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Agenda Item 5

Challenges of water scarcity in the Europe and Central Asia region and recommendations for adaptation

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I. BACKGROUND

1. The Food and Agriculture Organization of the United Nations (FAO), given its comparative advantages and focus on agriculture, wishes to contribute to the challenge of water scarcity as it affects Southeastern Europe: Albania, Bosnia and Herzegovina, Croatia, Kosovo, The former Yugoslav Republic of Macedonia, Montenegro, Serbia; Eastern Europe: Belarus, the Republic of Moldova, the Russian Federation and Ukraine; the Transcaucasus: Republic of Armenia, Republic of Azerbaijan, Georgia; and Central Asia: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan[1].

Water scarcity (FAO, 2009) is defined as a situation of imbalance between supply and demand of freshwater in a specified domain resulting from a high rate of demand compared with available supply, under prevailing institutional arrangements and infrastructural conditions. It is epitomized by no or partial satisfaction of expressed demand, tensions between users, competition for water, overabstraction of groundwater and possible negative impacts on the environment.

Water scarcity is relative, dynamic and can occur at any level of supply or demand. Its causes are many but are all related to human interference with the water cycle. It varies in time as a result of the natural hydrological variability but more so as a function of prevailing economic policy, planning, population growth and management approaches. It intensifies with increasing demand by users and with the decreasing quantity and quality of the resource. If correctly identified, many causes can be predicted and can be avoided and/or mitigated.

The three main dimensions that characterize water scarcity are: the physical lack of water availability to satisfy demand; the level of infrastructure development; and the institutional capacity to provide the necessary water services. Thus, in short, water scarcity can be physical, economical or institutional.

Of all economic sectors, agriculture is the one with the highest relevance for water scarcity. Under the joint pressure of population growth and changes in dietary habits, food consumption is increasing in most regions of the world. It is expected that by 2050 an additional 1 billion tonnes of cereals and 200 million tonnes of meat will need to be produced annually to satisfy growing food demand. Agriculture already accounts for 70 percent of global freshwater withdrawals, and more than 90 percent of its consumptive use. It could be argued that water demand for agriculture is not negotiable. However, considerable adjustments are possible in terms of increasing water productivity, spatial and temporal allocation and changes in societal habits. While none of these adjustments are without trade-offs, there is a need to carefully assess the options and scope for adjustment in agricultural water use in response to water scarcity.

2. This paper attempts to set out the water management issues and priorities in the aforementioned subregions in order to identify the most appropriate role for FAO. This includes background information on the subregions, water resources and water use, the impacts of water scarcity, and priorities for development and change.

3. The synthesis is based mainly on the data available from FAO's AQUASTAT database. However, other sources are quoted when these are available.

[1] These particular grouping of countries are broadly in line with those in FAO publication 23 Review of World Water Resources by Country. Only the Russian Federation is dealt with separately from Eastern Europe because of its size and the nature of its water resources which would tend to drown out other much smaller countries if put within a group.

II. POPULATION, WATER RESOURCES AND SCARCITY

4. Table 1 defines the countries in each of the five regions and summarizes basic land and population data, showing the relative importance of agriculture as a source of livelihood.

Table 1 Regional area, population distribution and agricultural employment (source AQUASTAT)

Groups of countries	Area (km^2)	Population (in 1996)			% of economic active population engaged in agriculture
			Per km^2	%rural population	
Southeastern Europe*	-	20 000 000	86	45	<20
Central and Eastern Europe	845 000	66 400 000	79	30	19
Russian Federation	17 075 400	148 126 000	9	24	12
Transcaucasus	186 100	16 674 000	90	40	25
Central Asia	3 994 400	54 588 000	14	54	30

*Estimates only because data for Kosovo, The former Yugoslav Republic of Macedonia, Montenegro and Serbia are not available
Southeastern Europe (excluding European Union countries): Albania, Bosnia and Herzegovina, Croatia, Kosovo, The former Yugoslav Republic of Macedonia, Montenegro and Serbia
The following subregions as defined in AQUASTAT
Eastern Europe: Belarus, Republic of Moldova, Ukraine
Transcaucasus: Armenia, Azerbaijan, Georgia
Central Asia: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan

5. After 1991 the population slightly declined in several countries of these groups of countries, mainly as a result of the prevailing difficult economic situation which led to low birth rates and increased migration to other areas. Population growth is now common in most of these countries.

6. The proportion of people working in rural areas demonstrates the importance of agriculture in the Transcaucasus and Central Asia, while urban-based industry is more important to the economies of Southeastern and Eastern Europe and the Russian Federation. Overall about 37 percent of the population lives in rural communities and about 20 percent of the economically active population is engaged in agriculture.

A. WATER RESOURCES AND WITHDRAWALS

7. Water availability and withdrawals vary widely across the regions and within countries. The complex interrelationships between surface water and groundwater make it difficult to assess water availability. Groundwater resources in one country may come from rainfall infiltration in an upstream country, thus making it difficult to distinguish between internal and external water resources. Also national boundaries in most cases do not coincide with natural watershed boundaries and in some cases rivers flow from one country to another and then back into the same country. Therefore, it is essential to deal with net flows in rivers to avoid double counting the resources.

8. The assessment of surface water runoff is also made difficult by the unavailability of a chronological series of natural flow measurements. Most of the figures quoted in reports, especially in Central Asia, correspond to the agreements on shared water resources rather than measured data. Experts also report that in some countries where water resources are shared, there is often a reluctance to share data on water resources, particularly among government departments still entrenched in the old centrally managed style of data management.

Table 2 Renewable water resources (RWR) and withdrawals by groups of countries

	RWR/capita (cm)	Withdrawals /capita (cm)	Agriculture (%)	Domestic and industry (%)
Southeastern Europe*	10 775	913	45	55
Eastern Europe	3 675	530	30	70
Russian Federation	31 883	455	20	80
Transcaucasus	7 067	1,375	68	32
Central Asia	4 261	2,518	91	9
European average	9 089			

*Estimates only because data for withdrawals for Bosnia and Herzegovina and Croatia, and all data for Kosovo, are not available

9. The average data provide a picture of water availability and withdrawals across these groups of countries and at face value they show little evidence of physical water scarcity. However, the data hide wide variations between countries within regions. For example in the Republic of Moldova (Eastern Europe) internal water resources are less than 227 cm/capita/yr and in Turkmenistan (Central Asia) there is only 327 cm/capita/yr. But these internally available water resources represent less than 10 percent of what is actually available in each country. This is due to the fact that flows from neighbouring countries contribute to the total annual water availability in excess of 2 000 cm/capita for the Republic of Moldova and over 5 000 cm/capita for Turkmenistan.

10. In parts of the Russian Federation there are more than 30 000 cm/capita but this is a very misleading picture. In the more densely populated western part, renewable surface water resources are estimated to be about 2 000 cm/capita compared with about 190 000 cm/capita in the sparsely populated regions of Siberia and the Far East.

11. Many countries rely on sharing water with other countries. Ukraine, for example, produces only 1 000 cm/capita of its own water resources but receives another 2 600 cm/capita from other countries: Uzbekistan (internal 700 cm/capita) receives another 2 300 cm/capita; and Azerbaijan (internal 1 000 cm/capita) receives 2 700 cm/capita.

12. Water withdrawals (Table 2) also vary considerably across the regions and also in how that water is used. The more industrially based economies like the Russian Federation and Southeastern and Central and Eastern Europe have low withdrawal per capita and most of this is for domestic and industrial use. In contrast the Transcaucasus and Central Asia, whose economies are still largely agriculturally based, have a much higher water use rate per capita with 68-90 percent of this going to irrigated agriculture.

13. Irrigated agriculture is important in varying degrees across all the groups of countries (Table 3). About 95 percent of the irrigated area uses surface water resources. Groundwater is not widely used. It is reported as an important resource for agriculture in Armenia and Azerbaijan in the Transcaucasus and about 6 percent of the irrigated area in Central Asia. The use of non-conventional water is limited to the Central Asian countries but in most cases it is not possible to make a distinction between the use of untreated wastewater and agricultural drainage water.

Table 3 Cultivated and irrigated areas (AQUASTAT)

	Cultivated (000s ha)	Irrigated (000s ha)	% Surface irrigation	% of cultivated area
Southeastern Europe*	5 500	500	-	1
Eastern Europe	39 449	3 048	27	7.7
Russian Federation	116 900	6 124	4	5.2
Transcaucasus	3 278	2 208	88	67.4 Ranges from 44% in Georgia to 80% in Azerbaijan
Central Asia	43 448	11 377	94	26.2 Ranges from 10% in Kazakhstan to over 99% in Turkmenistan

*Estimates only because data for withdrawals for Bosnia and Herzegovina and Croatia, and all data for Kosovo, are not available.

14. The most widespread irrigated crops are fodder (38 percent), cereals (28 percent), cotton (16 percent, mainly in Central Asia) and fruit and vegetables. Irrigated permanent crops (mainly grapes and fruit trees) represent about 7 percent of the area but in the Transcaucasus it accounts for 22 percent.

Consumption or use?

Although domestic and industrial water use is clearly important, agricultural water consumption is of much more concern not just in terms of the volume consumed but also because crop water evaporates into the atmosphere and is lost until it returns as rainfall. Domestic and industrial water is not consumed in the same way. Rather it is used and then returned to the basin, and although it may be of poorer quality, in many instances it is possible to use it again. In the same way inefficient irrigation, which is clearly undesirable but is nonetheless common place in many countries, may actually return water to the basin for potential re-use by recharging shallow aquifers. However, this water is not always easily accessed and again the quality of the water may be degraded with agricultural chemicals.

15. Drainage effluent is an integral part of water resources. Excess water is drained into rivers from some 25 million ha of low-lying land so that cultivation and cropping is possible. The most important crops on drained lands are fodder, including meadow and pasture areas, followed by cereals, potatoes and vegetables. In the drier areas of Central Asia and in parts of the Transcaucasus, drainage is an integral part of irrigation to prevent irrigation-induced water logging and salinization. In Central Asia almost half the irrigated area is affected by salinization mostly due to non-existent or decaying drainage infrastructure.

Southeastern and Eastern Europe and the Russian Federation

16. In Southeastern Europe: Albania, Bosnia and Herzegovina, Croatia, Kosovo, The former Yugoslav Republic of Macedonia, Montenegro and Serbia, there is growing competition for water resources between agriculture, domestic and industrial water needs, and an increasing awareness of environmental requirements. The countries in these regions are predominantly industrially-based economies but agriculture is still an important contributor to some (Table 2) and a significant consumer of water. The challenge is to reduce wastage and improve water productivity to maintain a vibrant agricultural sector while unlocking water resources for other uses. Data are not available for some of the countries in this region from AQUATSAT and other sources and so the regional data provided in Tables 1, 2 and 3 are estimates based on what is available. Eastern Europe, comprising Belarus, the Republic of Moldova and Ukraine, has a land area of 845 000 km^2 with a population of some 66.4 million. The northern part of this region is flat and low with numerous lakes, swamps and marshes with a continental climate. To the south is steppe lowland bordered by uplands to the west and southwest and is well known for its fertile black soils. The climate, long and warm summers and mild winters, is much more favourable for agriculture.

17. Average annual rainfall is 547 mm but in southern Ukraine it is only 360 mm. Droughts are recurrent and irrigation is necessary to meet summer crop water requirements. In the northwest towards the Carpathian Mountains rainfall increases to about 1 600 mm which makes drainage more important than irrigation in this area.

18. The Russian Federation is the largest country in the world with a population of some 140 million (UN estimated for 2010). The land to the east of the Urals and to the west (western Siberia) is generally flat but is more undulating to the south between the Black Sea and the Caspian Sea until it reaches the foothills of the Greater Caucasus mountains.

19. Eastern Russian Federation has a climate similar to that of central and Eastern Europe although with some extremes of temperature between summer and winter. The Black Sea coast climate is more temperate whereas in northern areas the climate has arctic winters and short summers. Temperature is a major constraint to agriculture over much of the territory.

20. The average annual rainfall is about 590 mm varying from less than 200 mm at the mouth of the Volga River where it enters the Caspian Sea to more than 1 000 mm in the mountains of the far east. Water is generally excessive in the northern regions and so drainage is the main issue. In the south, water scarcity during the cropping season means that irrigation is essential.

Transcaucasus

21. The Transcaucasus: Armenia, Azerbaijan and Georgia, lies between the Black Sea and the Caspian Sea in the foothills of the Caucasus Mountains. The land area is 186 100 km^2 with a population of 16.2 million (UN estimated for 2010). Large areas around the Black Sea, the Caspian Sea and the river deltas are lowlands.

22. The climate varies from warm, humid and subtropical in the northeast near the Black Sea coast, with average temperatures in summer of 22°C and in winter of 5°C, to typical dry continental, with average summer temperatures up to 27°C.

23. Average annual rainfall is 735 mm, varying from 200 mm in the Ararat Valley in central Armenia to 1 700 mm in western Georgia. Drainage is important in the high rainfall parts of Georgia whereas irrigation dominates in the south and east of the region. Drainage is also important in the irrigated areas to control salinity.

24. These three states share and rely almost entirely on the Kura-Araks river system for domestic and industrial water supplies, but particularly for irrigated agriculture which consumes about 68 percent of the resources. The basin covers all of Armenia, Azerbaijan, a large urbanized area of Georgia, and parts of the Islamic Republic of Iran and Turkey. Close cooperation and agreements between the countries is an essential part of monitoring, controlling and managing both abstraction and water quality. Treaties governing this major basin were set up by the Soviet Union and Turkey as far back as 1927, but with the demise of the Soviet Union in 1991, and the emergence of Armenia, Azerbaijan and Georgia as independent states, the entire river basin quickly became a transboundary water issue. The three nations began to see water from a country perspective rather than a regional one. As they developed their independence they did not develop a legal framework for the management of this shared resource thereby initiating the situation in which the Transcaucasus finds itself today (Newton, 2004).

25. One of the main reasons why Armenia, Azerbaijan and Georgia are being forced to confront the issue of the Kura-Araks Rivers is because of water pollution problems. The rivers are reported to be heavily contaminated with chemical, industrial, biological, agricultural and radioactive pollutants whose concentration is greater than normally accepted by international standards. Azerbaijan, the downstream nation, unlike Armenia and Georgia, lacks groundwater resources to provide an alternative clean water supply. Azerbaijan relies almost entirely on river water and so it complains about the contamination, but the process of cooperation is hindered by a

lack of transboundary cooperation mechanisms; appropriate institutional setup and a lack of emergent economic mechanisms with which to manage water resources.

26. Several bilateral agreements have been signed and laws established between Georgia and Armenia and Georgia and Azerbaijan but there is as yet no agreement between all three countries despite efforts made during the last years.

Central Asia

27. Central Asia: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan, has a total land area of 4 million km^2. Kazakhstan is by far the largest country. The population is 61.3 million (UN estimated for 2010) and is reported to be growing at a rate of 3 percent. There are food shortages in some countries and there are growing concerns about future food insecurity.

28. Mountain ranges lie along the east and south of the subregion and are almost permanently covered in snow. In the southwest lies the Kara-Kum desert which includes over 80 percent of Turkmenistan. Another large desert, the Kyzyl-Kum, extends over Kazakhstan and the north of Uzbekistan. The west is dominated by the Caspian Sea depressions and the Aral Sea lies in the central western part on the border between Kazakhstan and Uzbekistan. The Fergana Valley is a major agricultural area which is served by the Syr Darya River which lies along the border between Kyrgyzstan, Tajikistan and Uzbekistan.

29. The subregion's climate is continental with temperatures varying between 3°C and 20°C in winter and 19°C and 32°C in the summer. Average annual rainfall is 338 mm, varying from less than 70 mm in the plains to 2 400 mm in the mountains of central Tajikistan. Two major land quality problems related to irrigation in the region are the interrelated issues of salinity and water logging caused by high groundwater levels often exacerbated by overirrigation. This makes drainage important in this subregion.

30. Central Asia is reasonably well endowed with water with an average of over 4 000 cm/capita supplied from two major rivers, the Amu Darya and the Syr Darya, which flow from the upstream countries and the northern border of Afghanistan towards the Aral Sea. Most of this water comes from rainfall and snow melt in the mountains and not from the plains where rainfall is less than 100 mm. The average annual flow into the Aral Sea basin is about 103 km^3. However, accurate assessment is hampered by the large amounts of water withdrawn from the rivers for irrigation and to a lesser extent for domestic and industrial water supply.

31. The Amu Darya is the larger of the two rivers. It supplies water to irrigate 3.4 million ha (some 34 km^3) as well as domestic and industrial needs (another 4.8 km^3). The mean annual discharge is 66 km^3 and therefore, on average, there are about 27 km^3 going to waste in large depression lakes and wetlands. Although there appears to be sufficient water, various supply constraints, including shortages of water in some years, restricted canal carrying capacities, poor maintenance of infrastructure and weak water management, means that abstraction falls short of demand in most years. Research indicates that climate change too may also impact on this situation. The reduced contribution of glacier melt could reduce flows by 5-15 percent by 2085 and in the driest years this could be as much as 35 percent of current discharge. Although there is a high degree of statistical uncertainty this is clearly a very real threat that cannot be ignored in any future plans for the basin's water resources. Thus, in the worst case in 80 years time, it is possible that in extreme years it may only be possible to meet half the current demand for water. Experts in the subregion suggest that such risks need to be integrated into a comprehensive adaptation/risk management strategy for the basin as a whole.

32. Similar attention is needed for the Syr Darya River which has an annual mean flow of about 37 km^3, much of which is used for irrigation and serves Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan, before flowing into what remains of the Aral Sea. This river system flows through the highly fertile Ferghana Valley, home to some 10 million people. The quality of this river is threatened by abandoned Soviet Union-era uranium mines and pesticide dumps.

33. During the Soviet Union era in the 1960s the Aral Sea basin became the main producer of irrigated cotton. The irrigated area increased spectacularly from about 4.5 million ha in 1960 to almost 7 million ha in 1980. The population increased over the same period from 14 million to about 27 million. The resulting water withdrawals caused the severe disruption of the prevailing water balance in the basin which is still causing immense pollution and environmental problems. The traditional ecosystem of the two deltas of the Amu Darya and Syr Darya has perished, the marshes and wetland which covered some 550 000 ha and were a reservoir of biodiversity until the 1960s, have almost disappeared and the Aral Sea is drying up. During the 1980s the level of the Aral Sea was decreasing at a rate of 80-90 cm/year and in 1987 the north part split. By the early 2000s the main body had in turn split into western and eastern lobes. The 2009 summer witnessed the disappearance of the latter, which was the largest, and the further reduction of the remaining.

34. The Interstate Commission for Water Coordination of Central Asia (ICWC) was established by all five countries in 1993 as an attempt to foster cooperation among the five Central Asian States. Regrettably, almost two decades later, there is still no overall agreement to manage the transboundary resources with some countries still trying to keep alive the former water allocation system. The infrastructure and management systems were developed during the Soviet Union era and prior to its demise the irrigation systems were already under strain from spiralling energy and maintenance costs, from ageing infrastructure and salinity control problems. After 1991 most state funding stopped resulting in ineffective operation and maintenance for many years. In recent years budgets have been made available by some Central Asian countries such as Kazakhstan and Kyrgyzstan, but still remain woefully inadequate in comparison with the backlog of work. The poor salaries in the public sector also resulted in many of the most capable engineers leaving the public sector altogether for better employment prospects in private companies, leaving a significant skills gap in the water sector. This has been aggravated by the retirement of many of the most able and experienced older staff.

35. Cooperation requires political will from governments and leadership from both upstream and downstream countries. Central Asia has sufficient water resources for the population, agriculture and industry use. Therefore, the real problem is a scarcity of political commitment among the governments to find a new, viable, mutually acceptable and beneficial framework for cooperation giving proper consideration to the link between agriculture and energy. At the national level, the process of putting farmers in charge of the governance of irrigation services is still at the early stages and in some countries it has not yet started.

III. COPING WITH WATER SCARCITY

36. Although water scarcity can take many forms, the main driver for change is physical water shortages or the impending threat of shortages. Ways of dealing with scarcity also depend on the stage of development of the river basin.

37. The *development* phase occurs when the amount of naturally occurring water is not constrained and new resources are developed to meeting increasing demand. Water institutions are heavily involved in planning, design and construction of water resources projects. The *utilization* phase occurs when the infrastructure is established and the broad goal is to make the most out of these facilities. The *allocation* phase begins when a basin is near closure. The need then is to improve water productivity and to manage demand. Institutions need to change and concern themselves with water allocation, conflict resolution and regulation. Water management and regulatory functions gain prominence and coordination between the different competing interests becomes an issue. Moves are made to coordinate river basin management forums to resolve conflict and facilitate management. In some cases there is the *restoration phase* when water is abstracted beyond the renewable resource. Measures may include shifting to crops with lower water requirements, taking irrigated areas out of production and allocating water to higher value uses. Political involvement is also required to make tough decisions and return the basin to a balanced situation.

38. Within this context the available data would suggest that from a regional perspective Southeastern and Eastern Europe and the Russian Federation are still in the development and utilization phases and so physical water scarcity is not yet a major regional issue. This is not to say that these countries are without problems and will not experience problems in the future but the situation will depend on improving water management, productivity and cooperation among water users. This regional perspective may also hide countries and areas within countries where physical water availability is already causing concern.

39. The Transcaucasus and Central Asia are in the utilization and allocation phases of development where institutional changes become important, but there are also infrastructure problems reported in both subregions which rely heavily on irrigated farming. Increasing water scarcity is creating problems that are likely to worsen in the next decades.

IV. GROWTH OF TRANSBOUNDARY ISSUES

40. Water scarcity is exacerbated by transboundary water issues. Since the change from a centrally managed system in 1991 and the emergence of independent states, many countries across the region have viewed water from a national perspective rather than from a river basin point of view, particularly when there is political conflict between neighbours. In the Transcaucasus, for example, as countries developed their independence they have not given the same attention to the development of a legal framework for the management of shared resources. To varying degrees this is broadly the situation facing countries in other regions as well and needs addressing.

V. INSTITUTIONAL CULTURE AND CAPACITY

41. The culture of central management still pervades many water organizations and there is resistance to change and the creation of new institutions needed to cope with new situations. People and organizations move to protect their interests, influence and jobs. A ‘silo’ mentality still exists in many places, a reluctance to share information and cooperate with others, and this is reinforced when there is insufficient funding to support change, another common problem across the regions.

42. However, it is not just a physical lack of water that creates scarcity. Reports suggest that there is also a distinct lack of capacity to deal effectively with water resources management whatever the level of development. Capacity is defined as not just being about the training needs of individuals but rather capacity at four levels: individual; institutional; sector/network; and national, where an enabling environment is essential for good water resources management to develop and flourish. It is only when this is in place that sector organizations and institutions can function effectively with a clear mandate and individuals can work together within established rules and values and interact with other organizations. Over the past decade there has been ongoing work on the institutional issues in many of the countries of the region supported by such organizations as the World Bank, the European Union (TACIS) and others. But it is clear that the task they face is immense and progress seems slow. This includes increasing institutional accountability and capacity, adopting a service-oriented management approach with proper stakeholder involvement.

VI. OPTIONS FOR DEALING WITH SCARCITY

43. The policy and management options to deal with water scarcity are either supply enhancement or demand management depending on the state of basin development. Supply enhancement refers not only to increased storage capacity which in many countries is reaching its limits, but also on-farm conservation, small-scale water harvesting and storage systems, groundwater exploitation and re-use and recycling of drainage water and wastewater. In relation

to demand management in agriculture, options include the reduction of non-beneficial use of water, increasing crop water productivity and diverting water towards higher value crops.

44. Additional options include increasing investment in rainfed agriculture, which can improve overall agricultural productivity particularly where crop yields are low. These improvements in productivity can be materialized through promotion of good agricultural practices including conservation agriculture, weather insurance schemes as well as improved access to agricultural inputs and credits and better links to markets without a large impact on water resources.

45. Water savings can also be obtained by addressing issues of waste in the food chain, diets and the role of agricultural trade. In relation to waste, it is estimated that it may reach even 50 percent in some developed countries, therefore there is huge scope to reduce it with all the environmental benefits in saved resources, not only water. Current trends in increased meat and dairy product consumption has meant an even larger increase in terms of cereal production, most of which is used to feed cattle. The extent to which societies are willing to modify their diets as part of a larger effort to reduce their environmental footprint reaches far beyond water scarcity concerns. Yet it has implications in terms of national food security and associated water scarcity coping strategies. In relation to agricultural trade, it is relevant particularly for countries where water scarcity limits the selection of crops that can be grown in a given country. Analysing the implications for water resources, the concept of virtual water was developed in the 1990s to indicate that in functioning world markets, gains in water productivity can be achieved by growing crops in places where climate enables high water productivity at lower financial and environmental cost and trading them to places with lower productivity or water availability. Given the high potential, several countries in the region have to increase agricultural rainfed production, it should be a priority option to alleviate increasing pressure in water resources in dryer parts of the region and beyond.

VII. BASIC PRINCIPLES FOR POLICY-MAKERS

46. The selection of the right range of options to deal with water scarcity will depend on local conditions and it is unlikely that a single set of options can be designed as an “optimal” solution, nor is a particular option to be seen as desirable in all contexts. Therefore, rather that attempting to prescribe solutions to water scarcity, it is suggested that policy options and related strategies should be based on a set of six solid generic principles identified by FAO which are valid across socio-economic settings. These are recommended to the 37th Session of the European Commission on Agriculture (ECA):

- Base strategies on a clear understanding of the cases of water scarcity: strategies should be based on hard evidence and data. The interrelations between upstream and downstream watersheds, surface water and groundwater, between quality and volumes and the importance of recycling within river basins all have implications in terms of effectiveness of the proposed actions.
- Ensure cost-effectiveness with a full assessment of externalities: past experience shows that cost-benefit analysis has often overlooked or underestimated the potential negative impact of development on people or the environment, while overestimating the benefits. Cost-effectiveness analysis must include the time dimension as not only do economical factors change in time but so do knowledge and societal values. In many situations, this may mean less emphasis on capital cost of construction and more emphasis on capacity building.
- Improve water governance and institutional capacity: while designing strategies for coping with water scarcity, often the need for empowering local institutions reviewing policies and adapting legislation, become evident.
- Context-specificity: adapt response to local conditions. The response to water scarcity varies from country to country and may also be different for different basins within the

same country. It would not only depend on the specific local conditions *per se* but also on how the local reality interacts with neighbouring basins and countries.

- Ensure policy alignment between water, agriculture and food security: decisions outside the water domain such as those regarding energy prices and hydropower production, trade agreements, agricultural subsidies and poverty reduction strategies, have a major impact on water supply and demand and therefore on water scarcity. Alignment of the many policies, legislation and fiscal measures that influence water management, service delivery and level of demand is crucial, particularly when these decisions have a bearing on neighbouring countries as is the case in Central Asia and the Transcaucasus.
- Anticipate change through robust decision-making and adaptive management: planning and management systems need to be flexible, able to adapt to new challenges and need to be based on continuous social and institutional learning. Such a level of responsiveness is only possible if information and knowledge are updated, and if monitoring and information management systems continually provide decision-makers with reliable information on which to base these responsive decisions.

VIII. FAO'S ROLE

47. FAO is strengthening its role and presence through increasing its programme and activities in the water sector in the countries in the Europe and Central Asia region. Since the countries of the Former Soviet Union joined FAO, the Organization has been developed its water programme in its field of expertise, in consultation with other international agencies and partners, in order to enhance complementarities and avoid duplication of efforts.

A. WHAT FAO DOES BEST

48. FAO has a strong reputation for helping countries to plan and establish a sound basis for water management, particularly where agriculture dominates the national economies or when irrigation represents a large share of water use. FAO has a well established, comprehensive, worldwide database on water resources and agriculture, associated with extensive knowledge on issues, trends and challenges for agricultural water management. It also has a strong reputation for policy advice to governments for the development of water scarcity coping strategies, as well as for capacity building in the agricultural water sector. It is also well placed to gain access to and influence people through its international networks both at the highest national levels and more locally through its information gathering processes, publications and expert consultations. Due to its independent status, FAO provides an excellent fora for countries to discuss ways to deal with complex transboundary water issues. Over decades of activity FAO has accumulated valuable worldwide experience in water productivity and has published methodologies and guidelines that have become international standards. Likewise, FAO has been supporting efforts to properly address the problems countries face in maintaining irrigation and drainage infrastructure while trying to improve performance of irrigated agriculture. As a result of this, best practices and methods have been developed, published and widely disseminate.

B. MODALITIES OF FAO SUPPORT

49. FAO can offer its knowledge, skills and experience to support countries as they address their growing concerns over water scarcity. This is done by responding to government requests and pulling together the available capacities of local institutions and other international partner organizations. According to the resources allocated and extrabudgetary resources that may become available, FAO will undertake policy advice and capacity development activities and will provide technical assistance to help countries develop sound strategies to cope with water scarcity. This will include support to develop plans to modernize water management and infrastructure in agriculture.

50. Recently, FAO has been providing support to its Members in several areas, including the ongoing discussions in Central Asia, on how to achieve mutually beneficial multilateral water agreements. FAO has also supported the enhancement of the technical capabilities of engineers and managers of irrigation schemes from the Central Asian countries through hands-on training on the FAO methodologies and tools for developing investment plans for modernizing irrigation. FAO field work has focused on providing technical support to countries in the improvement of water productivity through several projects dealing with irrigation and drainage management and technologies, farmer organizations and their participation in water management and by supporting the ongoing institutional reform processes in the water resources sector in several countries of the region.

C. MAIN FAO PARTNERS IN THE REGION

51. Besides the numerous national institutions that are the main counterparts for FAO to implement its programmes, some international organizations are vital for FAO's outreach. Several International Financing Institutions (IFIs) are operating in the region and FAO is working towards improving its working relation with them. The list includes the European Bank for Reconstruction and Development (EBRD), the World Bank, the Islamic Development Bank (IsDB) and the Asian Development Bank (ADB).

52. The Consultative Group on International Agricultural Research (CGIAR) is quite active in the region particularly through the regional offices of the International Water Management Institute and the International Centre for Agricultural Research in the Dry Areas (ICARDA), but also the International Maize and Wheat Improvement Center (CIMMYT) and other CGIAR centres present in the region.

53. Partnerships are also being strengthened with other UN programmes and agencies such as with the United Nations Development Programme (UNDP), the International Fund for Agricultural Development (IFAD) and the recently created United Nations Regional Centre for Preventive Diplomacy for Central Asia (UNRCCA).

54. FAO has also obtained valuable support from the European Union and from national cooperation agencies from within and outside the region and will continue to strengthen collaboration with them to increase the resources channelled to support member countries' strategies to cope with water scarcity in the region.

55. Interstate organizations such as the Economic Cooperation Organization (ECO), The International Fund for Saving the Aral Sea (IFAS) and its sectoral bodies, in particular the Interstate Commission for Water Coordination (ICWC), are organizations with whom FAO is and will continue to partner with.

IX. RECOMMENDATIONS

56. The 37th Session of the ECA may wish to:

- comment and adopt the options for dealing with scarcity and the recommended basic principles for developing policy and related strategies;
- comment and make recommendations on the modalities and partnerships FAO proposes for future work in the region.

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