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Agroecology: Adapting to Climate Change in Semi-arid Areas for a Sustainable Agricultural Development

Executive Summary

The ability of the Near East and North Africa (NENA) region to attain significant progress towards the achievement of Sustainable Development Goal 2 (SDG 2) will largely hinge on sustainable management of agricultural water and adaptation to a changing climate. Agricultural transformation in the NENA region has followed a specific path resulting in imbalance between rural and urban agricultural development, particularly apparent in the food production systems in the region. One approach to consider in agricultural development would be agroecology, which can make an important contribution to the transformation towards more sustainable food systems by guiding adaptation strategies.

Agroecology is not completely new in the region. It is rooted in ancient agroecology heritage systems, based on traditional practices such as small-scale and family farming, oasis agriculture, traditional water-harvesting systems, transhumant pastoralism and artisanal fisheries. The NENA region has also developed important experiences related to sustainable agriculture and support for smallholder livelihoods. Agroecology approaches can build on these experiences and support a more integrated approach to the multiple objectives of environmental, social and economic development. Scaling up agroecology for adapting to climate change for food security will yield multiple benefits in terms of enhanced resilience of agriculture systems, improved management of natural resources, improved livestock and rangelands management, more effective management of genetic resources and biodiversity. It will require new approaches to research and knowledge sharing as well as making institutions work to support agroecology.

Suggested actions by the Regional Conference

The Regional Conference may wish to:

- recognize the contribution of agroecology to support adaptation to climate change in semi-arid areas for a sustainable agricultural development, food security and nutrition;
- request the Food and Agriculture Organization of the United Nations (FAO) to integrate agroecology into the existing Regional Initiatives;
- request FAO to strengthen its work on agroecology in the context of the United Nations (UN) Decade of Family Farming (2019–2028);
- call upon governments to identify and provide incentives to agricultural producers to foster transitions to more sustainable agriculture and food systems, considering the ten elements of agroecology; and
- invite stakeholders to establish national and regional platforms for exchange of knowledge and experiences on agroecology.

I. INTRODUCTION

1. From a scientific and technical perspective, agroecology applies ecological concepts and principles to agricultural production systems, focusing on the interactions between plants, animals, humans and the environment to foster sustainable agricultural development towards food security and nutrition for all, now and in the future. The concept of agroecology fosters interaction among various forms of knowledge, through a transdisciplinary, participatory and action-oriented approach, that engages both practitioners and scientists and leverages on traditional and local knowledge.

2. Agroecology approaches are of particular relevance to climate change[1] adaptation. Agroecology contributes to building resilient food systems, starting with greater integration of biodiversity into agricultural production systems and landscapes. It incorporates the biological, social and economic dimensions of systems at farm and landscape levels and promotes greater regional and international cooperation, which all contribute to climate change adaptation.

3. Agroecology in the NENA region is rooted in ancient agroecological heritage systems, based on small-scale and family farming, such as oasis agriculture, traditional water harvesting systems, transhumant pastoralism and artisanal fisheries. Such systems have been under severe environmental, economic and social pressures in the past decades, and their continued survival is a testimony to their resilience. Despite the general trend of public support that is more directed towards input-intensive agricultural production systems, important indigenous experiences in agriculture anchored in its territory and closely-linked to smallholder livelihoods have been going side by side in the NENA region. Agroecology approaches can build on these experiences and support integration of environmental, social and economic development. While the indigenous practices have supported resilience, there is a need to enhance them with the principles and best practices of agroecology to increase productivity. A transition is therefore needed to achieve more sustainable food systems that produce more, with more socio-economic benefits and with fewer environmental consequences (see Annex I for a list of elements defining agroecology).

4. This document reviews the challenges to sustainable food security and agriculture in the NENA region (Part II), makes the case for scaling up agroecology for adaptation to climate change for food security and nutrition (Part III) and proposes practical suggestions for the way forward (Part IV).

[1] http://www.fao.org/3/a-i4729e.pdf

II. CHALLENGES TO SUSTAINABLE FOOD AND AGRICULTURE IN THE NENA REGION

5. Agriculture in the NENA region must meet the challenges of ending hunger and malnutrition while addressing the rural livelihoods, the natural resources and the climate change challenges.

6. The challenges to food and nutrition include a wide range of natural and human-induced shocks, frequent incidences of droughts, high exposure to climate change, transboundary animal and plant pests and diseases (e.g. locusts and highly pathogenic avian influenza), conflicts and socio-economic difficulties, instability and protracted crises (e.g. in Palestine, the Sudan, Syrian Arab Republic and Yemen). The NENA region exhibits the highest number and intensity of conflicts in the world.

7. Agriculture is a vital economic and social sector in the region and contributed to 14 percent of the gross domestic product (excluding oil-rich countries) in 2016.[2] Small-scale and family farming plays an important role in food security, poverty alleviation and sustainable management of natural resources and faces many challenges in the region. As the number of smallholders is increasing, the average size of individual holdings is shrinking. Women's share in the agriculture labour force is important, but their access to land, information and services remain heavily constrained. The aging population of agricultural producers; limited access to social protection, assets, financial services, markets and effective extension services; in addition to weak producer organizations, are all severely constraining the development of family farming (pastoralism or other agricultural production) and limiting opportunities for youth employment in agriculture.

A. Degradation of natural resources

8. Family farmers are faced with a degrading natural resource base, caused by deforestation and overgrazing, depletion of biodiversity (including agricultural biodiversity), soil erosion, river and dam siltation, desertification and declining soil fertility. Overgrazing, illegal logging and the uncontrolled collection of wood due to inadequate management practices, excessive grazing pressures and sedentarization of nomadic people in mountain areas are major causes of land degradation across the region. Abandonment of traditional agriculture systems, like terraces, has caused significant problems of soil erosion and hydrologic disruption in many hill and mountain forest areas. The lack of clean alternative energy sources has significantly increased fuelwood consumption in many regions of North Africa, northern Anatolia and Iran (Islamic Republic of). Soil fertility is a limiting factor of production in irrigated and especially in dryland systems. Poor soils are often also associated with poor capacity for water retention. Soil-moisture retention and micro-climate management are crucial strategies.

9. The main challenge in terms of sustainable management of natural resources in the NENA region is the chronic shortage of water, which is the result of physical factors (the aridity of the climate), as well as policy and institutional factors. The steady increase in agricultural production in most countries of the region in recent decades is largely the result of intensification through irrigation. Often, such interventions have ultimately encouraged the overuse of water, in particular groundwater resources, and called into question the sustainability of the food systems in the region. Furthermore, droughts have exacerbated water scarcity in rainfed areas.

B. Climate change

10. Climate change is expected to introduce new risks for agricultural production and may complicate – even exacerbate – existing risks through both direct and indirect impacts. In the NENA region, climate change impacts will principally be channelled through the scarcity of water, in terms of reduced water availability and quality, increased crop demand for water, increased aridity and loss of biodiversity. Recent evidence points to consistent warming trends throughout the region with increased minimum and maximum temperatures, coupled with reduced precipitation, reduced runoff and increased

[2] World Development Indicators Database, 2018

evapotranspiration (to varying degrees).[3] Climate models also show a general increase in the frequency of warm days and longer dry spells across the region. Climate change will result in reduced crop and grassland yields, shortened cropping seasons, reduced cropping intensity, salinization, and replacement of C3[4] grasses with C4 grasses, which are generally of lower quality as fodder. Reduced fodder quantity and quality, changing disease patterns, reduced reproduction and productivity as a result of heat stress will affect livestock production and lead to replacement of livestock species and breeds, which may further threaten locally adapted breeds. In addition, livestock keepers may lose high percentages of their animals through natural disasters and unrest, which may push them into poverty due to the loss of their savings and productive assets. Climate change also jeopardizes the contribution of forests to the resilience of agricultural systems, such as through water and temperature regulation and the provision of habitats for important species like pollinators.

III. SCALING UP AGROECOLOGY FOR CLIMATE CHANGE ADAPTATION, FOOD SECURITY AND NUTRITION: POLICY OPTIONS AND EXPECTED BENEFITS

11. The ability of the NENA region to achieve significant progress towards the achievement of SDG 2 will hinge, to a large extent, on sustainable management of agricultural water and adaptation to a changing climate. Against a backdrop of population growth, increased pressure on natural resources including soils and water, the loss of biodiversity, and the uncertainties associated with climate change, agroecology can be part of the response to the necessary transition towards more sustainable food systems – food systems that produce more, with more socio-economic benefits and with fewer environmental consequences.

12. Agroecology, because of its unique, integrated and multidimensional benefits, can play an important role in the NENA's climate change adaptation and food security agenda. This section reviews the policy options and the expected benefits of scaling up agroecology.

13. Agroecology can contribute to resilience[5] of agriculture systems, sustainable management of natural resources, improved livestock and rangelands and to effective genetic resources and biodiversity management. Applying agroecology principles for climate change adaptation calls for farmer-centred new research and knowledge sharing approaches and agroecology-friendly institutions.

A. Resilience of agricultural systems

14. Mainstreaming agroecology principles and good practices is essential to building the resilience of agricultural systems in the region.

Box 1 Agroecology builds the resilience of agricultural systems[6]

At its core, agroecology can help build the resilience of agricultural systems, starting from the farm to broader landscape approaches. Agroecology principles are of particular relevance to climate change adaptation, as they aim to:

1) enhance the recycling of biomass, with a view to optimizing organic matter decomposition and nutrient cycling;

2) strengthen the "immune system" of agricultural systems through the enhancement of functional biodiversity, e.g. by creating habitats for natural enemies of pests;

[3] United Nations Economic and Social Commission for Western Asia (ESCWA) et al. 2017. Arab Climate Change Assessment Report – Main Report. Beirut, E/ESCWA/SDPD/2017/RICCAR/Report.
[4] United Nations Economic and Social Commission for Western Asia (ESCWA) et al. 2017. Arab Climate Change Assessment Report – Main Report. Beirut, E/ESCWA/SDPD/2017/RICCAR/Report.
[5] www.fao.org/3/a-i6583e.pdf
[6] FAO. 2016. The State of Food and Agriculture: Climate change, agriculture and food security. Rome.

3) provide the most favourable soil conditions for plant growth, particularly by managing organic matter and enhancing soil biological activity;

4) minimize losses of energy, water, nutrients and genetic resources by enhancing conservation and regeneration of soil and water resources and agrobiodiversity;

5) diversify species and genetic resources in the agroecosystem over time and space at the field and landscape levels; and

6) enhance biological interactions and synergies among the components of agrobiodiversity, thereby promoting key ecological processes and services.

15. Agroecology can be used to sustain ecosystem services relevant to agricultural production, such as pollination, natural control of pests and diseases, watershed protection, and erosion control. Sustainable management of ecosystems and natural resources at landscape scale can help to conserve and sustain water resources. Forests, for example, play a major role in the water cycle, ensuring quantity, quality and stability of water for human use. Livestock can provide natural fertilizer, seed dispersal and fire control because of limits on grass and bush coverage. These services are directly related to the resilience of agricultural livelihoods by reducing environmental risks and improving coping capacities. Adopting a landscape approach includes taking into consideration the physical and biological features of an area, people who influence it, appropriate institutions, policies and legal frameworks to improve coping capacities of communities.

16. For most farming families, agriculture is only one of several sources of income, and smaller size households often have higher shares of non-agricultural incomes than larger ones. An important strategy for increasing resilience among agriculture-based populations is to diversify among agricultural and non-agricultural sources of income. Agroecology supports the diversification of livelihoods both on farm and off farm, including by emphasising strong linkages with local markets. This creates work in processing and marketing – creating opportunities for both women and youth to improve their livelihoods. Other related economic activities include agritourism, which is an increasingly common strategy in agroecology landscapes that feature agricultural and wild biodiversity, and that value local cultures.

B. Sustainable natural resources management

17. Almost 90 percent of the NENA region's 14.1 million square km land area is subjected to land degradation of different forms such as soil nutrient depletion, salinity, as well as wind and water erosion. In the region, where water scarcity is also extreme, agroecology emphasizes: (1) prioritizing water harvesting for agroecological systems and conserving the natural resource base; (2) strengthening long-neglected rainfed agricultural systems; and (3) supporting transhumant pastoralism and sustainable rangeland management. Items 1 and 2 require (4) improved soil quality, and items 1, 2 and 3 require (5) adapted genetic resources. All items require (6) appropriate research and knowledge-sharing systems.

18. Agroecological production systems enhance soil health, which contributes to yield stability under climatic variability. Well-integrated crop and livestock production provides a range of income opportunities, lesser reliance on external inputs, better soil fertility with manure, better use of crop residues and by-products through feed and overall greater economic and environmental resilience. Polycultures exhibit greater yield stability and suffer fewer productivity declines during a drought than monocultures. Traditional agricultural systems in the region, some of which are recognized as Globally Important Heritage Agricultural Systems, show that polycultures and mixed systems offer important benefits in drylands. These include date palm plantations with an understory of olives, fruit trees and vegetables. For example, the oasis system in the Atlas Mountains of Morocco produces vegetables, cereals and fruits in conjunction with pastures for animals. These systems support livelihoods through

the growing of food and raising livestock, preserve water and biodiversity, and allow for crop rotation and agroforestry organized by efficient water management (Annex II).

19. Agroecology systems, including traditional systems in NENA, often involve the integration of trees in cropland and forestry (agroforestry), forestry and pastures (silvo-pasture), cropland and pastures, as well as cropland-forestry-and pastures (agro-silvo-pasture). Agroforestry and tree-based agricultural systems provide a wide array of benefits for local communities, the environment and grazing livestock. These include the provision of shade in grasslands and agricultural landscapes, important for shade-tolerant agricultural crops, grazing animals, and especially vegetable crops. Agroforestry can also provide improved soil fertility resulting in increased crop yields; fodder and fencing for livestock; fuelwood; timber for housing; and improved household resilience through the provision of additional products (e.g. fruits) for sale or home consumption. Trees and forestry are essential in these agroecology systems.

20. Water management is another important feature of agroecology farming systems, particularly in the irrigated drylands. The Ghout System in Algeria practised since the 15th century, sustains the survival of many livelihoods by supporting a mixture of date palm, vegetables, cereal, and fruit trees thriving on groundwater, while maintaining biodiversity of plants, animals and microorganisms. The Qanat Water System in Iran (Islamic Republic of), comprises underground tunnels where groundwater is channelled to irrigate plants and trees on which local communities have socially and culturally been dependent since early 800 BCE (before common era). The Aflaj Irrigation Systems of Oman represent also a sustainable type of irrigation system as old as 5 000 years in the region. Modern forms of small-scale and accessible water harvesting technologies are being developed through agroecology in other parts of the world and could be useful for the NENA region. For example, in Brazil, an agroecology programme in the semi-arid region consisted of implementing a number of rainwater-harvesting and exploitation technologies. These technologies include: sidewalk cisterns, water storage trench, underground reservoir, stone tank, rainwater catchment lagoon and public water pump.[7] Rainfed systems dominate food production and support 62 percent of farming households in the NENA region. However, variable rainfall, dry spells and droughts make rainfed farming, pasture management and aquaculture risky. Given limitations for expansion of irrigated farming and the need to reduce it in cases of extreme water scarcity, a key priority is to strengthen rainfed agriculture by improving soil moisture conservation and, where small water storage is feasible, providing supplemental irrigation. Adapted genetic resources are also needed. Investments in rainfed agriculture must also be supported by appropriate local processing and storage facilities and access to markets.

21. Agroecology practices can optimize water use through conservation agriculture, no-till and integrated soil fertility management that support water infiltration, reduced evaporation through soil coverage, the build-up of soil organic matter through use of manure and enlarged root growth and increased soil moisture holding capacity (e.g. by well-managed grazing). Agroecology's focus on maintaining crop and livestock diversity also allows farmers to utilize available water resources effectively by choosing species and breeds that contribute to biomass for healthy soils while being adapted to local water-scarce conditions.

22. In more drought-prone and marginal environments, water and land management practices that make use of indigenous technology and involve techniques such as water harvesting, micro-irrigation, mulching and the construction of hillside terraces lined with shrubs and trees, which enhance the ability of the soil to catch and store water, are proved to be highly effective. In Yemen, terraces built in steep slopes reduced runoff, helped to harvest water and protected the land from erosion. These indigenous agroecology practices need to be reinforced, upscaled and combined with social and economic elements of agroecology. Terraces are an age-old practice used for planting high value crops and trees in many countries such as Iraq, Jordan, Lebanon and Syrian Arab Republic and others while Jessours are used in Tunisia to conserve soil and water. The indigenous practices elaborated here need to be strengthened by

[7] Souza, M. and Lima, V. 2015. Agroecology in semi-arid regions: Practices and lessons for food and nutrition security, in FAO. 2015. Agroecology for Food Security and Nutrition: Proceedings of the FAO International Symposium.

integrating agroecology principles and best practices, to enable more productive and sustainable agricultural and production systems in the region.

23. Freshwater environments are among the most volatile and ephemeral ecosystems that exist and many fish species are highly adapted to fluctuating and variable conditions. Flood water increases the fish catch and enriches the soil. Combined with the increased recognition of the nutritional value of fish for food security and healthy diets, the importance of fish for a diversified livelihood strategy in drylands should be emphasized, promoted and developed, in conjunction with other food producing activities.

C. Improved livestock and range management

24. Regions identified as the most vulnerable to climate change are also regions where farmers, pastoralists and rural communities rely the most on livestock for livelihoods, which is expected to contribute more to food security and better nutrition. Traditionally, pastoral communities and livestock-keepers have much better capacity to adapt to livelihood threats and harsh climatic conditions.

25. Mixed crop-livestock systems contribute to enhanced resilience compared with specialized systems, through on farm income diversification and increased cash flow, and through increased nutrient and water use efficiency from recycling manure as fertilizers and crop residues and by-products as livestock feed.

26. Feed resources must be available and accessible to increase productivity of livestock and reduce the negative impact of climate variability. This requires better climate change impact assessments on rangelands and calls for interventions in animal mobility (e.g. through corridors and border regulations), feed management (e.g. storage, processing and transport) and stratification of production to reduce grazing pressure in arid areas. In Jordan, the piloted initiative for reviving the traditional Hema system has made remarkable success in rangelands management through securing rights and access to land tenure, improving governance of land and natural resources, enhancing income generation and promoting the active engagement of women.

27. Wherever possible, irrigating feed crops and grasslands as well as purchasing feed are immediate farm-level coping mechanisms for short-term adaptation to climate change. More systemic, longer-term adaptation options include grassland restoration or diversification in composition; improved use of waste and by-products (such as straw, bran or molasses) as feed; agroforestry with fodder trees and legume shrubs and trees to provide alternate feed resources, shade and retain water; and animal mobility.

D. Effective genetic resources and biodiversity management

28. Genetic diversity allows for greater sustainability, resilience and adaptability in production systems as they encounter the effects of climate change. With climate change, favourable conditions for crops and livestock will change geographically. Optimizing these conditions will thus require changes in species, varieties and breeds of crops, livestock, trees and aquatic species and their genetic improvement and management. The interaction between the environment, genetic resources and management practices that occurs *in situ* within agroecosystems often contributes to maintaining a dynamic portfolio of agricultural biodiversity.

29. It is widely recognized that breeding in water-limited environments is difficult but it has improved yield at about half the rate achieved for crops grown in higher rainfall regions. Dry areas offer a much less homogeneous population of target environments than areas with high and reliable rainfall. An important aspect of the relationship between the type of germplasm and drought resistance is the buffering capacity of heterogeneity. The much larger complexity in low rainfall areas suggests the need for a wider diversity of varieties. This might explain why it has been difficult traditionally to out-yield landraces consistently with genetically uniform modern germplasm in areas where rainfed crops are commonly grown under water-limited conditions.

30. Conservation and use of genetic diversity in plant and livestock breeding can be accomplished through participatory breeding efforts. The value of landraces, which are genetically heterogeneous, as sources of drought tolerance is well documented in the case of barley in Syrian Arab Republic, and landraces have been integrated into participatory plant breeding programmes where farmers and scientists work together to complement the strengths of each other. In evolutionary plant breeding, crop populations with a high level of genetic diversity are subjected to the forces of natural selection. In a cycle of sowing and re-sowing seed from the plant population year after year, those plants favoured under prevailing growing conditions are expected to contribute more seed to the next generation than plants with lower fitness. Thus, evolving crop populations have the capability of adapting to the conditions under which they are grown. This resilience is seen as a major advantage under the predicted threats of global climate change. A national programme of Evolutionary Plant Breeding has been underway since 2008 in Iran (Islamic Republic of) as a collaboration between national and international research centres, farmers and non-governmental organizations (NGOs).[8]

31. Participatory breeding initiatives also exist for livestock (although perhaps to a lesser extent than for plants). Breeding goals of traditional societies are far more multifaceted than those that guide breeding for intensive production systems that overwhelmingly value high productivity of cash products (e.g. meat, milk). One very important set of traits addresses the ability of livestock to survive harsh environments: resistance to diseases and parasites, tolerance to heat and cold and ability to retain body weight during periods of drought and feed shortage. Other traits may include aesthetic preferences, religious requirements and behavioural features. It is therefore important in breeding livestock for agroecology production systems to consult with livestock keepers – both women and men – about the traits that interest them. There are many cases where the substitution of native breeds through high-input-dependent exotic breeds or their dilution through crossbreeding has rendered communities dependent on outside supplies and subsidies, as well as vulnerable to ecological calamities. Once the inputs stop or the economic scenario changes, keeping "improved" animals is no longer technically feasible or economically viable.

E. Research and knowledge sharing centred on farmers

32. Adaptive capacity is a response to uncertain shocks and change and is therefore essential to resilience. Agroecology could help enhance the adaptive capacity of farmers by promoting social networks and models of cooperation, knowledge co-creation and exchange that builds the social dimension of resilience. By promoting farmer-to-farmer knowledge exchanges, agroecology strengthens the social fabric that is necessary for sharing and creating knowledge at local levels. Examples include soil and water conservation work which require reciprocal and mutual work, sharing or "lending" of livestock or seed among local communities in times of drought. Agroecology can strengthen resilience through collective knowledge and action research and knowledge management.

33. Agroecology requires a re-thinking of existing ways of doing research, as well as the topics of research. It underscores the importance of context-specific and continuously adapted knowledge to find solutions for complex and dynamic ecological and human systems. It is therefore a central tenet of agroecology that farmers' knowledge and understanding of management of local natural resources and knowledge of local cultural and social systems form the foundations of agroecology. By combining this knowledge with scientific understanding, complex adaptive agricultural production systems that effectively address food security and nutrition can be designed. Thus, in supporting agroecology, there is an important role to be fostered in co-creating knowledge between farming communities and scientists, and the many mediating organizations in between, including producer organizations, NGOs, governmental extension agencies and community-based organizations. Such knowledge sharing could be achieved through farmer-to-farmer exchanges and learning, innovation platforms, farmer, pastoralist and other field schools, or other horizontal systems of exchange and learning among farmers and between agricultural producers and other knowledge holders.

[8] See http://www.fao.org/agroecology/detail/en/c/1025758/ for further information.

F. Making institutions apply agroecology practices

34. Institutional arrangements and policies that support increased and stabilized returns from agroecology practices are essential. The success of agroecology depends on the strengthening of local and regional markets for the promotion of biodiversity and closer linkages between consumers and producers to enable accountability and fair prices. These markets play an even more important role under climate change. Dependence on imports to meet food needs may increase the risk of exposure to higher market and price volatility that is expected under climate change. Developing these market linkages requires investment in small- and medium-size food processors, and small-scale traders at retail and wholesale levels. Public procurement (e.g. school feeding) programmes that link agroecological producers with institutional markets assure smallholders a local market and fair prices. Rural credit, social protection, and land and water tenure arrangements all play very important roles in supporting or hindering farmers, pastoralists, forest dwellers and fisher folk in transitioning to more sustainable agricultural systems with higher resilience.

35. Transitions to sustainable food systems through agroecology require multi-layered support. Food producers who wish to transition to a more sustainable path face constraints and risks. They need to be supported by an enabling environment that provides positive incentives and helps to buffer agricultural producers while they transform their systems, which takes time to realize the full benefits. Access to education and training, opportunities to exchange knowledge and best practices with other producers, and awareness raising are crucial aspects. In addition to direct and indirect support to family farmers and pastoralists, transitions require innovations in policies and rural institutions – especially to coordinate actions at the landscape and territorial scales. Transitions also require innovations in the production, processing, marketing and consumption of food, leading to sustainability and equity throughout the entire food and agricultural system.

36. Scaling up agroecology practices requires greater recognition of the role of producer associations, NGOs/civil society organizations (CSOs) in shaping up the food security and agriculture adaptation to climate agenda and policies. This would take the form of awareness raising, building platforms for exchange of experiences and knowledge (e.g. the Pastoralist Knowledge Hub) and support to farmer and to farmer and south-south cooperation exchanges.

37. Multistakeholder partnerships are recognized as adequate platforms for policy dialogue between producers, governments, civil society, academia, private sectors and NGOs. Better integration and mainstreaming of agroecology in such platforms (e.g. the Global Agenda for Sustainable Livestock) can yield significant awareness and momentum across the supply chains to achieve practice change.

IV. THE WAY FORWARD

38. The above developments have made the case for upscaling agroecology practices and principles in the NENA region for sustainable food and agriculture and climate change adaptation. The way forward to scaling up agroecology will require the strengthening of advocacy for agroecology as a means for achieving sustainable food security and adapting to climate change as well as mainstreaming agroecology in the relevant regional and national programmes.

39. The NENA countries have adopted three regional initiatives as the main priorities for the FAO work in the region: Small-scale Family Farming for Inclusive Growth; Building Resilience for Food Security and Nutrition and Water Scarcity Initiative. The three initiatives offer significant opportunities for mainstreaming agroecology:

1. The Regional Initiative on Small-scale Family Farming provides an optimal framework for agroecology. The focus of the initiative on smallholders' productivity, access to land, sustainable production, resilience, access to knowledge and on strengthening the capacities of producer organizations, are all in line with the agroecology principles and practices. Mainstreaming agroecology in the regional initiative on small-scale family farming will require incentives to accelerate the adoption of agroecology knowledge through appropriate

investments, social protection measures to compensate for possible loss of revenue in the short term and intensive education, extension and knowledge transfer.

2. The Regional Initiative on Building Resilience for Food Security and Nutrition could greatly benefit from integrating biodiversity into the production system and minimizing the use of external inputs, which could in turn contribute to diversified and healthy diets. Resilience to shocks arising from climate change could also be adequately mitigated by adopting agroecology

3. The Regional Initiative on Water Scarcity could benefit from agroecology as it includes a range of options for enhancing water productivity, in particular in rainfed areas, including through improved soil management. Successful practices could be shared and up scaled. The Regional Collaborative Platform on Water Scarcity should more systematically promote agroecology practices that address water productivity.

40. The establishment of a regional multistakeholder platform for advocacy and exchange of experiences, learning from the global agroecology dynamics, may initially help in fostering policy change and accelerating the process of adoption of agroecology in the region. It should be accompanied by a systematic advocacy for mainstreaming agroecology in new projects, including, in particular the Green Climate Fund and Global Environment Facility Fund.

ANNEX I

Elements of agroecology (FAO 2017)[9], to be considered for promoting agroecology-based food and agricultural systems

Efficiency: Optimizing the use of resources
Balance: Securing favourable soil conditions and self-regulation
Diversity: Maximizing species and genetic resources across time and space
Co-creation and knowledge: Combining local and traditional knowledge and innovation
Recycling: Reutilizing nutrients, biomass, water and energy
Synergies: Using an optimal crop/livestock assemblage
Human and social value: Building on the culture, identity, tradition, innovation and knowledge of local communities and focus on the roles of women and youth
Circular Economy: Creating local solutions and local markets as virtuous cycles
Culture and food traditions: Producing healthy, diversified and culturally appropriate diets
Land and natural resource governance: Sustainably managing and protecting natural including genetic resources

[9] www.fao.org/agroecology/knowledge/10-elements/en

ANNEX II

Agroecology practices and their potential to enhance resilience to climatic stresses through improvement of soil quality for water conservation in cropping systems[10]

Potential benefits / Practices	Soil organic buildup	Nutrient cycling	Increase soil cover	Reduce evapotranspiration	Runoff reduction	Increase water-holding capacity	Increase infiltration	Microclimatic amelioration	Reduce soil	Reduce soil erosion		Increase hydrological regulation	Increase water-use efficiency	Increase mycorrhizal network
Diversification														
Mixed or intercropping			√	√	√			√	√	√			√	
Agroforestry	√	√	√	√	√	√	√	√	√	√			√	
Intensive silvopastoral systems	√	√	√	√	√	√	√	√	√	√		√	√	√
Crop rotation	√	√	√		√		√		√	√			√	
Local variety mixtures			√										√	
Soil management														
Cover cropping	√	√	√	√	√	√	√		√	√		√		
Green manures	√	√	√	√	√	√	√		√	√			√	√
Mulching	√	√	√	√	√	√	√	√	√	√		√	√	√
Compost applications	√					√								√
Manure application	√	√			√									
Conservation agriculture (organic no-till)			√	√	√		√		√	√			√	
Soil conservation														
Contour farming					√		√		√	√		√		
Grass striping/living barriers			√		√		√			√		√		
Terracing					√		√			√		√		
Check dams along gullies					√		√			√		√		

[10] adapted from Nicholls, C.I., and Altieri, M. A. 2015. Agroecology: Designing Climate Change Resilient Small Farming Systems in the Developing World, in FAO. 2015. Agroecology for Food Security and Nutrition: Proceedings of the FAO International Symposium.