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Addressing rising water scarcity in agriculture: introducing a new FAO Water Scarcity Programme and associated Regional Cooperative Platform

Executive Summary

At the 2020 Regional Conference for Asia and the Pacific (APRC35), FAO presented a technical paper titled *Setting regional priorities to manage water for agriculture under conditions of water scarcity*. The technical paper, and the proposal for a new Water Scarcity Programme contained within it, were widely endorsed by the 35th Regional Conference. This information document serves to provide an update on the follow up actions taken in response to APRC35 recommendations. It provides an overview of the five-year Water Scarcity Programme (WSP) for Asia and the Pacific region and progress made in its development. The WSP has now been developed in detail and is designed to support FAO Members in taking practical steps to address and manage water scarcity in a changing climate. The WSP is based on extensive scoping activities that FAO carried out between 2019 and 2021. It is a consultative document designed to allow the Regional Conference to provide inputs and comments for improvement.

Suggested action by the Regional Conference

The Regional Conference is invited to:

a. recognize that increasing water scarcity is a serious threat to food security, sustainable agriculture and resilience to climate change in Asia and the Pacific region;

b. support FAO's efforts in awareness-raising of water scarcity and elevate water in agriculture and climate change agenda through the COP27 and COP28 processes;

c. welcome FAO's efforts to support Members in managing water scarcity with a combination of interventions in technical and policy areas as part of a comprehensive Water Scarcity Programme; and

d. encourage FAO to take actions on key priorities for the Water Scarcity Programme, including regional linkage to the global Water Scarcity in Agriculture (WASAG) programme and actions to be taken by FAO towards activating regional (or subregional) mechanisms to increase coordination among national efforts to address water scarcity.

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Water Scarcity in Asia and the Pacific

1. FAO defines water scarcity as follows:[1] *Water scarcity arises when demand exceeds available supply, whether supply is limited by uncoordinated planning and inadequate hydraulic infrastructure or by the physical availability of water itself*.

2. Water shortages can be experienced on different timescales, including intra annual (seasonal) and inter annual from years to decades. The lack of appropriate type and scale of water storage infrastructure poses significant challenges during periods of water shortage. Water scarcity has long been a fundamental challenge in West Asia and parts of South Asia. The more recent emergence of water scarcity (particularly *seasonal* water scarcity) in other South Asian countries and throughout Southeast Asia results from increased demand arising from population growth, rapid economic development, significant changes in urban-rural demography, a rising demand for more and more varied food, and rapidly degrading water quality.[2]

3. Climate change acts as a multiplier of water scarcity, evidenced by the rising frequency and severity of droughts (including in countries that have not experienced drought in the past), in addition to increasing incidence of dry spells in the wet season owing to increasing seasonal variability and rising mean temperatures.

4. Managing rising water scarcity throughout the region is compounded by lack of comprehensive and accurate hydrological data, including quantity, quality and sector use. The availability of such data varies in countries throughout the region.

5. Asia and the Pacific region contains a highly diverse range of countries and climates that experience water scarcity of varying types and severities. This includes absolute water scarcity[3] in arid and semi-arid regions (large parts of South Asia and East Asia) and seasonal or inter-annual scarcity, where high seasonal variability means that scarcity is experienced for parts of the year (i.e. monsoonal Southeast Asia). The Pacific Islands face unique water scarcity challenges as they are often reliant on limited and often already overexploited groundwater supplies that are also vulnerable to pollution and saline intrusion. In addition to the range of biophysical water scarcity conditions, water scarcity is experienced in different ways across countries depending on the level of infrastructure development and water resources planning.

6. The agriculture sector is buffeted by conflicting pressures and targets. Food self-sufficiency and food security retain high political priority in most countries in Asia and the Pacific region. Agriculture is often a significant source of export earnings, and many countries have a substantial proportion of households that depend on agricultural incomes.[4] FAO estimates that the world will need to produce 50 percent more food between 2013 and 2050 to satisfy future demand, based on 2013 levels of production. At the same time, the agriculture sector share of the economy is declining, reflected in its contribution to the gross domestic product (GDP) which, by 2016, had fallen below 20 [5]. There has been a recent upturn in the contribution to GDP by agriculture throughout Asia, and agriculture continues to be important in multiple ways, not least in employment (with a median value of between 25 and 30 percent across the region), rural development, landscape maintenance and environmental services.

7. Agriculture drives water scarcity because evapotranspiration from irrigated agricultural land is by far the largest consumptive use of water withdrawn for human needs. In some countries, more than

[1] FAO. 2012. Coping with water scarcity: an action framework for agriculture and food security. FAO Water Reports, 38. Rome.
[2] United Nations World Water Assessment Programme/UN-Water. 2018. The United Nations World Water Development Report 2018. Paris, UNESCO.
[3] Absolute water scarcity is defined as an insufficiency of supply to satisfy total demand after all feasible options to enhance supply and manage demand have been implemented. FAO. 2008. Coping with water scarcity – an action framework for agriculture and food security. FAO Water Report 38. Rome.
[4] FAO. 2017a. The state of food and agriculture: Leveraging food systems for inclusive rural transformation. (also available at http://www.fao.org/publications/sofa/en/).
[5] World Bank. 2018. World Development Indicators [online]. https://databank.worldbank.org/reports.aspx?source=world-development-indicators

90 percent of the water used by humans is for irrigation, with the remainder used for drinking-water supply, sanitation, industry, mining, navigation and the environment.[6] The main cause of water scarcity in agriculture is agriculture itself, and there are added pressures from rapidly escalating industrial and urban water pollution that makes water unsuitable or unsafe for food production.[7]

WSP objectives

8. The Water Scarcity Programme (WSP) focuses on the sustainable use of water and the changes being forced on agricultural water use in response to overuse of water resources, drought, rising demands from other sectors, and the continuing imperatives of food security and ecosystem health. Climate change exacerbates these stresses.

9. The long-term objective of the WSP is to achieve sustainable use of water resources in all countries in Asia and the Pacific region. While there are many definitions of sustainability, FAO uses a working definition as follows: *Sustainable water use balances the social, human, economic and environmental demands for good quality freshwater (and the benefits of those uses) with the long-term availability of utilizable and replenishable surface and groundwater resources. It seeks to do this at minimum economic, social and environmental cost.*

10. The specific WSP objectives are provided below, according to priority areas of intervention:

Policy

11. Establish conditions for sustainable water management in all sectors, including provision of adequate environmental flows, by:

a. focusing on policy integration across sectors, especially water, agriculture and environment;

b. linking policy to action through the development of strategies, regulations, actions and investments;

c. supporting the implementation of policy through the introduction of practical management processes and skills; and

d. adapting policies in the light of experience.

Data and information

12. Improve assessment of water resources availability, use and demand across all sectors by:

a. developing and using assessment tools, policies and processes;

b. establishing routine water accounting at national level: establishing in-country capacity to routinely assess and predict water availability, current water use and projected water demands.

Allocation

13. Promote rational, equitable and transparent water allocation processes at national level in consultation with all stakeholders.

Practice

14. Promote sustainable agricultural and water management practices at farm and scheme levels that maximize food production and are consistent with sustainable regional water availability.

South-South and Triangular Cooperation

15. Establish and support regional cooperation on water scarcity management.

[6] World Water Assessment Programme. 2012. The United Nations World Water Development Report 4: Managing Water under Uncertainty and Risk. Paris, UNESCO. (available at: http://unesdoc.unesco.org/images/0021/002156/215644e. pdf).
[7] Damania, R., Desbureaux, S., Rodella, A.S., Russ, J. & Zaveri, E. 2019. Quality Unknown: The Invisible Water Crisis. Washington, DC: World Bank. doi:10.1596/978-1-4648-1459-4.

WSP activities

16. The underlying philosophy of the WSP is to develop and institutionalize selected practical activities that operationalize water policy and underpin the management of water scarcity within increasingly effective governance frameworks.

17. The WSP will adopt the subregions as they mirror the severity of the water scarcity challenge:

a. South and West Asia: seasonally wet (monsoonal) but predominantly dry (established water scarcity);

b. Southeast and East Asia: predominantly wet but seasonally dry (emerging water scarcity); and

c. the Pacific (limited agricultural water use, high rainfall and limited utilizable water resources).

18. WSP activities are broken down into four main pillars (Figure 1). These are closely interrelated:

a. Pillar 1: Develop practical capacity in routine water accounting to understand water use and demand;

b. Pillar 2: Develop water allocation frameworks and processes that are based on water accounting and help share water between the various demands;

c. Pillar 3: Work with farmers and water managers to adapt to water scarcity to optimize productivity with the amount of water that has been allocated; and

d. Pillar 4: Establish a Regional Cooperative Platform to capture and share lessons from regional leaders in water management and from WSP implementation.

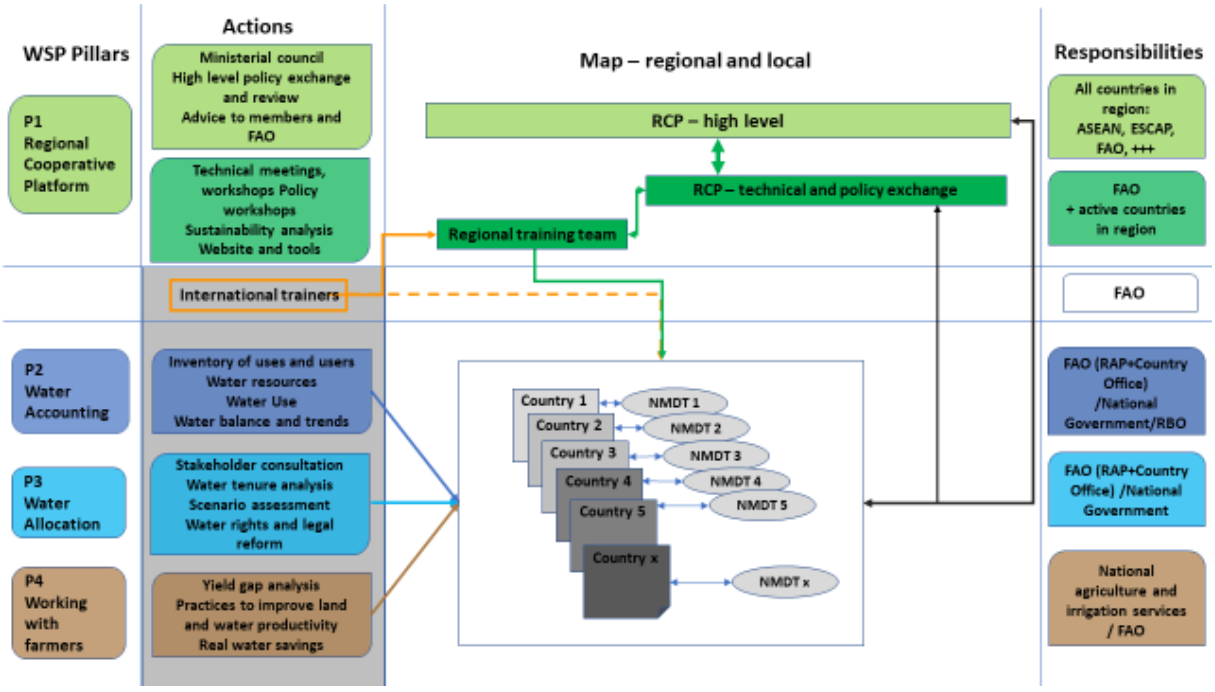

Figure 1. Water Scarcity Programme structure

19. Efforts will be made through the WSP to improve inclusivity. Gender mainstreaming and the extent to which the feminization of agriculture in some areas require different programming approaches. This includes for example the need for new research to fill existing gaps in knowledge and good practices.

Pillar 1: Develop practical capacity in routine water accounting

20. This pillar will develop practical capacity in routine water accounting in partner countries throughout the region to ensure that routine water accounting becomes a mandated, institutionalized and ongoing activity of the government agency responsible for water management at basin or national scale. Preparation work will entail training and identification of any policy and legal reforms required to enable routine water accounting. It will focus on the balance between useable renewable water resources and managed water use from surface water and groundwater, now and in the future, taking account of interannual variability and trends in supply and demand. Water accounts will incorporate the effects of poor water quality on water availability (treated and untreated wastewater).

21. National water accounting teams will be cross-disciplinary and have expertise in water, agriculture, environment and energy and will require good capability in geographic information systems (GIS) and in the use of remote sensing in water management. The depth and rigour of water accounting will be improved as the programme evolves. The main tasks will include the following:

a. establish a detailed baseline inventory of water users, water use, hydromet data, a GIS baseline (e.g. topography, land use) and stakeholder mapping;

b. prioritize catchments and river basins where water accounting is most needed;

c. complete staged basin/catchment accounting studies that use a range of local and global data sources and remote sensing products, beginning with simple and rapid assessments and progressively refining the quality of water accounts over time;

d. complete basin and national reviews of flow measurement;

e. complete simple national water accounts, balances and demand profiles: as countries progress, the accounting unit will explore the use of different national water accounting methods, such as Water Accounting Plus;

f. develop a national water register to track water availability and use, water entitlements and water allocations.

22. Preliminary analysis will be made at least at catchment scale (containing various sources, uses and users) and preferably for a complete river basin. In relatively rare cases, the analysis may be conducted for a defined aquifer. Even where hotspots are identified (e.g. a major city), the water accounting analysis will be framed within its hydrological and hydrogeological setting and the catchment/basin within which it sits.

Pillar 2: Develop water allocation frameworks and processes

23. Water allocation processes and procedures are needed to resolve priority needs for water and match them to available supply, while taking account of short- and long-term variability in water resources stocks and flows. Effective water accounting is essential for transparent and effective water allocation systems. Effective water allocation is also vital to provide the water required to restore ecosystems and associated services.

24. Understanding the real-world state of water uses, formal and informal rights, and water "ownership" (collectively known as water tenure) is essential before embarking in the development of formal water allocation systems. Without clear quantification of water use and a good insight into who uses water and how, water allocation processes will be poorly designed, dysfunctional and may even create harm.

25. The National Multidisciplinary Teams (NMDTs) will play a key role in coordinating multiple sectoral perspectives and in monitoring the representation of these perspectives at all stages of the allocation process.

26. Initial work will focus on:

a. diagnosis and selection of target basin/catchments/areas, including the understanding of existing water accounting and allocation processes, if any;

b. initial multistakeholder in-country meetings on water use and demand;

c. multistakeholder scenario-building;

d. water tenure studies and assessment of the legal provisions for establishing water entitlements ("rights" to use water that underpin a water allocation process and specify the nominal amount, conditions for use, and procedures for varying allocation against entitlement); and

e. parallel water policy analysis for water scarcity management, suggestions for reforms, and design of updated laws, regulations and procedures to reform or establish formal water rights and provide water allocation with a legislative basis.

27. The follow-up activities will pilot water allocation processes and procedures in a manageable river basin/catchment and in a newly established groundwater district and learn from the experience. If pilot work proceeds well, the next step will be to operationalize water deliveries to individual users under a bulk entitlement process[8] or other locally determined arrangements.

28. A key output from these activities will be the publication of a guide on the incremental development of options and practice for effective water allocation processes and procedures.

Pillar 3: Work with farmers and water managers to adapt to water scarcity

29. The proposed activities under this pillar will concentrate on managing and constraining agricultural water use and focus on demand management. It is important to understand that there are only a small number of ways to constrain water demand in agriculture:

a. reducing non-productive evaporation (e.g. mulching, irrigation scheduling and application, intercropping);

b. improving the efficiency of transpiration (mostly through crop breeding);

c. reducing net water consumption of crop production systems by modifying crop patterns (crops, varieties and planting dates); and

d. minimizing non-recoverable losses in water delivery systems, such as percolation and drainage to saline water bodies/groundwater (improved distribution and application efficiency in irrigation, irrigation scheduling).

30. Clearly, crop breeding is a research topic. Managing water scarcity from a farmer's perspective involves defining the traits that breeders should improve and making best use of existing and improved varieties in day-to-day farming. Practical realization of crop improvement depends on good farming practice and convergent outcomes in livelihoods and water use.

31. It is possible to reduce the area of irrigated crops to reduce water demand, but this results in lost production. However, as climate change and water scarcity worsen, broader-scale re-shaping of national agricultural systems becomes increasingly likely, with land retirement in some areas and substitution in others. However, there are considerable opportunities to improve the average productivity of land and water by improving total factor productivity to match levels achieved by the best farmers, provided that they are not using unsustainable practices. Yield gap analysis and evaluation of agronomic and water management interventions will guide practical implementation and financing (including loan preparation) and help prioritize crop- breeding efforts.

32. Significant funds have been spent on improving the technical efficiency of irrigation conveyance in canals and water application in the field. While there can be good operational reasons to improve efficiency, water is rarely saved by such activities and water consumption may actually

[8] Bulk entitlements are defined for groups of users – typically cities, municipalities, rural towns, irrigation systems, groundwater management areas, environmental sites, and so on. Typically, bulk entitlements sit within a hierarchy beginning with a basin plan, a water management plan for component areas, bulk entitlements and shares/distribution to users. There are many possibilities for sharing bulk entitlement with users, including the specification of individual entitlements (in Australia, for example, where the specification of individual entitlements preceded bulk entitlements by many decades).

increase,[9] with consequences for downstream users who previously relied on the return flows from "inefficient" irrigation.[10] If reduced quotas are associated with technical efficiency improvements, water savings can be reallocated elsewhere ("real" water savings). However, if there is no constraint on water consumed in the newly "efficient" location, then return flows will be reduced and will deprive downstream users (including ecosystems) of water that they had accessed in the past. It is important to note that evidence-based, accepted and enforceable water allocation systems do not yet exist at scale in any of the developing or emerging economies of Asia and the Pacific region.[11]

33. In this context, a tool called Real Water Savings[12] has been developed that allows planners and water managers to assess the likelihood of making real water savings from different sets of agronomic, water management and water technology interventions at field scale, and understand the likely consequences on water use at catchment and river basin scales. This and other analytical tools and processes will be used to plan adaptation and interventions in agricultural water management.

Pillar 4: Development of a Regional Cooperative Platform

34. The three practical pillars of the WSP will feed into a Regional Cooperative Platform (RCP) that is dedicated to improving policy and governance in water, agriculture and environment across the region. The RCP will entail collaborative technical and research work, complemented by high-level ministerial meetings to ensure review and buy-in at the highest policy level. The RCP will be established at regional level (ministerial) and national levels (NMDTs) and will focus on subregional thematic issues as needed.

35. High-level ministerial meetings under the RCP will aim to share experiences and stimulate policy innovation and new actions to support policy and to maintain and profile water scarcity on a high political agenda. The NMDTs will provide guidance and act as a liaison between individual countries, with assistance from FAO country offices and overall coordination from FAO's Regional Office for Asia and the Pacific.

36. A dynamic and flexible pool of trainers and experts will be established to build capacity in all aspects of water scarcity management and train teams in individual countries, using a "learning by doing" approach though practical application. There will be some international involvement to begin with, but the intention is phase this out as the regional team gathers strength and expertise.

[9] By definition, increasing technical water efficiency increases the proportion of water delivered that is consumed (via evapotranspiration).
[10] FAO. 2017. Does Improved Irrigation Technology Save Water? Cairo.
[11] The Asia Pacific Water Scarcity Programme supports countries to start developing water allocation systems under Pillar 2.
[12] https://www.futurewater.eu/projects/training-package-for-water-productivity-and-real-water-savings/