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FAO REGIONAL CONFERENCE FOR NEAR EAST

Thirty-fifth Session

Muscat, Sultanate of Oman, 2–4 March 2020

Ensuring environmental sustainability in the context of water scarcity and climate change

Executive Summary

The member countries of the Near East and North Africa (NENA) region requested a background paper on how to achieve greater environmental sustainability in agriculture in the face of water scarcity, climate change, land degradation and the deterioration of the ecological setting. This paper addresses the interactions between agriculture and the environment in the region and the impacts of these interactions on farming sustainability and on the integrity of the ecological setting and services. The progressive intensification of agriculture and resource use across NENA has contributed to widespread degradation of land, water and biodiversity, and these effects are being intensified by climate change.

Water scarcity is by far the most critical problem of the region, and is worsening with climate change. Over-abstraction of water is leading to widespread depletion, quality deterioration and saline intrusion. FAO's Regional Water Scarcity Initiative has built evidence and developed tools to address water scarcity, and promoted the necessary cross-sectoral policy dialogue on water and food security in the region. Its action needs to be continued and strengthened at country level. In addition, the misuse of pesticides and fertilizers is increasing groundwater and surface water pollution, as well as soil pollution. Across the region, soils have degraded, with declining levels of soil fertility and increased salinization. Overexploitation of rangelands and forests has contributed to desertification and biodiversity is being harmed by unsustainable agricultural practices. A range of policy responses are available and have been tested in the region and beyond. These must be considered and adapted to local realities. They include enhanced agriculture–environment policy coherence, the adoption of international standards for sustainable agriculture and environmental protection, investing in better evidence, developing incentive mechanisms for sustainable land and water management and environmental conservation, ensuring that public investment complements and engages private sector energies and investment, and specific approaches to enhance the sustainability of water management and rainfed agriculture. Regional cooperation has an important role to play in moving the region towards sustainable agriculture.

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Suggested action by the Regional Conference

The Regional Conference is invited to:

- acknowledge the results of the Regional Water Scarcity Initiative and call for the strengthening of efforts at national level towards improved water governance in support to food security;
- acknowledge the critical challenges posed by agriculture to the environment and biodiversity and the threat of climate change in the region, and encourage the adoption of sustainable and climate smart agriculture practices through appropriate policies, strategies and investments;
- support the development of national capacity to monitor the environmental aspect of agriculture through the use of Sustainable Development Goals (SDG) indicators with support from FAO.

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The interdependence of agriculture and the environment

1. Agriculture and the environment are interdependent as the integrity, value and quality of soil, water and biodiversity depend on sustainable agricultural practices.
2. For sustainable agriculture and a healthy environment, these mutual relationships must be understood and protected, and this is recognized in the SDG target for sustainable agriculture. SDG Target 2.4, regarding sustainable agriculture, covers the three dimensions of sustainable agriculture, economic, social and environmental. Under the environmental dimension, the SDG target highlights the key environmental factors for productive and sustainable agriculture: (1) sustainable water use; (2) soil health and prevention of soil degradation; (3) conservation of biodiversity through the use of biodiversity-friendly agricultural practices; and (4) management of the risk from fertilizers and pesticides.
3. Today's agriculture has been adapted to have many positive impacts on land and water resources and on the environment. Historically, the region's landscape has been formed and its natural resources protected by well-adapted traditional farming practices such as terracing, the training of watercourses and drainage. Today in the NENA region, not only have agricultural policies, incentives and technology increased land and water productivity enormously, they have also played a vital role in land and water management and conservation. Irrigation infrastructure plays a key role in water resource management, providing for flow regulation and flood protection. Agriculture has been adapted to use lower quality water, helping to alleviate water scarcity whilst protecting the environment. In Egypt, over 10 percent of freshwater withdrawals are reused, officially and unofficially, in the form of drainage water, without deteriorating the salt balance. Saline water is used to irrigate salt-tolerant crops whilst protecting soil resources and water quality. Several countries in the region reuse considerable quantities of treated wastewater in agriculture. For example, Jordanian farmers gave up fresh water in exchange for treated wastewater from the As-Samra wastewater treatment plant, and have adopted practices adapted to lower-quality water.
4. Nonetheless, the progressive intensification of agriculture and resource use across the NENA region has contributed to the degradation of land, water and biodiversity. Agricultural policy has promoted mechanization, monocropping and heavy use of fertilizers and pesticides, resulting in environmental risks and costs, particularly affecting soil fertility and structure and contaminating soil and water. Land policies and poor tenure have driven expansion into marginal lands, with resulting land degradation. Water and agricultural policies have promoted wholesale agricultural water abstraction and harmed downstream ecology. The costs of degradation have been considerable. It is estimated that land degradation costs Morocco 0.4 percent of GDP annually and Iran as much as 1.7 percent each year. In Tunisia, water depletion and water quality deterioration costs about 0.6 percent of GDP, and 1.2 percent of GDP in Morocco. Environmental policy has been reactive rather than proactive and often does not achieve significant change on the ground.
5. All these effects are being intensified by climate change. Climate change is already a reality in the NENA region and is expected to amplify the challenges of agricultural and environmental sustainability. In many areas, precipitation will decrease while uncertainty regarding the timing and frequency of rainfall will increase. The temperature in the region, which is already rising, is expected to continue to increase until the end of the century. Agriculture will experience higher temperatures during the growing season and more frequent and intense heat waves affecting one-third of the land area.
6. These changes will have considerable, largely negative, effects. The effects on water resources will include the reduction of soil moisture, run-off and groundwater recharge. In some areas, run-off is predicted to decrease by as much as 40 percent. Under a '2 to 4 °C warmer' scenario, annual water discharge, already critically low, is projected to drop by up to 45 percent. Sand and dust storms are expected to become more frequent and more intense, and flood events will multiply and become more severe. The Arabian Peninsula has already experienced damaging floods and areas such as the Nile Delta in Egypt and Oman are likely to suffer flooding and seawater intrusion caused by sea-level rise.

7. Droughts are expected to occur more frequently in the region (increasing in frequency by 20 to 60 percent by 2100) and to last longer. Between 1998 and 2001, Iraq, Jordan, Morocco and Syria experienced severe and protracted drought, with extreme impacts on food production. In Jordan and Syria, for example, cereal production fell by 40 percent and animal production fell by 35 percent. Agricultural production, food security and farmer incomes are at risk. Half of the NENA region croplands are classified as highly vulnerable and a 10 to 20 percent reduction in crop yields is expected by 2050 due to various impacts of climate change. Pastoral systems will suffer from the decline of the water and food resource base due to recurrent droughts. Small-scale farmers and pastoralists are the most vulnerable because of their direct dependence on climate and natural resources and their relative poverty.

8. The Arab region faces the largest expected GDP losses from climate change-induced water scarcity in the world. Figure 1 shows the predicted impact of climate change-induced water scarcity, as a share of regional GDP in 2050. (The range indicates the fact that different policies will lead to different results.)

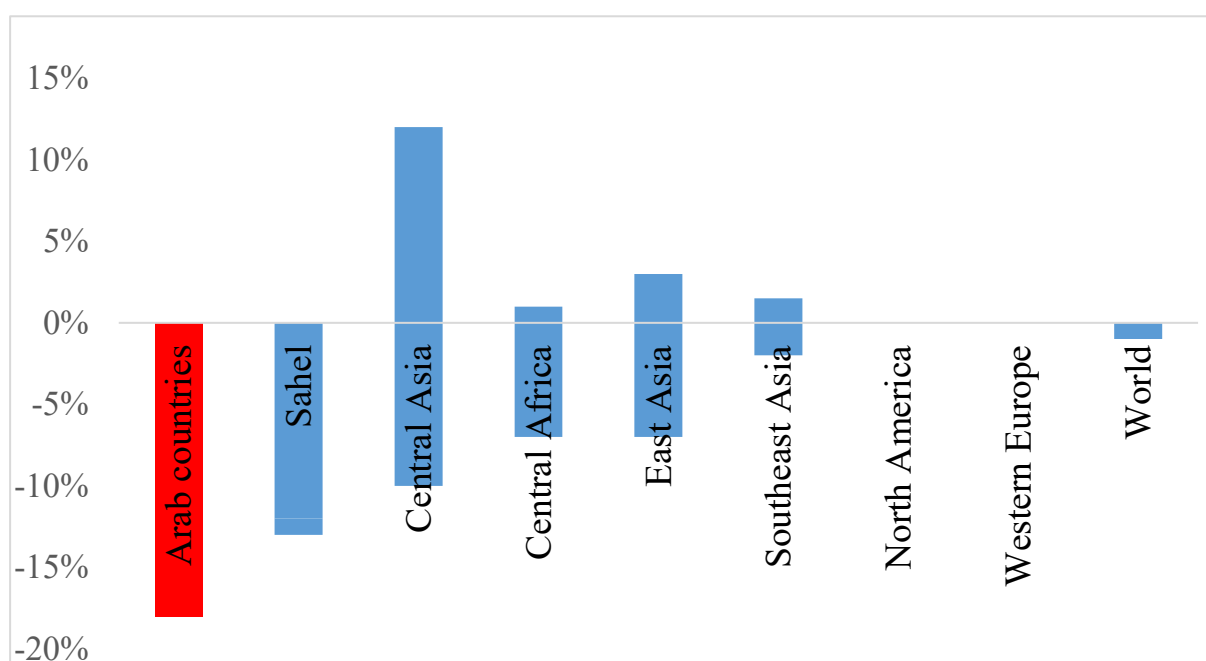


Figure 1: Impact of climate change-induced water scarcity, as a share of regional GDP in 2050.

Source: World Bank. 2016. *High and dry: Climate change, water and the economy*. Washington, DC. (Estimate for the Arab region excludes Mauritania, Somalia and the Sudan.)

9. In the past, food security policy helped drive degradation, but awareness of the need for change is growing. Because of food security concerns and the NENA region's low level of food self-sufficiency, food security policies have prioritized domestic production, particularly of cereals. This led not only to economic value foregone but also to the spread of production into marginal areas with resulting costs in terms of land degradation, biodiversity loss and desertification. Now, policies are progressively shifting to favour domestic production where comparative advantage can be combined with environmental sustainability, as with integrated approaches to sustainable rainfed cropping in semi-subsistence farming systems in countries like Mauritania, the Sudan, and Yemen. For other countries and farming systems, a comparative advantage approach to agriculture typically supports exporting high value produce to pay for cereal imports, as in Jordan or Morocco, or simply for import substitution, as with the countries of the Arabian Peninsula. At the same time, awareness of environmental issues has risen within both governments and civil society, and economic growth is providing some political and fiscal headroom to begin addressing environmental issues.

Agriculture has had negative effects on water resources, affecting the sustainability of agricultural production.

10. NENA is the driest and most water-scarce of the world's regions, with 6 percent of the global population but only 0.6 percent of the world's accessible renewable water. Annual water resources per capita (600 m³) are only one-tenth of the global average, having plummeted from 3 500 m³ fifty years ago due to population growth. Seven NENA countries are today classified as extremely water scarce (less than 100 m³ of total renewable water per capita). The NENA region has developed 80 percent of its available water resources, compared with 30 percent for the next region, South Asia, and a worldwide average of 10 percent.

11. Agriculture is the dominant water user, using 85 percent of the available resource. This has negatively affected other sectors and the environment. Irrigation water withdrawals are leaving the NENA region's fast growing cities and businesses short of water, affecting water availability downstream and discharges to the sea or lakes, reducing environmental flows and harming the downstream aquatic ecosystem, landscapes and riverine ecology. Also, large dependence on surface irrigation methods results in high non-productive water losses through evaporation. The Jordan River no longer sustains the precious asset of the Dead Sea. The Tigris and Euphrates rivers are dwindling towards minimum environmental flow levels. The Iraqi marshes have shrunk to 14 percent of their original size.

12. In many countries, past policies and investments over-allocated surface water to agriculture. At the same time, institutional, regulatory and incentive frameworks often did not optimize agricultural water use. The problem is worsening, as growing aridity increases the demand and as alternative uses demand more water. In response, most NENA countries have sought to improve agricultural sustainability through integrated approaches to water resource management, with mixed results.

13. In many countries in the NENA region, there are gaps between actual and attainable yields. In irrigated agriculture too much emphasis is given to increasing irrigation efficiencies, often resulting in increasing water use rather than saving water. By monitoring evapotranspiration and biomass production, land and water productivity can be assessed and productivity gaps can be identified. In this respect, the use of remote sensing techniques can help identify areas with potential for more sustainable and efficient use of natural resources.

14. Over-abstraction of groundwater is leading to widespread depletion, quality deterioration and saline intrusion. Examples of groundwater overuse include the exhaustion of aquifers in Yemen and plummeting water tables in many countries across the NENA region, such as Morocco, Syria and Iran. Groundwater over-abstraction is also drying up springs and oases, as with the mountain aquifers in Palestine and the Azraq Oasis in Jordan. In Syria, the Khabour karstic springs have been over-exploited, drying up the river. Where coastal aquifers are over-pumped, as in Gaza Strip and Tehama (Yemen), seawater intrudes and the aquifer becomes progressively saline. The common cause of this is the free-for-all race to obtain the maximum amount driven by the absence of effective groundwater governance mechanisms.

15. Recovering control over groundwater once it has been lost or polluted is very hard, but there is experience across the region and globally with a combination of measures. These include technical measures, such as efficient, water-saving technology¹; supply side measures, such as recharge; economic measures, which address the incentive framework on the cost side (particularly energy prices) and on the revenue side (for example, trade policy); and institutional measures, which develop governance and regulatory frameworks. Such frameworks are based either on regulatory measures, as in Jordan, or on decentralization and local participatory governance supported by monitoring,

¹ With regard to such technologies, governments should avoid the Jevons paradox – making resource use more efficient, thus increasing profitability and fostering more resource use instead of less. There are cases where schemes to increase water productivity have inadvertently increased water use.

information, education and communication, an approach which has been successful in Egypt in some localities, such as Salheia in the East Delta. A new governance model is being implemented in Morocco, promoting 'groundwater contracts' to protect the aquifer from over-exploitation and recharge the water table.

16. Groundwater, surface water and soil pollution are increasing. Fertilizer and pesticides are key to higher productivity, but their misuse has resulted in water and land pollution. Nitrates and pesticides seep into groundwater or enter water courses through drainage or run-off. Persistent organic pollutants remain in soils and in the food chain, where they can intoxicate humans. Organic insecticide residues, including DDT, occur in the Nile, with high concentrations in sinks such as Lake Manzala.

17. Policy, the incentive structure and lack of guidance have driven overuse of such chemicals, and monitoring and regulation generally remain weak. The resulting levels of fertilizer use are very high. Egypt uses an average of 650 kg/ha of fertilizer, five times the world average. Lebanon uses 330 kg/ha, more than double the global average. As production has intensified, pests have multiplied and unregulated use of pesticides is on the rise. The Sudan has increased pesticide consumption tenfold without adequate management or regulation. The Strategic Approach to International Chemicals Management (SAICM), adopted in the region in 2005, has had weak influence on laws and scant impact on regulation and enforcement.

18. Best practices to reduce chemical pollution involve strengthening regulatory approaches and simultaneously implementing integrated, environmentally-friendly approaches to both fertilization and pest management. Environmentally-friendly integrated nutrient management includes managing the nitrogen load and promoting optimal plant uptake, together with soil management. The International Code of Conduct for the Sustainable Use and Management of Fertilizers, endorsed in August 2019, provides a locally adaptable framework of good practice. Similarly, integrated pest management practices (IPM) include monitoring pest levels in order to minimize pesticide use and consequent pollution, promoting natural predators and developing pest-resistant varieties.

19. Increasing aridity is leading to intensified demand for water. Climate-smart agriculture, an enabling environment, effective regulatory frameworks and other factors that support production and agrifood systems can also increase resilience and promote climate change adaptation and mitigation. These factors can be adapted to suit the specific contexts of vulnerable areas throughout the NENA region. The focus is on new and adaptive technologies and cropping patterns and on increased water productivity, supported with improved monitoring and knowledge dissemination. Techniques include: soil and water conservation; reducing non-productive evaporation; and integrated crop, soil and water management.

Land and soils have been harmed by unsustainable farming and pastoral practices

20. Across the region, soils have degraded and soil fertility has declined. Many of the region's soils are naturally fragile and low in fertility. Of NENA's 500 million arable hectares, only 17 percent are highly productive (see Figure 2).

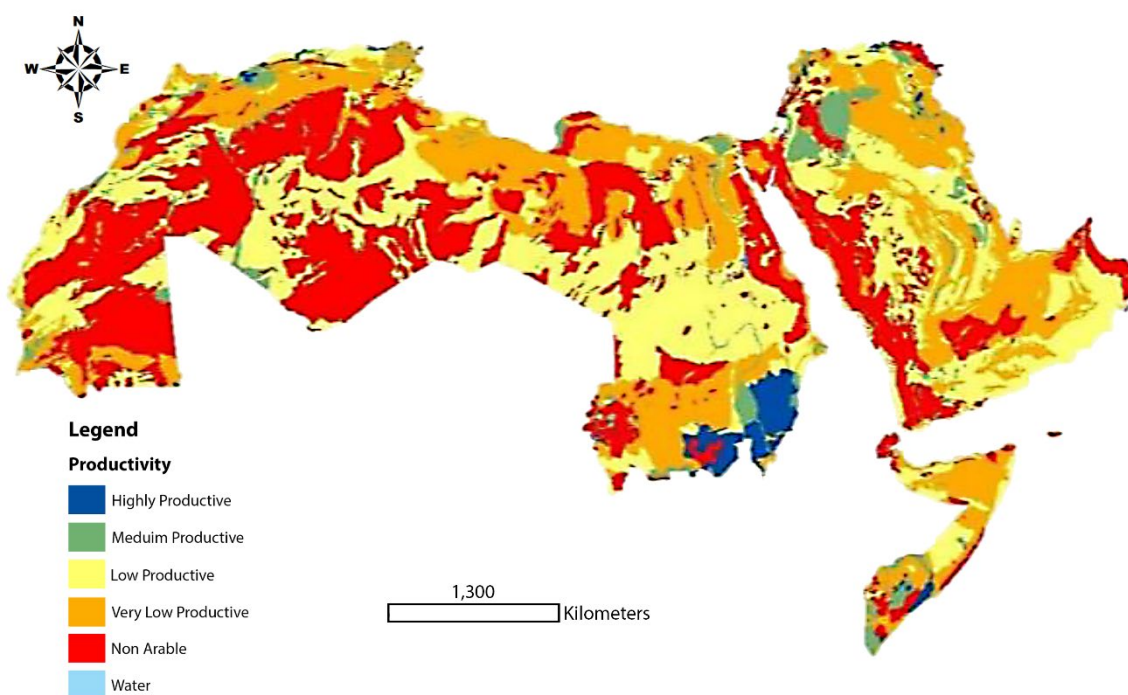


Figure 2: Soil productivity of the NENA Region.

Source: ESCWA. 2017. Arab Horizon 2030: Prospects for enhancing food security in the Arab Region. Beirut.

21. Unsustainable land management has worsened the problem. Loss of the soil's protective cover and lower soil quality reduce productivity and affect broader ecosystem services by causing hydrological disturbances, loss of biological diversity both above and below ground, and reduced soil carbon stocks and associated increases in CO₂ emissions. The low level of soil organisms also reduces the ability of the soil to filter out pollution.

22. Land losses due to degradation in North Africa are amongst the highest in the world. Today, the Desertification Control Programme Activity Centre, established by the United Nations Environmental Programme, classifies 73 percent (22 million hectares) of the 30 million hectares of rainfed cropland in the Near East as degraded. In the Maghreb sub-region, land degradation rates are also high, 69 percent in Morocco and Tunisia and 93 percent in Algeria. The economic costs of land degradation are high, USD 9 billion a year across the NENA region, between 2 and 7 percent of national GDP.

23. The main soil threats are erosion, salinity/sodicity, soil contamination, and organic carbon and nutrient depletion. (Typically, only half of the nutrients that crops take from the soil is replaced.) Major causes of soil degradation in the region are: excessive irrigation and poor drainage; wind and water erosion; water logging; over-grazing; loss of soil cover; sand encroachment; and overuse of herbicides, pesticides and chemical fertilizers. With the rapid rate of urbanization, today two-thirds of NENA's population lives in cities, significant quantities of arable land are being lost to construction. In Lebanon, the urban footprint doubled between 1962 and 2000, while agricultural land shrank by 35 percent. In the Nile Delta, the urban area tripled in just three decades (1988–2017), largely expanding onto agricultural land.

24. There are many technical solutions for an integrated approach to soil amendment. Organic fertilizer can increase soil fertility and improve soil structure, water retention and biological activity. Methods include incorporating crop residue and animal manure, and biological nitrogen fixation, using legumes for example. Minerals like rock phosphate and lime can also be incorporated. There are also

agronomic solutions, including diversified planting, sustainable crop rotation, agro-forestry and zero tillage (for which the International Center for Agricultural Research in the Dry Areas [ICARDA] has pioneered affordable seed drills). Knowledge-based policy-making is essential. In Tunisia, for example, the Land Degradation Assessment in Drylands framework (LADA) of the Food and Agriculture Organization of the United Nations (FAO) has been applied to develop the information base for policy and programmes. The Amman-based Institute for Digital Soil Mapping is developing soil capability mapping. It is important that the interventions considered be assessed within an integrated approach, to ensure synergy and optimal use of selected solutions.

25. Soil salinization has increased, especially in soil under permanent irrigation. Economic losses from salinity across the region are estimated to cost USD 1.6 billion annually, up to USD 2 750 per hectare of affected land. For instance, 45 percent of Syria's irrigated area suffers from salinization. In Egypt's Nile Delta, seawater intrusion is increasing soil salinity. In Oman, soil salinity is increasing due to use of saline groundwater.

26. Reducing soil salinity requires efficient water use and tactical leaching to maintain the correct salt balance, together with drainage water management. Egypt is a leader in drainage practice and has achieved greatly reduced salinity and waterlogging and good rates of return from drainage investments. The integrated planning tool DRAINFRAME, developed in Egypt, optimizes drainage investments within an integrated system.

27. Mismanagement of NENA's extensive rangelands, marginal cultivated lands and forests has led to widespread degradation and contributed to desertification. These lands are vital not only for providing feed for livestock and crops for family consumption but also as wildlife habitats, for retaining water, and for conserving plant genetic resources. However, the mismanagement of these fragile ecosystems readily results in loss of biodiversity and water retention capacity, invasion of alien species, carbon emissions and reduced productivity.

28. Region-wide, vegetation cover has decreased from 3.7 percent of the total land area in 1990 to 2.8 percent in 2013, while livestock numbers increased 25 percent. Oman has seen unsustainable animal overstocking, with the number of camels in Dhofar doubling over the decade to 2015. In Morocco, semi-arid rangeland has been extensively ploughed for unsustainable annual cropping. Forest cover, only 2.4 percent of the land area, is degrading, and primary and natural forests have shrunk by 14 percent between 1990 and 2015.

29. Sustainable management strategies for rangelands combine institutional measures to promote local organizations and sustainable cooperative management with an incentive structure and technical measures that contribute to lower stocking rates and controlled grazing practices. The keynotes are cross-sectoral integration and local ownership. The best technical practices applied in the region include conservation agriculture, no-tillage and water harvesting. In the dryland Gabes area of Tunisia, for example, rainwater was harvested to sustain drought- and salt-tolerant bushes and trees which served successfully as sources of cash and as dune-stabilizers. After six years, sand drift was totally arrested and range productivity increased fourfold.

Biodiversity is at high risk because of farming practices, and loss of biodiversity threatens agricultural sustainability

30. Biodiversity is an essential component of agricultural production systems, providing the ecosystem services that enable productive agriculture, but is being harmed by unsustainable agricultural practices. Examples are the huge range of biota in fertile soils and the range of insects necessary for successful crop pollination. Biodiversity also strengthens resilience to shocks and stresses, including resilience to the effects of climate change. An example of this is the forested mangrove of the Red Sea, which protects land and the coastal ecosystem from storms with its large root system. Furthermore, the development of new crop varieties often depends on access to genetic diversity.

31. Agriculture has had a negative impact on an already poor pool of biodiversity throughout the region. Intensive production systems of fewer species and breeds, pollution, negligent land and water management practices, and destruction of habitats, including forests and aquatic ecosystems, have contributed to this impact. Species populations have declined overall; the number of species threatened has increased; the diversity of domesticated livestock and plant species has dropped; and vital ecosystem services provided by pollinators, natural enemies of pests, soil organisms and wild food species, have continuously declined. In Egypt, studies have shown the impact of agricultural wastewater, leached fertilizers, herbicides, pesticides and sewage effluent on biodiversity in the Nile and on the broader ecosystem, including the decline of owls, kites and various pollinators. According to the 2015 International Union for Conservation of Nature (IUCN) Red List, some 2 476 species are under threat in the NENA region, including nearly 700 fish species and almost 450 plant species.

32. An integrated ecosystems approach to the reciprocal dependencies of farming and biodiversity is indicated in response to this situation. There are some positive signs in the region, resulting from the timid adoption of biodiversity-friendly approaches. Countries are preserving heritage agricultural systems such as Algeria's *ghout* system, designated a Globally Important Agricultural Heritage System (GIAHS) in 2011. New markets are emerging for wild food products, such as Jordan's sumac (*Rhus coriaria*), a shrub whose dried fruits are used as a spice. In addition to these measures, countries must look into economic incentives, e.g. taxes and subsidies, to support ecosystem services.

33. These approaches can be built upon. Countries require a framework to mainstream biodiversity into agricultural policy and programmes. Egypt and the Sudan have already factored agricultural targets into their National Biodiversity Strategic Action Plans (NBSAPs).

Policy responses for greater agricultural sustainability

A. Integrating agricultural, water and environmental policy, planning and programming

34. Integrating policy, planning and programming across sectors is as difficult as it is essential. Anexus approach should be adopted to ensure that water and environmental concerns are mainstreamed in agricultural programmes, investments and practices, and vice versa.

35. Depending on each country context, this may include legislation, joint committees at the ministerial level, permanent commissions, etc. It may also require an integrated and more cross-sectoral approach in policies, strategies or action plans and in the national documents submitted under international conventions, such as the Nationally Determined Contributions (NDC), the National Biodiversity Strategy and Action Plan (NBSAP), and the National Action Plans to Combat Desertification and Land Degradation. Systematically involving agriculture, environment and water ministries in joint preparation of Green Climate Fund (GCF) or Global Environment Facility (GEF) proposals related to biodiversity and climate change should also be considered.

36. The Cairo Declaration, adopted at the first joint regional meeting of water and agriculture ministers of the League of Arab States in April 2019, confirmed an agenda of coordination and policy coherence at the regional level that will also strengthen the national levels. The recent establishment of a regional coordination mechanism with a high-level joint technical committee will help strengthen the science-policy interface.

B. Adopting and implementing standards for sustainable agriculture and environmental protection

37. Standards, regulatory frameworks and codes of conduct or best practice need not remain mere reference documents. They are an essential part of an integrated approach, and they can draw on national, regional and global experience. Committed countries may consider developing national standards based on globally proven templates: for example, endorsing the new FAO biodiversity mainstreaming strategies; adopting the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests (VGGT); or incorporating the International Code of Conduct for the Sustainable

Use and Management of Fertilizers (endorsed by FAO's member countries at the 41st session of the FAO Conference in August 2019) into national regulations and practice.

C. Investing in better evidence

38. More and better evidence on environmental degradation and its relation to agriculture needs to be systematically built. This includes analysing and monitoring agricultural and water policies and practices and their impacts on water, soil, land, biodiversity, and on the cost of the loss of ecosystem services. A useful tool to measure soil degradation is the FAO LADA framework. One key approach is to measure agricultural sustainability through SDG Indicator 2.4.1, the official indicator for measuring progress towards achieving SDG Target 2.4 (Figure 2). Biodiversity, soil health and land degradation are particular areas in which knowledge and measurement should be improved.

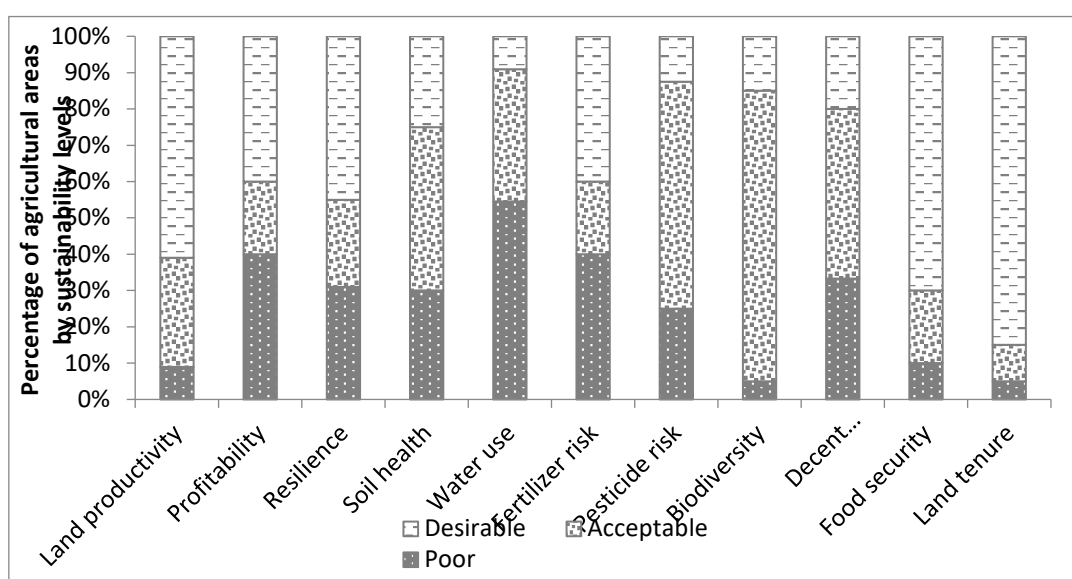


Figure 3: Example of SDG Indicator 2.4.1 dashboard:

Proportion of agricultural area under productive and sustainable agriculture

Source: FAO. 2018. SDG Indicator 2.4.1: Proportion of Agricultural Area Under Productive and Sustainable Agriculture – Methodological Note. Rome.

D. Aligning incentives for sustainable land and water management and environmental conservation

39. NENA governments have access to three levers that can encourage good farming, good water management and environmental protection. The first is production and consumption prices, which governments can readily align with good practices, notably through energy and trade policies. Food security policy must align with economic comparative advantage, promoting high-value production for market and export, where appropriate, and ensuring that measures to favour national production actually do enhance the incomes and food security of poor rural people and the sustainability of production systems. Second, governments can invest in infrastructure and projects that encourage and empower farmers to adopt good practices. Third, public policy can help motivate farmers to follow sustainable practice through mechanisms that carry part of the cost. These include financial mechanisms such as payments for environmental services (PES) and access to international cooperation and finance. An example of this is the Oued Lakhdar watershed management project in Morocco.

E. Public investment: knowledge, R&D, technology transfer, land and water infrastructure

40. One clear role for public investments is piloting innovations for environmental conservation. A good example of this is the GEF project in Morocco, Social and Integrated Agriculture Project (ASIMA). This project successfully demonstrated the technical and economic feasibility of conservation technologies, including the use of cactus and argan-based livestock feed as a means to reduce pressure on rangelands, and ways of conserving biodiversity by adding value to medicinal plants and by conserving the Saharan yellow bee. Other key areas for ‘soft’ public intervention include disseminating information and supporting farmer-based institutions.

F. Engaging private sector energies and investment

41. Producer and non-governmental organizations and civil society can be encouraged to contribute to sustainability by promoting dynamic, sustainable management practices. They can also promote the marketing and consumption of biodiversity-friendly products, for example, through local food movements and by creating spaces for farmers to sell biodiverse products, such as farmers’ markets, box-delivery schemes, consumer-purchase groups etc. Several examples exist in the region, including the conservation of the indigenous wild goat (*Capra aegagrus*) by the NGO Nature Iraq, and the educational programme in Jordan by the Beekeepers’ Union regarding the value of honeybees as bio-indicators and providers of ecosystem services and healthy products.

42. Governments can facilitate private sector engagement by providing a framework that incentivises sustainable practices, regulates or allows for self-regulation, and supports private initiative, for example through standards, labelling etc. Providing seed capital or enterprise funds to finance research and development and co-finance start-ups may also be indicated.

G. Factoring environmental considerations into water management and irrigation

43. With regard to water scarcity, NENA countries are well advanced in water management and well aware of the mechanisms for best practice integrated approaches². Likewise, best practice for efficient and high productivity irrigation management have been adopted throughout the region³. Yet water scarcity is increasing and the environmental impacts have not always been factored in. What is needed is for water strategies and programmes to be reviewed from the standpoint of environmental impacts and sustainable farming.

H. Integrated approaches to improving sustainable rainfed production

44. The sustainability of smallholder rainfed farming faces problems of poor soil quality, soil moisture deficits and high agro-climatic risk. Environmentally-friendly agro-ecological approaches and technologies exist, including conservation agriculture techniques such as improving rainwater infiltration, building up soil organic matter and improving soil structure, and adopting organic agriculture, agro-forestry and integrated crop and livestock systems.

I. Strengthening international and regional collaboration

2 The main approaches are: (i) integrated water resources management at the river basin level; (ii) subsidiarity, decentralization and participation; (iii) acting on the supply side drivers of scarcity; (iv) tackling groundwater depletion; and (v) putting in place the incentive framework for water use efficiency and productivity.

3 These practices are also well known. They include increasing water use efficiency and closing the yield gap through modernization and pressurized irrigation, and addressing the distorted incentives in the energy/water nexus.

45. Many of the challenges faced by the NENA region are common across the semi-arid world, and within the region most countries share all or some of the same challenges. There are considerable resources for cooperation and mutual learning and practice, including: institutions that support land, water and biodiversity management and protection, such as the United Nations Convention to Combat Desertification (UNCCD), the GEF, the International Land Coalition (ILC) and the Global Water Partnership (GWP); and knowledge resources, including AQUASTAT, FAOSTAT, the Global Soil Partnership and programmes such as LADA and the World Overview of Conservation Approaches and Technologies (WOCAT). The Regional Initiative for the Assessment of Climate Change Impact on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR) is another successful example of regional cooperation.

46. The League of Arab States (LAS) and its technical institutions have an important role to play in terms of supporting regional cooperation by strengthening joint sustainable agriculture programmes and projects.

47. FAO supports agricultural and environmental sustainability through three regional initiatives launched by NERC 32 in 2014: the Water Scarcity Initiative, the Resilience for Food Security and Nutrition Initiative and the Small-Scale Agriculture Initiative. These initiatives are mechanisms for identifying and disseminating innovation and best practice, forming partnerships, and mobilizing expertise and political will to address critical environmental challenges across the region.