

Workshop on Food and Nutrition Security,  
Cifal Jeju, 20-22 March 2013

# Overview of Food Security and Factors Causing Food Crisis

**Cherl-Ho Lee, Ph.D.**

**Emeritus Professor of Korea University  
Chairman, Korea Food Security Research Foundation**





# Outline of presentation

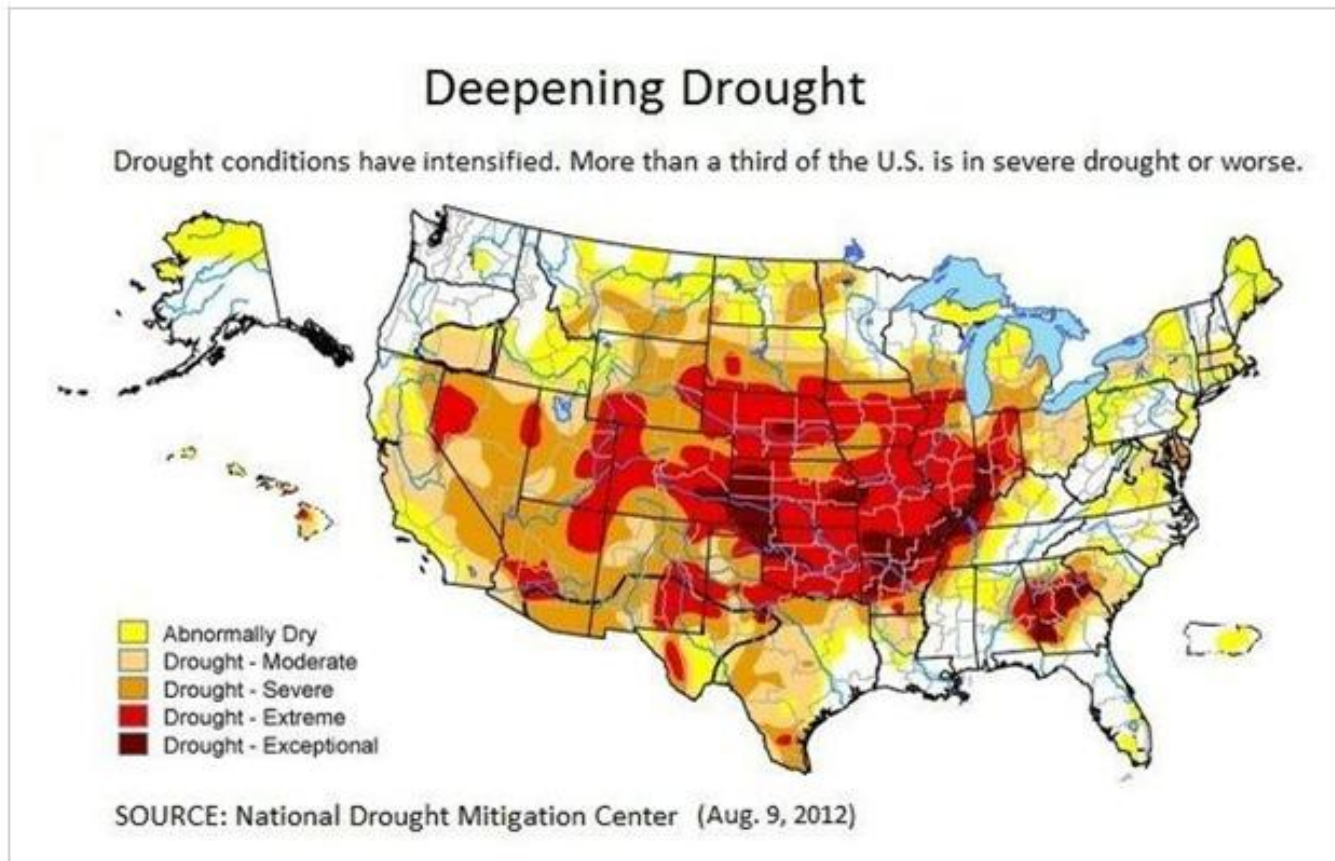
## 1. Global Food Crisis

- Present status and future prospect

## 2. Factors Causing Food Crisis

## 3. Food Situation in Korea

# Grain prices soar as drought impact deepens



*By John W. Schoen, NBC News*

The worst American drought in more than half a century is driving up grain prices and deepening worries about global food shortages.

# Corn prices hit record as crops shrivel

CNNMoney

31 comments

By Hibah Yousuf July 31, 2012: 9:55 AM ET

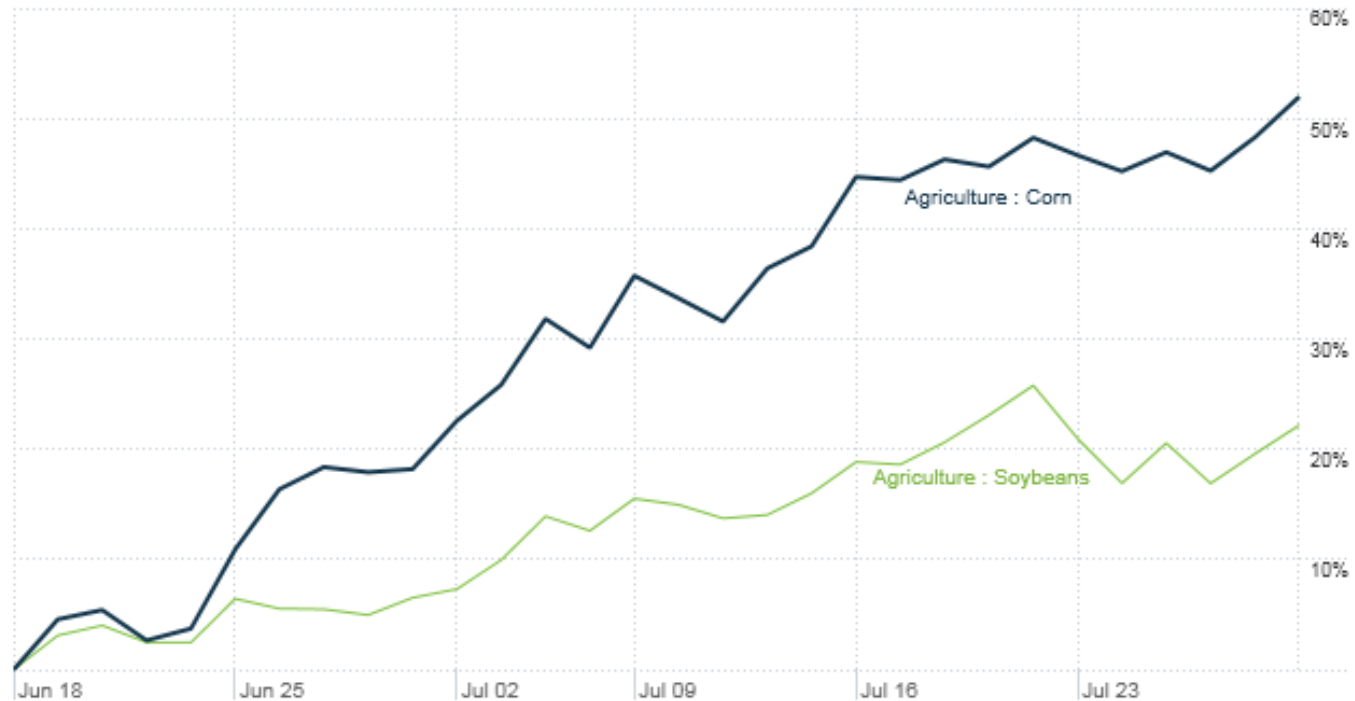
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## Corn and soybean prices



Click the chart to check prices of corn, soybeans and other commodities.

Corn prices surged to a new record high Tuesday, as the worst drought in more than 50 years continues to plague more than half the country.

Almost 90% of the United States' corn crops are in drought ravaged areas, according to the U.S. Department of Agriculture, and nearly 40% are situated in the hardest hit spots.

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## INVESTING NEWS BLOG

### Drought to inflict 3% to 4% rise in food inflation next year: Are you hedged with gold?

July 26, 2012

#### Crop's price has surged more than 50% since June 15

Although food isn't included in the government's official inflation index, the Consumer Price Index, this report bodes ill for anyone who must eat to live. Keep in mind too that corn is used to make ethanol-based gasoline. When was the last time you were at a gas station that wasn't serving up ethanol-based fuel? Gold won't power your car, but historically it has served as a valuable inflation-hedging tool:

*U.S. consumers may pay 3 percent to 4 percent more for food next year, as the effects of the country's worst drought since the 1950s work their way onto supermarket shelves, the Department of Agriculture said in its first forecast for 2013.*

*Beef may rise as much as 5 percent in response to tight supplies of corn, which is used to feed cattle, the USDA said today in a report on its website. The price of the grain, the country's biggest crop, has surged more than 50 percent since June 15. Food prices will rise 2.5 percent to 3.5 percent this year, the agency said, leaving its 2012 estimate unchanged.*

#### EXPERT INSIGHTS from

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# Surging grain prices could drive up S. Korea's inflation rate: Goldman Sachs

2012.07.31 13:27:06 | 2012.07.31 15:55:29

싸이월드 트위터 페이스북 미투데이

Rising grain prices would drive up South Korea's inflation rate by a maximum of 0.4 percentage points, according to an investment bank Tuesday.



The world-renowned investment bank (IB) Goldman Sachs warned that upsurges in international grain prices could lead to spikes in food prices and eventually trigger "Agflation" in Korea, thus pushing up the nation's inflation rate by 0.2 to 0.4 percentage points from the end of this year to early next year, according to the Korea Center for International Finance (KCIF).

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FOOD SECURITY

REVIEW

# Food Security: The Challenge of Feeding 9 Billion People

H. Charles J. Godfray,<sup>1\*</sup> John R. Beddington,<sup>2</sup> Ian R. Crute,<sup>3</sup> Lawrence Haddad,<sup>4</sup> David Lawrence,<sup>5</sup> James F. Muir,<sup>6</sup> Jules Pretty,<sup>7</sup> Sherman Robinson,<sup>8</sup> Sandy M. Thomas,<sup>9</sup> Camilla Toulmin<sup>10</sup>

Continuing population and consumption growth will mean that the global demand for food will increase for at least another 40 years. Growing competition for land, water, and energy, in addition to the overexploitation of fisheries, will affect our ability to produce food, as will the urgent requirement to reduce the impact of the food system on the environment. The effects of climate change are a further threat. But the world can produce more food and can ensure that it is used more efficiently and equitably. A multifaceted and linked global strategy is needed to ensure sustainable and equitable food security, different components of which are explored here.

12 FEBRUARY 2010 VOL 327 SCIENCE [www.sciencemag.org](http://www.sciencemag.org)

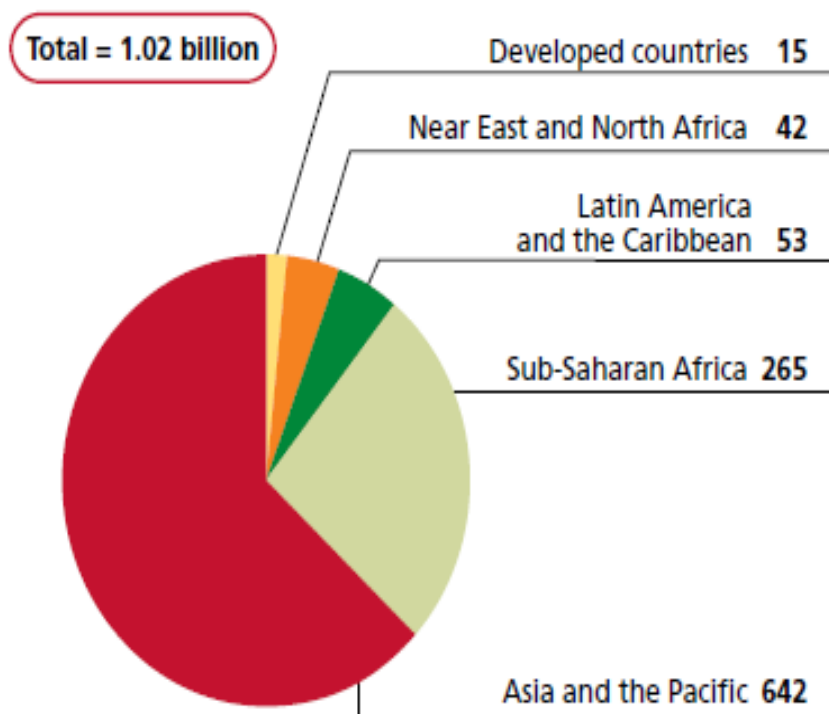
# Disputes on global food crisis



- Is world food production sufficient to feed world population – a matter of distribution?
- Will it be sufficient in the future?
- Is national food self-sufficiency meaningful in the globalized world?
- Is globalization helpful for the countries of food shortage?

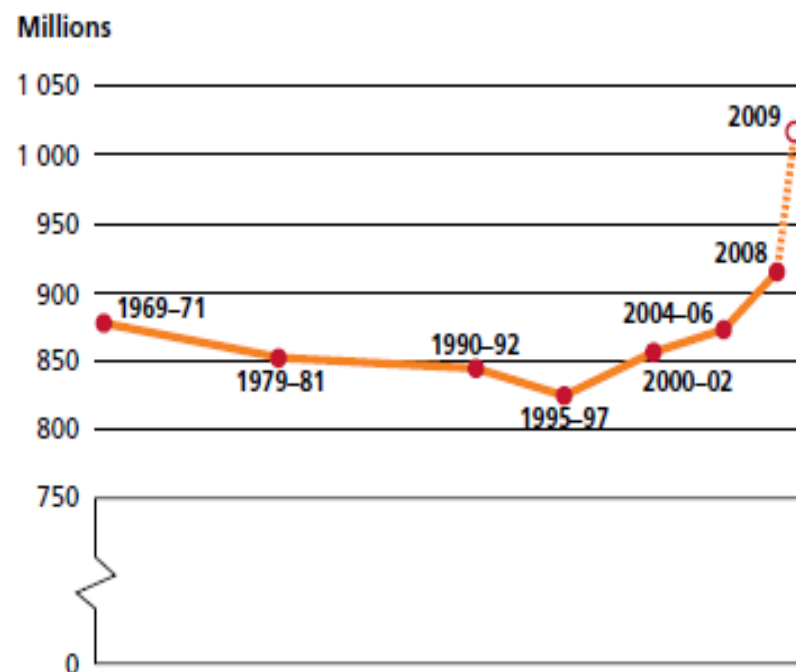
# World distribution of undernourished people

Undernourishment in 2009, by region (millions)



Source: FAO.

Learning from the past: number of undernourished in the world, 1969-71 to 2009



Source: FAO.

# Food situation after the trade liberalization under WTO

- Aggravation of uneven distribution of food.
- Disruption of food production infra-structure of developing countries.
- Strengthen the price decision power of food supplier.
- Control of food market by a few major companies and power countries.

Asia APO Workshop, 1999. 1. 27 - 2. 4, Tokyo, Japan

# International trade and Food security



*Country paper to be presented to the APO Workshop  
Seminar on International Trade and Food Security  
27 January - 4 February, 1999, Tokyo, Japan*

## **Impact of trade liberalization on food security situation in Korea**

*Cherl-Ho Lee*

*Center for Advanced Food Science and Technology(CA FST)*

*Graduate School of Biotechnology,  
Korea University, Seoul, Korea*

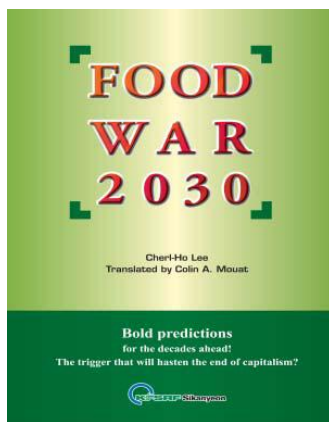


# Changes in Food Self Sufficiency

	<b>1970</b>	<b>1975</b>	<b>1980</b>	<b>1985</b>	<b>1990</b>	<b>1995</b>
<b>USA</b>	<b>111</b>	<b>174</b>	<b>157</b>	<b>173</b>	<b>142</b>	<b>129</b>
<b>Canada</b>	<b>132</b>	<b>171</b>	<b>181</b>	<b>202</b>	<b>223</b>	<b>172</b>
<b>France</b>	<b>141</b>	<b>152</b>	<b>178</b>	<b>204</b>	<b>210</b>	<b>181</b>
<b>England</b>	<b>59</b>	<b>64</b>	<b>96</b>	<b>114</b>	<b>116</b>	<b>114</b>
<b>Germany</b>	<b>72</b>	<b>80</b>	<b>91</b>	<b>95</b>	<b>114</b>	<b>113</b>
<b>Thai(rice)</b>	-	-	-	<b>146</b>	<b>138</b>	<b>218</b>
<b>China</b>	-	<b>98</b>	<b>92</b>	<b>94</b>	<b>100</b>	<b>94</b>
<b>Japan</b>	<b>46</b>	<b>40</b>	<b>33</b>	<b>31</b>	<b>30</b>	<b>30</b>
<b>Korea</b>	<b>81</b>	<b>76</b>	<b>56</b>	<b>48</b>	<b>40</b>	<b>28</b>



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2<sup>nd</sup> print: April 30, 2012



Sikanyeon Publishing  
First print: March 8, 2013

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**III. The Seed Wars**

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**VI. The Food Wars in 2030**

**VII. Tagore's Prophecy**

# World grain production and trade



**Total grain production 2.5 billion M/T**

Item	Production(M/T)	Trade(M/T)
Wheat	659.7 million	131.3 million(20%)
Rice	440.1 million	30.2 million( 7%)
Corn	802.4 million	91.8 million(11%)
Soybean	231.1 million	80.8million(35%)

**\*2007-2010 average**

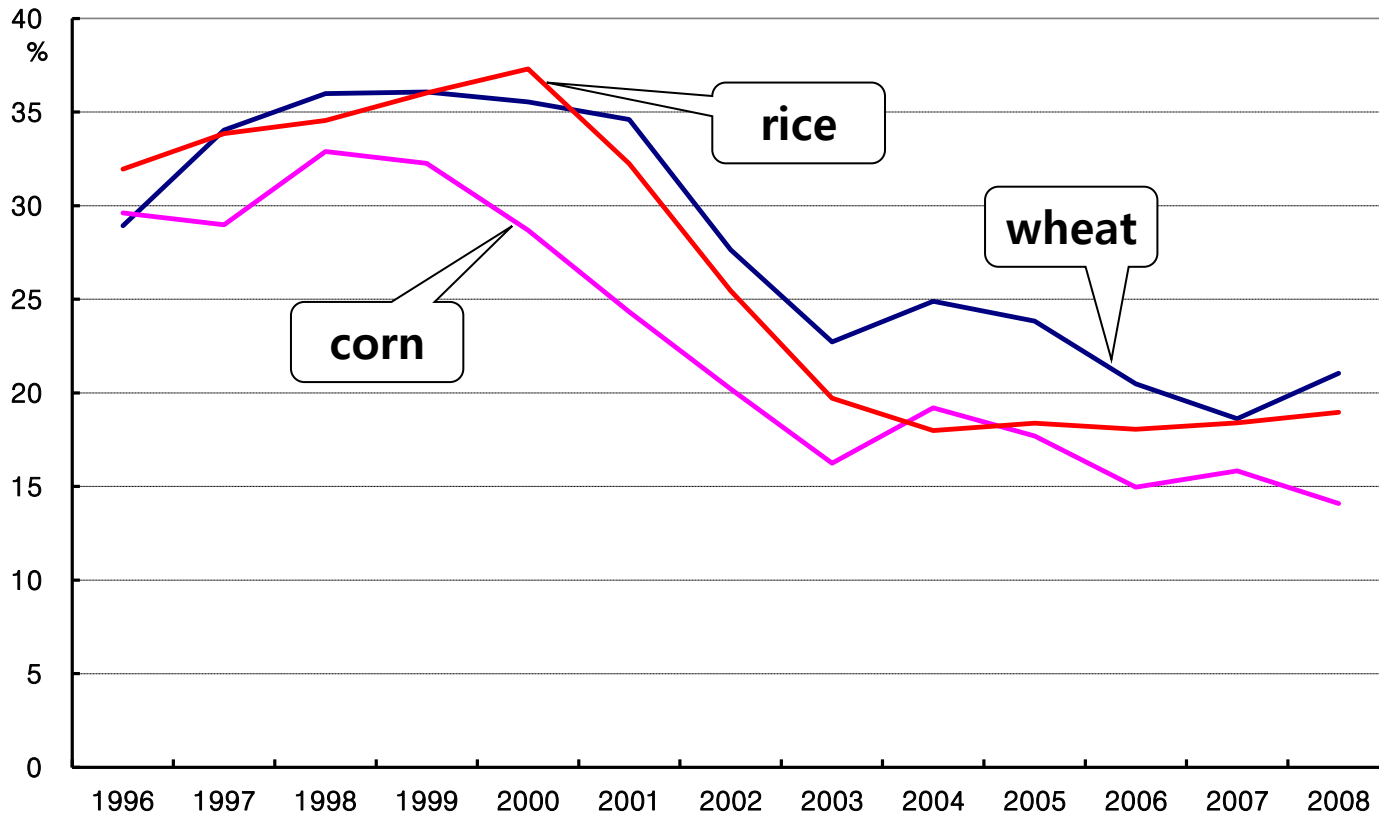




# Present World Food Situation

- Reduction of world grain reservoir and price hike
- Increase in undernourished people
  - Addition of 100 million undernourished people since 2008
- Over 18 million children under 5 years old dead by starvation and diarrhea every year

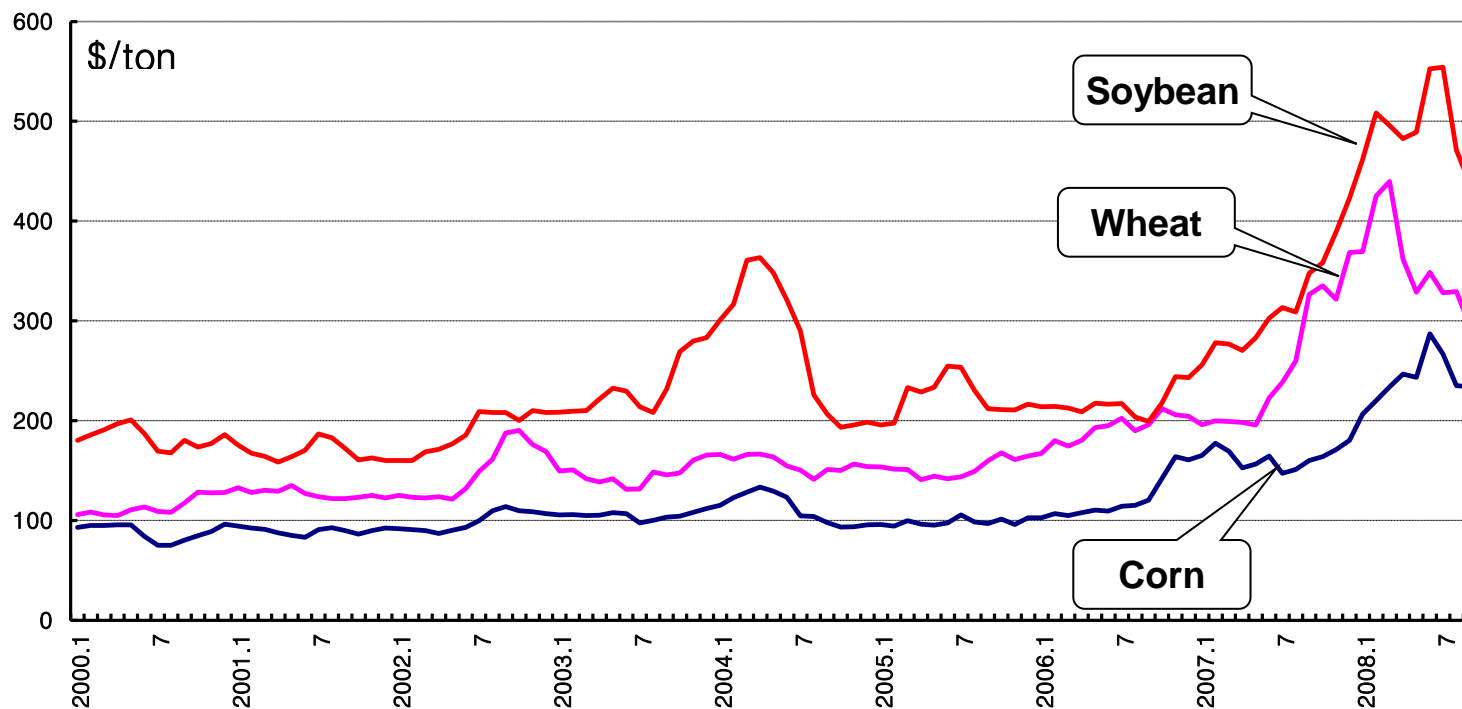
# Changes in world grain reservoir



[자료: 이정환, 2008]

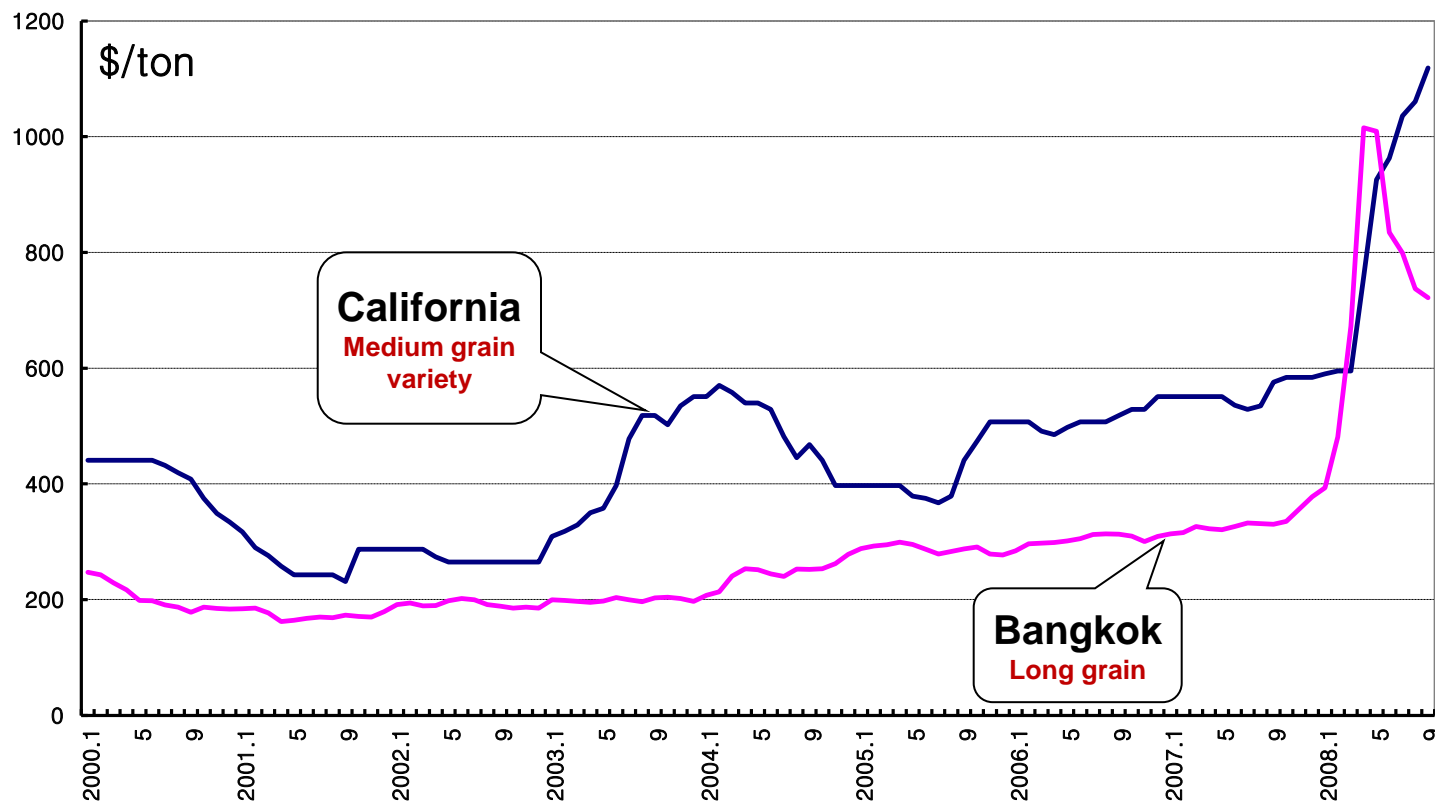


# Grain Price hike in 2007/2008



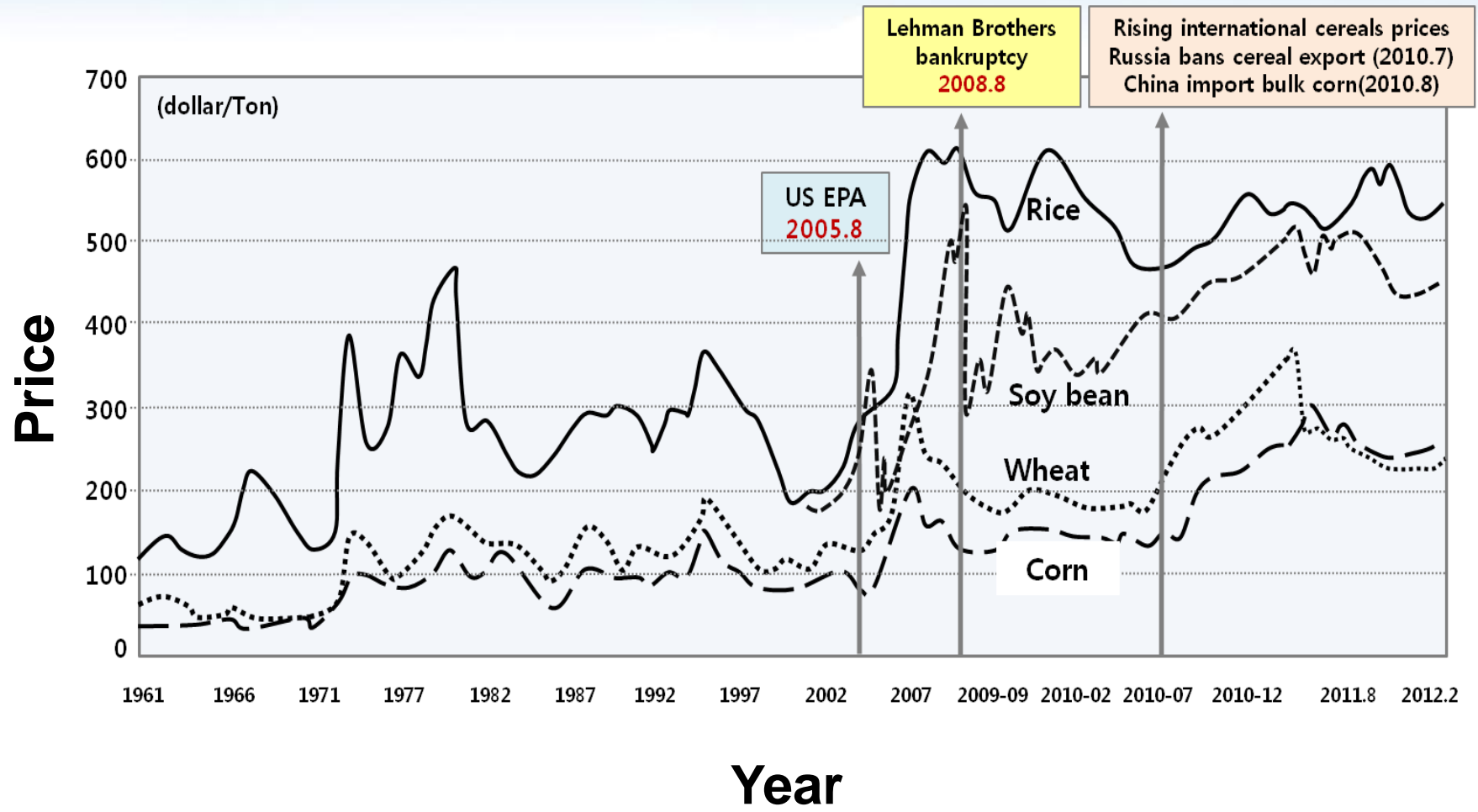


# Changes in rice price





# Changes in world grain prices





## Definition of Food Security

The World Food Summit of 1996 defined food security as existing “when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life”.

모든 사람들이 건강하고 활동적인 삶을 영위하기  
위한 안전하며 영양가 있는 식품을 항상 충분히  
얻을 수 있는 상태



# 3 Pillars of Food Security

- **Food availability (가용성)**  
Food production and supply
- **Food access (접근성)**  
Purchasing power, Food price
- **Food use (이용성)**  
Knowledge on nutrition,  
safety and water hygiene

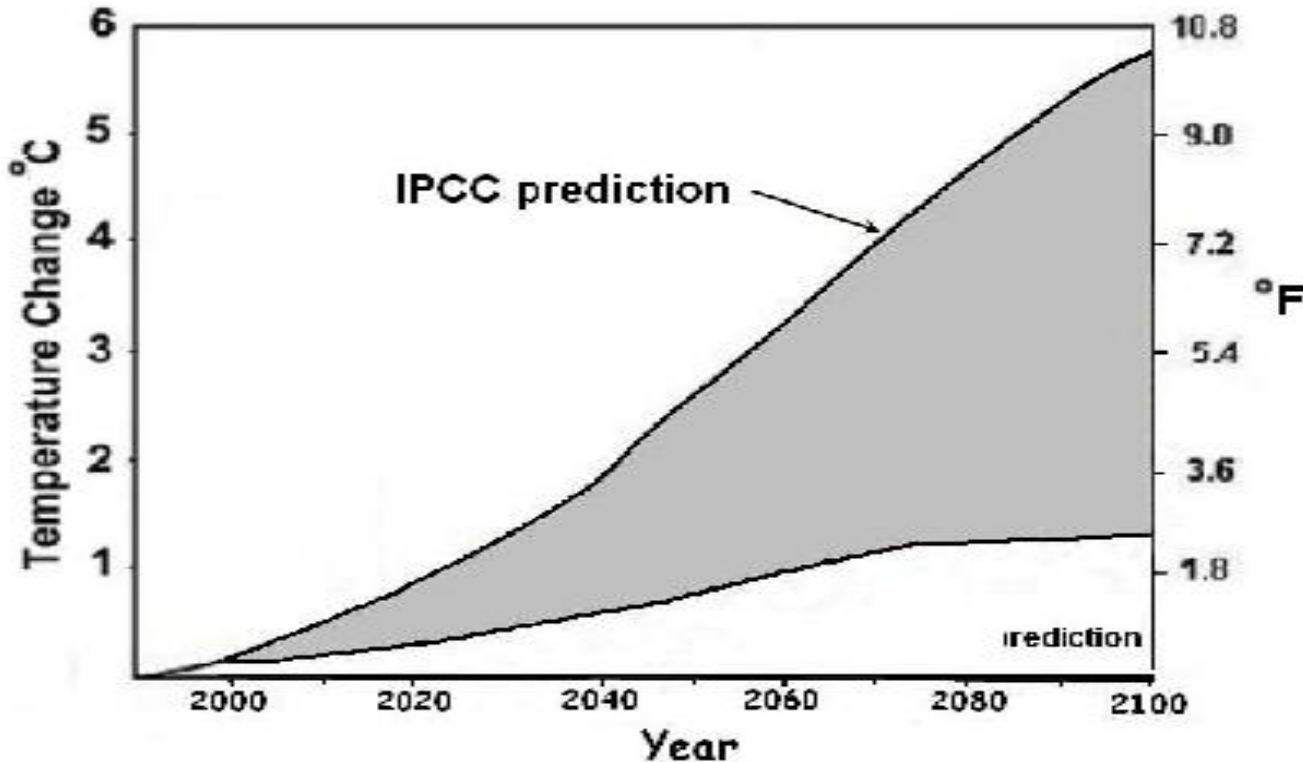
(자료; WHO, 2009)

# Factors causing global food crisis



## 1. Global warming and climate change

### IPCC Prediction of global warming in 21 C.

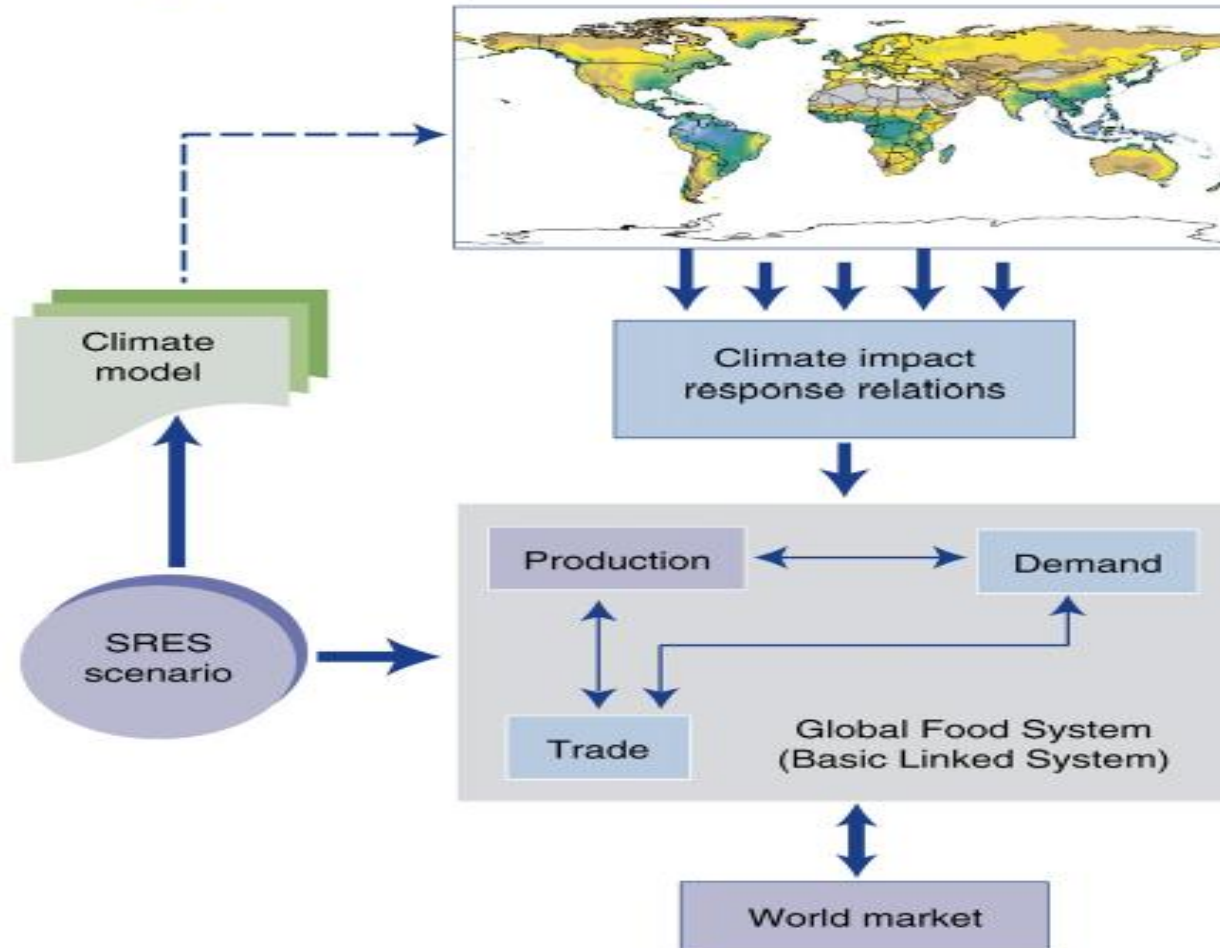


(Sources: IPCC website)

# Prediction model for world food production by climate change



## Ecological–Economic Analysis



[자료: Fischer et. al., 2007]



## Estimation of grain production change in 2080 by global climate change

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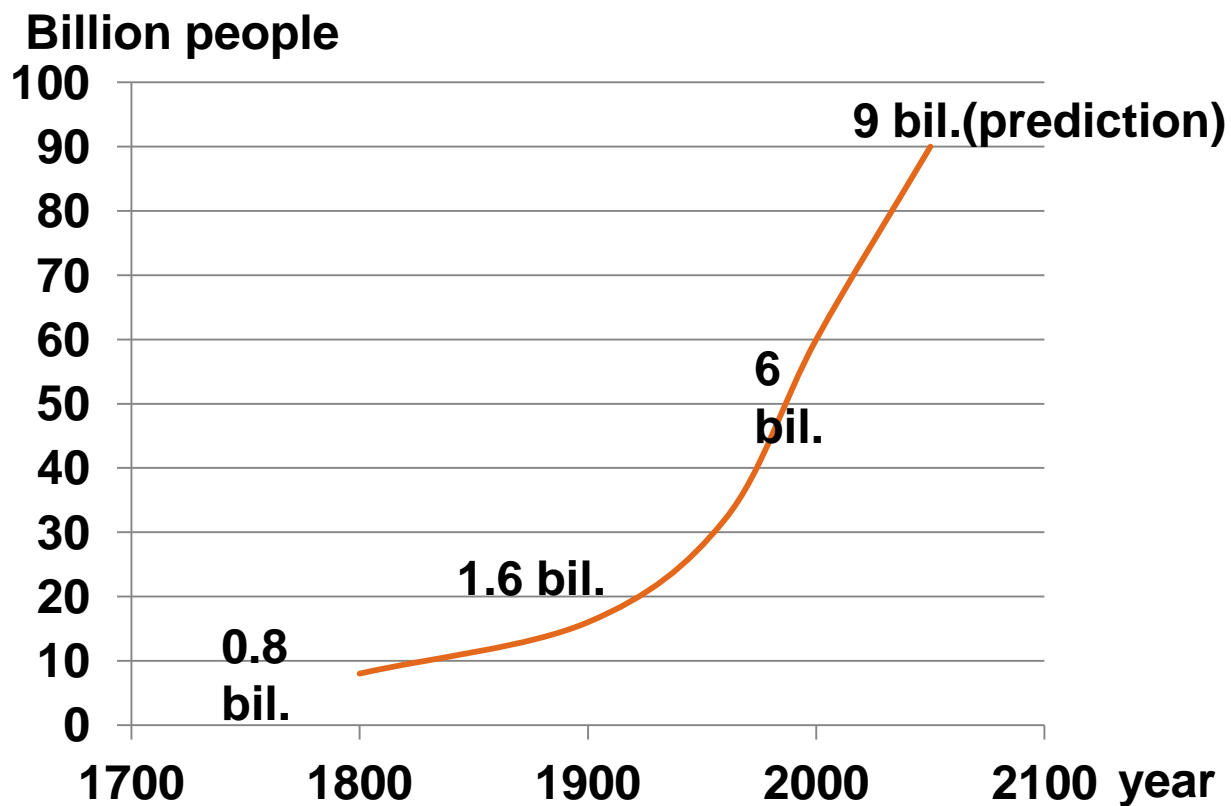
	1990-2080 (% change)
World	-0.6 to -0.9
Developed countries	2.7 to 9.0
Developing countries	-3.3 to -7.2
Southeast Asia	-2.5 to -7.8
South Asia	-18.2 to -22.1
Sub-Saharan Africa	-3.9 to -7.5
Latin America	5.2 to 12.5

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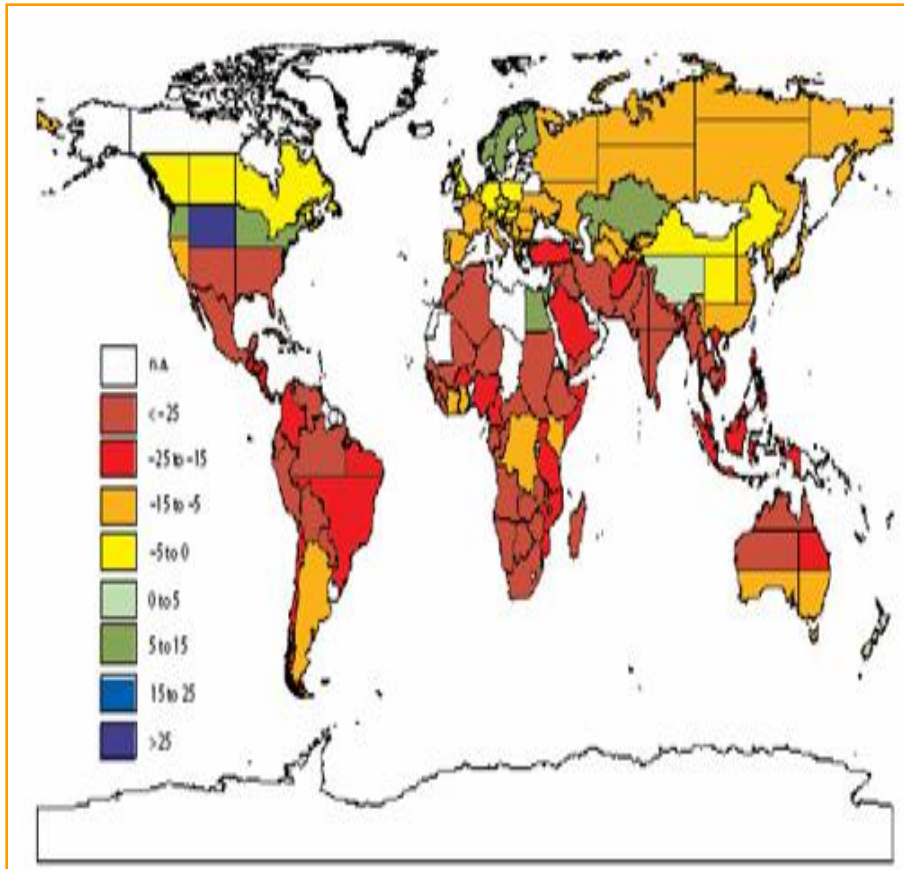
Source: Adapted from Tubiello and Fischer 2007.



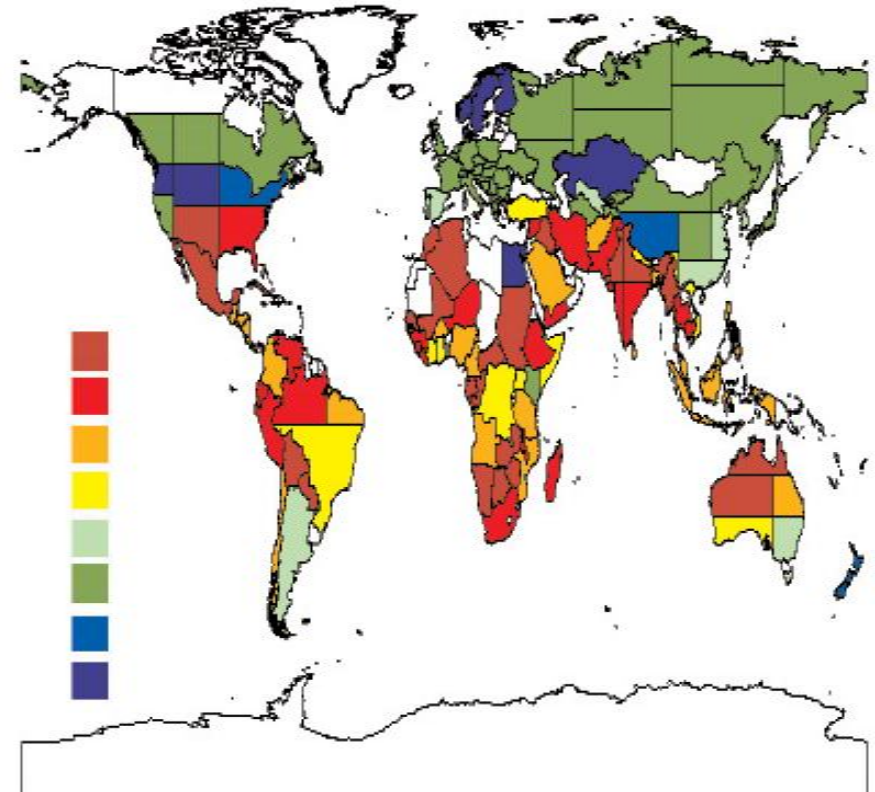
# World population change



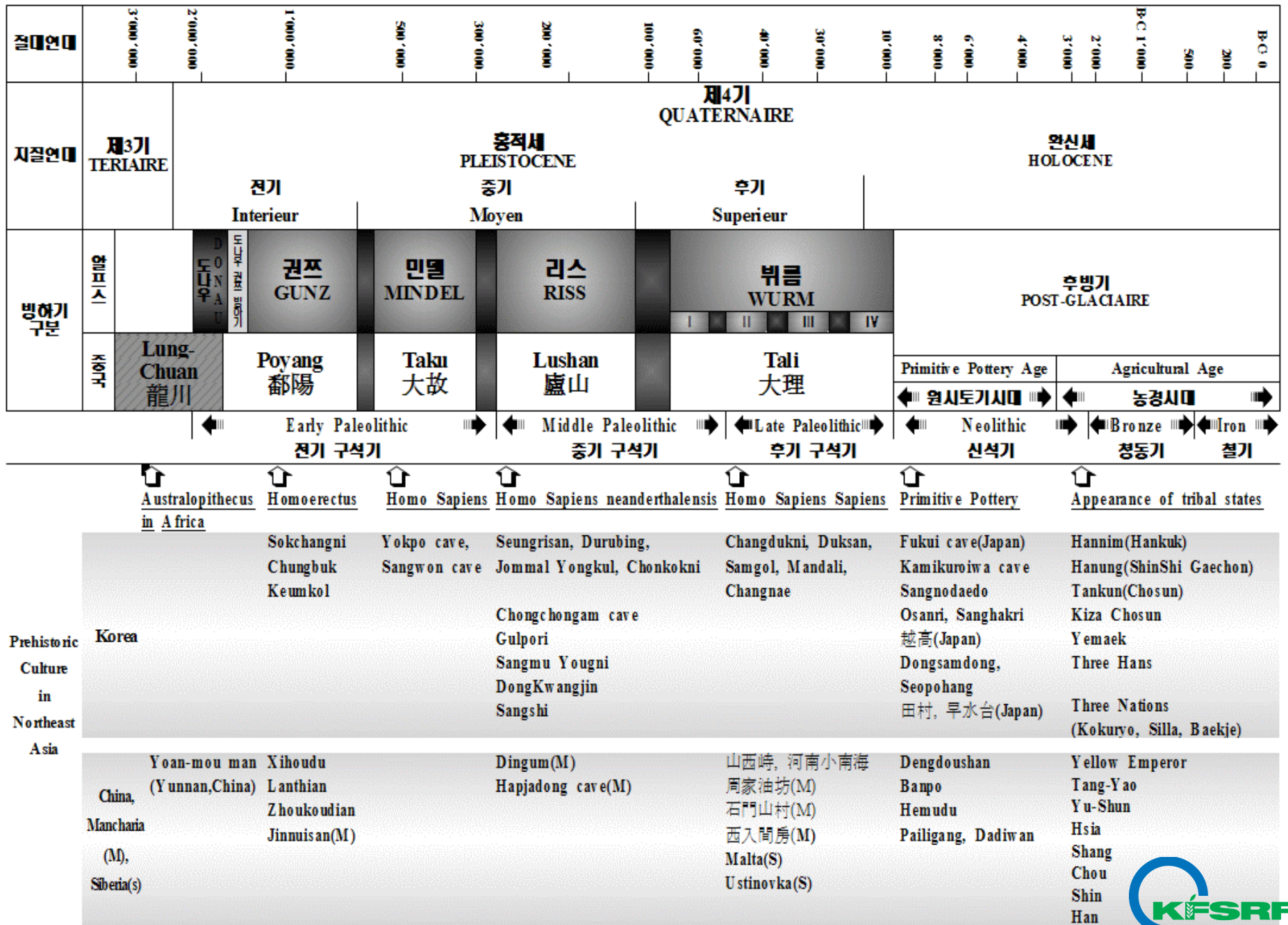
# Estimation of grain production change in 2080

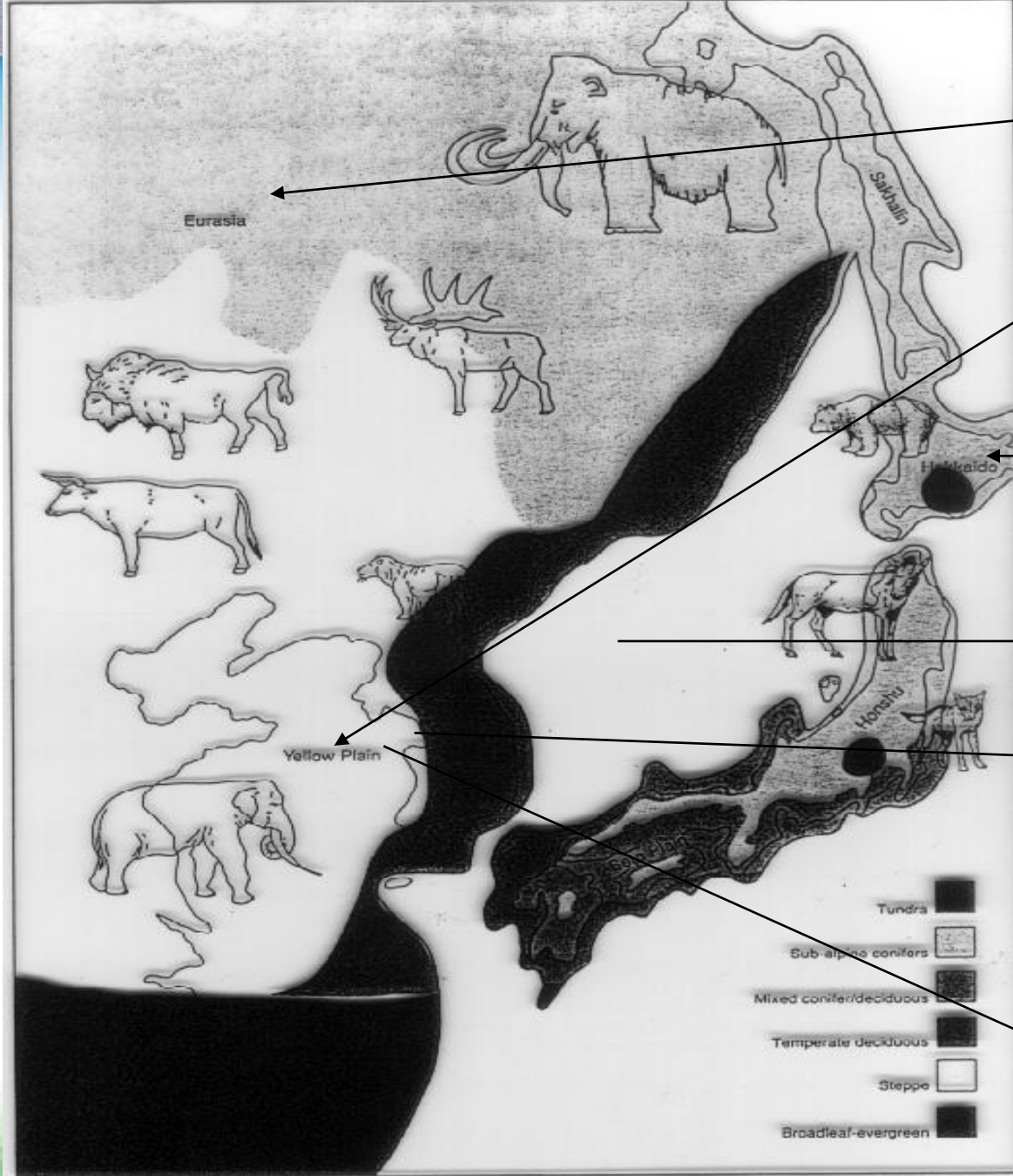


(a) Without mitigation



(b) Effect of mitigation





Eurasia



Yellow Sea

Hokkaido

East Sea

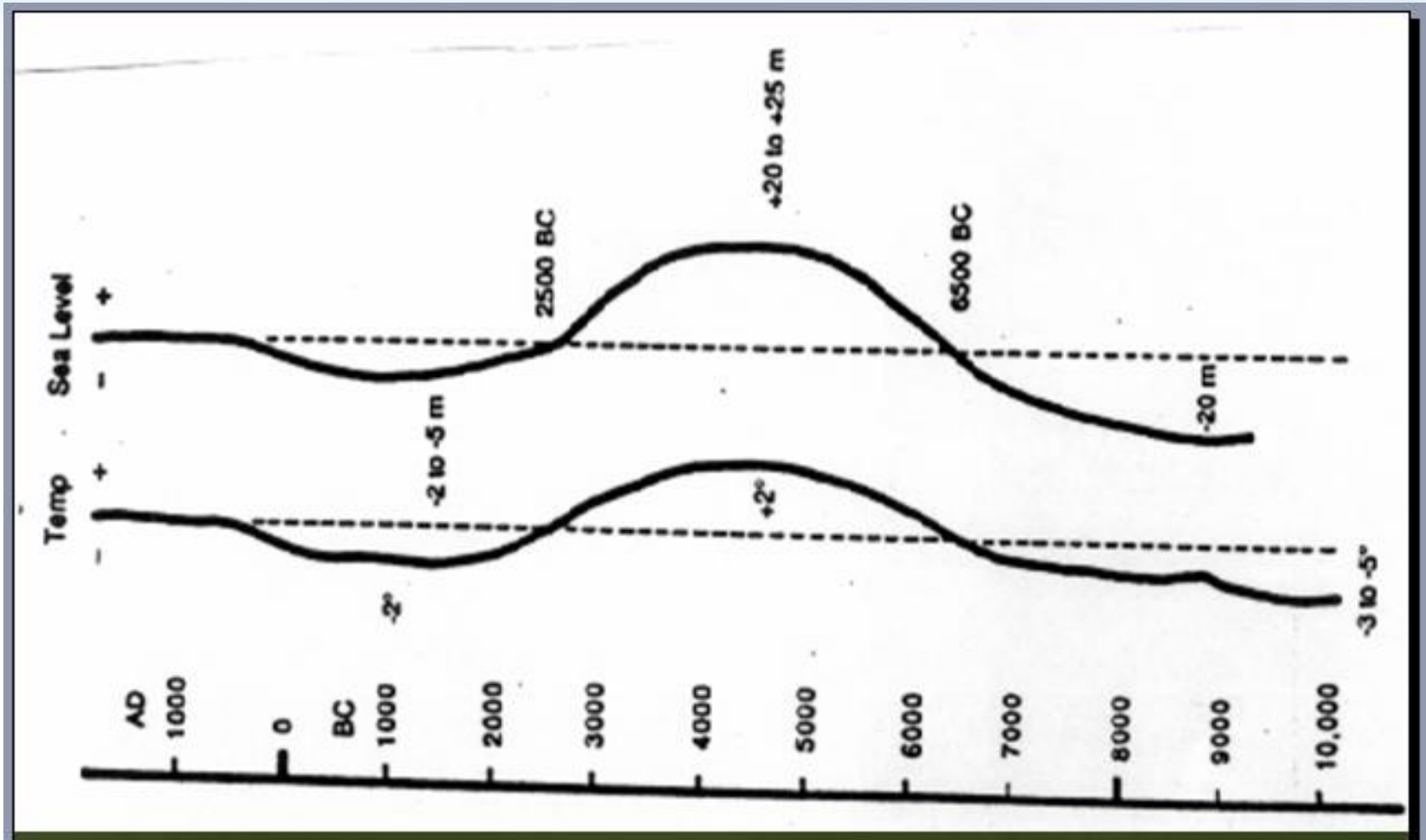
Korean peninsula

Steppe

*Geography of Northeast Asia in 16,000 B.P.*

(Barnes, 1993)

# Changes in earth temp. and sea-level during Holocene



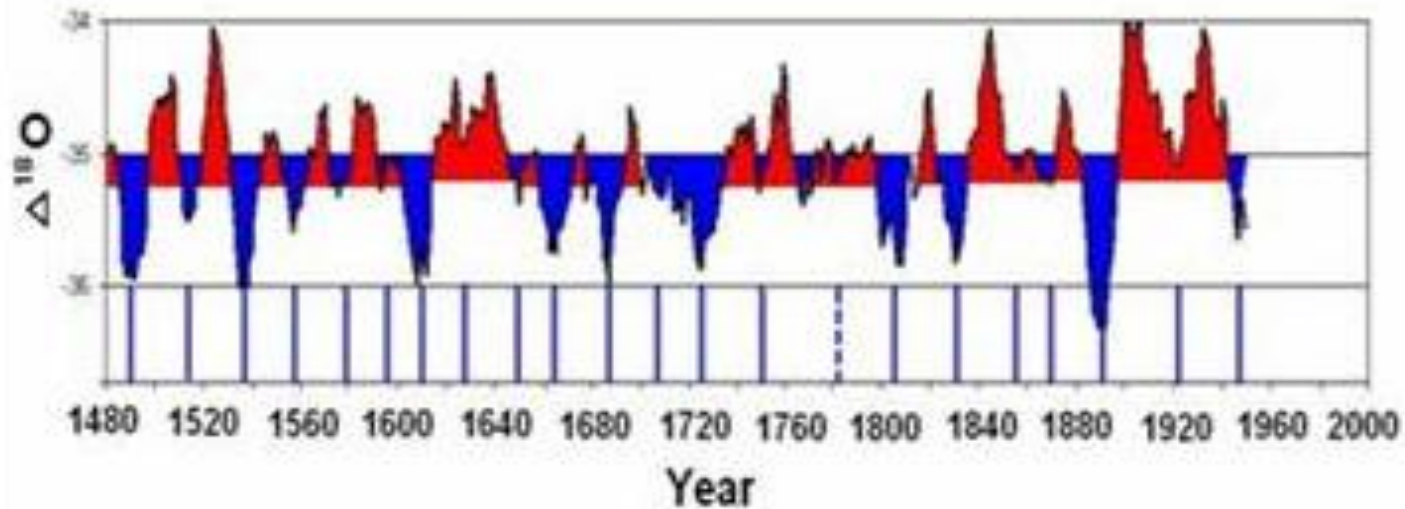
(Barnes, 1993)

# Warm and cool cycles on earth since AD1470



Blue = cool, red = warm.

Alternating climatic warming and cooling has occurred about every 27 years since 1470 AD, well before atmospheric  $CO_2$  began to increase



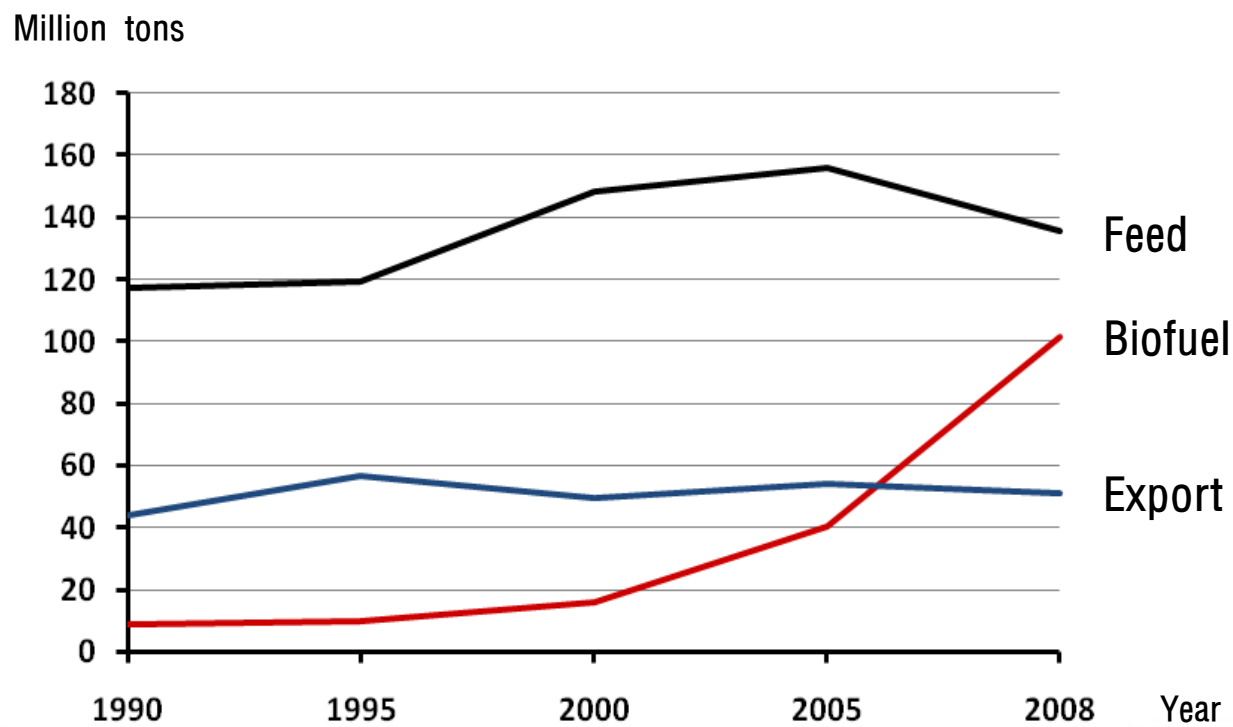
(Sources: IPCC website)



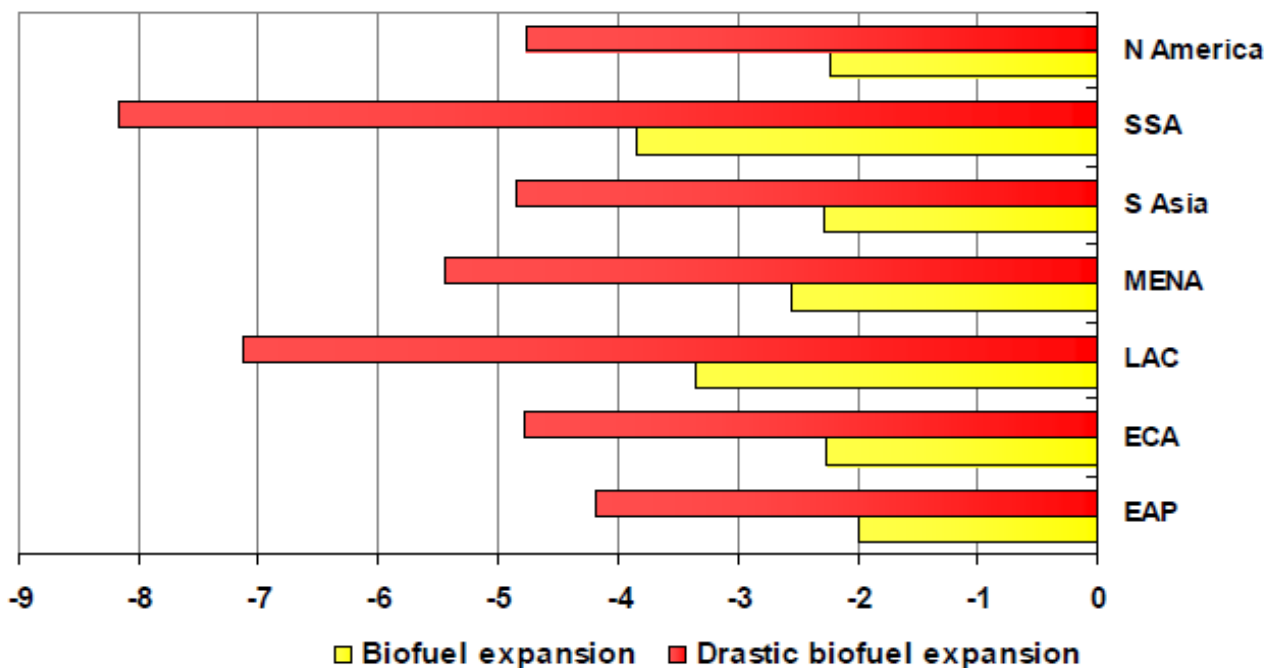
# Factors causing global food crisis

## 2. Bio-energy production from food grains

### <Corn utilization in USA>



# Prediction of available food energy change by bioenergy production (Rate of change by 2020,%)



Source: IFPRI IMPACT-WATER projections.

Note: N America = North America, SSA = Sub-Saharan Africa, S Asia = South Asia, MENA = Middle East & North Africa, LAC = Latin America & the Caribbean, ECA = Europe & Central Asia, EAP = East Asia & Pacific.

[ Joachim von Braun, 2010]



# Prediction of food price change by bioenergy production (Rate of change by 2020, %)

Crop	Scenario 1	Scenario 2
	Biofuel expansion <sup>1</sup>	Drastic biofuel expansion <sup>2</sup>
Cassava	11.2	26.7
Maize	26.3	71.8
Oilseeds	18.1	44.4
Sugar	11.5	26.6
Wheat	8.3	20.0

Source: IFPRI IMPACT-WATER projections.

Notes: <sup>1</sup>Assumptions are based on actual biofuel production plans and projections in relevant countries and regions.

<sup>2</sup>Assumptions are based on doubling actual biofuel production plans and projections in relevant countries and regions.

# Factors causing global food crisis



## 3. Animal food consumption by China and India

### Changes in food consumption in China (per caput per year)

	Urban			Rural		
	1990 (kg)	2006 (kg)	2006/1990 ratio	1990 (kg)	2006 (kg)	2006/1990 ratio
Grain	131	76	0.6	262	206	0.8
Pork, beef and mutton	22	24	1.1	11	17	1.5
Poultry	3	8	2.4	1	4	2.8
Milk	5	18	4.0	1	3	2.9
Fish and aquatic products	8	13	1.7	2	5	2.4
Fruits	41	60	1.5	6	19	3.2

Source: Data from National Bureau of Statistics of China 2007a and 2007b.



## Conversion rate of feed protein by animals

<b>Animal foods</b>	<b>Conversion rate (%)</b>
<b>Beef</b>	<b>4.6</b>
<b>Pork</b>	<b>12.5</b>
<b>Chicken</b>	<b>17.7</b>
<b>Milk</b>	<b>22.9</b>
<b>Egg</b>	<b>23.5</b>

[Park, H.J. and Lee, C.H.; Food Preservation, 2008]

# Area needed for the production of food for a person per year(1million kcal)

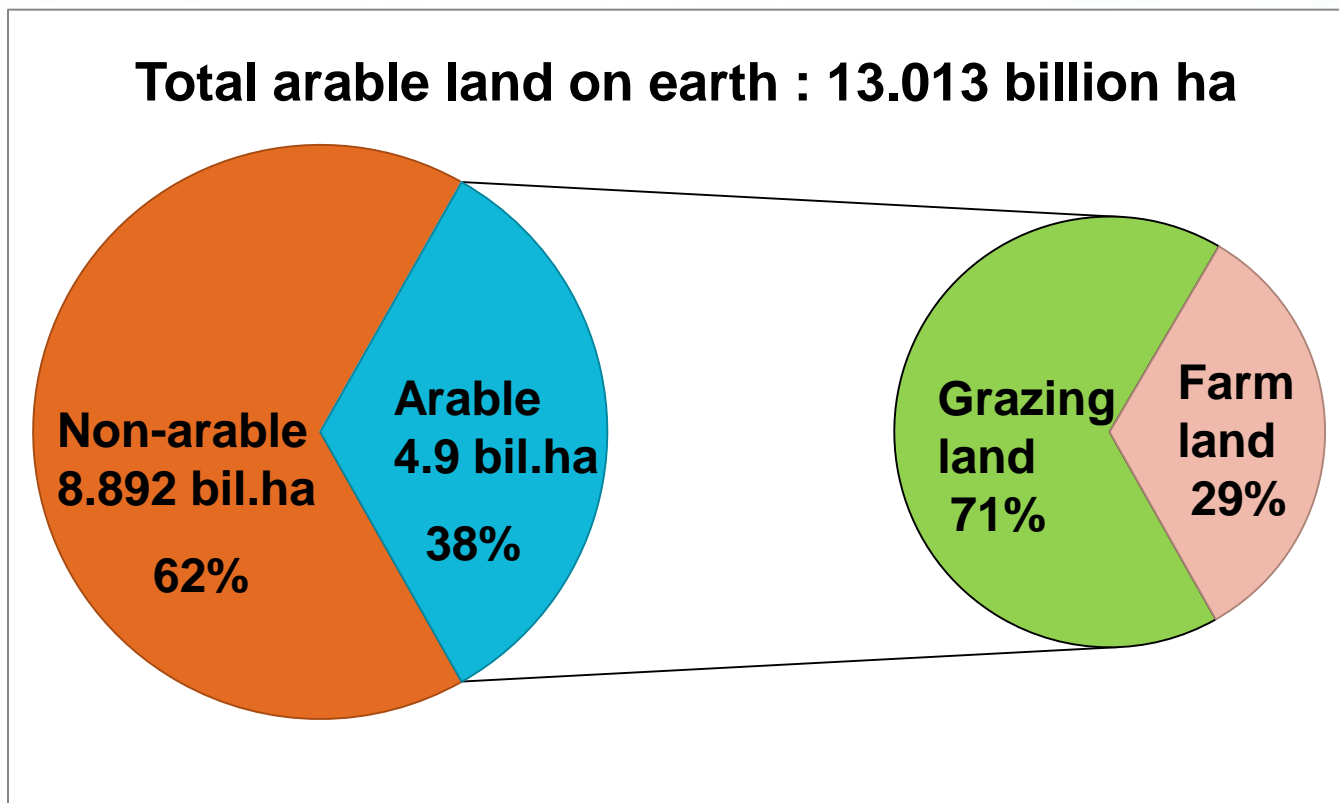


<b>Food</b>	<b>Needed area (ha)</b>
<b>Sweet potato</b>	<b>0.04</b>
<b>Sugar</b>	<b>0.05</b>
<b>Rice</b>	<b>0.07</b>
<b>Barley</b>	<b>0.11</b>
<b>Wheat</b>	<b>0.13</b>
<b>Soybean</b>	<b>0.21</b>
<b>Milk</b>	<b>1.10</b>
<b>Egg</b>	<b>2.80</b>
<b>Chicken</b>	<b>3.70</b>
<b>Beef</b>	<b>6.80</b>

[Park, H.J. and Lee, C.H.; Food Preservation, 2008]

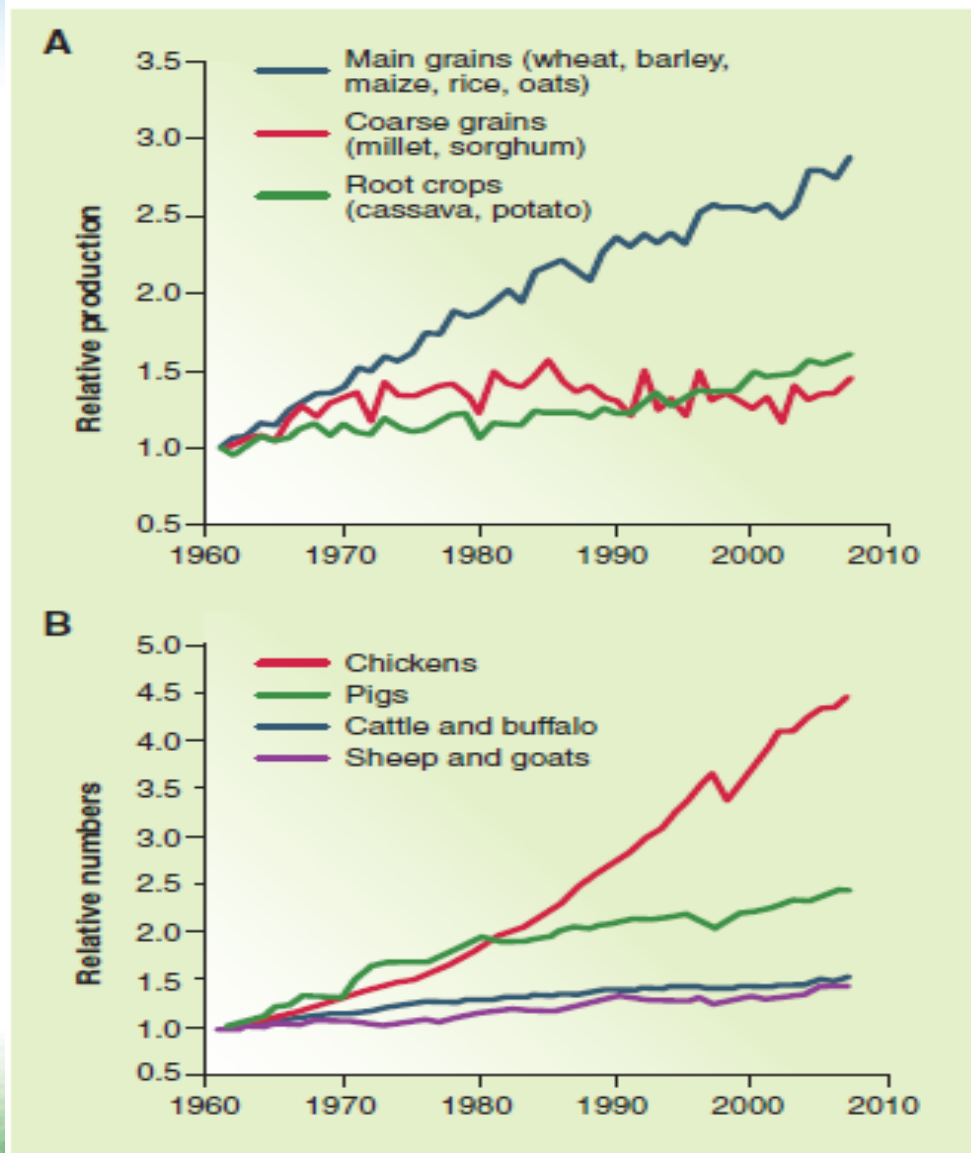


# Status of land utilization on earth



[Park, H.J. and Lee, C.H.; Food Preservation, 2008]

# Changes in world crop and livestock productions (Base year 1961)



**(A) Major crop plants**

**(B) Major types of livestock.**

[Godfray et.al, 2010]

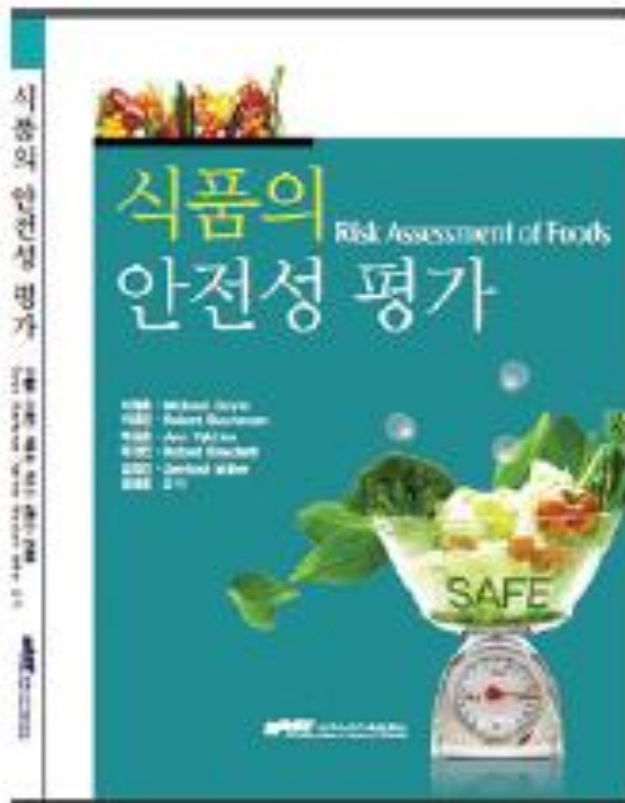
# Comparison of the impact of grazing and intensive grain-fed livestock systems on water use, grain requirement, and methane production

Water	Measure of water use	Grazing	Intensive
		Liters day <sup>-1</sup> per animal at 15°C	
Cattle	Drinking water: all	22	103
	Service water: beef	5	11
	Service water: dairy	5	22
Pigs (lactating adult)	Drinking water	17	17
	Service water	25	125
Sheep (lactating adult)	Drinking water	9	9
	Service water	5	5
Chicken (broiler and layer)	Drinking water	1.3–1.8	1.3–1.8
	Service water	0.09–0.15	0.09–0.15
	<i>Feed required to produce 1 kg of meat</i>	<i>kg of cereal per animal</i>	
Cattle		–	8
Pigs		–	4
Chicken (broiler)		–	1
	<i>Methane emissions from cattle</i>	<i>kg of CH<sub>4</sub> per animal year<sup>-1</sup></i>	
Cattle: dairy (U.S., Europe)		–	117–128
Cattle: beef, dairy (U.S., Europe)		53–60	–
Cattle: dairy (Africa, India)		–	45–58
Cattle: grazing (Africa, India)		27–31	–

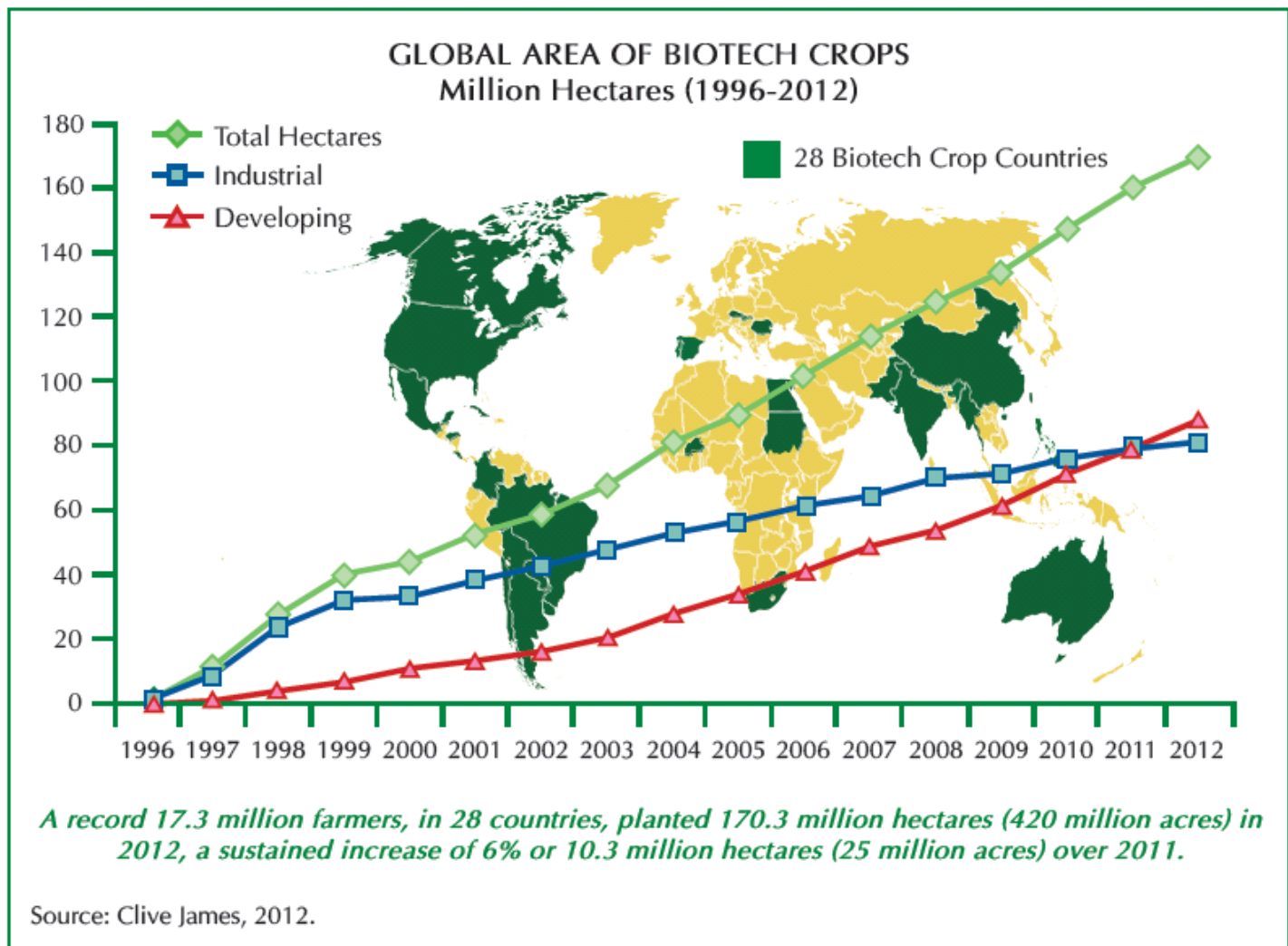
# Factors causing global food crisis



## 4. Conflict on the use of GM foods



# Global area of biotech crops



# Applications of GM technology



**Table 1.** Examples of current and potential future applications of GM technology for crop genetic improvement. [Source: (18, 49)]

Time scale	Target crop trait	Target crops
Current	Tolerance to broad-spectrum herbicide	Maize, soybean, oilseed brassica
	Resistance to chewing insect pests	Maize, cotton, oilseed brassica
Short-term (5–10 years)	Nutritional bio-fortification	Staple cereal crops, sweet potato
	Resistance to fungus and virus pathogens	Potato, wheat, rice, banana, fruits, vegetables
	Resistance to sucking insect pests	Rice, fruits, vegetables
	Improved processing and storage	Wheat, potato, fruits, vegetables
Medium-term (10–20 years)	Drought tolerance	Staple cereal and tuber crops
	Salinity tolerance	Staple cereal and tuber crops
	Increased nitrogen-use efficiency	
Long-term (>20 years)	High-temperature tolerance	
	apomixis	Staple cereal and tuber crops
	Nitrogen fixation	
	Denitrification inhibitor production	
	Conversion to perennial habit	
	Increased photosynthetic efficiency	

[Godfray et.al, 2010]

# Other factors

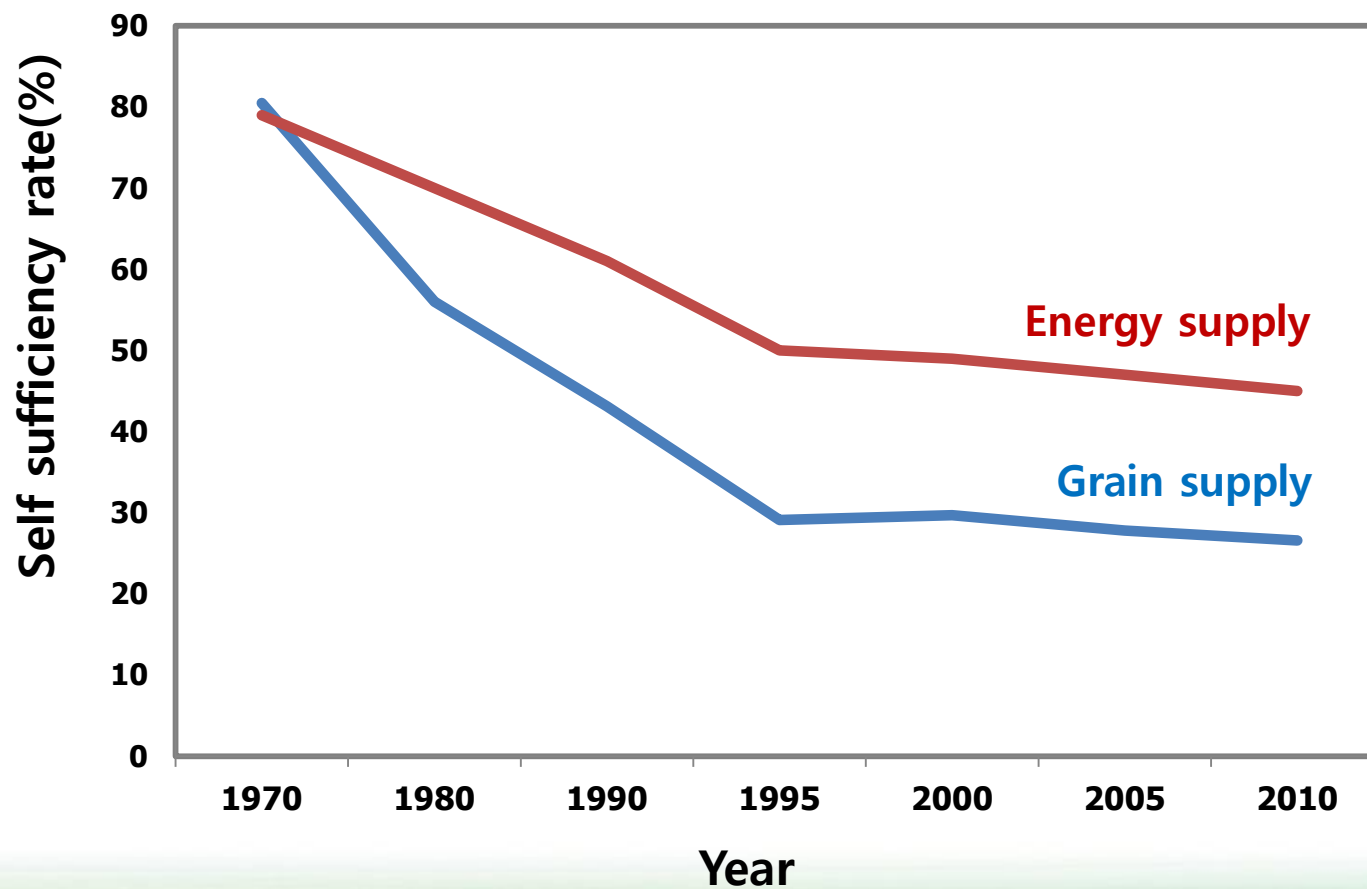


- Higher oil prices
- High prevalence of livestock diseases by globalization
- Market disturbance by speculation
- Trade restriction by food nationalism





# Food situation in Korea





# Special situation of Korea

- **Food security – Very weak**
  - Import 70% of grain consumption
- **Demand for food safety – Very high**
  - Frequent food safety incidences
  - Mistrust for government authorities
  - Irresponsible action of some consumer organizations and news media
  - Passive response of scientific circles

# Food safety and Food security



- Two faces of a coin
- **Mutually colliding and complementing**  
Food shortage – No room for food safety  
Unsafe – No use a pile of food

**Food safety**↑ - **Food Availability** ↓ - **Food price**↑

**Need social consensus to harmonize  
food safety and food security**

# 2009 IUFOST-Japan

# Food safety and Security Symposium



INTERNATIONAL UNION OF FOOD SCIENCE & TECHNOLOGY

## E-Newsline

## #5

### In This Issue

[Food Safety and Security Symposium-Nagoya Japan](#)

[IUFOST breaks into the Blogosphere](#)

[IUFOST Distance Education Module Update](#)

### What's New This Week

[-Kellogg's to stamp out imitation cereals as Corn Flake sales soar](#)

[-Actimel advert banned over 'misleading' claims](#)

[-Analyst ups Coca-Cola estimate](#)

[-Supermarkets reducing organic ranges](#)

[-Kraft to wait for Cadbury's Q3 results](#)

[-UK consumers want food labelled with country of origin](#)

[-Kraft makes multi-million dollar](#)

### IUFOST -JAPAN Food Safety and Security Symposium

September 2009 saw the opportunity for the IUFOST leadership to reaffirm and renew our long relationship with IUFOST founding member, Japan with the IUFOST-Japan Food Safety and Security Symposium, meetings with Japan industry and research institutes, with our colleagues in IUFOST Japan and with hands-on training in Cup-of-Noodle making.

*From left: IUFOST Japan President, Tomohiko Mori, Academy Fellow Katsuyoshi Nishinari and Academy Founding Fellow and former IUFOST Governing Council member, Kyoden Yasumoto*



The first paper of the symposium was given by Prof Seiichi Homma, the immediate past Commissioner of the Food Safety Commission, in the Cabinet Office of the Japanese government. He reminded us of Japan's high dependency on imported food, some 60% of its needs. Pressure was therefore on government both on food security, and on food safety, as improved methods of analysis lowered detection levels of pesticide residues and contaminants. Then Prof Takanori Mine, Director of Food Safety Research for ILSI Japan

 인

# 2009 IUFoST-Japan



## Food safety and Security Symposium

September 12, 2009, Nagoya University, Japan

- Food Safety and Security in Japan  
Seiichi Homma (passed Commissioner of Food Safety Commission)
- Food Safety and Food Security – IUFoST Global Role  
Geoffrey Campbell-Platt (IUFoST President, Univ. of Reading, UK)
- Food Safety and Security in China  
Piingfan Rao (Fuzhou Univ., China)
- Food Safety and Security in Korea  
Cherl-Ho Lee (Korea Univ., Korea)
- Food Safety and Security in Canada  
Rickey Yada (Guelph Univ., Canada)



# Korean Dilemma

1. **Grain self-sufficiency below 30% - Does Korean government take this situation seriously as crisis and is willing to improve?**
2. **Rice market will be opened in 2015 – Is Korean rice competitive to the imported rice?**
3. **Non-GM crops are disappearing from the world market – Are Koreans ready to consume GM food?**
4. **Ever-increasing constrains on food industries – is Korean food chain sound and responsible for national food supply?**

# MFAFF plan for food self-sufficiency (%)

	<u>2010</u>	<u>2015</u>	<u>2020</u>
Grain self-sufficiency(+feed)	26.7	30	32
Grain self-sufficiency(food use)	54.9	57	60
Calorie self-sufficiency	50.1	52	55
Food sovereignty	27.1	55	65
Rice	104.6	98	98
Wheat	1.7	10	15
Soybean	31.7	36.3	40
Meat	72	71.4	72.1
Milk and their products	65.4	65	64

# Anthropological evaluation of the 60 years division of Korean peninsular



	South Korea	North Korea
Per capita daily food intake (g)	1,300	500(+)
Energy intake (kcal)	2,000	1,600
Energy composition(C:P:F)	65:15:20	80:12:8
Grain self-sufficiency (%)	26	97
Average height(cm, M/F)	173/159	166/155
Obesity ratio(%)	33	-
Tuberculosis, contraction/dead (person/100,000)	90/8	344/25
Per capita GDP (US\$)	17,175	960
Political system	Open, Capitalistic	Closed, Socialistic



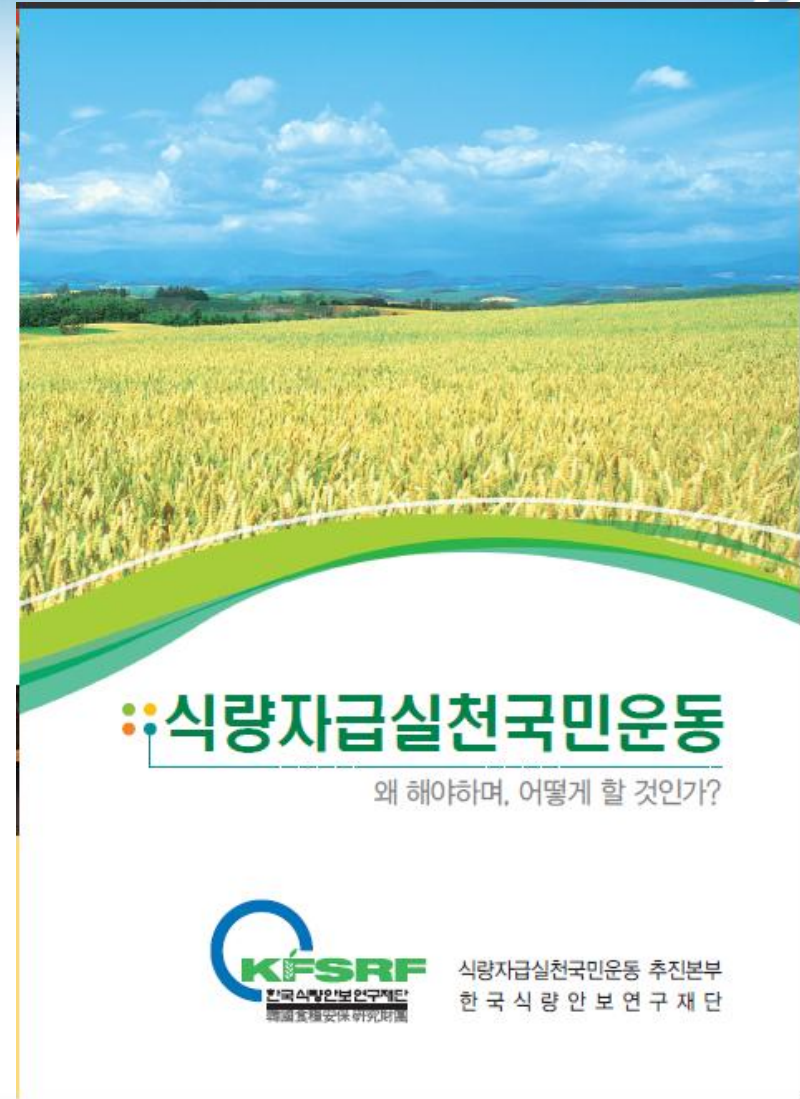
# Optimal Food consumption model of Korean

Contant	Detail
Nutritional goal of traditional Korea diet	Energy 2,000 – 2,500 kcal Protein 80-90g (Animal protein 20-30%)
Energy composition	CHO 75%: Protein 15%: Fat 10%
Optimal food consumption model of Korean	Food consumption pattern of 1980 Rice intake – 2 times of today Animal food intake – ½ of today Amount of food intake- 1,000g/capita/day
Grain self-sufficiency in 1980 in Korea	56%

# FOOD ACTION of Korea

Started March, 2011

Organized by  
Korea Food Security  
Research Foundation



**식량자급실천국민운동**  
왜 해야하며, 어떻게 할 것인가?

**KFSRF**  
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韓國食糧安謀研究財團

식량자급실천국민운동 추진본부  
한국식량안보연구재단



# FOOD ACTION

- (1) Eat fresh and local food for health.
- (2) Eat breakfast for health and vitality.
- (3) Economize food and reduce waste.
- (4) Grow vegetables at home and garden.
- (5) Cultivate idle-land and double-cropping.



# FOOD ACTION



- (6) Produce Top-rice of best quality.
- (7) Globalize Korean food of high quality and safety.
- (8) Support and up-bring food industry as the major food supplier.
- (9) Keep bio-resources and sea area for sustainable food production.
- (10) Create new agricultural and fishery societies as the root of people' s life.





# Declaration of People's Movement



- Economize food and be ashamed of food wasting.
- Create sound food culture recognizing the effort of food producers.
- Try best for the stable supply of safe and nutritious food.
- Research and develop sustainable food production and bio-resource systems.
- Create new farm and fishery lands as the root of people's life.





아이디

비밀번호

**로그인**

[회원가입](#) [아이디/비밀번호 찾기](#)



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