



Coping with Drought in the Caribbean

Bano Mehdi

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Is this an issue of concern?

- According to the IPCC (FAR), the occurrence of droughts in the Caribbean is a real threat...
- According to the IPCC WGII SPM Fourth Assessment Report;
 - “More intense and longer droughts have been observed over wider areas since the 1970s, particularly in the tropics and subtropics.”
 - “Drought affected areas will likely increase in extent.”

Definitions of drought

- Meteorological drought
 - Agricultural drought
 - Hydrological drought
 - Socioeconomic drought
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- Low flows can also cause challenges for water resource managers

Definition

- “prolonged absence or marked deficiency of precipitation”
- One comprehensive definition of a drought is “a prolonged period of abnormally dry weather that depletes water resources for human and environmental needs”

(Atmospheric Environment Service Drought Study Group 1986).



Meteorological drought

- Meteorological drought is defined usually on the basis of the degree of dryness (compared to some “normal” or average amount) and the duration of the dry period.
- Definitions are region specific since precipitation are highly variable from region to region.
- For example, some definitions of meteorological drought identify periods of drought on the basis of the number of days with precipitation less than some specified threshold.

Agricultural drought

- Agricultural drought links various characteristics of meteorological drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil water deficits, reduced ground water levels, etc.
- Plant water demand depends on prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and the physical and biological properties of the soil. A good definition of agricultural drought should be able to account for the variable susceptibility of crops during different stages of crop development, from emergence to maturity.

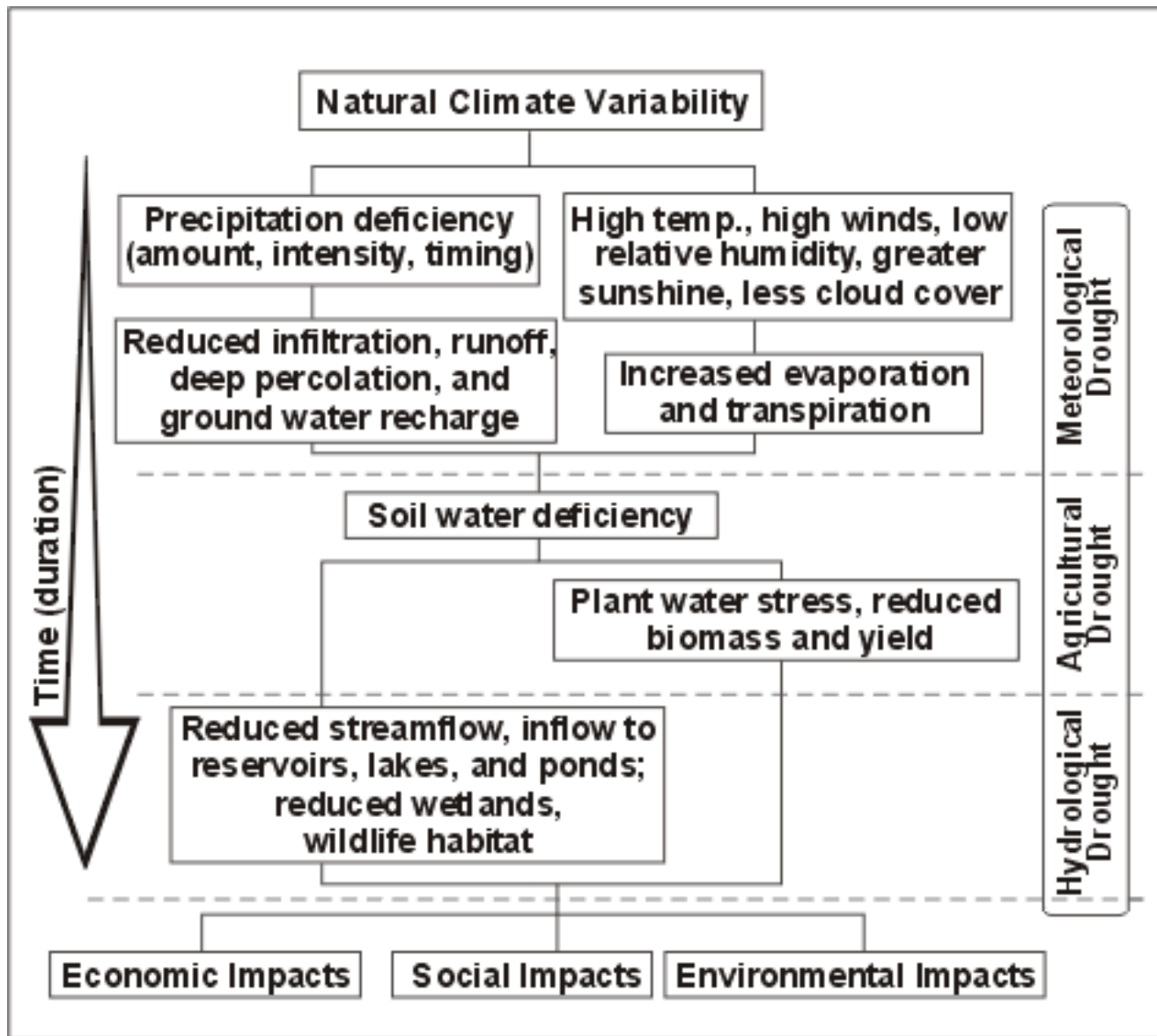


Hydrological drought

- Hydrological drought is associated with the effects of periods of precipitation shortfalls on surface or subsurface water supply (streamflow, reservoir and lake levels, ground water).
- The frequency and severity is usually defined on a watershed or river basin scale.
- Although all droughts originate with a deficiency of precipitation, hydrologists are more concerned with how this deficiency plays out through the hydrologic system.
- Usually there is a lag between the occurrence of meteorological and hydrological droughts.

Socioeconomic drought

- Socioeconomic drought occurs when the demand for an economic good exceeds supply as a result of a weather-related shortfall in water supply.
- It associates the supply and demand of economic goods with elements of meteorological, hydrological, and agricultural drought.
- The supply of many economic goods, such as water, forage, food grains, fish, and hydroelectric power, depends on weather.
- It differs from the other types of drought because its occurrence depends on the time and space processes of supply and demand.



Low flow

- A flow index, such as the 7Q10 flow can be interpreted as the 7-day low flow with a 10-year return period, using daily discharge data.
- Previous analysis of Ontario low flows focused primarily on the 7Q2, 7Q5, 7Q10, and 7Q20 flows



Low flows

- 7Q10 is one of the most widely used (design or reference) low flow indices/instream flow methods
- Today, the Ontario Low Water Response uses % of lowest average summer month flow



Indices to monitor drought

Palmer Drought Severity Index (PDSI)

uses temperature and rainfall information in a formula to determine soil dryness. It is most effective in determining long term drought (several months)

It uses a 0 as normal, and drought is shown in terms of minus numbers; for example, - 2 is moderate drought, - 3 is severe drought, and - 4 is extreme drought.

It is a soil moisture algorithm that considers water supply (precipitation), demand (evapotranspiration-Thornthwaite) and loss (runoff)

Palmer Classifications	
4.0 or more	extremely wet
3.0 to 3.99	very wet
2.0 to 2.99	moderately wet
1.0 to 1.99	slightly wet
0.5 to 0.99	incipient wet spell
0.49 to -0.49	near normal
-0.5 to -0.99	incipient dry spell
-1.0 to -1.99	mild drought
-2.0 to -2.99	moderate drought
-3.0 to -3.99	severe drought
-4.0 or less	extreme drought



Indices to monitor drought

Standardized Precipitation Index (SPI)

is a probability index that considers only ppt.

Based on the probability of recording a given amount of precipitation.

Probabilities are standardized, so an index of 0 indicates the median precipitation amount (half of the historical precipitation amounts are below the median, and half are above the median).

SPI Values	
2.0+	extremely wet
1.5 to 1.99	very wet
1.0 to 1.49	moderately wet
-.99 to .99	near normal
-1.0 to -1.49	moderately dry
-1.5 to -1.99	severely dry
-2 and less	extremely dry