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THE CONTRIBUTION OF FAO'S FIVE PRINCIPLES FOR SUSTAINABLE AGRICULTURE TO THE IMPLEMENTATION OF AICHI BIODIVERSITY TARGET 7

1. The Executive Secretary hereby provides, for the information of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) at its nineteenth meeting, a note received from the Food and Agriculture Organization of the United Nations (FAO) on the above captioned subject. This information is provided by the Executive Secretary in an unedited form and in the language in which it was received.

2. FAO has also asked the Executive Secretary to bring the following points to the attention of the Subsidiary Body and to the Conference of the Parties:

Considerations of the conservation and sustainable use of biodiversity with regards to sustainable agricultural development and food security are not new to SBSTTA or the Conference of the Parties. Over the years, the Conference of the Parties has adopted many decisions toward this objective, including the Programme of Work on Agricultural Biodiversity, the Strategic Plan for Biodiversity 2011–2020, and the Aichi Biodiversity Targets. There are many efforts under way throughout the world, by governments, indigenous and local communities, NGOs and the private sector to achieve Aichi Biodiversity Target 7. However, progress is slow. Given the inseparable association between conservation and sustainable use of biodiversity and sustainable food and agriculture, the Conference of the Parties at its thirteenth meeting may wish to consider the following actions:

(a) To note the importance of sustainable food and agricultural systems to the Post-2015 Sustainable Development Agenda of the outcomes of Rio 20+ and to the Global Hunger Initiatives;

(b) To acknowledge the strong inter-dependence between conservation and sustainable use of biodiversity and sustainable food and agricultural systems, and the importance of both to food and nutritional security, poverty reduction, and environmental sustainability;

(c) To welcome the five principles for sustainable food and agriculture proposed in the note contained in the annex and request the Executive Secretary and FAO to strengthen their collaboration and to increase support to countries in implementing them;

(d) To recommend that CBD and FAO increase sharing of successful lessons in order to accelerate the progress toward Aichi Biodiversity Target 7;

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(e) To promote strengthened financial support to FAO and its partners in promoting policies and actions related to sustainable food and agriculture and the conservation and sustainable use of biodiversity; and

(f) To encourage Parties to harmonize national development policies, actions and agendas being led by various arms of the government and institutions for sustainable food and agriculture and for conservation and sustainable use of biodiversity.

The contribution of FAO's five principles for sustainable agriculture to the implementation of Aichi Biodiversity Target 7 – *'By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity'*

PURPOSE AND SCOPE OF THE REPORT

The thirteenth Conference of the Parties (COP) of the Convention on Biological Diversity (CBD) will, amongst other things, discuss strategic actions to enhance the implementation of the Strategic Plan for Biodiversity 2011-2020 and the achievement of the Aichi Biodiversity Targets, including with respect to mainstreaming and the integration of biodiversity within and across sectors, including agriculture, forestry and fisheries.

In that perspective, FAO agreed to prepare a guidance document to support the implementation of Aichi target 7, i.e. *By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity*. This document summarizes the challenges of agriculture and its sustainability, briefly presents how the international community is getting prepared to address these challenges and introduces FAO's vision for sustainable food and agriculture. It then presents the five principles of food and agriculture that are underpinning the implementation of this vision, as well as critical areas of intervention in order to transition to sustainability and suggests partnerships as a way forward to transition to sustainability.

FOOD AND AGRICULTURAL SYSTEMS AND THEIR SUSTAINABILITY

World food security was defined by the World Food Summit in 1996 as "all people at all times have physical, social, and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life" (FAO, 1996). Agriculture produces about 23.7 million tons of food every day, which is about 19.5 million tons of cereals, roots, tubers, fruit and vegetables, 1.1 million tons of meat, and 2.1 billion liters of milk a day. Capture fisheries and aquaculture produce more than 400 000 tons of fish per day, and forests provide 9.5 million cubic meters of timber and fuel wood. In addition, it employs more than a third of the world's workers.

But agriculture must do more: To respond to the demand of a population of 9.3 billion in 2050, it will have to produce 13.5 billion tonnes of food by 2050 – almost 5 billion tonnes more than the current 8.4 billion tonnes, and do this without jeopardizing the opportunities for the future generations to feed themselves (FAO, 2014). The challenge is not just increasing overall food supply, but also increasing the capacity of the world's poorest people to access food. Since the majority of the world's poor and food insecure are based in rural areas, growth in agricultural productivity and incomes is an essential step towards eradicating hunger and poverty.

In spite of the growth in agriculture during the Green Revolution, almost 800 million people remain hungry today (FAO, IFAD, and WFP, 2015), two billion suffer from micronutrient deficiencies, and the natural environment has been negatively impacted. Many agricultural activities are impacting negatively on the very natural resources on which our food systems depend. Agricultural pressure on water resources is a leading factor of water scarcity and pollution. One-third of soils are moderately to highly degraded due to erosion, nutrient depletion, acidification, salinization, compaction and chemical pollution (FAO, 2011) and the world continues to lose 0.05 to 0.10 million km² of arable and grazing land every year (Scherr and Yadav, 2001). Approximately 75 percent of crop biodiversity has been lost (Thomas *et al.*, 2004) and 22 percent of animal breeds are at risk due to a very narrow genetic base of major crops and breeds (FAO, 2012). More than half of fish stocks are fully exploited (FAO, 2014). Nearly 60-70 percent

of global loss in biodiversity (Alkamade et al., 2009) is attributed to food production, which is responsible for around 50 percent of deforestation (CBD, 2014).

The current trajectory of agricultural intensification is not sustainable. To face the combined challenges of a growing global population, increasing competition for scarcer land, water and energy resources, and climate change, agriculture must adopt a new paradigm to become sustainable.

SUSTAINABILITY IN THE INTERNATIONAL CONTEXT

Although sustainability is not a new concept, it is now gaining the world's attention. The UN placed it at the heart of human development with the landmark Brundtland Report that called for a development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987).

The need to combine environmental, economic and social dimensions to achieve sustainable development is at the center of governmental agendas since 1992, when the Rio Earth Summit launched Agenda 21, a framework for action aimed at achieving a balanced and integrated approach to environment and development issues (UNCED, 1992). Since then, a number of objectives have been endorsed by the international community as a testimony of their growing commitment to sustainable development.

At the Rio+20 Conference, States acknowledged the need to further mainstream sustainable development at all levels, integrating economic, social and environmental aspects and recognizing their interlinkages, so as to achieve sustainable development in all its dimensions (United Nations, 2012a). They also recognized that poverty eradication, changing unsustainable and promoting sustainable patterns of consumption and production and protecting and managing the natural resource base for economic and social development are the overarching objectives of and essential requirements for sustainable development. They reaffirmed the necessity to promote, enhance and support more sustainable agriculture, including crops, livestock, forestry, fisheries and aquaculture, that improves food security, eradicates hunger and is economically viable, while conserving land, water, plant and animal genetic resources, biodiversity and ecosystems and enhancing resilience to climate change and natural disasters.

In addition, the UN Secretary General launched the Zero Hunger Challenge, aiming for achieving 100 percent access to adequate food all year round, zero stunting in children less than two years old, the sustainability of all food systems, a 100 percent increase in smallholder productivity and income, and zero loss or waste of food (High-Level Task Force on the Global Food Crisis, 2012).

The UN and its agencies have also adopted a framework for advancing environmental and social sustainability, which calls for a common vision, rationale, objectives and indicators across the UN system (United Nations, 2012b). They will develop policies and strategies that embed a broad view of sustainability, avoid unnecessary trade-offs or harm to people and the environment, and systematically integrate environmental and social considerations in all programmes and projects.

At the Rio Earth Summit in 1992, the Convention on Biological Diversity (CBD) was opened for signature, recognizing the need for international safeguards to the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from the use of genetic resources. The Aichi Biodiversity Targets of the Strategic Plan of the Convention on Biological Diversity (CBD) for 2011-2020 are essential to reach the Sustainable Development Goals (SDGs), soon to be endorsed by countries. Amongst the 20 Aichi Biodiversity Targets, Target 7, "By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity" has especial relevance to sustainability of agricultural and food systems.

Sustainability of food and agriculture is at the heart of FAO's new Strategic Framework approved by the Conference in June 2013. It is the specific focus of its Strategic Objective 2, which aims at sustainably increasing the production of goods and services from agriculture (includes crops, livestock, forestry, fisheries and aquaculture). FAO and other partners have developed and promoted various frameworks to move towards sustainable food and agricultural systems. Many of these frameworks are sectoral and address the sustainability of crops (Save and Grow), livestock (Global Livestock Agenda for Action),

forestry (Sustainable Forest Management), fisheries, and aquaculture (Ecosystem Approach to Aquaculture). Others address cross-sectoral themes related to natural resources (soil, water, biodiversity, climate, energy) as well as the social dimension of sustainability (good or effective governance, gender equality, decent employment, voluntary guidelines (FAO, 2014; Faurès, 2015). In 2014, the Committee on Agriculture (COAG), one of FAO's Governing Bodies, recommended that FAO further integrate its work on sustainable food systems.

FAO believes that only a holistic vision and approach, that builds and combines the existing sectoral and cross-sectoral frameworks, would best support a successful transition towards sustainable food and agriculture, and contribute to the achievement of Aichi Target 7.

A COMMON VISION FOR SUSTAINABLE FOOD AND AGRICULTURE

FAO's vision for sustainable food and agriculture is that of *“a world in which food is nutritious and accessible for everyone and natural resources are managed in a way that maintain ecosystem functions to support current as well as future human needs. In this vision, farmers, pastoralists, fisher-folks, foresters and other rural dwellers have the opportunity to actively participate in, and benefit from, economic development, have decent employment condition and work in a fair price environment. Rural women, men, and communities live in security, and have control over their livelihoods and equitable access to resources which they use in an efficient way”* (FAO, 2014).

In this vision, agriculture is represented at the interface between the world's natural and human systems. It is the 'engine' that transforms natural resources and the environmental services they provide into agricultural products – food, feed, fibre and fuel. The characteristics of this transformation process – such as the type of production system, the nature of the producers involved and their capacity to access productive inputs as well as the type of agricultural value chains their products may flow through – determines a set of associated benefits (or costs) such as poverty reduction, nutritional and health improvements as well as maintenance and enhancement of environmental services.

In the future, most of agriculture's products and services will continue to come from individual sectors of agriculture: crops, livestock, forestry, fisheries and aquaculture. However, transitioning towards sustainable agriculture requires a look at the 'engine' of the transformation process as a whole, identifying the direct and associated benefits needed from agriculture for a given location and time frame, and then identifying levers that can enact changes as needed.

An important aspect will be taking a cross-sectoral point of view: Rather than considering agricultural sectors as competitors, opportunities for creating synergies must be sought and negative externalities among them minimized. For example, important complementarities exist between crops and livestock, and between capture fisheries and aquaculture (FAO, 2014). All of them are supported by forests, and together, all of them provide ecosystem services, especially soil formation, water purification, biodiversity conservation and climate regulation. Sustainable agriculture will maximize them, and minimize negative externalities.

The CBD defines the Ecosystem Approach *as a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way (...). It is based on the application of appropriate scientific methodologies focused on levels of biological organization which encompass the essential processes, functions and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of ecosystems (CBD, 2000)*. FAO's vision aims at putting into practice this approach that is relevant for integrating cross-cutting issues.

In FAO's vision, sustainable food and agriculture systems do not exist in a vacuum: Global external drivers such as population growth, urbanization, climate change, economic policies and markets, and national drivers such as policies for economic development, environmental protection and social welfare have considerable influences on them. The vision also recognizes that achieving sustainability depends on our ability to identify and balance various trade-offs between human and natural systems, within both, and over time. An example of a trade-off between human and natural system is the impact of rising

consumption on natural resources. Trade off within the natural system can be exemplified by the impact of intensification (e.g. that may reduce deforestation) on quality and availability of soil and water. Thus, decision to implement sustainability of food and agriculture must be supported by the national and local capacities to recognize and balance such trade-offs for benefits to the society now while also ensuring them for the future.

FAO's Strategic Objective on sustainable agriculture led the development of FAO's vision for Sustainable Food and Agriculture and identified five principles guiding the transition to sustainable food and agriculture. The vision and principles were presented to FAO's Committee on Agriculture (COAG), on the occasion of its 24th Session, where Member Countries supported this work.

FIVE KEY PRINCIPLES FOR SUSTAINABILITY IN FOOD AND AGRICULTURE

In order for food and agricultural systems to be sustainable, they must equally and simultaneously address social, economic and environmental dimensions. Neglecting any one area jeopardizes the attainment of sustainability in others. The following five inter-connected principles can collectively guide the process of transition to sustainable agriculture, and contribute to conservation of biodiversity – a critical component of sustainability.

These principles are closely aligned with the vision described above. The first three principles address the major components of the system: the natural system, the human system, and the 'engine of transformation'. Two more principles cut across these three 'pillars' and provide the ground for transition towards sustainable systems (FAO, 2014).

Principle 1. Improve efficiency in the use of resources

Further gains in productivity will be needed to ensure sufficient supply of food and other agricultural products while limiting the expansion of agricultural land. FAO estimates that ninety percent of the growth in crop production globally in 2050 will come from the existing land (FAO, 2009), and with less water than is available now. Dependence for food on fewer plants, animal and fish species and exploiting only a subset of genetic diversity within those species makes the agricultural food and food systems extremely vulnerable, in addition to being nutritionally inadequate. Excessive use of energy, chemical fertilizers and pesticides not only wastes money, it also pollutes air and water, destroys beneficial biodiversity, and contaminates soils. Technologies such as improved locally adapted varieties and breeds, conservation agriculture, site-specific nutrient management including organic manure, precision irrigation, balanced feed, improved management of livestock breeds resulting in less greenhouse gases emissions, and policies such as elimination of perverse subsidies that encourage overexploitation of fish would help produce more with less and protect the natural resource base (FAO, 2014).

Contribution of Principle 1 to Aichi Target 7. Principle 1 supports Aichi Target 7 by directly addressing sustainable use of biodiversity, especially the genetic resources for food and agriculture. Greater resource use-efficiency saves land, water and biodiversity, and enhances ecological services underpinning food production. Technologies such as IPM and lower use of relatively less harmful pesticides would protect populations of pollinators and other friendly insects essential for global food security.

Case study: Sustainable water development in the Near East and North Africa region. The severity of Water Scarcity in the Near East and North Africa is unprecedented. FAO in the region is leading a regional mechanism that will help achieve sustainable water development. Although there are no simple solutions to water scarcity in the region, there are smart choices and sustainable options. These include cost-effective water investments, management practices, and promotion of water accounting incentive frameworks. A set of climate change adaptation solutions is being planned for selected 'green sectors' of the region, including cropping systems, forests, range-lands and fisheries. Since water is a cross-sectoral issue, its solution must necessarily include cross-sectoral integration.

Principle 2. Conserve, protect and enhance natural resources

While improved resource-use efficiency can help reduce pressure on ecosystems, it can also lead to expansion of agricultural production and the subsequent resource depletion and degradation. That is why direct action is needed to conserve, protect and enhance natural resources. Intensification limits encroachment of agricultural land over natural landscape but it often comes together with practices that include high use of inputs, in particular water, fertilizers, and pesticides. These in turn, when not properly used, deplete soils, pollute water, and destroy biodiversity. World's tropical forests remove from the atmosphere 4.8 billion tonnes of carbon dioxide a year, or about 18 percent of annual emissions from burning fossil fuels (Lewis et al., 2009). Reforestation and reducing the rate of deforestation will not only mitigate impact of climate change, it will also contribute to sustainability through soil formation, water purification, biodiversity and pollination. Agroecology, management of ecosystem services and biodiversity, and the optimization of natural biological processes will contribute to a sustainable agricultural intensification. Global instruments, such as CBD, the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), and the Red List of the International Union for Conservation of Nature (IUCN) among others – provide for inter-country collaboration in the conservation of natural resources.

Contribution of Principle 2 to Aichi Target 7. Biodiversity ‘underpins ecosystem functioning and the provision of ecosystem services’ (CBD, 2010) that agriculture uses to deliver its goods and services. Principle 2 aims at conservation of biodiversity and other natural resources. Efforts to protect forests and fragile ecosystems, reforestation, in-situ or ex-situ conservation of agricultural biodiversity, and many of the technologies and policies described under Principle 1 would also protect and enhance biodiversity and contribute to sustainable food and agriculture.

Case study: Laws and policies for agroecology and sustainable land management in Latin America. As the expansion of agroexports and biofuels continues unfolding in Latin America, the concept of agroecologically based production systems gain increasing attention (Altieri et al., 2008). Laws, policies and incentives for mainstreaming environmental friendly agricultural practices have been widely adopted in the region, with amongst others the law for comprehensive agricultural health (“ley de salud agrícola integral” in Venezuela), law for the regulation and promotion of organic agricultural and non-timber forest production (“ley de regulación y promoción de la producción agropecuaria y forestal no maderable ecológica” in Bolivia), or the National Policy for Biodiversity Conservation and the establishment of Private Reserves of Natural Heritage (RPPNs) in Brazil.

Principle 3. Protect and improve rural livelihoods, equity, and social well-being

Agriculture is the major source of livelihoods for about 2.5 billion people (FAO, 2013), most of them living in rural areas where 75 percent of the world's poor live. The degradation of agro-ecosystems directly affects the food supply and income of the poor, increasing their vulnerability and creating a vicious cycle of poverty, further degradation and hunger. Poverty is a major cause of natural resource degradation and agricultural development is the most effective means of reducing rural poverty and food insecurity. Female farmers who disproportionately bear the brunt of this poverty have potential to bring out 150 million people of the poverty trap if given equal access to knowledge and resources. To be sustainable, agriculture must provide adequate access to resources and decent employment conditions to those who practice it, especially women, in an economically and physically safe, and healthy environment. With increased capacity, including the entrepreneurial and managerial capacity, rural producers can work themselves out of the hunger-poverty trap.

Even if the world produces the extra food needed by 2050, approximately 300 million people would still be hungry for lack of resources to access food. In order to protect the natural resources, including biodiversity, it is critical that poor have access to better paying rural jobs and to productive resources, so that they can buy food. Some 150 million people worldwide are prevented from falling into extreme poverty thanks to social protection. Such support helps households manage risk and mitigate shocks that would otherwise leave them trapped in poverty and hunger (FAO, FAD and WFP, 2015). Safety nets

when properly implemented as in the case of Productive Safety Net Program (PSNP) in Ethiopia or the *Fame Zero* program in Brazil not only provide the support needed at the moment but also help create attitude and capacity among the poor to do more for themselves (HLPE, 2012).

Contribution of Principle 3 to Aichi Target 7. Principle 3, among other things, aims at reducing the destruction to biodiversity brought about by hunger and poverty. Addressing the problem of hunger and poverty through creation of rural jobs, empowering women, and provision of safety nets will all reduce overexploitation of forests, land and water, and help protect biodiversity for sustainable agriculture and food systems. To reduce the destruction of biodiversity, alleviating farmers' constraints to the adoption of sustainable practices will be crucial. A combination of cross-sectoral programmes supported by an appropriate package of incentives and empowering farmers through improved knowledge of ecosystem-based agricultural production would support farmers in the transition to more sustainable practices.

Case study: Mainstreaming biodiversity conservation and sustainable use for improved human nutrition and well being in Turkey. Agricultural biodiversity plays a pivotal role in sustaining and strengthening **nutrition**. In Turkey, the habit of consuming wild food plants is still prevalent, although it is decreasing due to lack of knowledge about their characteristics and value. The FAO project called "Mainstreaming biodiversity conservation and sustainable use for improved human nutrition and wellbeing" aims at improving knowledge of biodiversity for food and nutrition and thereby enhance the well-being, livelihoods and food security of target beneficiaries in Turkey. It is linked with the National Biodiversity and Genetic Resources Program, and the agrobiodiversity, health and diet policies and strategies.

Principle 4. Enhance the resilience of people, communities and ecosystems, especially to climate change and market volatility

Natural disasters or extreme weather events, food safety emergencies, market volatility and civil strife impair the livelihoods of millions of people who depend on agriculture for their livelihoods and negatively impact sustainability of food and agriculture. In the context of sustainable food and agriculture, resilience is the capacity of farming communities, households or individuals to maintain or enhance system productivity by preventing, mitigating or coping with risks, adapting to change, and recovering from shocks. Policies, technologies and practices that build producers' and ecosystems' resilience to climate change, market volatility, and other threats would contribute to sustainability.

Biodiversity plays a key role in reducing vulnerability of agro-ecosystems to climate variability and improves the resilience of farmers, forest dwellers and fishermen who depend on them for their livelihoods. It provides the genes necessary to adapt to future environmental conditions, and the use of a wider, more diversified, genetic resource base (at species and varieties levels) by farmers contributes to resilience. Diversification strategies also help cope with markets variability: if the price of one commodity falls, farmers have an opportunity to balance their income with another.

Contribution of Principle 4 to Aichi Target 7. Decisions made under conditions of crisis have far-reaching consequences for households and communities. Individuals may lose their assets, such as land, trees, water or fishing rights, overuse them or trade them in order to meet their immediate needs, despite the potential negative impacts on natural resources and on their own future. Principle 4 builds resilience of the vulnerable with strategies, plans, and measures such as flexible fishing strategies, introduction of pest-resistant varieties and breeds, improved market governance, social safety nets, insurance and credit to enable them to cope with natural disasters and other risks without damaging their natural resource assets including biodiversity that are critical to sustainability of food and agriculture.

Case study: The US Whole-Farm Revenue Protection policy, an insurance scheme incentivizing to diversify cropping systems within farming regions. The United States Department of Agriculture recently introduced the Whole-Farm Revenue Protection policy, which allows farmers to insure all crops on their farms at once, as opposed to insuring them crop-by-crop. The lack of specific insurance programmes for fruit and vegetables in the past has been a disincentive for growers to diversify beyond

commodity crops. This new way of insuring crops offers farmers enhanced flexibility and provides a greater incentive to diversify cropping systems within farming regions.

Principle 5. Promote responsible and effective governance mechanisms

Food and agriculture systems must be based on an enabling environment – policies, laws and institutions – that promotes effective and fair governance, i.e. that ensures accountability, equity, transparency and the rule of law. The underpinning processes must be participatory and involve all key stakeholders, men, women, public and private sectors and civil society. They need to be provided with an enabling institutional and policy environment that provides the right incentives that support the adoption of appropriate practices on the ground. Responsible and effective governance creates trust and encourages buying in. Only when rules of the game are constructed through participation, and are transparent and applied fairly would the stakeholders play by them.

Contribution of Principle 5 to Aichi Target 7. Principle 5 helps develop acceptable solutions to the degradation of natural resources and creates trust among all stakeholders throughout the food production and consumption chain. It especially encourages farmers, pastoralists, fishermen, and forests dwellers to manage and use biodiversity effectively for sustainable food and agriculture.

Case study: A national-level sustainable agriculture paradigm to organic farming in Bhutan. At Rio +20, in June 2012, the Prime Minister of Bhutan announced the ambitious goal of the country to switch to fully organic food production by 2020 through an incremental step-by-step and product-by-product approach, through the National Organic Policy.

SUSTAINABLE FOOD SYSTEMS

Sustainable food systems are defined by the High Level Panel of Experts (HLPE) as “food systems that deliver food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised” (HLPE, 2014). Such food systems are underpinned by sustainable production and consumption, a consumer-driven concept that requires consideration of all the aspects and phases in the life of a food or agricultural product. At the Rio+20 Conference, States reaffirmed that promoting sustainable consumption and production patterns is one of three overarching objectives of, and essential requirements for sustainable development.

Indeed, consumption is the main driver of production and determines agricultural practices and their sustainability. Conservation and sustainable use of natural resources including biodiversity, essential for sustainable food and agriculture, can be achieved only if consumption is also considered. As incomes rise, preference and use of livestock products also rises, increasing demand for feed and fodder. Over half of the world’s global agricultural production is used as feed (FAO, 2006). Considerably more nutrients, water and energy are required in producing a given quantity of livestock product (e.g., meat) than a plant product (e.g., grain), and the relationship between deforestation and livestock production has been well documented. Promotion of nutritionally balanced healthy diets that would include grains, vegetables and fruits along with livestock products would help achieve the same objective. The World Health Organization (WHO, 2009) estimated that 65 percent of the population lived in countries where overweight and obesity killed more people than underweight, supporting the case for addressing overconsumption.

Case study: Influencing the demand at local government level – the example of Sweden. The City of Malmo, Sweden, has adopted a policy requiring all food served or ordered by the city to be climate friendly, organic and ethically certified (where appropriate) by 2020. Schools, health care organizations and public hospitality agencies are expected to adhere to this policy. Since municipalities tend not to have great influence on national agriculture policies, emphasizing sustainability in food purchasing can be an indirect way to support ecological farming practices that benefit ecosystem services.

As implementing sustainable food systems requires adoption of an end-to-end approach, the five principles proposed above need to be applied all along the food chain. They can in particular be used when looking at food losses and wastes. Approximately 1.3 billion tons of food, roughly 33 percent of the food produced for consumption, are lost or wasted after using the natural resources to produce and process them. Investments in reducing losses in the field as well as post-harvest would save the natural resources that would otherwise be needed to produce that food. For this, an enabling environment for investment in development and deployment of appropriate (that use the available resources more efficiently to produce a given quantity of safe and nutritious product) crop and livestock varieties and breeds, efficient and sustainable management practices, storage, nature-friendly transport, processing and packaging infrastructure and facilities, proper pricing and effective markets would be needed. Capacity building at all levels from farmers, researchers, policy makers, to consumers would result in informed decision-making to ensure that adequate, safe and nutritious food is produced, processed, marketed and consumed, or discarded only if necessary. Such facilities and capacities are especially deficient in the many developing countries.

IMPLEMENTING SUSTAINABLE FOOD AND AGRICULTURE: FROM CONCEPTS TO ACTION

Over the past 25 years, FAO has developed a number of frameworks and approaches that have strengthened the capacities of Member Countries in making the transition toward a more sustainable food and agriculture (FAO, 2014). The lessons learned confirm that the transition to sustainability requires political commitment, knowledge and people's participation. An important lesson is that programmes must be designed and led by the country itself so that the approach is coherent, comprehensive and adapted to the country's specificities. The work needs to be embedded in Country Programming Frameworks, National Strategic Plans, or similar strategies that reflect countries' priorities.

Transitioning towards more sustainable food and agricultural systems is a dynamic process and is context specific. The exact steps needed to implement sustainable food and agriculture would differ according to location and scale (community, national or global level). The solutions must be context specific, and the stakeholders will need to adjust and change the selected practices and policies over time. Countries would need to consider the following four areas in implementing sustainable food and agriculture that can be defined by responding to four questions:

1. Evidence: What are the key areas of imbalance in the current agricultural system?

Sustainable agriculture relies on evidence-based planning and management that is underpinned by suitable statistics, geospatial information and maps, qualitative information and knowledge. Analysis, especially of trade-offs, should focus on both production systems and the underlying natural and socio-economic resources (Faurès, 2015). Scientific knowledge should be complemented by traditional knowledge. Through this process, stakeholders develop shared understanding of complex issues and address the associated uncertainties.

2. Dialogue: How do we manage agriculture to achieve a better balance between the economic, social and environmental benefits it could generate?

Since sustainability is a process that involves balancing across a range of objectives and stakeholders, dialogue is an essential feature for success. Successful collaboration underpins the definition of mutually agreed objectives that balance the five principles. Wide stakeholder participation and dialogue improves the understanding of trade-offs to be balanced and facilitates consensus building. It also helps in mobilizing and empowering stakeholders, and improving the knowledge base. Partnerships ensure buy-in from stakeholders and help capitalize on their capacities and comparative advantages.

3. Tools: What are the key levers to move towards a more sustainable balance of direct and associated benefits from agriculture?

Formulating and implementing enabling tools is at the center of the process of transition. The tools to be used in the transition towards more sustainable agriculture are many: guidance, standards, regulations,

institutional rules and frameworks, and incentives needed to help producers moving towards sustainable practices. The tools used must be adjusted based on the accumulating evidence and on the consensus reached through dialogue.

4. Practice change: What are the key entry points, institutions and stakeholders needed to move the levers of change?

Practice change is obtained through awareness raising, capacity building, innovation, and the effective implementation of the tools. It needs to be supported by effective management systems designed to reflect national priorities and policies. Practiced change must be based on clear operational objectives and address the most relevant issues, after some risk assessment. Effective practice change will be the adoption of sustainable agricultural practices making full use of technology, research and development. Progress achieved in the change of practices will be measured through the indicators developed as part of the evidence.

A number of policy and methodological tools have been developed by United Nations organizations and inter- and non-governmental organizations to support countries addressing these four questions. Key policy and methodological tools for to help achieve Aichi Biodiversity Target 7 are already referenced (CBD, 2013).

MEASURING SUSTAINABILITY OF FOOD AND AGRICULTURAL SYSTEMS

There have been considerable discussions on measurement of agricultural sustainability during the last three decades, and they have evolved over time with the evolution of the definition of agricultural sustainability itself. When sustainability was considered exclusively as an environmental issue, the measurements proposed reflected that vision. Since the acceptance of three dimensions of sustainability, i.e., environmental, economic, and social, the measurements have also broadened to include ‘indicators’ for each of those dimensions. As with the definition of sustainability of agriculture, there is no agreed list of indicators to measure its different dimensions. Both individual and composite indicators have been proposed; the latter are a little more subjective and difficult to implement as they often involve construction of indices based on arbitrary weights assigned to different factors being integrated (Becker, 1997; Conway, 1993; Gomez-Limon and Sanchez-Fernandez, 2010; Lynam and Herdt, 1989; Pretty, 2008; Rigby et al., 2001; Swaminathan, 1991; Tabora, 1991; TAC/CGIAR, 1989).

The recent thinkers of indicators for agricultural sustainability have generally espoused the SMART (S= specific, M= measurable, A= attainable, R= relevant, and T= time-bound) criteria (Doran, 1981) originally proposed for developing management goals and objectives and evaluating performance. It is extremely difficult to develop a universal and agreed list of indicators that, sustainability being context specific, would be useful in most or all situations of food and agriculture. In spite of a large body of work and considerable progress, identification and use of indicators to measure agricultural sustainability continues to be ‘work in progress’.

The five FAO principles underpinning sustainable food and agriculture are inter-related. For example efficient use of water for irrigation in Principle 1 would also contribute to conservation of water in the domain of Principle 2 or higher productivity on the existing land (Principle 1) would reduce the need for deforestation to bring additional land under agriculture saving and enhancing biodiversity and other ecosystem services (Principle 2) and help mitigate climate change to improve rural livelihoods (Principle 3) and improve resilience of rural people (Principle 4). It naturally follows that an indicator for one principle may have a bearing on other principle(s).

The following are some indicators for each of the five FAO principles underpinning agricultural sustainability. Policy- and decision makers may find them useful to select those that are relevant to their circumstances and fine-tune and use them to assess sustainability of their food and agricultural systems:

Principle 1 seeks to maximize the efficiency in the use of natural resources (e.g., soil, water, biodiversity) and other inputs. The focus is on getting more products and/ or services per unit of resource used. Therefore, overall compound productivity trends, production per unit of land, water, energy, labour,

fertilizers, pesticides, feeds or hormones used; existence/ number of policies that favour efficient use of resources and inputs; percent of producers using one or more improved technologies (e.g., varieties, breeds, feeds, nutrient management, water management, pest management, etc.); percentage of agricultural area under sustainable agricultural practices; and percent of total production based on improved technologies may be considered.

Principle 2 focuses on conservation of natural resources. Possible list of indicators may include rate of deforestation; area reforested, existence/ number of policies that encourage conservation of forests land, and water; percentage of agricultural area under sustainable agricultural practices, percent of arable land lost to degradation; percent organic matter in the soil; depth of water table; chemical content of water in rivers, lakes, and the subsoil; area under *in-situ* conservation of biodiversity; number of distinct genotypes of plants, livestock, and fish conserved in gene banks; genetic dissimilarity among crop, livestock, and fish breeds grown; percent of production using technologies that reduce greenhouse gas emissions; and amount of pesticides used.

Principle 3 addresses improvement of livelihoods and social well-being especially of the rural population. Indicators such as percent of rural population employed; disposable rural family income; income of rural women; presence/ number of policies and initiatives to build capacity of rural producers; proximity of producers/ farmers to markets; policies to procure products from producers at reasonable price; and presence/ number of policies and initiatives aimed at improving social well-being such as access to basic services such as water, health and education as well as presence of and capacity to implement social protection and safety nets may be considered.

Principle 4 focuses on enhancing resilience of people, communities and ecosystems especially to climate change and market volatility. Presence of and capacity to implement social protection and safety nets; presence of and capacity to implement disaster management policies and practices; stockpiling of and capacity to distribute basic livelihoods supplies (e.g., seeds, fertilizers, fishing nets); percent production employing climate-robust technologies such as drought resistant crop varieties or pest resistant livestock; and presence of policies to facilitate quick availability of insurance and credit may reflect the extent to which a society or country is enhancing the resilience of its people and systems to deal with risks and disasters.

Principle 5 focuses on the importance of ‘good governance’ and advocates strong institutions and capacities, participation, transparency, accountability, equity and rule of law for sustainable food and agriculture. It is relatively more difficult to identify indicators to measure some of these components. Percent decisions reached through stakeholder participation and consensus building; percent confidence of the producers and consumers in their government or institutions to serve or protect their interests; level of confidence among the producers for fair access to productive resources (e.g., through land tenure and water rights) especially by women and the poor; and presence of institutions and mechanisms to address irregularities quickly and locally and percent of such irregularities so settled may be useful in measuring progress in the implementation of this principle.

Case study: Developing targets and indicators for the National Biodiversity Strategy and Action Plan in Brazil.

National Biodiversity Strategies and Action Plans (NBSAPs) provide excellent instruments for mainstreaming biodiversity for food and nutrition. In Brazil, a revision of the national targets of the NBSAP, including provisions for the conservation of crop wild relatives and of those species of potential and economic importance for crop improvement and for food and nutrition, and the development of indicators and monitoring systems was engaged in 2011.

The establishment of the Brazilian Panel on Biodiversity (PainelBio) and the launch of a broad policy consultation led to the identification of indicators that can contribute to mainstreaming biodiversity for food and agriculture, such as the “number of species from the Brazilian native biodiversity included in food and nutritional security policies” to measure the achievement of the National Biodiversity Targets for 2011-2020.

As mentioned above, there is increasing recognition of the need to consider the sustainability of food systems as a whole. Considering two major areas impacting on sustainability of food systems, i.e., food loss/ waste and overconsumption, indicators to measure progress may be ‘per capita loss/ waste of food’ and ‘percent obesity’. Another useful indicator in this area would be the ‘percent of discarded food collected and distributed among the needy’ by the Food Banks and others operating in many countries of the world.

The indicators suggested above are only a few of many that policy- and decision makers may consider for their situations, keeping in mind that indicators that have the buy-in of the stakeholders and are fine-tuned to suit the specific situations are most useful. At the start, it may be more desirable to use a few indicators with large impact, that are easy to measure, and that have bearing on more than one principle of sustainability. As experience is gained, more and more complex indicators may be considered. The usefulness of the indicators would need to be regularly assessed and adjustments made as needed.

PARTNERSHIPS FOR THE TRANSITION TOWARDS MORE SUSTAINABLE FOOD AND AGRICULTURAL SYSTEMS

Effective delivery of sustainable food and agriculture calls for partnerships that bring together stakeholders from the public and private sectors, producers, research and academic institutions, civil society and community organizations. Partnerships should leverage expertise and resources and win support for innovation and investment.

At the global level, various UN institutions have been supporting countries in their transition toward sustainable food and agriculture over the years. FAO has developed various sector-specific and cross-sectoral frame works and approaches and been promoting them (FAO, 2014). Other UN organizations, including CBD, the United Nations Conference on Trade and Development (UNCTAD), the United Nations Department of Economic and Social Affairs (UN/DESA), also support and provide options on policies and technologies toward this goal (CBD, 2010; Giovannucci et al., 2012; UNCTAD, 2013). The Consultative Group for International Agricultural Research (CGIAR), the Organisation for Economic Co-operation and Development (OECD) and others have also been promoting sustainable food and agriculture. Considerable experience and knowledge also exists in the developing countries themselves in implementing sustainable food and agriculture, and opportunities for South-South cooperation should not be overlooked. Thus, the countries have many international institutions to partner with in their quest for sustainable food and agriculture.

FAO and its partners, including CBD, can support countries in making the transition toward sustainable food and agriculture a reality by providing assistance in the following areas:

Build institutions and processes to drive the transition to sustainability

FAO and its partners can assist countries in building and strengthening their institutional capacities to develop and implement policies and strategies for sustainable agriculture. Capacities are especially needed in identifying issues, incentives, innovative responses, and in carrying out performance assessments. The experience of countries, especially from the South that have successfully developed capacities for implementing sustainability are especially useful to others in similar economic, ecological and social circumstances.

Promote appropriate practices and priority-setting

FAO and its partners can provide countries proven policies, technologies, approaches, methods and relevant instruments to help prioritize their production and conservation concerns and agree on objectives, strategies, plans and measures. Given the importance of innovation in the transition to sustainability, FAO and its partners can assist countries in strengthening their technical capacity to evaluate, select and implement innovative practices. Many such technologies and practices are already available. However, as sustainability is of an evolving nature, they must be continually fine-tuned and new ones developed as needed.

Strengthen country capacities to participate effectively in international processes

Many international instruments developed by FAO and others in the UN system aim at building global consensus, fostering national approaches, improving governance and strengthening the capacities of stakeholders to deal with issues of climate change, trade, conservation and sustainable use of natural resources. Those instruments have direct impact on the productivity and sustainability of agriculture. However countries differ in their capacities to contribute to, implement and benefit from them. FAO and its partners can strengthen country capacities to contribute to and benefit from these instruments with direct relevance to sustainable food and agriculture.

Strengthen capacities for data collection and analysis, disseminate information and monitor progress

Collection, analysis and interpretation of data and information are essential for making informed and evidence-based decisions. Recent developments in the field of information and communication technology, including internet, social media and cell phones, provide an ideal means for communicating and disseminating information and also channels for feedback and sharing. “Smart” indicators are particularly powerful tools for monitoring the social, economic and environmental impacts of policies and technologies but building an objective, efficient, easily accessible and user-friendly set of indicators is a complex task. FAO and its partners can assist countries in improving their communication capacities and in the development and use of effective indicators relevant to their situations.

Provide mechanisms for international collaboration

FAO and its partners can contribute to informed discussion and decision-making. For example, in collaboration with CBD, the Commission on Genetic Resources for Food and Agriculture (CGRFA) could produce periodic state-of-the-world reports identifying and promoting appropriate policies and technologies for the sustainable use of genetic resources, and propose options for maximizing synergies and minimizing negative externalities. Member Countries might also consider placing the transition to sustainable agriculture as a standing item on the agendas of the COPs, FAO Conference and its Technical Committees on agriculture (COAG), fisheries (COFI) and forestry (COFO). Experiences, constraints, opportunities and progress in sustainable agricultural development could be discussed regularly also by the Committee on World Food Security (CFS), which would be an ideal forum for analysing cross-sectoral issues and their implications for food security. The committees would also support countries in implementing and further strengthening their sustainable agriculture development plans, at national and local levels. Similar opportunities also exist with other UN institutions, especially the CBD with respect to biodiversity.

The farmers, foresters and fishers will ultimately determine whether the vision of sustainable food and agriculture is realized. Policy-makers and innovators can facilitate it by providing legal and institutional frameworks, incentives, rights and infrastructure. The transition to sustainable agriculture will require major improvements in the efficiency of agriculture, in systems for protecting natural resources, in the resilience of food, socio-economic and ecological systems, and in governance. Field implementation should ensure ownership by the communities that will ultimately decide the relevance of the issues identified and the legitimacy of the responses proposed. International organizations, such as FAO and CBD, can assist countries in making appropriate choices on those issues and in making the transition toward sustainable food and agriculture.

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