DROUGHT MONITORING ACTIVITIES IN DEPARTMENT OF METEOROLOGY SRI LANKA

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DEPARTMENT OF METEOROLOGY
SRI LANKA

Outline

- ❑ Climate of Sri Lanka
- ❑ Drought events in Sri Lanka
- ❑ Drought monitoring activities in the Department of Meteorology
- ❑ Ongoing improvement activities in the department
- ❑ Conclusion

CLIMATE OF SRI LANKA

Sri Lanka is an island in the tropics

Tropical and Monsoonal

Two seasonal monsoonal wind regimes

Changing Wind Flow during the year by 180 degrees across the Country

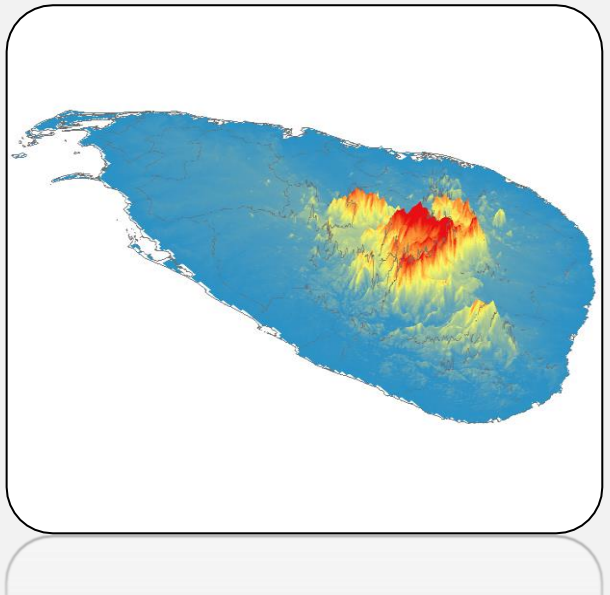
Mild Climate

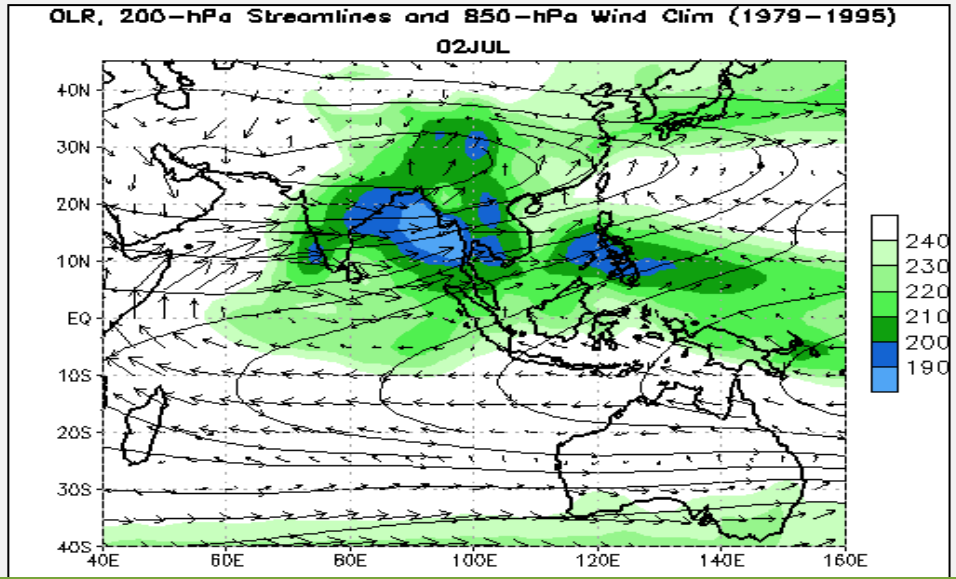
Average Rainfall : 1860 mm/year

Range of rainfall : 950 – 6000 mm

Mean Temperature : 27.5 C

25-30 lowlands and 10-15 mountain areas

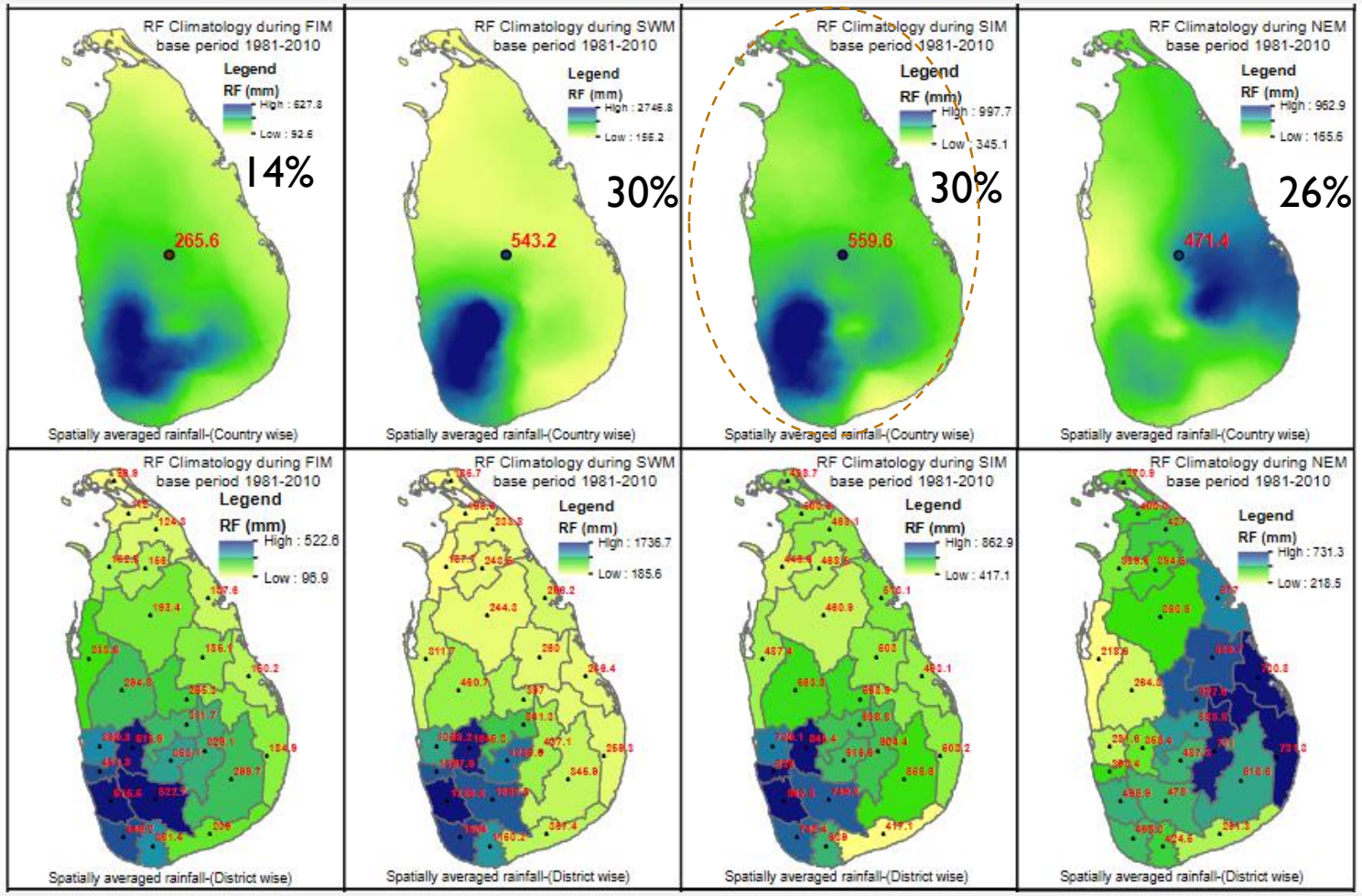




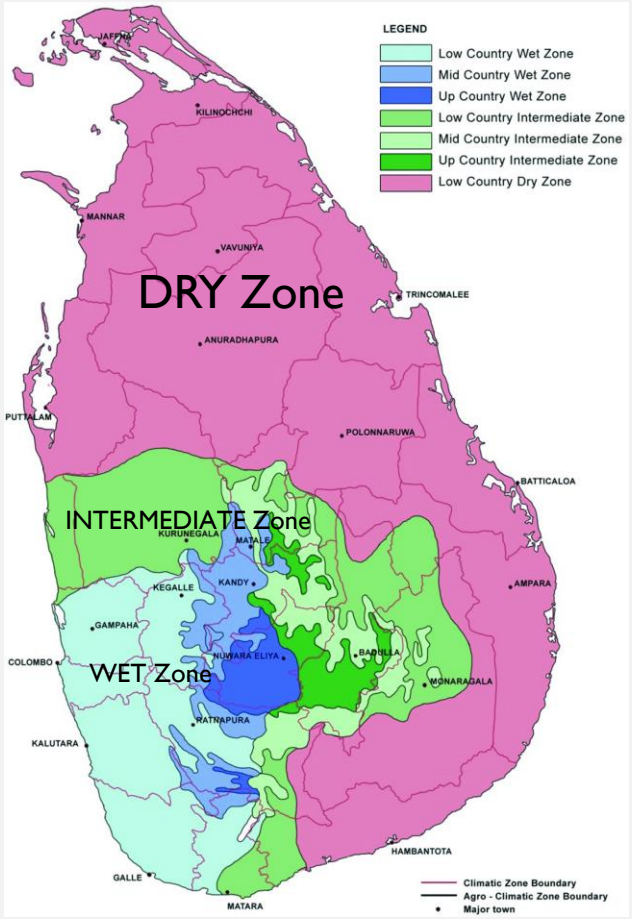
Extreme heat correlated with Rainfall Distribution

M A M J J A S O N D J F

March-April	May-Sep	October-November	December-February
IM1	SW Monsoon	2Ind Inter monsoon	NE Monsoon



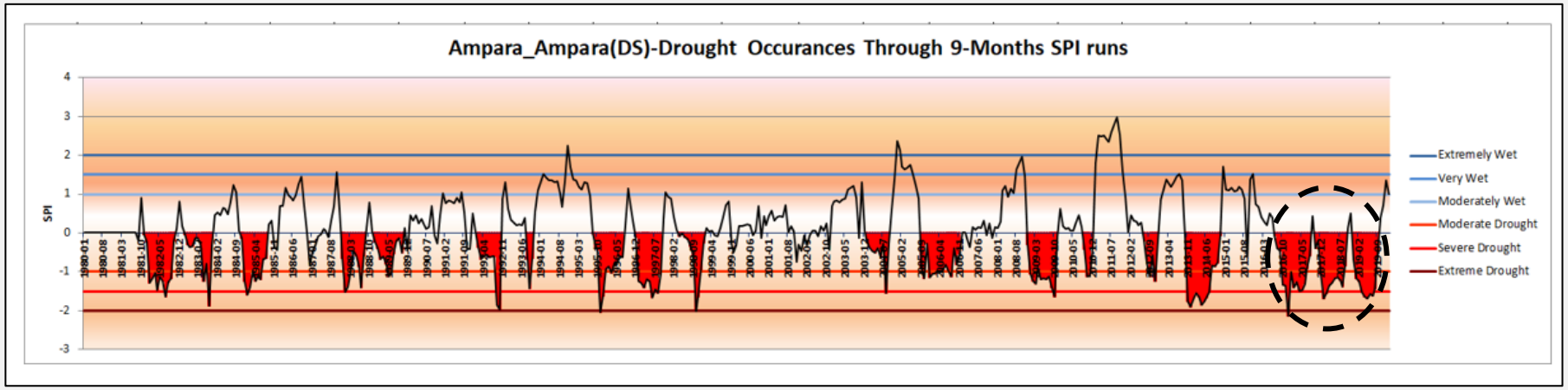
Climatic Zones



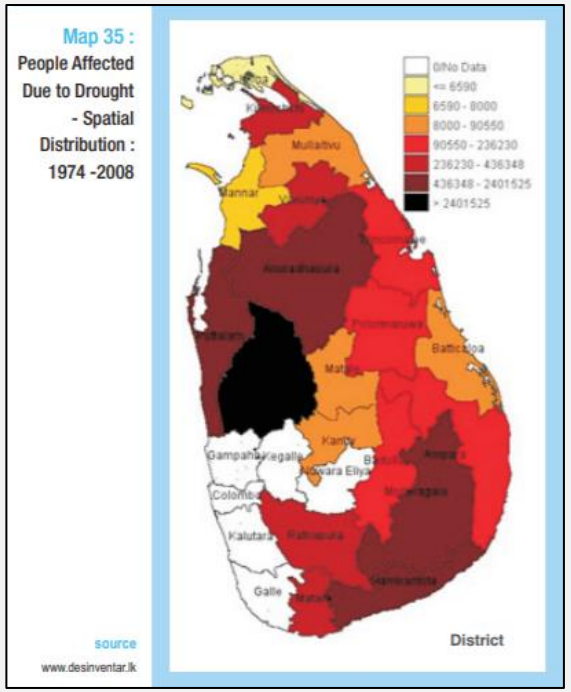
Punyawardana et al

Significant recent Drought events

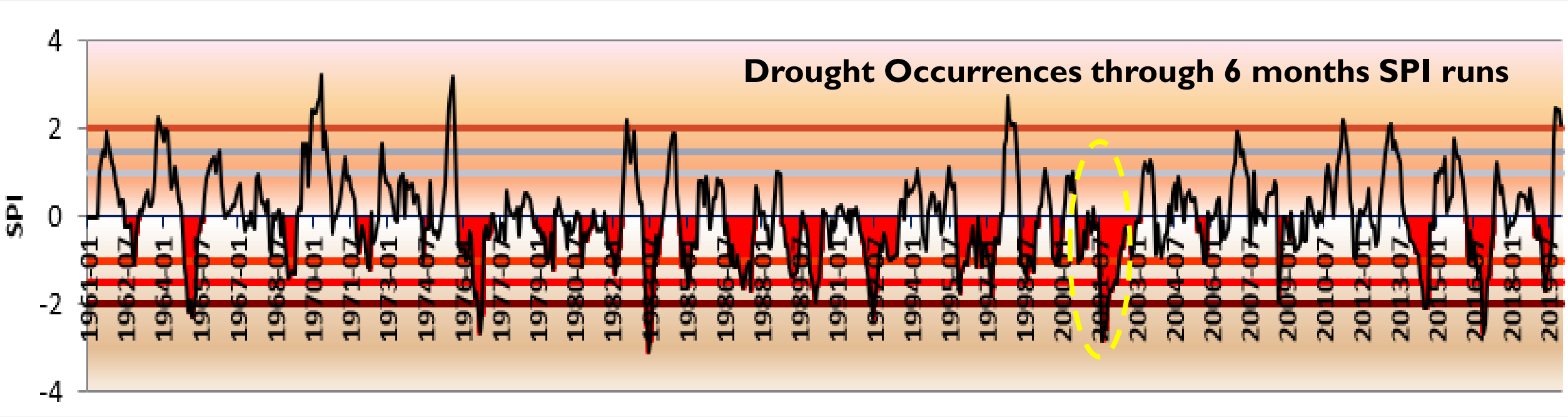
1. 2019 Drought



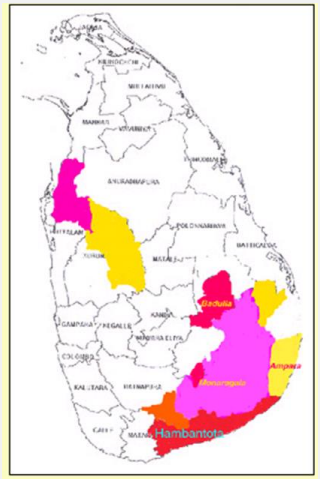
- In 2019, over 600,000 people have been affected by the drought in Sri Lanka.
- The worst affected group was the farming communities especially in Northern, North Central, Central and North Western Provinces.
- Heavily impact the National development by destructing the agricultural practices, failures in hydroelectricity, compensations for affected families etc. (Disaster management centre)



Significant droughts events – 2. Hambanthota, 2001



- More than 370,000 families were affected by this severe drought.
- The drought has been powerful enough to dry up eight of the major reservoirs in the district.
- Monaragala, Ampara, Kurunegala, Badulla, Ratnapura, Puttalam districts also were affected by this severe drought.



Monthly Drought Monitoring Bulletin by using SPI

Started to Issue from January 2018

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வளிமண்டலவியல் திணைக்களம்
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Monitoring of Meteorological Dryness Through Standardized Precipitation Index (SPI) at the end of June_2021
(Drought Monitoring Division,Centre for Climate Change Studies, Department of Meteorology)

PREAMBLE

In order to provide latest information regarding meteorological drought to improve the nation's preparedness for drought and more specifically, enhance drought readiness the Department of Meteorology initiate a monthly drought monitoring bulletin since January 2018.

Meteorological drought is usually defined on the basis of the degree of dryness (in comparison to some "normal" or average amount) and the duration of the dry period. This Drought Monitoring Bulletin has been prepared using the World Meteorological Organization (WMO) recommended Standardized Precipitation Index (SPI) technique. Monthly rainfall data from more than 250 stations were used to prepare this high resolution maps .

INTERPRETATION OF MAPS

The 3-month SPI provides a comparison of the precipitation over a specific 3-month period with the precipitation totals from the same 3-month period for all the years included in the historical record. A 3-month SPI reflects short and medium term moisture conditions and provides a seasonal estimation of precipitation. In primary agricultural regions, a 3-month SPI might be more effective in highlighting available moisture conditions.

The 6-month SPI compares the precipitation for that period with the same 6-month period over the historical record. For example, a 6-month SPI at the end of March compares the precipitation total for the October previous year to March this year period with all the past totals for that same period.

The 9-month SPI provides an indication of inter-seasonal precipitation patterns over a medium timescale duration. Droughts usually take a season or more to develop. SPI values below -1.5 for these timescales are usually a good indication that dryness is having a significant impact on agriculture and may be affecting other sectors as well.

12-month SPI reflects long-term precipitation patterns. A 12-month SPI is a comparison of the precipitation for 12 consecutive months with that recorded in the same 12 consecutive months in all previous years of available data. Because these timescales are the cumulative result of shorter periods that may be above or below normal, the longer SPIs tend to gravitate toward zero unless a distinctive wet or dry trend is taking place. 12-month SPI tied to stream flows, reservoir levels, and even groundwater levels at longer timescales.

OBSERVED FEATURES

The maps represent monthly accumulated rainfall (mm) during June 2021 (Fig 1) , monthly received rainfall as a percentage with respect to 30 year average (1981-2010) for May 2021 (Fig 2).

Excess of rainfall was recorded over most parts of the island except in Nuwara Eliya, Kandy and Hambanthota districts where deficit of rainfalls reported during the month of June 2021 (Fig 2).

Gampaha, Kurunegala, Puttalam, Mannar, Mullaitive and Batticaloa districts received around 200% of their normal rainfall while Kilinochchi and Jaffna received more than 300% of their normal.

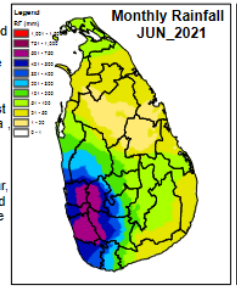


Fig 1 : Monthly accumulated rainfall

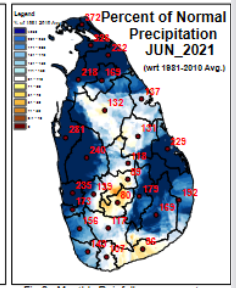


Fig 2 : Monthly Rainfall as a percentage from long-term average (1981-2010) map

Figure 3 a, b, c ,d, e represents 3-month, 6-months, 9-month, 12-month and18-months SPI calculations using standared color code provided by WMO respectively. They show the degree of wetness and dryness across the country during the periods under review.

Legend

SPI Classification

- -2.0 and below (Extremely dry)
- -1.5 - -1.99 (Severely dry)
- -1.0 - -1.49 (Moderately dry)
- -0.5 - -0.99 (Mildly dry)
- -0.49 - +0.49 (Normal)
- +0.5 -).99 (Mildly wet)
- +1.0 - +1.49 (Moderately wet)
- +1.5 - +1.99 (Severely wet)
- +2.0 and above (Extremely wet)

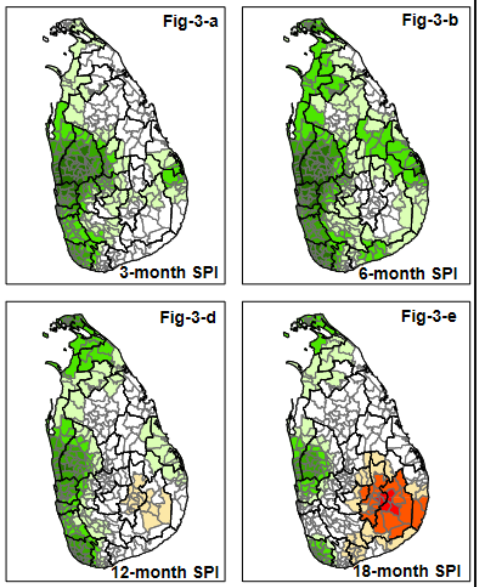


Fig 3 : 3 month (3-a), 6 month (3-b), 9 month (3-c) , 12 month (3-d) , and 18 month (3-e) SPI values through the end of June 2021 for the 331 Divisional Secretariat Divisions (DSD) in Sri Lanka

Most of the SPI scales indicate normal and wet conditions in most parts of the island (Fig 3-a, Fig 3-b, Fig 3-c, Fig 3-d).

Severely to moderate dry conditions were observed in few pockets in Badulla, Monaragala and Hambanthota districts under long term SPI scales (Fig 3-e).

Note:- Data used to develop the maps are not quality controlled.

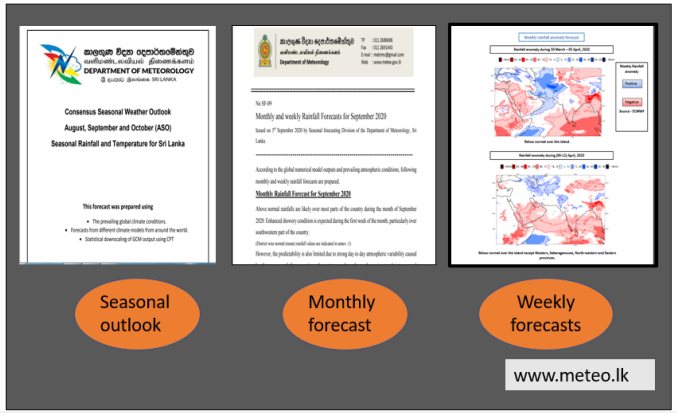
Seasonal Forecasts

Updates of National Forecasts

Seasonal Forecast
- It consists with rainfall and temperature forecasts for next 3 months along with individual monthly forecasts.

Monthly Forecast

Weekly forecast
- Weekly briefing for the requested parties(agriculture/water sectors) on each Monday



IMPROVEMENT ACTIVITIES OF DROUGHT MONITORING

1.PRISM development for Sri Lankan context - sponsored by world food programme (WFP)

Remote Sensing

CHIRPS
Climate Hazards Group InfraRed Precipitation with Station data

Blending Approaches

What do we mean by blending:

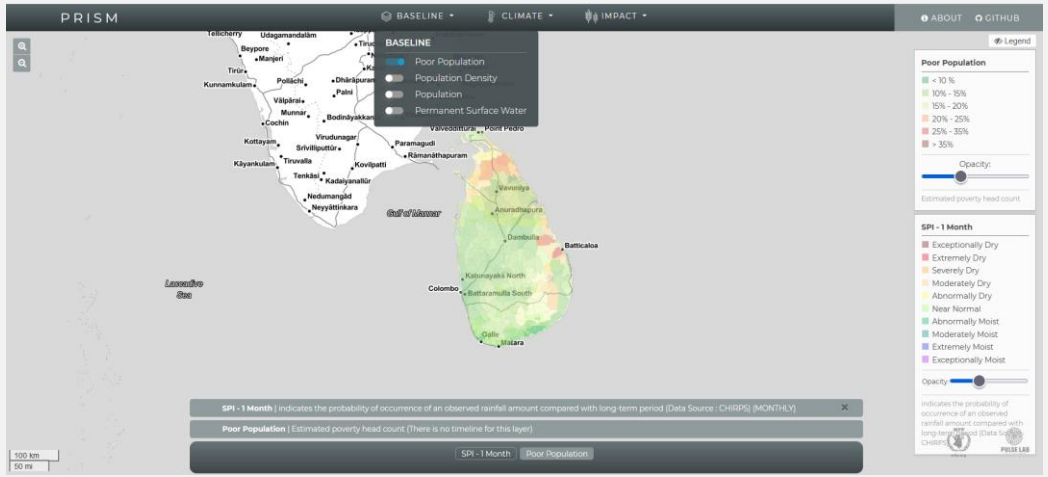
Blending is the combination of two estimates into a single value. We use a well known approach, where by the SRE is taken as a so called *first-guess* that is adjusted by observations from ground measurements of rainfall. The approach used is as follows:

$$BRE = SRE + F(SRE - OBS)$$

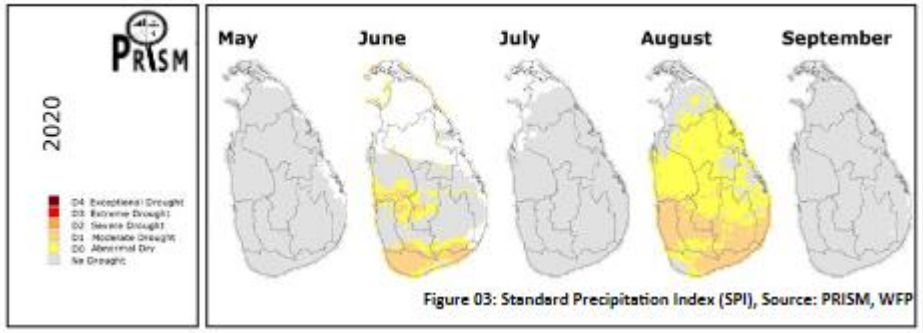
This means that we take the SRE and apply a correction **F** that is related to the differences between observations and the SRE.

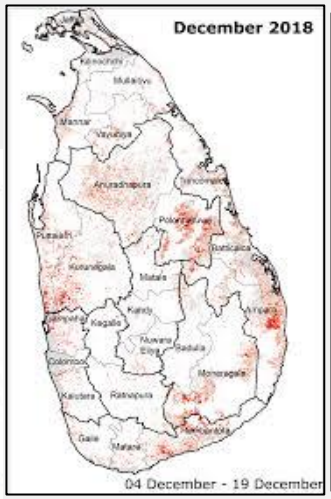
The correction factor is then applied to the differences between the SRE and the gauge rainfall. The SRE undergoes a bias correction, as the bias of the SRE in Namibia is very strong.

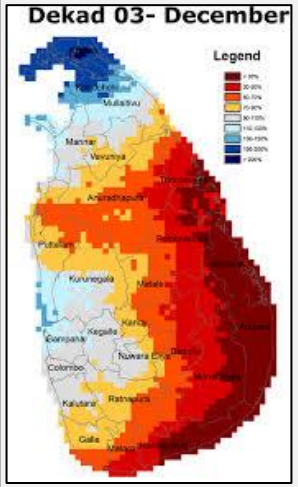
Gridded satellite rainfall estimates (SREs)

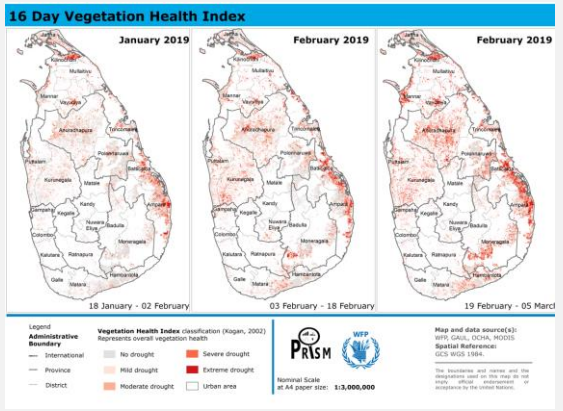


Drought









- Output showed good results for the 2017-2018 drought

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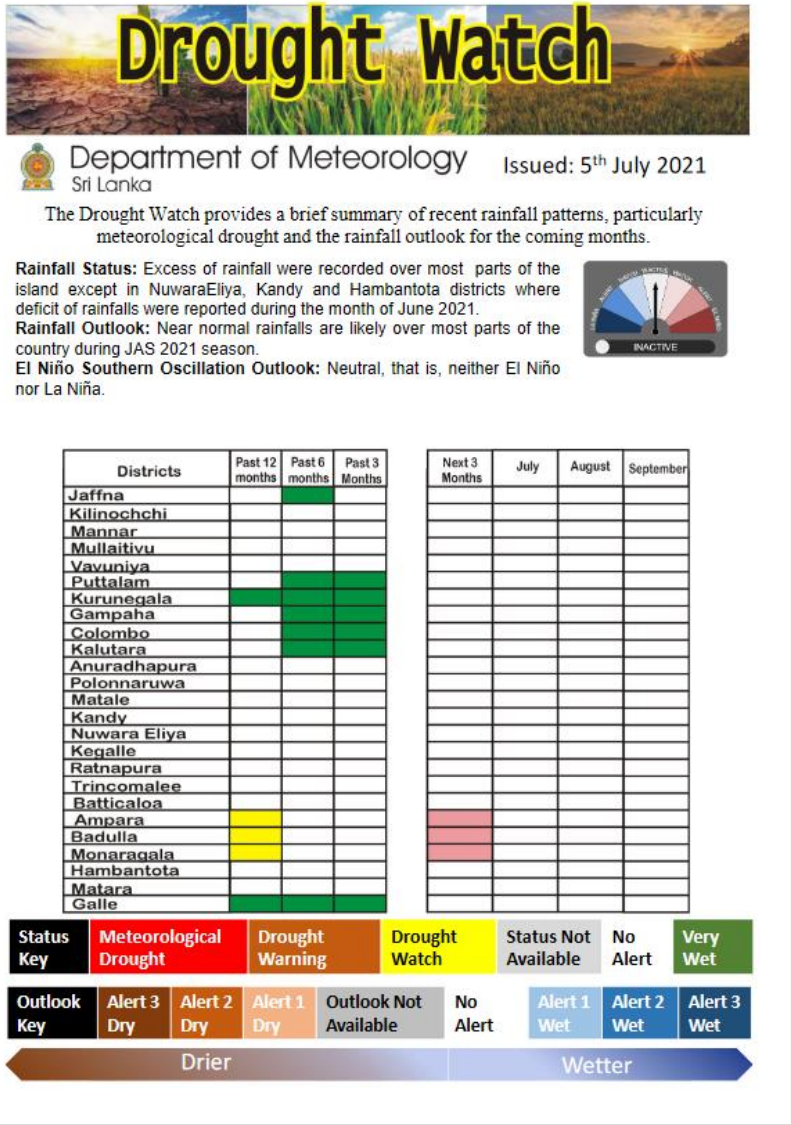
SRI LANKA

IMPROVEMENT ACTIVITIES OF DROUGHT MONITORING Ctd…..

2. PLANNING TO ISSUING A DROUGHT WATCH BULLETINE

it is in the process of preparing and expected to issue in very near future



Drought Watch

Department of Meteorology
Sri Lanka

Issued: 5th July 2021

The Drought Watch provides a brief summary of recent rainfall patterns, particularly meteorological drought and the rainfall outlook for the coming months.

Rainfall Status: Excess of rainfall were recorded over most parts of the island except in NuwaraEliya, Kandy and Hambantota districts where deficit of rainfalls were reported during the month of June 2021.
Rainfall Outlook: Near normal rainfalls are likely over most parts of the country during JAS 2021 season.
El Niño Southern Oscillation Outlook: Neutral, that is, neither El Niño nor La Niña.

Districts	Past 12 months	Past 6 months	Past 3 Months	Next 3 Months	July	August	September
Jaffna							
Kilinochchi							
Mannar							
Mullaitivu							
Vavuniya							
Puttalam							
Kurunegala							
Gampaha							
Colombo							
Kalutara							
Anuradhapura							
Polonnaruwa							
Matale							
Kandy							
Nuwara Eliya							
Kegalle							
Ratnapura							
Trincomalee							
Batticaloa							
Ampara							
Badulla							
Monaragala							
Hambantota							
Matara							
Galle							

Status Key	Meteorological Drought	Drought Warning	Drought Watch	Status Not Available	No Alert	Very Wet

Outlook Key	Alert 3 Dry	Alert 2 Dry	Alert 1 Dry	Outlook Not Available	No Alert	Alert 1 Wet	Alert 2 Wet	Alert 3 Wet

Drier — Wetter

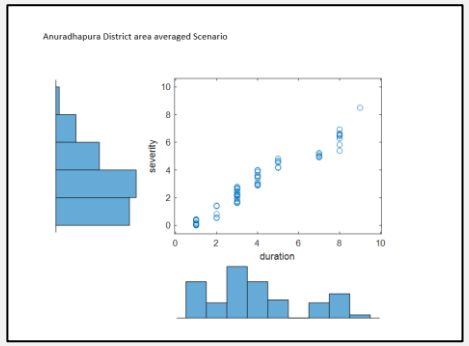
IMPROVEMENT ACTIVITIES OF DROUGHT MONITORING Ctd…..

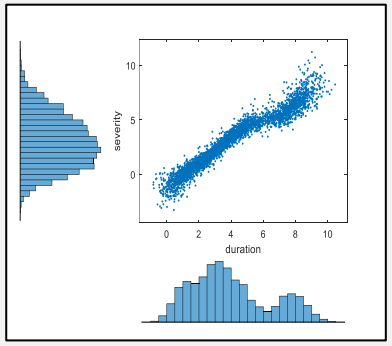
3. Development of Drought frequency curves/recurrence intervals

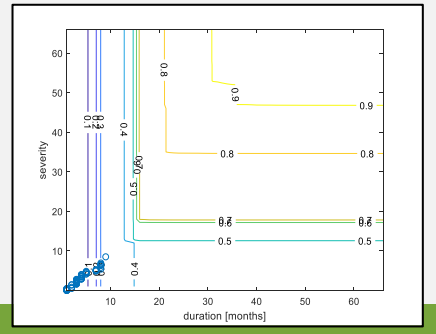
Collaboration with University of Colombo-Severity frequency curves

can be applied to quantify the frequency of drought events characterised by severity and duration at different timescales

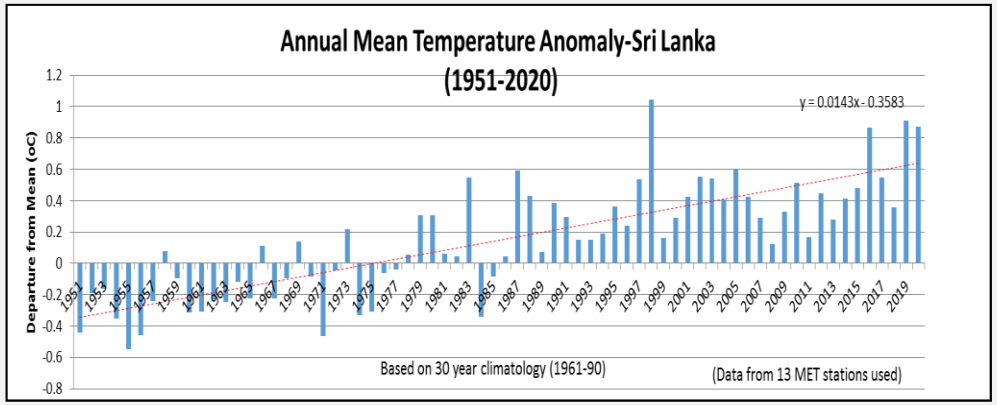
- **Step 1** • Calculate drought variables (Severity and Duration) using drought indices
- **Step 2** • Fit D and S to a range of cumulative distribution functions
- **Step 3** • Use copula to joint S and D in to bivariate distribution
- **Step 4** • Generate random drought events using copula parameters
- **Step 5** • Calculate recurrence intervals of droughts using generated random drought events



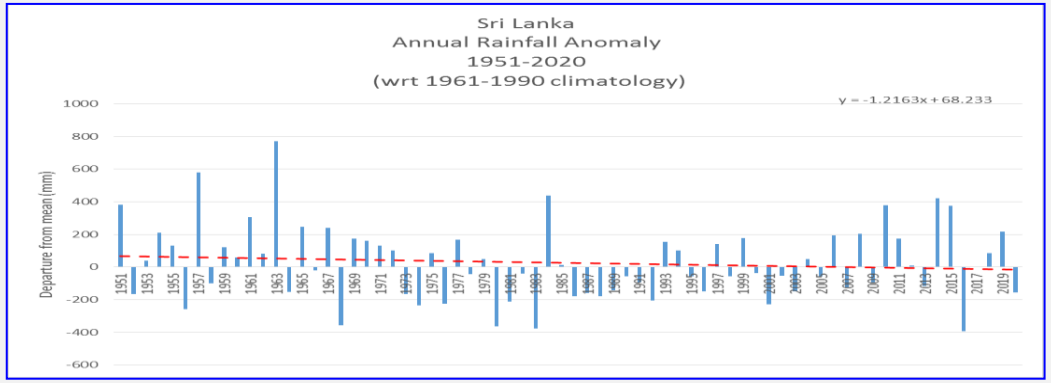




Current situation in Sri Lanka



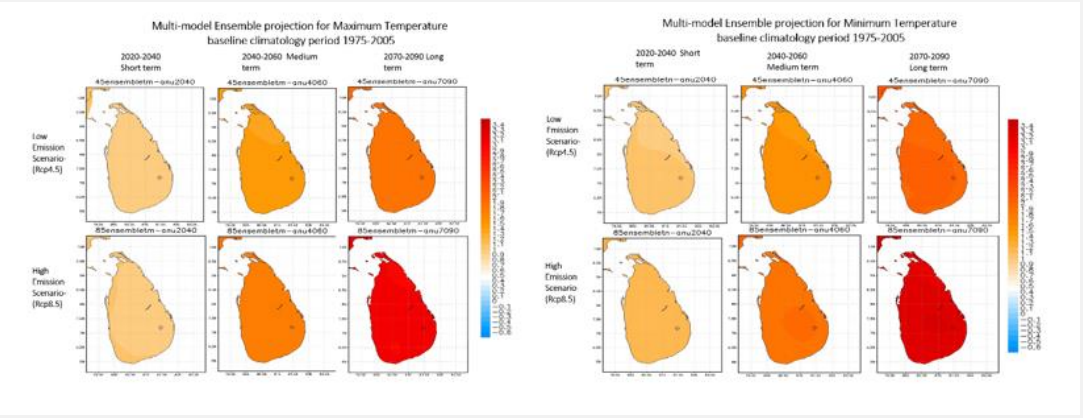
Annual average rainfall



Future climate change scenario for Sri Lanka

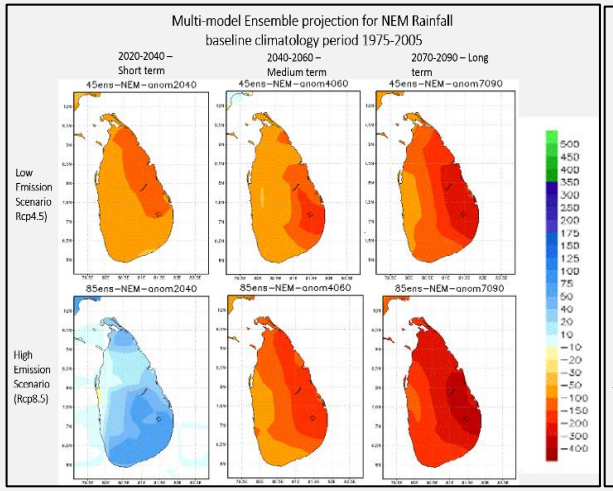
-Mr.K.H.M.S.Premalal (Unpublished paper)

Maximum Temperature *Minimum Temperature*

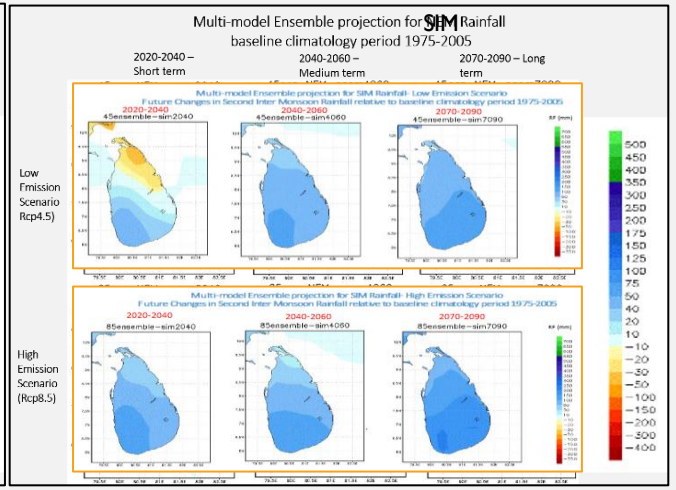


(2020-2040) (2040-2060) (2070-2090). (2020-2040) (2040-2060) (2070-2090).

Rainfall during NE monsoon *Rainfall during 2nd Inter-monsoon*



(2020-2040) (2040-2060) (2070-2090).



(2020-2040) (2040-2060) (2070-2090).

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SRI LANKA

To declare a Drought

Meteorological Drought

Reduced precipitation → Less water enters ground

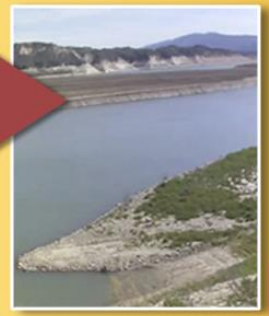
Higher temperatures and winds, lower relative humidity, greater sunshine → Increased water loss from plants, land, ocean

Agricultural Drought

Reduced soil moisture

Crops suffer; reduced yields

Hydrological Drought



Reduced water in streams, lakes, reservoirs

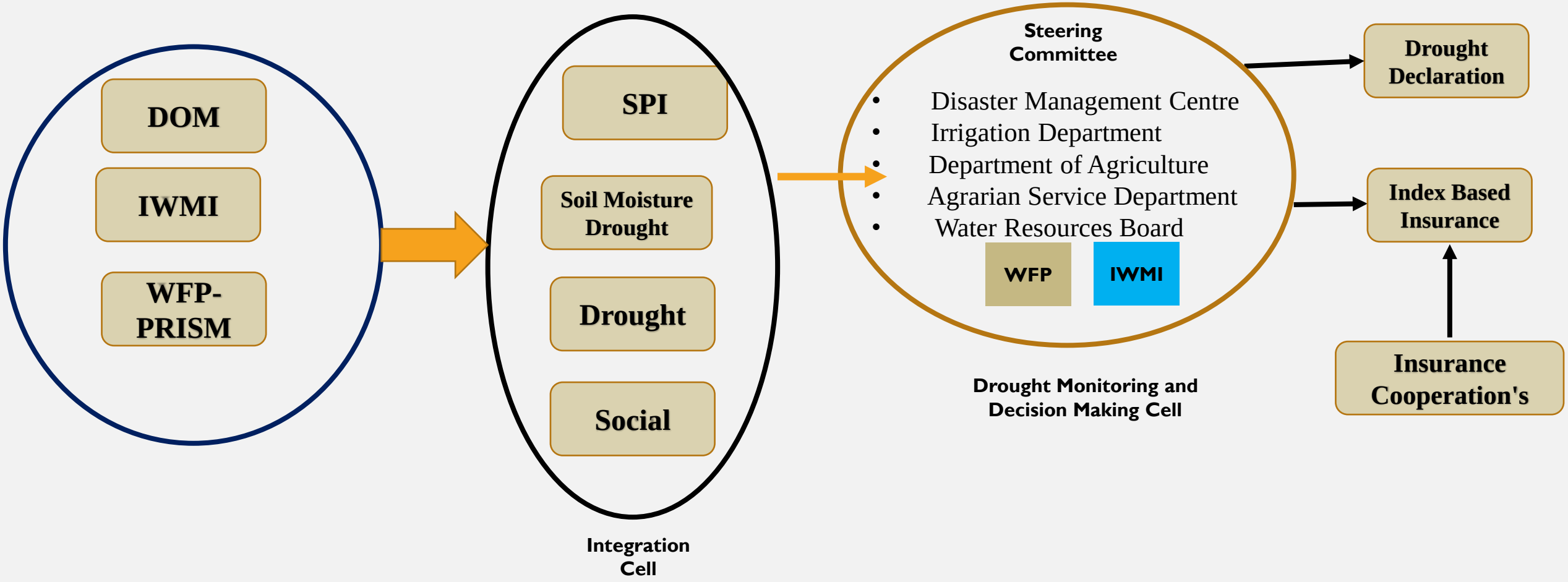
Wildlife habitats stressed

Socioeconomic Drought

Demand of economic goods exceeds supply; strains on community and economy

Impacts increase over time

Proposal for drought declaration



RECOMMENDATIONS AND CONCLUSIONS

Institutional measures

- To enhance rain gauge density/ Automated rain gauges
- Increase temperature observation network
- Capacity enhancement of Meteorological and Agriculture officers
- Enhanced the quality of Agro-met Bulletin/Agro-met advisories

National level long /short term measures

- Climate Smart Agriculture
- Issue drought tolerance or flood tolerance varieties/ seeds for farmers
- Change cropping pattern
- Keep the income satisfactory level of farmers (Economist)
- Rainfall harvesting
- Ground water recharge
- Crop insurance policy

Thank you

SARRC Disaster Management Center for Initiating this type of workshop