



GCE A level

1204/01-A

New A2

**GEOGRAPHY - G4
SUSTAINABILITY**

P.M. TUESDAY, 2 February 2010

Examination copy

To be given out at the start of the examination.

The pre-release copy must not be used.

RESOURCE FOLDER

ADVICE TO CANDIDATES

In this synoptic exercise you will be assessed on your ability to **synthesise knowledge and understanding and skills** derived from your A level course.

You are reminded that assessment will take into account the quality of written communication used in your answers.

The main focus of the materials in this Folder is on food supplies for cities. It contains information about a number of cities located in contrasting environments and wider considerations, such as the reliability of food supplies and ways of increasing food supplies.

Guidelines for using the pre-release materials

The contents of the booklet should be studied carefully. The examples given will help in answering some of the questions on the question paper. To give a fuller answer, it is advisable to look at other material before the examination. This could be similar topics, related to information in other countries, or may be the same countries but in greater depth or on closely related topics. It would be particularly useful to note if other case studies seem similar in nature, or if they show contrasting perspectives to those from the material in this Resource Folder.

Some of the resource materials come from Geography textbooks, but others come from companies, pressure groups, research organisations, governments and private individuals. In some cases they are using information to promote their own interests rather than to represent an impartial view. It is worth considering if they are trying to support a particular interest group and persuade readers to agree with them. In finding other materials it is worth bearing in mind that they might not be presented in an impartial and objective way.

Material in the Resource Folder may often be related to other themes found in G4, and to other units in Geography AS and A2. These links should be noted, as there will be opportunities to refer to such connections with other work in some of your answers. Being able to link together different parts of your Geography studies is important and will be rewarded in answers. Such linkages are sometimes referred to as 'synopticity'.

Textbooks, journals, good quality newspapers and television and radio programmes are good sources of information. Probably the most accessible source of geographical information is the Internet, but it is also the one which may be most susceptible to bias and lack of impartiality. Many of the resources are extracted or adapted from sources on the Internet. These sources have the web addresses provided. Many are only extracts or shortened versions of fuller documents. It is well worth following these links for greater depth of reading and for more recent updates of material.

Each candidate will be provided with a copy of the Resource Folder, for use in the examination, at the same time as the question paper is issued at the beginning the examination on the day set for the paper.

Copies of the Resource Folder printed earlier, with added notes, or notes from research carried out in the previous six weeks, may not be taken into the examination.

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Figure 1 Characteristics of 12 selected cities from sources available in 2008

City	Population (millions)	Average annual income (\$US)	Houses with clean water (%)	Houses with refuse collection (%)	Cars per 1000 population	Life expectancy (years)	CDI (City Development Index)**
Accra* (Ghana)	3.35	2280	46	60	24	58	46.6
Bangalore (India)	7.35	2648	47	96	130	66	58.0
Dhaka* (Bangladesh)	12.62	219	80	50	7	64	48.4
Havana* (Cuba)	2.33	2249	85	100	32	79	71.0
Jakarta* (Indonesia)	15.14	2843	15	84	68	72	69.2
Lagos (Nigeria)	10.14	1024	65	8	4	49	29.3
Lahore (Pakistan)	7.95	428	84	50	45	65	61.1
Melbourne (Australia)	3.75	16 845	99	100	500	82	95.5
Rio de Janeiro (Brazil)	12.32	5850	95	88	177	74	79.4
Seoul* (South Korea)	23.43	18 970	100	100	340	78	86.0
Singapore* (Singapore)	4.61	26 590	100	100	135	84	94.5
Stockholm* (Sweden)	1.91	25 030	100	100	390	82	97.4

* denotes capital city

** CDI is the measure used by The United Nations Human Settlements Programme, (<http://www.unhabitat.org/>)

Figure 2 Problems of food supply for urban areas

A very real and tangible growing concern that we face today is how we will manage to feed another 3 billion people expected to populate the earth in the next 50 years, especially given the huge inequalities in food distribution that currently exist. The food requirements for people in large urban centers seem to be an especially difficult problem to solve. Although they only cover 2% of the Earth's surface, cities consume 75% of the Earth's resources. Today, 50% of the earth's population live in urban areas. In addition, it has been predicted that by 2025, urban populations are expected to increase to 65% of the global population. Over the next 50 years, that figure will go up to 80%, with the number of humans living in urbanized centers expected to increase by 2% every year this century.

One major issue related to rapid urban growth is food production. Metropolitan areas rely on food produced in rural areas and, as of 2001, 40% of the world's land area was used for food production (crops and grazing). Environmental impacts from agricultural practices include deforestation, reduction of natural resources, dry land salinity, high water consumption, and pesticide, herbicide, and fertilizer contamination. The transportation and refrigeration of food from rural to urban areas also results in the consumption of significant amounts of fossil fuel producing environment-damaging amounts of greenhouse gases.

Our current methods of agricultural production are rife with problems that have to be addressed. The harmful effects of current agricultural practices on drinking water supplies, both on the surface and below ground, is just one example. "Humans already use more than half of all accessible, renewable fresh water, and 70-80 percent of that is used by agriculture, more than any other human activity. Currently, over 40 percent of world food production occurs on irrigated land." This puts an enormous strain on our current water supply.

Source: Columbia University



Urban and rural areas

Figure 3 Recent UK food imports and exports in total, and for cereals

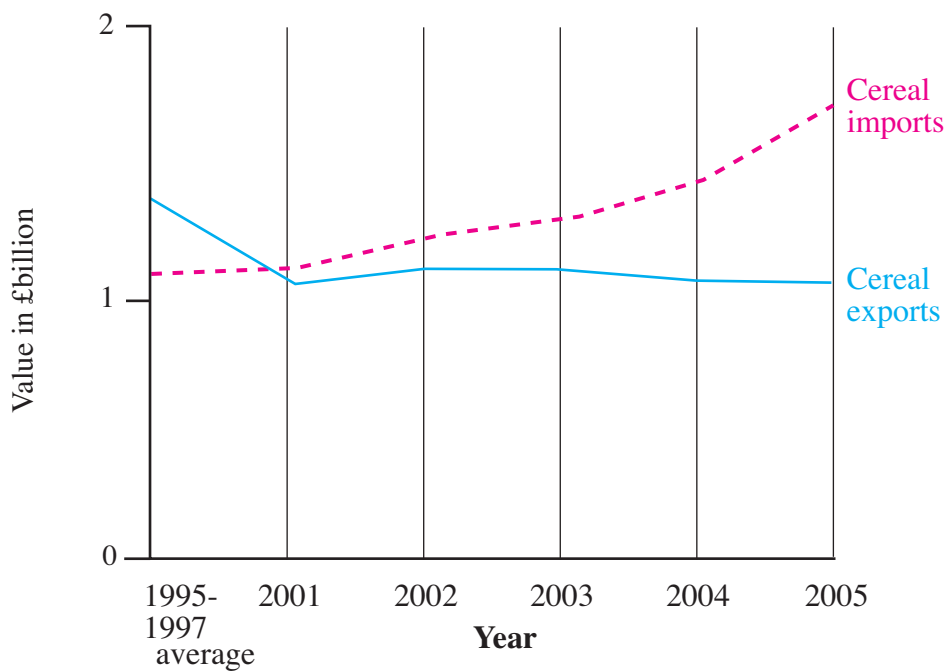
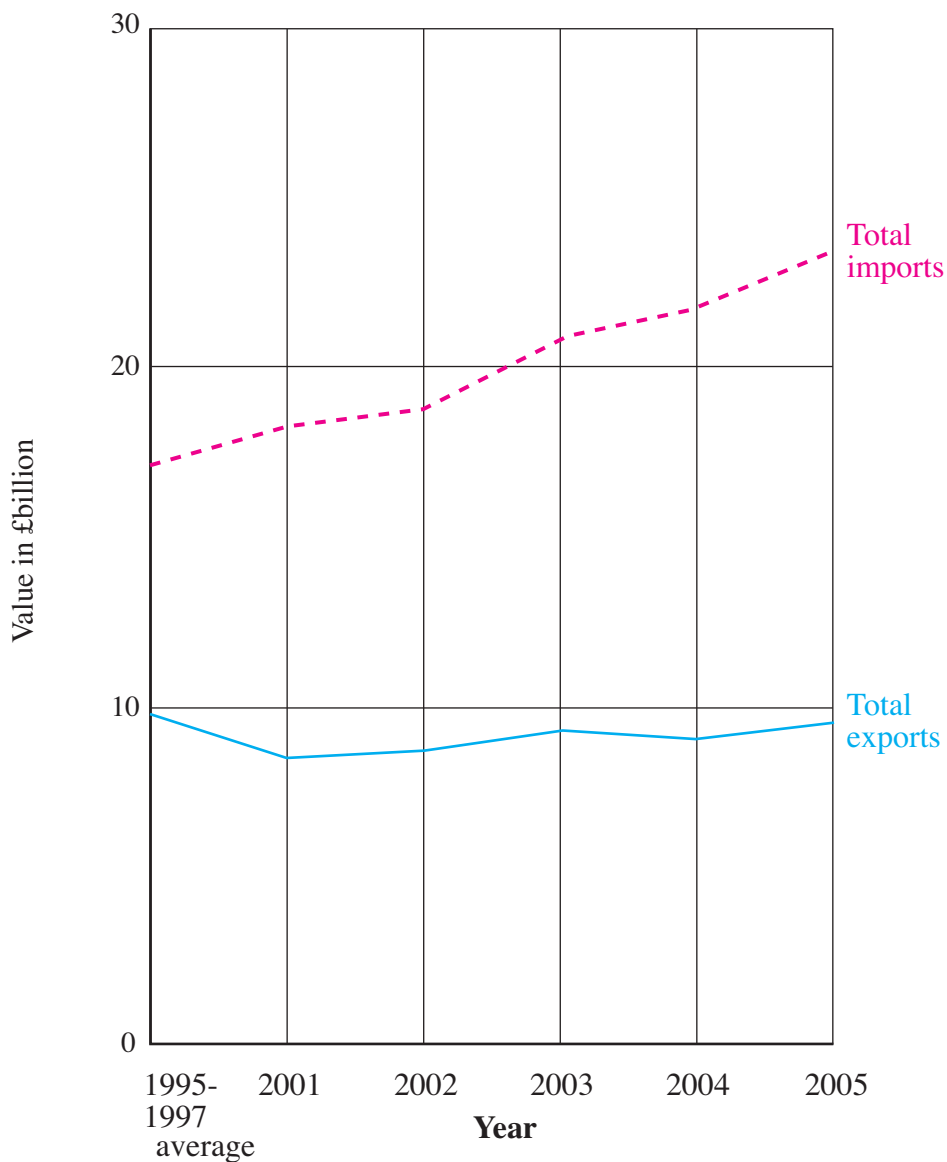


Figure 4 Concern over world food supplies, 2007

Global cereal prices are expected to remain at high levels for the coming year due largely to problems in production in several major exporting countries and very low world stocks, warns the latest *Food Outlook* report issued today by Food and Agriculture Organisation of the United Nations (FAO) in London.

FAO expects many countries will pay more for importing cereals from world markets than they did in previous years, even though they are expected to import less. Record freight rates and high export prices are the main reasons for the increase in their import bills.

FAO's latest analysis suggests that international cereal prices are fuelling domestic food inflation in many parts of the world. For most cereals, says the report, "supplies are much tighter than in recent years while demand is rising for food as well as animal feed and industrial use. Stocks, which were already low at the start of the season, are likely to remain equally low because global cereal production may only be sufficient to meet expected world utilization." The report says that while agricultural commodity prices rose sharply in 2006, in some cases they are soaring at an even faster pace this year.

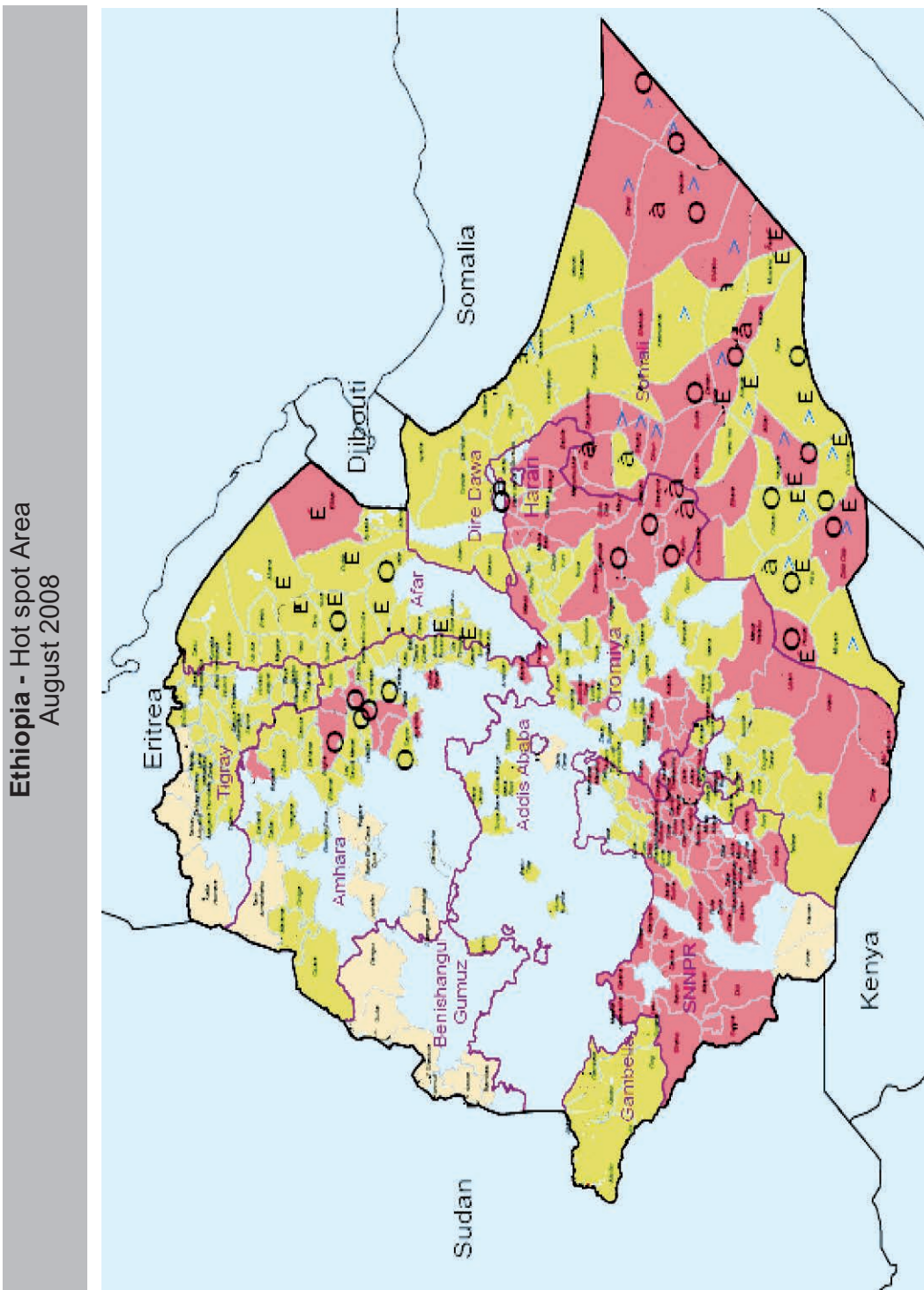
According to the FAO analysis, the world has rarely felt "such a widespread and commonly shared concern about food price inflation, a fear which is fuelling debates about the future direction of agricultural commodity prices in importing as well as exporting countries, be they rich or poor."

Soaring petroleum prices have driven up prices for agricultural crops by raising input costs and by boosting demand for those crops used to produce biofuels. *Food Outlook* warns that the combination of high petroleum prices and the desire to address environmental issues is likely to boost demand for feedstocks, especially sugar, maize, rapeseed, soyabean, palm oil and other oilcrops as well as wheat for years to come.

Source: <http://www.fao.org>



Figure 5 Food supply problems in Ethiopia, August 2008



Ethiopia - Hot spot Area
August 2008



Legend

Hot Spot

- Close Monitoring
- Medium
- Critical

- Water Shortage
- a Pest/Locust Infestation
- E Food Insecurity/high malnutrition rate
- Pasture shortage Livestock movement/death

0 25 50 100 150kms

Map data source(s):
OCHA, DPPA, WFP, UNICEF

DISCLAIMERS:
The designations employed and the presentations of material on the map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

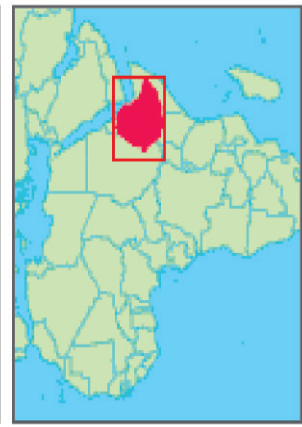


Figure 6 Areas where land is being used for fuel rather than food

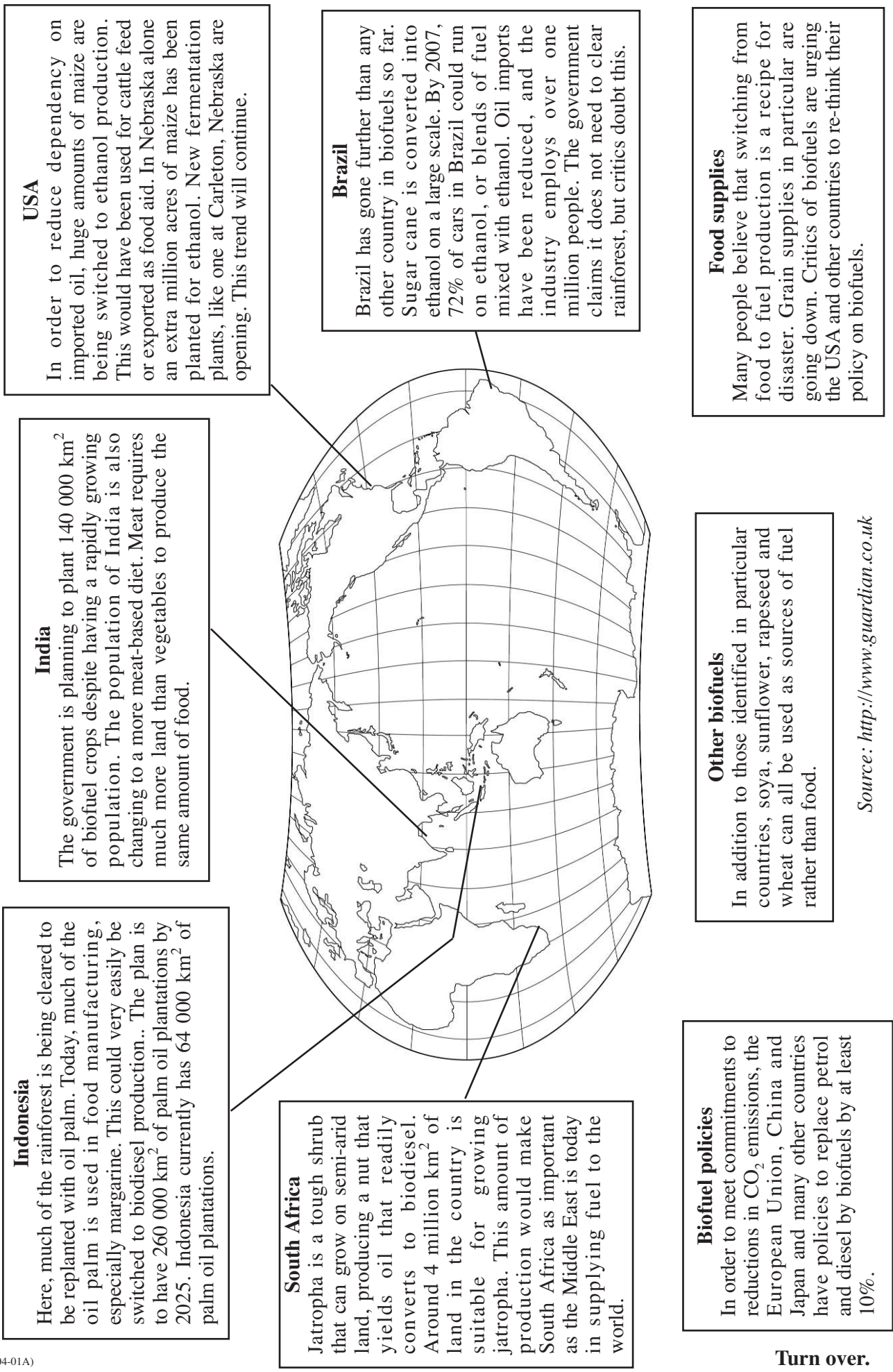


Figure 7 The impact of rising affluence

Spending on food in China US(\$)

Year	2003	2004	2005	2006	2007
Expenditure on food US\$ million	197 818	213 312	232 803	264 965	276 255

Lester Brown, head of the Worldwatch Institute, is the author of the book *Who Will Feed China?*

He believes that a food crisis is only just beginning. As well as the new competition between food and fuel, the Chinese and Indian populations are booming. As they become richer, their populations are giving up their traditional vegetable-rich diets to adopt typical 'American' diets that contain more meat and dairy products. Meat demand in China has quadrupled in 30 years, and in India, milk and egg products are increasingly popular.

It takes 7kg of grain to produce 1kg of beef, and increased demand for beef will require huge amounts of grain-growing land. Much of this land will need to be irrigated. "Water tables are now falling in countries that contain over half the world's people," Brown points out. "While numerous analysts and policymakers are concerned about a future of water shortages, few have connected the dots to see that a future of water shortages means a future of food shortages."

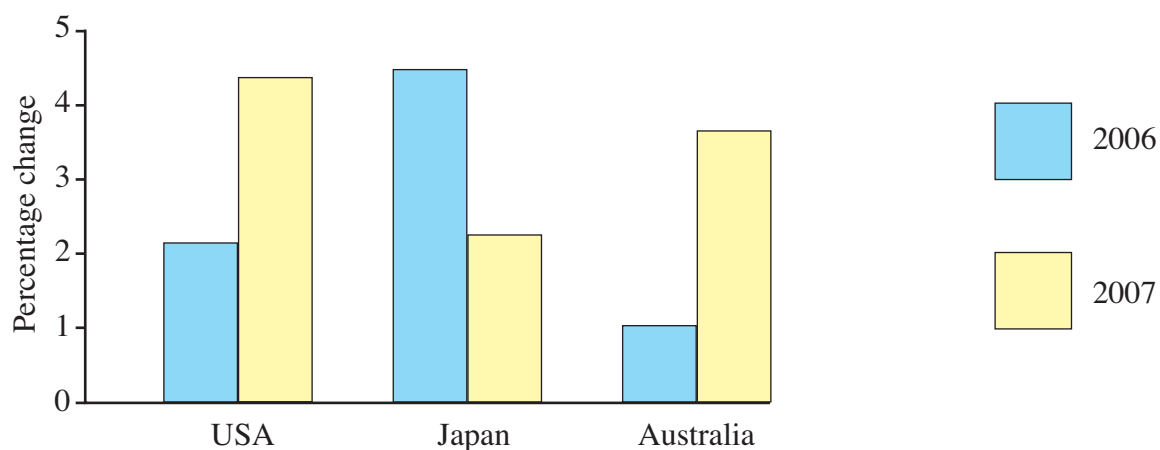
New figures from the World Bank, he says, show that 15% of the world's present food supplies, on which 160 million people depend, are being grown with water drawn from rapidly depleting underground sources, or from rivers that are experiencing reduced flows. In large areas of China and India, the water table has fallen catastrophically.

Earlier this year, water specialists from hundreds of institutes around the world published the biggest ever assessment of water and food. Their conclusions were chilling. With the earth's water, land and human resources, it would be possible to produce enough food for the future, they said. "But it is probable that today's food production and environmental trends will lead to crises in many parts of the world."

On the other hand, Brazil's president, Luiz Inácio Lula da Silva, told *The Guardian* that there was no need for world food shortages, or any destruction of forests to grow more food at all. "Brazil has 320 million hectares [3.2 million sq km] of arable land, only a fifth of which is cultivated. Of this, less than 4% is used for ethanol production ... This is not a choice between food and energy."

Others say that high food price rises are only temporary, and will fall back within a year as the market responds. Technologists pin their faith on GM crops, or drought-resistant crops, or trust that biofuel producers will develop technologies that require less raw material or use non-edible parts of food. The immediate best bet is that countries such as Argentina, Poland, Ukraine and Kazakhstan will grow more food for export as US output declines.

Source: <http://www.guardian.co.uk>

Figure 8 Percentage change in the cost of food from Hong Kong's most important sources

Source: www.info.gov.hk

Figure 9 Food trends in Japan

As a developed country, Japan has had virtually no concerns over food supply over the last 60 years. Food from Japan far exceeded imports. It had a high self-sufficiency rate.

The food self-sufficiency rate is defined by 'domestic food supply / national food demand', which means the relationship between agricultural production and consumption by the population within a country. There has been a decline in Japanese food self-sufficiency. The source of food consumed by Japanese people has switched from home produced to imported. This has been greatly influenced by dietary changes, such as a decrease in consumption of rice suited to domestic production in Japan, to an increased consumption of livestock products, oils and fats which are largely dependent on imports.

Food supplies from Japanese agricultural products fell by 26% between 1965 and 2003, and changes in agricultural production are also contributing to the decline in self-sufficiency. During this time, although individual crop yields rose sharply, the total area devoted to crop cultivation fell by 40%.

Japanese farmers are now concentrating on smaller quantities of high value foods, such as high quality vegetables, fruits, and livestock products.

Source: www.ffc.agnet.org

Figure 10 Genetically Modified (GM) Crops

How do GM crops work?

There are two main types of GM crop being grown at the moment. The first can tolerate herbicides that wipe out all other plants. The idea is that farmers can spray their crop with a 'broad-spectrum' herbicide that will wipe out every plant in the field except the crop. Since weeds compete for water, sunlight and soil nutrients, such GM crops might produce higher yields. They may also require less herbicide than conventional crops, so growing them may do less damage to the environment.

The second major type of GM crop is modified to produce a toxin that kills pests that feed on it. So far, the most common is known as Bt cotton, a cotton plant modified with poison-producing genes taken from the bacterium *Bacillus thuringiensis*.

What are the benefits of GM crops?

GM scientists claim that GM crops can give us healthier food, produced in a more efficient, environmentally-friendly way. The main advantages are:

- Crops can be created that are resistant to drought, and so can be grown in areas where agriculture was not possible previously.
- They can be designed to be rich in a particular mineral or vitamin which might normally be lacking in diets in particular areas.
- Yields can be increased dramatically. This would be of particular value in the developing world where food shortages sometimes occur.
- The need to use pesticides and herbicides is considerably reduced.
- Because so much food can be produced from existing farmland, there is no need for agriculture to encroach on environmentally sensitive areas, for example, there is no need to use nature reserves or clear tropical rainforest for agricultural use.

Source: <http://www.bbc.co.uk>

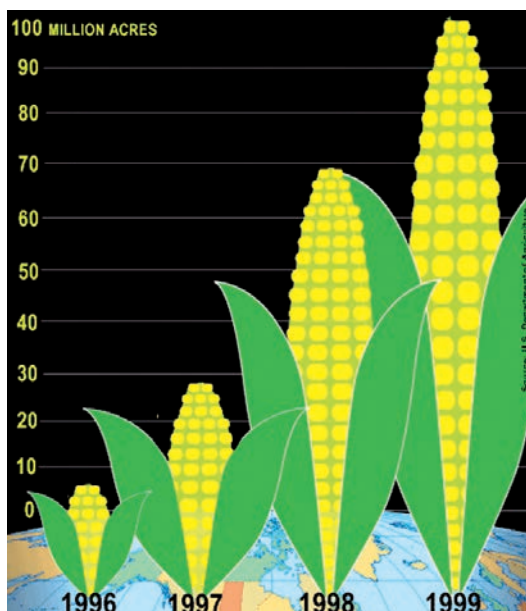


Figure 11 Opponents of GM crops

The scientific grounds for objecting to GM crops have yet to be proven, but if correct, they will be very powerful arguments.

- Many GM crops are designed to be immune to one, very strong herbicide. If this is sprayed on the crop, all other weeds are destroyed. This could virtually eliminate biodiversity. Also, the GM crops may hybridise with natural species, some of which may be weeds. In the hybridisation, they may acquire the resistance to herbicides from the GM crops. Their spread would then be uncontrollable.
- Research and development is only really possible by a few truly giant multinational corporations. The funding required is so vast. If they become the standard crops, all farmers will have to buy seeds from just a small number of firms, or possibly just one. In order to control weeds and pests, they would be forced to buy pesticides and herbicides designed by that company that cannot harm the crop. This would place the future of the world's food supply into the hands of a small number of corporate bosses. They would exert massive power over almost all governments of the world.
- GM crops produce good yields, but the seeds are infertile. Farmers are forced to buy new seeds each year. In the past, farmers saved seeds from the harvest to sow the next year.
- One of the main reasons for developing them is to prevent food shortages. Many groups argue that there is no shortage, the only problem is the distribution of food throughout the world. This argument may well have been true in the past, but other evidence suggests that this argument is no longer valid.
- Those who generally favour organic food are outright against GM crops. Others claim that they would be harmful to human health, but no evidence to support this has been proved so far. There are groups that claim it is going against nature, and playing God with the earth's resources. Such crops are often described as Frankenstein crops. As yet, none of these groups has produced hard evidence. Many rational people wonder if their concerns should be listened to. For example, if problems are found in the future, but we are more or less committed to GM crops, how can the clock be turned back?

Source: <http://www.bbc.co.uk>

Figure 12 Vertical farms

Scientists at Columbia University are working on a new way of growing food, in a new kind of skyscraper: the “vertical farm”. It would consist of a 30-storey building with glass walls, topped off with a huge solar panel. On each floor there would be giant planting beds, indoor fields in effect. There would be a sophisticated irrigation system.

It would prevent huge amounts of food having to be trucked, shipped or flown in, from across the country, and across the world to cities like New York. The Vertical Farm project is working towards an urban model for food production. This would significantly reduce rural agricultural land use, and minimise runoff that includes pesticides, herbicides, and fertilizers. Vertical farming would therefore greatly diminish impacts on the public’s health and on the functioning of terrestrial and aquatic ecosystems. Other beneficial environmental effects are numerous and could include a decrease in global warming by returning farmland to hardwood forest. More land that exists as free space also will assist in restoring and maintaining biodiversity. In addition, the vertical farm would use community wastewater to safely irrigate crops and aquaculture. If designed properly, the vertical farm could convert black and grey water into drinking water.

The specific goals for this year’s Vertical Farm project include:

- 1 Design a building that will produce enough of a wide variety of food items to feed 50,000 people.
- 2 Include organic poultry and fish production with an emphasis on ethical treatment.
- 3 It must have zero net emissions.
- 4 The farm must convert black and grey water into drinking water and recycle all evapotranspiration water vapour.

Source: www.verticalfarm.com



Artist's impression of a vertical farm

Source: <http://news.bbc.co.uk>

Figure 13 City farms

Producing food on allotments in a city

City farming is spreading fast. It was estimated in 1993 that city farms were contributing 15% to world food production and it was expected to grow to 33% by 2005. Some 800 million people worldwide were involved in urban agriculture in 1996, growing fruits, vegetables, and herbs, as well as raising livestock.

Poor people in cities farm scraps of ground wherever they can grow something to provide some food and make some money, and they save money they would have spent on food.

City farmers play a major role in waste recycling, creating a closed system in which organic wastes - from food, manufacturing and sewage - are reused instead of festering in dumps and polluting waterways. Human waste is turned into compost, domestic wastewater safely irrigates many crops, and aquaculture stabilizes animal manure. In Mexico City many families keep pigs, urban pig farmers recycle up to 4,000 tons of the city's food wastes every day.

And city farming empowers women. Women in a vegetable-growing cooperative in Bogota, Colombia, earn three times more than their husbands do.

All over the world urban food production is growing more rapidly than urban population. In greater Bangkok, 60% of the land is under cultivation, 72% of all urban families are engaged in raising food, mostly part-time. In Moscow, the share of families raising food more than tripled between 1972 and 1992, from 20% to 65%. In Dar-es-Salaam in Tanzania the proportion of households engaged in food production grew from 20% to more than 65% between 1970 and 1990. In Argentina the number of participants in the community agriculture program grew from 50,000 to 550,000 between 1990 and 1994, and the supporting institutions grew from 100 to 1,100.

City farming is growing just as rapidly in the rich cities of the West, perhaps more because of environmental concerns rather than to feed the hungry.

Source: <http://www.journeytoforever.org>

Figure 14 Some consequences of farming in cities

In 2001, Food and Agriculture Organisation of the United Nations (FAO) officials were concerned about the capacity of large cities in Asia, Latin America, and Africa to feed themselves. They found that by 2010 many of these cities will require massive increases in the number of truckloads of food coming into the area each year, increases that would overwhelm the capacity of these cities to distribute food. Bangkok will need 104,000 additional 10-tonne truckloads each year, Jakarta will need 205,000, Karachi 217,000, Beijing nearly 303,000, and Shanghai just under 360,000.

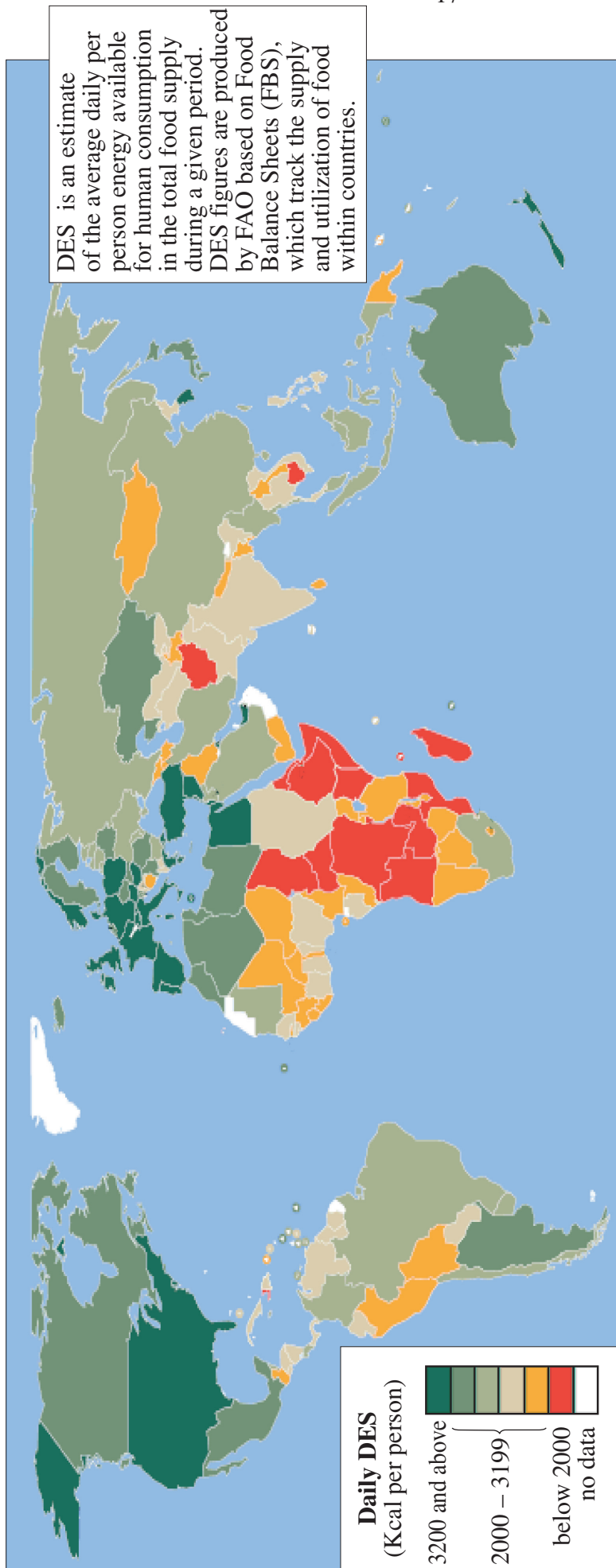
For the inhabitants, cities bring certain gastronomic advantages. A diversity of people and businesses means access to a wide range of cuisines compared with more-traditional fare in the countryside. Cosmopolitan commerce means that specialized stores and international supermarkets stock a variety of ingredients. At the same time, a more hurried urban lifestyle often means that city folk have less time to cook or prepare meals from raw ingredients and that they opt for the convenience of processed, prepared, or even fast food. (Consumers in urban areas pay up to 30 percent more for their food than people in rural areas do, partly because they grow fewer of their own ingredients and partly because the food travels farther.)

But the change in habits raises all sorts of nutritional and logistical concerns. Foods that are more processed require more refrigeration, clean water for preparation, and sophisticated transport lines. They also mean more sugar and fat in the diet, which combined with more sedentary urban lifestyles encourages diabetes and obesity. A study of 133 developing countries found that migration to the city can more than double per capita intake of sweeteners, simply because they are available cheaply. Traditional staples, whole grains, potatoes and other root crops, and some vegetables, on the other hand, are often more expensive in urban areas. For example, surveys show that recent migrants to Hanoi, Vietnam, eat less rice, corn, vegetables, and beans than they used to and eat more meat, fish, eggs, milk, soft drinks, and canned and processed food. Home-prepared meals are gradually replaced by restaurant fare and street food.

Source: Earthscan



Figure 15 Dietary Energy Supply (DES) throughout the world in kilocalories (kcal) per person per day



While DES does not indicate food consumption, it does identify: those countries in which people are more likely to have enough to eat (represented by shades of green); those in which the daily DES is marginal (beige); those in which hunger and malnutrition are likely to be widespread (orange). Those countries that face the most severe food supply shortages, with average daily DES below 2000 kilocalories per person per day, are coloured red.

Source: <http://www.fao.org>

Figure 16 Extremes of food consumption

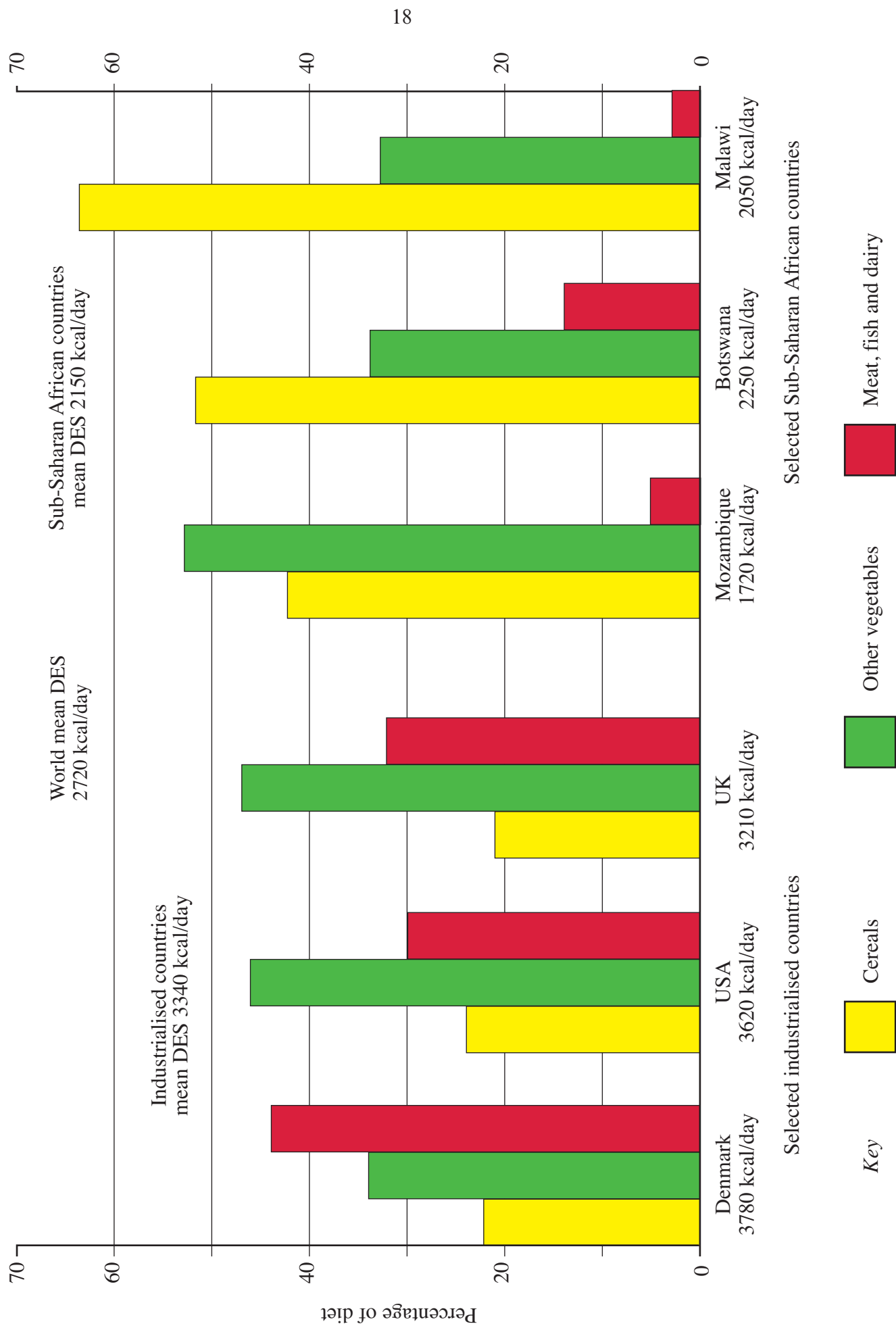
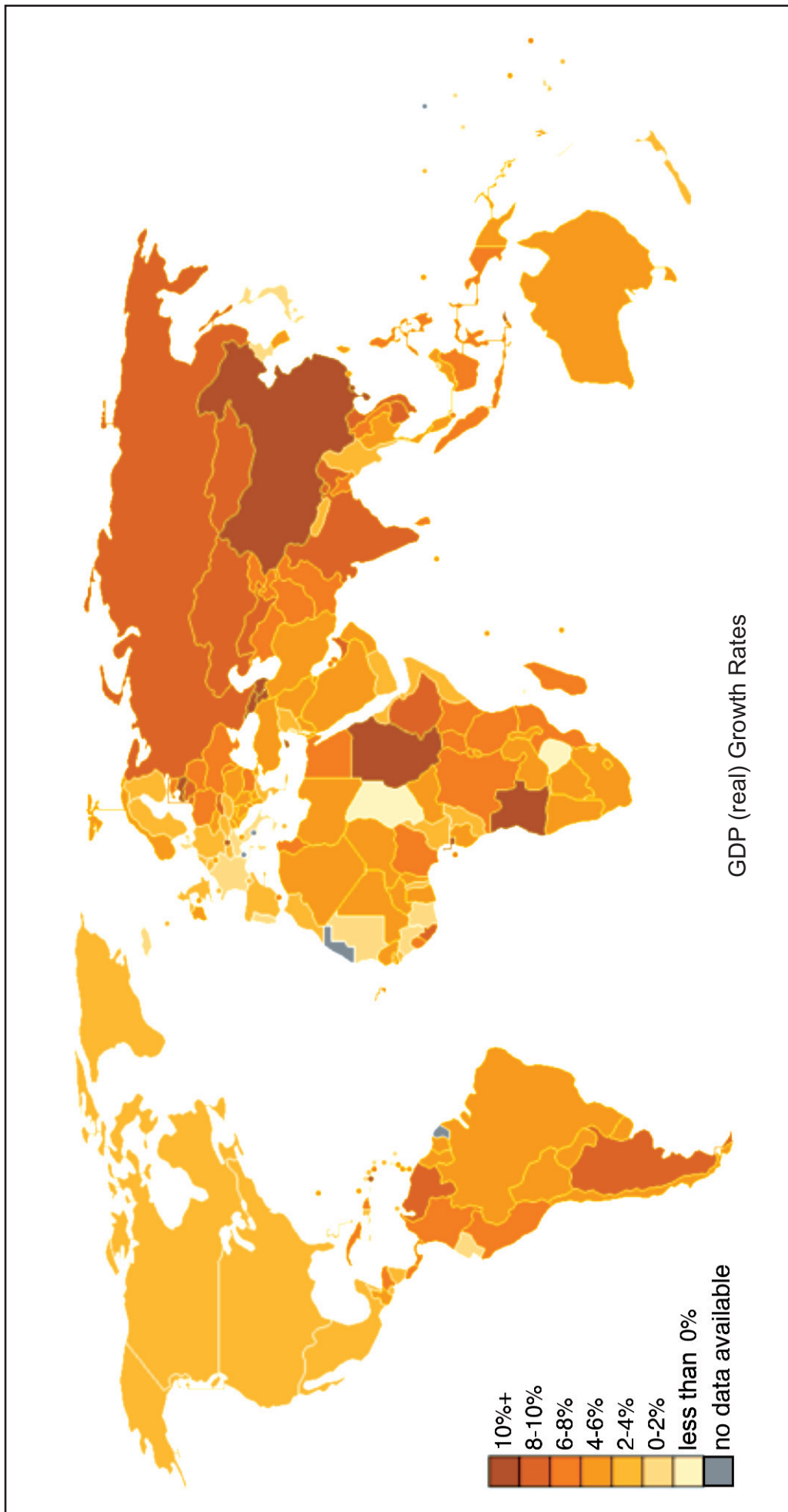


Figure 17 Changes in GDP per capita between 2000 and 2008



Source: CIA World Factbook 2008

Sources

- Figure 1 The United Nations Human Settlements Programme, <http://www.unhabitat.org/>
- Figure 2 Columbia University Department of Environmental Health Sciences P6325: Medical Ecology Spring 2004
- Figure 3 <http://www.defra.gov.uk/farm/policy/regulation/charge/pdf/long-term-trends.pdf>
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Photograph Source: <http://news.bbc.co.uk/1/hi/world/americas/6752795.stm>
- Figure 13 <http://www.journeytoforever.org/cityfarm.html>
- Figure 14 State of the World - Our Urban Future, Earthscan 2007
Photographs <http://uk.news.yahoo.com/itn/20081013/img/puk-1223899113-uk-00423b78a-70515a2c48eb.html> and <http://www.flickr.com/photos/kubyaddi/1468678620/>
- Figure 15 <http://www.fao.org/NEWS/1998/img/NMpdfs/world-e.pdf>
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- Figure 17 <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2003rank.html>