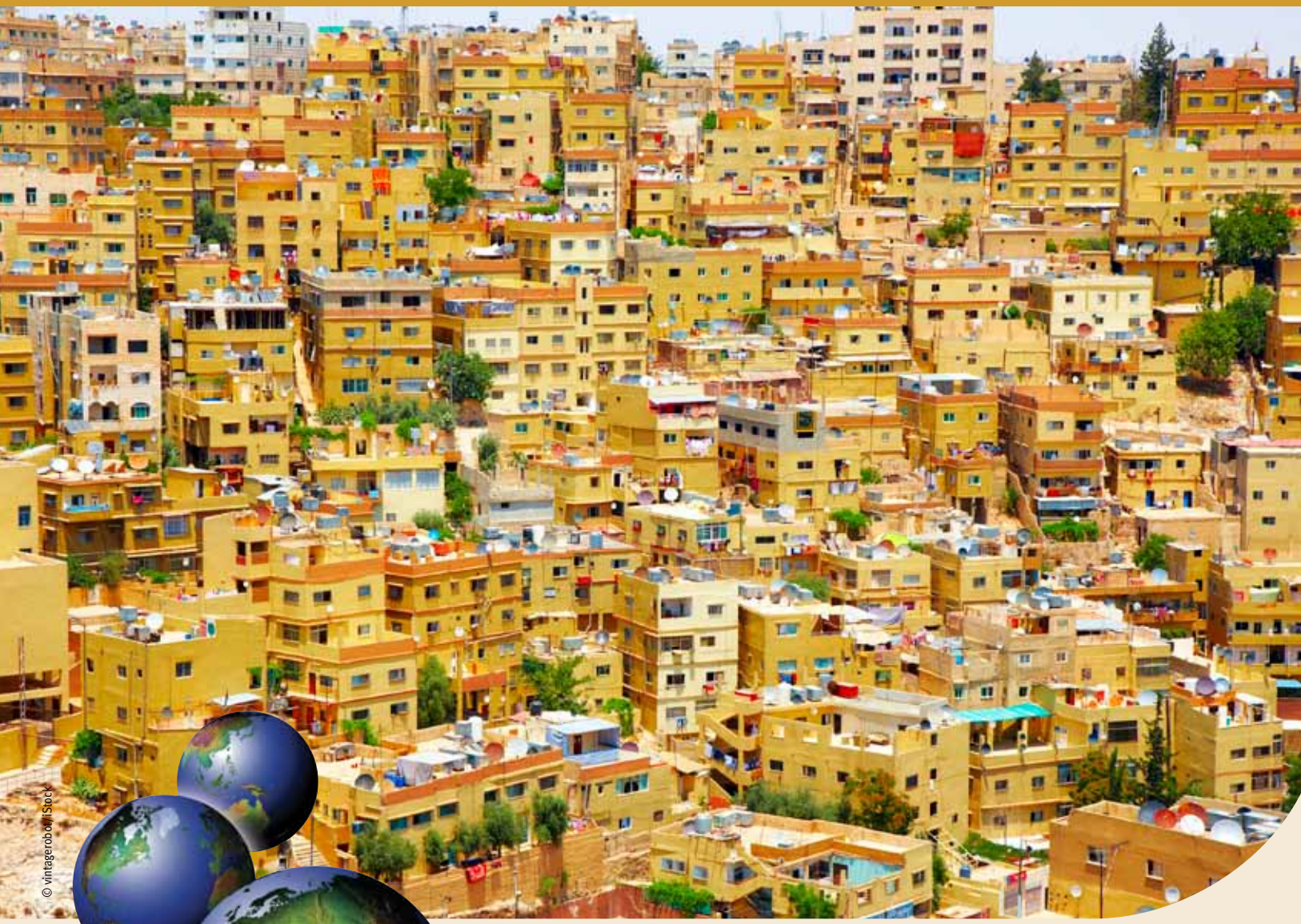
CHAPTER 14

West Asia



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Main Messages

Initiatives to introduce policy mixes to achieve a higher level of integration at different sectoral levels remain modest. West Asia has, however, made some progress on environmental governance and tends to rely on command-and-control measures rather than market-based instruments.

Financial investment has enabled some countries to make good progress towards Millennium Development Goal targets for water supply and sanitation (MDG 7c), but more efforts are still needed, especially in Yemen. In the past four decades, water policies have focused on supply infrastructure, especially in urban areas, aiming to overcome shortages through technical solutions including desalination. Coordination with other policies that prioritize balancing water supply with demand is crucial. The success of water policies in the region is contingent on political, financial and human commitment, reliable assessment of supply and demand, effective legal and institutional arrangements and active public-private sector partnerships.

National action plans to combat land degradation and desertification should be integrated with the sustainable use of natural resources, biodiversity conservation and plans to reduce the impacts of climate change. Integrated action to reduce land degradation, a significant issue in the region, would also address the regional phenomena of dust storms.

The region needs to strengthen its legislative and institutional frameworks for developing sustainable energy systems if it is to achieve global goals. Policy development to promote energy efficiency and renewable energy is evolving but, despite a wealth of renewable energy sources, the energy sector is still characterized by heavy reliance on fossil fuels, leading to high carbon emissions and adverse environmental impacts. The building sector is a major energy consumer, especially for air-conditioning, though green building practices are now emerging through the adoption of industry energy-efficiency codes.

Countries should confirm their commitments to protect the coastal and marine ecosystem through harmonization of the ecosystem approach with integrated coastal zone management plans and strategies. Strong coastal development plans reflect the implementation of coastal and marine policies in West Asia. Achieving marine biodiversity conservation is progressing through the establishment of marine protected areas and the application of integrated fisheries management.

INTRODUCTION

West Asia is geographically grouped into two sub-regions: the Arabian Peninsula, including Yemen and the Gulf Cooperation Council (GCC) countries of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates; and the Mashriq, which includes Iraq, Jordan, Lebanon, the Occupied Palestinian Territories (OPT) and Syria. The region covers about 4 million km^2 approaching 2.5 per cent of world's total land area. The environment is predominantly arid and semi-arid. Rainfall is scarce but with significant spatial and temporal variability. Water scarcity and frequent and persistent spells of drought are common, making water the region's most precious resource.

The region faces major environmental challenges in the need to address water scarcity; land degradation and desertification; increasing fossil fuel-based energy production and use with high inefficiencies in generation, distribution and end use; and conservation and sustainable use of marine and coastal resources. Climate change is becoming one of the region's main problems with potentially adverse impacts on the economy and human-well being. Water availability is projected to drop in most of the region by 2050, mainly due to rising temperatures and decreased precipitation (UNEP 2010; IPCC 2007). Much of the coast, especially in the GCC countries and Yemen, is vulnerable to sea level rise, which threatens large areas with inundation and saltwater intrusion (AFED 2009).

The drivers of environmental change in the region are linked to peace and security, demography and the state of the economy. The international desire to secure valuable energy resources and disputes including the current political conflict are playing a major role in the ongoing environmental degradation in the region. Environmental damage is escalating and the number of displaced people is increasing, straining the environment and contributing to the degradation of land and water resources (UNEP 2010).

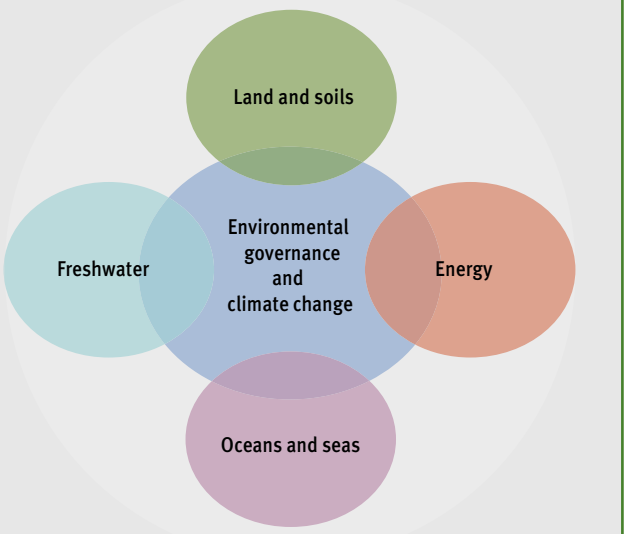
The total population of West Asia was estimated at 134 million in 2010, or 1.94 per cent of the world population. Given an annual growth rate of around 3 per cent, it is expected to reach 205 million by 2030 (UNPD 2008). Although fertility rates in the region are declining, the momentum of population growth is still high, partially due to cultural and religious beliefs and difficulties hindering family planning (UNEP 2010). Urban communities represent more than 90 per cent of the population of the GCC countries, about 75 per cent of the Mashriq sub-region, and 31 per cent in Yemen. These high population growth rates and urbanization together with current consumption patterns compound the pressures on the region's limited land and water resources. Generally speaking, the young and ever-increasing population, as well as its mobility, represent new prospects for development but may also exacerbate pressure on already strained resources and ecosystems. More resources and services are required to support the demand for jobs, housing, health, water, energy and education; hence land use change is expected to be a major issue in the region (UNEP 2010). Furthermore, an influx of expatriates into the GCC countries only adds to pressure on already strained and limited land and water resources (UN ESCWA 2005).

Profits from the export of petroleum have made many countries in the region dependent on a continued oil boom. *© Ryan Lindsay*

Most of the West Asian countries' economies depend on oil and gas export revenues, especially GCC countries. In general, the region holds 52.2 per cent of world oil reserves and 24.6 per cent of world gas resources (OAPEC 2009). Oil and gas exports along with petrochemicals are the main source of income in GCC countries. In the Mashriq sub-region and Yemen, however, agriculture is the main economic activity, contributing 30 per cent of gross domestic product (GDP) and employing more than 40 per cent of the workforce (UN ESCWA 2002), although there are also some extractive industries in countries such as Jordan and Syria. On a per-person basis, the GCC country with the highest GDP is Qatar, earning US$77 000 per person in 2010 (UNDP 2010). These high earnings are reflected in high per-person energy consumption, with many of the GCC countries having carbon dioxide (CO_2) emissions of more than 25 tonnes per person per year in 2006 (UNDP 2010). Furthermore, the concentration of oil and extractive industries in the region strains the environment by polluting the atmosphere and degrading land and water resources. New initiatives are, however, being implemented to reduce the emissions and waste output associated with development, for example at Masdar City in Abu Dhabi (Sgouridis and Kennedy 2010).

The rapid development of the past 30 years has been the main driver of continued degradation of the environment in West Asia. In spite of the progress that has been achieved to meet the MDGs, more effort is needed (UN DESA 2011). Governments of the region are dealing with these challenges by creating suitable conditions and empowered communities, with national environmental policies having been developed in all West Asian countries. The UN Conference on Environment and Development in 1992 – the Rio Earth Summit – accelerated the setting-up and strengthening of environment ministries and authorities, the adoption of national strategies, financial resource mobilization and the creation of partnerships.

Figure 14.1 Priorities for action in West Asia



Environmental institutions have been accorded high priority and status in all countries of West Asia (UNEP 2010), and a range of institutions has been established to implement policies, enforce laws and set standards and norms. However, these policies remain sectoral in nature and participation of the major public groups in environmental governance remains weak. There is no clear policy for the integration of these groups in the environmental governance process at either national or regional levels.

The environmental policies of West Asian countries rely mainly on command-and-control mechanisms rather than on economic instruments, though there have recently been various initiatives to use market-based instruments to offer incentives and change behaviour; these include water cost recovery options and a road toll system.

Through a consultative process, the four most pressing environmental challenges identified in West Asia are freshwater; soil, land use, land degradation and desertification; energy; and oceans and seas. Policies and policy considerations relating to the cross-cutting issues of environmental governance and climate change have been incorporated into the four priority areas as appropriate (Figure 14.1).

POLICY APPRAISAL

Freshwater

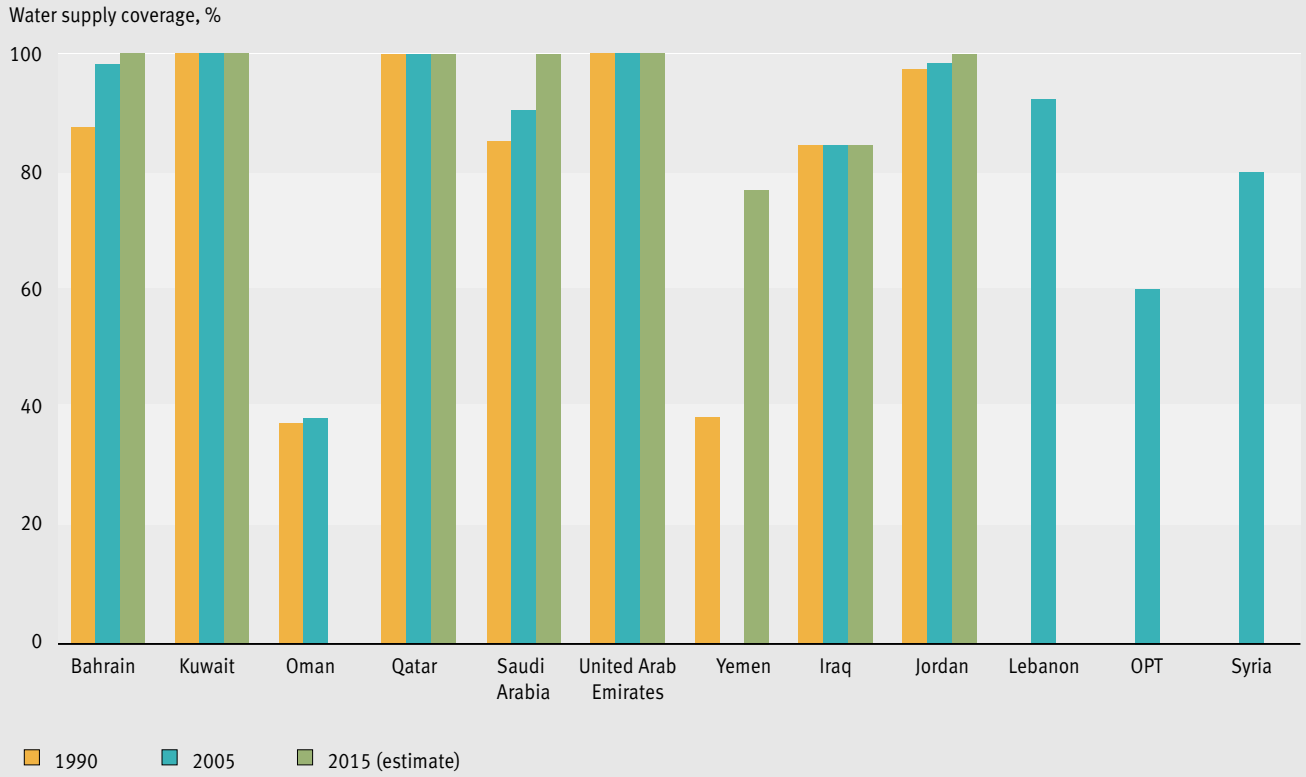
The water sources of the West Asia region, estimated at 106.5 km^3 (UNEP 2011), consist of renewable surface and shallow groundwater resources supplemented by non-renewable groundwater, desalinated water and treated wastewater. Surface water resources are estimated at 86 km^3 concentrated mainly in the Mashriq sub-region, with 63 km^3 available from mainly shared rivers, the Euphrates, Tigris, Jordan, Yarmouk and Al Kabeer al-Jounbi, and the remaining 13 km^3 supplied by small rivers, springs and intermittent wadi flow (UN ESWCA 2007b; Abdulrazzak *et al.* 2002; Al-Rashed and Sherif 2000; Abdulrazzak 1995, 1994). The total renewable groundwater resources in the region are estimated at 15.5 km^3 (UNEP 2011). Iraq, Lebanon and Syria rely on river flows supplemented by limited groundwater resources, while Jordan, OPT, Yemen and the GCC countries rely on renewable groundwater sources supplemented by extensive non-renewable groundwater reserves and desalinated water (UNEP 2007; Dabour 2006).

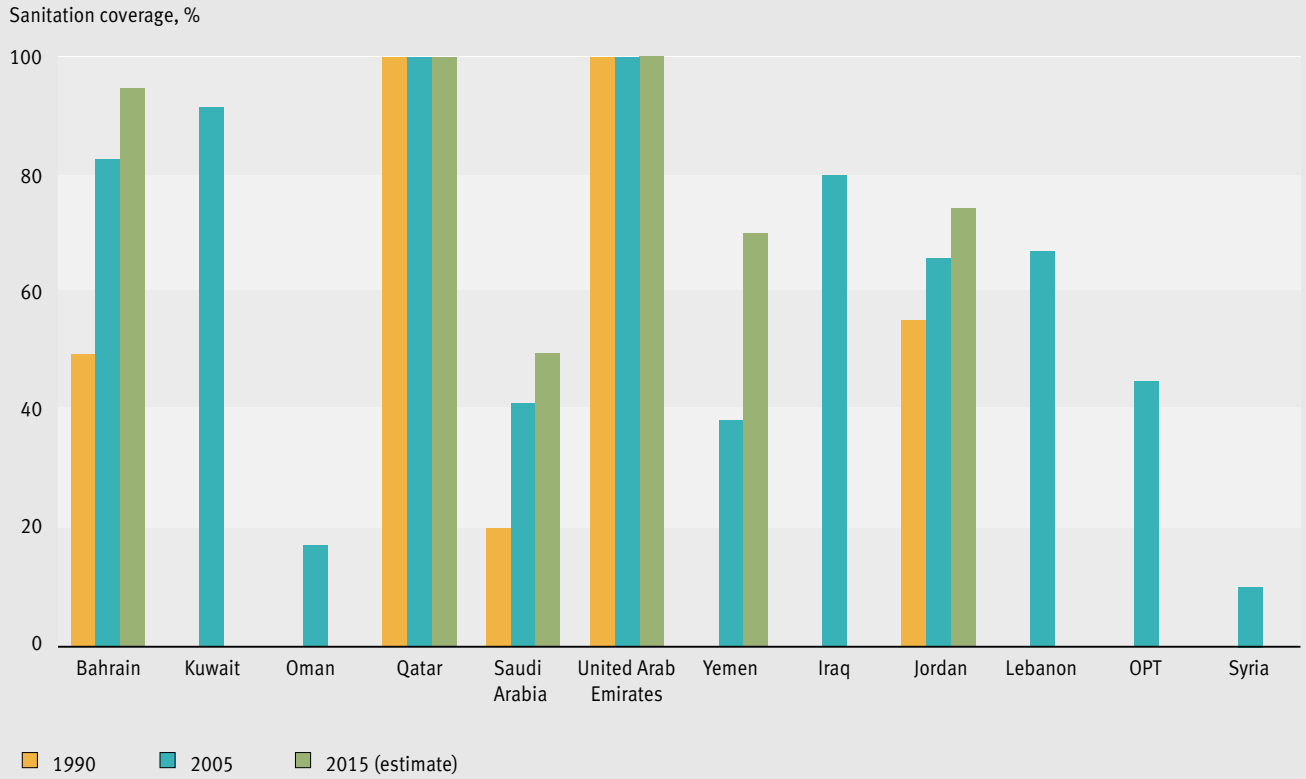
Desalinated water, which has become a dependable domestic water supply source, contributes 3.3 km^3 and meets 56 per cent of the domestic water requirements of the GCC countries (Word Bank 2005). The GCC is home to about 44 per cent of world desalination capacity (AFED 2010; UN ESCWA 2007b). Around 2.3 km^3 of treated waste and drainage water is used in urban landscaping and feed-crop production together with 9 km^3 of untreated wastewater. Total water demand in the domestic, industrial and agricultural sectors was estimated at 83.4 km^3 in 1990, rising to 112.8 km^3 in 2000, and is expected to reach 167.4 km^3 in 2025 (UNEP 2011). High population growth and urbanization rates, increased frequency of drought and extreme events, accelerated economic activities and improved standards of living have contributed to the widening gap between supply and demand, and to higher levels of pollution and resource depletion. The region's increasing water scarcity is evident in the reduction in annual per-person renewable water resources from 1 050 m^3 in 1990, to 553 m^3 in 2010; this is expected to fall to 205 m^3 in 2025 compared to a world average of 7 243 m^3 per person per year (CEDARE and AWC 2004).

Water scarcity due to climate change may reduce the available renewable water resources by 15–20 per cent in the next 50 years, leading to decreases in the flow of major rivers and groundwater recharge rates, a higher frequency of flash floods and droughts, and a loss of productivity in rain-fed areas (AFED 2009). The increase in temperature due to climate change is expected to lead to increased water demand, especially for irrigated agriculture; saltwater intrusion from sea level rise; a decline in provisions for tourism, and changes in crop production systems (AFED 2009).

Previous water policies that emphasized the development of supply infrastructure made it possible for most of the countries to be on track to achieve the Millennium Development Goal (MDG) 7c targets for water supply and sanitation. Regional coverage in 2008 reached 92 per cent for water supply and 81 per cent for sanitation, with major achievements in urban areas (UN DESA 2011). Coverage in rural areas is lower, especially in Iraq, Syria, Oman, OPT and Yemen. Higher coverage has been achieved in the GCC countries than in the Mashriq sub-region, corresponding to the availability of financial resources (Figure 14.2). Drinking water coverage in West Asia ranges from 100 per cent in most of the GCC countries to 52 per cent in Yemen. Between 1990 and 2008, the coverage for domestic water supply increased by 4 per cent and for sanitation by 5 per cent. It is estimated that since

Figure 14.2 Domestic water supply and sanitation in West Asia, 1990–2015





Source: CEDARE and AWC 2004

1990, 47–49 million people have gained access to a drinking water supply and 42–43 million to sanitation (UN DESA 2011). Most countries are expected to meet the MDG targets in 2015, with the exception of Yemen and OPT. Despite the substantial progress towards MDG 7c, more than 41 000 people have died during the period from 1990 to 2008 because of poor access to safe water supplies and inadequate sanitation facilities.

Water policies implemented during 1960–2000 as part of annual or five-year development plans addressed water scarcity by making use of supplies from major rivers, shallow and deep groundwater and desalination. Services were expanded to improve water supply and sanitation coverage, especially in urban areas, and measures were taken to manage demand, including water-saving technology, leak detection and public education, and expansion of irrigation schemes to enhance self-sufficiency in certain commodity food crops.

Since 2000, with the region's water resources – especially renewable resources – exploited to the limit of capacity, governments have been paying more attention to developing policies that emphasize comprehensive planning, with longer horizons in line with the integrated water resources management approach called for in the Johannesburg Plan of Implementation (WSSD 2002). This takes into account the water deficit of more than 50 km^3 estimated for 2025. Jordan, OPT and Yemen, and more recently United Arab Emirates – have already formulated their integrated management plans and begun implementation with varying degrees of success. Oman and Saudi Arabia are in the process of finalizing their plans while others have established timelines (AFED 2010).

Jordan's integrated water management plan considers all water resources in the Lower Jordan Valley, including groundwater, wastewater, saline water and floodwater. *© Miguel Nicolaevsky/iStock*

The region's water policy priorities should focus on three key objectives: comprehensive planning within the framework of integrated water resources management; supply-demand management measures to reduce the water deficit and increase water-use efficiency; and management of agricultural water consumption. Indicators to measure progress on water supply and sanitation are:

- annual per-person water consumption from renewable water sources – or water sustainability – as a measure of scarcity and depletion;
- population with access to safe water supply and sanitation as a measure of service coverage and proximity to the MDG target; and
- water losses from the irrigation and domestic water distribution systems as a measure of water use efficiency.

Planning within an integrated approach

Effective policy calls for planning in line with the principles of integrated water resources management. Current efforts have been confined to the formulation of water policies within national development plans and focused on supply development and limited demand management practices (UN ESCWA 2001). For some countries, the availability of financial resources has been considered a means of addressing the problem.

The planning process should be appropriate to the social, economic and cultural conditions of the region while considering the complexity of the problem: increasing and competing water demands; water governance issues; adaptive capacity in case of uncertain water availability and extreme events; changing socio-economic development patterns – including demographic trends and changing consumption patterns; food security and the volatile international food market; tension over shared water sources both for rivers and aquifers shared between countries of the region as well as other neighbouring countries; and climate change impacts.

Coordinated and integrated planning within and across water and water-related sectors promotes the balance of supply with demand. The objective is to achieve resource sustainability, efficiency and protection; to manage risks including climate change impacts; and to manage disputed shared sources. Additional benefits include increased safe water supply and sanitation coverage, especially for the poor; health benefits related to water quality; compliance and enforcement of legislation; information; and improved cooperation and trust in working on shared resources. The region should build on experience of integrated water management in Jordan, OPT and Yemen – and more recently in Saudi Arabia and the United Arab Emirates – to update future plans and share experience with other countries (World Bank 2009).

Among the key limitations are a lack of adequate and trained technical and managerial capacity to accommodate the highly complex integrated water resources planning process, set well

defined objectives, formulate and implement multi-objective measures, and commit the necessary financial and human resources to strengthen governance issues. Difficulties lie in establishing the free dissemination of information and the coordination of different data sources; reliable assessment resources; and identifying water requirements during a period of dynamic socio-economic development and environmental change. For transboundary resources, there are conflicting national interests in forging equitable sharing agreements. All these issues can be addressed through integrated water resources management, supported by strong commitment on the part of decision makers to place water high on the political agenda.

The integrated water resources management framework is not an option but an essential requirement if water management is to be enhanced in the region. The experience gained from its formulation and implementation in Jordan and OPT can inform the planning process of the Mashriq sub-region, while Yemen's plan (Box 14.1) can inform that of the GCC countries, which share similar environmental and social conditions. In addition, documentation of lessons learned through the practical implementation of management measures could help to build national capacity for updating any existing integrated water management plans.

In terms of environmental governance, certain enabling conditions are necessary for the success of the integrated approach. Decision makers and stakeholders must fully understand the relevant policy statements and must define the objectives and mandate of the water and water-related sectors; enable the free dissemination of information; commit the necessary financial and adequately trained human resources; increase reliance on national expertise; adopt a community-based management approach; and enforce coordination mechanisms. This requires comprehensive and enforced legislation.

Supply-demand management to reduce water deficits

On the supply side, appropriate measures include the development of renewable groundwater within sustainable yields; augmentation from water desalination; reuse of adequately treated wastewater; rainwater management and harvesting; artificial groundwater recharge; flood control structures; and a limit on the mining of non-renewable groundwater. Demand measures include economic mechanisms such as partial cost recovery; socially acceptable tariffs; subsidies and incentives for improving water-use efficiency, especially in the irrigation sector; modification of building codes for water saving; leakage control; decentralization of water utilities; groundwater metering; and effective coordination of international funds supplemented by public awareness. This is in addition to supporting non-governmental organizations and stakeholder participation.

Limited management measures have been implemented in Jordan, OPT, Yemen, and recently Saudi Arabia and the United Arab Emirates, mainly through water-saving technology, public education and leak detection in large cities, and incentives such as subsidies and loans.

Expected benefits include coordination in balancing water supply through rational utilization of all sources, with demand reductions achieved within 25 years. Such rationalization includes the use of renewable and non-renewable sources within their sustainable yields; increasing domestic supply from desalination; reusing adequately treated wastewater; establishing strategic groundwater reserves in the Arabian Peninsula sub-region and Jordan; and developing rainfall harvesting infrastructures in Jordan, Lebanon, Oman, Saudi Arabia, Syria, United Arab Emirates and Yemen. Demand management measures aim to reduce water losses from distribution systems from the present levels to 5–20 per cent of the non-renewable resources, especially in the irrigation

Box 14.1 Yemen's integrated water resources management plan

Yemen's progress on water management was supported by an investment plan and the prior establishment of a comprehensive legislative framework. Supply and demand objectives have to a certain extent been achieved, aided by assessment of the water supply along with supply-and-demand management projects in the domestic and irrigation sectors. The supply side includes dams for flood control and recharge, control of groundwater withdrawal in certain areas, reuse of treated wastewater, and rainwater harvesting; while the demand side includes such management tools as the renovation of terraces, decentralization of water utilities, appropriate domestic tariffs, subsidies to improve water-use efficiency in the irrigation sector, incentives, and the creation of water user associations in coordination with the Ministry of Agriculture. Evaluation of climate change impacts was also carried out.

The process involved academics, UN agencies and non-governmental organizations, in addition to coordination of the international funding agencies and identifying the necessary financial and human resources. Benefits have included improved planning at basin level, increased investment in wastewater treatment, increased service coverage in the cities of Sana'a, Aden, Taiz, and Hudadiah, rationalizing the use of groundwater resources especially in the Sana'a basin, and enforcing tariff collection. The principal constraints have been under-commitment of financial and human resources and a lack of public-private sector partnerships (CEDAR and AWC 2004).

sector. Socially acceptable economic tools include gradual cost recovery, and loans and incentives to reduce consumption. Measures also include administrative steps to decentralize functions, change building codes and regulations, encourage stakeholder participation and establish modern agricultural practices, including hydroponics and irrigation systems. These can lead to changes in behaviour and consumption patterns, reduced pollution and depletion especially of non-renewable and shared sources, and improved water productivity, and can contribute to meeting the MDG goals.

The main challenge is to shift water from being heavily regulated and subsidized, which is largely dictated by a strong agricultural lobby, into the realm of partially priced goods and services. In most countries of the region, subsidy policies have contributed to wasteful water consumption, though this is now changing in Jordan, Saudi Arabia and Syria. Challenges also lie in overcoming the reluctance to reuse treated wastewater, providing adequate financial sources in the Mashriq sub-region, and low capacity for integrated and comprehensive planning, especially in the Arabian Peninsula sub-region (AFED 2010). Further, there is reluctance to take appropriate action to reduce the power of the agriculture lobby.

Similar economic and social characteristics across the region provide opportunities to share many supply-and-demand management experiences. Experience of desalination in the GCC countries can be shared with the Mashriq sub-region while taking full consideration of the environmental impacts, especially Jordan, the OPT and Yemen, while measures such as water storage and rainwater harvesting infrastructure are replicable in most of the countries. Other successes include water-saving technologies, leak detection and repair, public awareness campaigns and groundwater metering – introduced, for example, in Bahrain (Box 14.2), Jordan, Saudi Arabia and Syria – and decentralization of water utilities. In addition, water user associations in Jordan (the Local Farmers Association, for example), Oman and Yemen can be replicated in all countries.

Desalination remains the most practical way of meeting rising demand for water in the countries of the Gulf Cooperation Council. *© Tanuki Photography*

Box 14.2 Leak detection and repair of the distribution system in Bahrain

Water distribution leakage is in the range of 30–50 per cent in certain areas in Bahrain, resulting in the loss of costly desalinated water, contamination with wastewater and changes in the water table that can damage urban infrastructure. Bahrain's management measures achieved a 5–15 per cent reduction in leakage, saving 25 million m^3 of desalinated water and reducing costs by US$18–25 million in 2000 (World Bank 2008). Improvements were seen in water supply reliability and coverage, enhanced technical and managerial staff capacity, and reduced impacts from a high water table such as nuisance odours, soil contamination and damage to urban buildings and roads. In addition, the measures helped in-house water auditing, and increased public awareness and social responsibility for conservation of an already limited resource. Such demand management measures could be replicated in many big cities in the region.

Enabling conditions require comprehensive water sector reform and include good governance conducive to inter- and cross-sectoral coordination; adequate investment; financial transparency and accountability; public acceptance of cost recovery tools with socially acceptable tariffs; and application of the polluter-pays principle. Other enabling conditions include commitment to the right to water; ensuring that stakeholders have an active role in decision making; a free flow of information; separation of service providers and regulatory functions; and effective capacity-building programmes.

Management of agricultural water consumption

The agricultural sector, which uses more than 85 per cent of the region's water, has been oriented towards food self-sufficiency in certain commodities and overall food security in light of increasing food prices, rural development and rising incomes. In Lebanon, Jordan, Syria and Yemen, the sector employs 30–40 per cent of the domestic population, while in the GCC countries it depends on foreign labour (UNEP 2010). Agricultural intensification has accelerated groundwater depletion, especially in the Arabian Peninsula, as well as increased agro-pollution and soil salinity. The sector is characterized by low irrigation efficiency of 30–45 per cent and the cultivation of particularly water-thirsty crops, resulting in low water productivity (AOAD 2009). Water scarcity and pollution can be alleviated by increasing the use of adequately treated wastewater; rainwater

harvesting on mountain terraces; modern agricultural and irrigation systems; and subsidies, incentives and soft loans to promote the application of water-saving technologies. Water sustainability can also be enhanced by groundwater metering, partial cost-recovery tariffs, application of the virtual water concept, increasing the number of water user associations, market integration between countries, and making use of World Trade Organization (WTO) and other trade agreements.

The benefits of integrated management to the agricultural sector include enhanced water-use efficiency of 15–30 per cent above the current level, resulting in substantial water savings and increasing the water available to meet domestic demand and achieve the MDG targets (UN DESA 2011). Improving water-use efficiency will increase water productivity and farmer income, and conserve non-renewable groundwater for future generations. The current system of subsidies and soft loans available for modern agricultural and irrigation systems provides an effective economic tool to reduce water consumption and prevent groundwater depletion and pollution from agrochemicals. The current secondary and tertiary level wastewater treatment facilities, especially in GCC countries, provide water suitable for a number of crops (UNEP 2010). However, more attention should be given to the monitoring and enforcement of water-saving technologies to reach a defined level of efficiency and achieve appropriate water treatment standards.

Limited commitment to providing the necessary financial resources to implement water-saving irrigation technologies and assess climate change will impact water availability, agricultural productivity and biodiversity. Problems include difficulties in convincing farmers to shift to modern irrigation techniques and use treated wastewater, and in developing adequate human resources to monitor compliance with water treatment standards, along with weak marketing strategies and the impact of foreign labour. Other challenges include overcoming reluctance to move away from the concept of irrigation water as free or heavily subsidized, especially groundwater, to acceptance of cost recovery and pricing of water allocations. There is a need for significant investment in wastewater treatment, awareness campaigns, modernized irrigation and agricultural systems, and the establishment of user associations.

Agricultural policies have to be compatible, coordinated and integrated with broader water policies. Investment is required for wastewater facilities to increase reuse volumes, and for subsidies and loans to increase take-up of water-saving technologies. Enabling conditions must be established for setting efficiency rate targets of 75 per cent for irrigation, and for the gradual phase-out of water-thirsty and low cash-value crops in favour of importing crops (the virtual water concept). Growing wheat, for example, requires large amounts of water. By importing wheat and concentrating on crops that require less water, a country can acquire virtual water and use existing resources more efficiently.

Additional measures include limiting the export of green animal feed, increasing the number of water user associations and taking advantage of WTO and bilateral agreements between Arab countries (UNEP 2010).

Similarities in the irrigation supply, consumption practices and arid environment of most countries provide opportunities to share success stories as well as market and trade complementarities, and take advantage of possibilities for integration at the regional or sub-regional level. The success of large agricultural companies in Saudi Arabia could, for example, help some countries of the Mashriq sub-region to expand their activities and increase water productivity. Use of the virtual water concept and intra-region agricultural policies provide an opportunity for cooperation in agricultural production based on comparative advantage, while conserving local water resources for future generations (Box 14.3).

Box 14.3 Irrigation management in Saudi Arabia

Saudi Arabia's agricultural sector is responsible for more than 85 per cent of the country's water consumption, especially from non-renewable and sometimes shared groundwater resources. During 2005–2007, renewable water resources of 2.5 million m^3 were supplemented with 16.2 million m^3 from non-renewable groundwater sources to satisfy irrigation demands. Even though the 2010 total demand of 18.7 million m^3 is expected to decrease to 12 million m^3 in 2025, the gap between the total irrigation demand and the supply from renewable water sources will still be considerable.

The government recently implemented a number of measures to limit irrigated food production by decreasing the subsidy on diesel fuel and gradually reducing the purchase of local wheat. In 2009, it set a target to eliminate wheat production over an eight-year period, and at the same time increased incentives and loans for modern irrigation systems, provided subsidies for animal feed imports while banning the export of fodder, and established strategic food reserves (AFED 2010). Further measures have been implemented to freeze the amount of land used for agriculture; promote cultivation under glass; improve the coordination of the agricultural sector with other relevant policies; and encourage agricultural investment abroad by forming committees and setting aside funds to encourage the private sector. These measures have contributed to reducing the amount of irrigated land, the production of wheat and groundwater mining, and increased interest in the reuse of treated water (Hussain *et al.* 2010). Future action includes evaluation of irrigation cost-recovery options, groundwater metering and setting limits on water allocation to the various sectors.

Fields in Halabiye, Syria, where scientists are working with farmers to breed more robust crops. *© Joel Carillet/iStock*

Soil, land use, land degradation and desertification

Most of West Asia is characterized by patchy vegetation, sandy soils and arid to hyper-arid conditions. Drylands make up 64 per cent of the total area of 4 million km^2 (Abahussain *et al.* 2002; Al Kassas 1999). Rangelands fall into the largest land-use category, with lands cultivated with annual and permanent crops representing 4.8 per cent, and forests 1.4 per cent (FAOSTAT 2008; AOAD 2007). High and sustained population growth and urbanization rates coupled with rising rates of consumption increase the pressure on limited land resources.

The biophysical characteristics of the region, combined with population growth and socio-economic policies, are the main drivers of land degradation and desertification, one of the main problems facing West Asia. Proximate causes include intensification of crop and livestock production and pastoral activities; development of human settlements and infrastructure; wars; policies that subsidize unsustainable practices such as irrigation with fossil or saline water; overuse of agrochemicals; overstocking of livestock; and lack of appropriate integrated water-land-use planning and management. All these developments have resulted in reduced ecosystem products and services, widespread desertification and land degradation including biodiversity loss, which, in turn, affects human well-being (ACSAD *et al.* 2004).

The impacts of land degradation have been most serious in the countries where the share of agriculture in gross domestic product (GDP) is high, such as Lebanon, Syria and Yemen (UNEP 2010), and are further exacerbated by frequent droughts and climate change. Policies to combat land degradation and desertification must take into consideration the region's multiple challenges of sustained population growth, rapid urbanization rates, increasing demand for natural resources, a declining natural resource base, varying rates of economic growth and increasing incidence of poverty in communities that depend mainly on land resources. A lack of financial resources, appropriate technologies and institutional capacities, as well as limited stakeholder and civil society participation must also be taken into account (SRAP 2007).

Indicators for measuring the progress of selected land-use policies include:

- the proportion of land affected by desertification (erosion and salinization);
- the proportion of land that falls into nationally protected areas and forest;
- livestock numbers relative to the carrying capacity of rangelands;
- land-use change, including the proportion of productive area lost to urbanization;
- the proportion of land under modern irrigation; and
- levels of productivity (tonnes per hectare) and production (tonnes per year).

Successful policy options that show potential to accelerate the achievement of internationally agreed goals can be addressed as three clusters:

- developing rangelands and combating land degradation;
- achieving food security and cropland rehabilitation; and
- adopting integrated policies for improving land and water use with local community participation.

Developing rangelands and combating land degradation

Policies to develop national and regional rangelands help to improve their management by prohibiting cultivation in designated areas while protecting and rehabilitating degraded rangelands (Box 14.4) (Kattach 2008).

The benefits include the protection, conservation, sustainability and improvement of natural vegetation productivity and diversity.

Box 14.4 Protection and rehabilitation of rangelands in Syria

The main objective of Syria's policy is to conserve vegetation density, productivity and biological diversity, improve the livelihoods of local communities, reduce dust and sand storms, and increase carbon sequestration. The aim is to protect and rehabilitate degraded areas in the Al-Bishri rangeland of the Syrian steppe. Implementation involves local community participation in selecting degraded areas, seeding and planting, and the control and reduction of grazing pressure through collaboration between local herders and animal-fattening cooperatives. After three years of rehabilitation and protection, forage production increased from 90 kg to 320 kg per hectare per year and bare soil decreased from 91 to 32 per cent. The diversity of plants increased from 27 species from 23 genera and 13 families to 83 species from 55 genera and 17 families, and the density of edible shrubs increased from 0.02 to 4 plants per m^2 (Kattach 2008). In the long term, vegetation density, productivity and diversity, and carbon sequestration are expected to increase to optimum levels, alongside the prevention of dust and sand storms. This is in addition to providing more forage for livestock, reducing the need for feed and the cost of meat production.

In addition, improved rangelands help to prevent soil erosion, conserve water, increase carbon sequestration, reduce both the frequency and magnitude of dust and sand storms, and provide links to global support for combating desertification. Limitations include reduced open grazing areas for herders, competition with cropping, lower direct financial returns to herders and increasing risk of conflict with local communities.

These policies can be replicated and scaled up for implementation in similar degraded rangelands at regional and global levels.

Achieving food security and cropland rehabilitation

Food security has continued to be the main concern of national governments in the region since the concept was introduced in the 1980s. The world food crisis in 2007, accompanied by soaring food prices, revitalized the need and desire of some countries to become self-sufficient in certain agricultural commodities, and especially to restrict the export of cereals and livestock feed (AOAD 2009). As a result, national agricultural policies were revised to increase agricultural production, and government control of farming systems was relaxed in favour of decentralization. Avenues for offering incentives in the form of price controls, tax breaks and reductions, cereal and animal feed export restrictions, easy loans, and the introduction of efficient techniques in reclamation and irrigation were explored. This is in addition to developing adaptation policies to climate change such as using saline water for agricultural production, developing new local crop varieties tolerant of aridity and drought conditions, and rehabilitating rainwater harvesting systems (Box 14.5).

After introducing a series of incentive measures, benefits have included relative food security with regard to certain commodities, which in turn reduced dependency on food imports and helped to alleviate poverty and hunger.

The limitations to agricultural practices such as flood irrigation have included depletion of water resources in a region that is already water-short. Overuse of aquifers has led groundwater to suffer from saltwater intrusion in coastal regions, and salination has rendered large areas of agricultural land useless and converted landscapes into desert (Hussain *et al.* 2010). However, the governments of the region are left with no choice but to reclaim new areas and salinated fields, and re-cultivate them in order to meet the ever-increasing demands for food. Drought and climate change are working against achieving food security, as persistent drought has continued to affect the region for the past few years.

Policies to improve agricultural productivity are being replicated with modifications to suit each country's economic and social conditions.

Box 14.5 Sustainable agricultural development in Bahrain

The National Strategy for Sustainable Agricultural Development aims to upgrade the agricultural sector in Bahrain. It includes goals and programmes that contribute to agricultural growth and preserve agricultural heritage. The main objectives of the strategy include achieving relative food security, conserving natural resources, protecting agricultural land, using modern technologies to encourage agricultural investment, making the agricultural sector economically efficient, contributing to the needs of citizens and residents for food, and supporting small farmers (Ministry of Municipalities Affairs and Land Use Planning 2010). To attain the strategy's objectives, communication and cooperation were enhanced between the various parties involved in the country's agricultural sector. In addition, the strategy concentrates on involving diverse communities while paying special attention to farmers as central to agricultural development.

Benefits of the strategy include the modernization of production systems, conservation of water and land, increased agricultural productivity, relative food security, reduced groundwater consumption, increased vegetation cover including palm trees, a boost to agricultural trade, promotion of the national economy and a reduction in unemployment.

In order to create enabling conditions, governments of the region eased access to finance and technical services. Agricultural research and extension were strengthened to boost productivity and conserve water and land resources, thus promoting good agricultural practices. New crop varieties suited to drought conditions were introduced as well as new cultivation methods.

Enabling conditions for rangeland protection policies in West Asia have been jointly implemented by various institutions, with assistance from developed countries and research centres. The success of land degradation control depends on the presence of a favourable framework, including organizational, institutional, legal and political structures and processes that promote programme planning and implementation. This included analysis of the factors influencing institutional response capacity, and from there the development of recommendations for capacity building and participatory modalities (UN ESCWA 2007a).

Integrated policies for improving land and water use with local community participation

The 2007 report of the Intergovernmental Panel on Climate Change (IPCC 2007) indicates that the problem of land degradation and desertification prevalent in West Asia will be exacerbated by climate change. The expected increase in temperature, decline in precipitation, and greater intensity and frequency of droughts and dust storms will impact rangelands and rain-fed cropland and contribute to land deterioration, biodiversity loss and the spread and intensification of desertification.

Mindful of this, Jordan's policies deal with the strategic improvement of rain-fed agriculture and the prevention of land degradation and desertification. Achieving these objectives involves long-term mainstreaming of integrated strategies for improving productivity; rehabilitating, conserving and sustaining land and water resources; combating desertification; and mitigating the impacts of drought and climate change.

Tomato crops by the Dead Sea. Here, drip irrigation uses nearly 50 per cent less water than traditional irrigation. *© Ricardo De Mattos*

Implementing these strategies is more effective with the participation of local traditional resource users, recognizing the interrelationship between these and other environmental issues at the local, national, regional and global levels (Box 14.6). The benefits of these policies are the protection, conservation, sustainability and optimization of natural resource productivity and the potential for diversifying income sources with links to global support for improving farmers' livelihoods. Factors that determine success include soil and water conservation, irrigation, forestry, livestock, range management and community-based resource management, enhanced technical capacity of local managers and local institution building. Indicators of success include the long-term rehabilitation of degraded lands, halting of desertification processes and increased resilience to climate change, while short-term benefits include increased agricultural productivity, improvements in individual and family incomes, greater drought resistance of rural production systems and protection of biodiversity (UN ESCWA 2007a).

In semi-arid areas the implementation of policies with an emphasis on agricultural production leads to a reduction in the rangeland available for livestock grazing. In many countries most of the farmers are also livestock owners and their herds graze on lands with low productivity and on crop residues. Farming practices in these areas return very few nutrients and organic matter to the soil and provide little protection from wind erosion. Livestock grazing of virtually all crop residues is particularly problematic (UN ESCWA 2007a). Policy limitations also include the continuous out-migration of the younger members of rural families, creating local labour shortages.

In many countries of the region successful programmes tend to emphasize the significance of comprehensiveness and integration. An excellent policy in one country does not usually stand alone and, as such, cannot easily be transferred or successfully replicated in its original form in a new location (UN ESCWA 2007a). New circumstances, new management and various interdependent problems such as poor and low implementation capacities, lack of financial resources and marginalized local stakeholders, can make many successful programmes lose their effectiveness under replication.

The evaluation and assessment of successful policies have demonstrated that the alleviation of land degradation depends not only on the motivation of individual stakeholders, but also on the creation of enabling conditions for effective collective action by the whole community, and this makes implementation of such policies more challenging. The development of appropriate policy frameworks and incentive structures is key to inducing sustainable management of natural resources. Environmental governance should be incorporated in the activities of social, economic and administrative institutions, with environmental and land-use policies central to the coordination and management of the various sectors of the national economy. Governance encourages the use and application of scientific data and information for the sustainable development of natural resources. On a larger scale, it fosters an understanding of the

Box 14.6 Integrated agricultural management in Al-Karak, Jordan

The main objectives of Jordan's policy were to arrest land degradation, optimize the long-term productive capacity of land and water resources, improve the income of vulnerable farmers, especially women, with their active participation, safeguard and upgrade the productive potential of natural resources and enhance returns, prevent soil degradation, restore soil fertility, promote efficient use of soil and water, strengthen the capacity of local technical and managerial staff, and meet the needs of local farmers. To achieve these objectives, the programme provides technical and financial support aimed at:

- building soil and water conservation structures and improving agricultural production;
- enhancing sustainable land and water management practices;
- promoting rural microfinance to support on- and off-farm activities;
- tree planting;
- building cisterns and dams for water harvesting;
- improving animal husbandry;
- maintaining springs and irrigation canals; and
- constructing small reservoirs, known as *hafira*, to retain run-off for later use.

Local communities have benefited from the newly vibrant agricultural sector through processing local products and having better access to financial services. Some 5 350 households have benefited from the various soil and water conservation measures, while spring protection and/or rehabilitation programmes alone having benefited about 1 000 households (Ministry of Water and Irrigation 2008). The improved agricultural extension services are estimated to have reached about 22 300 households, and the provision of loans and support for developing alternative income-generating activities has benefited more than 5 000 women and landless farmers (UN ESCWA 2007a).

These investments in soil and water conservation have reduced and will continue to reduce the degradation of the fragile ecosystems in the project area. They will also improve vegetative cover, reduce run-off and soil loss, improve soil fertility, and enhance sustainable use of the natural resource base. The project has raised awareness about the impacts of land degradation and desertification while improving farmer's livelihoods, diversifying income sources, and alleviating both poverty and out-migration.

main economic, social and environmental issues among many stakeholders, helping to achieve a balance between governance needs and governance capacity (UN ESCWA 2007a).

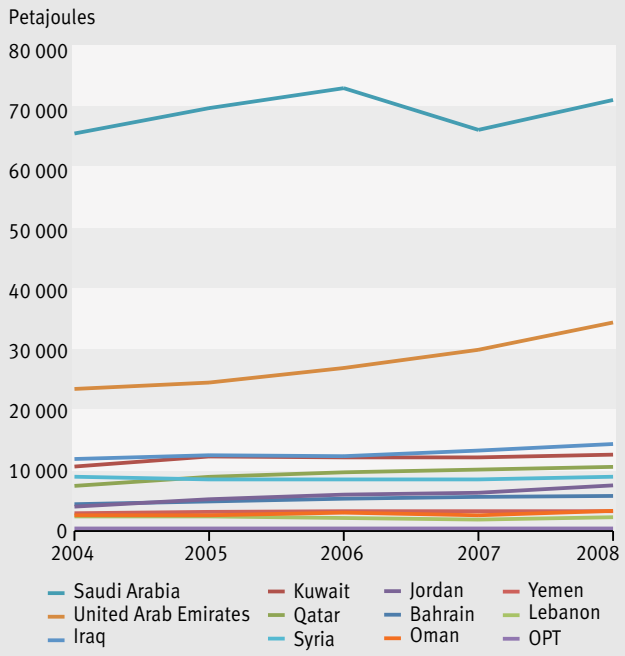
Energy

Energy resources

West Asia is one of the major players in the global energy market, having 52.2 per cent of world oil reserves and 24.6 per cent of world gas resources (OAPEC 2009). The region produces nearly 17.3 million barrels of oil a day, accounting for 27.6 per cent of world oil exports. Rapid economic development, population growth, urbanization, and changes in standards of living in West Asian countries have led to increases in energy demand (Figure 14.3) (IEA World Energy Agency 2010). Despite rich renewable resources, the energy sector is characterized by heavy reliance on fossil fuels. In addition, the regional economy is still largely dependent on fossil fuels to fulfill increasing energy demands. The use of fossil fuels is always accompanied by considerable environmental impacts including deteriorating local air quality and rising greenhouse gas concentrations in the atmosphere, contributing to climate change.

Energy consumption rose steadily in most of West Asia between 2004 and 2008, increasing by some 20 per cent over the period (Ruble and Nader 2011). But with accelerating rates of development and rapid urbanization in the majority of the region, energy demand is now increasing drastically in all sectors, including electric power production, domestic energy use and transport. In view of energy security and safety

Figure 14.3. Primary energy consumption in West Asia, 2004–2008



Source: IEA 2010

issues, the sharp increase in oil and gas prices, climate change and environmental considerations, as well as technological advances, energy planning in several countries is now addressing more decentralized energy generation options. The region is characterized by rich renewable resources including solar, wind, geothermal and, to some extent, biomass, and over the past decade has been shifting its policies towards diversification of energy sources and placed energy efficiency and renewable technologies high on national policy agendas. Some examples of renewable energy initiatives include Jordan's objective to generate as much as 7 per cent of its energy from renewable sources by 2015 and 10 per cent by 2020, while solar capacity is expected to reach 300–600 megawatts over the same period; Abu Dhabi's aim of generating up to 7 per cent of its energy from renewable sources, with planned investments reaching US$22 billion; Syria's intention to generate 7.5 per cent of its electrical energy from renewable resources by 2020; and Lebanon's target for renewable energy of 10 per cent of total energy supply by 2013 and 12 per cent by 2020 while also aiming to reduce energy consumption by 6 per cent by the 2013 (Ruble and Nader 2011; Verdeil 2008).

Successful energy policies in the countries of West Asia cluster around two main areas:

- energy efficiency in the building sector including systems for space heating and cooling, and measures for promoting the use of renewable energy resources; and
- energy generation mixes and targets for clean energy production, which require governmental commitment and advanced legislation.

Abu Dhabi's US$600-million solar power plant, expected to be complete in 2012, will be one of the largest concentrated solar power plants in the world. *© Fernando Alonso Herrero*

Indicators for measuring the progress of the selected energy policies are:

- energy savings in percentage terms or cost terms, reduced air conditioning system sizes and impacts on local markets;
- total surface area of solar water heaters installed (market penetration); and
- diversification of energy sources as part of countries' plans, and renewable energy capacity as a proportion of total capacity.

Policies that have been shown to be effective in reducing energy consumption with the participation of the local community address the energy performance of buildings and their cooling and water systems (Hajiah 2010; Maheshwari and Al-Murad 2001), promote renewable energy resources (Shahin 2010; Houri 2006; Kablan 2004) and encourage diversification of energy supply options (Ruble and Nader 2011; Hainoun *et al.* 2010; Reiche 2010). These policies may have high potential for replication in countries with similar climate or socio-economic characteristics and similar regulations to those of West Asia.

Regional policy interventions for improving buildings' energy performance and implementing renewable energy enhancements such as water heating are directly linked to policy formulation regarding population growth, urbanization, and associated economic activities and technological affordability. Further policies that are of equal importance, but have only recently been formulated, address public transport, car fleet age and codes for fuel use.

Building and systems energy performance

Energy efficiency in the building sector has been a primary national target for West Asian countries, and thermal guidelines and codes for buildings have been developed and implemented in most of the region (Ali *et al.* 2008; Alnaser *et al.* 2008; Aftab and Elhadidy 2002). Al-Ajlan *et al.* (2006) reported that improving the efficiency of Saudi Arabia's air-conditioning alone provided a return on investment equivalent to 400–500 megawatts per year of generating capacity, a saving of up to US$250 million per year. The countries' energy performance codes for buildings focused on solutions to improve heating and cooling loads and have, to some extent, addressed the use of efficient systems and processes for heating/cooling and lighting.

More recent codes tackle green building design and performance. Hybrid air-conditioning, for example, has high potential for saving energy either through optimized operation or by integrating renewable energy sources into their function (Farraj *et al.* 2010; Fasiuddin *et al.* 2010; Ghaddar *et al.* 2010; Ghali *et al.* 2008). Building code development has reached an advanced stage, and is now considering smart systems and green designs that meet the American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE) goal of zero-energy building in the coming decade. The development of carbon-neutral Masdar City in Abu Dhabi is a process of "transforming oil wealth into renewable energy leadership", with the long-term goal of a "transition from a 20th century, carbon-based economy into a 21st century sustainable economy" (Reiche 2010).

The introduction of green building codes in some West Asian countries has been successful in reducing electricity consumption in buildings through guiding the selection of building materials and glazing choices, and setting upper limits on lighting intensity and cooling/heating (Al-Temeemi 1995; Kellow 1989). The success of this policy has been due to multiple factors including:

- a rigorous technical methodology for developing a building code responsive to a country's climate and the availability of building materials;
- a short payback period for several of the proposed energy conservation measures;
- the ability to ensure compliance through setting upper limits on the capacity of the electric supply/meter to the building unit;
- the ability to enforce building codes in the public and commercial sectors;
- awareness and understanding among the professional community of best practices to improve building performance; and
- flexibility and room for innovation in the selection and introduction of new energy conservation measures and practices that provide the contractor, owner and operator of the building with choice (Maheshwari and Al-Murad 2001).

The significance of such concepts and products is evident in their incorporation in international standards for green buildings such as the Building Research Establishment Environmental Assessment Method (BREEAM) and Leadership in Energy and Environmental Design (LEED), which use environmental assessment methods and rating systems.

The development of thermal codes and ratings enables countries to reduce operational energy consumption for heating, ventilation, air-conditioning (HVAC) and lighting over a building's life cycle, thus reducing emissions of greenhouse gases. By adopting green building envelopes that provide high insulation and air tightness, energy savings of 30 per cent and higher have been achieved in Bahrain, Jordan and Kuwait, among others (Hajiah 2010; Ministry of Public Work and Housing 2009a, 2009b; Alnaser *et al.* 2008; Maheshwari and Al-Murad 2001). The introduction of building thermal codes and ratings can be implemented through limiting the electric power supply capacity to a building, which forces designers and contractors to follow the code. Energy conservation in buildings extends beyond the envelope to include cooling systems, solar water-heating systems and energy-efficient appliances. It also calls for the greater availability of green market products and technologies associated with building services and materials.

The main challenges hampering the implementation of new building codes include higher capital costs, the need for short and long-term planning, low skill levels and both financial and strategic inadequacy. The economic feasibility of adopting building codes is well established and the costs of some envelope measures have been reduced by the use of local materials, while others such as double glazing remain expensive. Countries with moderate climates such as Lebanon and Syria can use other less expensive cooling methods such as fans and evaporative coolers. Not all GCC countries have implemented building codes, although they can afford them. Nonetheless, the market is open for transfer of green designs and services for buildings.

GCC countries are coordinating their energy regulations and encouraging the exchange of case studies of successful sustainable buildings. Some countries with moderate climates in the Mediterranean, Jordan, for example, have implemented a code or, like Lebanon, are considering guidelines while providing incentives through reduced building fees for those following the code (Chedid and Ghajar 2004). The Kuwait Energy Code for buildings is a good example that could be replicated not only by GCC countries with similar climatic conditions and a need for air-conditioning around the year, but also for West Asian countries facing the problem of drastic increases in energy demand (Box 14.7) (Hajiah 2010; Maheshwari and Al-Murad 2001). In addition, thermal insulation according to the Syrian Thermal Insulation Code is mandatory for new buildings in Syria (Ministry of Electricity 2007a). With climate change resulting in warmer

Box 14.7 Energy conservation in buildings in Kuwait

Demand for electrical power In Kuwait has progressively increased, particularly in the past two decades. Generated capacity was about 11 000 megawatts in 2009, and this is expected to rise to about 22 000 megawatts in 2020 (Hajiah 2010). As all electricity generation depends on fossil fuel resources, power plants consume about 55 per cent of Kuwait's total primary energy. In addition, 85 per cent of electrical peak power and 60 per cent of the country's total annual output is used for air-conditioning and lighting in buildings.

The Ministry of Energy in Kuwait launched its energy code for buildings in 1983 with a set of mandatory standards and regulations to enhance energy conservation and decrease the progressive negative impacts on the climate (Hajiah 2010; Maheshwari and Al-Murad 2001). The main objectives of the building code, which is applied to new and retrofitted air-conditioned buildings, are to decrease the capacity of air-conditioning systems and to reduce the peak power demand by introducing smaller units.

Table 14.1 shows the energy savings and peak-power reductions in some of Kuwait's buildings. The implementation of the energy code has saved Kuwait nearly US$10 billion over the past two decades (Hajiah 2010).

conditions in the Mediterranean region, the adoption of building codes becomes a necessity (UN ESCWA 2008).

Building codes that use local materials, green products and energy-efficient systems for cooling, heating and lighting require cooperative and well-organized planning by the government, by financial, educational and legislative institutions, and by the private sector. It is vital for the government to establish the necessary reforms and then to make them mandatory for all new and retrofitted air-conditioned buildings.

Promoting renewable energy resources

Some West Asian countries have adopted policies to promote the use of solar technologies including solar water heaters, taking advantage of the area's abundance of natural solar energy. These policies particularly address the needs of remote and rural populations with only an unreliable supply of conventional energy or none at all. This has been done in parallel with the adoption of performance standards for solar water-heating systems and awareness campaigns that demonstrate their economic, social and environmental benefits. Policies include subsidies for water heaters and tax exemptions for their manufacture; for example, Syria has made the installation of solar water-heating systems mandatory for new buildings and an assessment has to be carried out and submitted with the application for a building license (Hainoun *et al.* 2010; Kraidy 2007). In Jordan and the OPT, raw materials for manufacturing solar water heaters are tax exempt (PEC 2006; Hrayshat and Al-Soud 2004).

Solar water heaters have multiple benefits. They rely on pollution-free, inexhaustible and safe energy, and are simple, reliable, cheap and easy to install. They reduce consumption of fossil fuels and emissions of greenhouse gases. In summer months, when the entire region enjoys long sunny periods, solar water heaters can meet most of the demand for domestic hot water, drastically reducing consumers' energy use.

Solar water heating has become an increasingly common and cost-effective way of meeting domestic energy demand. *© Igor Bystrov*

The main challenges to the widespread use of solar water-heating systems include fossil fuel or electrical energy subsidies, lack of financing schemes and incentive programmes, low levels of public awareness, limited distribution and the need for a larger number of qualified personnel to design, size, install and maintain the systems. The role of government is indispensible in developing the market through establishing energy standards and labelling programmes, regulatory instruments to mandate installation in

Table 14.1 Energy savings and peak-power reductions in Kuwait

Building	Year of implementation	Energy saving (%)	Peak-power reduction (%)
Kuwait Port Authority	1996	30	20
KISR main building	2000	21	20
MEW and MPW buildings	2004	20	38
Public Authority for Civil Identification	2004	12	5
Al-Fanar shopping mall	2004	8	15
Smart Operation Strategies in eight government buildings	2007	–	40
Building Avenues Mall (Phase 1)	2009	12	2.4

Note: KISR – Kuwait Institute for Scientific Research; MEW – Ministry of Electricity and Water; MPW – Ministry of Public Works.

Source: Hajiah 2010

Sunrise in Bethlehem, which enjoys the extended periods of high solar intensity characteristic of the region. *© Pavel Skopets*

new residential and commercial buildings, innovative financing schemes, and other economic incentives. In addition, testing, certification and accreditation schemes should be introduced to make sure that the quality of the systems is acceptable and meets consumer expectations.

Box 14.8 Solar water heaters in Jordan and the Occupied Palestinian Territories

With economic growth and an increasing population, energy consumption in Jordan is expected to increase by 50 per cent over the next 20 years. Indeed, the primary energy demand of 7.5 million tonnes of oil-equivalent in 2008 is expected to double by 2020. In the OPT, around 96 per cent of the energy requirement is currently met by imports, accounting for up to 19.6 per cent of GDP (Shahin 2010). Around 38 per cent of its energy use is domestic.

The serious scarcity of fossil fuel resources leaves the OPT relying totally on imports, which reached about US$374 million in 2009 (Shahin 2010). The cost of electricity typically represents 10 per cent of household incomes, exceeding levels in neighbouring countries (Abu Hamed *et al.* 2012; Abualkhair 2007).

With Jordan and OPT, like the rest of the region, enjoying long periods of high solar intensity, solar water heating is an effective solution to meeting residential energy demands. By enhancing solar water heating, Jordan aims to increase its share of energy from renewable sources to about 7 per cent in 2015 and 10 per cent in 2020, equivalent to 200–600 megawatts of solar energy (Shahin 2010).

With the same climate as Jordan and OPT (Box 14.8), Lebanon has the potential to promote a range of solar energy applications (Ghaddar *et al.* 2006; Al-Mohamad 2001), and has recently initiated a programme for installation of solar water heaters, providing zero-interest loans to consumers (Houri 2006). Syria has plans for further promotion of solar water heating and GCC countries are currently developing their own plans.

Strengthening the legislative and institutional framework is indispensable in the diffusion of green energy technologies including solar water heaters. To overcome the barrier of high up-front costs, governments can provide financial incentives, as in Jordan, Lebanon and Syria, and/or make concessional funding available to consumers. In addition, marketing campaigns that educate the public about the economic and environmental benefits of renewable energy are vital (Ghaddar *et al.* 2006; Houri 2006; Kablan 2004). All these need to be complemented by building local capacity through training and education programmes.

Diversifying energy supply options

Emerging technologies are expected to accelerate diversification of energy supply options for the region, which has a proven abundance of renewable energy resources, especially solar and wind. Oil-importing countries such as Jordan and Lebanon have already adopted polices to diversify their fuel mix by using renewable energy technologies. The same policies are at the early stages of development in the oil-rich countries of the GCC. As indicated in Table 14.2, many countries of the region have already announced national renewable energy targets.

Table 14.2 Renewable energy targets for selected countries

Jordan	Wind: 600–1 000 megawatts; solar photovoltaics: 300–600 megawatts; waste-to-energy: 20–50 megawatts
Kuwait	Renewable capacity: 5% by 2020
United Arab Emirates (Abu Dhabi)	Electricity generating capacity: 7% by 2020
Lebanon	Renewable capacity: 12% by 2020
Occupied Palestinian Territories	Renewable capacity: 20% by 2020

Source: Ruble and Nader 2011

The benefits of a diversified energy supply include its contribution to meeting the energy needs of people and stimulating economic growth, which is of particular interest in hydrocarbon-scarce economies. Indigenous renewable energy enables oil-importing countries to secure their supply, avoid the volatility of the global oil market, reduce dependence on imports, and minimize burdens on the state budget. In addition, diversification of sources might encourage West Asian countries to share complementary energy supplies. The region is highly reliant on fossil fuels and has one of the highest carbon footprints in the world (Reiche 2010). Switching to sustainable sources of energy would help improve both environmental quality and public health while reducing greenhouse gas emissions and conserving non-renewable fossil fuel resources for future generations. Promoting renewable energy technologies would, additionally, improve energy access, particularly in remote and rural areas.

Scientists say that a species of coral in the Red Sea could stop growing by 2070 if current warming trends continue. *© Claes Torstensson*

A number of barriers often put renewable energy solutions at an economic, regulatory or institutional disadvantage, and the situation in West Asia is no exception. These barriers include a lack of or weak legal and institutional frameworks; slow and incomplete market-liberalization processes; poor capacity for managing and disseminating information about the opportunities provided by renewable energy technologies; low levels of consumer awareness leading to low demand; lack of national standards, testing and certification schemes; weak capacity in local assembly and manufacturing, distribution, installation and maintenance; and a lack of proper financing schemes together with heavily subsidized prices for oil and gas. To overcome such barriers, different countries have developed a range of policy packages, appropriate to their national circumstances, that combine both regulatory and market-based instruments.

Diversification of the energy supply has high potential for replication in the region. Several countries have already started to develop national energy strategies that include this policy and the rest are planning to do the same.

Governments have a central role to play in setting and developing national energy strategies and master plans. Public-private partnerships are vital for achieving renewable energy objectives, as private-sector investment is often necessary to overcome shortages of the capital needed for expanding energy systems. Governments need to develop an enabling environment conducive to private-sector participation. Reforming the energy sector, allowing independent power producers to enter the market, and formulating regulatory mechanisms to secure fair market competition would be major steps to achieving this.

Oceans and seas

West Asian countries lie within three different major areas: the Regional Organization for the Protection of the Marine Environment (ROPME) area, the Red Sea and Gulf of Aden, and the Eastern Mediterranean Sea. All countries have coastal areas, with the Sultanate of Oman, Saudi Arabia and Yemen having the largest, while Iraq and Kuwait have the smallest (UNEP 2010).

The different coastal and marine environments of West Asia are facing common threats due to pressures resulting from national development plans, including the urbanization of coastal zones, tourism, land use and reclamation (Figure 14.4), maritime and oil traffic, rapid industrialization and overfishing (Sheppard *et al.* 2010). In addition, due to specific socio-economic conditions, the impacts on the marine and coastal environment are more severe in some areas than others. Among the issues are the depletion of living resources, coastal zone degradation and marine pollution, while challenges include integrated coastal zone management, management of marine protected areas and gaps in information and knowledge. Since the main centres of economic activity and population are on the coast in the majority of West Asian countries, sea level rise and

related impacts of coastal inundation and increased salinity of aquifers and soil are a real risk. Bahrain, Kuwait, Qatar and the United Arab Emirates are the countries most vulnerable to sea level rise (AFED 2009). Significant warming of seawater due to the outflow of warm water from desalination plants may cause coral mortality, loss of biodiversity, depletion of fisheries, invasion of alien species and other environmental stresses. Given the rapid rates of change and the extent of pressure on the coastal environment, measures of biodiversity are not a clear indication of the background resilience of the system or the overall integrity of ecosystem function (Sheppard *et al.* 2010; Price 2002).

Indicators to measure the progress of the selected policies include:

- marine and coastal biodiversity indices;
- level of compliance with national legislation related to fisheries;
- trends in landings of marine biological stocks;
- funds allocated to research and assessment of marine biodiversity; and
- levels of compliance with measures to protect the coastal and marine environment.

The recommended policies can be grouped into four clusters:

- integrated and ecosystem-based marine planning and management;
- enhancing protection of coastal and marine ecosystems;
- controlling and combating marine pollution; and
- fisheries management.

From within these clusters, three policies were selected that have a history of implementation in most West Asian countries, that show some degree of success in ensuring the sustainable development of the coastal and marine environment, and that can be replicated and transferred. The three selected policies are:

- integrated coastal zone management;
- the establishment of marine protected areas; and
- fish stock enhancement.

Integrated coastal zone management

Integrated coastal zone management is a process of achieving sustainable development goals and objectives in coastal areas within the constraints of physical, social and economic conditions as well as within those of legal, financial and administrative systems and institutions, providing a cooperatively developed framework for the long-term conservation and management of coastal and marine resources (PAP-RAC 2011). One of its fundamental requirements is a strong set of policies for the management of the coastal environment and its resources, backed by appropriate legislation or a similar legal base. Many West Asian countries have developed strong policies and the legal base also exists in Lebanon, Qatar, Saudi Arabia, United Arab Emirates and Yemen (Tortell 2004). However, there appear to be some difficulties in moving on to the next step, which is implementation. Among the different policies and policy tools that form the framework of integrated coastal zone management are an integrated coastal planning process backed by a planning/management authority, or its equivalent, and a coastal planning/management office; a coastal zone monitoring programme; an environmental impact assessment; and implementation of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities at a regional level.

Kuwait's heavily populated low-lying coast is particularly vulnerable to potential sea level rise. *© Øystein Lund Andersen*

It is important to mention that an integrated approach is essential if national and regional, rather than simply sectoral, objectives and targets are to be achieved. Integration is required between central and local governments; various sectors in government, administration and the community; and governments, civil society and private sectors. In addition, countries sharing the same water body need to adopt regional approaches for policy implementation.

Through the rational planning of activities, integrated coastal zone management facilitates the sustainable development of coastal areas by ensuring that the environment and landscapes are taken into account in harmony with economic, social and cultural development. Benefits include the preservation of coastal zones for current and future generations; ensuring the sustainable use of natural resources, particularly with regard to water; ensuring the preservation of the integrity of coastal ecosystems, landscapes and geomorphology; and preventing and/or reducing the effects of natural hazards and in particular of climate change.

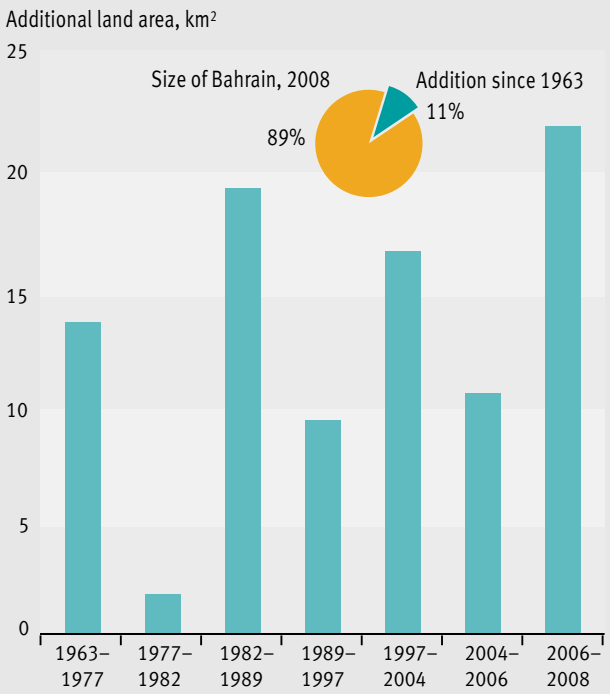
The integrated approach improves coherence between public and private initiatives, and between all decisions made by public authorities at the national and regional levels that affect the use of the coastal zone. Related institutional strengthening can also help communities adapt to the impact of climate change. The region has recently witnessed a new trend in the integration of ecotourism policy in the framework of integrated coastal zone management in Jordan, with a project developed in 2010 by the Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA) and the Aqaba Special Economic Zone Authority, focusing on the enhancement of ecotourism based on coral reefs and other coastal habitats in the Gulf of Aqaba. Such a policy can enhance efforts to protect the coastal and marine environment.

Before an effective integrated resource management system can be established, some barriers need to be faced. The most salient of these can be overcome by the establishment of an appropriate management system and the development of environmentally sound policies for, amongst others, land reclamation, urbanization and fisheries. Many West Asian countries have significant reclamation activities with adverse impacts on coastal and marine ecosystems and their services. These activities sometimes aim to improve land availability, as in Bahrain (Figure 14.4), or to provide vast recreational opportunities. An effective integrated management policy that improves public awareness and enforces existing laws related to the use and protection of natural resources can help to overcome these limitations.

Programmes for the integrated management of coastal zones can be replicated either under different sectoral programmes or within the framework of an ecosystem approach, or under a management authority or its equivalent, which would necessitate coastal planning offices. Many regional and international organizations are involved in the transfer of know-how and knowledge between different countries (Box 14.9).

Integrated management of the coastal and marine environment cannot occur under the current arrangements of many West Asian countries, where responsibilities and activities are divided between a number of ministers and organizations. Enabling factors include preparing integrated marine and coastal development plans that incorporate the principles of multiple uses and an ecosystem approach, establishing institutional arrangements for marine and coastal planning, enforcing the outcomes of environmental impact assessments, and building capacity for a better understanding of the marine environment.

Figure 14.4 Reclaimed land in Bahrain, 1963–2008



Note: Land reclamation periods vary.

Source: Zainal 2009

Box 14.9 Coastal and Area Management Programme (CAMP) in Lebanon

The CAMP-Lebanon project, part of the Mediterranean Action Plan (MAP), was implemented within UNEP's Coastal Area Management Programme. It aims to improve sustainable coastal management and integrates environmental concerns into development plans (Mehdi 2004). CAMP-Lebanon addresses the conservation of natural coastal resources in the area between Damour and Naqoura, an 8-km-wide strip of land, by applying concepts of sustainable development as well as methods for integrated coastal and marine management alongside economic and social development. The project area was defined at two levels:

- the national coastal area to the south of Beirut; and
- the three municipalities of Damour, Sarafand and Naqoura as the operational area.

Thematic activity on integrated coastal area management was split into several components:

- land-use management;
- cultural heritage and sustainable development;
- the status of environment, agriculture and fishery;
- the socio-economic situation;
- a legal framework; and
- a national strategy.

The most important elements of CAMP-Lebanon have been developed and articulated in the national strategy for integrated coastal area management and the project has developed a crucial legal tool, the proposed law on integrated coastal area management.

Establishment of marine protected areas

Marine biodiversity in the region faces extensive threats including the unprecedented pace of recent construction along and off the coastline. Together with destructive and wasteful fishing, these developments seriously threaten coastal habitats in most West Asian countries (UNEP 2010). Introducing financial incentives through integrating the economic benefits of ecosystem services into development costs is one way to overcome marine biodiversity loss. Marine protected areas are another effective tool for biodiversity conservation, habitat protection and fisheries management, acknowledged at national, regional and international levels. Since 2009, most West Asian countries have had biodiversity strategies in place supported by UNEP's implementation programme and projects funded by the Global Environment Facility (GEF), especially in Lebanon, Iraq, OPT, Syria and Yemen.

Three policy options have been adopted at the national level to speed up the process of reaching agreed goals:

- rehabilitating degraded habitats and conserving biodiversity;
- documenting marine life and biodiversity; and
- establishing multi-purpose protected areas in various marine and coastal ecosystems.

Marine protected areas require a well-defined conservation plan backed by legislation, a monitoring programme to ensure sustainability, and effective partnership between different stakeholders, supported by research into best management practice by such regional marine and coastal programmes as the Regional Organization for Protection of the Marine Environment (ROPME) and the Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA). The benefits of establishing marine protected areas are the conservation and improvement of biological diversity; the maintenance of essential ecological process within the natural system; the sustainable management of marine renewable resources including fisheries; and the protection and restoration of degraded habitats while facilitating the implementation of an ecosystem approach (Box 14.10).

A researcher documents information during a coral reef resilience survey. *© J Tamelander/IUCN*

Fish stock enhancement

Another policy cluster addresses biodiversity conservation through integrated fisheries management, an initiative aimed at tackling the issue of how fish resources can best be shared between competing users within the broad context of ecologically sustainable development (Shing 2001). There are several marine fisheries management policies within the cluster, currently practised to overcome management obstacles and problems facing the fishery sector.

Data clearly show very substantial declines in commercial fish over the past 10–20 years (Sheppard *et al.* 2010), while Bishop (2002) and Sheppard *et al.* (2010) have demonstrated a link between the permanent loss of inter-tidal and shallow sub-tidal nursery grounds with declining fish and shellfish catches. Marine stock enhancement, an approach that addresses these

Box 14.10 Marawah Biosphere Reserve, Abu Dhabi, United Arab Emirates

The Marawah Marine Protected Area, the largest in the region with a total area of 4 255 km², became the first UNESCO Marine Biosphere Reserve in the region in 2007. Marawah itself, just one of 20 islands that make up the protected area, is flanked by Jarnain Island to the north, Abu Al Abyad Island to the east, the mainland to the south and Sir Baniyas to the west. The protected area is a representative example of the Gulf region, containing coastal areas, salt flats (*sabkhas*), shallow waters and shallow islands as well as seagrass habitats. The island hosts a significant population of dugongs, four species of marine turtle, 70 species of fish, and coral reefs and expanses of mangrove (*Avicennia marina*) that are important habitats for many terrestrial and marine species.

Resident and migratory bird species such as ospreys, sooty falcons and several tern species, are part of the ecosystem, with bottlenose and humpback dolphins also found in the surrounding waters, making the area important for its biodiversity. Preserving the natural diversity and quality of the coastal and marine environment is what the reserve aims to achieve. It has established a 12-member marine ranger force to carry out surveillance and control programmes, essential infrastructure has been procured and maintained, and the rehabilitation of a mangrove site on Marawah Island has begun. The island is also of great cultural and archaeological significance, with more than 20 sites dating back 7 000 years to the Stone Age (SCENR *et al.* 2008).

issues, involves a set of management measures for releasing farmed organisms to enhance or restore fisheries. Engineered artificial reefs, which help to restore lost or degraded marine and coastal environments, can also enhance re-stocking of depleted commercial fish and shellfish.

Such practices, including sea ranching, stock enhancement and restocking, are widespread, often controversial, and have varying levels of success (Lorenzen *et al.* 2010). Fish stock enhancement, one of the successful policies, involves the annual release of tens of thousands of fish fingerlings in different parts of the territorial waters.

The benefits of this policy are mostly in rehabilitating depleted fisheries, and also include the potential to reduce the time needed to rebuild some severely overexploited ones or improve the productivity of other, healthy fisheries. Only if large-scale fish releases are completed and the effects on the fisheries measured and documented will it be possible to quantify and value the economic benefits of the programme.

Stock enhancement, which can be very costly and absorb major resources, is not a substitute for fisheries management (AFED 2009). Understanding both the biology and the culture technology of a species is critical to the success of stock enhancement programmes, the impacts of which may be insignificant and can be extremely difficult to assess. If not carefully managed, stock enhancement programmes can affect the gene pool of wild stocks and there can be complications when exotic species are introduced as part of the enhancement programme.

The potential for restocking and stock enhancement stems mainly, but not entirely, from the development of technology to produce juveniles of a wide variety of coastal fish and shellfish in hatcheries (Bell *et al.* 2006). Restocking and stock enhancement

A school of striped mackerel feeding in the Red Sea. *© Dirk-Jan Mattaar*

programmes, in which West Asian countries have developed considerable expertise, are applied in intricate human-environment systems involving dynamic interactions between the resource, the technical intervention and the people who use it, making replication complex (Box 14.11).

Stock enhancement programmes should be considered within the broader issue of fisheries management (Shams and Uwate

Box 14.11 Fish stock enhancement in Bahrain

Bahrain is an island state and its people have a strong affinity with the sea. Landings of some preferred fish such as grouper have declined dramatically in the last 10–20 years. One successful management policy that is being followed on an annual basis is the enhancement of fish stocks, which have suffered over the years as too many fishers catch too many fish. In 1994, tens of thousands of orange spotted groupers were successfully released; in 1996 and 1997 stock enhancement activity focused on the release of yellow-finned black sea bream and sobaity sea bream.

Several fish species such as white-blotched grouper and striped grouper, parrotfish and sobaity sea bream were rarely seen in fish markets before the start of the release programme in 1994, but the annual release of different species has enabled the refinement of the technology and reduced mortality and costs. The General Directorate of Fisheries, for example, has recently made arrangements with Durat Al-Bahrain, in the southwest of the Kingdom, to deploy different types of artificial reefs to be used for the release of sobaity sea bream and grouper fingerlings.

However, as a result of insufficient funding for the fish release programme, modern fish tagging technology could not be applied to assess its success. Some people, however, have reported large quantities of small groupers and sobaity and shaem sea bream in the market just after fish release. Additionally, in the post-release period, actual grouper landings were high. This suggests that the releases have had a positive impact on the fishery, especially on landings (Zainal and Abdulqader 2009; Shams and Uwate 1996).

1996). Enhancements affect complex fisheries systems and, to be successful, must contribute to a broad set of biological, economic, social and institutional management objectives (Lorenzen 2008), so it is important to compare the costs of the programmes with the benefits. Finally, public cooperation is very helpful.

CONCLUSIONS

Environmental policies in West Asian countries have been developed over the past two decades and continue to progress; however, they need to become proactive rather than reactive. Additionally, environmental governance, rather than merely focusing on environmental policies, needs to take account of societies' common goals and engage with various stakeholders in the design and execution of policies. The integration of sectoral policies is also important. Regional environmental governance is crucial for the West Asia region as the countries share common environmental conditions. There is also a need for clear, integrated policies, not just targets, aimed at shifting the region from current long-established economic systems towards a green economy.

Failure to introduce sectoral policy integration, policy mixes and regional integration will intensify currently unsustainable consumption and production patterns, especially for energy, water, food security and marine resources, with the potentially grave consequences of natural resource depletion and increased pollution, which in turn impact human health and well-being.

The region's marginal biophysical characteristics, population growth, urbanization and socio-economic policies, coupled with high rates of natural resource consumption, are the main drivers of environmental problems. Insecurity and conflicts are also among the regional drivers of environmental degradation. These are further exacerbated by frequent droughts and climate change.

There is a general lack of coherent environmental data and information tools in the West Asia region. The systematic collection, processing, analysis, production, dissemination and exchange of environmental information would lead to more robust decision making and proper policy formulation and implementation. Trends show the need to make use of additional measures to improve enforcement and compliance processes. Moreover, there is a significant need for regular environmental reporting in all West Asian countries as well as greater public and private participation (UNEP 2010).

The involvement of the public in the environmental regulatory systems remains low because people are neither well informed nor encouraged to participate. Although access to general environmental information has recently improved, much effort is still required to achieve real public participation in environmental management.

Several countries in West Asia undertake enabling initiatives to facilitate the implementation of green technologies to reduce pollution and waste, to conserve energy and to rationalize water use. Most of the countries have developed policies to integrate cleaner production concepts in the industrial sector and established centres to help build capacity. However, the effectiveness of policy implementation is unsatisfactory.

Proper allocation of authority within environmental governance needs to be enhanced and environmental institutions empowered. Strengthening the role of various stakeholders, including non-governmental organizations, the private sector and local communities, would improve execution, monitoring, reporting and achieving the collective goals as well as increasing cooperation at national and regional levels, and would lead to better implementation of environmental policies.

Many policy options could be seen as inducing the necessary structural changes to achieve better environmental governance in the region. Such options include the integration of environmental impact assessment in decision-making processes and development plans, the decentralization and development of institutions, and improving access to environmental information to improve public engagement.

The challenge for the water sector lies in achieving sustainable water development through balancing supply and demand, with priority given to meeting the MDG 7c targets. Water resources policy should be coordinated with agriculture, environment, housing, and social and economic policies to achieve internationally agreed goals. The updating of water legislation and strengthening of intra-institutional coordination mechanisms, the free dissemination of information and the enhancement of stakeholder participation are necessary to the comprehensive and integrated management of the water sector. Essential management measures include greater efficiencies in water use, especially in the irrigation sector; protecting water sources from pollution and depletion; and deploying adequate financial and qualified human resources. The integrated water resources management approach provides an innovative planning tool to overcome existing obstacles and address future

Box 14.12 The Council of Arab Ministers Responsible for the Environment (CAMRE)

Within the framework of the League of Arab States (LAS), CAMRE was established as a high-level institution to ensure the proper coordination of environmental policies in the Arab region, which includes all the countries of the West Asia region. CAMRE aims to identify major environmental problems, set priorities and address issues related to a sustainable environment. CAMRE has played, and continues to play, a major role in the coordination of environmental policies of the Arab countries at regional and global levels and has ensured a certain level of replication of environmental policies among West Asian countries. In addition, CAMRE ensures that all LAS institutions are addressing environmental issues in a comprehensive and harmonized manner.

water sector challenges. Successful national formulation and application of an integrated management approach can be replicated across the region given the homogeneity of its natural, physical, social, economic and cultural settings.

Screening and analysis of policies implemented to prevent and mitigate land degradation in West Asia show that the region is in line with the main goal of the Johannesburg Plan of Implementation, Paragraph 40 (WSSD 2002). However, the main challenges are the formulation and implementation of bottom-up policy to encourage community participation, and the enhancement of regional cooperation through projects to conserve natural resources, increase land productivity, and prevent and mitigate soil erosion and dust storms. Integrated land, agriculture and water policies include modern agricultural techniques, sustainable agricultural production systems and afforestation to achieve relative food and water security.

Featuring three integrated wind turbines, the Bahrain World Trade Center boasts the world's most sophisticated skyscraper energy recovery system. *© Klaas Lingbeek- van Kranen*

Policies focused on the energy efficiency of buildings have been successful in the development of green building codes and expanding the market for innovative green services and efficiency-oriented companies, which attract professional participation to improve practices. The public at large understands the policy concepts and has the awareness to implement efficient practices as long as the building fabric options and systems are economically justifiable and mandated by governments. Replication of building and systems energy policies has a high success rate due to the similarity of climates and needs, and the high level of motivation for increased development, innovation, and investment for the greening of the building sector by professional, private and government entities.

Energy policies related to power generation have a more top-down approach that relies on country goals to increase the share of energy production from clean sources. Decision-making tools to decide on the energy generation mix have to include environmental impact assessments. West Asian countries are looking at various options including nuclear energy, as renewable energy generation is still not seen as cost-effective compared with the conventional resources that are abundant in GCC. Energy policies cannot be developed independently of freshwater policies. The challenge lies in how to optimize the development of policies that address the demand of both energy and water at minimal cost to the environment. Cooperation between Arab countries to complement each others' energy needs would have more success where alternative sources of energy generation are used.

Policies for oceans and seas are clustered around the integration of management tools in order to achieve sustainable development of the coastal and marine areas. West Asian countries should confirm their commitment to an ecosystem approach through continued support for the integrated management of the coastal and marine environment. To this end, policy implementation tools such as strategic social and environmental impact assessments should be considered during project planning.

The development and improvement of management systems for marine protected areas and regional networks are important for conservation of the region's biodiversity. Global climate change will exert additional impacts on the coastal and marine environment, and regional adaptation strategies should take into consideration the environmental, social and economic differences between countries. The region has a very high potential for the transfer of several policies to ensure the sustainable development of the coastal and marine environment of the West Asia region.

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