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GLOBAL MONITORING AND EARLY WARNING SYSTEM ON WATER IN AGRICULTURE

I. Introduction

1. Population growth, with its food requirement and changes in diets, is one of the major drivers for water demand. Food demand is forecast to grow by 70 percent by 2050. Therefore, water is increasingly becoming a scarce resource in many regions of the world. Globally, around 70 percent of the total water is withdrawn by agriculture for irrigation to produce over 40 percent of the world food on 15 percent of the arable land (almost 20 percent in developing countries). The remaining 60 percent of the world food is produced under rainfed agricultural systems, exposed to the uncertainties of rainfall patterns and climate variability in general.

2. The impacts of climate change are expected to be felt most immediately through changes in the global hydrological cycle. Impacts of climate change related to water are being experienced in the form of more severe and more frequent floods and droughts. Higher average temperatures and changes in precipitation and temperature extremes are projected to affect the availability of water resources, including a further deterioration of the water quality. In coastal areas, sea water level rise is affecting prime agricultural land in e.g. low-lying deltas and salt water intrusion takes place in rivers and in groundwater resources resulting in reduced yields and/or necessity to change crops. The magnitude and frequency of natural meteorological events and the rising severity of their impacts on patterns of human settlement and land-use point to a need to both anticipate and mitigate these water related impacts, particularly in terms of global food production.

3. Increasing water scarcity and the consequent competition for water between economic sectors are among the major threats to global food production. In order to be prepared for, and prevent or mitigate negative effects on food production, a global monitoring and early warning system on water in agriculture would fill a current gap in global information flows. This system would monitor the key water-related factors determining food production at national, regional and global level and provide relevant information for actions to be taken.

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4. In terms of water quantity, the existing monitoring and early warning systems, particularly those already present in the World Meteorological Organization (WMO) and FAO, are relevant but not sufficient. The global information system on water and agriculture (AQUASTAT) assesses trends in agricultural water use in relation to available resources. The Global Information and Early Warning System on Food and Agriculture (GIEWS) makes regular synoptic assessments of the entire range of factors affecting food security. In particular, it utilizes FAO's ARTEMIS (Africa Real Time Environmental Monitoring Information System) generated multi-temporal vegetation data (dekadal from SPOT-4) and estimated rainfall data (from meteorological satellites) in African countries to assess crop conditions and forecast agricultural productions and yields. The Global Land Cover Network (GLCN) monitors changes in land cover and models long-term trends in deltaic systems and distribution of mangroves for assessment of environmental services. What is missing is a more tightly integrated seasonal and annual assessment of water resources (quality and quantity) linked to agricultural production that establishes annual monitoring baselines and provides early warning of water resource shortfalls and damaging flood events.

5. In terms of water quality and the impacts on and stemming from agricultural production, there are no directly relevant global monitoring and early warning systems. The United Nations Environment Programme Global Environment Monitoring System (GEMS) Water Programme and GEMStat offer national reporting of water quality in the same way as AQUASTAT. However, countries that have experienced rapid urban and rural development are observing eutrophication and salinity impact and constraints on agricultural production. Clearly more systemic reporting would be beneficial over and above the periodic reporting that national and local environmental agencies undertake. In some cases, near real-time monitoring to detect effluent discharges may be in place but only where comprehensive environmental regulation is in force and actively implemented. Therefore the implications of including water quality into a global monitoring would need to be examined from the start.

6. A Global Monitoring and Early Warning System on Water in Agriculture would enable the prediction of water-related circumstances that cause negative impacts on food production systems (irrigated and rainfed) at different time scales (multi-annual, annual and seasonal). The implications at national, regional and global level would need to be assessed as early as possible together with the probable duration of the stress.

II. A Possible Approach

7. In order to design and establish the architecture of a Global Monitoring and Early Warning System on Water in Agriculture at three levels, global, regional and national, the suggested approach is to build a simple practical system that relies on data which are already collected and regularly updated by the respective custodians of the data. Depending on the size of the countries and the availability of meteorological and hydrological information, early warning systems may also be dynamically downscaled for sub-national areas. The most suitable organizations to coordinate, compile and disseminate the results of the system would be identified at national, regional and global level. Finally, the need for additional data requirement would have to be evaluated.

8. The early warning system would be based on a combination of meteorological, hydrological, soil and water data collected through gauging stations and satellite information. To become operational and useful at regional and national levels, the information needs to be translated and communicated to support decisions. Early warnings will produce forecasts at two time scales (i) annual and (ii) before commencement of the season, when decisions are about to be taken for the season by different actors. This kind of early warning will include hydrological modelling and forecasts of rivers, lakes and groundwater, as well as information on water quality, which are important for irrigated agricultural systems. In addition, a near-real time information system on intra-seasonal rainfall anomalies is important in order to assess implications for yields,

and thus food production, and the repercussion on food security which is particularly critical for rainfed agriculture.

9. The monitoring and early warning related to impacts of water quality on agricultural production would need to be examined as a special case.

III. Initial Steps

10. Initial steps would involve the identification of institutional mandates, functions and capacity well suited at the global, regional and national levels. Discussions would have to take place with relevant organizations, developing alternatives for the architecture, evaluating the alternatives, recommending best options, and estimating the costs. Expertise of UN-Water members and partners would be mobilized in the process.

11. Following this initial appraisal, an analysis of the list of countries vulnerable to water-related food insecurity is recommended. This would attempt to categorize countries according to their particular physiographic and socio-economic vulnerability to water related impacts and would include an analysis of related institutions at national and local levels. A number of representative countries should be identified where pilot implementation could be attempted. An outline of the proposal for pilot implementation would be prepared.

12. Subsequently, pilot implementation of the recommended architecture could be undertaken at the global, regional and national level. The experience of pilot implementation would need to be assessed and analysed. Recommendations for fine tuning of the proposed architecture for the pilot countries can then be developed and accompanied by recommendations for replication. Information and capacity building material supporting the implementation and replication of the architecture in other vulnerable countries will also be developed, along with the associated cost estimates.

13. In relation to water quality, it would be advisable to look at the feasibility of including water quality information into the overall monitoring and global water monitoring system as a parallel activity and then integrate findings into the pilots as appropriate.

14. These steps have cost implications. The initial exploration, selection of pilots and the pilot-implementation would need to be budgeted assuming that both regular programme and extra budgetary resources would be made available.