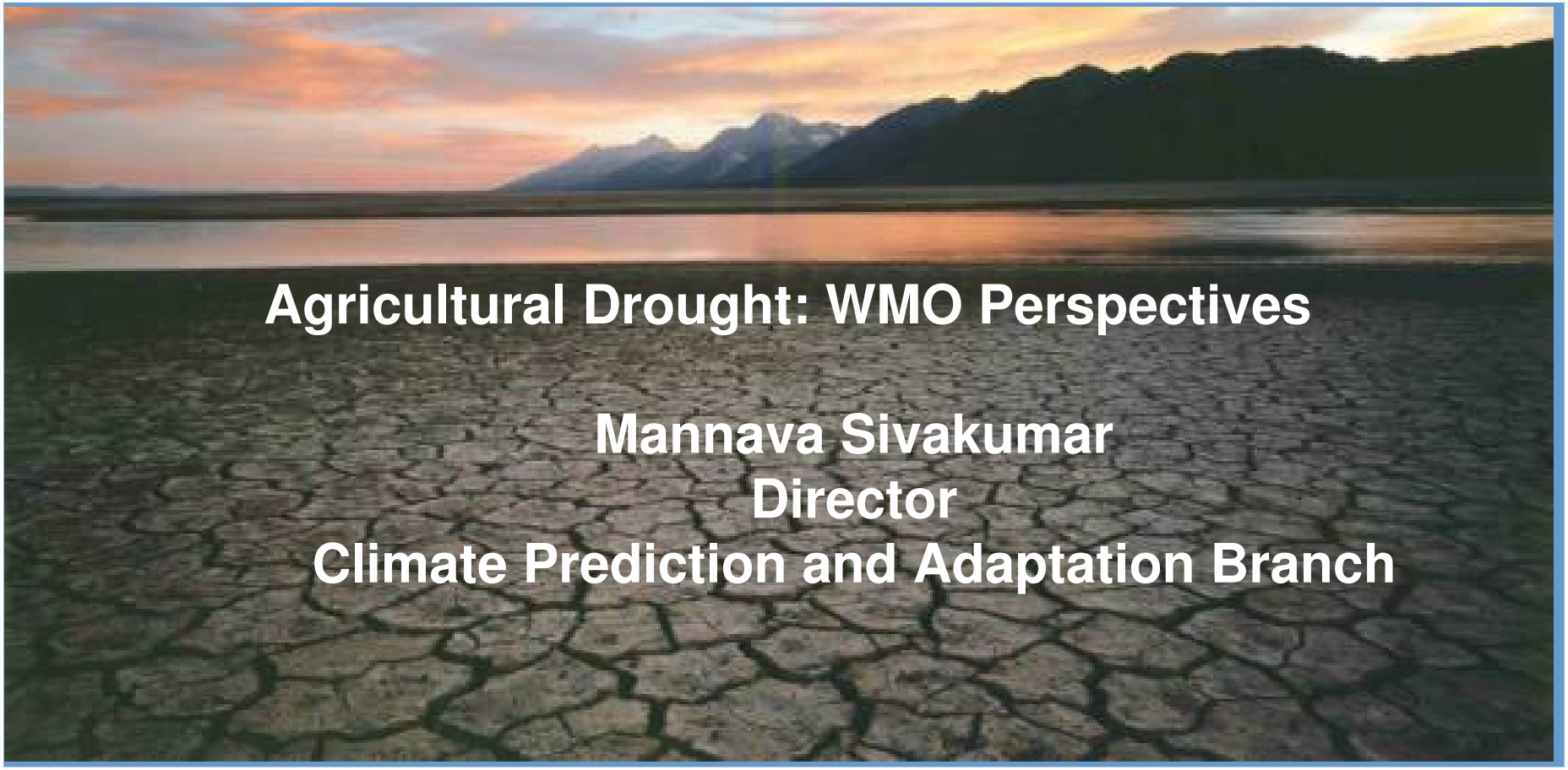
World Meteorological Organization

Working together in weather, climate and water

WMO



Agricultural Drought: WMO Perspectives

Mannava Sivakumar
Director
Climate Prediction and Adaptation Branch

Presentation

- Introduction
- Drought Management
- WMO Actions to promote Drought Preparedness and Drought Management
- WMO Perspectives on Agricultural Drought
- Some thoughts for this Meeting
- Conclusions

WMO's Emphasis on Drought Issues

As the United Nations specialized agency with responsibility for meteorology and operational hydrology, the World Meteorological Organization (WMO), since its inception, has been addressing the issue of agricultural droughts. The fight against drought receives a high priority in the Long-term Plan of the WMO, particularly under the:

- Agricultural Meteorology Programme
- Hydrology and Water Resources Programme
- Technical Cooperation Programme

WMO Secretariat and the NMHSs

- WMO's Agricultural Meteorology Programme and the Hydrology and Water Resources Programme work through the NMHSs in drought preparedness and drought management
- NMHSs play a crucial role in the drought task force at the national level
- NMHSs provide seasonal forecasts and early warnings
- They help build public awareness about droughts
- They teach people about drought

Drought Management

Drought management has three major components:

- Monitoring and early warning
- Risk and impact assessment
- Mitigation and response

NMHSs Role in the Provision of Drought Monitoring, Risk Assessment and Early Warning

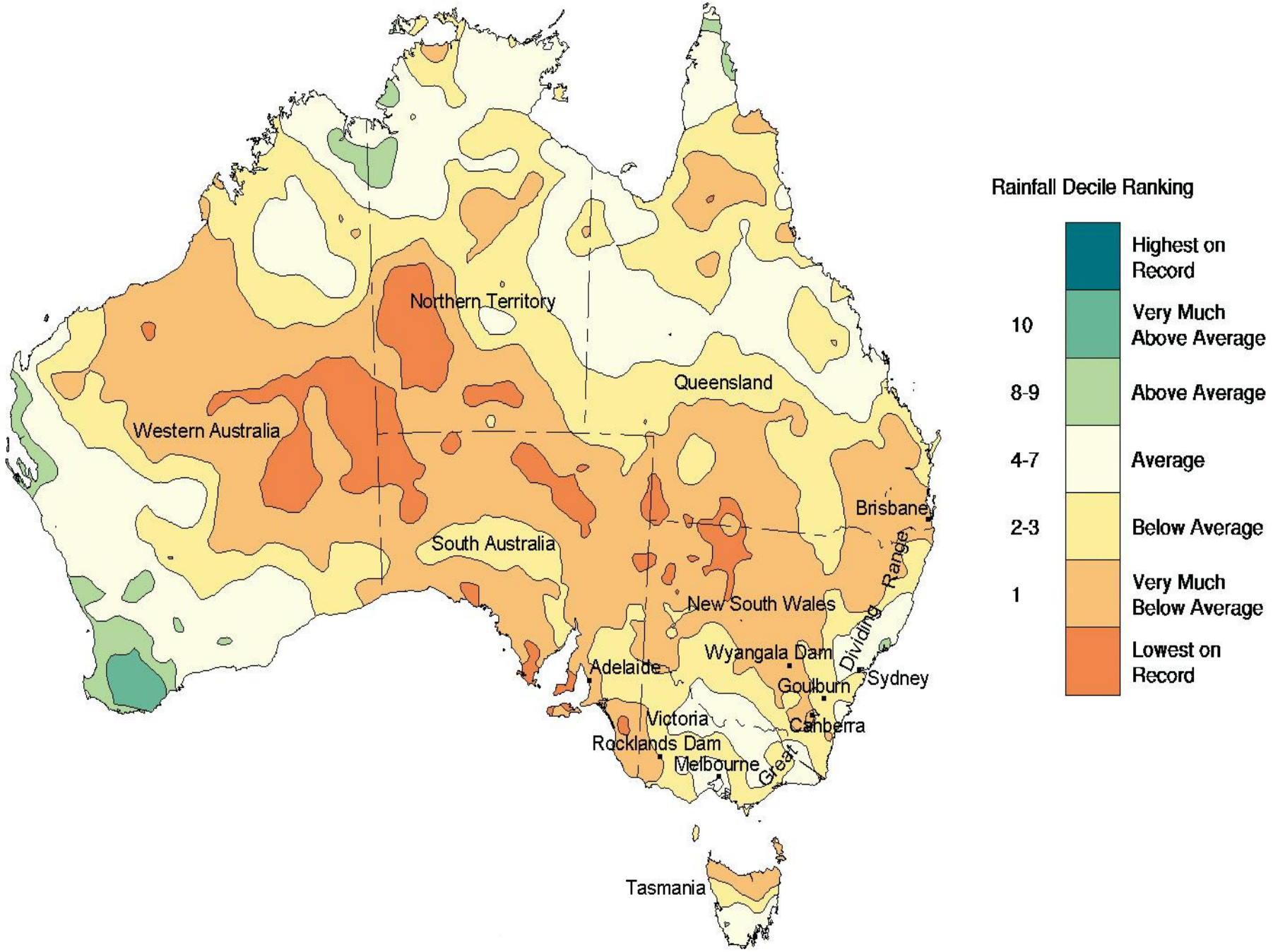
Provide information on:

- Timing of droughts
- Drought intensity
- Drought duration
- Spatial extent of a specific drought episode
- An analysis of the risk of the phenomenon and its likely effect on agricultural production.

Importance of Early Warning Systems for Drought

The provision of meteorological and hydrological support to early warning of droughts is perhaps the most fundamental aspect of services that are supplied by NMHSs and they contribute to all four phases of Early Warning Systems:

- Mitigation or prevention
- Preparedness
- Response
- Recovery


Rainfall Decile Ranking
10
8-9
4-7
2-3
1
Highest on Record
Very Much Above Average
Above Average
Average
Below Average
Very Much Below Average
Lowest on Record
Northern Territory
Queensland
Western Australia
South Australia
New South Wales
Brisbane
Dividing Range
Wyangala Dam
Adelaide
Goulburn
Sydney
Victoria
Canberra
Rocklands Dam
Melbourne
Great
Tasmania

WMO's Actions to Promote Drought Preparedness and Drought Management

- The Commission for Agricultural Meteorology (CAgM) of WMO has been very active in addressing the issue of agricultural drought and made recommendations regarding the role of agrometeorology in helping to solving drought problems in drought-stricken areas, particularly in Africa.

- The Commission appointed a number of working groups and rapporteurs with specific terms of reference

- Based on the activities of these working groups and rapporteurs, a number of reports were published and distributed by WMO.

Working Groups on Drought appointed by CAgM 1967-83

- CAgM-IV (Manila, 1967) – Working Group on Assessment of Drought
- CAgM-V (Geneva, 1971) – Working Group on the Meteorological Factors Concerning certain Aspects of Soil Deterioration and Erosion
- CAgM-VI (Washington, 1974) – Rapporteur on the Frequency and Impact of Water Deficiencies for Selected Plant-Soil Systems
  - (Resolution 2) – Drought and Agriculture
- CAgM-VII (Sofia, 1979) – Working Group on the Agrometeorological Aspects of Land Management in the Arid and Semi-Arid Areas with special reference to Desertification Problems
  - Rapporteur on Drought Probability Maps
- CAgM-VIII (Geneva, 1983) – Working Group on Meteorological Aspects of Agriculture in Drought-Prone and Semi-Arid Areas
  - Rappporteur on Drought Probability Maps

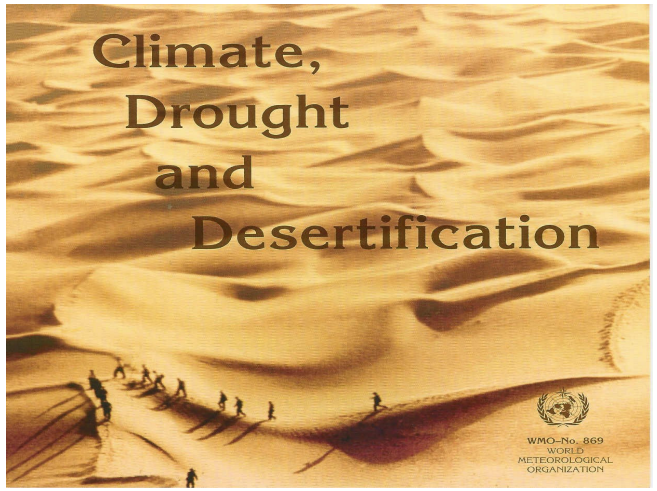
Working Groups on Drought appointed by CAgM 1986-2002

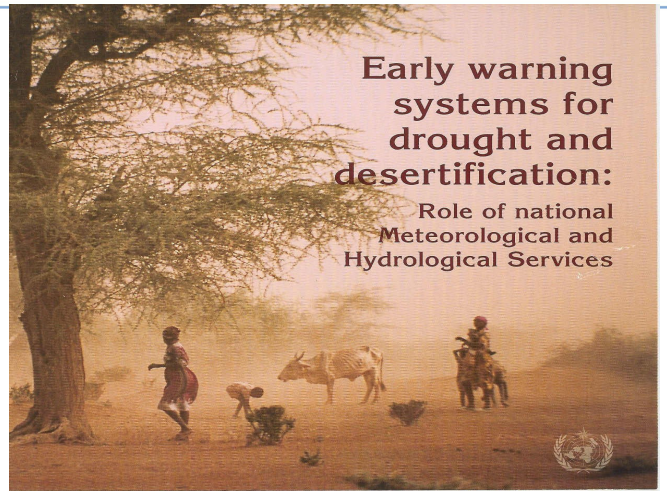
- CAgM-IX (Madrid, 1986) – Working Group on Monitoring, Assessment and Combat of Drought and Desertification
- CAgM-X (Florence, 1991) – Working Group on Extreme Meteorological Events
- CAgM-XI (Havana, 1995) – Working Group on Desertification and Drought
- CAgM-XII (Accra, 1999) – Working Group on the Impacts of Desertification and of Drought and other Extreme Meteorological Events
- CAgM-XIII (Ljubljana, 2002) – Expert Team on Reduction of the Impact of Natural Disasters and Mitigation of Extreme Events in Agriculture, Rangelands, Forestry and Fisheries

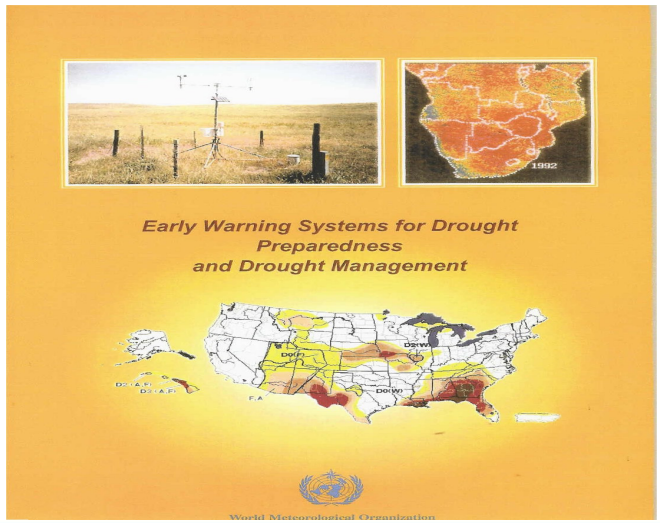
Agrometeorological Applications addressed

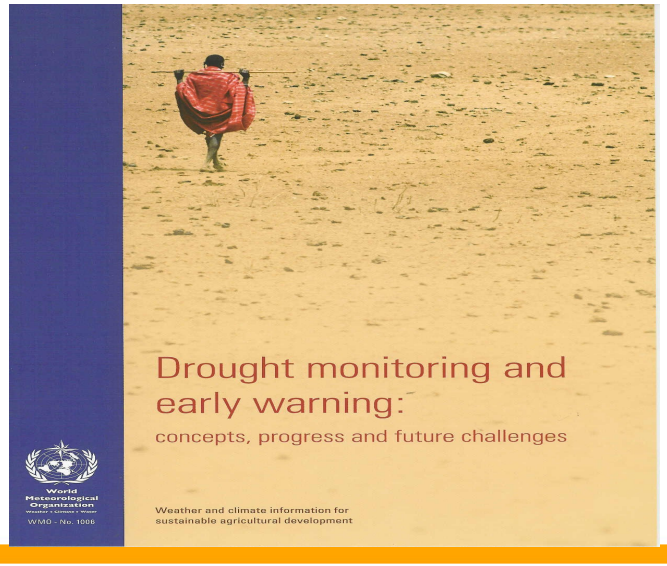
- Drought monitoring, forecasting and control
- Meteorological aspects of drought processes
- Operational use of agrometeorology
- Measures to alleviate the effects of droughts
- Assessment of the economic impacts
- WMO/UNEP book "Interactions of Desertification and Climate"
- Capacity building activities

Publications on Drought









Capacity building activities

- Workshop on Drought and Desertification in Israel (May 1997)
- UNDP/UNSO/WMO International Workshop on "Coping with Drought in sub-Saharan Africa: Best Use of Climate Information" in Zimbabwe (Oct 1999)
- Expert Group Meeting on Early Warning Systems for Drought Preparedness and Drought Management in Portugal (Sep 2000)
- Training Seminar/Workshop on Drought Preparedness and Management (Gambia, 1995; Morocco 1996)
- Roving Seminars on the Application of Climatic Data for Drought Preparedness and Management of Sustainable Agriculture (Ghana, 1999; China, 2001; Antigua, 2004)

Support to Regional Institutions

- 1972 - WMO expert missions led to establishment in 1974 of AGRHYMET in Niamey (Niger) under the auspices of CILSS
- 1989 - WMO established 2 Drought Monitoring Centres (DMCs) in Nairobi (Kenya) and Harare (Zimbabwe), with support of UNDP
- 1993 - WMO & Economic Commission for Africa (ECA) sponsored establishment of African Centre of Meteorological Applications for Development (ACMAD) in Niamey (Niger)
- 2006 – WMO and the UNCCD Secretariat collaborated actively with the establishment of a Drought Management Centre for the South-Eastern Europe (DMCSEE). The 11 countries in the Region elected Slovenia to host this Centre and an International Steering Committee is now in place to guide the establishment and operations of this Centre.

WMO Perspectives on Agricultural Drought

START INDEX

WORLD METEOROLOGICAL ORGANIZATION

TECHNICAL NOTE No. 138

DROUGHT AND AGRICULTURE

Report of the CAgM Working Group on the Assessment of Drought
prepared by C. E. Hounam (chairman), J. J. Burgos, M. S. Kalik,
W. C. Palmer and J. Rodda

WMO - No. 392

Secretariat of the World Meteorological Organization - Geneva - Switzerland

Classification of Drought Definitions

- Rainfall
- Rainfall with mean temperature
- Soil water and crop parameters
- Climatic indices and estimates of evapotranspiration
- General definitions and statements

Definitions based on rainfall

- Less than 2.5 mm in 48 hours
- Rainfall half of normal or less for a week
- Ten days with rainfall not exceeding 5 mm
- 15 days with no rain
- 15 consecutive days, none with 0.25 mm
- 15 consecutive days, none with 1 mm
- 21 days or more with rainfall less than 30% of normal
- 21 days with precipitation less than 1/3 of normal

These appeared to be geared mainly to climatic experience in the British Isles or perhaps northeastern USA, where rainfall is received at fairly frequent intervals

Meteorological Indices of Agricultural Drought

While some scientists have used meteorological data to develop methods for computing the extent and severity of agricultural drought, some other maintained that meteorologically derived indices were useless.

The opponents of drought indices are, essentially, pointing out that the problem is so complex tht no single index can possibly take full account of all the pertinent physical and biological factors.

In as much as drought is regarded as abnormal dryness, rather than a climatic state or type, the various indices of aridity, designed to delineate or characterize climatic types, are not considered to be true drought indices.

Oldekop, Lang, Koppen, de Martonne, Meyer, Thornthwaite, Angstrom, and Emberger are prominent in most such accounts.

Agricultural Drought

Defined as derived numbers or letters which indirectly express the degree to which growing plants have been adversely affected by an abnormal moisture deficiency.

The deficiency may result either from an unusually small moisture supply or an unusually large moisture demand.

The purposes of an Index

- To evaluate climatic proneness toward aridity
- To estimate areal irrigation requirements
- To evaluate drought in a local setting
- For periodic reporting of the severity and regional extent of drought

Drought Index examples in practice (1)

- Potential evapotranspiration methods (WMO Technical Note 83)

- Actual evapotranspiration methods (Baier and Robertson, 1966; Baier 1967)

- Drought for spring wheat (Mack and Ferguson, 1968 – soil water accounting procedures)

- Drought for maize (Barger and Thom, 1949 – statistical analysis of yield and rainfall data at six stations in Iowa)

Drought Index examples in practice (2)

- Moisture stress days (Denmead and Shaw, 1962 – turgor loss points for corn as a function of evapotranspiration at field capacity and root zone moisture; Dale 1964; Dale and Shaw 1965; Dale 1968)

- Drought and fire in vegetation (Keetch and Byram, 1968)

- Drought in semi-arid pastoral areas (White 1955)

- Palmer drought index (Palmer 1965)

- Foley drought index (Foley 1957)

Some thoughts for this meeting

- **Agricultural drought depends on soil moisture and evapotranspiration deficits.**

- **Agricultural impacts caused due to short-term precipitation shortages, temperature anomaly that causes increased evapotranspiration and soil water deficits that could adversely affect crop production.**

Some thoughts for this meeting

- A drought index should integrate various parameters like rainfall, temperature, evapotranspiration (ET), runoff and other water supply indicators into a single number and give a comprehensive picture for decision-making.

- Agricultural drought indices should be based on soil moisture and evapotranspiration deficits and should help effectively monitor agricultural drought.

Conclusions

- There is a need to consider all critical aspects that contribute to incidence of droughts and their impacts in the agriculture sector.
- A consensus agricultural drought index should help explain not only the degree of severity of droughts, but also assist policy makers in taking early actions to alleviate their impacts.

Thank You