Resource security

Case study

Food, water and energy security in South Asia – a nexus perspective from the Hindu Kush Himalayan region

South Asia faces the challenge of providing enough water and energy to grow enough food for the increasing population. The Hindu Kush Himalayan (HKH) ecosystem is vital for the promotion of food, water and energy security downstream. The issues and challenges in the food, water and energy sectors are interrelated in many ways and cannot be managed effectively without integration. Moreover, there is a high degree of dependency of downstream communities on upstream ecosystem services such as water for irrigation, HEP and drinking water.

Photo 3.4: The many ecosystems benefits of the Hindu Kush Himalayan region for the water–food–energy nexus: the Rampur dam in India

Asia accounts for around 66 per cent of the world's population, and 59 per cent of water consumption. South Asia has just 3 per cent of the world's land but around 25 per cent of the world's population. Thus, water and food security are vital. South Asian countries, including Afghanistan, Bangladesh, India and Pakistan, are home to 40 per cent of the world's poor population, and over half the population is food-energy deficient. About 20 per cent of the population lack access to safe drinking water.

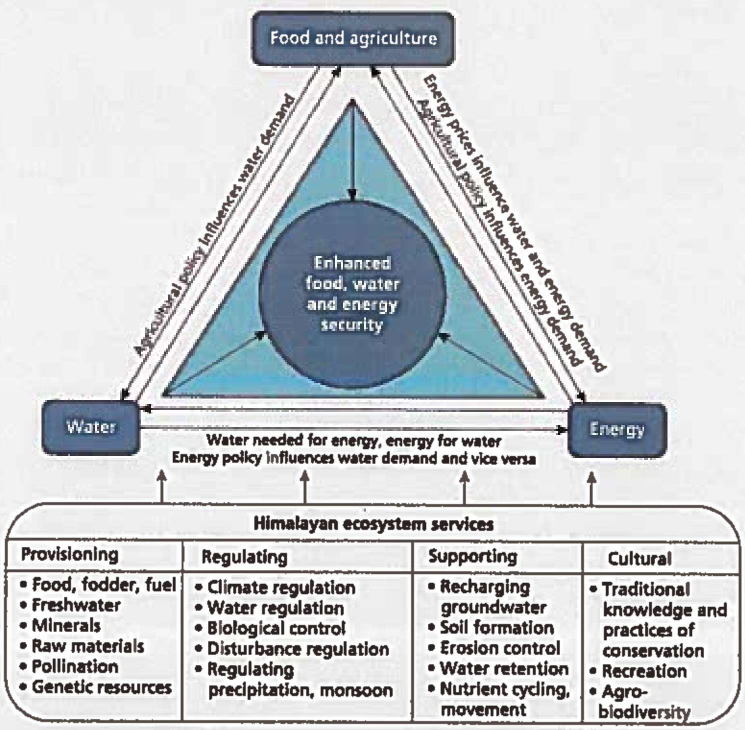

Figure 3.19: The interdependence of water, food, energy and ecosystem services

Just as food and water are essential for human existence, energy is key to human development. The nexus approach to water, food and energy is an integrated method for achieving security in all three elements. The nexus approach stresses the need for cooperation among the water, food and energy sectors, despite the competition for scarce resources. The ecosystem services provided by the Hindu Kush Himalayan (HKH) region are vital for the security of all three sectors. For example, 1.3 billion people rely on fresh water from the HKH region.

There are many challenges facing South Asia, including population

Case study (continued)

Table 3.6: Key indicators related to agriculture, water and energy security in South Asia

Indicator	2007	2050 projection
Population (millions)	1,520	2,242
Annual population growth rate (%)	1.5	0.53
Population below $1.25/day (million)	596	14.1
Undernourished population (%)	21.8	4.2
Arable land (million ha)	204	213
Irrigated area (million ha)	104	135
Cultivated land (ha per person)	0.12	0.08
Agricultural growth rate (%)	2.4	1.3
Total water consumption in agriculture (km^3)	1,479	1,922
Total water withdrawal for irrigation (km^3)	1,095	1,817

growth, rapid urbanization, industrialization as well as the uncertainties of climate change. These changes are leading to increased demand for, and pressure on, resources. Most ecosystem services are used and managed at a variety of scales, from the local to the international, and managed by a variety of stakeholders, for example farmers, politicians, industrialists, water engineers and urban populations. In addition, there are upstream–downstream linkages in the case of the HKH.

Table 3.7: Key features and challenges of food, water and energy security in South Asia

Key characteristics	Adaptation challenges	Interface among food, water and energy resources and adaptation to climate change
Food security		
Huge, chronically undernourished population		
About half of the world's poor (46%) and 35% of the world's undernourished live in South Asia	Provision of food, water and energy to a large malnourished population without degrading the natural resource base and environment	To meet the nutritional needs of all, food production to double in the next 25 years
Burgeoning human population		
About 25% of the world's population (projected to amount to 2.3 billion by 2050) lives in just 3% of the world's land area	To feed the growing population, agricultural production will have to increase by 70%, energy by 40%, and water by 57%	Increased pressure on land, water and energy to meet demand
Declining cropland		
Per capita arable land continually declining due to population growth, urbanization and increasing biofuel cultivation to meet energy demand	Limited option for growing more food grain by expanding crop area	Competing demand for land for food, bioenergy production and ecosystem services

Case study (continued)

Key characteristics	Adaptation challenges	Interface among food, water and energy resources and adaptation to climate change
Intensive food production		
Food production becoming increasingly water and energy intensive	Adapting to the declining groundwater table	Agricultural growth constrained due to shortage of energy and water
Changing food preferences towards meat		
The meat production process requires more energy and water	About 7 kg of grain equivalent required to produce 1 kg of meat	Increased pressure on water to meet the food requirement
Sensitivity to climate change		
Food production highly vulnerable to climate change due to rising temperatures, accelerated glacial melting, increased evapotranspiration and erratic rainfall	Uncertainty in water availability due to rapid glacier melt and changes in monsoon pattern in the Himalayas	Climate change likely to be a critical factor in increasing water and energy demand for food production and land demand for biofuel production
Water security		
Growing water stress		
Growing water demand for agriculture, energy, industry and human and livestock use; annual water demand predicted to increase by 55% compared with 2005	Providing access to safe drinking water in the face of increasing variability in the water supply	Water-intensive adaptation practices leading to increased water pollution and waterborne diseases, high child mortality, poor human health
Upstream–downstream dependence on water		
High dependence of downstream communities on the upstream for water to grow food and generate hydropower	Need for enhanced upstream–downstream coordination and cooperation for sustainable development of Hindu Kush Himalayan (HKH) water resources	HKH rivers are the lifeline for dry-season water for irrigation, hydropower and major economic activities
Increasing dependence on groundwater for food production		
About 70–80% of agricultural production dependent on groundwater irrigation	Adapting to declining water tables	Groundwater pumping for irrigation requires excessive energy, further increasing electricity demand
Energy security		
High energy poverty		
About 63% of the population without access to electricity; 65% use biomass for cooking	Providing adequate and reliable energy to a large population without increasing pollution	Growing demand for water and land for energy production

Case study (continued)

Key characteristics	Adaptation challenges	Interface among food, water and energy resources and adaptation to climate change
Under-utilized potential for hydropower and clean energy		
Hydropower in the Himalayas limited in places due to the risk of causing landslides	Restricted adaptation options	Energy diversification to meet growing demand for food, water and economic growth

Source: http://www.tandfonline.com/doi/full/10.1080/14693062.2015.1029865

Between 1950 and 2010 the population of South Asia almost tripled. The increased demand for water poses problems for farming. Up to half of the food energy comes from rice and wheat, but these are very water dependent – up to 1,000 tonnes of water are needed to produce 1 tonne of rice. They depend on water from the HKH region during the dry season. The HKH is also the source of water for hydroelectric power. However, the region is experiencing deforestation, land degradation, soil erosion, overgrazing and declining productivity. Soil erosion has led to an increase in the frequency and severity of flooding. Without proper ecosystem management in the HKH, water, food and energy security are all at risk.

Online case study

Energy resources in Nepal

Activity 7

1. Outline the factors that will make food security in Asia in 2050 difficult to achieve.
2. Explain the importance of ecosystem services in the functioning of the water–food–energy nexus.

Case study

Improving food security in South Africa

A number of studies have looked at the potential impact of climate change on maize and potato production in South Africa. A 10 per cent reduction in rainfall is likely to lead to a 4 per cent reduction in maize yields, whereas an increase in rainfall is likely to cause a rise in the maize yield. Increased temperatures would lead to a decrease in potato production. Farmers have already started taking measures to adapt to these changes. There has been diversification, substitution of crops, changes in planting times, greater use of shade crops, a change from flood irrigation to sprinkler irrigation, and soil conservation measures. Irrigation has been the most favoured adaptation, as water is the main limiting factor for agriculture in South Africa.

▲ **Photo 3.5:** Modern farming in South Africa