E

February 2014

منظمة الأغذية والزراعة للأمم المتحدة | 联合国粮食及农业组织 | Food and Agriculture Organization of the United Nations | Organisation des Nations Unies pour l'alimentation et l'agriculture | Продовольственная и сельскохозяйственная организация Объединенных Наций | Organización de las Naciones Unidas para la Alimentación y la Agricultura

EUROPEAN COMMISSION ON AGRICULTURE

THIRTY EIGHTH SESSION

Bucharest, Romania, 1 and 2 April 2014

Agenda Item 6

Towards risk-based drought management in Europe and Central Asia

Executive Summary

Over the past 30 years droughts in Europe and Central Asia have become more frequent and more severe and concern has grown about the significant economic, environmental and social impacts they have agriculture and related sectors. To reduce societal vulnerability to droughts, a paradigm shift is needed from the reactive crisis management approach that currently prevails, to a more proactive risk management approach. Drought risk management seeks to increase the capacity of individuals, organizations and society as a whole to better cope with the impacts of drought, by focusing on drought preparedness plans and related measures that should be planned proactively and implemented before, during and after droughts. Although institutions engaged in disaster and drought risk management planning and operations in Europe and Central Asia have gained significant capacity since the droughts of the early 2000s, they still remain relatively unprepared for droughts. There is a greater recognition of the need for enhanced drought risk management and increased efforts to develop drought preparedness plans and implement actions to reduce the impact of droughts. However, the development and implementation of full-fledged drought plans remain limited. Under the reviewed Strategic Framework 2010-2019, FAO is strengthening its role in contributing towards the "increased resilience of livelihood to threats and crisis" (Strategic Objective 5). Building on more than 10 years of risk and crisis management interventions specifically for the agriculture, food and nutrition-related sectors, under its resilience agenda, FAO will support on-going efforts on drought risk management at local, national and multi-country levels, in close consultation with stakeholders and partners.

Guidance Sought

The 38th session of the ECA may wish to comment on and recommend continuing to enhance FAO's strategic position for increasing people's resilience to droughts in Europe and Central Asia. It may also wish to recommend actions for developing policies, strategies and action plans on drought risk management.

I. Background

1. Drought[1] is a normal and recurrent feature of the climate in Europe and Central Asia. However, over the last 30 years, droughts have dramatically increased in number and their impact in the region has also increased, raising concern about economic, social and environmental effects.

2. Drought induces serious economic impacts in agriculture and related sectors, including forestry and fisheries, by reducing or eliminating farm production, adversely affecting food prices, trade, and market access and decreasing farm income and unemployment (FAO, 2013).

3. In 2003, one of the most widespread droughts in European history occurred, affecting over 100 million people and a third of the EU territory and resulting in at least 8.7 billion Euros in losses (European Commission, 2007).

4. Also, in 2000 and 2001, an especially severe drought caused significant economic and social impacts in Central Asia, particularly in Tajikistan, Turkmenistan and Uzbekistan. Residents of drought-stricken rural areas lost as much as 80 percent of their income, while poverty rates rose significantly, and malnutrition and water-related diseases became more widespread (World Bank, 2005). In Tajikistan alone, the direct economic cost in terms of lost agricultural production for that period was estimated at between USD 100 million and USD 159 million, or nearly 5 percent of national GDP (World Bank, 2006).

5. Less intense, widespread failure of rain-fed grain crops occurred again in 2008-2009 causing sizeable declines in the irrigated crop area and yields (USDA FAS, 2008). In Turkey, agricultural losses were in the order of USD 1-2 billion, with 435,000 farmers affected.

6. Figures 1 and 2 show the percentage of crop area affected by drought in Europe and Central Asia during 2001 and 2003, when agriculture was negatively impacted.

[1] Drought is generally defined as an extended period – a season, a year or several years – of deficient precipitation compared to an average for a region that results in water shortage for some activity, group or environmental sector (NDMC, 2008).

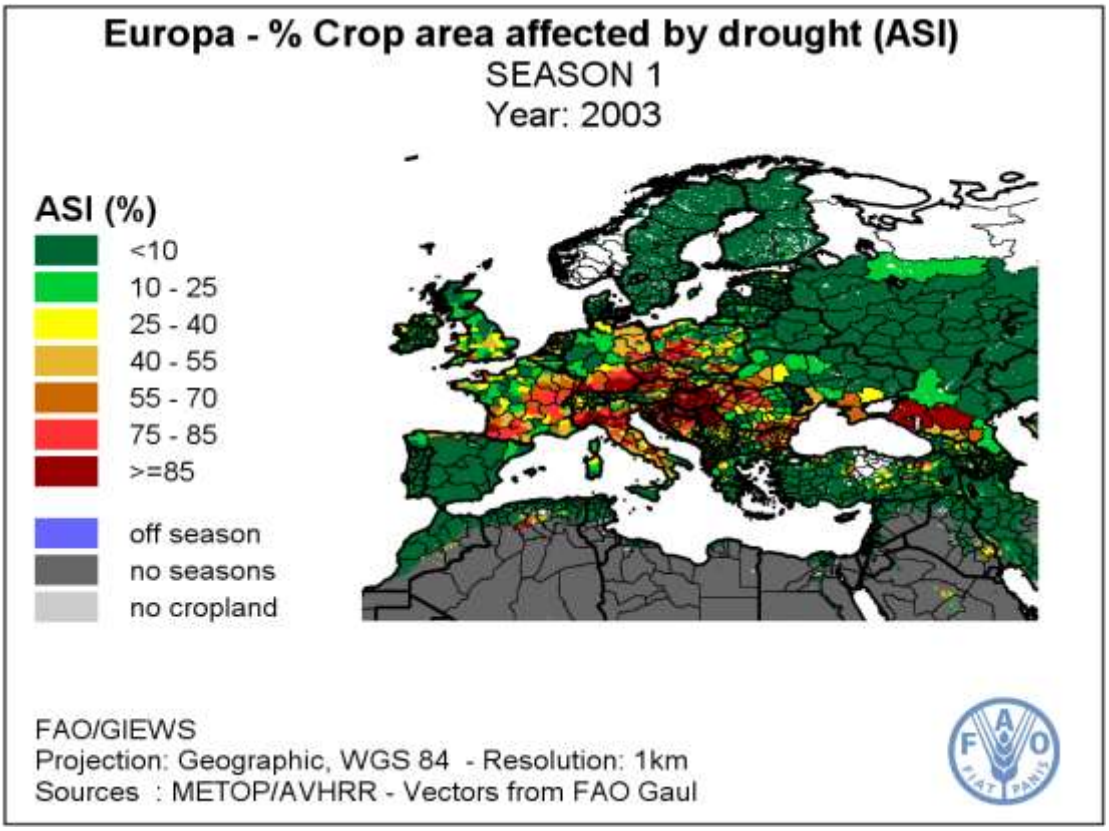

Figure 1. Europe - % of crop area affected by drought (ASI) - Season 1 - Year: 2003 (FAO/GIEWS [2014]).

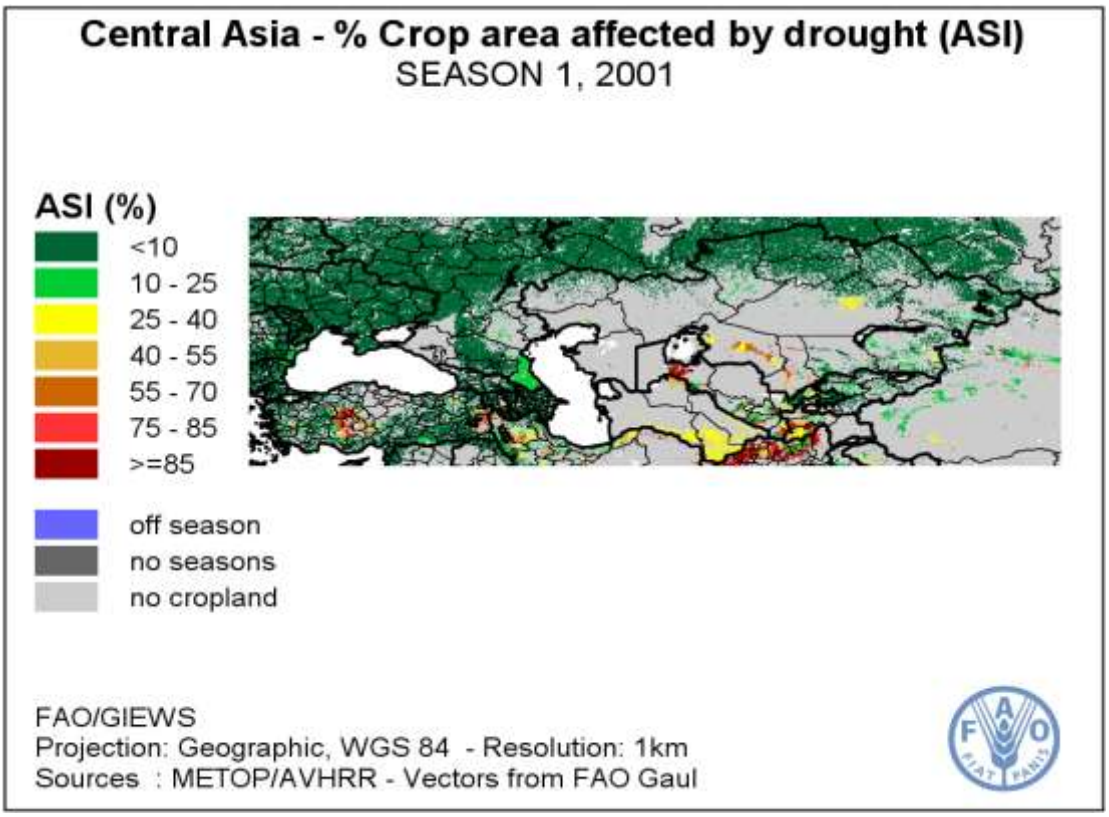

Figure 2. Central Asia - % of crop area affected by drought (ASI) - Season 1 - Year: 2001 (FAO/GIEWS [2014]).

7. Coupled with climate change and growing anthropogenic pressures, drought is an increasing threat to water security in Europe and Central Asia.

8. Recent analysis has revealed that many river basins in Europe, especially in the southern region, are likely to experience more frequent periods of reduced water supply due to climate change (Forzieri et al., 2014). This is likely to be caused by a combination of increased frequency and severity of drought and more intensive water use.

9. Climate change is also expected to further increase water scarcity in Central Asia and the type of problem experienced at the Aral Sea. Moreover, increased frequency of drought and reduced agricultural productivity are widely predicted (Perelet, 2008). According to FAO (2014), climate change is expected to affect Central Asian countries in similar ways, ranging from a reduction in glaciers/snow pack and consequent reduction in river flow that irrigation systems depend on, to desiccating and erosive winds. There is variable evidence regarding long-term declines in average rainfall that could be associated with climate change; however, there is diverse evidence that patterns of rainfall have shifted in terms of timing, duration and intensity; all of which pose challenges to land users, hydro-power corporations, industry, urban centres and other water users.

II. Drought risk management

10. Drought has historically been managed using a crisis management approach in both developed and developing countries. In this reactive approach, ad-hoc emergency measures are often implemented in response to drought conditions. It has been found that these measures often result in ineffective, poorly coordinated, and untimely outcomes and do little to reduce the underlying vulnerabilities that cause drought impacts (Wilhite et al., 2005). In fact, although relief measures do provide immediate benefits, they can also cause increased dependencies, which increase long-term drought vulnerability. Therefore, during the last two decades, there has been an increasing shift in focus towards drought risk management.

11. Drought risk management seeks to increase the capacity of individuals, organizations and society as a whole to reduce the likelihood of experiencing the effects of droughts, by focusing on drought preparedness plans and coordinated measures that should be planned proactively and implemented before, during and after droughts. These measures can be identified by carrying out a drought planning process and implemented through the resulting drought plan.

12. The development of a drought plan requires at least three components: (1) a monitoring and early warning system; (2) vulnerability and impacts assessment; and (3) mitigation and response actions.

A. Drought monitoring and early warning systems

13. The development of a drought monitoring and early warning system is critical for assessing drought conditions, communicating threats, and triggering actions in a systematic and efficient manner as drought conditions intensify.

14. In the region, the European Commission's Joint Research Centre has developed a European Drought Observatory for assessing, monitoring and forecasting droughts at European level (http://edo.jrc.ec.europa.eu). Also, interoperability arrangements have been established with key data centres at European, regional, and local levels. In south-eastern Europe, Slovenia was selected by the eleven-country region to host the Drought Management Centre for South-eastern Europe (DMCSEE) with support from the UNCCD Secretariat in cooperation with the World Meteorological Organization (http://www.dmcsee.org).

15. The European Drought Observatory and the DMCSEE provide a Europe-wide picture of the occurrence, severity, extent and duration of droughts, including direct access to information provided

by national, regional and local services. As reported by the European Commission (2012a), drought indicators are now available on a preliminary basis for precipitation, soil moisture, vegetation response and a combined indicator targeted at agricultural droughts. However, further efforts are required to test and improve the indicator set and to add more data from national and river basin levels.

16. In the framework of the EU/FAO Improved Global Governance for Hunger Reduction Programme, FAO is developing the Agriculture Stress Index System (ASIS) to detect agricultural areas, at global level, that have a high likelihood of water stress (drought). Based on Earth Observations, ASIS could support the agricultural drought monitoring activities of the region (see www.fao.org/climatechange/asis/en/).

17. In Central Asia, as reported by FAO (2013), upgrading hydro-meteorological monitoring services and improved information sharing is a priority throughout the region. There is a legacy of national hydro-meteorological networks and related scientific capacity which are, in general, sufficiently functional to allow countries to monitor broad trends pertinent to climate, as well as to trigger the declaration of drought emergencies and response strategies. However, there is a need to improve the instrumentation of old hydro-meteorological networks (river and rainfall gauges) within countries, enable access to available hydro-meteorological data by potential users and increase cooperation between countries on improving drought monitoring and early warning systems.

B. Impact and vulnerability assessment

18. A drought monitoring and early warning system will help to identify the risk of experiencing the physical onset of drought (i.e., frequency, severity, and spatial extent), and track ongoing drought conditions to provide early warning for the implementation of timely and effective drought mitigation and response actions. However, as described by Wilhite et al. (2005), vulnerability must also be assessed to fully understand the likelihood of being affected by drought conditions.

19. Drought, like other natural hazards, has both a natural and social component. As described by Wilhite (2005), the risk associated with drought for any region is a product of both the region's exposure to the event and the vulnerability of society. That is, the threat of harm from drought is based on a combination of the frequency, duration, and severity of drought events experienced and the susceptibility of people or a particular sector to the negative effects associated with drought.

20. Exposure to drought varies regionally and there is little, if anything, we can do to reduce the recurrence, frequency, or incidence of precipitation shortfalls. However, measures can be taken to increase resilience of livelihoods to drought events. An assessment of drought impacts and underlying vulnerabilities will help policy and decision makers identify who and what are vulnerable to droughts and why, in order to identify and target appropriate and effective drought risk management options.

21. Recent droughts in Europe and Central Asia have revealed vulnerabilities that make the regions susceptible to drought.

22. In general, in Europe, the European Commission (2012b) cites the discharge of pollutants, hydromorphological alterations and water abstractions (mainly due to demographic growth, land use, and economic activity) as significant pressures on EU waters. In addition, it cites the insufficient use of economic instruments to address market failures, a lack of integration and coherence between policies, ineffective water and drought governance, and knowledge gaps as problems that are hampering the reduction of water stress and vulnerability to extreme events.

23. Specifically, in terms of vulnerability, the economies of Central Asia and Transcaucasia are still largely based on agriculture. This sector, which contributes 10-38 percent of GDP and 18-65 percent of employment, makes the economies of these countries vulnerable to shocks from drought, given its reliance on water supplies. Moreover, there is significant integration between agriculture and industry (e.g. cotton growing) at the national level, which implies a significant multiplier effect from agricultural drought.

24. Although agro-ecological conditions in Central Asia render the sector vulnerable, several changes in agriculture in the 1990s heightened this susceptibility. Crop diversity diminished during the 1990s; in all countries, crop rotations became unsustainable and fodder became scarce. These factors have made farmers less able to spread the risk between different crops, or even livestock, and they have thus become more vulnerable. The underdevelopment of financial systems that should be able to absorb or moderate risk, especially in rural areas, has also increased socioeconomic vulnerability in the region.

25. Another main cause of vulnerability to drought is water scarcity[2], mostly due to high water withdrawals for irrigated agriculture and deteriorating water quality (e.g. salinity) created by ageing infrastructure and poor water management in both Central Asia and Turkey. In recent years, budgets have been made available by some Central Asian countries for modernizing irrigation systems, although they remain woefully inadequate. Following the breakup of the USSR, transboundary water issues have also increased the complexity of the management of water resources, putting increased pressure on the region's finite water resources.

C. Drought risk reduction strategies

26. A better understanding of drought risks allows for more informed decision making and the selection of more appropriate and effective management options. Although they can be described in a variety of ways, these management options typically include a range of drought preparedness, mitigation, response, and recovery strategies (see Box 1 for a list of definitions).

Box 1. Typology of drought risk reduction measures

1. Drought preparedness refers to the knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current drought events or conditions.

2. Drought mitigation is the lessening or limitation of the adverse impacts of droughts. Mitigation measures encompass engineering techniques as well as improved policies and public awareness.

3. Drought response is the provision of emergency services and public assistance during or immediately after a drought in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected. It can be of an immediate, short-term, or protracted duration

4. Drought recovery refers to the restoration, and improvement where appropriate, of facilities, livelihoods and production conditions of drought-affected communities, including efforts to reduce drought risk factors.

Source: UN/ISDR Terminology of Disaster Risk Reduction (http://www.unisdr.org/we/inform/terminology)

[2] **Water scarcity** 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 (FAO, 2010).

27. Following the new paradigm of drought risk management, the European Commission issued a Communication on Water Scarcity and Droughts in the European Union (European Commission, 2007), which proposed seven main policy options to address water scarcity and drought challenges in the EU; namely, water pricing, more efficient water allocation, improved drought risk management, considering additional water supply infrastructures, fostering water efficient technologies and practices, developing a water-saving culture in Europe, and improving knowledge and data collection. A review of progress on these activities was conducted in 2012 (European Commission, 2012a). As noted, a European Drought Observatory has been developed and the application for EU Solidarity Funds is being modified to foster use of the financing mechanism for drought. In Mediterranean countries (e.g., Spain, Cyprus, Greece), the development of drought management plans has progressed but their implementation and integration with river basin management plans (which are part of the EU Water Framework Directive requirements) remains limited. In general, the report stated that progress has been made in implementing the seven policy options, but the overall objective of reversing water scarcity and drought trends has not yet been achieved.

28. Progress in drought risk management has also been made in other European and Central Asian countries. For example, in 2012, FAO supported the Ministry of Agriculture and Food Industry of Moldova in carrying out an impact assessment of drought conditions in the country and this work is continuing to reduce the impacts of drought on small-scale farmers by improving fodder conservation and grain storage, promoting drought-tolerant seed varieties and good agronomic techniques, and improving the management of pastures and irrigation systems (FAO, 2012). Also, Turkey has developed an Agricultural Drought Action Plan which outlines priority areas for mitigating and responding to drought, and has established the "Flood and Drought Management Planning Department" for the coordination of drought preparedness and response operations by relevant institutions.

29. In Central Asia, there has largely been a centralized and response oriented approach to the impacts of drought in the region, with a gradual shift to more risk management activities (FAO, 2014). However, the development and implementation of longer-term programs to plan for and mitigate the effects of future droughts is still at an early stage in most countries. Disaster management training and the development of natural disaster management plans have progressed, early warning systems in Central Asia function better than before, and there have also been investments in climate-smart agronomic practices. However, progress has been scattered and sporadic; a more systematic approach is required for the development of drought programs and management plans. Until now only a few initiatives have been specifically directed at managing and mitigating droughts.

30. Most Central Asian countries are aiming to incorporate drought management into agricultural, rural and food security strategies through the dissemination of appropriate technologies and to combat drought and support policy and incentive measures to use land and water resources more rationally. Most countries also have institutions that coordinate emergency preparedness, as well as response and recovery systems; however, these need to be reinforced with real information exchange and cooperation between agencies at national level, between local-level agencies, and with much greater community participation and support (World Bank, 2005).

III. Towards action plans

31. The European Commission (2012a) describes several actions that are needed to enhance drought management in Europe. A better understanding of the causal relationships between drivers, pressures, and impacts would help to identify the most critical and cost-effective measures for addressing water scarcity and drought. Subsequently, a coherent set of such measures (e.g., land use policies, green infrastructure, alternative water supply options, etc.) need to be included in drought plans and/or river basin management plans.

32. As reported by FAO (2014), the way forward for Central Asia can be summarized by three broad measures that need to be taken. Firstly, the provision of regular and timely hydro-meteorological data

to provide early warning; secondly, the implementation of options for coping with water scarcity; and thirdly, a reconciliation of the national legal and institutional frameworks. All three of these measures require linkages and should work complementarily.

33. Methods to ensure availability and access to early warning hydro-meteorological information need to be developed . A system that can track seasonal, weather and climate risks particularly in the area of drought, and provide reliable projections on crop yields, rainfall and vulnerability information is also needed in all countries. Similarly, assessments and regular monitoring need to be carried out to create vulnerability profiles that, once in place, could provide good targeting mechanisms and context to implement drought policy plans. Finally, actions and measures to mitigate drought impacts in the long and medium-terms, as well as response and recovery actions need to be planned and implemented before, during and after droughts.

34. All countries could also benefit from investments aimed at coping with water scarcity as a means of building resilience to drought. Selection of the right range of policy and management options (e.g. supply enhancement, demand management, waste reduction in the food chain and shifts in diets) 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.

35. The legal and institutional frameworks in all Central Asian countries also need to be harmonized, strengthened and adjusted. Water laws and guidelines on possible actions in specific circumstances during drought years need to be enhanced or developed. Contingency plans should be designed, made operational and enforced by governments, by law, and state programs. A sustainable drought policy would lead to early intervention and mitigation and less costly damages incurred from drought.

IV. Developing a drought management strategy

36. Drought planning has received increased attention in recent years by natural hazard and water planners around the world, although much more work is needed (Sivakumar et al, 2011). Drought planning revolves around efforts to better understand the nature of drought and its effects on society and the environment. This knowledge can then be used to implement appropriate and effective measures to minimize the likelihood of experiencing harm from future droughts.

37. Drought planning provides an opportunity for decision makers to identify sectors that are vulnerable to drought and investigate management options before a crises occurs. With this information, decision makers can identify and implement the most appropriate and cost-effective strategies available in a efficient strategic and systematic manner. This will help foster a more informed decision-making process and the development of efficient drought management programs, which are often outlined in a drought plan.

38. Several drought planning methodologies have been developed to provide guidance on developing a national drought plan (see FAO/NDMC, 2008; WSCEN, 2008; Iglesias et al., 2007; and Wilhite et al., 2005). For example, the "10-Step Drought Planning Process" has been developed by the National Drought Mitigation Center in the United States (Wilhite et al., 2005). This process provides a set of guidelines that outline the key elements of a drought plan and a process through which they can be adapted to any level of government (i.e., community, river basin, state, provincial, or national) or geographical setting. A drought plan can be developed as part of a natural disaster or sustainable development plan, a water resources plan, or stand-alone drought mitigation plan.

39. Box 2. NDMC ten step drought planning process

1. Appoint a drought task force
2. State the purpose and objectives of the drought plan
3. Seek stakeholder participation and resolve conflict
4. Inventory resources and identify at risk groups
5. Establish and write the drought plan
6. Identify research needs and fill institutional gaps
7. Integrate science and policy
8. Publicize the drought plan
9. Develop educational programs
10. Evaluate and revise the drought plan
Source: NDMC Drought Preparedness Planning (http://drought.unl.edu/portals/0/docs/10StepProcess.pdf)

40.The goal of the planning process is to significantly change the way entities prepare for and respond to droughts, by placing greater emphasis on risk management and the adoption of appropriate mitigation actions. It must be viewed as an ongoing process, continuously evaluating changing vulnerabilities and how governments and stakeholders can work in partnership to lessen risks associated with drought.

V. FAO's role and programme recommendations

A. FAO's role

41.Under the reviewed Strategic Framework 2010-2019, FAO is strengthening its role in contributing towards "increased resilience of livelihood to threats and crisis" (Strategic Objective 5) to help the world's most vulnerable people achieve food and nutrition security, by applying an inter-disciplinary and programmatic approach that integrates the agriculture, livestock, fisheries/aquaculture, forestry and natural resource management sectors.

42. Building on more than 10 years of risk and crisis management interventions specifically for the agriculture, food and nutrition-related sectors, under the FAO's resilience agenda, the Organization is increasing its support to member countries for disaster risk management at the local, national, regional and global levels through the following four main, mutually reinforcing and interdisciplinary Organizational Outcomes:

- Govern risks and crises: OO1. Countries and regions have legal, policy and institutional systems and regulatory frameworks for disaster and crisis risk management for agriculture, food and nutrition.
- Watch to safeguard: OO2. Countries and regions provide early warning and vulnerability analysis and measurement against potential, known and emerging threats.
- Apply risk and vulnerability reduction measures: OO3. Countries reduce risks and vulnerability at household and community level.
- Prepare and respond: OO4. Countries and regions affected by disasters and crises with impact on agriculture, food and nutrition prepare for, and manage effective responses.

43. In Europe and Central Asia, FAO will continue responding to government requests for increased resilience of livelihoods to drought, in close consultation with stakeholders and partner organizations,

such as international financing institutions, centres of the Consultative Group on International Agricultural Research, UN agencies, the European Union and interstate organizations. The focus will be on supporting countries to "govern risks and crises" with the "adoption and implementation of legal, policy and institutional systems and regulatory frameworks for drought risk management", through "improving national and regional capacities to formulate, promote, mainstream and implement policies, strategies and plans for drought risk management". Technical assistance will be provided with due consideration to cross-cutting themes such as gender and governance.

44. Although drought risk management is gaining momentum in Europe and Central Asia, additional action is needed to reduce the threat of drought. Most countries have developed plans, such as National Action Plans for UNCCD, and sectoral strategies that integrate drought issues. However, fully-fledged policies and related action plans for appropriate drought management and proactive drought preparedness are insufficient, if not completely lacking, in most countries. The Final Declaration of the High Level Meeting on National Drought Policy (Geneva, March 2013) encourages all Governments to develop and implement National Drought Management Policies and urges UN agencies to support them. As a concrete follow-up to the final declaration, FAO has already started developing capacities on drought risk management in the region. In 2013, FAO commissioned a study on drought characterization and management in all countries of Central Asia and Turkey to evaluate drought occurrence, impacts and underlying vulnerabilities, and the current state of drought risk management at national level. Moreover, FAO, in collaboration with the World Meteorological Organization and UNCCD Secretariat, provided training on the formulation of national drought strategies and related action plans to government representatives from Eastern Europe in July 2013 and from Central Asia and Turkey in November 2013. The Organization stands ready to support countries through the process for developing and implementing such policies at national and regional levels.

B1. Recommendations for governments

45. The 38th Session of the ECA may wish to recommend that countries:

- Adopt the Final Declaration of the High Level Meeting on National Drought Policy (HMNDP) which recognizes the "urgent needs for countries to manage droughts effectively and better cope with their environmental, economic and social impacts" and, "encourage governments around the world to develop and implement national drought management policies, consistent with their national development laws, conditions, capabilities and objectives".
- Enhance greater intersectoral coordination and joint action by all governments and private sector institutions and organizations involved in drought management, as well as the allocation of resources, for the development and implementation of such policies.
- Facilitate the development of capacities on proactive risk-based drought-management for more robust planning and investment decisions.
- Help farmers to anticipate, plan and manage drought successfully and build planning and response capacities of rural communities which should play a leading role in drought preparedness for the adoption of self-reliant approaches to manage climate variability.

B2. Recommendations for FAO

46. The 38th Session of the ECA may wish to recommend that FAO and other organizations:

- Support national and regional capacity development programmes to institutionalize policy work and implementation mechanisms and approaches for drought risk management.
- Support national and sub/regional institutions or networks to combat land degradation and cope with water scarcity, focusing particularly on increasing water use efficiency in Central Asia, in line with the resources allocated and extra-budgetary resources that may become available.

- Promote enhancement of regional and local cooperation in data and information exchange, including regional networks/cooperation and drought monitoring and early warning centres in Central Asia.
- Foster and support regional collaboration, experience exchange and information and knowledge sharing.
- Assist governments in assessing the cost-effectiveness of drought preparedness and impacts on food production and security.

References

European Commission (2007) Communication from the Commission to the European Parliament and Council: Addressing the challenge of water scarcity and droughts in the European Union. COM(2007) 414.

European Commission (2012a) Communication form the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Report on the Review of the European Water Scarcity and Droughts Policy, COM/2012/0672.

European Commission (2012a) Commission Staff Working Document: Executive Summary of the Impact Assessment, SWD(2012) 381.

Forzieri, G., L. Feyen, R. Rojas, M. Florke, F. Wimmer, and A. Bianchi (2014) Ensemble Projections of Future Streamflow Droughts in Europe, Hydrology and Earth Systems Science, 18: 85-108.

Food and Agriculture Organization of the United Nations (FAO) (2014) Draft Report: Drought in Central Asia: Towards management of drought risks in Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan and Uzbekistan. Unpublished.

Food and Agriculture Organization of the United Nations (FAO) (2013) Resilient livelihoods - Disaster risk reduction for food and nutrition security, Rome, Italy, 92 pp.

Food and Agriculture Organization of the United Nations (FAO) (2012) Promotion of Disaster Risk Reduction in Agriculture for small farmers in Moldova: Project Document for Funding.

Food and Agriculture Organization of the United Nations (FAO) (2010). Agenda Item 5. Challenges of water scarcity in the Europe and Central Asia region and recommendations for adaptation, ECA 36/10/3, pp.14.

Food and Agriculture Organization/National Drought Mitigation Center (FAO/NDMC) (2008) "The Near East Drought Planning Manual," Food and Agriculture Organization of the United Nations (FAO): Rome: Italy.

Iglesias, A., A. Cancelliere, D. Gabina, A Lopez-Francos, M. Moneo, G. Rossi (eds) (2007) "Drought Management Guidelines, European Commission – EuropeAid Co-operation office Euro-Mediterranean Region Programme for Local Water Management (MEDA Water) Mediterranean Drought Preparedness and Mitigation Planning (MEDROPLAN), pp. 78.

Kossida, M., A. Kakava, A. Tekidou, A. Iglesias, M. Mimikou (2012) Vulnerability to Water Scarcity and Drought In Europe: Thematic Assessment for EEA Water 2012 Report. European Topic Centre on inland, coastal, and marine waterers, EEA/NSV/10/002, 102 pp.

Perelet, R. (2008) Climate Change in Central Asia, United Nations Development Programme, http://europeandcis.undp.org/data/show/6EEEA7CD-F203-1EE9-B8E09D9A56670836

Sivakumar, M.V.L. (2011) 'Current Droughts: Context and Need for National Drought Policies',

in M.V. L. Sivakumar, R.P. Motha, D. A. Wilhite, and J.J. Qu (eds) Towards a Compendium on National Drought Policy, World Meteorological Organization, Geneva

Svoboda, M. (2012) 'Efforting a Global Drought Early Warning System', Proceedings of the

92nd American Meteorological Society Annual Meeting, Jan 24, New Orleans, LA

United Nations Convention to Combat Desertification (UNCCD) (2008) Dialogue on establishing a Drought Management Centre in Central Asia in the Context of the United Nations Convention to Combat Desertification, UNCCD and OSCE, http://www.unece.org/fileadmin/DAM/env/SustainableDevelopment/3Session/Informal%20documents/in_session/OSCE_t_concept_paper.pdf.

United States Department of Agriculture Foreign Agricultural Service (2008) Middle East and Central Asia: Continued Drought in 2009/10 Threatens Greater Food Grain Shortages. Commodity Intelligence Report, http://www.pecad.fas.usda.gov/highlights/2008/09/mideast_cenasia_drought.

Wilhite, D.A., M.J. Hayes, and C.L. Knutson (2005) "Drought Preparedness Planning: Building Institutional Capacity", In: Drought and Water Crisis: Science, Technology, and Management Issues, ed., D.A. Wilhite, Taylor and Francis: New York, 93-135.

World Bank (2005) Drought: Management and Mitigation Assessment for Central Asia and the

Caucasus, World Bank Europe and Central Asia Region, Environmentally and Socially

Sustainable Development Department (http://siteresources.worldbank.org/INTECAREGTOPRURDEV/Resources/CentralAsiaCaucasusDroughtAssessment-Eng.pdf).

World Bank (2006) Drought: Management and Mitigation Assessment for Central Asia and the

Caucasus, Regional and Country Profiles and Strategies, World Bank Europe and Central

Asia Region, Environmentally and Socially Sustainable Development Department (http://siteresources.worldbank.org/INTECAREGTOPRURDEV/Resources/CentralAsiaCaucasusDroughtProfiles&Strategies-Eng.pdf).

Water Scarcity and Droughts Expert Network (WSCEN) (2008) Drought Management Plan Report: Including Agricultural, Drought Indicators and Climate Change Aspects. European Commission Technical Report-2008-023. Luxembourg: Office for the Publications of the European Communities, 109 pp.