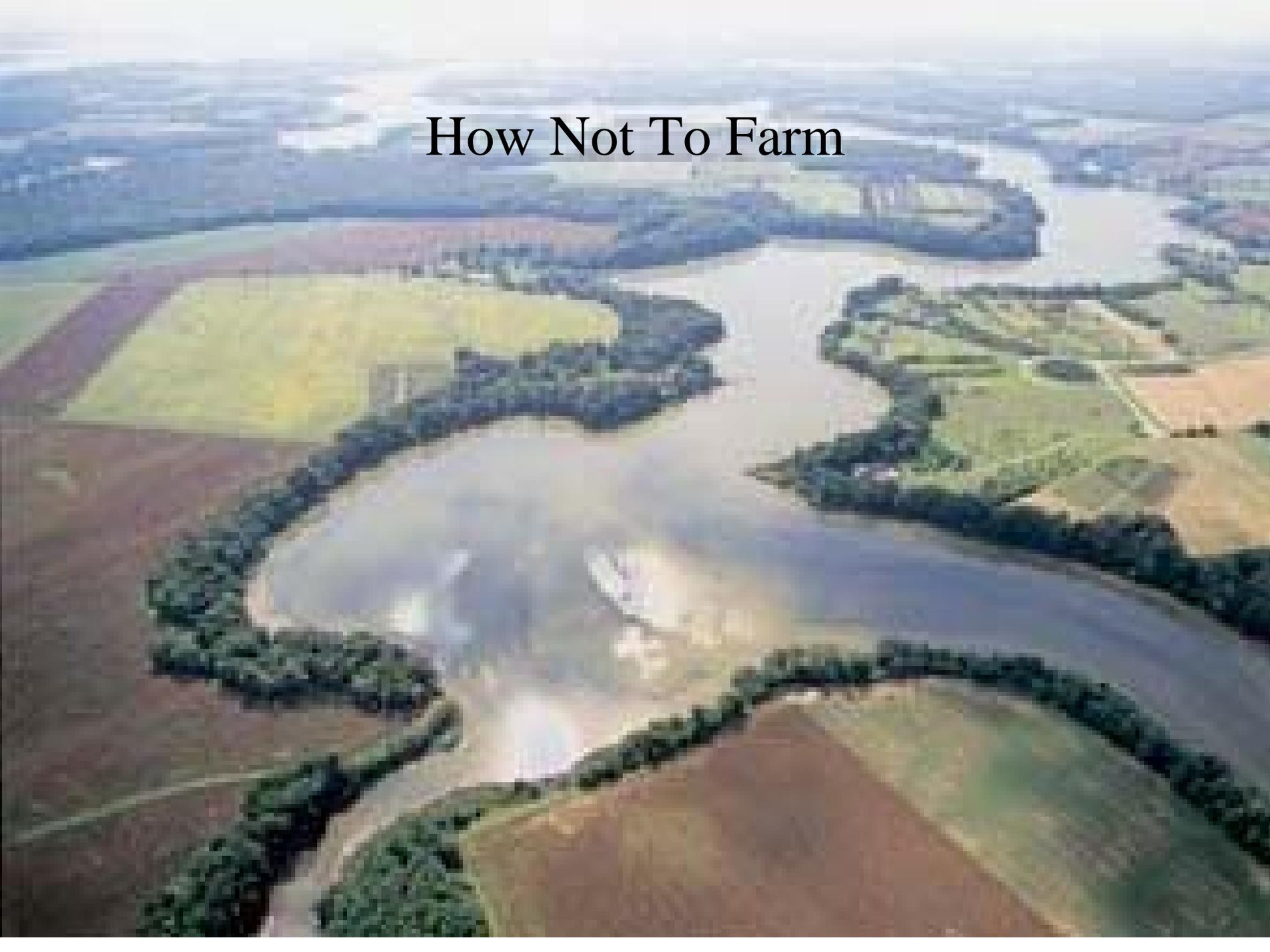


# How Not To Farm



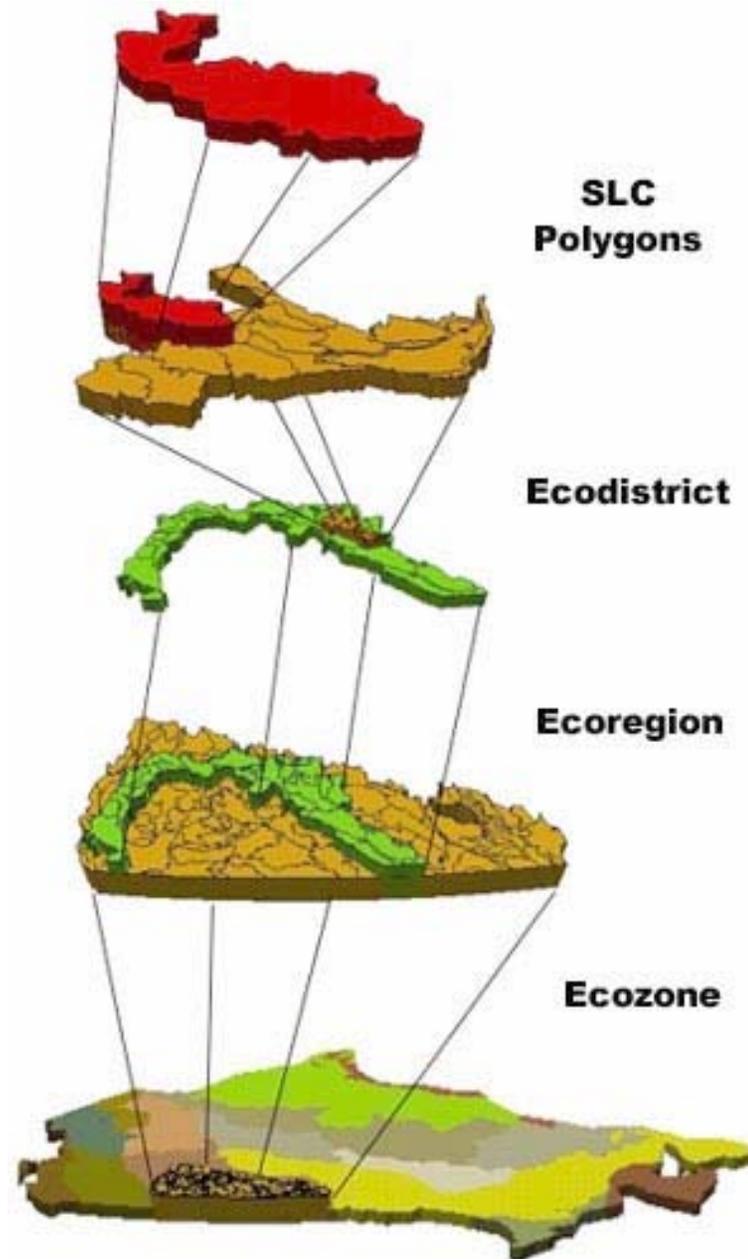
# This Is Why



# Water: Part I

## Agricultural Runoff







**Basic  
Science**

**Medical  
Ecology**

**Applied  
Science**

# ***Basic Sciences:***

*Geology*

*Ecology*

*Oceanography*

*Hydrology*

*Biochemistry and Molecular Biology*

*Physics*

*Atmospheric Sciences*

*Chemistry*

*Remote Sensing*

# ***Applied Sciences:***

*Biostatistics*

*Medical Sciences*

*Epidemiology*

*Anthropology*

*Agronomy*

*Environmental Health Sciences*

*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*

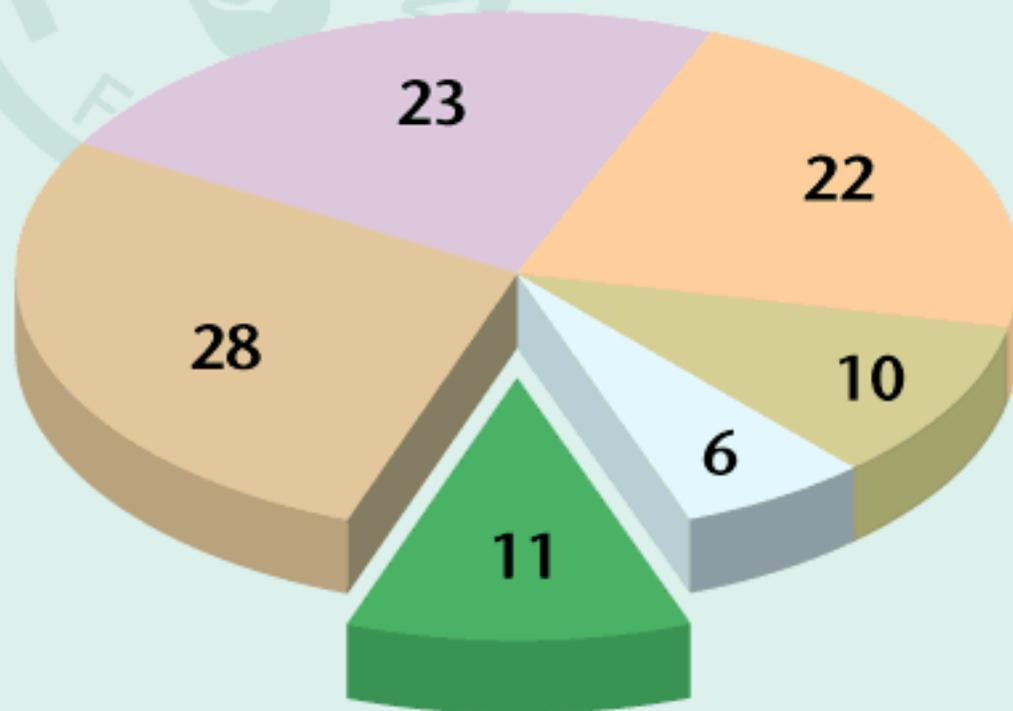
*Filariasis*

*Nipha*



# Soil limits agriculture

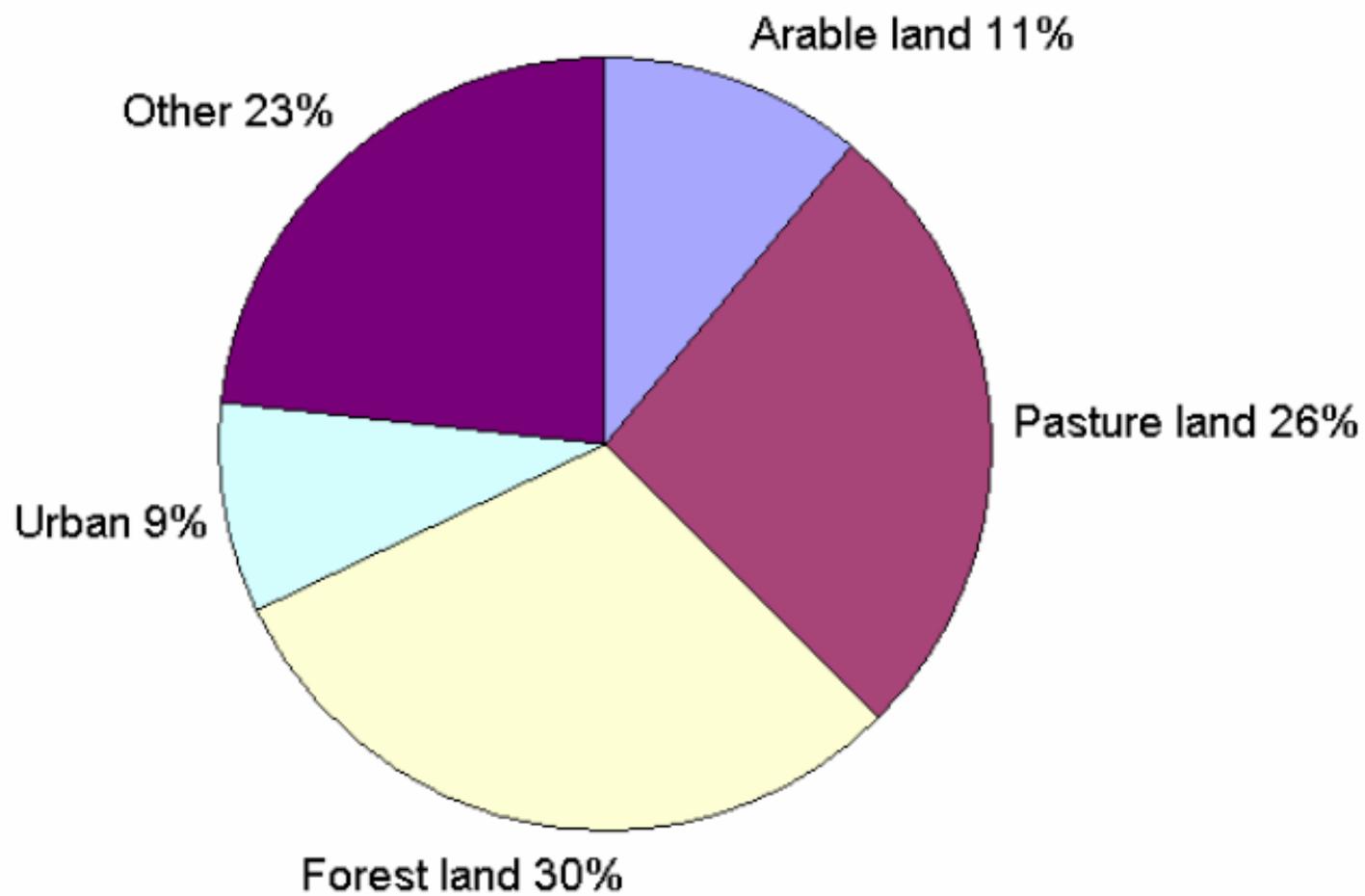
Percentages of total world land area



- Soil too dry
- Chemical problems
- Soil too shallow
- Soil too wet
- Permafrost
- No limitations

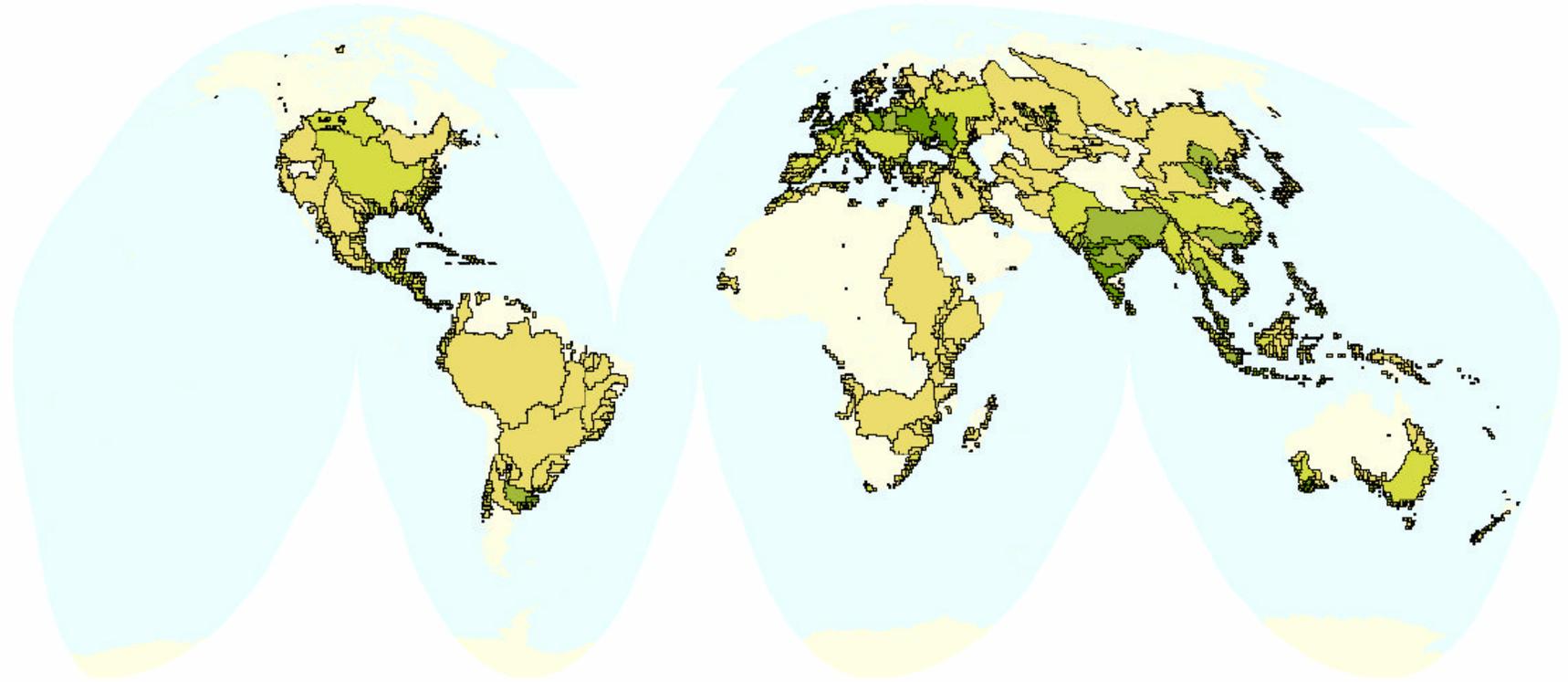
Only 11 percent of the world's soils can be farmed without being irrigated, drained or otherwise improved.

## Land Area on Earth



(Buringh, 1989; WRI, 1994)

## Cropland Area by River Basin



**Map Projection:** Interrupted Goode's Homolosine

**Citation:** World Resources Institute - PAGE, 2000

**Notes:**

Percentage of  
cropland area  
by basin

< 1

1 - 20

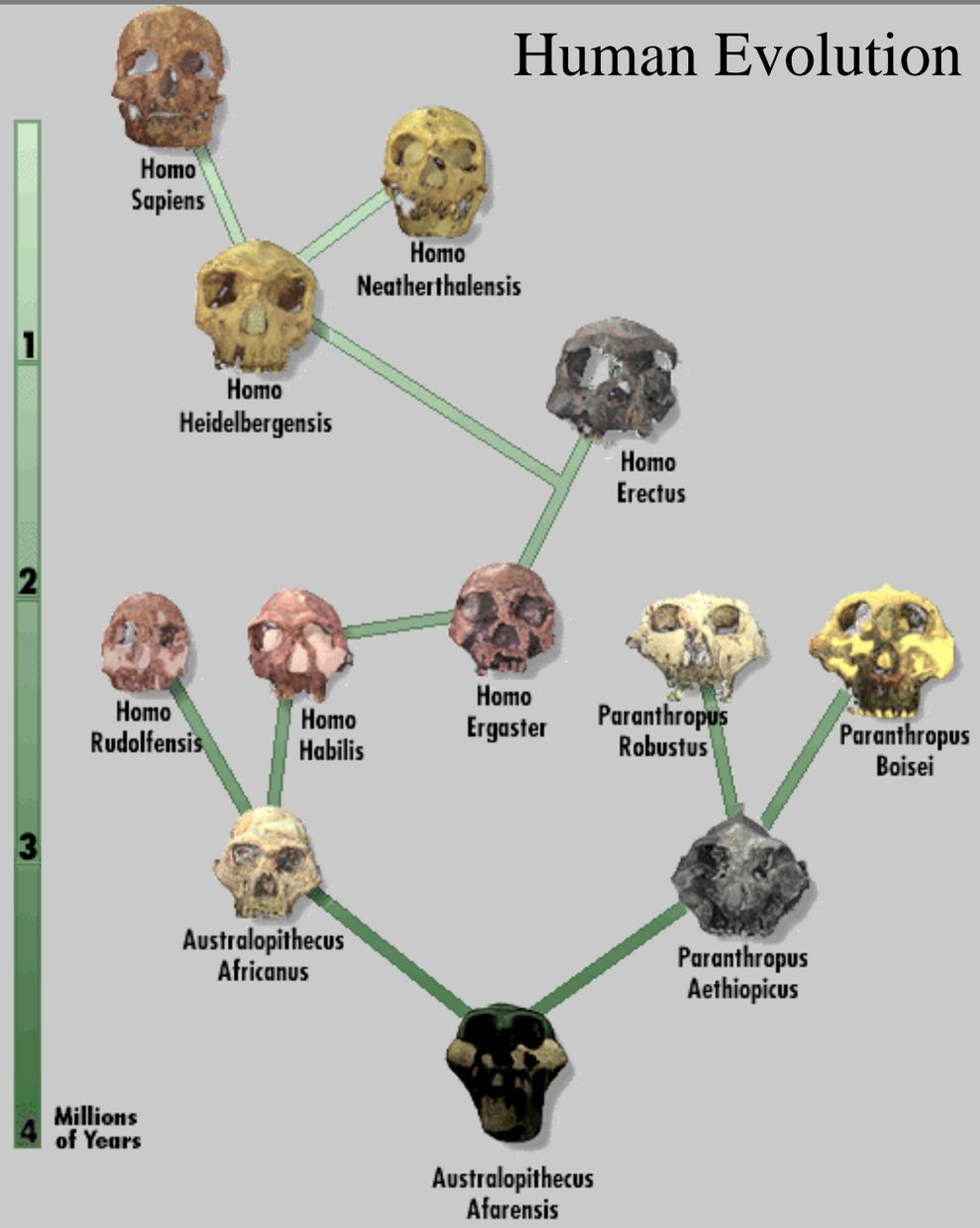
21 - 40

41 - 60

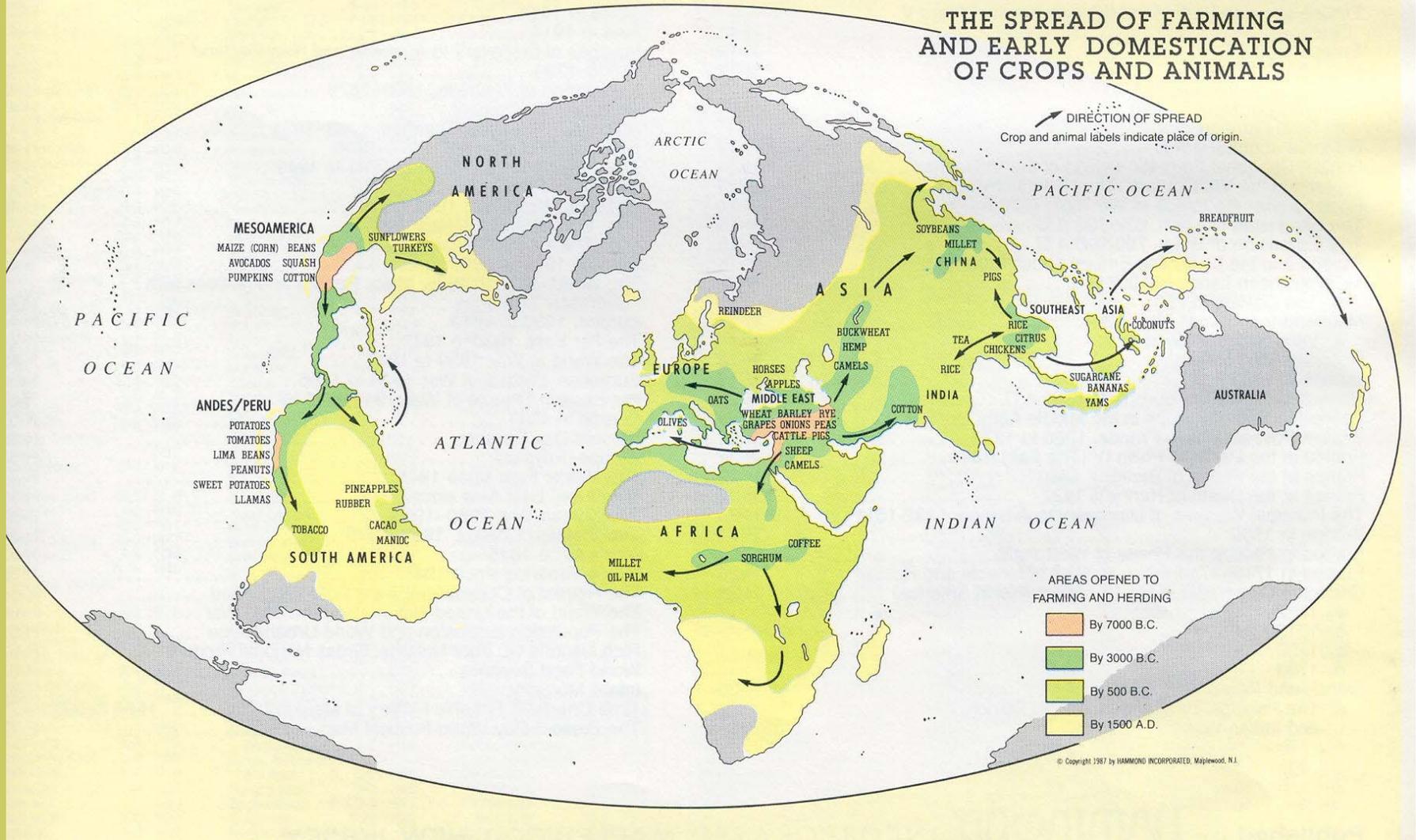
> 60

# A Very Brief History Of Farming

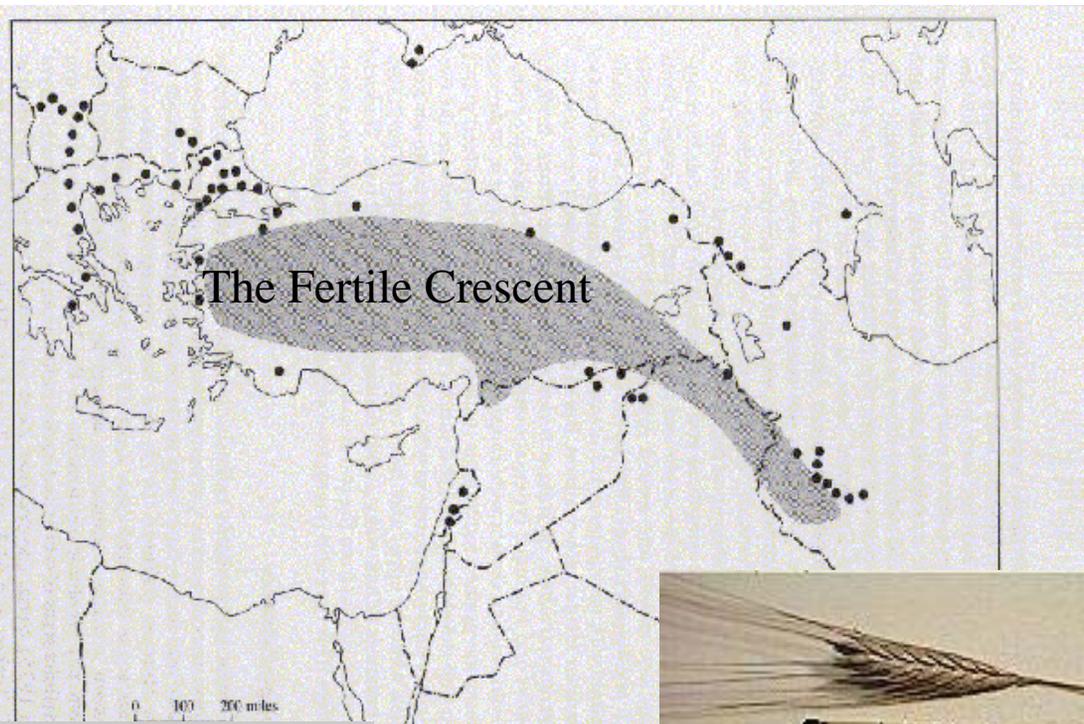
# Human Evolution



# THE SPREAD OF FARMING AND EARLY DOMESTICATION OF CROPS AND ANIMALS



# Early Wheat Farming Sites



## • Harvest:

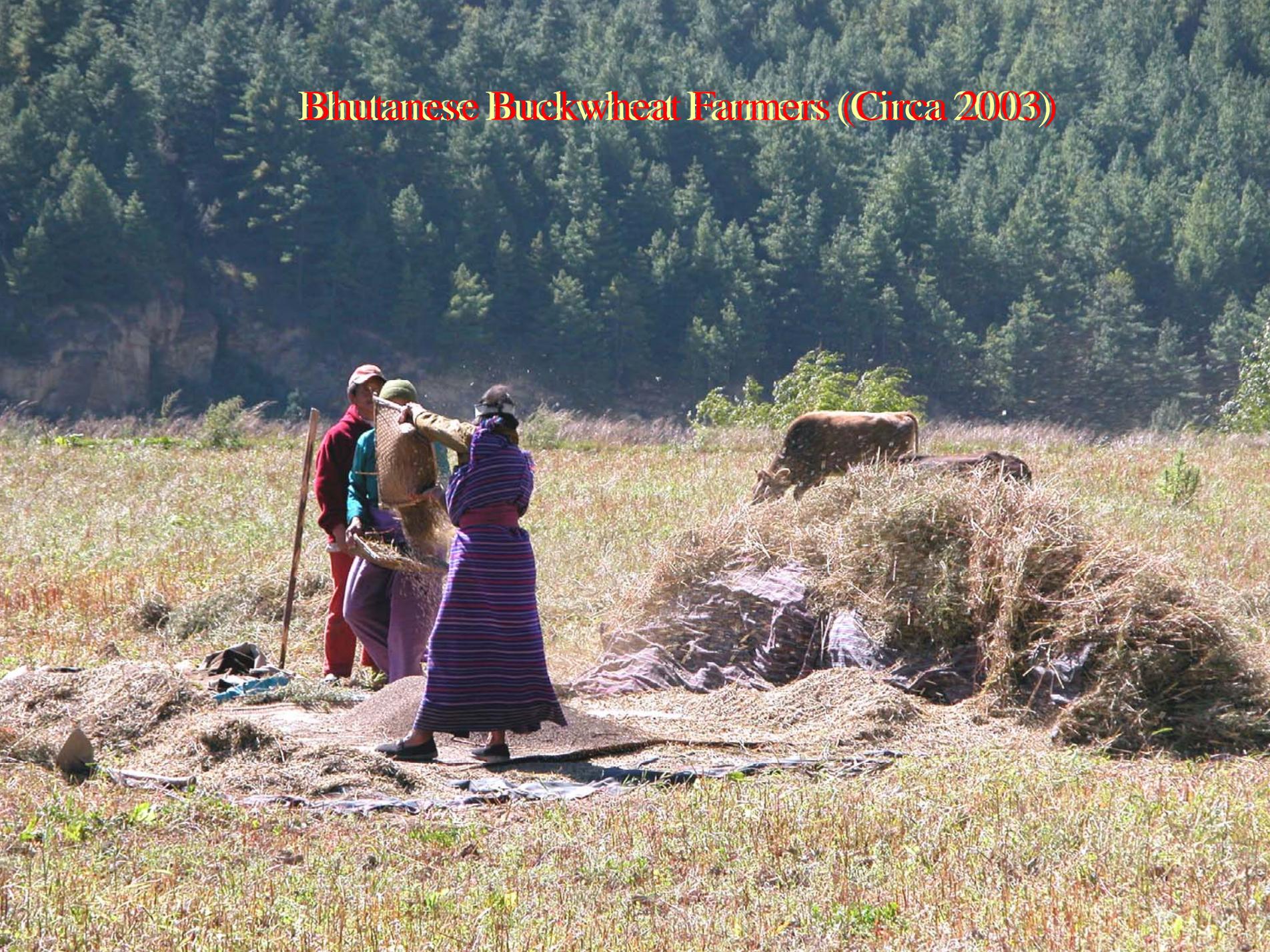
- hand-stripping + bag: average: 2.05 kg/h
- reconstructed sickle: average: 2.45 kg/h
- 46% by weight of actual grain: threshing with wooden mortar and pestle + wind winnowing



Einkorn Wheat\*

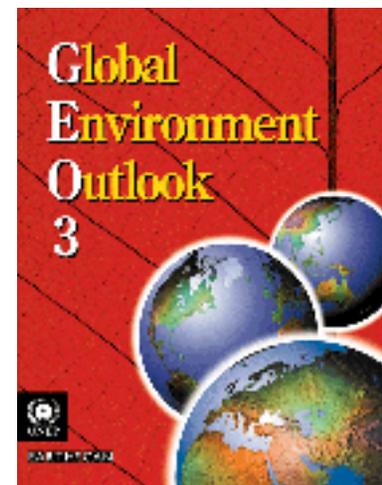
\*double the seeds, needs watering.

# Bhutanese Buckwheat Farmers (Circa 2003)



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

## Web Links

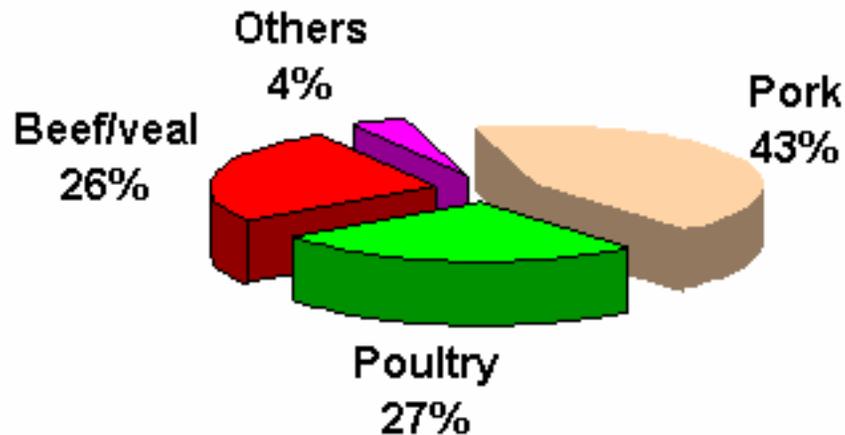
<a href="#"><u><i>The Food Time Line</i></u></a>	<a href="#"><u><i>U FL Agriculture Course: Mickie Swisher</i></u></a>
<a href="#"><u><i>History of Horticulture Course</i></u></a>	<a href="#"><u><i>OSU Chronology of Agriculture</i></u></a>
<a href="#"><u><i>Seeds of Change, Food Origins</i></u></a>	<a href="#"><u><i>Seeds of Change, Herbs and Spices</i></u></a>
<a href="#"><u><i>Plants of the Bible</i></u></a>	<a href="#"><u><i>French Agropolis Museum</i></u></a>
<a href="#"><u><i>Food History News</i></u></a>	<a href="#"><u><i>Gallery of Regrettable Foods</i></u></a>
<a href="#"><u><i>Association of Food and Society</i></u></a>	<a href="#"><u><i>Food in History Bibliography</i></u></a>
<a href="#"><u><i>Food-Past and Present</i></u></a>	<a href="#"><u><i>Food-born Diseases</i></u></a>
<a href="#"><u><i>Scholars' 1911 Encyclopedia Britannica</i></u></a>	<a href="#"><u><i>Genetically Modified Food</i></u></a>
<a href="#"><u><i>United Nations Relief</i></u></a>	<a href="#"><u><i>Plants and People</i></u></a>
<a href="#"><u><i>World's Largest Vegetable</i></u></a>	<a href="#"><u><i>Nuts</i></u></a>
<a href="#"><u><i>El Nino</i></u></a>	<a href="#"><u><i>Ending Hunger</i></u></a>
<a href="#"><u><i>UN Food and Agriculture Organization</i></u></a>	<a href="#"><u><i>US EPA Water Quality</i></u></a>
<a href="#"><u><i>Ethnobotany</i></u></a>	<a href="#"><u><i>Oxfam</i></u></a>
<a href="#"><u><i>Oyster Links</i></u></a>	<a href="#"><u><i>Academic Horticulture Sites</i></u></a>

<http://images.google.com/imgres?imgurl=people.uncw.edu/hinese/HON%2520210/McDonalds%2520Josh.jpg&imgrefurl=http://people.uncw.edu/hinese/HON%2520210/Honors%2520Food%2520index.htm&hl=en&h=1584&w=1714&start=20&prev=/images%3Fq%3Dorigins%2Bof%2Bagriculture%26svnum%3D10%26hl%3Den%26lr%3D%26ie%3DUTF-8%26sa%3DG>

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

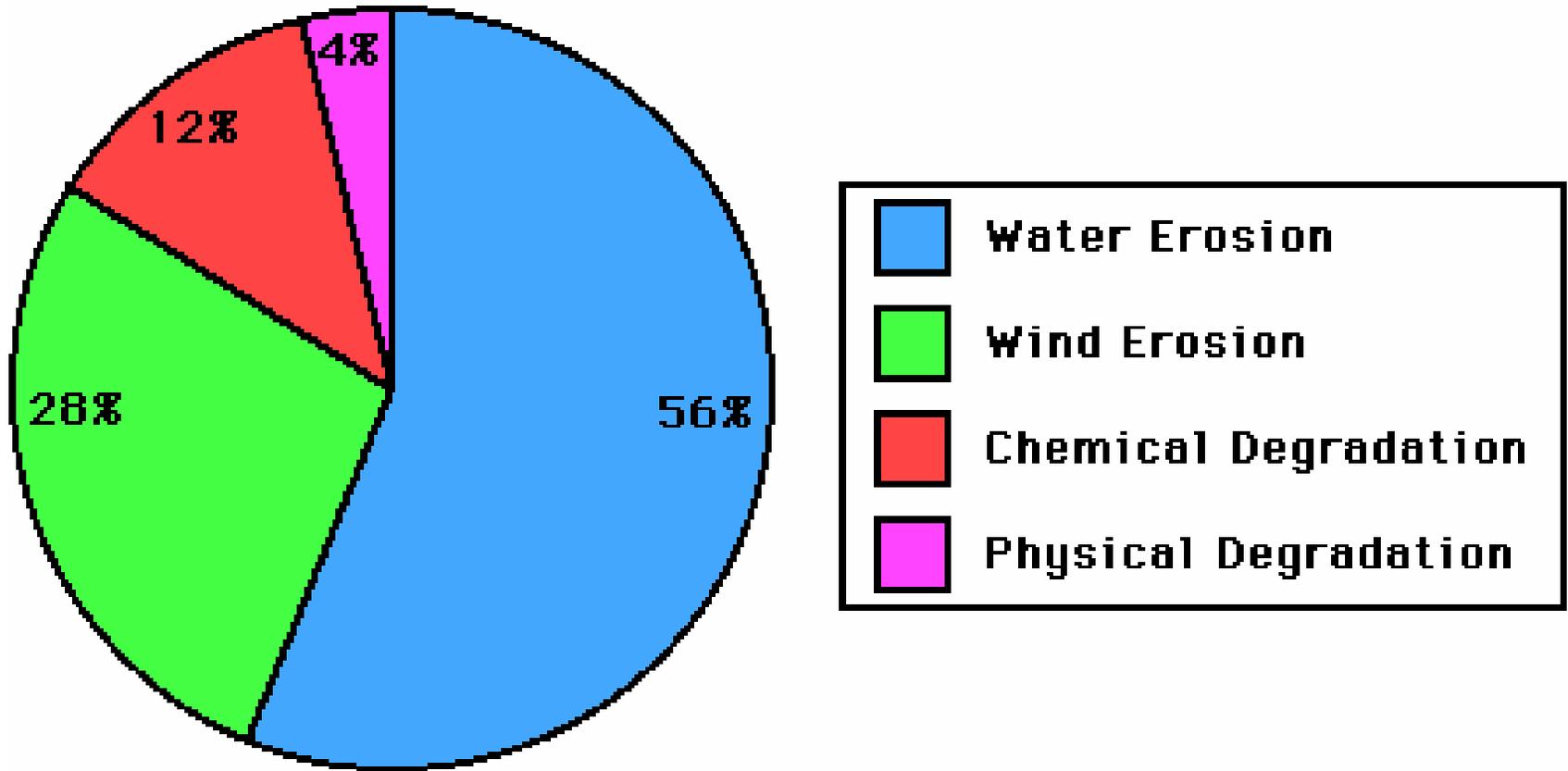
## **World Meat Consumption by Species (%)**

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

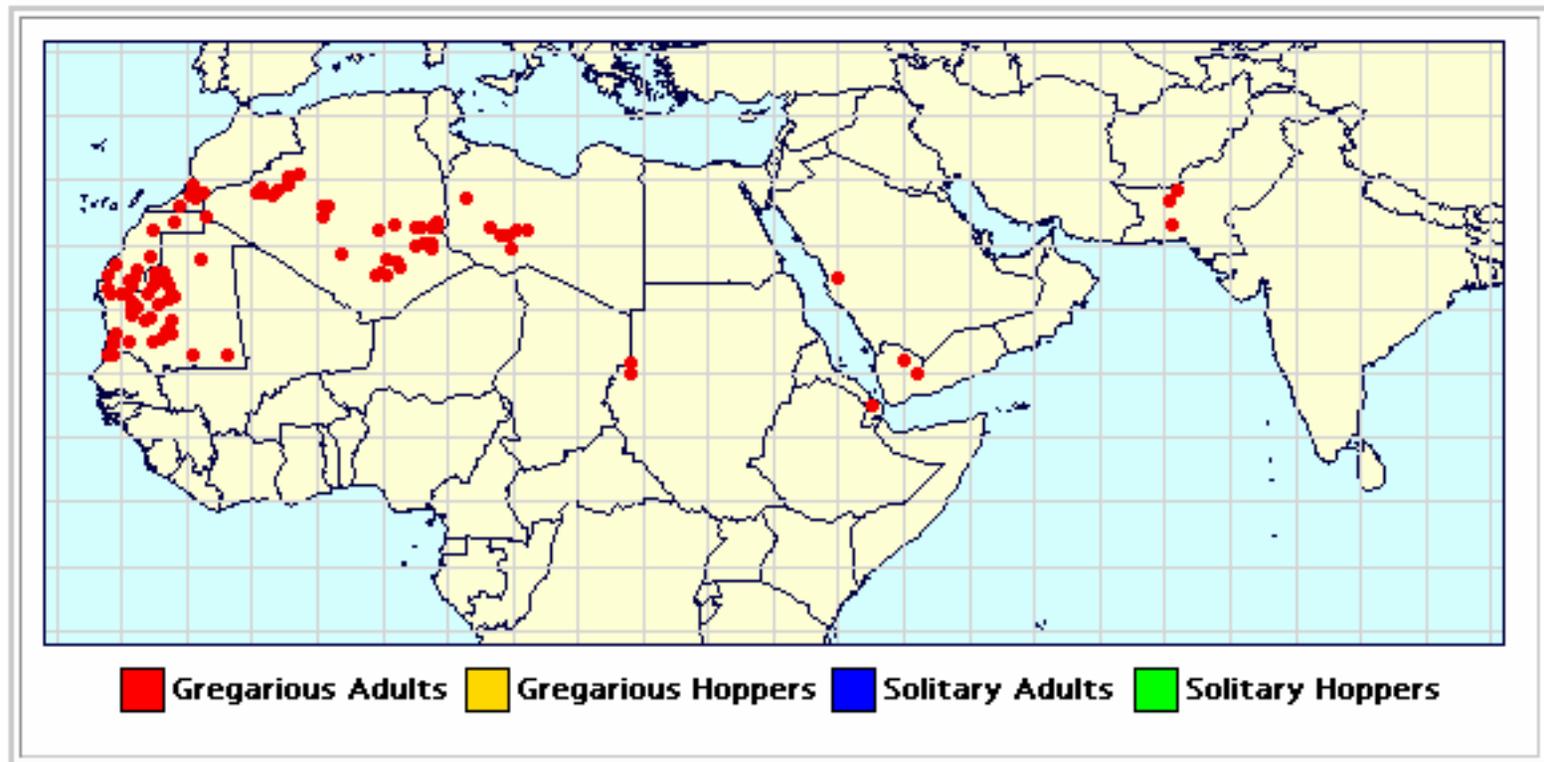
Fertilizers

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

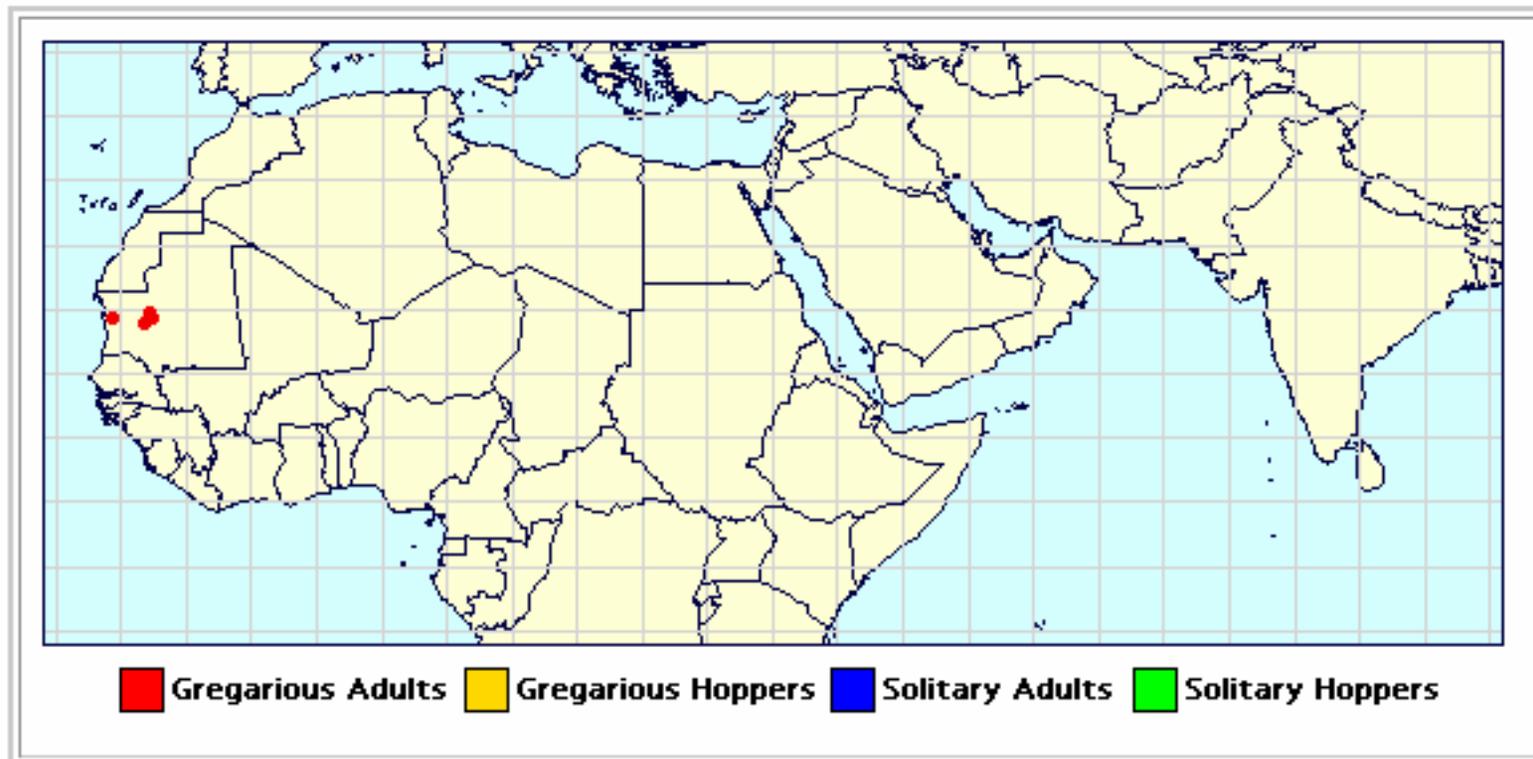
Europe	800	(32%)
United States	500	(20%)
Canada	100	(4%)
Other industrialised countries	500	(20%)
Asia developing	300	(12%)
Latin America	200	(8%)
Africa	100	(4%)
TOTAL	2 500	

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

### Gregarious adults from 25-12-1995 to 25-12-1996



### Gregarious adults from 25-12-2003 to 01-12-2004





**Global Herbicide Directory**  
**Third Edition**

# TFI | The Fertilizer Institute

<b>World Consumption</b>	<b>Item</b>			
	<b>Nitrogenous Fertilizers</b>	<b>Phosphate Fertilizers</b>	<b>Potash Fertilizers</b>	<b>Total Fertilizers</b>
<b>1997/98</b>	81,317 *	33,293	22,577	137,188
<b>1998/99</b>	82,814	33,312	22,041	138,167
<b>1999/00</b>	84,917	33,288	22,096	140,302
<b>2000/01</b>	80,949	32,472	21,778	135,198
<b>2001/02</b>	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\*

<u>Country</u>	<u>1997/98</u>	<u>1998/99</u>	<u>1999/00</u>	<u>2000/01</u>	<u>2001/02</u>
----------------	----------------	----------------	----------------	----------------	----------------

### Nitrogen

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

### Phosphate

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

### Potash

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



European Fertilizer Manufacturers Association



## EFMA 10th Anniversary

[Table Of Contents](#)

[Foreword](#)

### EFMA 10th 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, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O) 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, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O 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 drug approved by the FDA  
industry needs to fill up a good sized room  
with reports and tests proving it does more  
good than harm.

To get an agro-industry product taken off the market,  
one needs to fill a good sized room with reports  
that prove it does more harm than good.

DOCUMENTS

LINKS

INSTITUTIONS

EXPERTS

ACTIVITIES

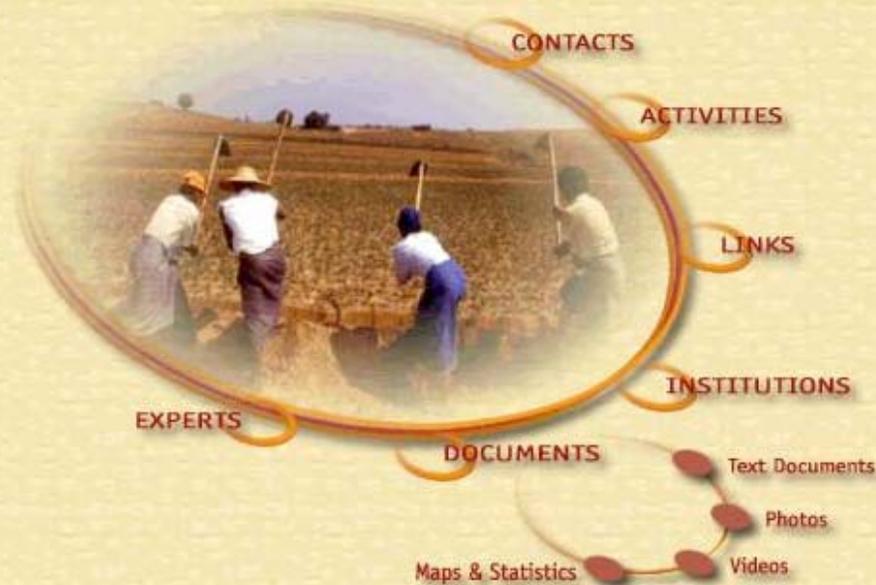
CONTACTS

عربي

ENGLISH

FRANÇAIS

ESPAÑOL

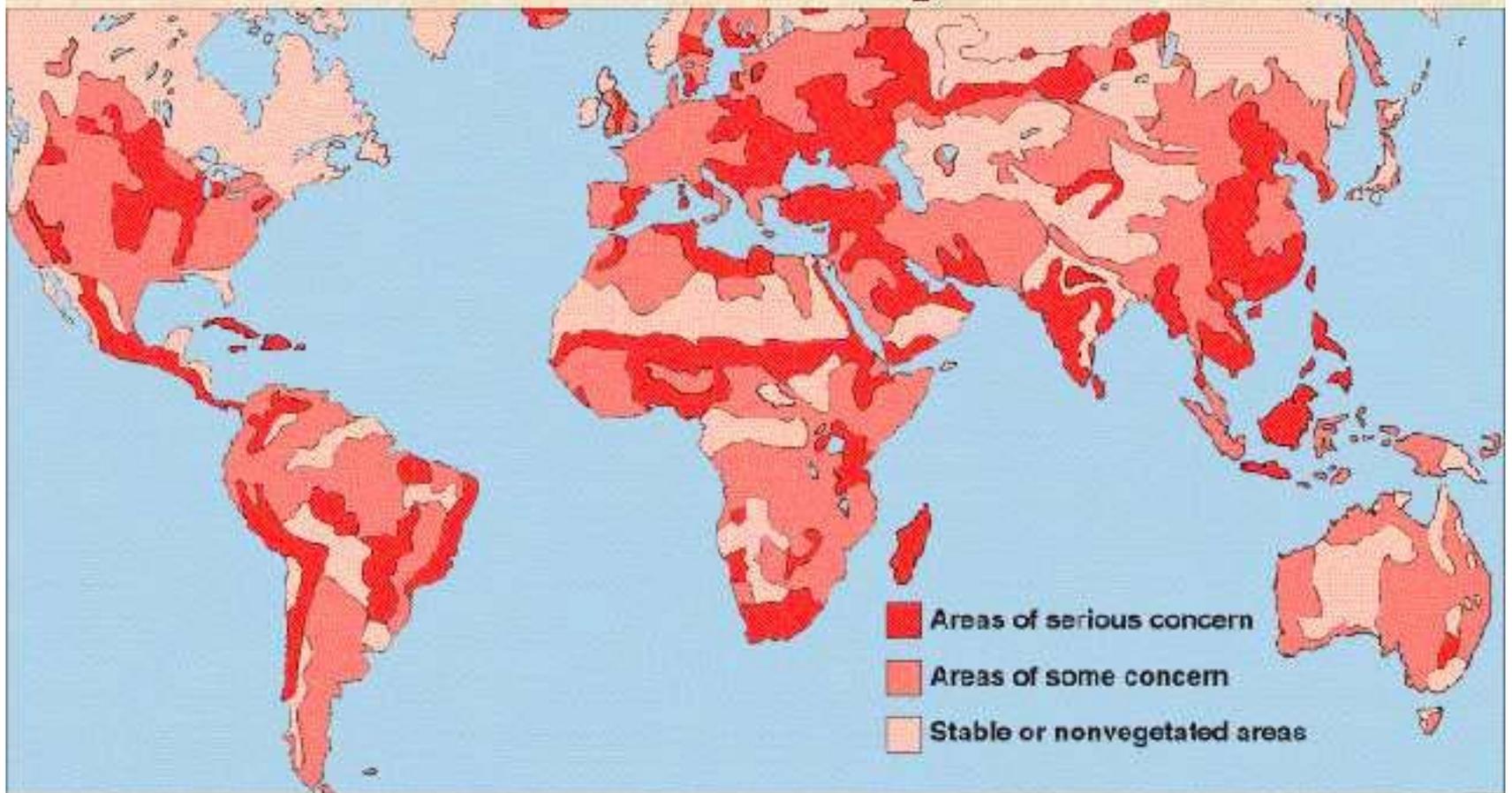


The FAO Web site on [desertification](#) aims to assist national, regional and international stakeholders and networks involved in sustainable development of drylands and in particular in the implementation of the [United Nations Convention to Combat Desertification \(UNCCD\)](#).

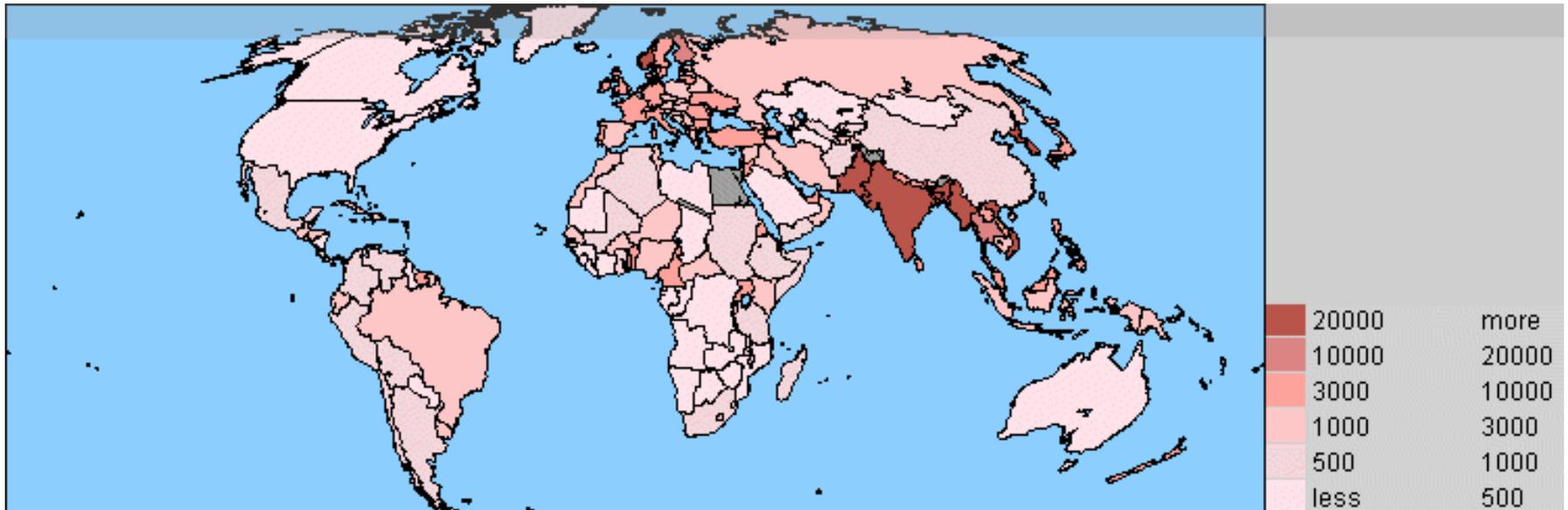
The Web site contains technical and scientific data and information, available at FAO, as well as links to a number of highly informative Web sites on desertification.  
The information provided in this site represents a significant share of the FAO knowledge and expertise on sustainable development and drylands management.

The design of the site has been harmonised with the [Italian Clearing-House on Desertification](#), as a result of the collaboration between FAO and the Italian Committee to Combat Desertification.

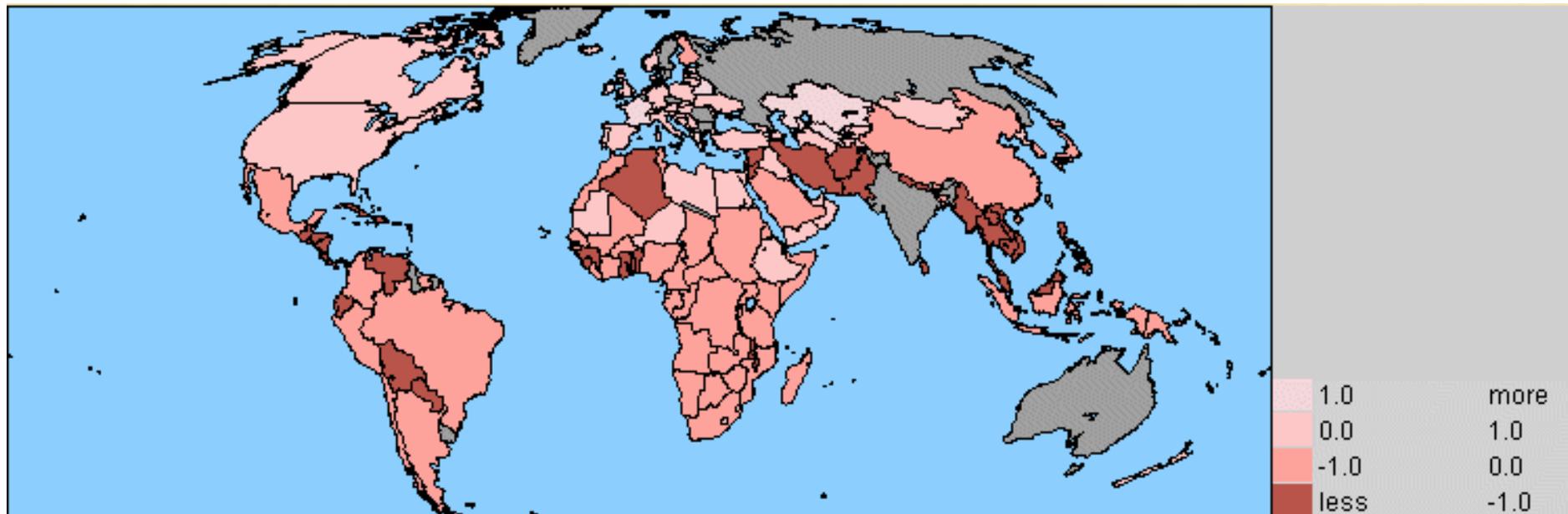
# Soil Erosion & Agriculture



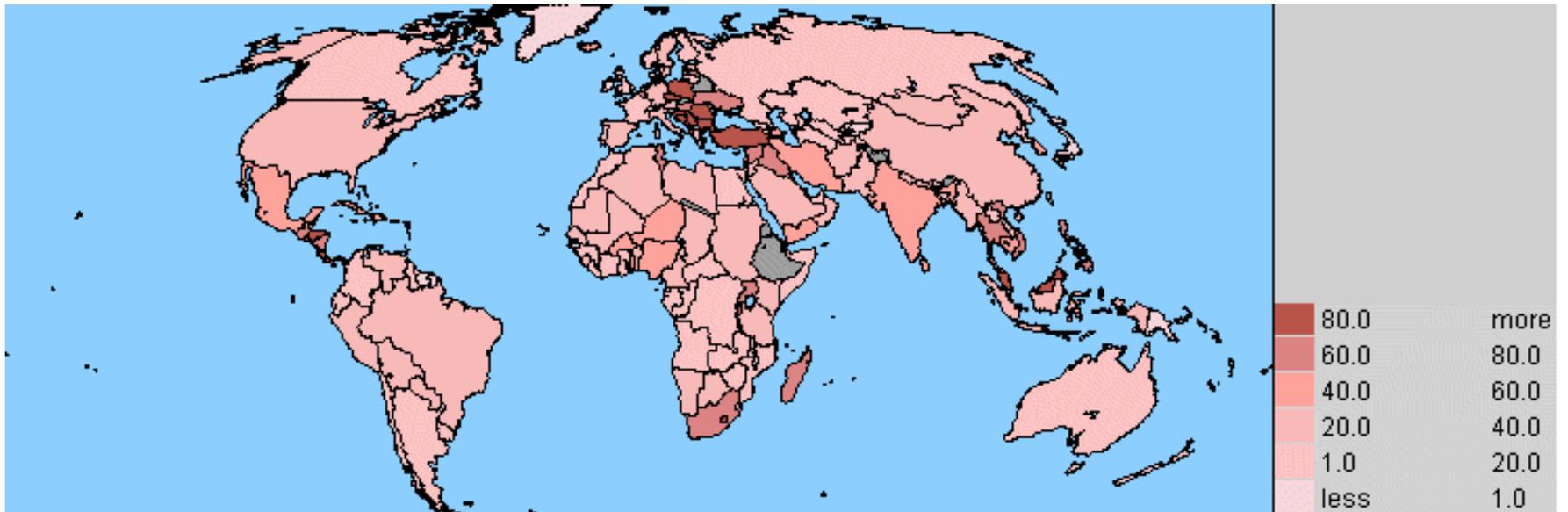
# Global Density Of Livestock



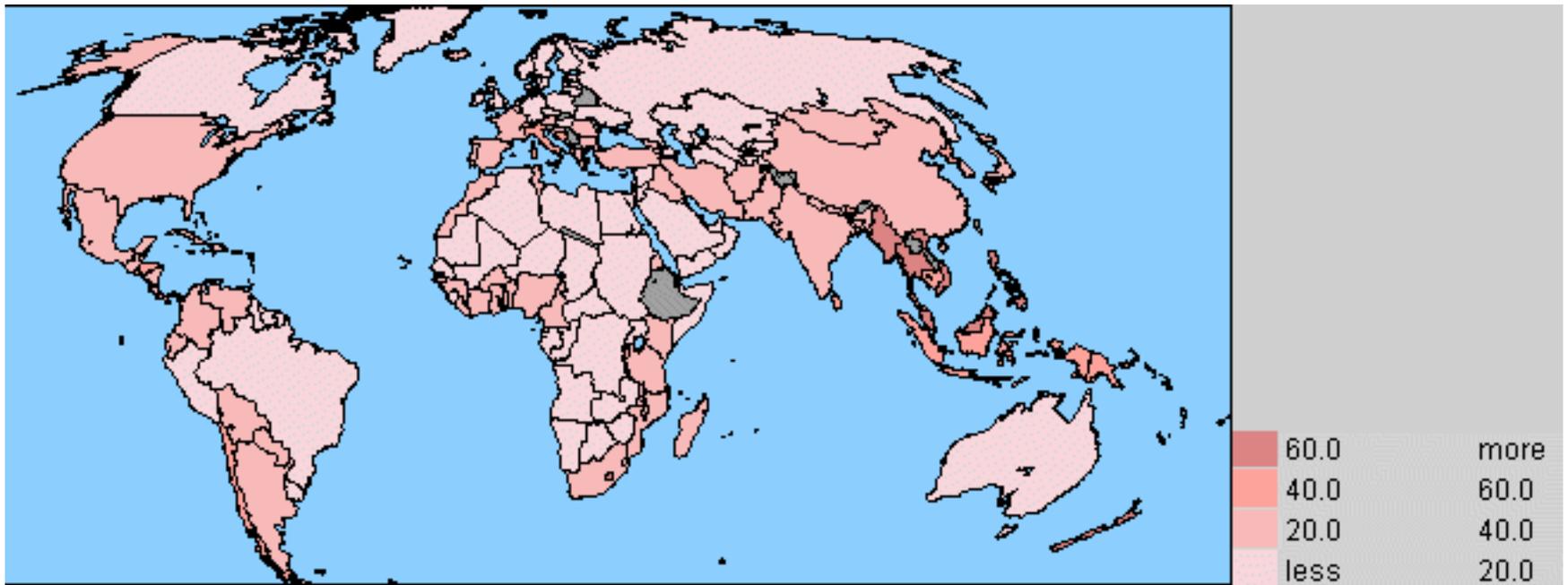
# Global Deforestation (%) 1990-1995



## Human Degraded Land (%)



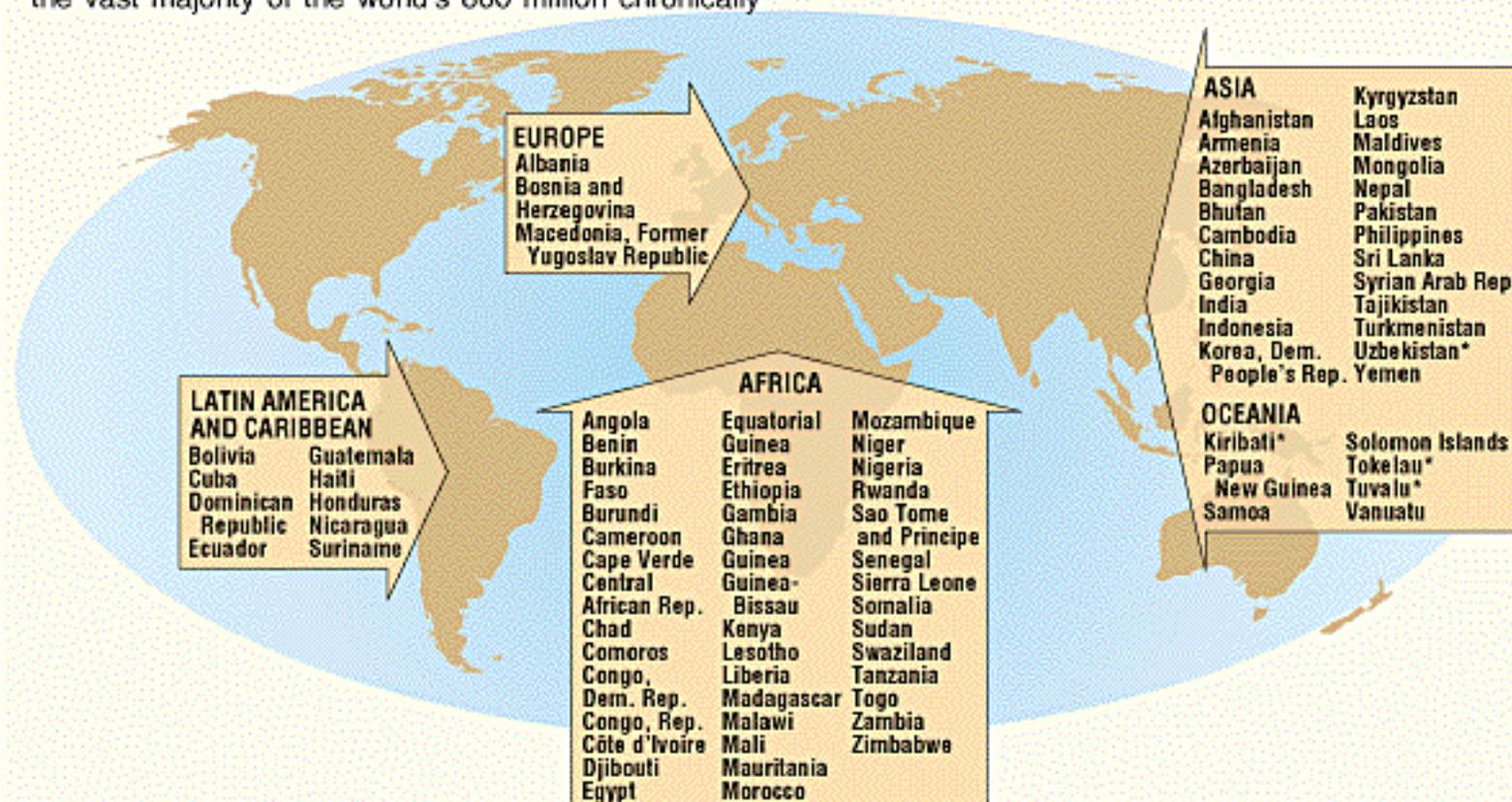
## Land With Erosion and Salinity Risk (%)



# 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

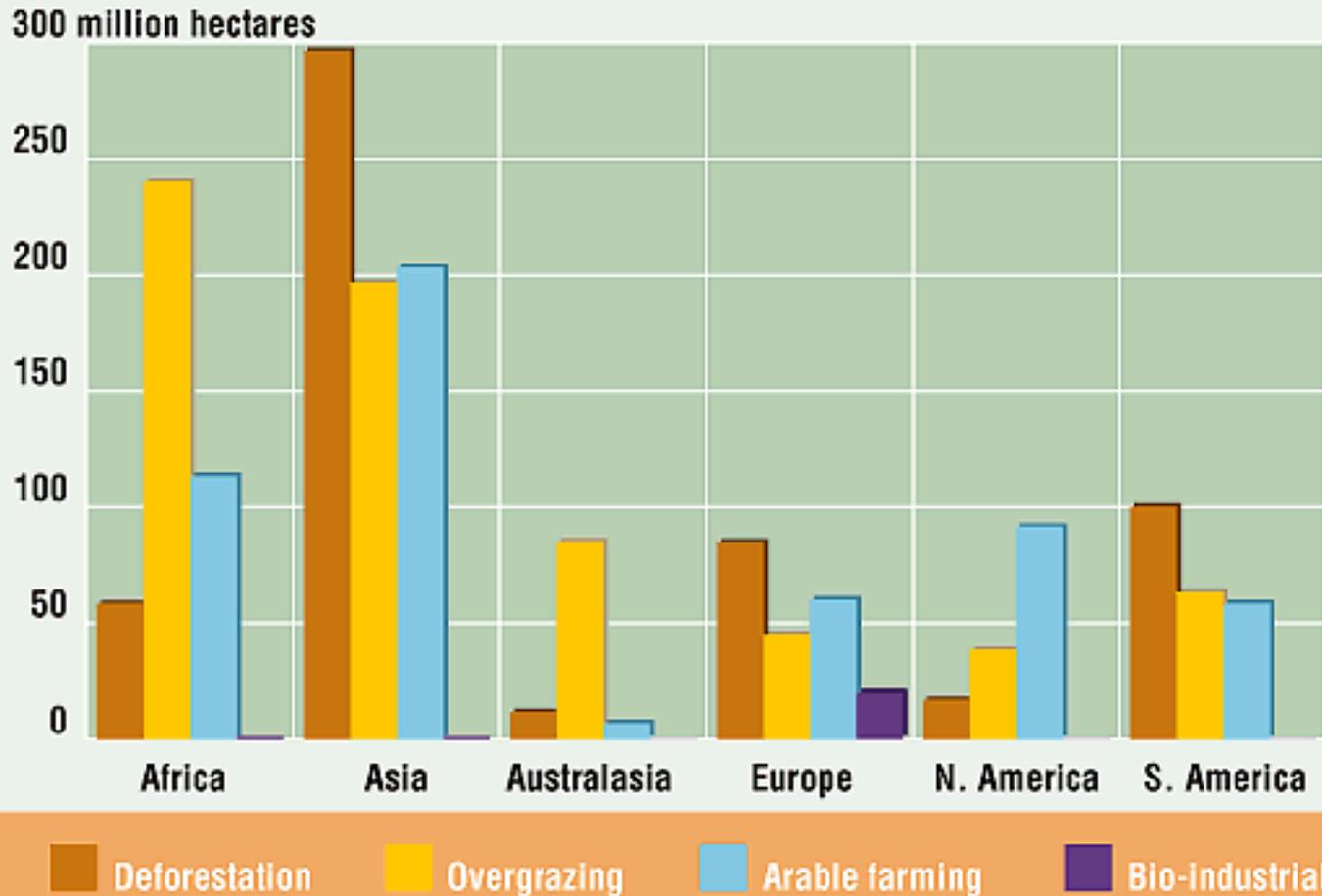
undernourished people. Many LIFDCs, particularly in Africa, do not grow enough food to meet all their needs and lack sufficient foreign exchange to fill the gap by purchasing food on the international market.



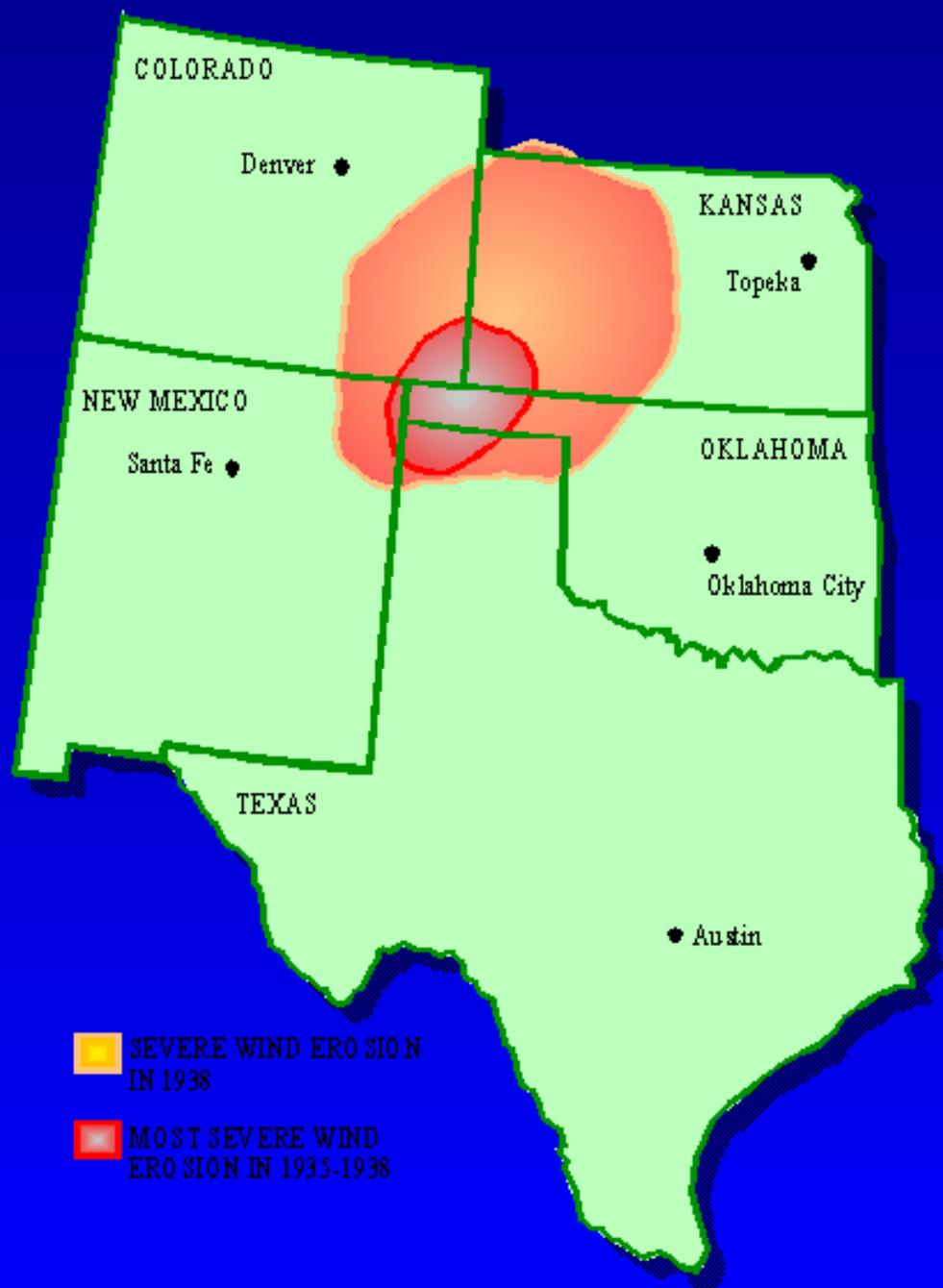
Source: UN Food and Agriculture Organization

\* Non FAO Member Nations

## MAIN CAUSES OF DRYLAND SOIL DEGRADATION BY REGION



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



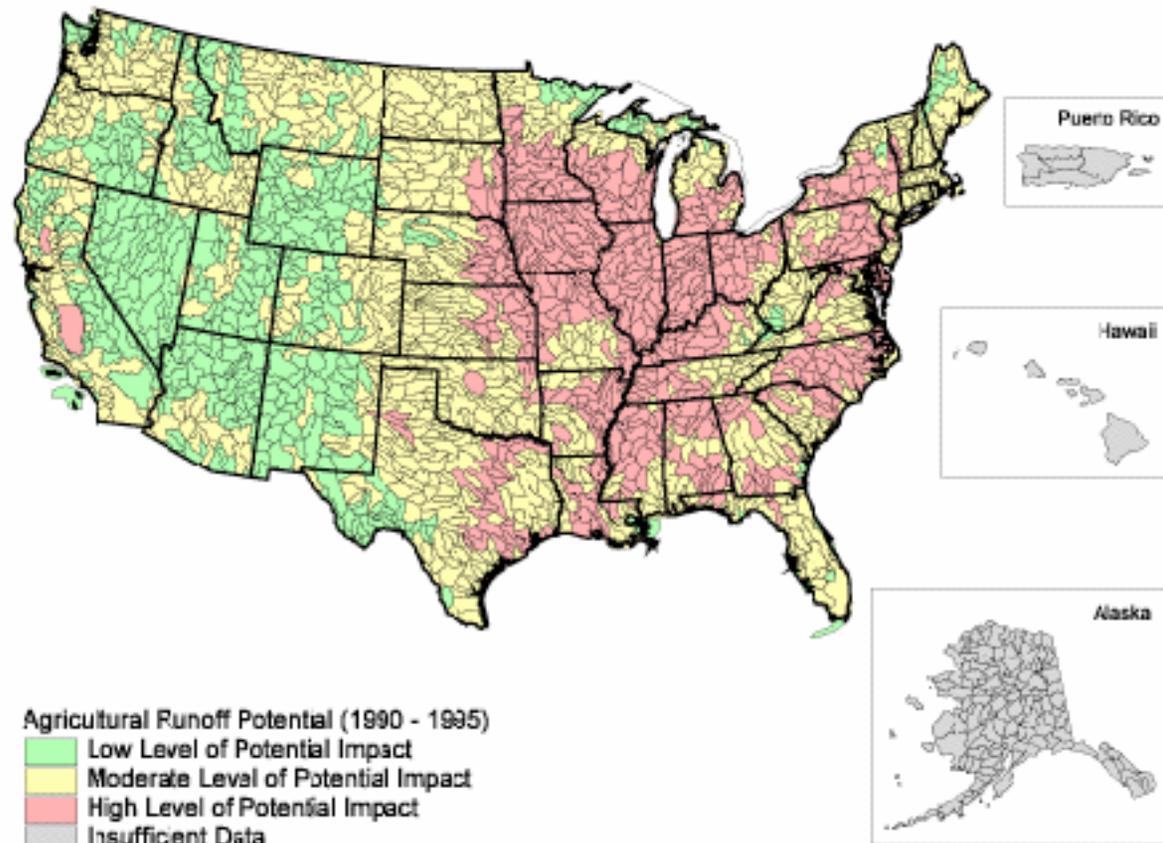
SEVERE WIND EROSION  
IN 1938

MOST SEVERE WIND  
EROSION IN 1935-1938

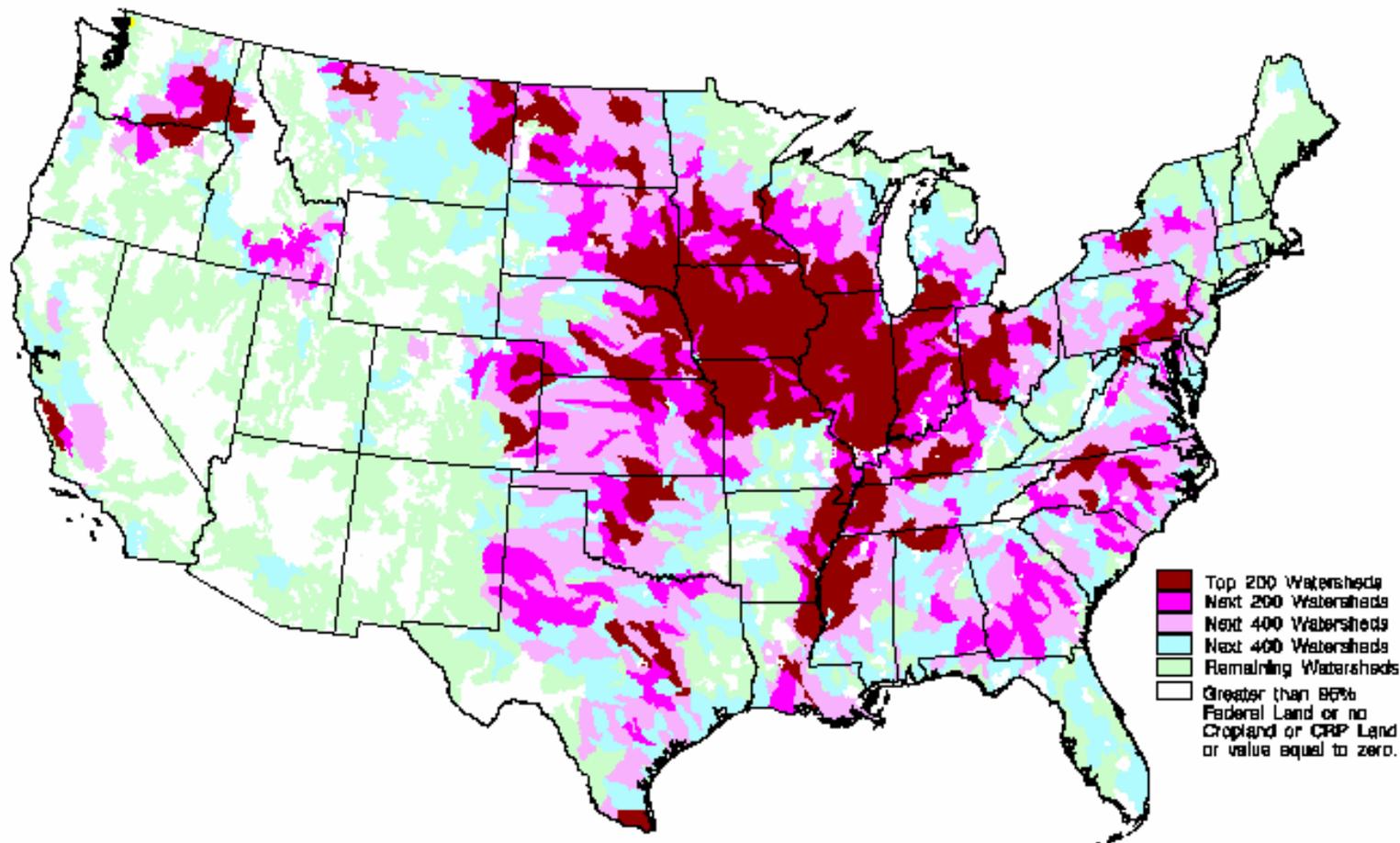


# Agricultural Runoff Potential

1990 -1995



# Loss of Soil from Farm Fields, Sheet and Rill Erosion

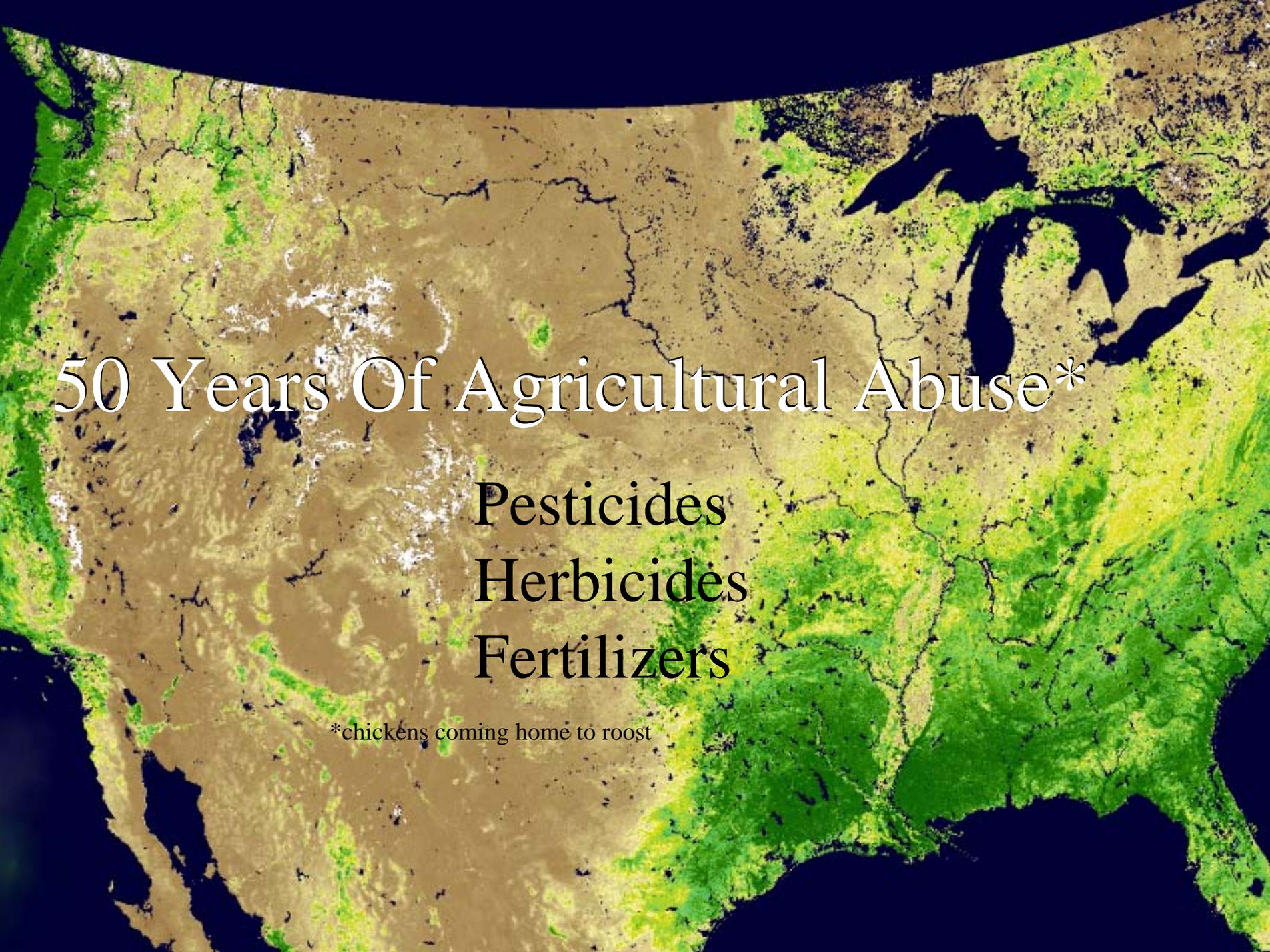


For Cultivated and Non-Cultivated Cropland and Land in CRP in 1982.

U.S. Department of Agriculture  
Natural Resources Conservation Service  
Resource Assessment and Strategic Planning Division  
Map ID: BMW.2124 October 1997

# Case History: The Mississippi River Flood Of 1993





# 50 Years Of Agricultural Abuse\*

Pesticides  
Herbicides  
Fertilizers

\*chickens coming home to roost

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.

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

1992

1993

## PRE-FLOOD

September 24, 1992



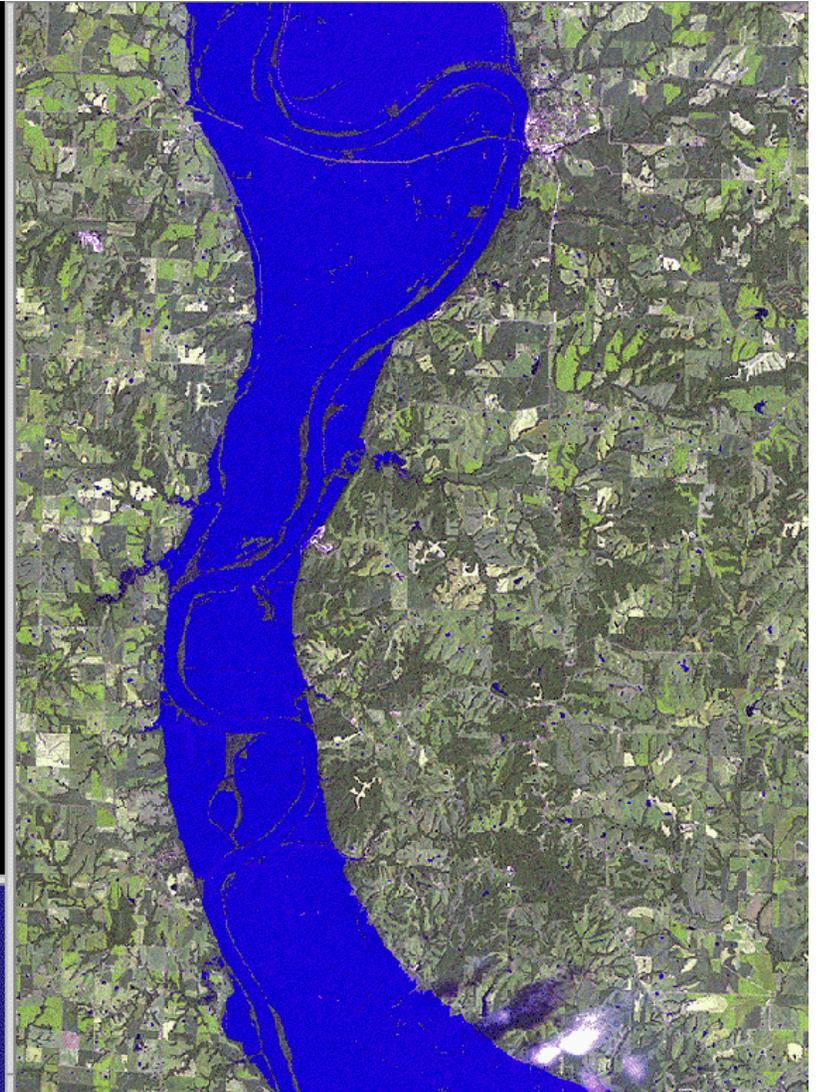
- o The floodplain is used largely for agriculture, as can be seen by the regular pattern of fields in the areas near the river.
- o The bluffs which mark the extent of the floodplain can be clearly seen in the zoomed image as the lines where there is a distinct change in pattern from the regular fields in the floodplain to the more dendritic pattern in the uplands.



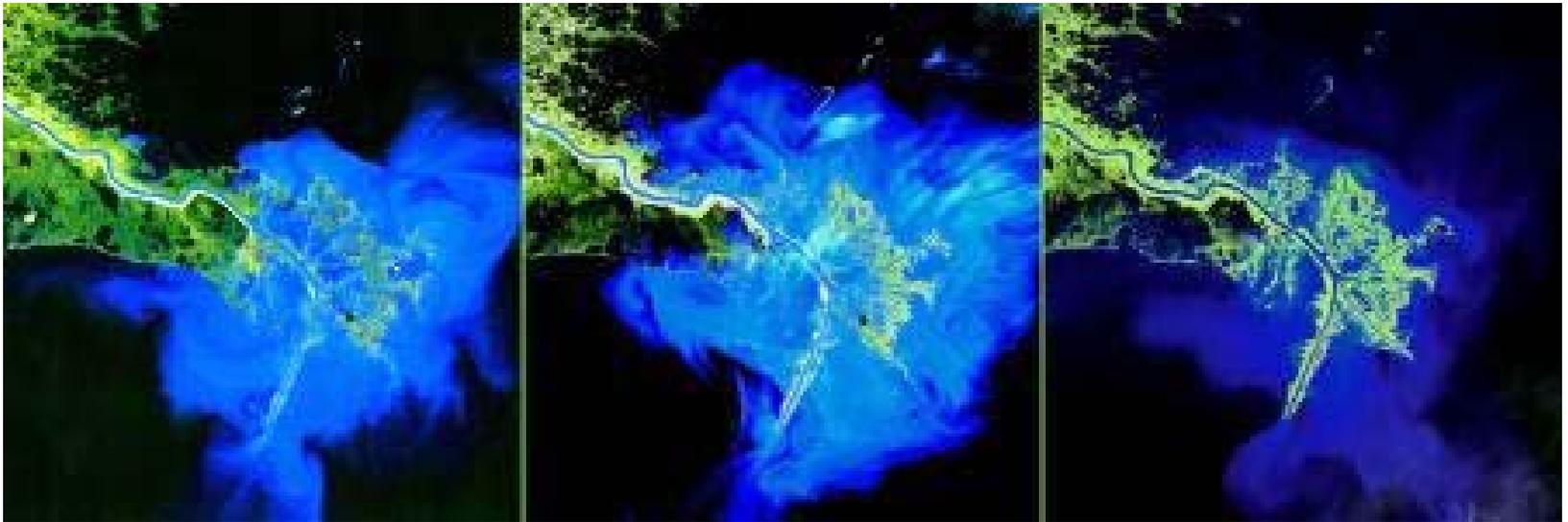
## Peak Flood August 1, 1993



- o This image shows the extent of flooding three days after the flood crest.
- o Note that most of the floodplain from bluff to bluff was inundated.



# *Mississippi Delta*



1973

1989

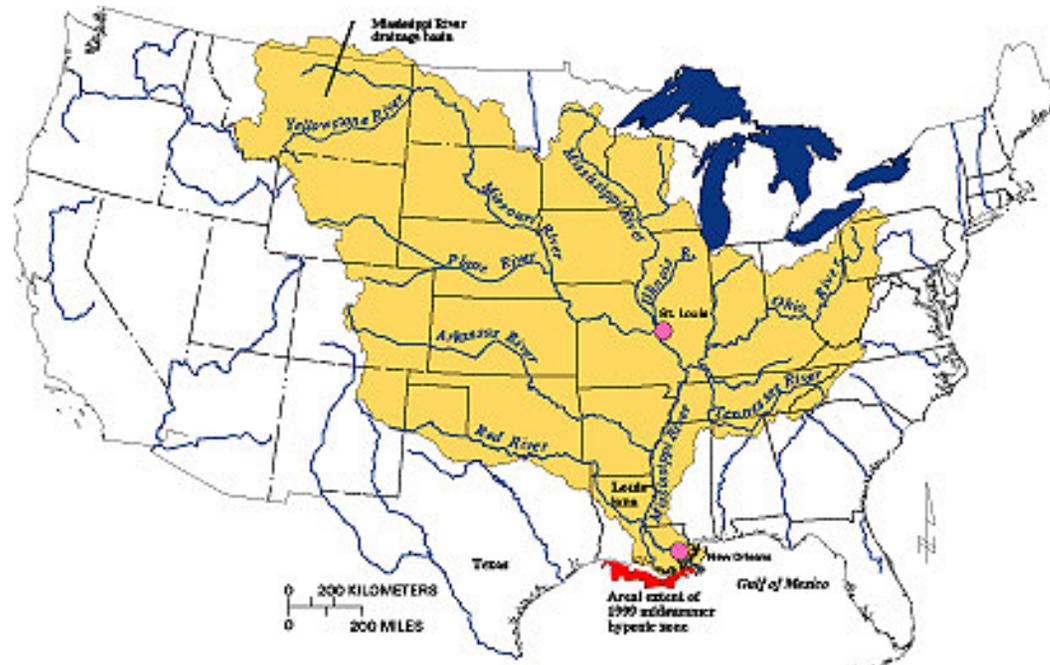
2003

## 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*



# 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

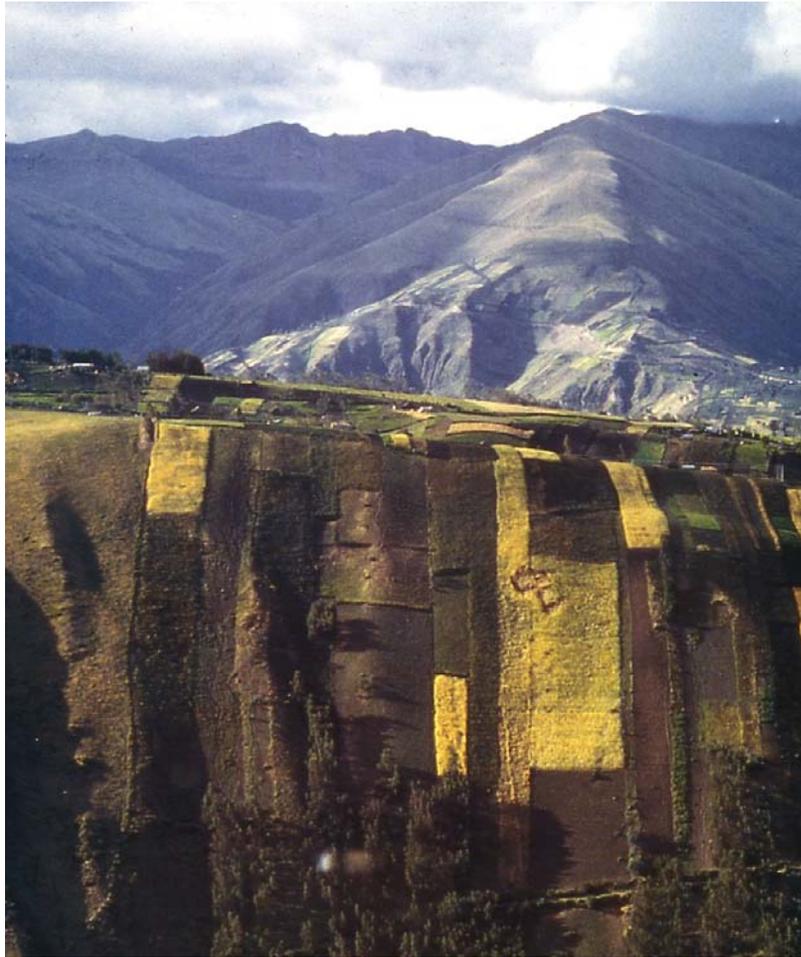
Imagine, if you will, a vertical farm

Imagine all the good that will come from it

# *Advantages Of Vertical Farming*

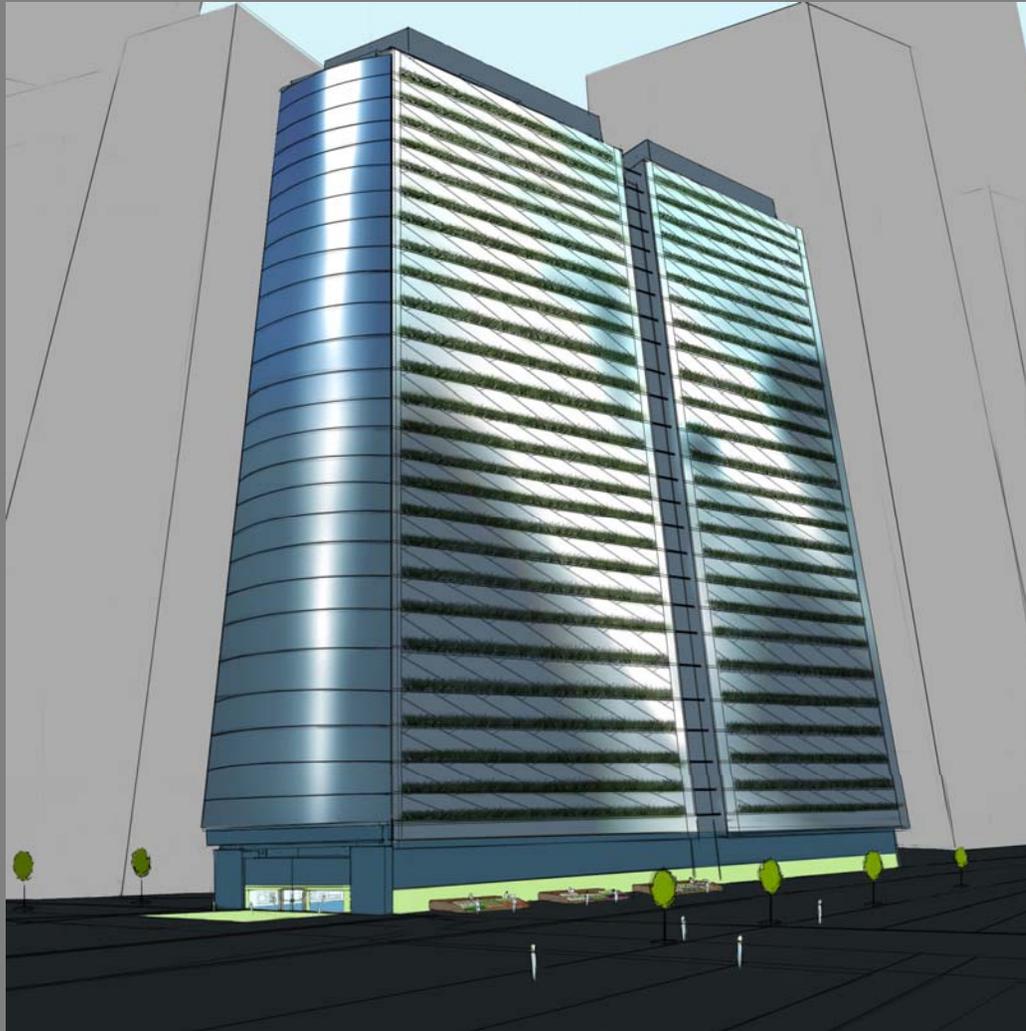
- *Year-round crop production*
- *No weather related crop failures due to droughts, floods*
- *Eliminates agricultural runoff*
- *Converts black water to potable water*
- *Greatly reduces the incidence of many infectious diseases*
- *Adds energy back to the grid via methane generation*
- *Dramatically 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](http://www.verticalfarm.com)

*The Vertical Farm:  
A possible Solution*



# URBAN ECOLOGY

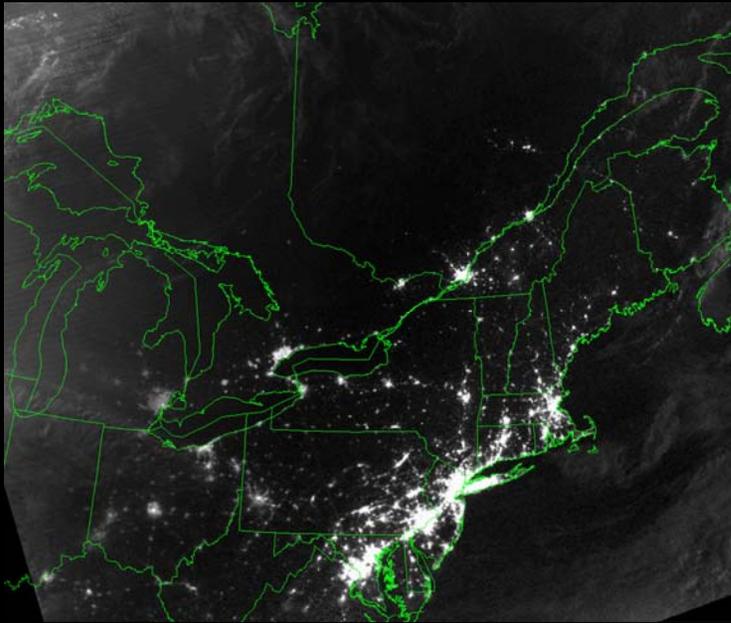
Vibrant, successful cities are not only possible but necessary for the health of society and our planet. Urban Ecology plans and designs cities that sustain the people, natural resources, and economy necessary for everyone to thrive.



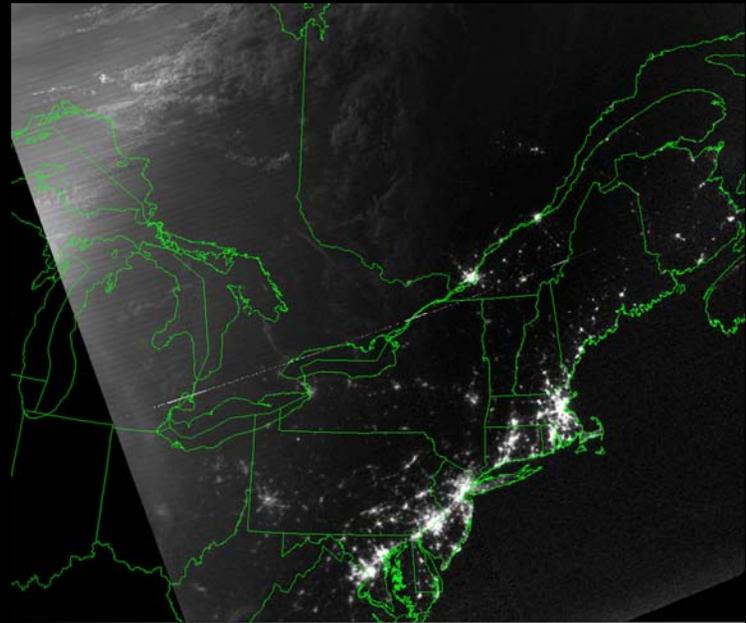
# *Advantages Of Vertical Farming*

*Adds energy back to the grid via methane generation*

*“What A Difference A Day Makes”*

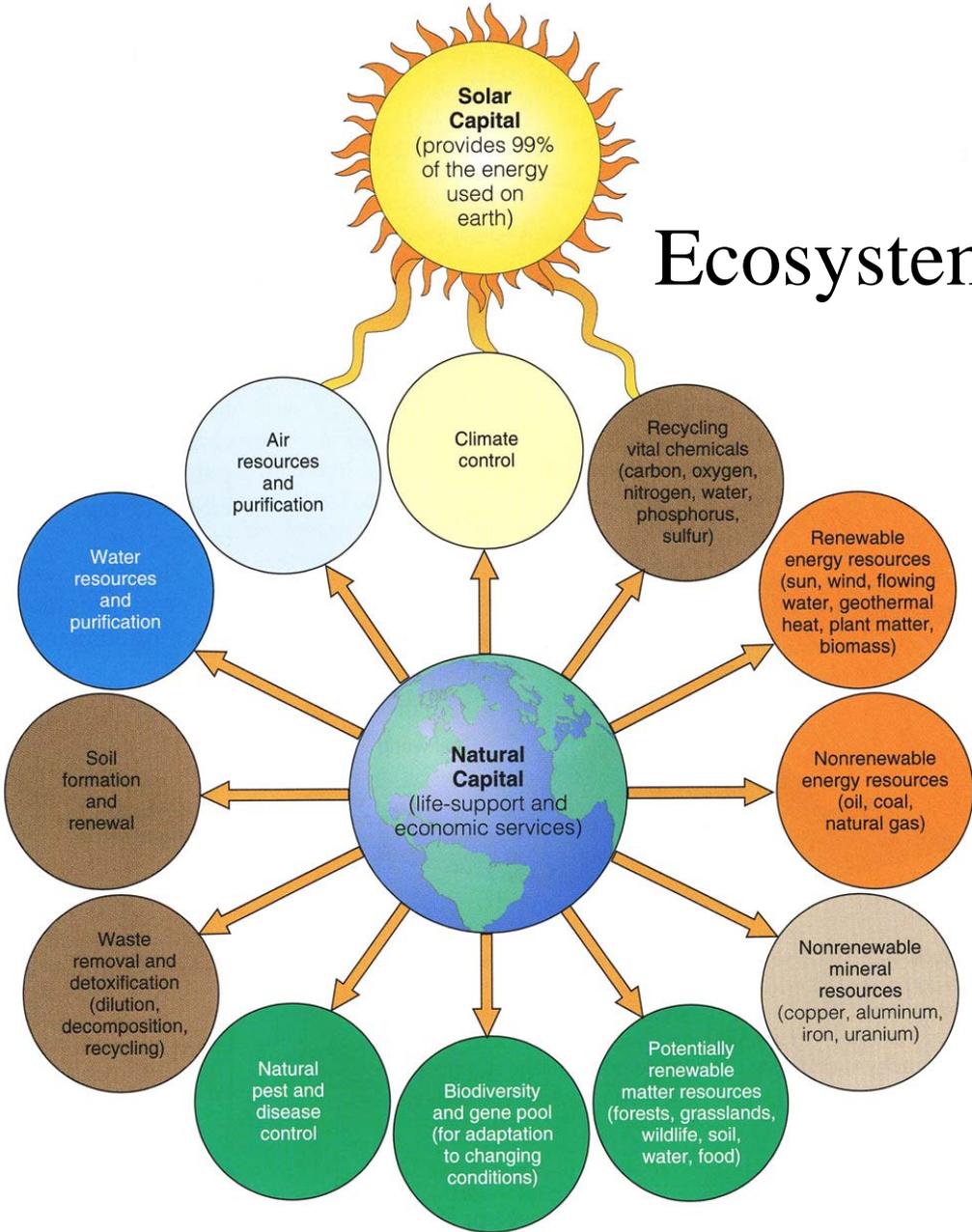


*August 14th*



*August 15th*

# Ecosystem Services\*



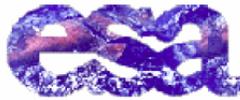
\* from: *Living In The Environment* Thompson Brooks/Cole Pubs. 2004

# *Advantages Of Vertical Farming*

## *Returns farm land to nature, restoring ecosystem services*

Issues in Ecology

9/26/03 6:32 PM



---

### **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*

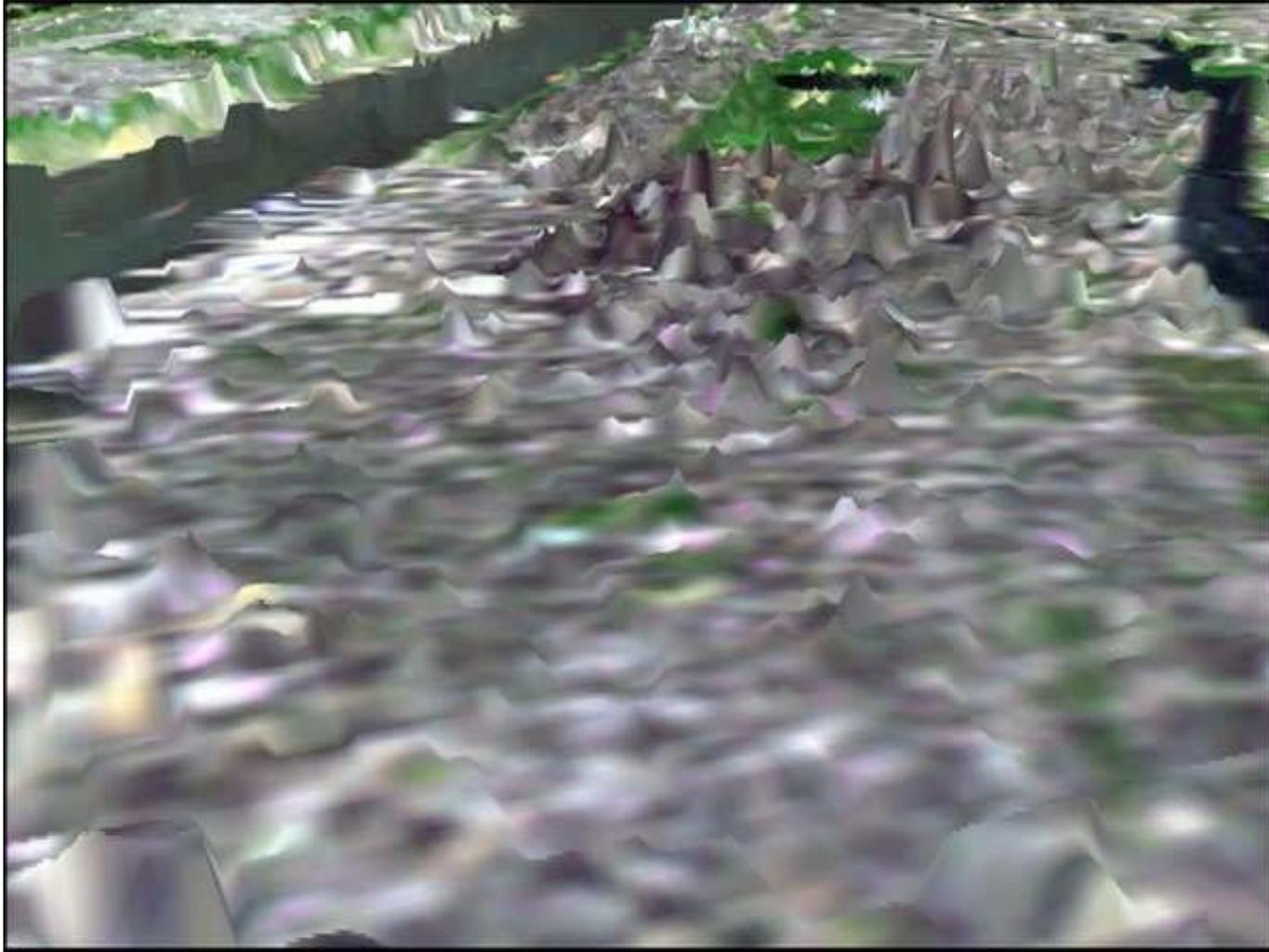


Photo: NASA



COLUMBIA UNIVERSITY  
IN THE CITY OF NEW YORK

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*Class Of 2003*

Kristin Anderson

Nicola Areshenko

Alan Brown

Jennifer Buskey

Amanda Colligan

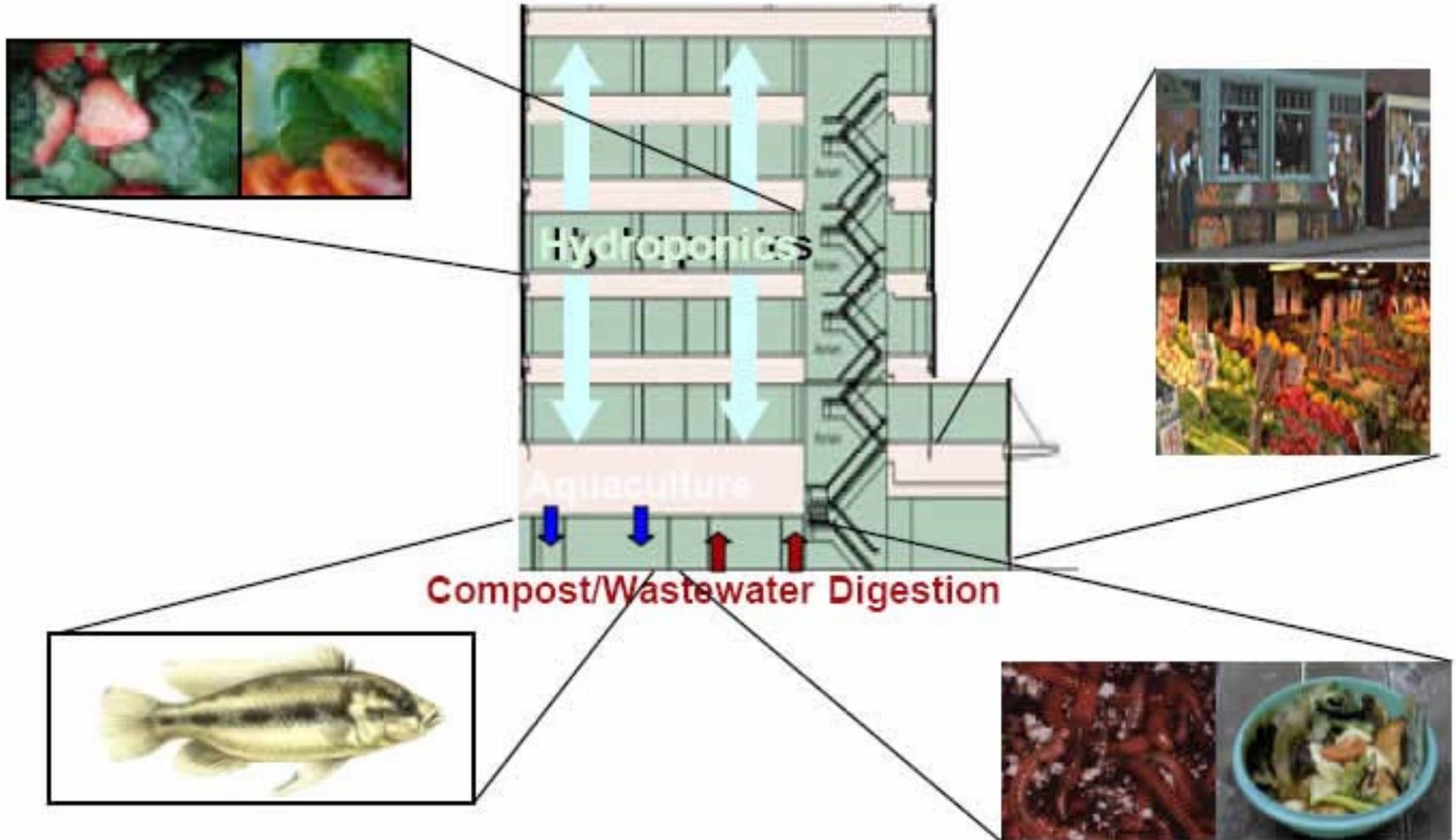
Marisa Dahlman

Catherine Dell'Orto

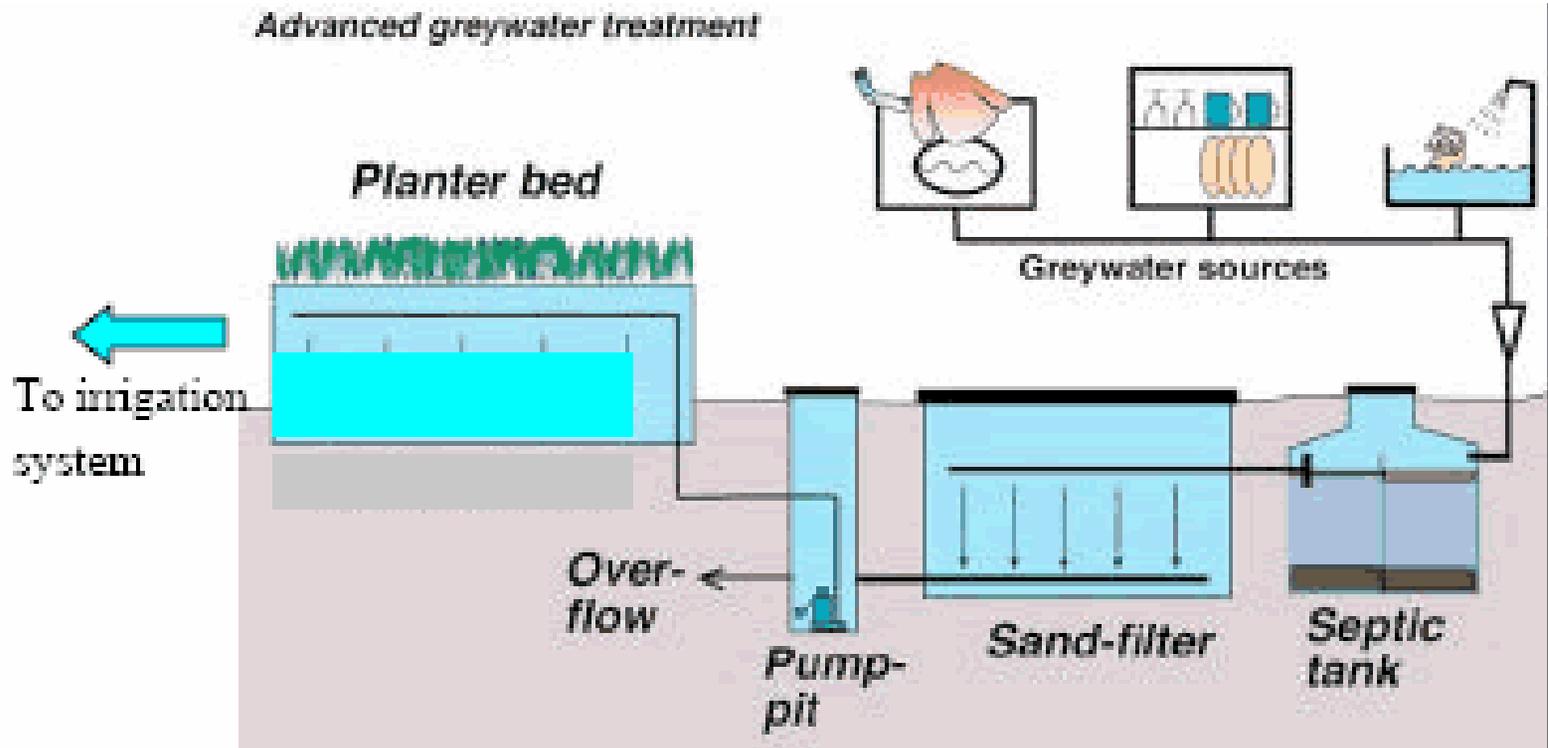
Catherine Tuglus

Steve Chen, technical advisor

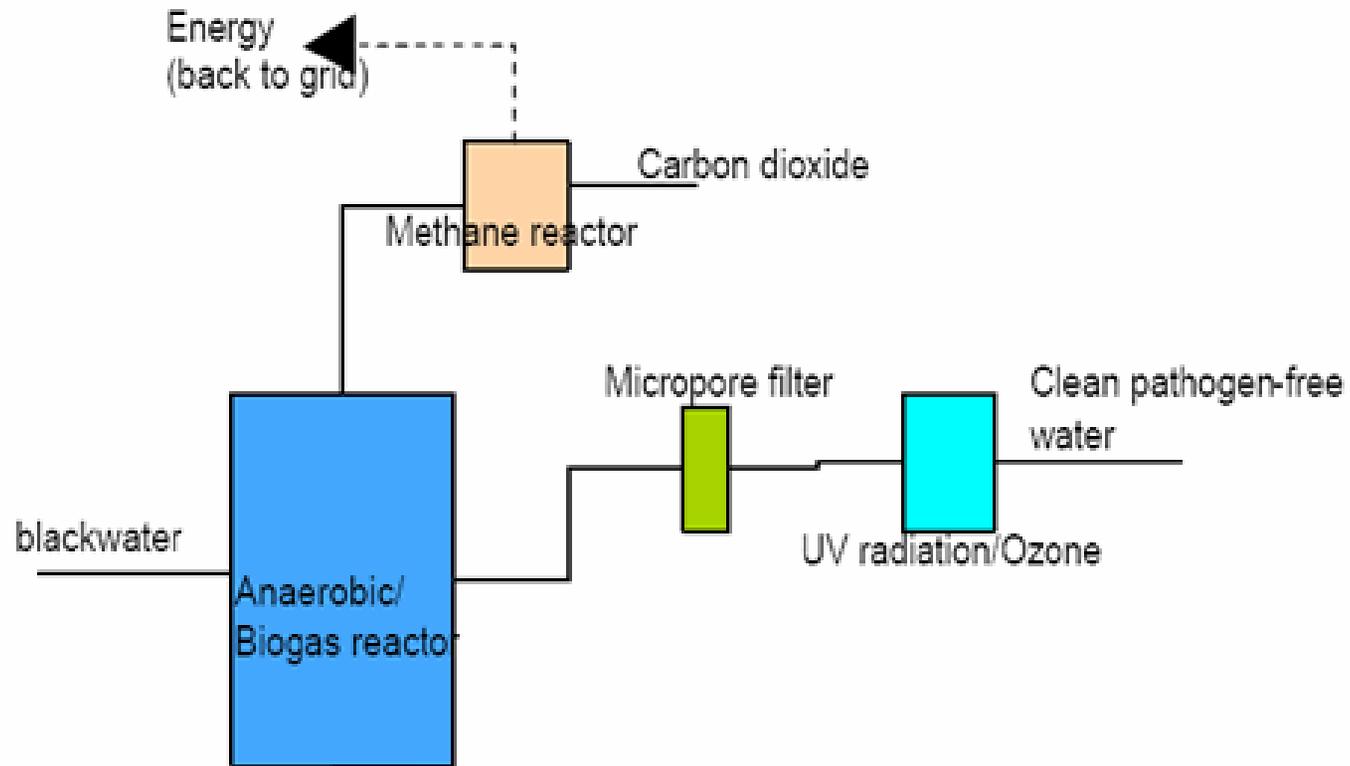
# *How It Could Work*



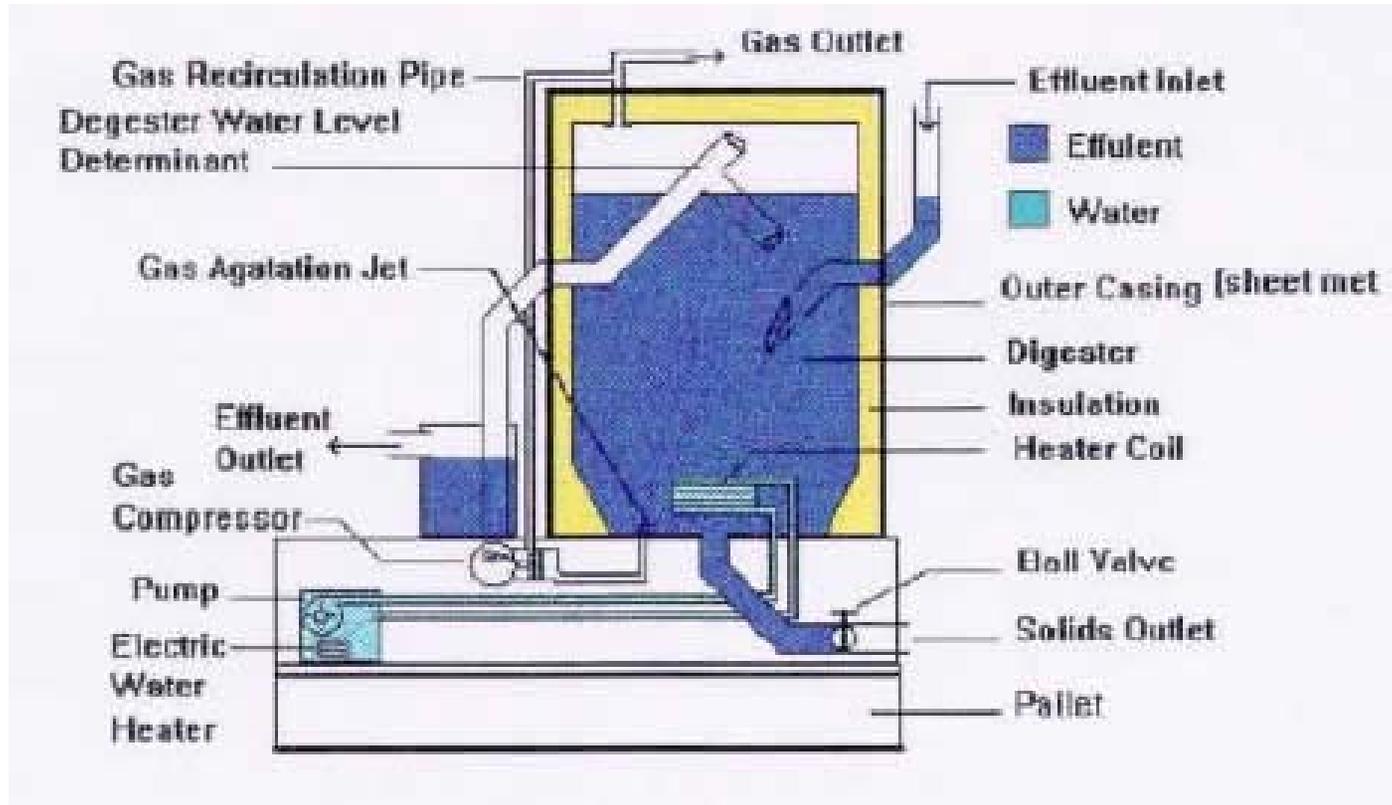
# Bioremediation



# *Energy Considerations*



# *Methane Digester*



# FARMING IN THE Z-AXIS:

## THE VERTICAL FARM

6TH STREET BASIN,  
GOWANUS CANAL, BROOKLYN

HEALTHY TRANSPORTATION  
ALTERNATIVES

CROPS DISTRIBUTED LOCALLY  
AND REGIONALLY

EXISTING BUILDINGS  
REACTIVATED

PUBLIC EDUCATION

ELECTRICITY GENERATION

JOB CREATION

NEIGHBORHOOD PROMENADE  
RELEASE METHANE TO POWER PLANT

TO POWER STATION  
TO PARKING  
TO PROSPECT PARK

RELEASE CO2 TO  
SALT MARSH

RECLAIMED SALT MARSH

PUMP BLACKWATER  
FROM CSO'S

TO DOWNTOWN  
TO PHASE I  
WATER TREATMENT

CONTINUOUS  
TIERED GROW-  
FLOORS =  
SURFACE  
+ CAPTURE

HELICAL  
TORSION BEAM =  
STRUCTURE  
+ FLOW

NEIGHBORHOOD  
PROMENADE

SEWAGE IN / CLEAN WATER OUT

+ PUBLIC SIGNAGE

+ STRUCTURAL  
MAST &  
HOLDING TANKS

+ BLACKWATER BIOGAS  
REACTOR

+ COMPOSTABLE  
PLANT  
PRODUCTION

+ EDIBLE CROP  
PRODUCTION:  
24 HOUR/365 DAY  
HYDROPONIC  
GROWING

+ DECORATIVE  
PLANT PRODUCTION

+ PUBLIC  
INTERCHANGE  
PLATFORM

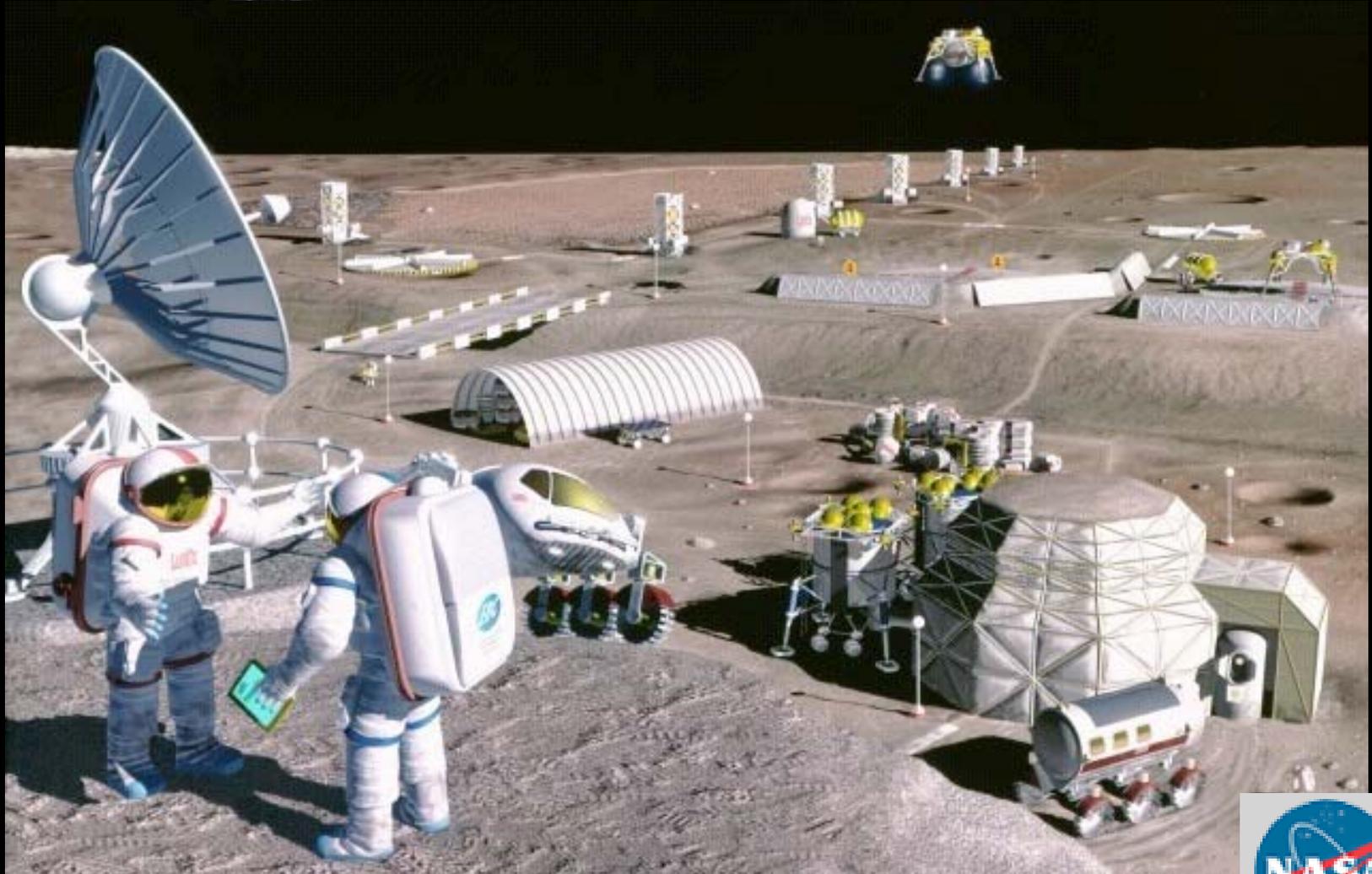
+ GREENMARKET/  
PUBLIC ACCES  
TO SALT MARSH

- PUMPING STATION/  
UNDERGROUND  
PARKING

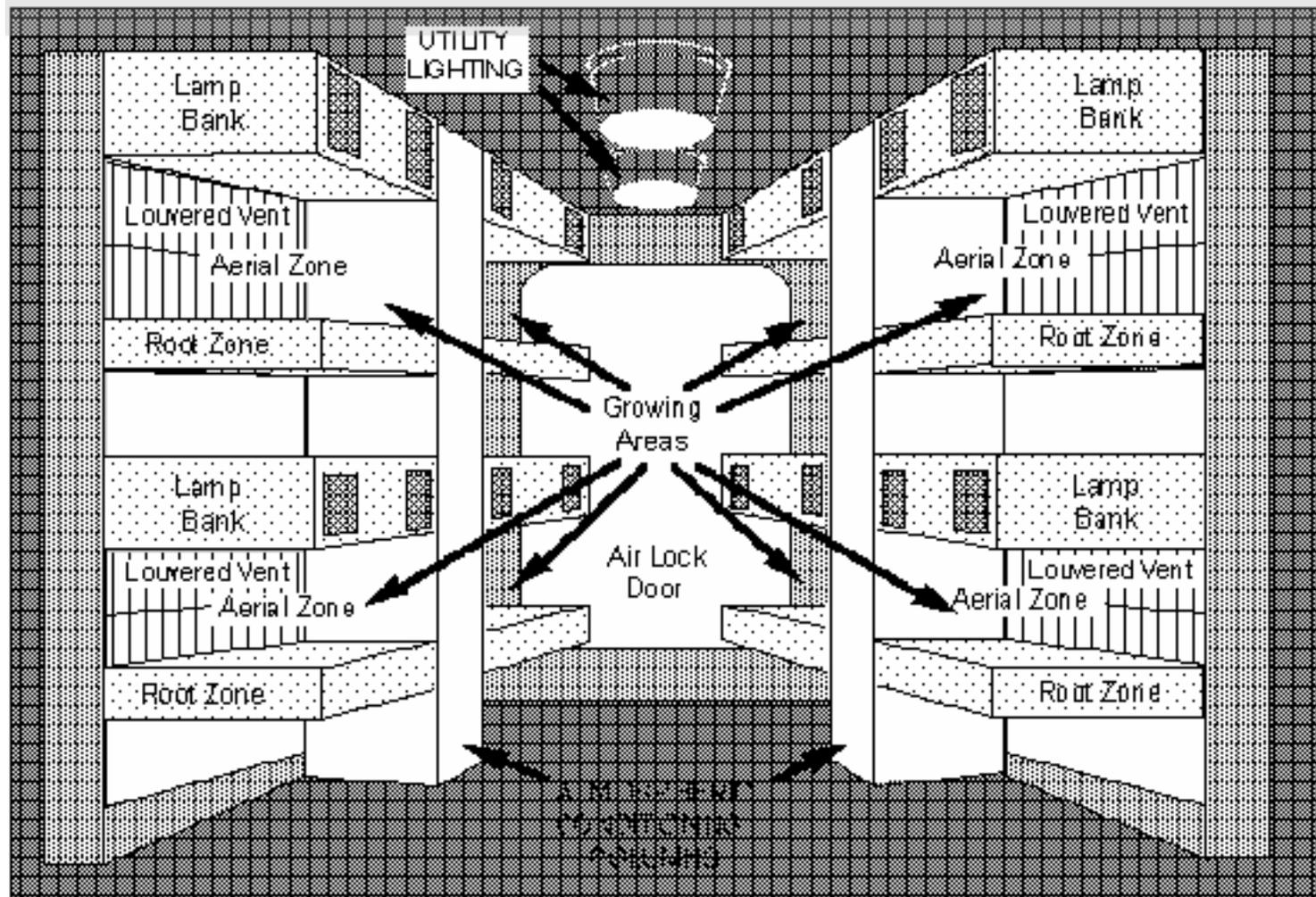
Original Design by Andrew Kranis, Columbia University School of Architecture 2003



# A lunar colony



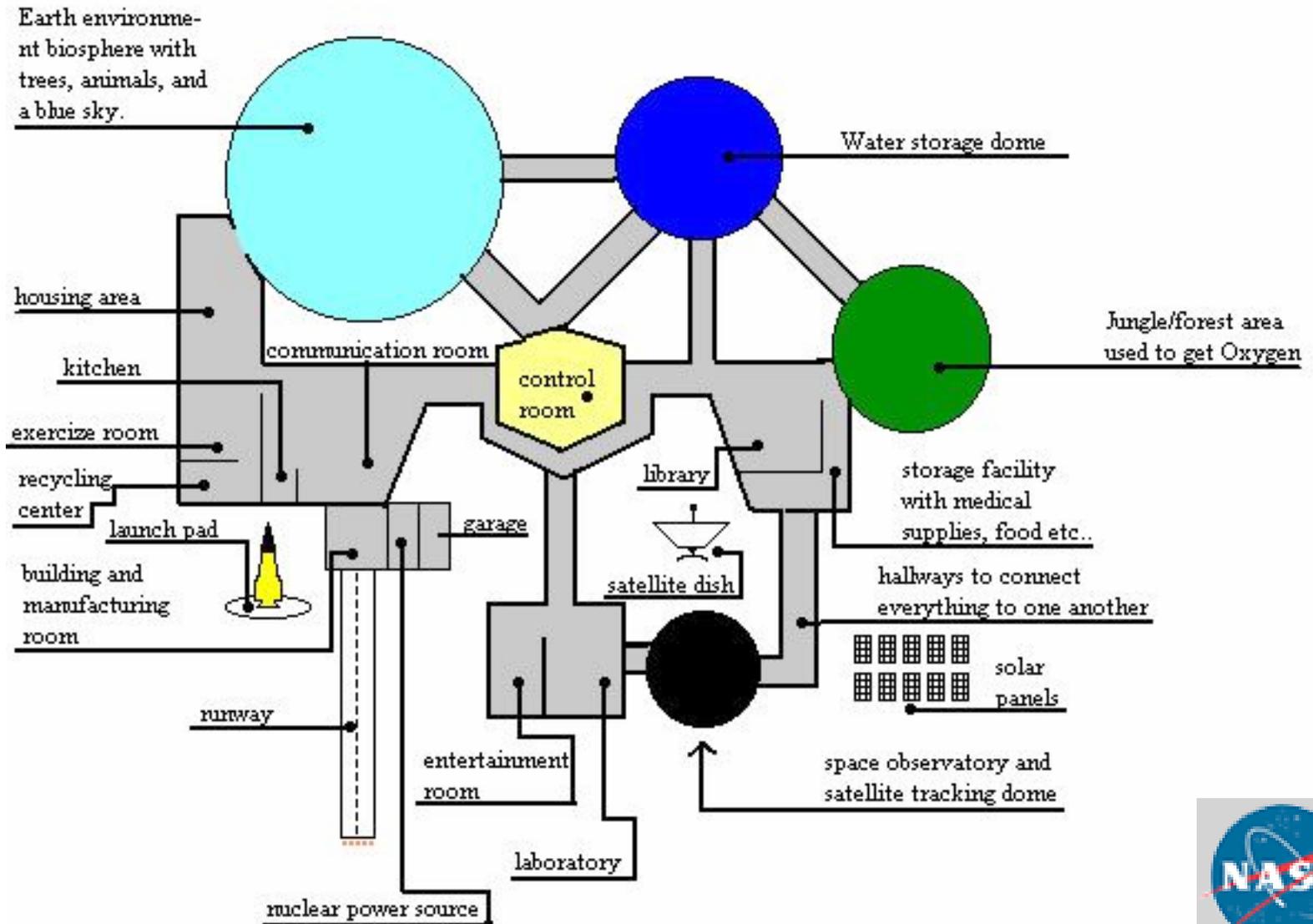
# Schematic for advanced life-support system



Or a colony on Mars



# Components for a Mars colony





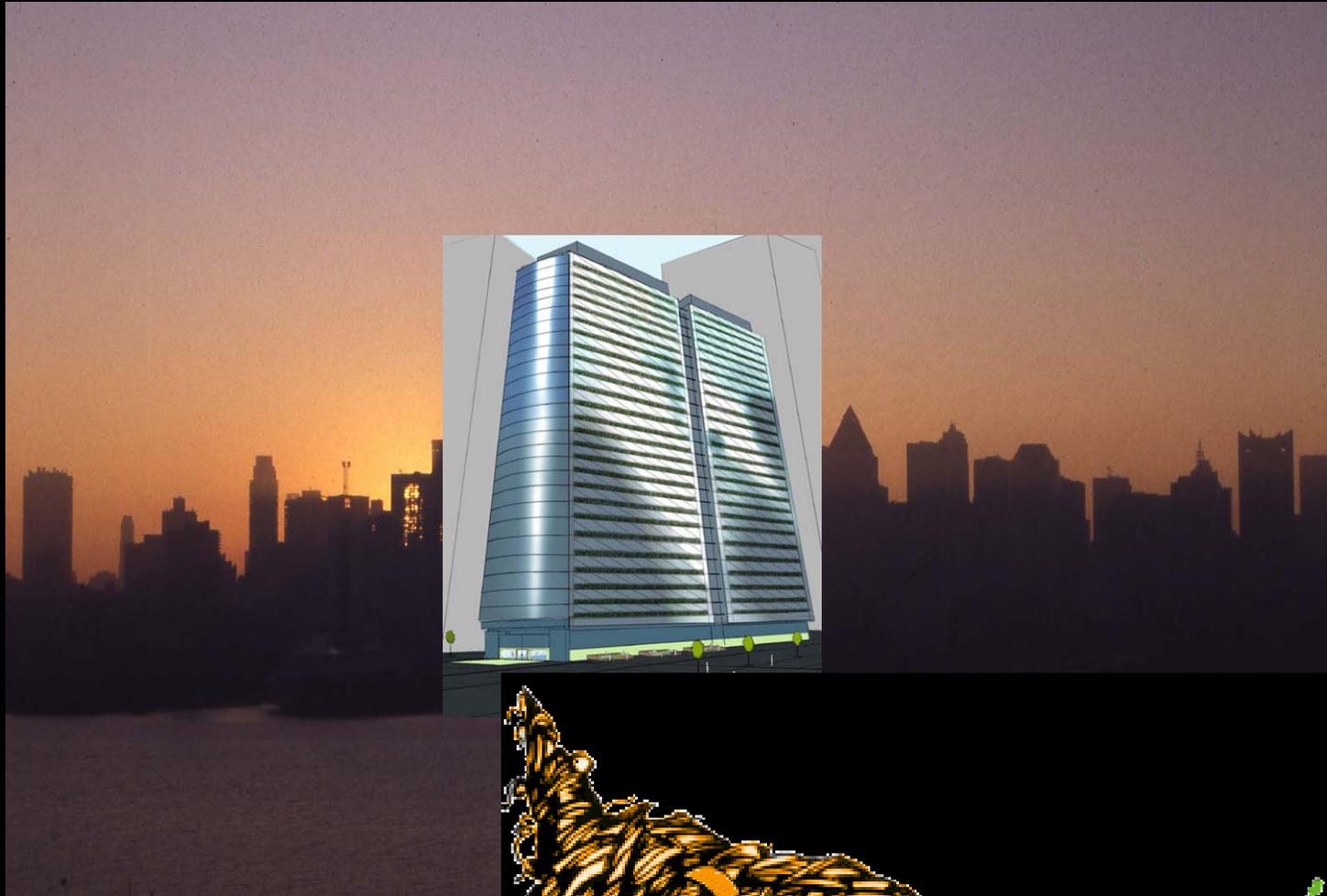
I have a feeling we're not  
in Kansas anymore.



# *So, What's For Dinner?*



# Anything you want



Any Time You Want It



Any Where In The World



Or In The Universe

