

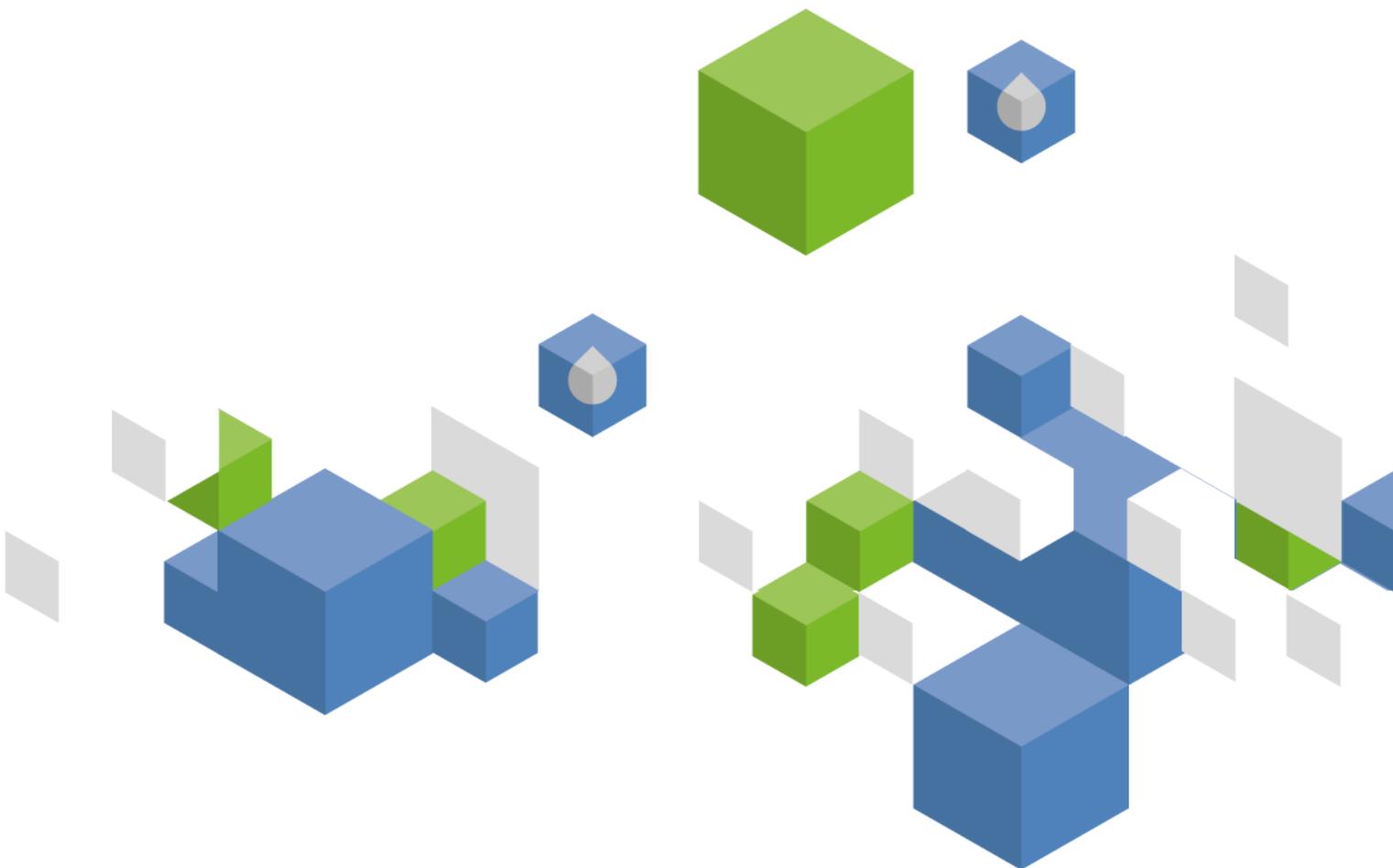


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Democratic People's Republic of Korea

GEOGRAPHY, CLIMATE AND POPULATION

Geography

Located on the northern part of the Korean peninsula in the far east of Asia, the Democratic People's Republic of Korea has a total area of 120 540 km². It is bordered in the north by China, in the northeast by the Russian Federation, in the east by the Sea of Japan, in the south by the Republic of Korea and in the west by the Yellow Sea and the Korea Bay. There are nine provinces and two municipalities under central authority, including the capital city Pyongyang.

Some 80 percent of the total area of the country consists of mountains and uplands. The average height of the highlands in the northeast is 1 000 m above sea level. Based on topographic features and land use, the country can be divided into four zones:

- The northeast, where the high mountain area represents 21 percent of the territory, is essentially a forest area with practically no agriculture.
- The hilly areas, surrounding the high mountains in the north and the central chain of mountains with large areas under forest, representing 40 percent of the territory, are suitable for the cultivation of scattered plots of potato, wheat, barley and vegetables. They also have some pasture land.
- The east coast, representing 22 percent of the territory, is submountainous or hilly, but it also includes some lowlands where rice is cultivated. In addition to forest and pasture, there are slopes suitable for maize and vegetable cultivation.
- The western plains, mainly devoted to rice cultivation, represent 17 percent of the territory.

In 2009, the total cultivated area was about 2.9 million ha, of which 2.7 million ha were annual crops, of which almost 50 percent were cereals, and 0.2 million ha were permanent crops (Table 1).

Climate

The country has a continental climate with four distinct seasons. Long winters bring cold clear weather interspersed with snow storms as a result of north and northwest winds from Siberia with temperatures ranging from -20 to -40°C. The average number of days with snowfall is 37. The weather is harsh in the northern mountainous regions. Spring and autumn are marked by mild temperatures and variable winds. Summer tends to be short, hot, humid and rainy because of the south and southeast monsoon winds that bring moist air from the Pacific Ocean. The average summer temperature is 25°C.

Average annual precipitation is 1 054 mm, ranging from 810 to 1 520 mm. About 60 percent of all precipitation occurs between June and September.

FIGURE 1
Map of Democratic People's Republic of Korea



DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA

FAO - AQUASTAT, 2011

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TABLE 1
Basic statistics and population

Physical areas			
Area of the country	2009	12 054 000	ha
Cultivated area (arable land and area under permanent crops)	2009	2 855 000	ha
• as % of the total area of the country	2009	24	%
• arable land (annual crops + temp fallow + temp meadows)	2009	2 650 000	ha
• area under permanent crops	2009	205 000	ha
Population			
Total population	2009	24 238 000	inhabitants
• of which rural	2009	40	%
Population density	2009	201	inhabitants/km ²
Economically active population	2009	12 953 000	inhabitants
• as % of total population	2009	53	%
• female	2009	45	%
• male	2009	55	%
Population economically active in agriculture	2009	3 099 000	inhabitants
• as % of total economically active population	2009	24	%
• female	2009	46	%
• male	2009	54	%
Economy and development			
Gross Domestic Product (GDP) (current US\$)	2008	40 000	million US\$/yr
• value added in agriculture (% of GDP)	2008	23.3	%
• GDP per capita	2008	1 658	US\$/yr
Human Development Index (highest = 1)		-	
Access to improved drinking water sources			
Total population	2008	100	%
Urban population	2008	100	%
Rural population	2008	100	%

Population

In 2009, the population was an estimated 24.2 million inhabitants of whom around 40 percent lived in rural areas (Table 1). The average population density is 201 inhabitants/km². In 1996 population density varied from 44 inhabitants/km² in Yanggang-do province to 1 177 inhabitants/km² in Pyongyang. The annual demographic growth is an estimated around 0.7 percent for the period 1999-2009.

ECONOMY, AGRICULTURE AND FOOD SECURITY

In 2008, gross domestic product (GDP) was US\$ 40 000 million of which agriculture accounted for 23.3 percent (CIA, 2009).

The total population economically active in agriculture in 2009 was around 3.1 million inhabitants, amounting to 24 percent of the economically active population, of which 46 percent were women.

In the 1980s it was estimated that the Democratic People's Republic of Korea had about 38 000 cooperative farms (kolkhoz) and 180 state farms (sovkhoz), the former cultivating more than 90 percent of the total cultivated land. However, since the mid-1990s, the Government has tended to advocate the gradual transfer of the cooperative farms to state farms.

The Democratic People's Republic of Korea continues to suffer widespread food shortages as a result of economic problems, limited arable land, lack of agricultural machinery and energy shortages. The country remains highly vulnerable to natural disasters. The most recently severe flooding in August 2007 caused widespread damage to crops and infrastructure in six southern provinces. The country has also suffered from the effects of the global commodity crisis, with rampant increases in market prices for staple foods and fuel. WFP/FAO assessments confirmed a significant deterioration in food security in 2008 (WFP, 2009).

WATER RESOURCES

Most of the rivers run west to the Yellow Sea (Korea Bay). They rise in the mountain ranges of the north and east of the country. There are five river basin groups:

- the Yalu river flows southwest from the Changbai mountain range to the Korea Bay. It forms the border with China;
- the Tumen river flows east from the Changbai mountain range to the Sea of Japan. It forms the border with China and further downstream with the Russian Federation;
- the Taedong river basin is internal and is the largest one within the country. The Taedong river flows west to the Korea bay near Pyongyang.
- the west coast river basin comprises many small streams rising in the northern and eastern mountain ranges; and the
- east coast river basin.

The internal renewable surface water resources are approximately 66 km³/year. In comparison with the Republic of Korea (approximately the same area and precipitation), groundwater resources are an estimated 13 km³/year, most of which (12 km³/year) comprise the base flow of the rivers. The internal renewable water resources are therefore about 67 km³/year (=66+13-12) (Table 2).

TABLE 2
Water resources

Renewable freshwater resources			
Precipitation (long-term average)	-	1 054	mm/yr
	-	127 000	million m ³ /yr
Internal renewable water resources (long-term average)	-	67 000	million m ³ /yr
Total actual renewable water resources	-	77 150	million m ³ /yr
Dependency ratio	-	13.2	%
Total actual renewable water resources per inhabitant	2009	3 183	m ³ /yr
Total dam capacity	2009	10 550	million m ³

Since the Yalu river with a total flow of 4.9 km³/year and Tumen river with a total flow of 15.4 km³/year form the border with China, half of the total average discharge of these rivers, or 10.15 km³/year, is considered as external resources of the Democratic People's Republic of Korea. The total renewable water resources are therefore an estimated 77.15 km³/year.

In 2009, total dam capacity was estimated at 10.55 km³. The West Sea Barrage (or Nampho Barrage) involving an 8 km dam across the Taedong river was completed in June 1986. It consists of a main dam, three locks and 36 sluices, and is believed to be the longest dam in the world. The barrage today provides water for irrigation, industries and municipalities. Another major dam has been built on the Yalu river. The Hwanggang dam, on the Imjin river, with an estimated capacity of 400 million m³ of water, was completed in 2007. It is 42 km north of the border with the Republic of Korea, and provides water for hydropower and irrigation. The Innam dam on the Bukhan river was completed in 2003 with a total capacity of 2.62 km³. The dam is 710 m wide and 121.5 m high.

INTERNATIONAL WATER ISSUES

The Imjin river is a major waterway that starts in the Democratic People's Republic of Korea and ends in the Republic of Korea to the northwest of Seoul. The Democratic People's Republic of Korea has built several dams on this river including one a few kilometres north of the heavily armed border between the two countries that have yet to sign a formal peace treaty to end the 1950-1953 Korean War. In 2009, the Republic of Korea complained to the Democratic People's Republic of Korea about a sudden release of water into the river flowing across their border that left six people missing. The Democratic People's Republic of Korea has failed to notify the Republic of Korea ahead of releasing water on several previous occasions, resulting in flood damage. The Democratic People's Republic of Korea has claimed its dams

on the Imjin are designed to release water automatically when they reach a certain threshold (Reuters, 2009). Cooperation between the two countries on flood control and setting up warning systems has so far not been successful.

In 2005, the Republic of Korea constructed the Peace dam on the Bukhan river, the only dam in the world constructed with no reservoir. The dam is to prevent flooding from the Innam dam in the Democratic People's Republic of Korea.

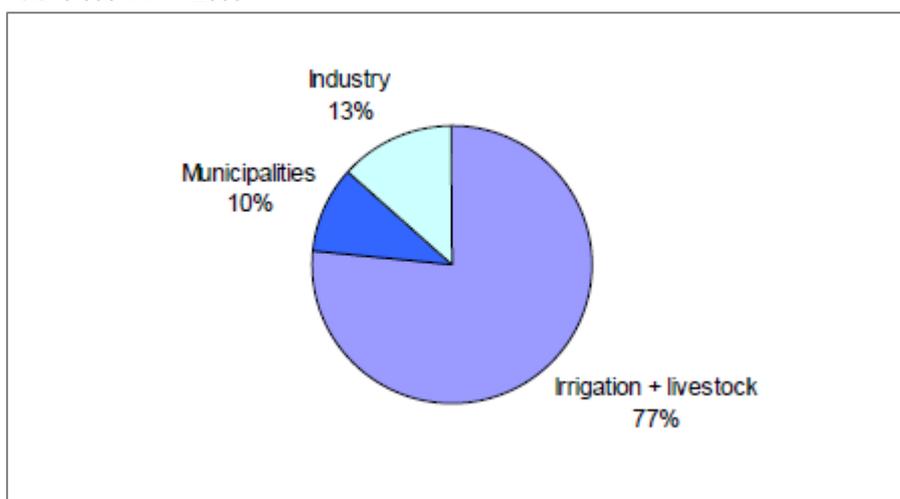
WATER USE

In 2005, the total water withdrawal was estimated at about 8.66 km³/year, of which 6.61 km³/year (77 percent) for agriculture, 0.90 km³/year (10 percent) for municipalities and 1.15 km³/year (13 percent) for industry (Table 3 and Figure 2).

TABLE 3
Water use

Water withdrawal			
Total water withdrawal	2005	8 657.8	million m ³ /yr
- irrigation + livestock	2005	6 610	million m ³ /yr
- municipalities	2005	902.8	million m ³ /yr
- industry	2005	1 145	million m ³ /yr
• per inhabitant	2005	365	m ³ /yr
Surface water and groundwater withdrawal	2005	8 657.8	million m ³ /yr
• as % of total actual renewable water resources	2005	11.2	%
Non-conventional sources of water			
Produced wastewater		-	million m ³ /yr
Treated wastewater		-	million m ³ /yr
Reused treated wastewater		-	million m ³ /yr
Desalinated water produced		-	million m ³ /yr
Reused agricultural drainage water		-	million m ³ /yr

FIGURE 2
Water withdrawal by sector
Total 8.658 km³ in 2005



IRRIGATION AND DRAINAGE

Evolution of irrigation development

Irrigation development in the Democratic People's Republic of Korea has always been a major objective in the agriculture sector and more than half of the cultivated area is irrigated. In 1976, as a way of increasing the arable land area, the authorities launched a "nature re-making programme" with the following objectives to:

- complete the irrigation of non-paddy lands;
- reclaim 100 000 ha of new land;
- build 150 000-200 000 ha of terraced fields;
- reclaim tidal land; and
- conduct work on forestation and water conservation projects.

The 1987-1993 plan target was to reclaim some 300 000 ha of tidal land. In 1989, a project was initiated to build a 400 km long canal by diverting the flow of the Taedong river along the west coast. As part of the irrigation system, the canal would provide water to rural areas and newly reclaimed tidal land in South Hwanghae and South Pyongan provinces.

By late 1990, a total of 800 km of large and small irrigation waterways had been completed. In early 1994, there were about 40 000 km of irrigation waterways together with 1 770 reservoirs and 26 000 pumping stations for irrigation purposes. In December 1995, the Kangryong Waterway (40 km) was constructed.

In 1975 the total area equipped for irrigation was an estimated 900 000 ha, in 1985 at 1 270 000 and in 1995 it accounted for 1 460 000 ha or 56 percent of the cultivated area (Table 4). Unfortunately no more recent official figures could be found. The irrigated land includes plains, terraced fields and tidal land.

In 1990, out of 1 420 000 ha of irrigation about 1 220 000 ha were irrigated from surface water and 200 000 ha were irrigated from groundwater resources (Figure 3).

FIGURE 3
Source of irrigation water on areas equipped for full control irrigation
Total 1 420 000 ha in 1990

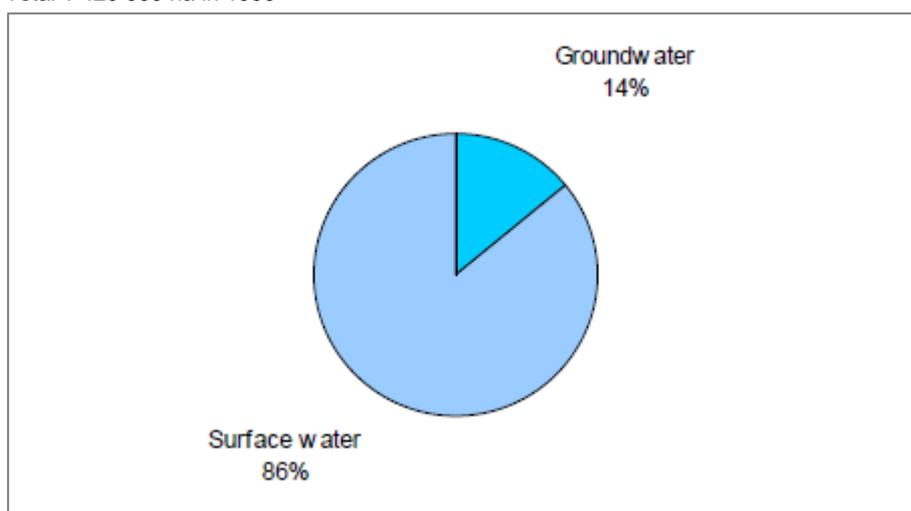


TABLE 4
Irrigation and drainage

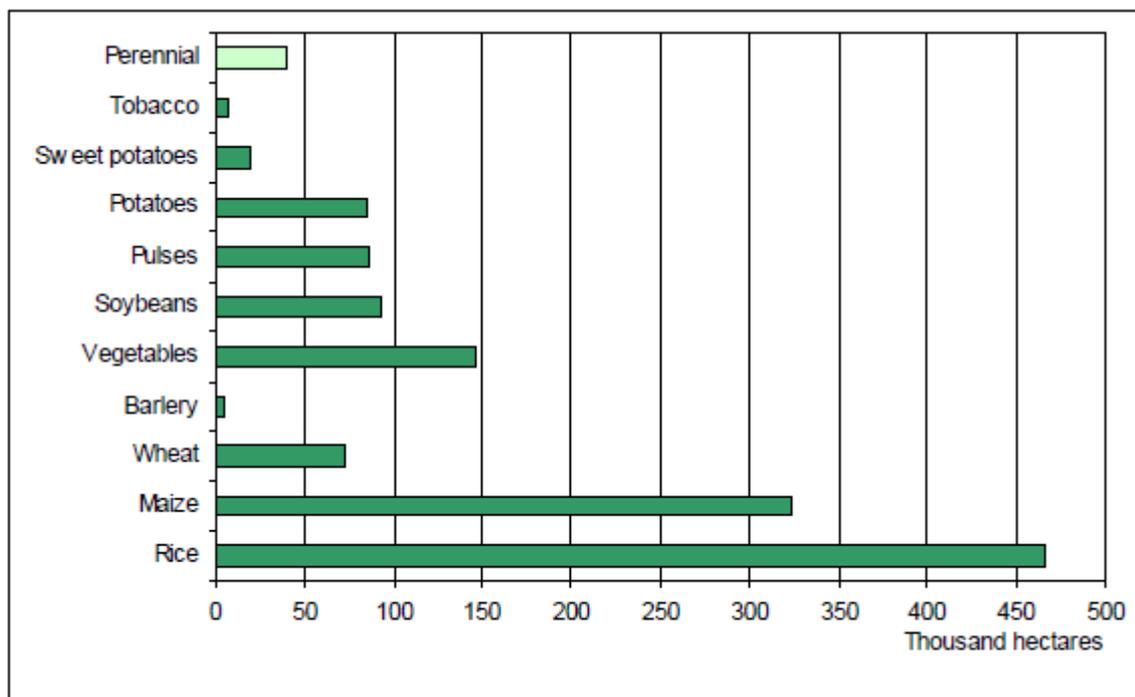
Irrigation potential		-	ha
Irrigation			
1. Full control irrigation: equipped area	1995	1 460 000	ha
- surface irrigation	1995	1 460 000	ha
- sprinkler irrigation	1995	-	ha
- localized irrigation	1995	-	ha
• % of area irrigated from surface water	1990	86	%
• % of area irrigated from groundwater	1990	14	%
• % of area irrigated from mixed surface water and groundwater		-	%
• % of area irrigated from mixed non-conventional sources of water		-	%
• area equipped for full control irrigation actually irrigated		-	ha
- as % of full control area equipped		-	%
2. Equipped lowlands (wetland, ivb, flood plains, mangroves)		-	ha
3. Spate irrigation		-	ha
Total area equipped for irrigation (1+2+3)	1995	1 460 000	ha
• as % of cultivated area	1995	56	%
• % of total area equipped for irrigation actually irrigated		-	%
• average increase per year over the last 10 years	1985-1995	1.4	%
• power irrigated area as % of total area equipped		-	%
4. Non-equipped cultivated wetlands and inland valley bottoms		-	ha
5. Non-equipped flood recession cropping area		-	ha
Total water-managed area (1+2+3+4+5)	1995	1 460 000	ha
• as % of cultivated area	1995	56	%
Full control irrigation schemes		Criteria	
Small-scale schemes	< ha	-	ha
Medium-scale schemes		-	ha
large-scale schemes	> ha	-	ha
Total number of households in irrigation		-	
Irrigated crops in full control irrigation schemes			
Total irrigated grain production	2005	3 757 000	metric tons
• as % of total grain production	2005	80	%
Harvested crops			
Total harvested irrigated cropped area	2006	1 341 000	ha
• Annual crops: total	2006	1 302 000	ha
- Rice	2006	465 000	ha
- Maize	2006	323 000	ha
- Wheat	2006	73 000	ha
- Barley	2006	5 000	ha
- Vegetables	2006	146 000	ha
- Soybeans	2006	93 000	ha
- Pulses	2006	86 000	ha
- Potatoes	2006	85 000	ha
- Sweet potatoes	2006	19 000	ha
- Tobacco	2006	7 000	ha
• Permanent crops: total	2006	39 000	ha
- Other perennial crops	2006	39 000	ha
Irrigated cropping intensity (on full control equipped area)			%
Drainage - Environment			
Total drained area		-	ha
- part of the area equipped for irrigation drained		-	ha
- other drained area (non-irrigated)		-	ha
• drained area as % of cultivated area		-	%
Flood-protected areas		-	ha
Area salinized by irrigation		-	ha
Population affected by water-related diseases		-	inhabitants

Although no figures are available, the main irrigation technique is surface irrigation, while sprinkler and micro-irrigation were introduced on non-paddy fields in the late 1980s.

Role of irrigation in agricultural production, the economy and society

In 2006, total harvested irrigated cropped area was an estimated 1 341 000 ha and cereals accounted for two-thirds of that area (rice accounted for 35 percent, maize 24 percent) (Table 4 and Figure 4).

FIGURE 4
Irrigated crops on areas equipped for full control irrigation
Total harvested area 1 341 000 ha in 2006



WATER MANAGEMENT, POLICIES AND LEGISLATION RELATED TO WATER USE IN AGRICULTURE

Institutions

At the national level, the agriculture sector is directed by the Agriculture Commission, which is in charge of the planning, management and technical direction of production. Within the Agricultural Commission, the Department of Irrigation and Drainage has the task of providing technical assistance to farmers and of developing irrigation techniques.

At provincial level, the Agricultural Commission is represented by the Provincial Rural Economy Committee (PREC), which is directly responsible for the production and management of the state farms and supervises agricultural production through District/County Cooperative Farm Management Committees (CCFMCs). The country has over 200 districts and counties where the CCFMCs are entrusted with the planning, production and management of cooperative farms. The CCFMCs also directly supervise state enterprises concerned with agricultural production (i.e. farm machinery and implement factories, tractor stations and irrigation offices).

Water management

Since 60 percent of the total annual precipitation is in summer, the Democratic People's Republic of Korea has emphasized irrigation from its first development plan in 1957-1960, even extending into mountainous areas. Substantial investments were made to construct dams and reservoirs, canals and pumping stations (Woon-Keun Kim, 1999).

Challenges faced are the shortage of arable land and the increasing costs of land reclamations as well as the massive rise and fall of river/lake levels caused by heavy rainfall and drought at critical points in the crop cycle. Strategic options aiming to achieve sustainable food security by improving agricultural production systems could be based on: (i) reconstructing flood-stricken areas, (ii) developing hilly mountainous land and reclaiming tidal land, (iii) modernizing irrigation systems through increased investment, and (iv) improving anti-flood forestation.

Policies and legislation

Agricultural policies of the Democratic People's Republic of Korea are directed towards solving the problem of food shortages through the 'four improvements' in agricultural technology: irrigation, farm mechanization, rural electrification, and agricultural chemicals. The government has also carried out a number of reclamation projects to increase the area of arable land. Priority has been given to improving the agricultural infrastructure, especially expanding irrigation facilities, and terracing and draining new arable land (Woon-Keun Kim, 1999).

The Government has adopted two strategies to meet its future cereal requirements:

- increase production by using high-yielding varieties (HYVs), and through more efficient, and environmentally sound soil and crop management practices; and
- increase the area of cultivated land by reclaiming tidal lands.

ENVIRONMENT AND HEALTH

The Democratic People's Republic of Korea is applying knowledge on sustainable development of upland water catchments and use of marginal agricultural land to help reduce soil erosion, protect natural resources and increase agricultural output. In a country that largely depends on agriculture for self-sufficiency, and has recently seen its agricultural production devastated by floods and droughts, an integrated and participatory approach to basin management is essential. Applying basin management throughout the country, planting trees in the uplands and developing integrated approaches to the use of natural resources will help diminish soil degradation and the dangers of downstream sedimentation. Trees help retain water in the soil, prevent water from flowing downstream all at once during heavy rains and keep moisture in the soil during low rainfall. Their roots also cling to the soil, making it more difficult for soil to erode (FAO, 2005).

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