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### Agenda Item 10

**Sustainable intensification and diversification of crops and agriculture  
towards food and nutrition security**

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## I. Introduction

1. Over the past 50 years, millions of people in Asia and the Pacific have been lifted out of poverty and the availability of food supplies has outpaced the growth in population. However, despite the substantial progress, the region still accounts for 62 percent of the world's hungry people, and the levels of undernutrition and malnutrition remain unacceptably high. Estimates suggest that by 2050, the region will add another one billion people; income levels will rise further and urbanization levels will exceed 64 percent compared with 42 percent in 2010. Meeting the food needs of this larger, more urban and more prosperous population will require near doubling the availability of food in the region. The additional food will have to be provided through a combination of increased production, reduced post-harvest losses and additional imports. In view of the declining availability of arable land in the region, more than 95 percent of the future increase in production will have to come from increases in yields and cropping intensity.<sup>1</sup>

2. Rising income levels and progressive urbanization have also spurred a shift in dietary patterns – from traditional carbohydrate-based diets to diets richer in proteins and micronutrients (e.g. fruits, vegetables, meat, eggs, milk and fish). This has resulted in heightened demand for cereals, for human consumption as well as for livestock production. This competition will further intensify in the future. While this diversification can potentially create new opportunities for farmers and provide more balanced diets for future generations, it will also require a more complex policy and institutional response that can stimulate income growth and employment in the rural areas, protect the livelihoods of small-scale farmers and ensure adequate access by the poorer sections of society to the food they need to live healthy lives.

3. This discussion paper examines the main trends in intensification and diversification in Asia and the Pacific region and identifies priority action areas at the country and regional levels to strengthen the ability of countries in the region to meet future food needs on a sustainable basis. The paper also stresses the need for strengthening the linkages between sustainable supply growth, improved food and nutritional security at the household level, and improved management of natural resources and the environment.

4. While climate change and increased resource competition for biofuel production will pose major challenges for food security, this paper does not address those issues explicitly since the theme of climate change and food security was discussed extensively during the thirtieth regional conference<sup>2</sup> and issues related to biofuels are covered in a companion paper in this conference.<sup>3</sup>

## II. Trends and structural changes in production systems

### A. Crops

5. The region has a respectable record of improving yields of selected crops – rice, wheat and maize (for feed), in particular. During the green revolution period, the cereal yields in the region increased at a rate of 3.9 percent per year. In recent years (1999–2009), the rate of yield growth has declined to 1.5 percent. Within cereals, there is a marked decline in the rate of increase in production of rice and wheat. While growth in rice paddy yields in the region declined from 2.4 to 1.3 percent, the

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<sup>1</sup> FAO projects a net increase of some 120 million hectares in the arable land area in developing countries between 2005 and 2050. The bulk of this projected expansion is, however, expected to be in sub-Saharan Africa and Latin America. Projections show practically no expansion in East Asia and about 6 million hectares (approximately 1.5 percent of the current arable land area) in the rest of Asia. (Bruinsma, Jelle. 2009. *By How Much Do Land, Water and Crop Yields Need to Increase by 2011?* Expert Meeting on How to Feed the World in 2050, FAO Rome.)

<sup>2</sup> Agenda item APRC/10/2: Integrating climate change adaptation and mitigation for food security and sustainable development in the region.

<sup>3</sup> Agenda item APRC/12/INF/9: Bioenergy development and food security policy.

growth in the yields of wheat have fallen from 3.8 to 1.1 percent from 1999 to 2009. Maize, on the other hand, has shown high rates of productivity growth in view of the availability of hybrid maize and rapid growth in maize demand for animal feed. Production of other coarse cereals, such as millets, barley and sorghum, has stagnated.

6. In this context, it is important to note that despite the deceleration in productivity growth of cereals, average per capita availability has kept pace with population growth rates, although with considerable variation across countries and subregions.<sup>4</sup> While average per capita consumption of rice and wheat – the main staple crops of the region—has shown a declining trend over the last decade because of changing diet patterns, these crops remain critical to the food security of the rural and urban poor. On the whole, however, since average cereal consumption levels in the region have reached medium to high levels of food intake, the future growth in demand for cereals for food will likely be considerably lower than in the past. The real challenges in cereal production will arise from competition with animal feed, biofuels and poor people's access to cereals for food.

7. Production and productivity performance of pulses – a food source rich in protein and essential amino acids – have been poor, particularly in South Asia. Pulse yields have stagnated and the area under pulses has declined. This has resulted in rising relative prices of pulses and declining per capita consumption because these sources of protein and iron have been priced out of the reach of the poor. Production and aggregate availability of fruits and vegetables generally has increased rapidly, but much less is known about how the actual consumption patterns of these foods have evolved among various socio-economic groups, especially the poor and undernourished.

8. There is also a need to recognize the role of home gardens in food and nutrition security. Home gardens are permanently cultivated in compounds around the household. They are common in densely populated rural and peri-urban areas. Small ponds in home gardens can play an important role in fish production and in providing water for many household and farming uses. A well-developed home garden can often out-produce a typical fruit and vegetable farm, in terms of food calories per unit area, with far less labour. With shrinking farmlands and increasing urbanization, the development of urban and peri-urban horticulture is an important source of food to ensure the availability of nutritionally adequate diets.

9. More particularly, in Pacific Islands Countries, rapid changes in dietary patterns among the younger generations have increased dependence on international food markets and marginalization of crops such as aroids, banana/plantain, breadfruit, coconut, sweet potato, yams, taro and root and tuber crops. These crops are important for food and nutritional security, income generation and cultural identity in these countries. In addition, Pacific Island Countries face many more challenges, including small populations and economies; weak institutional capacity in both the public and private sectors; remoteness from international markets; susceptibility to natural disasters and climate change; fragility of land and marine ecosystems; limited fresh water supply; high costs of transportation; limited diversification in production and exports; dependence on international markets; export concentration; and income volatility and vulnerability to exogenous economic shocks such as the cost of fossil fuels.

10. Progress in crop productivity in the past relied heavily on promotion of high-yielding varieties in high-potential areas, application of high levels of chemical fertilizers and pesticides, irrigation and use of mechanized farm equipment powered by fossil fuels. While this strategy supported the early industrialization processes in the region and contributed to poverty reduction in general, it also had significant negative impacts on the natural resource base, resulting in land degradation, contamination and overexploitation of ground water, build-up of pest resistance and erosion of biodiversity. These trends have raised serious concerns about the sustainability of the intensification model followed in the past and the ability of the region to meet the future food and nutrition security challenge.

11. Another consequence of these trends has been the loss of diversity in cropping patterns, further endangering both ecological and economic sustainability. Crop diversification has advantages in that it improves soil health, reduces pest loads and counters the spread of disease. It can also be a

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<sup>4</sup> South Asia, in particular, may be at risk in this context because of its relatively lower rate of decline in population growth and increasing income inequalities.

means of exploiting market opportunities and improving dietary balance. A field study conducted at the Indian Agricultural Research Institute, New Delhi, for example, concluded that on a sandy clay loam soil, partial diversification by including mung bean during the summer in the rice-wheat system can enhance productivity and profitability. Including more profitable higher-value crops (e.g. vegetables) in the marginal and upland areas of Asia can have similar impacts, but such shifts have been constrained by poor infrastructure, limited marketing opportunities and limited policy support for a wider set of crops.

## **B. Livestock, aquaculture and forests**

12. Animal and forest-based foods make a significant contribution to food and nutrition security at national, regional and global levels. The contribution of capture fisheries to per capita global food supply has stabilized over the last few decades, and aquaculture has emerged as the fastest growing subsector of the global food economy; more than 90 percent of global aquaculture production originates from Asia. Similarly, the livestock sector has emerged as a dynamic food subsector since the early 1980s, in response to growing demand for meat, milk and eggs. While global meat consumption recorded a compound annual growth of 2.5 percent between 1980 and 2007, consumption in the Asia-Pacific region grew at 5 percent per year. Global milk consumption grew 1.4 percent per year during the same period and 4.3 percent per year in the Asia-Pacific region.

13. This growth notwithstanding, the contribution of animal source foods (ASFs) to food energy and protein intake remains low, with high levels of nutritional deficiencies in many parts of the region, particularly South Asia and pockets of Southeast Asia. Given the high bioavailability of protein, iron and Vitamin A in ASFs, measures to enhance their contribution in poor people's diets would significantly reduce undernourishment and disease burden caused by protein and micronutrient deficiencies.

14. The contribution of forestry to food security has not received the recognition it deserves. Communities living in densely forested areas depend for their livelihoods and food security directly on plants and animals from forests. Studies in forested areas of Northeast Thailand have shown that 60 percent of all food came directly from the forests. As a category, non-timber forest products (NTFPs), in the form of food, medicine and other products, contribute a large share towards people's livelihoods. NTFPs, like mushrooms, honeybee keeping, medicinal plants, rattan, bamboo and resins, are now being managed into village-level enterprises, and they form the basis for small business opportunities for forest-dependent communities. ASFs derived from forests included small rodents, reptiles, birds, snails and insects, as well as larger animals. The forest dwellers and villagers around the area also derive valuable vitamins and micronutrients from trees which are rich in edible leaves, gums, oils, nuts, fruits, tubers and roots. Forests also serve as a source of fodder for livestock that most villagers routinely keep for milk and meat. In addition, the role of forests in watershed management cannot be diminished – forests not only are a source of clean water on a perennial basis, they also control the flow in a manner to limit flash floods from occurring too frequently. Beyond that, villagers are beginning to introduce timber and other species into agricultural lands. Such agroforestry techniques, while benefitting the farm crops, are also diversifying farmers' income.

15. The aquaculture and livestock sectors have experienced rapid structural changes in the organization of production and distribution of final products. In many places, aquaculture has transformed from extensive/semi-intensive pond culture and rice-fish culture to a wide variety of production systems including: semi-intensive and intensive freshwater and brackish pond culture; inland and marine cage culture of finfish, crustaceans and mollusks; integrated paddy plantations with finfish and crustaceans; pen culture in freshwater and brackish water; and industrialized circulating systems. Similarly, the production in the poultry and pig sectors has been intensifying rapidly, led by large integrated firms and increasing cross-border trade in live animals. Furthermore, the livestock production systems in the region come in close contact with wildlife and human settlements, creating favorable environments for the emergence of novel pathogens which can jump to new host systems including humans.

16. Environmental, food safety, and animal and human health implications of concentrated livestock and aquaculture production systems have recently come under increased scrutiny. Some of these include: the emergence and spread of high impact infectious diseases (many of which are transboundary in nature); the influx of high levels of drug residues into the environment; emergence of antibiotic-resistant strains of bacteria because of the indiscriminate use of antibiotics; loss of biodiversity and genetic resources; and adverse effects on the environment and local nutrient balance from large concentrations of waste products. Similarly, high-input, high-output intensive aquaculture systems can result in nutrient and organic enrichment of recipient waters, which builds up anoxic sediments. Large-scale shrimp culture in some areas has resulted in degradation of wetlands, water pollution and salinization problems. There is also a vigorous public debate about livestock's role in greenhouse gas emissions and the role the livestock sector can play in climate change mitigation.

17. Despite the increasing contribution of large-scale production systems to the regional food supply, fish farming and livestock rearing remain as key livelihood and risk-mitigation activities for millions of small-scale and marginal farmers in the region. It is widely recognized that the aquaculture and livestock sectors have an important role to play in enhancing food and nutrition security, generating employment, empowering women and contributing to broad-based economic growth and poverty alleviation.

### **C. Potential and constraints**

18. A paper prepared for the FAO Expert Meeting on How to Feed the World in 2050<sup>5</sup> concluded that large and economically exploitable yield gaps in wheat, maize and rice still remain in many countries. Large yield variations across countries in the region and across geographical/agro-ecological regions within countries point towards considerable potential to produce more food with the same resource base. Exploitation of this potential would require renewed focus on research to adapt promising technologies to local conditions, and new biotechnologies. In addition, there are many farming systems – such as conservation agriculture, integrated crop livestock production and sustainable forest management – that, with appropriate management practices and technologies, could use inputs (e.g. fertilizers, pesticides, water, locally available feed resources including crop residues and agro-industrial by-products) more efficiently, use and enhance ecosystem services and increase productivity.

19. Similarly, there is considerable room for productivity growth in the livestock sector. The private sector led the adoption of advanced breeding and feeding technology in the broiler and pig subsectors, which spurred significant productivity gains; however, the same result has not been achieved with beef and meat from small ruminants. Similarly, in the dairy subsector, significant advances have been made in the breeds developed for temperate regions, but much work remains to be done to improve the performance of dairy breeds in tropical low-input environments. Improving the availability of animal feed is another area that needs attention as improved animals are rarely able to achieve their potential because of unavailability of good quality feed. Technology development towards improving genetics and nutrition of ruminant animals in the tropical environment and investment in enhancement of the animal feed resource base (especially those feeds that do not compete with human food such as co-products of the biofuel industry and agro-industrial by-products) can go a long way towards enhancing productivity and easing pressures on natural resources and the environment.<sup>6</sup>

20. The policy and institutional framework in many countries is not always serving the needs of the poorest households. Poor service delivery (health and extension) and a failure to create reliable access to markets and credit for smallholder farmers are two examples of such failings. The

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<sup>5</sup> Fischer, RA, Derek Byerlee and G.O. Edmeades. 2009. "Can Technology Deliver on the Yield Challenge to 2050?", paper prepared for the Expert Meeting on How to Feed the World in 2050, FAO.

<sup>6</sup> It is recognized that there are significant losses in the agricultural value chain and that sustainable gains at the production level have limited value if optimizing one component results in inefficiencies elsewhere in a complex system also featuring livestock, fisheries and forestry. However, since the issues related to value chain development, post-harvest processing, transportation and distribution are covered in a companion paper, these are not addressed in this paper.

institutional and policy frameworks tend to support intensive and commercial agriculture, both in providing services and in facilitating access to markets. If household-level food and nutrition security is the goal, this will need to change and governments will need to provide support for innovative institutional arrangements that can provide smallholders with reliable market access, including allowing them to enter into supply arrangements with large retailers and processors.

21. On a more practical level, however, realizing this productivity potential will be contingent on the ability of countries to provide an enabling policy and institutional environment, including remedying existing policy failures such as inappropriate or poorly targeted subsidies on inputs (e.g. water, feed, pesticide, fertilizer, energy)<sup>7</sup>. It will also be necessary to put in place an encouraging incentive regime that rewards adopters of good practices, improve provision of input and advisory services, farmer organization, risk management, and rural finance. Also required will be improved and sustainable partnerships and networks at the local, national and regional levels, including with scientists, civil society, the private sector, farmers and other stakeholders. The challenges, therefore, are as much organizational and institutional as they are technological.

### III. Investment in sustainable production capacity

22. It is clear from the discussion in the previous section that meeting future challenges of food and nutrition security will require: (1) substantial investment in improved resource use efficiencies; (2) development of appropriate technologies; and (3) control along the value chain in a manner that facilitates integration of environmental health, economic profitability and social and economic equity goals. FAO has recently released a comprehensive publication, “Save and Grow”, which argues that an ecosystem approach must underpin farming systems for the sustainable intensification of production. Other studies have reached the same conclusion, such as the International Fund for Agricultural Development’s (IFAD’s) Rural Poverty Report,<sup>8</sup> the United Kingdom’s Foresight Report<sup>9</sup> and the International Assessment of Agricultural Knowledge, Science and Technology (IAASTD).<sup>10</sup> “Save and Grow” provides a toolkit of adaptable farming systems, technologies and practices and explores the policies and institutional arrangements that will support the large-scale implementation of sustainable crop production intensification.<sup>11</sup>

23. One important focus area for sustainable crop intensification in the future will be breeding improved crop varieties for a wide range of agro-ecosystems and farming practices. This would mean promoting high-yielding varieties for diverse agro-ecological and climatic conditions, including marginal environments, and developing new varieties for a range of crops, including those that have been hitherto neglected and underutilized but are important for the region’s poor. Examples of such crops include sorghum, millets, pulses, roots and tubers and oilseeds. These crops can also play a significant role in enhancing soil nutrition and the overall resilience of ecosystems. Further, since the diets of most ruminants in the region are based on crop residues, the crop breeding strategies must also take into account the feeding quality of crop residues. This would require a strengthening national programmes for plant genetic resources conservation, plant breeding and seed and planting materials distribution in order to deploy improved crop varieties that are adapted to specific environmental and production conditions, resilient to climate change, disease and pest pressure, and that use nutrients, water and external inputs more efficiently.

24. Recent trends in privatization of plant genetic resources and plant breeding through the increasing use of IPRs, especially plant breeders’ rights and patents, have stimulated private sector

<sup>7</sup> Should this not be feasible, alternative options such as rationing or social demand management, which have proved to be effective for energy and water, could also be considered.

<sup>8</sup> IFAD 2010 Rural Poverty Report 2011. New realities, new challenges: New opportunities for tomorrow’s generation. Rome.

<sup>9</sup> Foresight 2011. The future of food and farming: Challenges and choices for global sustainability. Final project report. London, The Government Office for Science.

<sup>10</sup> IAASTD, 2009. Agriculture at the crossroads. B.D. McIntyre, H.R. Herren, J. Wakhungu & R.T. Watson, eds., Washington D.C.

<sup>11</sup> FAO. 2011. “Save and Grow: A policymaker’s guide to the sustainable intensification of smallholder crop production.

investment in agricultural research and development. This has contributed towards development and introduction of sound, sustainable technologies. But, there has also been an increasing concentration in the pattern of this investment raising concerns about access to new plant varieties by poor countries and smallholder farmers. More importantly, this has skewed research towards development of plant varieties for a limited number of major crops that can potentially generate higher commercial benefits rather than those that can generate maximum public good. At the same time, inefficiencies in public sector institutions hamper technology development and diffusion, including development and dissemination of improved plant varieties, agronomic practices, new technologies for pests and disease control etc.

25. Similarly, growth in the livestock sector has been led primarily by private investment. This has driven technology developments that are highly scale-intensive to the exclusion of those that may be suited for smallholder production systems. As in the crop sector, there has been an increasing concentration in the pattern of investment that has been skewed towards genetic improvement of few major species and commercial breeds in intensive production systems that generate higher commercial benefits than local and adapted breeds that can generate maximum public goods. Production intensification in many countries was driven by importation of feeds and commercial exotic breeds, leading to the loss and genetic dilution of local and adapted breeds. Overcoming these constraints would require strengthening national programmes for animal genetic resources characterization, breeding and conservation, and deployment of improved breeds that are adapted to specific environmental and production conditions, resilient to climate change, disease and pest pressure, and that use feeds, water and external inputs more efficiently. The first review of the implementation of the Global Plan of Action for Animal Genetic Resources in 2012 will provide a better assessment on the status of livestock diversity in the region.

26. A good assessment of resources availability is a pre-requisite for enhance resources use efficiency. But, there is limited availability of sound data for the livestock sector. Not many countries have national feed inventories, databases on feeding systems, or data on available feed resources and their composition.

27. Research on public good aspects of technology development for livestock – such as impacts on poor people or externalities related to the environment or public health – has also not received adequate attention.<sup>12</sup> A more sustainable path of development would require correcting these failures, ensuring that externalities are properly reflected in the economics of production and strengthening sector governance in a manner that facilitates development and adoption of environmentally friendly technologies, promotion of biodiversity and participation of smallholders in expanding markets.

28. The region has the world's highest rates of mineral fertilizer use, on average, but there is large variation across countries within the region. East Asia – China, Japan and Republic of Korea, in particular – has a very high rate of fertilizer use (close to 250 kg per hectare of harvested area compared with the world average of less than 130 kg and the developed country average of 140 kg per hectare). But, the uptake efficiency is not very high. In China, for example, N-uptake efficiency is estimated between 25 and 30 percent in rice, wheat and maize and less than 20 percent in vegetables. The remainder is simply lost to the environment, resulting in greenhouse gas emissions, acidification and high levels of nitrogen in agricultural runoff. Further, in most countries in the region, the common practice is to broadcast urea onto wet soils before transplanting or into standing water, and then to broadcast one or more top-dressings in weeks after transplanting. Such practices are agronomically and economically inefficient and environmentally harmful. Similarly, in the livestock sector, the feed conversion efficiency and feed-nitrogen use efficiency for most ruminants in the region is approximately 50 percent of that in countries with more intensive production systems. Improving this efficiency requires a series of actions, including capacity building and information dissemination in support of adopting good farming and land management practices (e.g. conservation agriculture); better feeding and breeding strategies to increase animal productivity; establishment of national

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<sup>12</sup> FAO. 2010. State of Food and Agriculture 2009: Livestock in the Balance, FAO, Rome, Italy.

regulations for sound land husbandry; and development of tools, methods and systems to monitor soil health.

29. Irrigation was key to improving agricultural productivity and stimulating rural growth in the past. Indeed, the region now contains almost three-quarters of the world's irrigated land, making it the most intensively irrigated region in the world. About one-third of Asia's cultivated land is already irrigated, compared with 10 percent in North America and 6 percent in Africa. South Asia accounts for the largest share of irrigated area (more than 40 percent), followed by East, Southeast and Central Asia (Mukherji and Facon et al, 2009).<sup>13</sup> But, the region is reaching limits in the additional water it can provide. The large-scale centrally managed irrigation schemes of the past have come under increasing criticism for being non-responsive to farmers' needs, and indiscriminate pumping of groundwater has resulted in serious depletion of water levels in many parts of Asia. With growing demands from other economic sectors, agriculture will need to adapt to improve water productivity<sup>14</sup> and to minimize water pollution from agricultural land. This will require renewed investment in irrigated agriculture as well as upgrading of rainfed farming. Specific strategies and investment areas would vary from country to country, but would generally comprise modernizing existing irrigation schemes to introduce flexibility and reliability in canal irrigation service delivery to enable farmers to adopt sustainable intensification practices by promoting water-saving technologies including those that contribute to saving other inputs; building on local initiatives to improve water-use efficiency and water productivity; promoting public-private partnerships in managing irrigation and drainage schemes; building capacity and knowledge; and improving coordination and collaboration with other agencies to maximize returns from investment in irrigation (Mukherji and Facon, et al, 2009). The availability of a sound water accounting framework that considers all scales of water management from the farm to the field to the river basin is essential to underpin efforts to improve water productivity and water conservation as water savings at the farm do not always translate into equivalent water savings in the system or the river basin level. Additionally, since the irrigation systems as a rule provide water for multiple uses and users and not just crops, efforts at reducing water inputs into the crop system may result in significant losses of productivity or benefits for the overall system.<sup>15</sup> In this regard, if planned early in the modernization process, the integration of various aquaculture options and service requirements of aquatic resources into irrigation management systems can provide significantly improved investment returns.

30. Dedicated and adequately resourced agricultural extension support systems (both human and financial) played a critical role in technology adoption at the time of the Green Revolution. The region also has a long and rich experience with participatory extension approaches, farmer field schools in particular. These approaches emphasize people-centred learning and use innovative methods to create an environment, including learning networks, in which the farmers have the opportunity to learn about production problems and ways to address them. Overall, however, the extension and learning systems have suffered from under-investment. It is vital to ensure strong research extension linkages and organizationally sound delivery approaches.

31. Smallholder farmers and those in more marginal environments are more dependent on ecosystem goods and services and need maximum support for meeting their subsistence needs, finding remunerative markets for their surplus produce, and adopting farming practices that increase farm productivity and profitability and minimize negative environmental impacts. Some of these include conservation agriculture, participatory plant and animal breeding, diversification of cropping patterns (including legume intensification), integrated pest management and integrated nutrient management. On the institutional side, these technologies will need to be supported by effective farmer organizations that can inform the larger research community about ongoing on-farm needs and can

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<sup>13</sup> Mukherji, Aditi and Thierry Facon. 2009. Revitalizing Asia's irrigation to sustainably meet tomorrow's food needs. IWMI (International Water Management Institute), FAO and Asia-Pacific Water Forum.

<sup>14</sup> FAO has developed a number of tools such as AquaCrop, (<http://www.fao.org/nr/waterr/aquacrop.html>) and MASSCOTE (Mapping System and Services for canal Operation Techniques) (<http://www.fao.org/nr/water/news/masscote.html>)

<sup>15</sup> FAO-RAP is developing an evaluation framework for the sustainability of water saving irrigation.

facilitate participatory planning, farmer education and enhanced bargaining power for smallholder farmers, including women, to access resources and markets.

32. Improved production efficiency is necessary but not necessarily sufficient for improving food security. Physical and economic access to adequate and sufficient food at the household level is influenced by a number of socio-economic, political and cultural factors, and it is hard to prescribe generalized solutions that can address the complex issue of distribution of food supplies. Each country will have to discover its own model, but there are a number of experiences – both within and outside the region – that can provide important lessons to guide the formulation of appropriate policies, programmes and delivery systems. A detailed analysis of these experiences is not within the scope of this paper, but the region has generally lagged behind in strengthening the legal, social, political and administrative processes for improving food access at the household and individual levels. It must be understood that equitable access to sufficient nutritious food at the individual and household levels is not just a social imperative; it is also critical for augmenting labour productivity and sustaining future economic and social development. The region's sustainable development has been hindered because of persisting inequities in food access. Hence, a decisive shift in the governance paradigm of food systems must occur that can give as much emphasis to access to food as to production.

33. Rural women across the Asia-Pacific region play a critical role in supporting all the pillars of food security, but continue to face social and policy barriers in accessing skills, training, assets and inputs. Such inequality is particularly severe in South Asia and has been found to be a prominent factor in explaining persisting high child malnutrition rates there. Improved gender equality in access to opportunities and assets will not only contribute to higher agricultural production and better nutrition, it will also have a long-lasting impact on economic growth. Indispensable elements of all interventions aimed at achieving sustainable food and nutrition security include closing the gender gap by recognizing women's crucial role and extensive knowledge in agricultural production; ensuring equal access to assets and skills; strengthening rural institutions and making them more gender-aware; and building the human capital of women and girls.<sup>16</sup>

34. Finally, true food security includes good nutrition. Policies and programmes to promote nutrition need to focus on promoting nutrition-sensitive agricultural production, good feeding and caring practices, appropriate nutrition education and capacity building of local institutions. In this context, FAO recently has been placing increasing emphasis on dietary diversity and food-based approaches (e.g. fortification, dietary diversification, bio-fortification). These approaches, in conjunction with nutrition education, can potentially improve dietary habits and feeding practices. Schools can serve as an important entry point in this respect.

#### IV. Conclusions and recommendations

35. Notwithstanding the progress in reducing poverty and augmenting food supplies, the region faces formidable challenges in protecting and enhancing food and nutrition security in the future. The region accounts for 62 percent of the world's hungry people and levels of undernutrition and malnutrition are unacceptably high. The natural resources – agrobiodiversity, land and water, in particular – are under tremendous pressure, and these pressures have been exacerbated by unsustainable agricultural practices. As a result, historical gains are increasingly at risk. *The Conference may wish to recommend according high priority to the pursuit of sustainable food and nutrition security objectives by adopting environmentally friendly, economically efficient, socially equitable production policies and practices.*

36. While wide yield gaps still exist in modern varieties of most crops, growth in the yields of rice and wheat has fallen dramatically and production of other coarse cereals such as millets, barley and sorghum has stagnated. Production and productivity performance of pulses has also been poor. These crops have an important role to play in sustaining long-term agricultural productivity, adding to crop diversity, enhancing micronutrient availability and increasing the earning capacity of the poor. Equally

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<sup>16</sup> FAO. 2011. State of Food and Agriculture 2011: Women in Agriculture – Closing the Gender Gap for Development, FAO, Rome, Italy.

important is the enhancement of the value of crop residues which forms a large part of the diets of ruminant animals on small farms. *The Conference may wish to recommend that focused efforts be made to enhance the sustainable productivity of all crops and cropping systems, in particular those relevant to poor peoples' diets and livelihoods.*

37. Within the livestock sector, considerable productivity gains have been made in the broiler and pig subsectors but the same has not been true in ruminant meat and milk. The ruminant subsector is in dire need of attention for improving productivity and reducing greenhouse gas emissions. *The Conference may wish to recommend increased public investment to support technology development towards improving the performance of local breeds of ruminant animals (dairy and small ruminants in particular) in the region. The Conference may also recommend the development of policies and measures to reduce the environmental impact of livestock production and ensure a pro-poor sector development.*

38. Overall, the livestock and aquaculture sectors have done well in meeting the growing demand for food, but have not done so well in supporting livelihoods, preserving natural resources and the environment and protecting animal, human and ecosystem health. There is a need to find a balance among the multiple objectives these sectors must support. *The Conference may wish to recommend improved support for development and implementation of good aquaculture and animal production practices – in particular, integrated crop-livestock agroforestry systems – and better oversight and coordination in these sectors so as to establish the technical, institutional and policy measures necessary to effectively, safely and equitably deliver on the multiple objectives. The conference may also wish to recommend increased investment in prevention and control of high impact emerging and re-emerging infectious diseases (including zoonoses) through support of capacity development at international, regional, national and subnational levels using a multi-sectoral and multi-disciplinary approach (the One Health approach).*

39. The contribution of forestry to food security requires to be looked at afresh, considering the critical role it has been playing. Besides being a source of food, particularly during vulnerable times, NTFPs provide the means to earn extra cash for forest-dependent communities. With management, they also provide opportunities for developing small enterprises. The forests are equally critical for watershed management, including water conservation, and provide the original source material for incorporating into agroforestry practices. *The Conference may wish to highlight the role of forests in food security, livelihood development and other related areas so these vital functions are given renewed attention and recognition and institutional and policy measures effectively capture and retain the forests' role and importance in the region.*

40. Public investment in agricultural research and extension has declined and national research and extension systems have become inefficient. Private-sector investment, on the other hand, has remained skewed towards crops of commercial interest. This does not bode well for long-term food and nutrition security. *The Conference may wish to recommend stepped up public investment in national agricultural research and extension systems (NARES), forging research alliances with private sector and civil society organizations with closer links to farmers. The Conference may also recommend organizational reforms of NARES to strengthen research–extension linkages and to encourage higher levels of operational autonomy and strategic accountability.*

41. A rich set of experiences is now available to provide effective safety nets in food access, but globally, only a few countries have managed to operate them efficiently. In this context, conditional cash transfers have emerged as one of the good practices, although these may not be relevant for marginal and remote areas with poorly functioning food markets. Under those circumstances, direct food distribution programmes might still be relevant. Further, sustainable improvements in food security in Asia must also incorporate specific nutritional initiatives into the programme designs, with special emphasis on dietary diversity and other food-based approaches. *The Conference may wish to recommend assigning high priority to the design and implementation of cost-effective and efficient safety nets in food access for rural and urban poor.*

42. It is important to recognize that in addressing the issues outlined above, action will be required at all levels – local, national and international. The challenges of mobilizing adequate public and

private investment will require integrated efforts by a wide range of stakeholders within and outside the region. It is also imperative that such efforts be conscious of the region's socio-economic and cultural dimensions. While there are no off-the-shelf technological and institutional solutions that can be applied in all different contexts, the region certainly has a number of successful models and initiatives that can serve as sources of lessons for formulating future strategies and programmes. FAO has a unique role as an effective facilitator in exchanging knowledge and evidence-based solutions, and is uniquely positioned to provide thought leadership and technical assistance in partnership with other UN agencies, the Consultative Group on International Agricultural Research (CGIAR) system, national and regional organizations, international financial institutions, civil society organizations, the private sector and research and development organizations. *Within the scope of this paper, the Conference may request FAO to further assist member countries in the following areas:*

**1. Development of strategic analyses and investment guidelines**, including generation of sound data assessments of the negative impacts of current agricultural practices, and policy and institutional analyses, in support of sustainable intensification and diversification; providing advice on the formulation of relevant national strategies and action plans, and facilitating mainstreaming of these strategies and action plans into national food security plans.

**2. Knowledge generation and sharing through research, dialogue, and dissemination**, including summarizing and disseminating local knowledge and innovations, with a particular emphasis on knowledge of women and local and indigenous communities; identifying and piloting technologies in crops, livestock, forestry, fishery production and processing and land and water management; and working with farmers to adapt prioritized technologies in an integrated and sustainable way.

**3. Promotion of capacity development** on the formulation and implementation of relevant strategies, programmes and policies, updated technologies and good practices in the agricultural sector at regional, sub-regional, national and local levels. This could also include enhancing the technical capacity of agriculture service providers, local farmer/community networks, cooperatives and community based organizations.

**4. Facilitating regional cooperation** through the establishment of regional cooperation networks, positioning the FAO Regional Office for Asia and the Pacific as a coordinating hub, to strengthen awareness raising, policy dialogue, strengthen research and extension linkages, information and knowledge exchange, sound and harmonized data collation, joint research activities and technical cooperation.