
   1 in 8

5. hunger-relief recipients who are homeless
   10.00%

6. hunger-relief recipients who had to choose between paying for food or utilities
   46.00%

7. average annual household income of hunger-relief recipients
   $10,030

8. number of feeding agencies in america
   62,000

9. pantry programs that rely solely on volunteers
   58.00%

10. meals served from $1 donation
    7

VERTICAL FARM

concept + theory
community
program introduction
building codes
tectonics
history + context
economics
charleston
polyethylene film
VERTICAL FARM

multi-wall polycarbonate + corrugated polycarbonate
<table>
<thead>
<tr>
<th>Covering</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Light Transmission</th>
<th>&quot;U&quot; Factor</th>
<th>Insulating Value &quot;R&quot;</th>
<th>Estimated Lifetime</th>
<th>Cost per Sq. Ft.**</th>
</tr>
</thead>
</table>
| Single Polyethylene Film | • Inexpensive  
                     • Easy to install   | Short life          | 85 %               | 1.2        | .83                 | 1 to 4 years       | $0.85              |
| Double Polyethylene Film | • Inexpensive  
                     • Saves on heating costs  
                     • Easy to install   | Short life          | 77 %               | 70         | 1.43                | 1 to 4 years       | $17.10             |
| Corrugated Poly carbonate | • High transmittance  
                     • High impact resistance | Scratches easily    | 91 %               | 1.2        | .83                 | • 15 plus years    | $1.30              |
| Glass Double Strength | • High transmittance  
                     • High UV resistance  
                     • Resists scratching | High cost            | 88 %               | 1.1        | .91                 | 25 plus years      | $3.00              |
| Glass Insulated   | • High transmittance  
                     • High UV resistance  
                     • Resists scratching | Very high cost       | 78 %               | .70        | 1.43                | 25 plus years      | $6.00              |
| 8mm Twin Wall Poly carbonate | • High impact resistance  
                     • Saves on heating costs | Requires glazing system to install  
                     • Scratches easily | 80 %               | .61        | 1.64                | • 15 plus years    | $1.65              |
| 10mm Twin Wall Poly carbonate | • High impact resistance  
                     • Saves on heating costs | Requires glazing system to install  
                     • Scratches easily | 90 %               | .56        | 1.79                | • 15 plus years    | $2.50              |
| 16mm Triple Wall Poly carbonate | • High impact resistance  
                     • Saves on heating costs | Requires glazing system to install  
                     • Scratches easily | 78 %               | .42        | 2.38                | • 15 plus years    | $4.00              |
VERTICAL FARM

edge monkeys
VERTICAL FARM

program introduction
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economics

[Image of a vertical farm building with solar panels]

greenpix
algae facade
VALLEY FARM
volatile organic compounds
* harmful organic chemicals
* found in:
- paints
- solvents
- newspaper
- cleaning chemicals
- vinyl flooring
- carpets
- adhesives + caulks
- air fresheners
- fuel
- pressed wood furniture

SOLUTIONS!
- Increase Ventilation.
- Don’t use things with VOC’s.

OR....
according to a study done in 1973 by NASA, the low levels of VOC’s given off by synthetic materials [better known as “off-gassing”] when placed in a sealed environment were combatted by the existence of....

**PLANTS!**

“If man is to move into closed environments, on Earth or in space, he must take along nature’s life support system.” Plants.
Research labs represent a similar type of construction, in terms of materials, personnel, and equipment they contain. Costs are high compared with buildings designed simply for user comfort. Because of these higher costs, in energy consumption as well as in construction, labs represent a special challenge and opportunity in sustainable design.

- Labs use 5 to 10X as much energy as typical office buildings. [HVAC loads due to ventilation requirements]
- Can cost twice as much to build, or more....
vertical farm criteria

ventilation
- recirculated air vs. outside air

water
- gray water collection + HVAC water

pipe materials
- metal vs. plastic [recyclable?]

electrical/lighting
- daylighting vs. diffuse lighting

digital data
- computers + robotics?

the future?
- adaptability of structure vs. cost effectiveness and functionality.
a green and happy vertical farm.
precedent infrastructure building skins kinetic architecture social justice ecology structure systems

VERTICALFARMSTUDIO
precedent infrastructure building skins kinetic architecture social justice ecology structure systems
precedent infrastructure building skins kinetic architecture social justice ecology structure systems
precedent infrastructure building skins kinetic architecture social justice ecology structure systems
What is **NET-ZERO**?

A building that creates as much energy as it uses

Net-Zero **Site Energy**
- Site produces at least as much energy as it uses in a year

Net-Zero **Source Energy**
- Accounts for “upstream” in efficiencies

Net-Zero **Carbon**
- Factors in “grid” supply carbon intensity

Net-Zero **Energy Cost**
- Annual revenues exported by the building are equal or greater than utility bills paid
NET-ZERO design process

Understand the Site Context

Reduce Energy Loads

Meet Energy Loads Efficiently

Generate and Supply Energy From Renewable Resources

Energy Conservation Efforts must address all energy use aggressively

Conditioning of outdoor air (ventilation)
What is a **ZERO ENERGY BUILDING (ZEB)**?

Independent from the energy grid

Energy harvested on-site

Predicted by Building Information Modeling (BIM)

Combine Passive Solar & Natural Air Conditioning

---

**BedZED**

Environmentally Friendly Housing

Hackbridge, Wallington, Surrey, England
PASSIVE SOLAR DESIGN

Uses solar strategies to heat air and water

No mechanical systems

Stores heat during colder months

 Releases heat when necessary
What is a **PASSIVE HOUSE**?

Reduces heating energy consumption by 90%

Well-Insulated, virtually air-tight building

Requires little energy for heating and cooling

A “design process” integrated with architectural design
Heating water with the sun
Water for the home is heated primarily via a solar thermal system on the roof, although supplementary electric water heating may be used when needed. In addition, a photovoltaic solar array could be used in a net-metering system to help offset electrical consumption costs.

Managing sunlight
A second-story deck shades windows on the first floor, so the winter sun—lower in the sky—helps warm the house, but the hottest summer sun stays out, keeping it cooler.

Windows
Windows are triple-glazed to minimize heat loss. Coated glass helps reflect heat back inside the house in winter and keeps some heat out in summer. The largest windows in the house face south, to take advantage of light and warmth from the sun.

Heat Exchanger
The purpose of the heat exchanger is to continuously replace stale air in the house with fresh air from outside, while preserving the warmth from the interior air. As the stale air from inside passes through the device, its heat is transferred to the fresh air entering from outside. In summer, when added warmth isn’t needed, the heat exchange function may be bypassed.

Walls
For insulation and air-tightness, the Landau house uses a double-wall system for exterior walls, with a continuous primary air barrier between layers. A secondary air barrier sheathes the entire house just beneath the siding. The total wall thickness is about 17 inches, about three times that of a conventional house.

Flooring
A concrete slab rests on a 15-inch layer of foam insulation. A sheet of polystyrene acts as the primary barrier.
PASSIVE HOUSE in the US

Passive House design is expensive

Current design strategies account for 40% excess energy use

Passive Buildings use up to 90% less energy

Passive House Institute
What is ENERGYplus/PLUSenergy?

Produces more energy than it consumes

Originated by Rolf Disch, Freiburg, Germany

Designed as a community of homes with negative energy consumption
Solar Settlement

Designed by Rolf Disch – Freiburg, Germany

Built 2000-2005

Emissions-Free

CO₂ neutral

59 PlusEnergy Homes
precedent infrastructure building skins convertible systems social justice ecology structure systems
TRADITIONAL FARMING METHOD
Figure 1. Freestanding hobby greenhouse styles.