



# 9. Food & Agriculture



# 1. INTRODUCTION



# The current situation

- Food is now cheap- 40% cheaper than in 1960.
- World per capita food production has risen by around 25% since 1960.
- Pesticides are widely used, but they have may inflict damage on the environment.
- The “industrialization” of agriculture has led to other problems such as topsoil erosion, pollution of rivers and oceans, loss of wildlife.

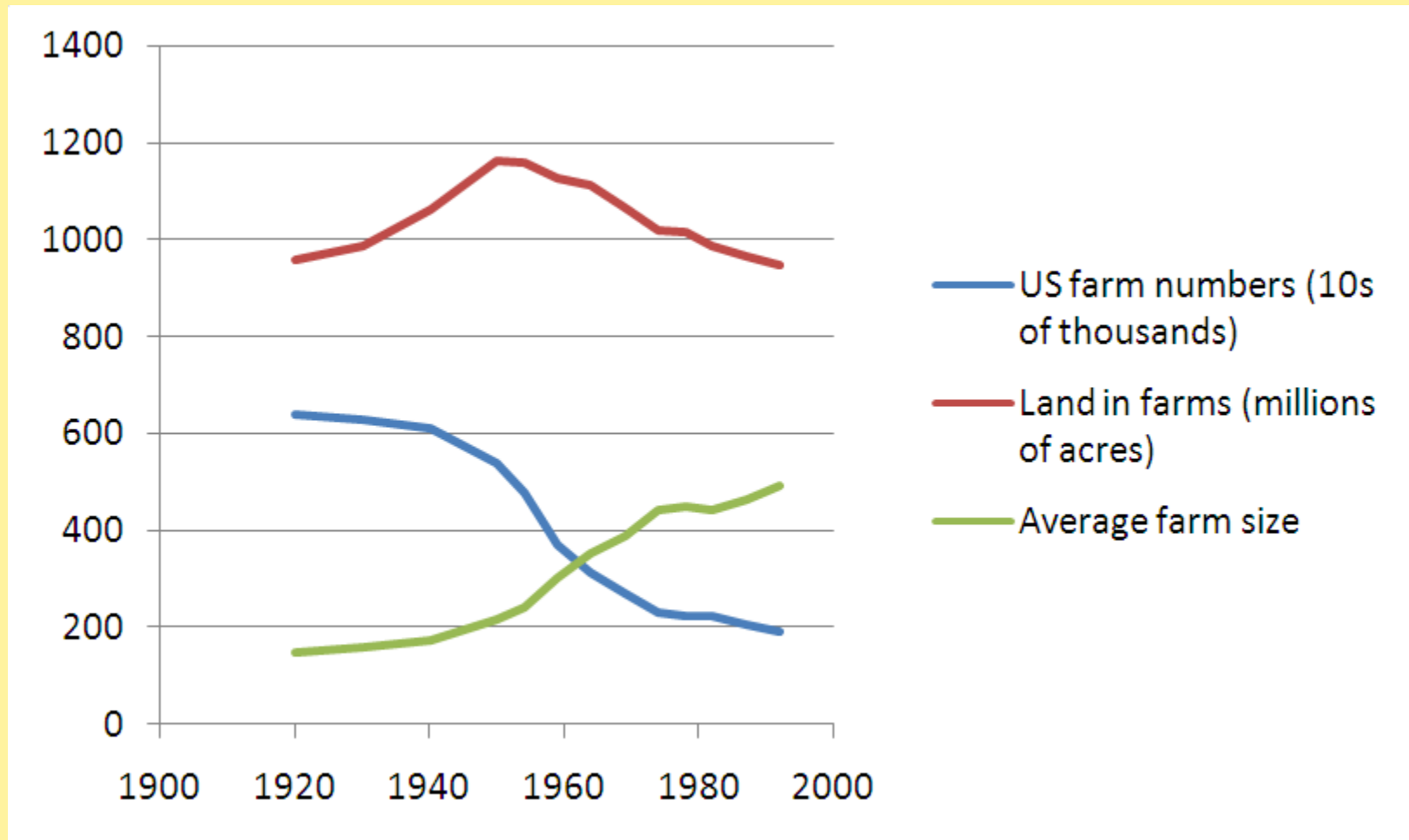
# US Agriculture: The last hundred years

- Increased mechanization and industrialization => reduced workforce
- Farms are getting bigger, but the total land being farmed remains similar.
- Globalization and increased concentration on specific crops.
- Increasing dependence on off-farm income.



Cargill grain elevator, Mississippi River  
Picture by Kelly Martin, GFDL,  
[From Wikimedia Commons](#)

# Trends in US farming



Graphs by Martin Walker. Farm size is in acres. Source: USDA, 1994.

# Are small farms still relevant?

- Small farms find themselves working in an industry increasingly geared towards large producers.
- Small farmers generally lack a reliable source of adequate credit. Many seek income from off-farm employment.
- Yet small farms often play a key role in rural communities.
- Some argue that small farms are much more suitable than large farms for sustainable agriculture.

*D'Souza & Gebremedhin, Sustainability in Agricultural and Rural Development, Ashgate Publishing, 1998.*



Small farm, [from Flickr](#).  
Picture by [Photofarmer](#),  
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# US Public Policy: Help or hindrance?

- Some such as [Schumacher](#) have argued that US farm policy in the late 20<sup>th</sup> century was not sustainable.
- Nevertheless, public policy tended to favor more “industrial” approaches, and to regard sustainable practices as marginal and more costly.
- This approach began to change in the 1990s. The 2002 Farm Bill contained a significant shift in policy, with less emphasis on retiring fragile land, and increasing support for environmental improvements in:
  - How working land is used
  - Wetland restoration



Picture [from WM Commons](#), by Diz28, public domain.



## 2. FOOD PRODUCTION





# Feeding the world

- Figures vary but undernourishment probably affects 10-20% of the world's population.
- There is enough food produced to feed everyone- but food production is not evenly distributed. Thus food rots in one part of the world, while people starve in another part.
- With rising affluence population growth slows, but there is an increasing demand for meat products, which require much more acreage per pound than do cereal crops.



# Some ways to increase agricultural output

- ***Extensification***: Convert wild land to cropland.
- ***Intensification***: Apply chemical fertilizer to increase yields.
- ***Irrigation***: May be used to convert non-arable land to arable land.
- ***New plant strains*** (produced either by traditional breeding or by new genetic engineering methods) may enhance the productivity of the land considerably.

# The Green Revolution

*In 1960 dire predictions were made for mass starvation in India and other countries, yet it never happened. How was this done?*

- New high yielding plant varieties were developed, and these greatly improved productivity per acre in countries such as India. These varieties were made available even to the poorest farmers.
- Unfortunately many of these varieties require chemical fertilizers and irrigation.



Picking rice in Bangladesh  
[USAid](#) picture [from WM Commons](#)



# Fisheries

- A good example of what happens when a demand on an ecosystem exceeds supply! Many fisheries around the world are now overfished- resulting in the collapse of the fishing industry in these locations.
- Fish farming (aquaculture, now 20% of all fish) has helped offset these losses.



# 3. AGRICULTURE AND THE ENVIRONMENT

# Land

- 30% of the world's fertile farmland was lost through erosion between 1955 and 1995.
- To maintain food production, new land must be found, causing deforestation.
- Industrial farming methods may cause heavy loss of nutrients, which may require heavy fertilizer use.



Farm near Kitchener, ON, by Stan Shebs  
Picture [from WM Commons](#), CC license



# Water

- Roughly 70% of the world's freshwater supply is used for agriculture.
- About 40% of the world's population is in areas that must share water resources. This leads to water shortages, such as the [2007 shortage in Atlanta](#).



Photo by USDA, taken [from WM Commons](#)

# Pollution

- Industrializing agriculture often leads to large-scale intensive agriculture, which may put stress on the local environment from:
  - Excess fertilizer use, causing algal blooms in nearby rivers which in turn causes death of other aquatic life through [eutrophication](#).
  - Massive amounts of waste such as pig sewage.



Eutrophication of the Potomac River.  
Picture: US NOAA





## 4. NEW TRENDS

# New technology

- **Hydroponics:** Grow crops without the need for fertile soil or a good climate- simply needs fresh water and chemical nutrients. Capital intensive.





# Genetically modified (GM) crops

- Using genetic engineering, scientists can transplant genes from one organism into another, or to modify existing genes. In the Amflora potato developed by BASF, the gene for producing undesirable amylose is turned off. This means that all the potato's starch is amylopectin, which is a valuable feedstock. There are no plans to use Amflora potatoes for food, but all GM crops are controversial in Europe.



# Genetically modified crops

- GM crops are more politically acceptable in the US, where they are widely used. Monsanto, Aventis and others have developed maize (corn) that is resistant to herbicides such as “Roundup”, or that is poisonous to insect pests.
- Proponents argue that these modifications are just equivalent to careful plant breeding, and that they aid the environment by greatly reducing pesticide use.
- Critics argue that non-GM crops may be permanently modified by cross-pollination.
- Monsanto retain control on all sales of their seeds, preventing farmers from keeping seeds back for future years and thereby causing resentment.



Pest resistant corn



“Golden rice” is fortified with Vitamin A.





# The future- possible problems

- Increasing population and affluence causes an increasing demand for food, and agricultural land.
- Modern agriculture is causing the loss of fertile topsoil, loss of the fresh water supply (water tables falling) and environmental stress from fertilizers and pesticides
- Will these two factors combine to give a “crunch” later in this century, or will technology provide the answers?