

## Applied Sciences:

Biostatistics      Medical Sciences  
Epidemiology   Anthropology  
Environmental Health Sciences   Agronomy  
Socio-Medical Sciences   Toxicology  
Medical Geography

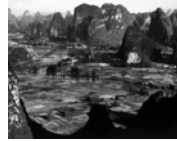
Environmental Degradation Leads To Health Risks



Microbe-contaminated food and water kill up to two million children in developing countries each year

<http://www.fao.org/ag/magazine/0304sp1.htm>

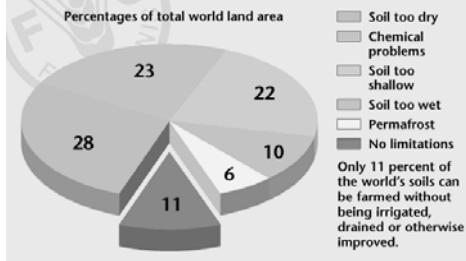
## Many Tropical Diseases Are Transmitted At The Agricultural Interface



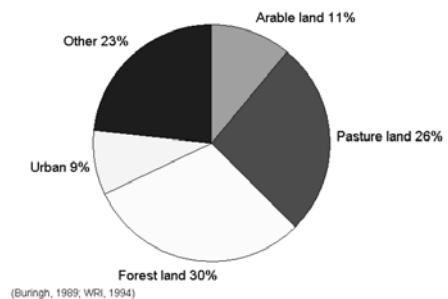
*Malaria*  
*Hookworm*  
*Geohelminths (ascaris, trichuris)*  
*Schistosomiasis*  
*Filariasis*  
*Nipha*

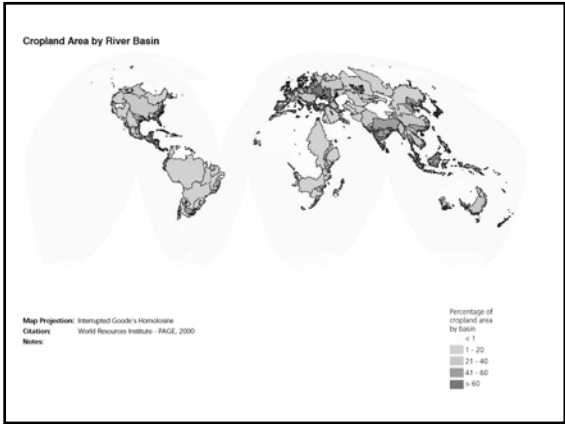


## Soil limits agriculture

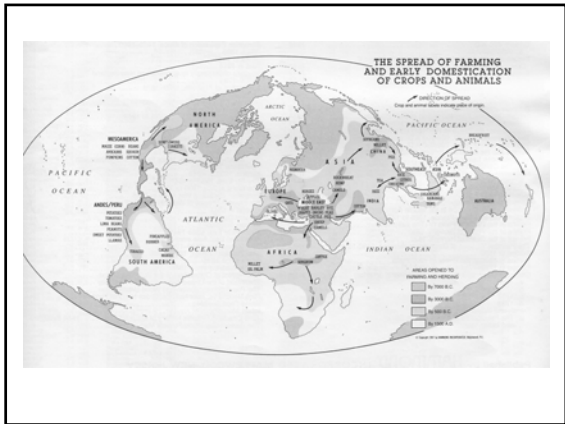
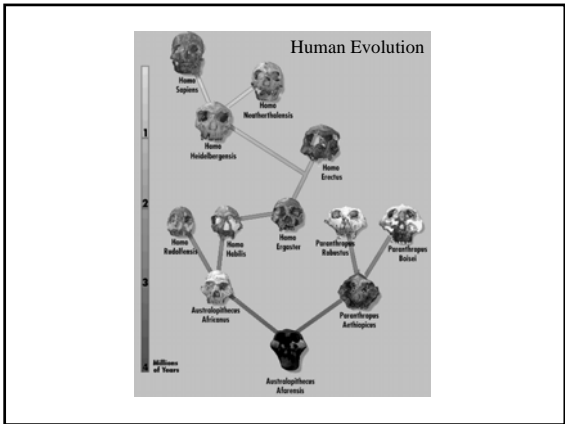


## Land Area on Earth





## A Very Brief History Of Farming



### Early Wheat Farming Sites

**ORIGINS OF AGRICULTURE**  
**NEOLITHIC**

The Fertile Crescent

• Harvest:

- hand-stripping + bag: average 2.05 kg/h
- reconstructed sickle: average 2.45 kg/h
- 46% by weight of actual grain: threshing with wooden mortar and pestle + wind winnowing

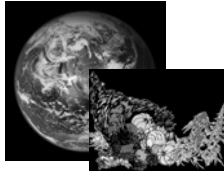
**Einkorn Wheat\***

\*double the seeds, needs watering.



## Global Agricultural Production Index

1975 1980 1985 1990 1995 2000  
 Global Totals\*: 71 79 91 101 109 125



\*Net Production Index Number

Source: FAOSTAT

[http://gocependium.grid.unep.ch/data\\_sets/land/reg\\_land\\_ds.htm](http://gocependium.grid.unep.ch/data_sets/land/reg_land_ds.htm)

### Web Links

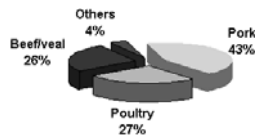
<a href="#">The Food Time Line</a>	<a href="#">U.F.L. Agriculture Course: Mickie Swisher</a>
<a href="#">History of Horticulture Course</a>	<a href="#">OSU Chronology of Agriculture</a>
<a href="#">Seeds of Change, Food Origins</a>	<a href="#">Seeds of Change, Herbs and Spices</a>
<a href="#">Plants of the Bible</a>	<a href="#">French Acropolis Museum</a>
<a href="#">Food History News</a>	<a href="#">Gallery of Reputable Foods</a>
<a href="#">Association of Food and Society</a>	<a href="#">Food in History Bibliography</a>
<a href="#">Food-Past and Present</a>	<a href="#">Food-born Diseases</a>
<a href="#">Scholars' 1911 Encyclopaedia Britannica</a>	<a href="#">Genetically Modified Food</a>
<a href="#">United Nations Relief</a>	<a href="#">Plants and People</a>
<a href="#">World's Largest Vegetable</a>	<a href="#">Nuts</a>
<a href="#">EJ Nuts</a>	<a href="#">Eating Storage</a>
<a href="#">U.N. Food and Agriculture Organization</a>	<a href="#">U.S. FFA Water Quality</a>
<a href="#">Eduaboutary</a>	<a href="#">Oxflam</a>
<a href="#">Oyster Links</a>	<a href="#">Academic Horticulture Sites</a>

<http://images.google.com/imgres?imgref=people+in+cj+edu+lines+HONS+7520193M+Food&imgrefurl=http://people.ucsc.edu/~hines/HONS+7520193+Hons+7520193+2520index.html&imgref=1584&w=1714&star=2&prev=images%3Fq%3Dorigins%2Bof%2Bagriculture%26vman%3D10%268%3D0or%26r%3D%26ic%3DUCF-8%26ic%3DG>

## 40% Of All Grains Are Grown For Animal Feed

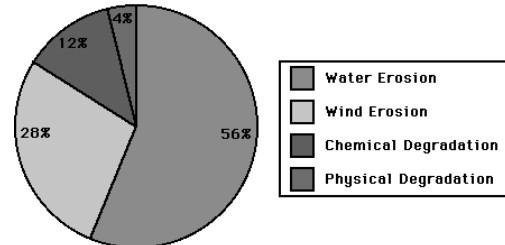
### World Meat Consumption by Species (%)

Source: USDA'S FAS



[http://www.gov.on.ca/OMAFRA/english/livestock/swine/facts/info\\_qs\\_species.htm](http://www.gov.on.ca/OMAFRA/english/livestock/swine/facts/info_qs_species.htm)

## World-Wide Soil Degradation Mechanisms for all Land-Use Types



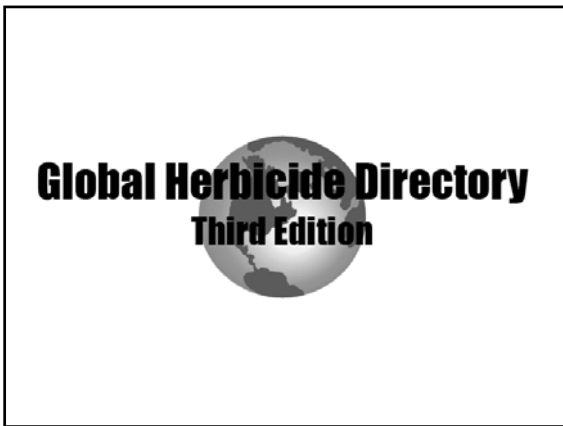
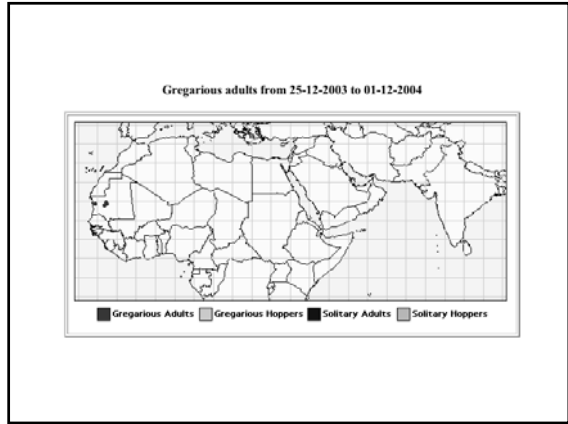
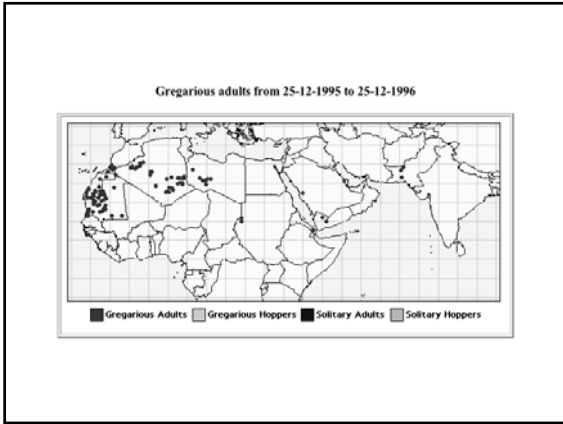
## Agricultural Land Abuses

Pesticides  
 Herbicides  
 Fertilizers

### World Pesticide Use (1,000 metric tons)

Europe	800	(32%)
United States	500	(20%)
Canada	100	(4%)
Other industrialised countries	500	(20%)
Asia developing	300	(12%)
Latin America	200	(8%)
Africa	100	(4%)
TOTAL	2 500	

[http://www.pan-uk.org/briefing/SIDA\\_FIL/Chap1.htm#\\_ftnref1](http://www.pan-uk.org/briefing/SIDA_FIL/Chap1.htm#_ftnref1)



**TFI** The Fertilizer Institute

World Consumption	Item			
	Nitrogenous Fertilizers	Phosphate Fertilizers	Potash Fertilizers	Total Fertilizers
1997/98	81,317 *	33,293	22,577	137,188
1998/99	82,814	33,312	22,041	138,167
1999/00	84,517	33,288	22,096	140,302
2000/01	80,949	32,472	21,778	135,198
2001/02	81,970	33,050	22,711	137,730

<http://www.tfi.org/Statistics/worldfertuse.asp>

\* Thousand metric tons

**Major Fertilizer Consuming Countries**

In million metric tons, years ending June 30\*

Country	1997/98	1998/99	1999/00	2000/01	2001/02
<b>Nitrogen</b>					
China	23.0	22.9	24.1	22.1	22.5
India	11.0	11.4	11.6	10.9	11.3
United States	11.2	11.3	11.2	10.5	10.9
France	2.5	2.5	2.6	2.3	2.4
Pakistan	2.1	2.1	2.2	2.3	2.2
<b>Phosphate</b>					
China	9.3	9.4	9.0	8.7	8.9
India	4.0	4.1	4.8	4.3	4.3
United States	4.2	3.9	3.9	3.9	4.20
Brazil	2.0	2.0	2.0	2.3	2.5
Australia	1.1	1.0	1.1	1.1	1.2
<b>Potash</b>					
United States	4.8	4.5	4.5	4.5	4.5
China	3.4	3.5	3.4	3.5	4.0
Brazil	2.4	2.3	2.2	2.6	2.7
India	1.4	1.3	1.7	1.6	1.7

**EFMA 100th Anniversary**

**Origins**

**Fertilizer, agriculture and the production of food**

The commercial production of fertilizer is one of a combination of technologies that has made it possible, in the course of the twentieth century, to dramatically increase the quantity and quality of food produced on agricultural land.

At the turn of the century, the population of the world was 1.6 billion and the annual consumption of the three major plant nutrients (N, P2O5 and K2O) in the form of mineral fertilizers amounted to less than 3 million tons. As the end of the century approaches, world population has reached 5.9 billion and annual consumption of N, P2O5 and K2O is approximately 135 million tons. In the 40 years between 1950 and 1992, the area of planted arable land increased by 14.5 per cent from 611 million hectares to 700 million hectares; in the same period, grain output rose from 692 million tons to a staggering 1,920 million tons, an increase of 177.5 per cent.

## Clean Water Act

Originally enacted under the administration of Gerald Ford in 1977 and amended under the administration of George W. Bush in 2002

### Activities Exempt under the Clean Water Act, Section 404(f):

- Established (ongoing) farming, ranching, and forestry activities
- Plowing
- Seeding
- Cultivating
- Harvesting food, fiber, and forest products
- Minor drainage
- Upland soil and water conservation practices
- Maintenance (but not construction) of drainage ditches
- Construction and maintenance of irrigation ditches
- Construction and maintenance of farm or stock ponds
- Construction and maintenance of farm and forest roads, in accordance with best management practices
- Maintenance of structures, such as dams, dikes, and levees

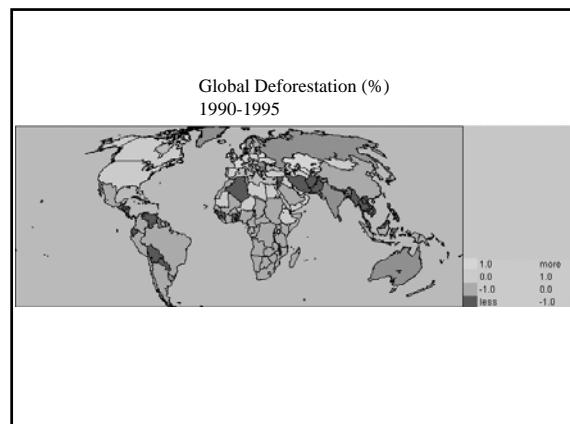
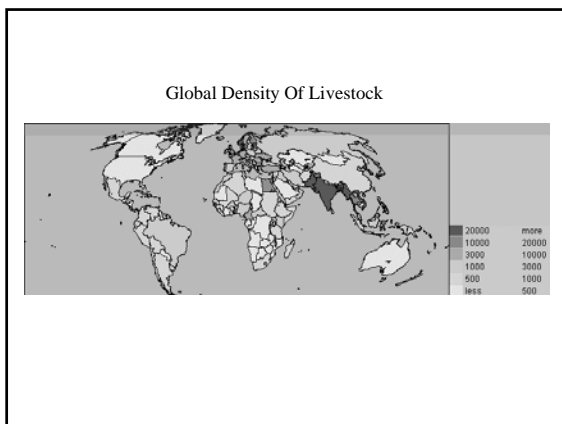
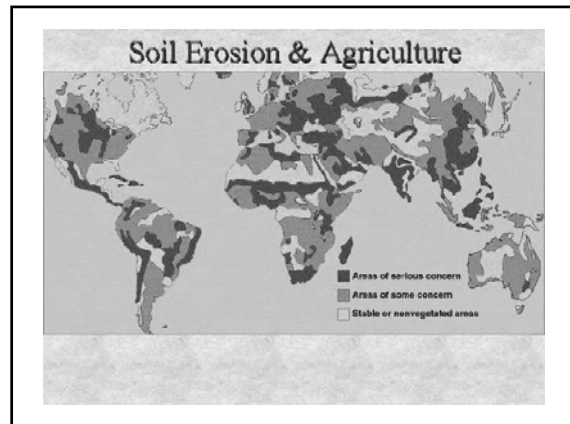
See: <http://www.epa.gov/region5/water/cwa.htm>

To get a new agro-industry product approved by the FDA, industry needs to fill up a mountain of paperwork with reports and tests proving that the product is safe.

To get an agro-industry product approved for the market, one needs to fill a good sized mountain of paperwork that prove it does no more harm than food.

The screenshot shows the 'Documents' section of the FAO website. It features a navigation menu with links for DOCUMENTS, LINKS, INSTITUTIONS, SPREADS, ACTIVITIES, and CONTACTS. A central graphic shows a globe with various regions highlighted and labeled: CONTACTS, ACTIVITIES, LINKS, INSTITUTIONS, SPREADS, and DOCUMENTS. Below the graphic, there are three columns of text: 'The FAO Web site on desertification aims to assist national, regional and international establishments and networks involved in sustainable development of drylands and in particular in the implementation of the United Nations Convention to Combat Desertification (UNCCD).', 'The Web site contains technical and scientific data and information, available at FAO, as well as links to a number of highly informative Web sites on desertification.', and 'The design of the site has been harmonized with the Italian Charter on Desertification, as a result of the collaboration between FAO and the Italian Committee for Combating Desertification.'

<http://www.fao.org/desertification/default.asp?lang=en>



Human Degraded Land (%)



Land With Erosion and Salinity Risk (%)

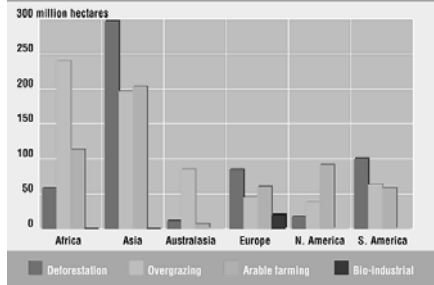


**Low-Income Food-Deficit Countries (as of February 1998)**

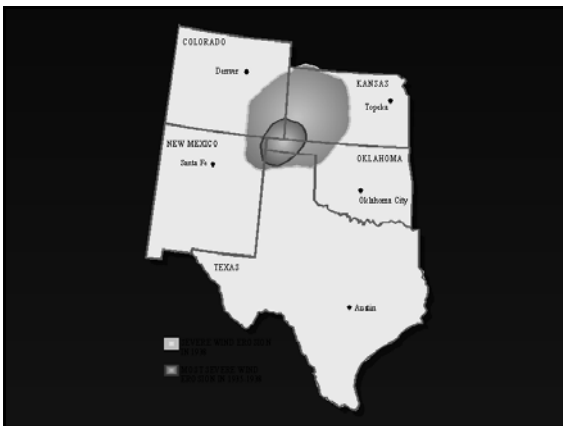
At present, 86 nations are defined as Low-Income Food-Deficit Countries (LIFDCs) - 43 in Africa, 24 in Asia, 9 in Latin America and the Caribbean, 7 in Oceania and 3 in Europe. These countries are home to the vast majority of the world's 800 million chronically undernourished people. Many LIFDCs, particularly in Africa, do not grow enough food to meet all their needs and lack sufficient foreign exchange to fill the gap by purchasing food on the international market.

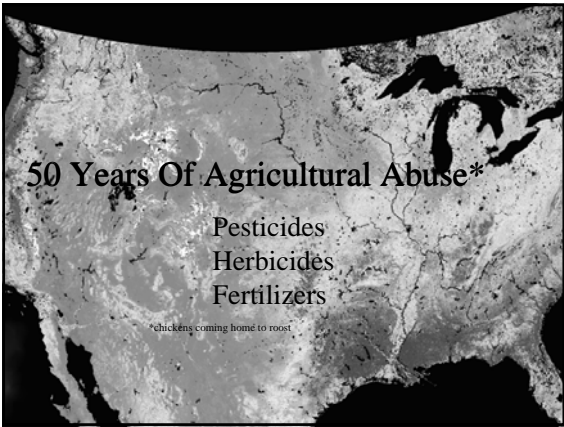
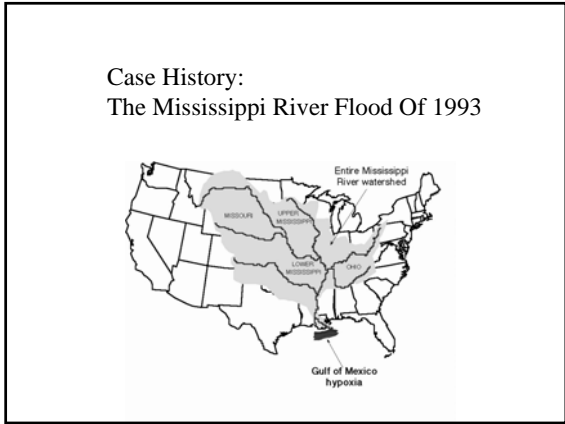
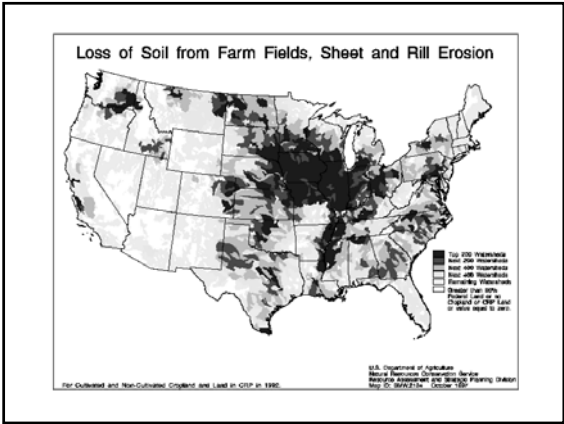


**MAIN CAUSES OF DRYLAND SOIL DEGRADATION BY REGION**



<http://www.fao.org/desertification/default.asp?lang=en>





QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.

*Location Of Dams On Tributaries Of The Kansas River*

QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.

QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.

## Weather Conditions

QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.

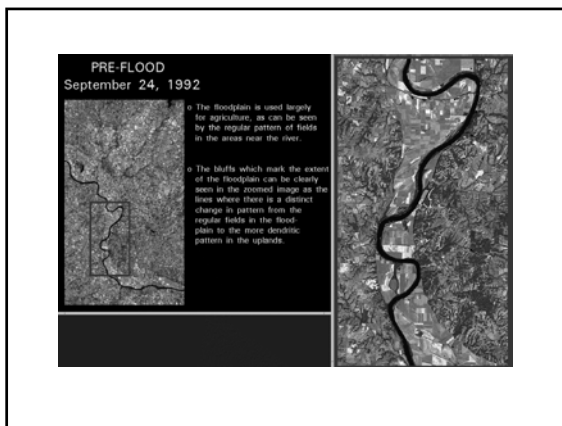
This pattern prevailed for 2 months (June & July)

## What A Difference A Year Makes

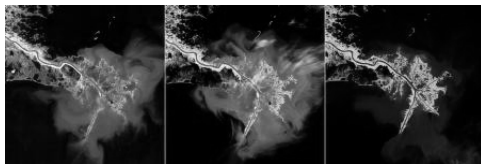
QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.

1992

1993



## Mississippi Delta



### People and the Flood:

Nearly fifty people died as a result of the flooding, 26,000 were evacuated and over 56,000 homes were damaged. Economic losses that are directly attributable to the flooding totaled \$10-12 billion. Indirect losses in the form of lost wages and production can not be accurately calculated.

**The consequences of flooding were determined by land use patterns.**

## Welcome To The Dead Zone



*The Gulf of Mexico Dead Zone  
and  
Red Tides*

## BAY ISSUES



## Polluted Agricultural Runoff

Polluted agricultural runoff from the Central Valley is one the single largest sources of water pollution in San Francisco Bay. For more than

<http://www.savesfbay.org/campaigns/fillpollution/runoff.cfm>

## Imagination Leads To Reality

Flight and on to the moon, Mars, and beyond

The telephone, the cell phone

Satellites of all kinds

Telescope, Hubble Space Telescope

Microscope, atomic force field microscope

Computer, DNA as a programming substance

The Internet

Genetic engineering, altering the course of evolution

Imagine, if you will, a vertical farm

Imagine all the good that will come from it

## Advantages Of Vertical Farming

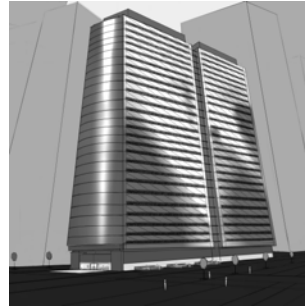
- Year-round crop production
- No weather related crop failures due to droughts, floods
- Eliminates agricultural runoff
- Converts black water to potable water
- Greatly reduces the incidence of many infectious diseases
- Adds energy back to the grid via methane generation
- Dramatically reduces fossil fuel use (no tractors, plows, etc.)
- Converts abandoned urban properties into food production
- Sustainability for urban centers
- Creates new employment opportunities
- Returns farm land to nature, restoring ecosystem services
- Reduces the incidence of armed conflict over natural resources, such as water and land for agriculture

*A Vertical Farm\**



*\* not exactly what I imagined*

*Virtual Vertical Farm\**



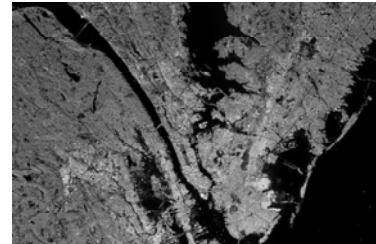
\*www.verticalfarm.com

*The Vertical Farm:  
A possible Solution*



**URBAN ECOLOGY**

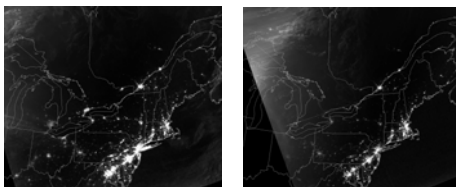
Vibrant, successful cities are not only possible but necessary for the health of society and our planet. Urban Ecology plans and designs cities that sustain the people, natural resources, and economy necessary for everyone to thrive.



<http://www.urbanecology.org/>

*Advantages Of Vertical Farming*  
*Adds energy back to the grid via methane generation*

*“What A Difference A Day Makes”*



*August 14th*

*August 15th*

**Ecosystem Services\***



\* from: *Living In The Environment* Thompson Brooks/Cole Pub. 2004

*Advantages Of Vertical Farming  
Returns farm land to nature,  
restoring ecosystem services*



**Ecosystem Services: Benefits Supplied  
to Human Societies by Natural Ecosystems**

by  
Gretchen C. Daily, Susan Alexander, Paul R. Ehrlich, Larry Goulder, Jane Lubchenco, Pamela A. Matson,  
Harold A. Mooney, Sandra Postel, Stephen H. Schneider, David Tilman, George M. Woodwell

Other imminent threats include the alteration of the Earth's carbon, nitrogen, and other biogeochemical cycles through the burning of fossil fuels and heavy use of nitrogen fertilizer; degradation of farmland through unsustainable agricultural practices; squandering of freshwater resources; toxification of land and waterways; and overharvesting of fisheries, managed forests, and other theoretically renewable systems.

*Vertical New York City*



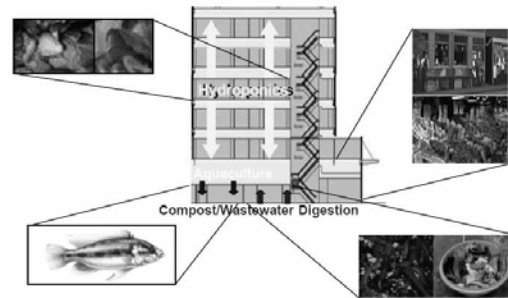
Photo: NASA



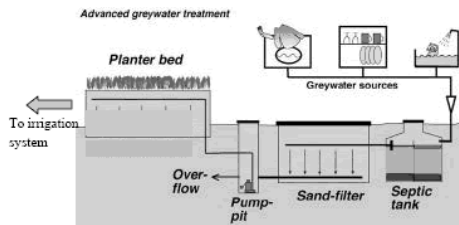
*Medical Ecology  
Class Of 2003*

- Kristin Anderson
- Nicola Areshenko
- Alan Brown
- Jennifer Buskey
- Amanda Colligan
- Marisa Dahlman
- Catherine Dell'Orto
- Catherine Tuglus
- Steve Chen, technical advisor

*How It Could Work*



*Bioremediation*



*Energy Considerations*

