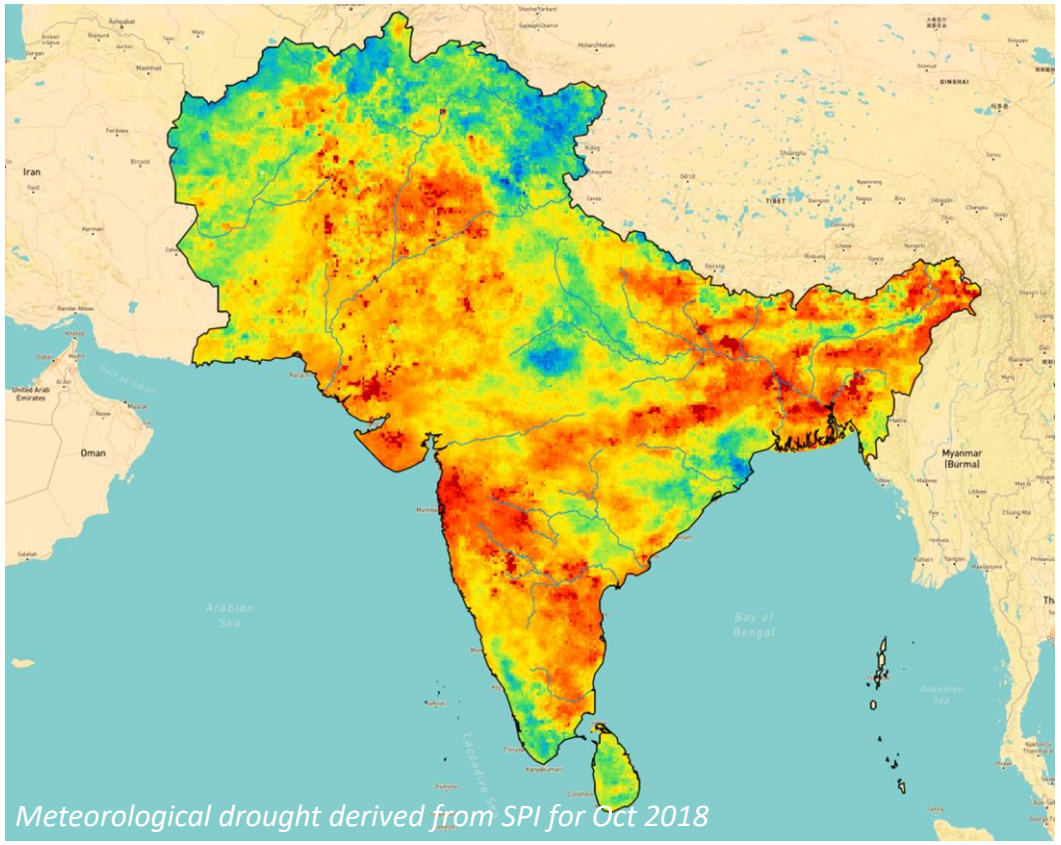


Meteorological drought derived from SPI for Oct 2018


Dried out South Bank Trans-basin Canal of the Deduru Oya reservoir

Earth observation data for drought monitoring and early warning in South Asia and Africa

18 November 2021

UN-SPIDER Bonn International Conference

Giriraj Amarnath
Principal Researcher – Disaster Risk Management and Climate Resilience &
Research Group Leader: Water Risks to Development and Resilience

IWMI International Water Management Institute

CGIAR RESEARCH PROGRAM ON Water, Land and Ecosystems

ICAR

MAFF Ministry of Agriculture, Forestry and Fisheries 農林水産省

Key points

- **Past drought management** efforts have been reactive (costly, untimely, ineffective & poorly coordinated).
- Impacts are increasing and becoming **increasingly complex across sectors**, demonstrating increasing vulnerabilities.
- **Impact assessments** are lacking, no consistent methodology. Costs/losses not well documented.
- **Drought impacts** retard/set back development efforts.
- **Climate change** is and will continue to alter the frequency, severity and duration of droughts for many regions— increasing costs and reducing recovery times.
- Given increased drought incidence and upward spiraling impacts, **how can we convince policy makers that drought preparedness and the application of the principles of risk management are worthy of upfront investments**?

Deduru oya reservoir affected by severe drought that affected the Sri Lanka in 2017

Overview

- **Goal** - build climate resilience, reduce economic and social losses, and alleviate poverty in drought prone regions through an integrated drought risks management

- **Impact** – Promote science-based products (monitoring and forecasting system) for improved water management interventions to stabilizing the access to water and food security; Supports on policy making for sustainable development under the future drought risks.

- **Partnership** – institutional coordination for drought mitigation efforts, sub-national knowledge products and capacity building

IWMI's Drought Resilience Initiatives

2005 — Established
South West Asia Drought Monitor

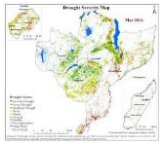
US OFDA

2014 — SADMS
South Asia drought program

IDMP, CGIAR, ICAR

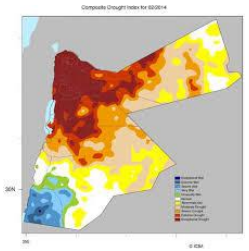
2016 — SADMS++
Moving from drought monitoring to management and Southern Africa

CGIAR WLE, ICAR, Japan's MAFF



2018 — MENA Drought
Digital data advances for improved drought management

USAID



2019 — Next generation Drought system

AF-DEWS and Drought insurance

WORLD BANK GROUP

2020 — Awarded
Geospatial World Excellence Award

GEOSPATIAL WORLD™

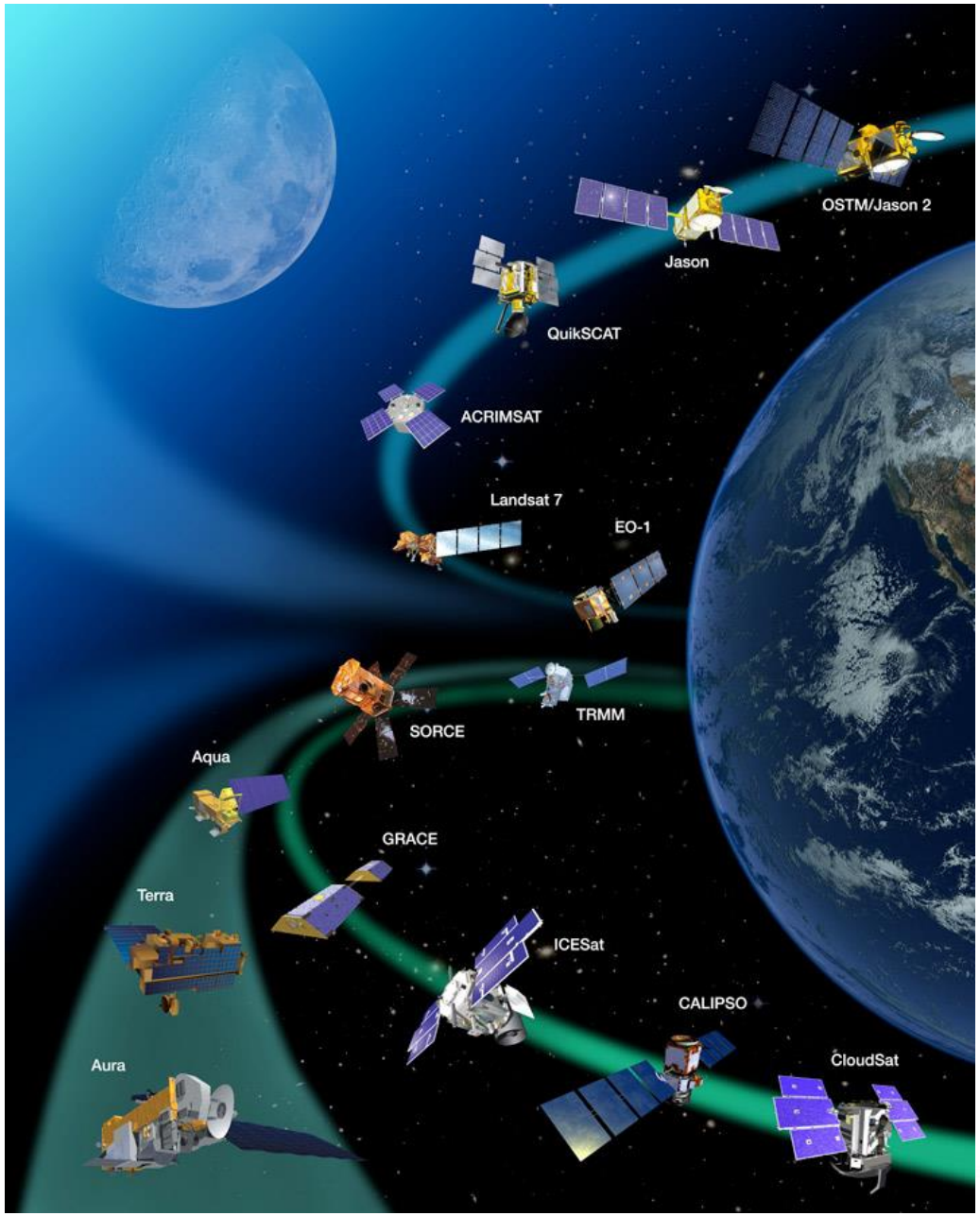
2021 — WASA, AICCRA and SADRI initiatives
Africa flood and drought monitor, Drought risk profile

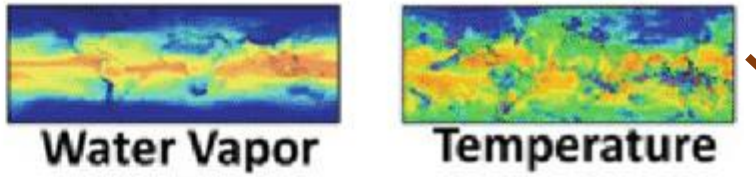
Helmsley Foundation / World Bank

HELMSLEY CHARITABLE TRUST

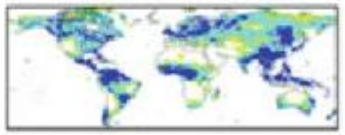
WORLD BANK GROUP

Monitoring multivariate drought indices

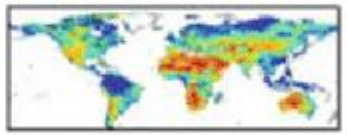


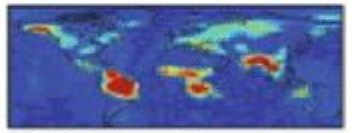

Water Vapor

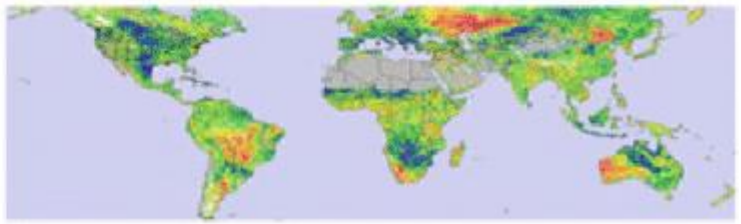
Temperature

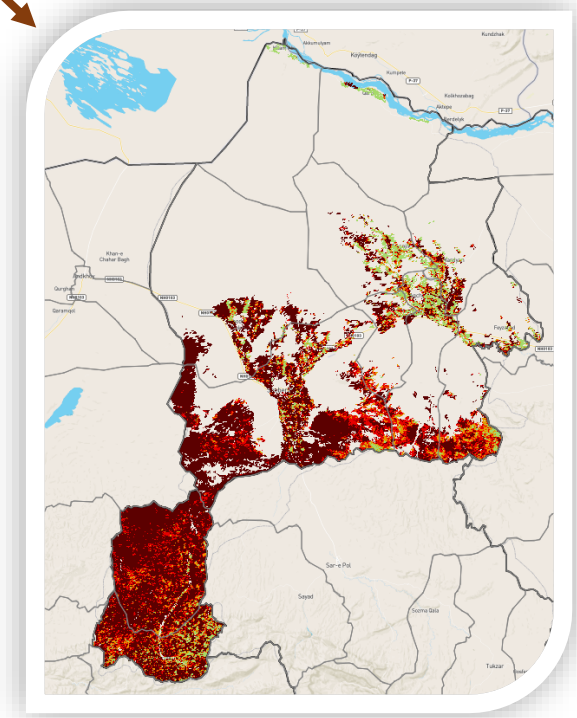

Precipitation


Snow


Soil Moisture


Groundwater

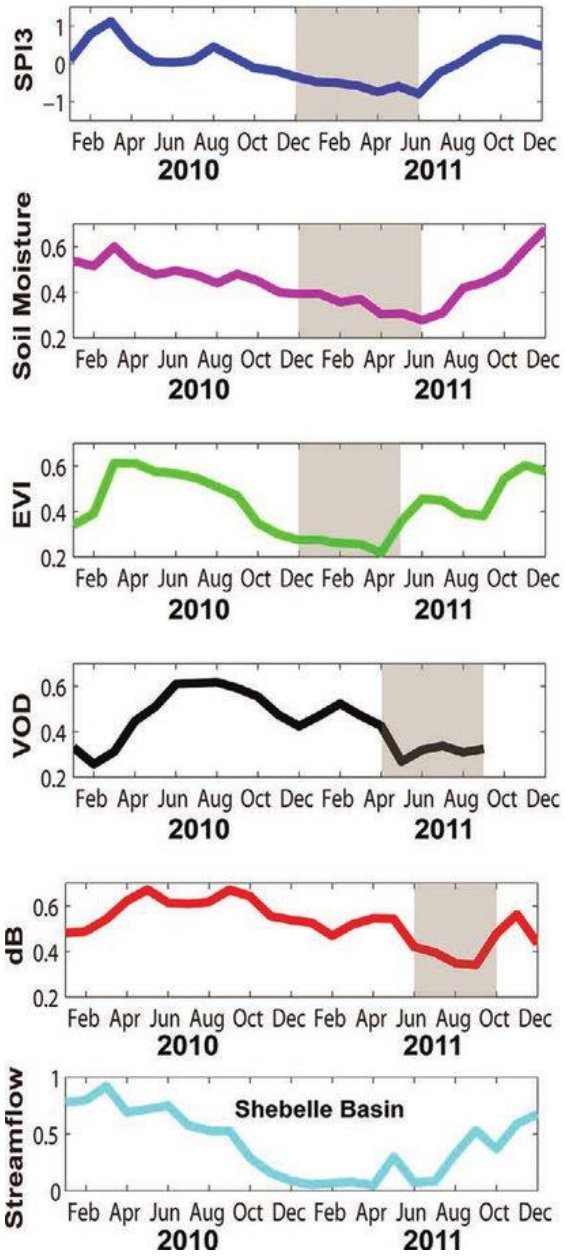

Vegetation Health Index



2021 Drought severity map, Jawzjan Province, Afghanistan

Monitoring multivariate drought indices

Index	Data source	Drought type	Attributes
SPI	Bias-corrected TMPA (2009–present), hybrid observational/reanalysis (1950–2008)	Meteorological drought	0.25°, SPI-1, -3, -6, -12
VIC soil moisture index	VIC land surface model (1950–present)	Agricultural drought	0.25°, daily
SMOS soil moisture index	SMOS retrievals (2010–present)	Agricultural drought (top 5 cm of soil)	0.25°, daily
NDVI, EVI	GIMMS NDVI (1982–2008), MODIS EVI (2000–present)	Ecological drought (optical based)	8 km/0.5°, bimonthly/daily
VOD index	SSM/I, TRMM, AMSR-E VOD (1987–2008); AMSR-E VOD (2000–present)	Ecological drought (passive microwave)	0.25°, daily
dB index	QuickSCAT (1999–2009), ASCAT (2009–present)	Ecological–hydrological drought (active microwave)	0.25°, 2/4 days
Streamflow percentiles	VIC land surface model (1950–present)	Hydrological drought	822 streamflow gauges, daily/monthly
Cumulative streamflow deficit	VIC land surface model (1950–present)	Hydrological drought	822 streamflow gauges, daily/monthly



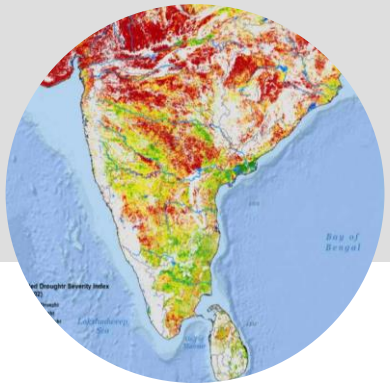
DOI: 10.1175/BAMS-D-12-00124.1

The South Asia Drought Monitoring System (SADMS)

How can we leverage the SADMS for action and decision making?

Capabilities

- Weather forecast and climate information
- Monitoring drought types (Meteorological, Agricultural, Hydrological)
- Single and Composite indices
- Thresholds to determine drought
- Data analytics capabilities and integration of multisource information
- Advance visualization and automation



Information

Relevant to needs

- Government (e.g. MoA, NDMA)
- Development partners (e.g. WB)
- Universities / Researchers
- Farmers (esp youth)

Geographically specific

- National
- State
- District
- Farm-scale

Action

Identify potential solutions and priority actions using SADMS knowledge, such as:

- Weather alerts (e.g. Supports early warning)
- Rainfall Anomaly, SPI (e.g. 40% deficit, SPI <-2.0)
- Snow cover (e.g. % snow deficit)
- Vegetation Condition (e.g. VHI, %Crop cover)
- Composite Index (e.g. IDSI <20% Extreme Drought)

Decision

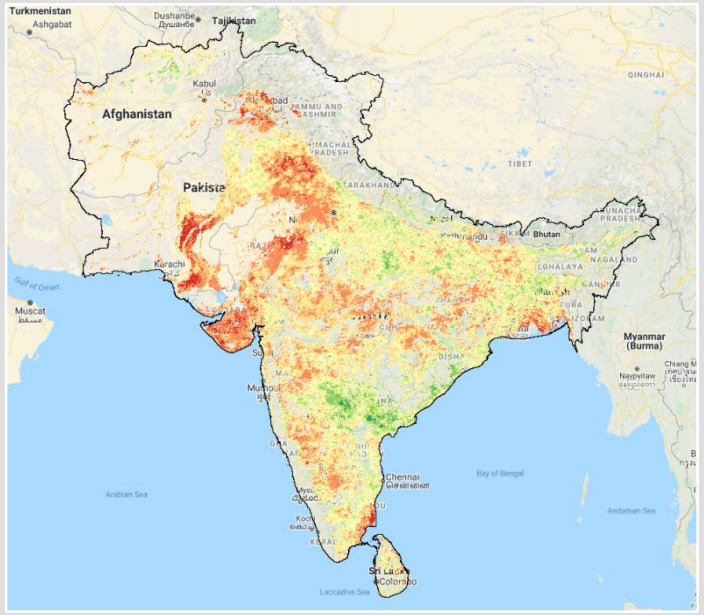
- Selection of appropriate indicators to define drought
- SADMS decision support tool leverage the seasonality
- Supports in drought determination and declaration process
- Strengthens Integrated Drought Risk Management (Early Warning (e.g. Drought districts, Early Action e.g. Food relief drought contingency, Early Finance e.g. link with PM Welfare Scheme, PMFBY)

Drought Surveillance System for South Asia

GEOSPATIAL WORLD AWARDS

GEOSPATIAL media + communications

Information and Action

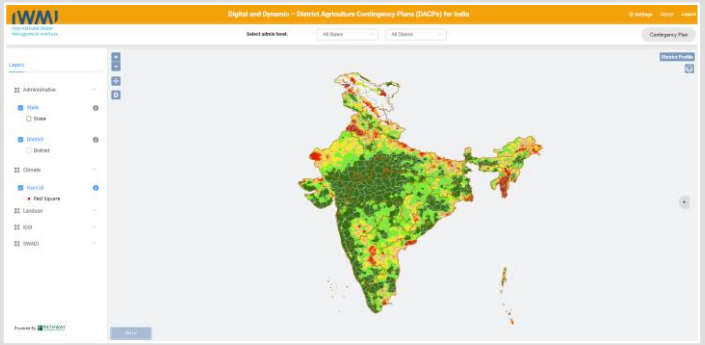


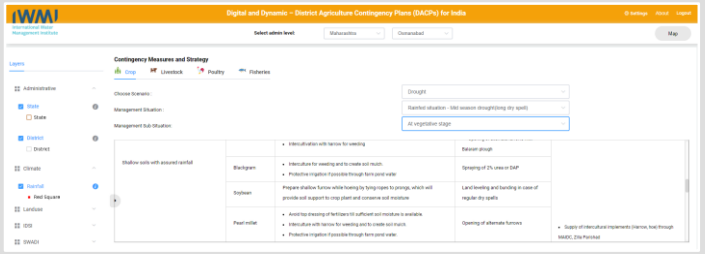
Agriculture Stress monitoring using satellite indices

Knowledge

Consultation and awareness on the digital tools and actionable information

Decisions





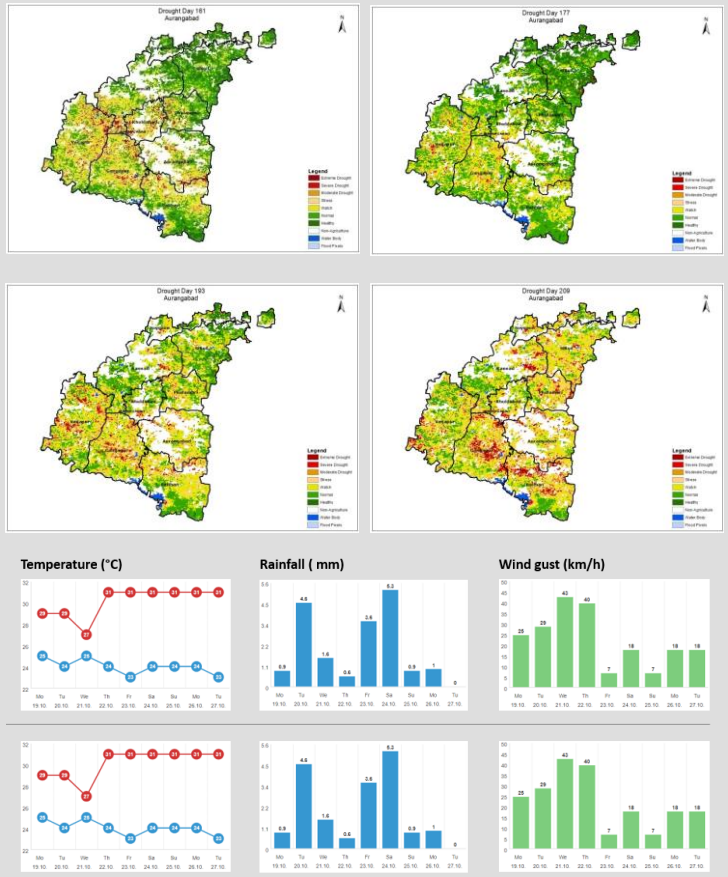
Drought response strategies integration information and knowledge products for decision making process

Drought Surveillance System for South Asia

GEOSPATIAL WORLD AWARDS

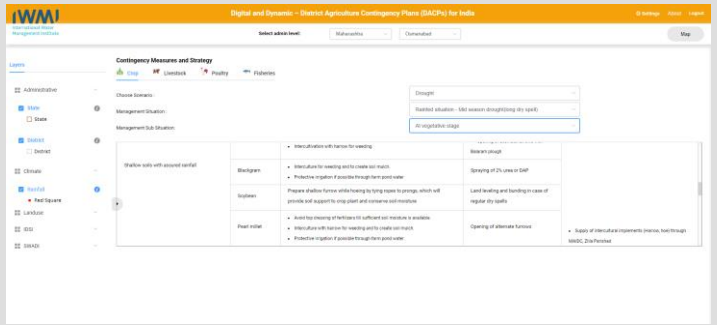
GEOSPATIAL media + communications

Drought Severity Maps



Digital and Dynamic Contingency Plans

- Ridge and furrow sowing, BBF for Soybean
- Sprinkler & Drip irrigation
- Harvested Water for protective irrigation
- Spraying of KNO3



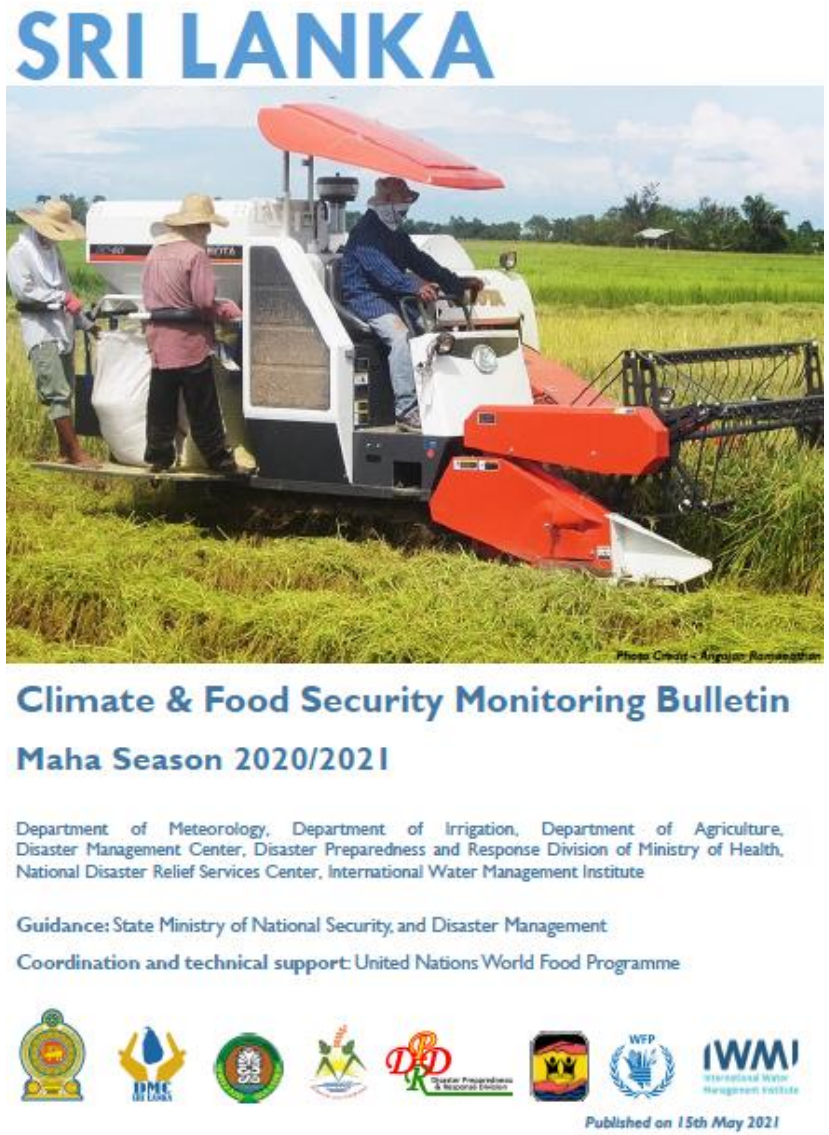
Preparedness and real time measures taken up:

Impact

- Soybean+ Pigeon pea: 7-8 q/ acre for Soybean
- 5-5q/acre only Pigeon pea
- Cotton: 12-14 q/acre

Drought response strategies integration information and knowledge products for decision making process

Climate and Food Security Bulletin



- Strengthening institutions capacity to develop and use drought monitoring/early warning systems to support early responses by the disaster risk agencies in Sri Lanka
- Promote leadership of the national governments, based on informed analysis and participatory-based action preparations

https://wle.cgiar.org/solutions/climate-and-food-security-monitoring-bulletins-sri-lanka

Scaling SADMS Drought Resilience Initiatives

Focus on: Drought preparedness systems; Regional efforts to reduce drought vulnerability and risk

Afghanistan
Drought Early Warning Support (AF-DEWS) tool

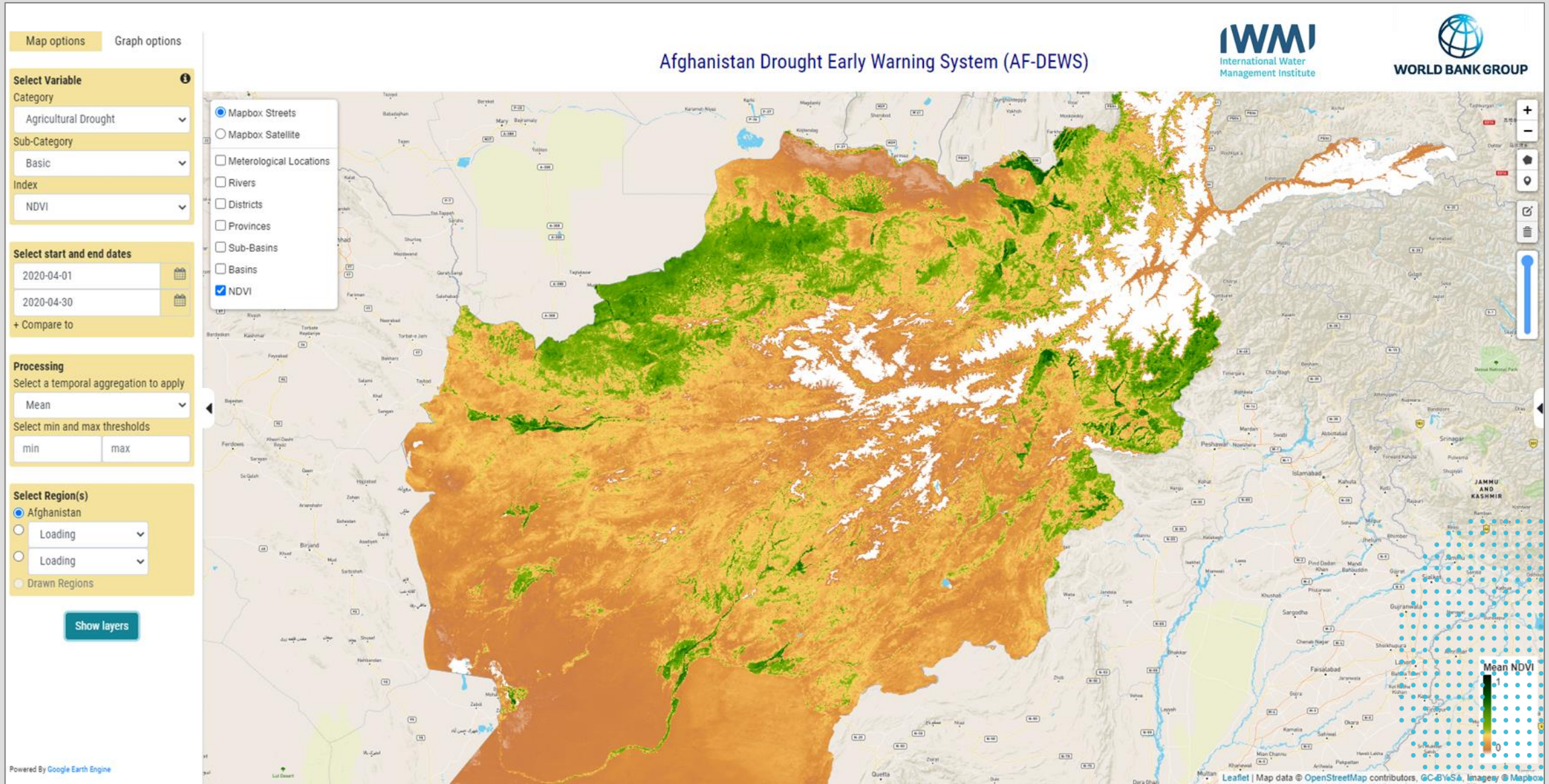
South Asia Regional Mechanism and Country Specific initiatives
Promoting knowledge products and tools for an integrated drought risk management in

MENADrought
Develop drought indicators and drought action plans

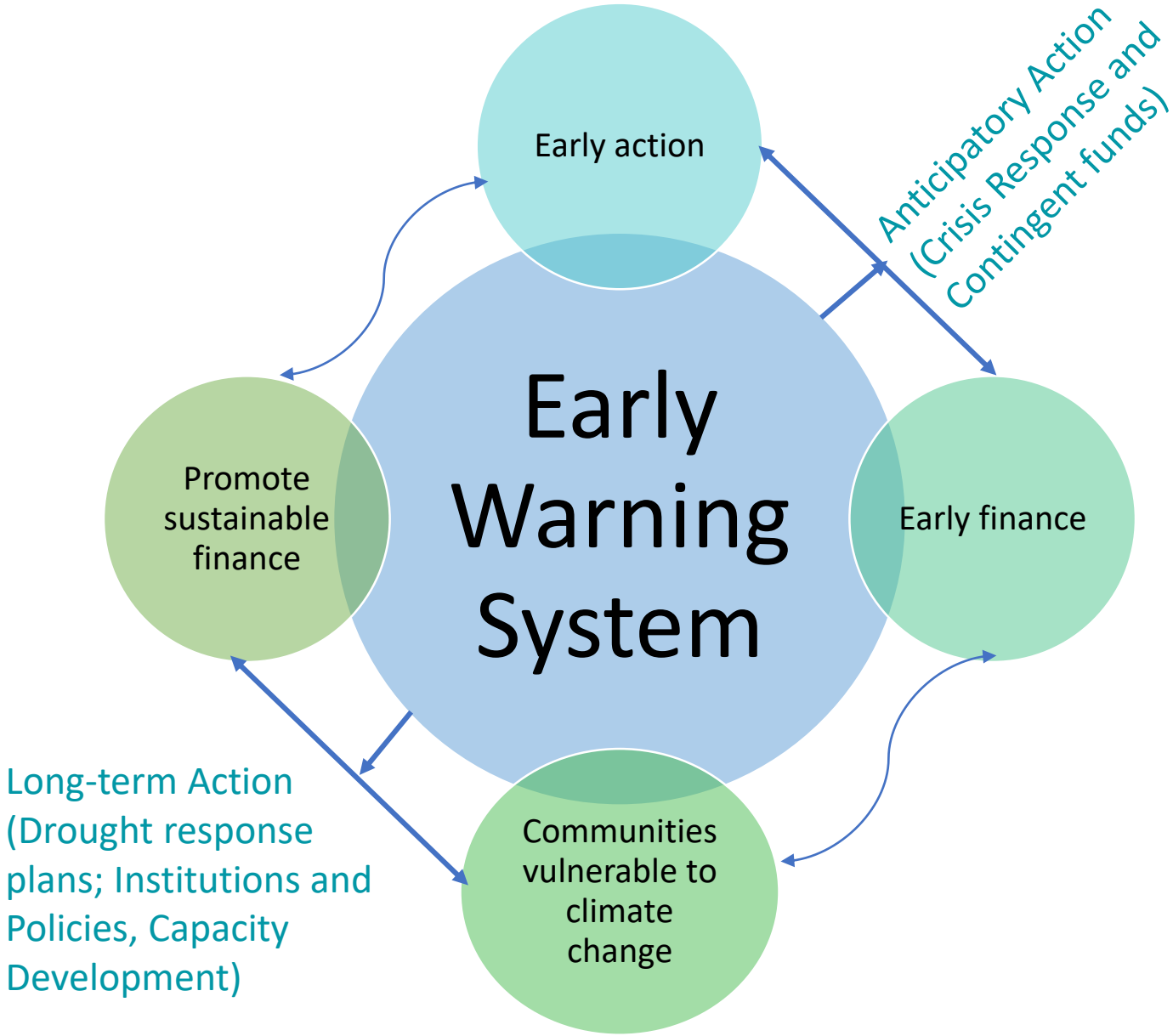
Continent of Africa
IWMI's Water-Secure Africa (WASA) Initiative and in collaboration with Digital Earth Africa Platform developing resilience application in managing floods and drought using open source data and tools for entire Africa

AICCRA Zambia
Develop drought indicators and climate information services and integrate in AgData Hub

Afghanistan Drought Early Warning Decision Support Tool (AF-DEWS)



Key synergies from Drought Early Warning System

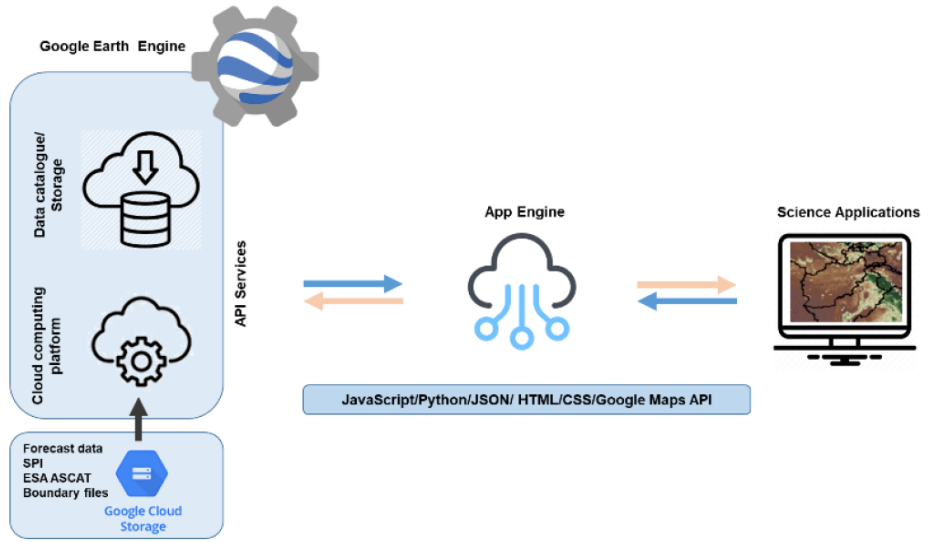


Source: IWMI

Afghanistan Drought Early Warning Decision Support Tool (AF-DEWS)

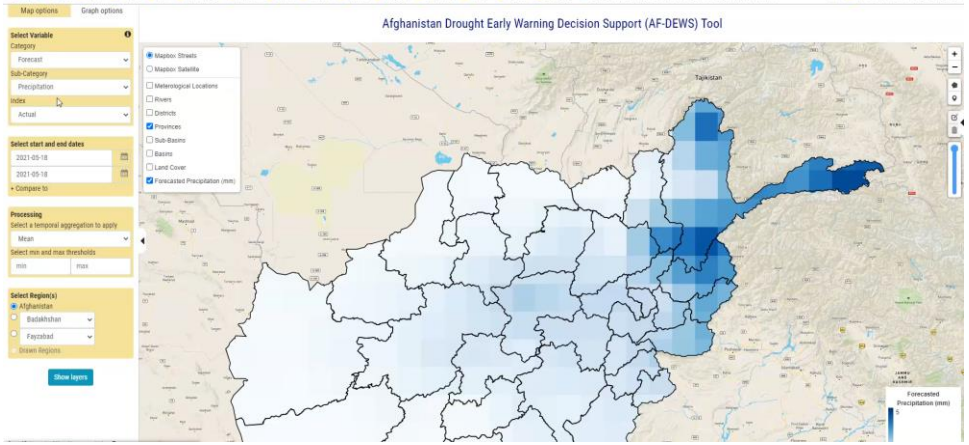
Innovations

The AF-DEWS is a powerful tool that can access open-source satellite data and produce science-based knowledge products to assist decision-making.



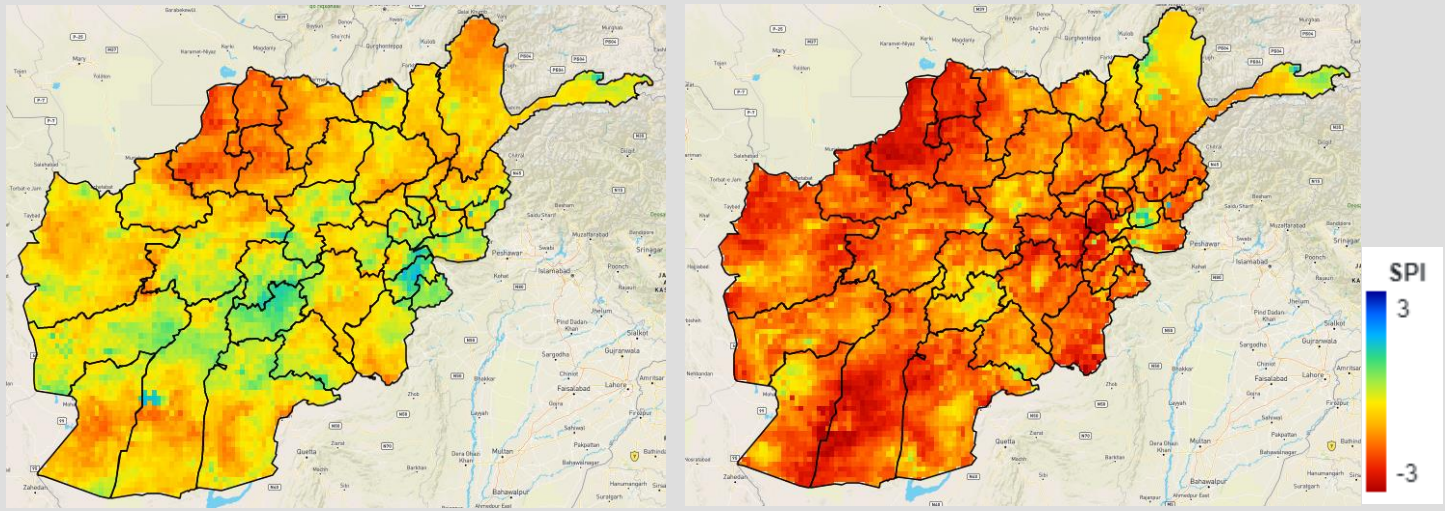
- Tool developed using Earth Engine and Google Cloud Platform and offers high security standard, easy access and maintenance.
- Provides information on weather forecast and more than 35 drought indices on meteorological, hydrological and agricultural drought.
- Easy to access, utilize information for timely early action and early finance and can help mitigate impacts
- Rapid dissemination and robust analytical tools for value-added services

AF-DEWS Tool Demo



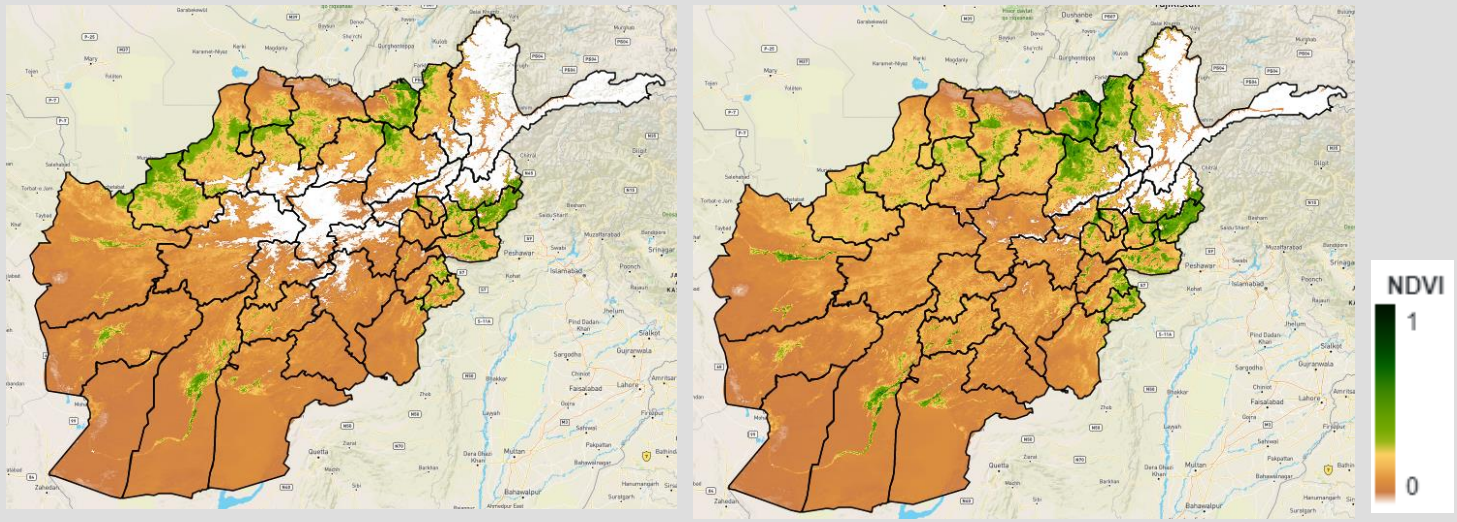
Early warning and drought risk assessment in Afghanistan

Meteorological drought condition for Jan and Feb 2021



- Standardized Precipitation Index (SPI) is a widely used index to characterize meteorological drought to monitor and follow drought conditions and helps in establish a level of drought early warning.
- In comparison of 3-month SPI between Jan and Feb 2021, the meteorological drought continues with severe and extreme drought across Afghanistan with severe to extreme drought noticed in Badghis, Herat, Farah, Nimroz, Helmand and Kandahar provinces.

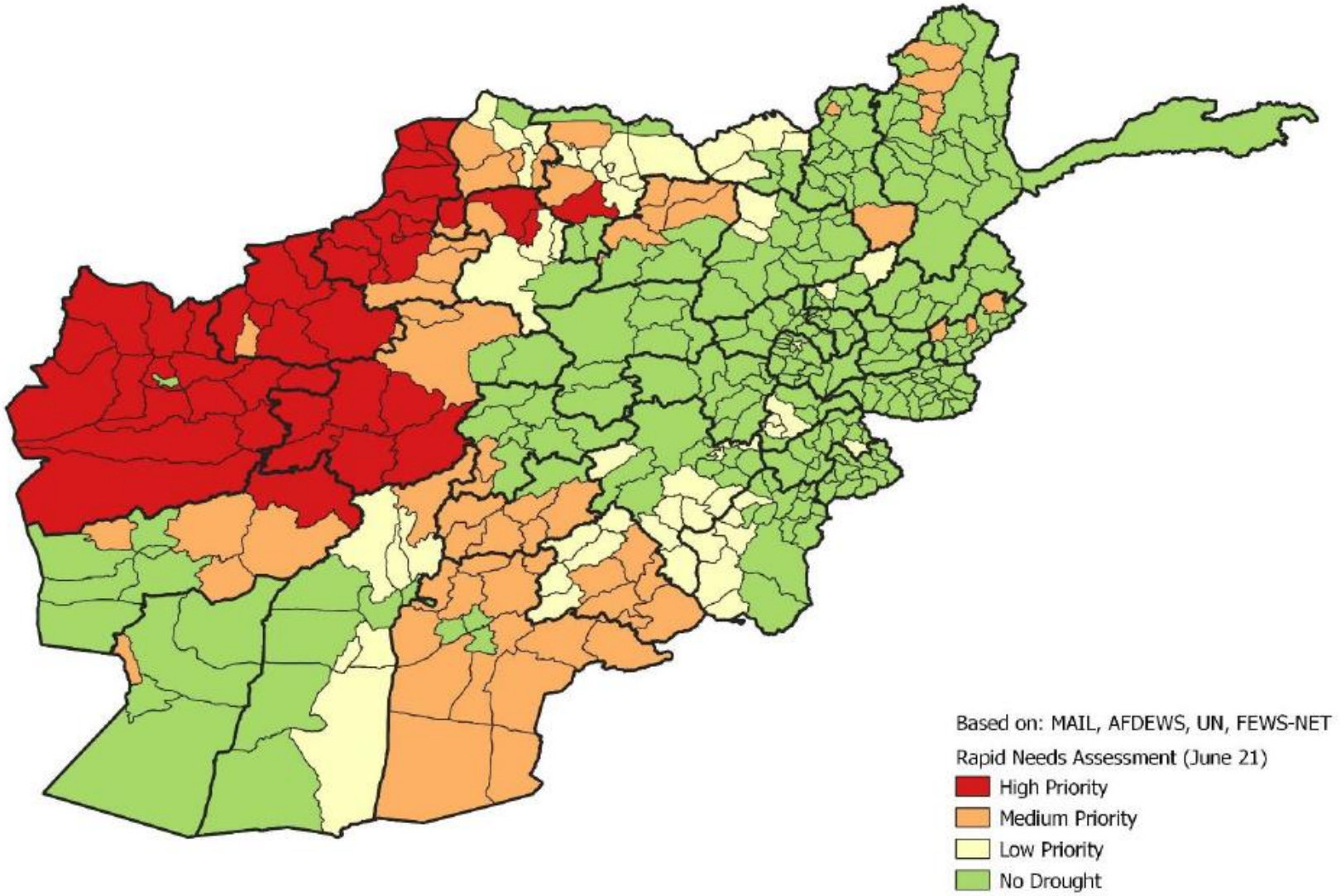
Agriculture drought condition for March and April 2021



- Monitoring vegetation condition using NASA's MODIS Terra & Aqua satellite data can measure the impacts of drought.
- Provinces namely with poor vegetation cover Badghis, Faryab, Sar-E-Pul and Baghlan in rainfed areas due to deficit rainfall and snow cover accumulation in Jan-Feb month.
- The challenges remains on the crop health risks with delays in growing condition can significantly impact crop yields.

Source: AF-DEWS

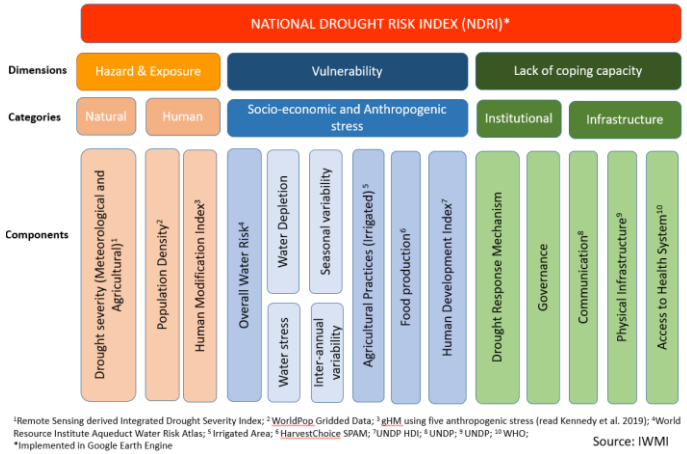
RAPID NEEDS ASSESSMENT OF DROUGHT CONDITIONS

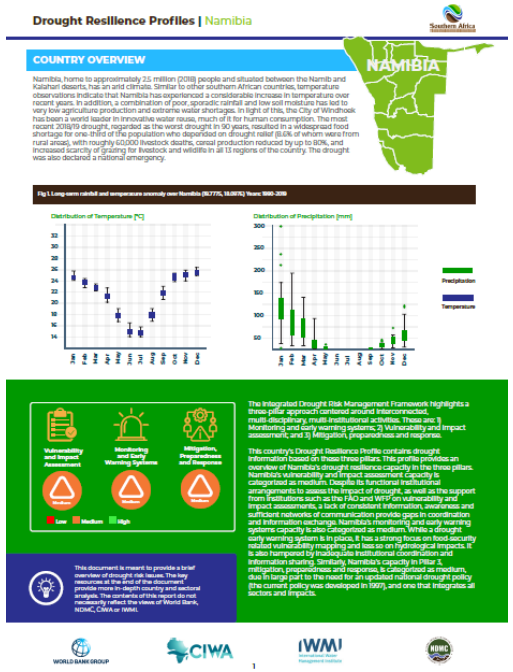


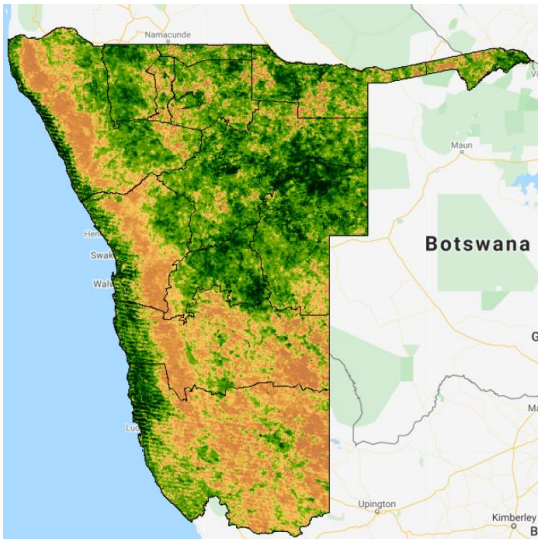
- During the past wet season (October-April) meteorological drought conditions emerged over large swath of western, northern and central Afghanistan.
- Below average precipitation combined with above average temperatures caused an anticipated depletion of soil moisture with negative impacts on crop vigor and growth.
- Overall, **40% of Afghanistan districts (160 out of 401) are experiencing drought conditions.**
- **On 22nd June 2021, H.E. President of Afghanistan declared drought conditions in the Country.**

Data Source: AF-DEWS; ENETAWF Bulletin

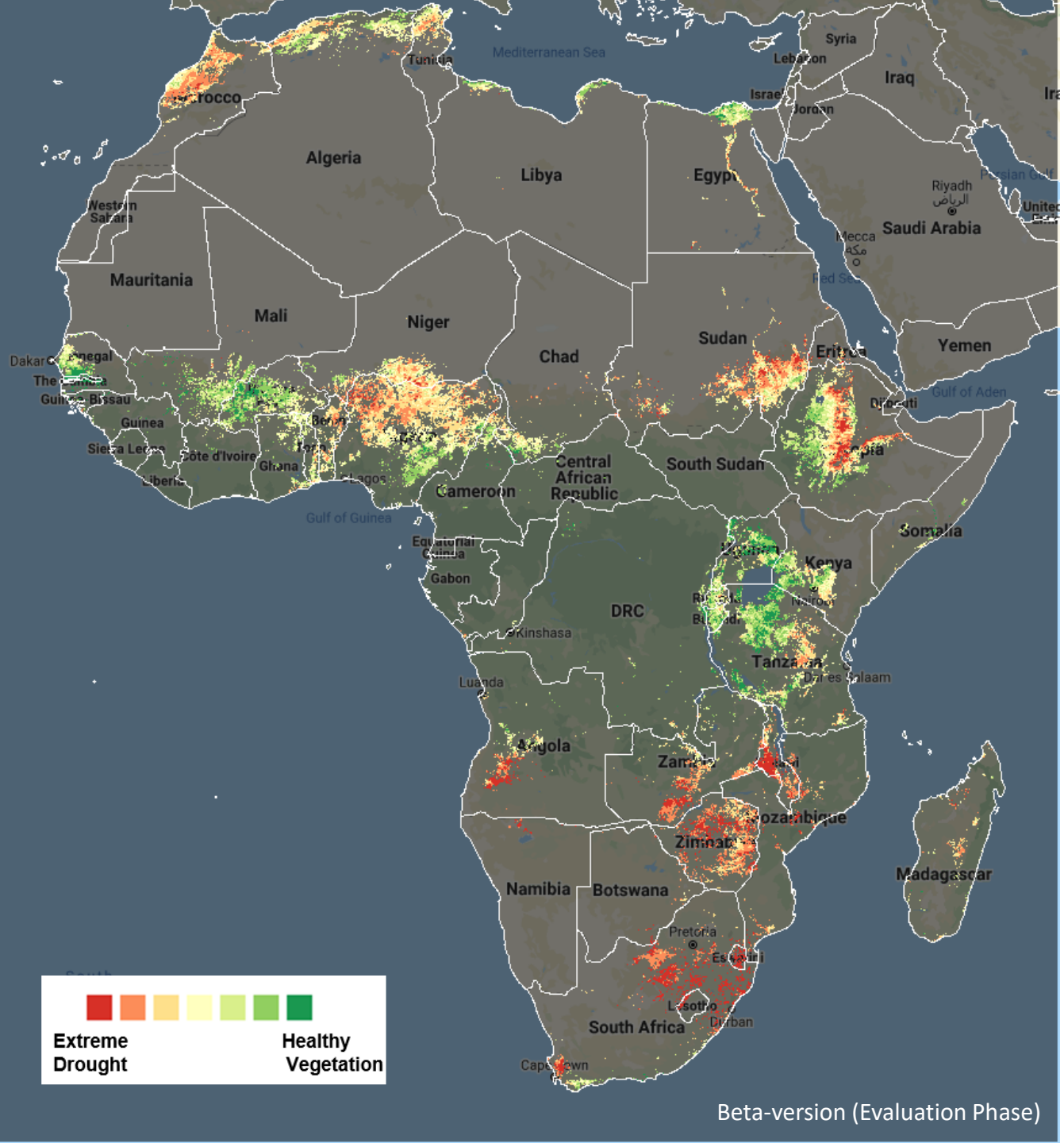
Drought Resilience Initiative's Africa

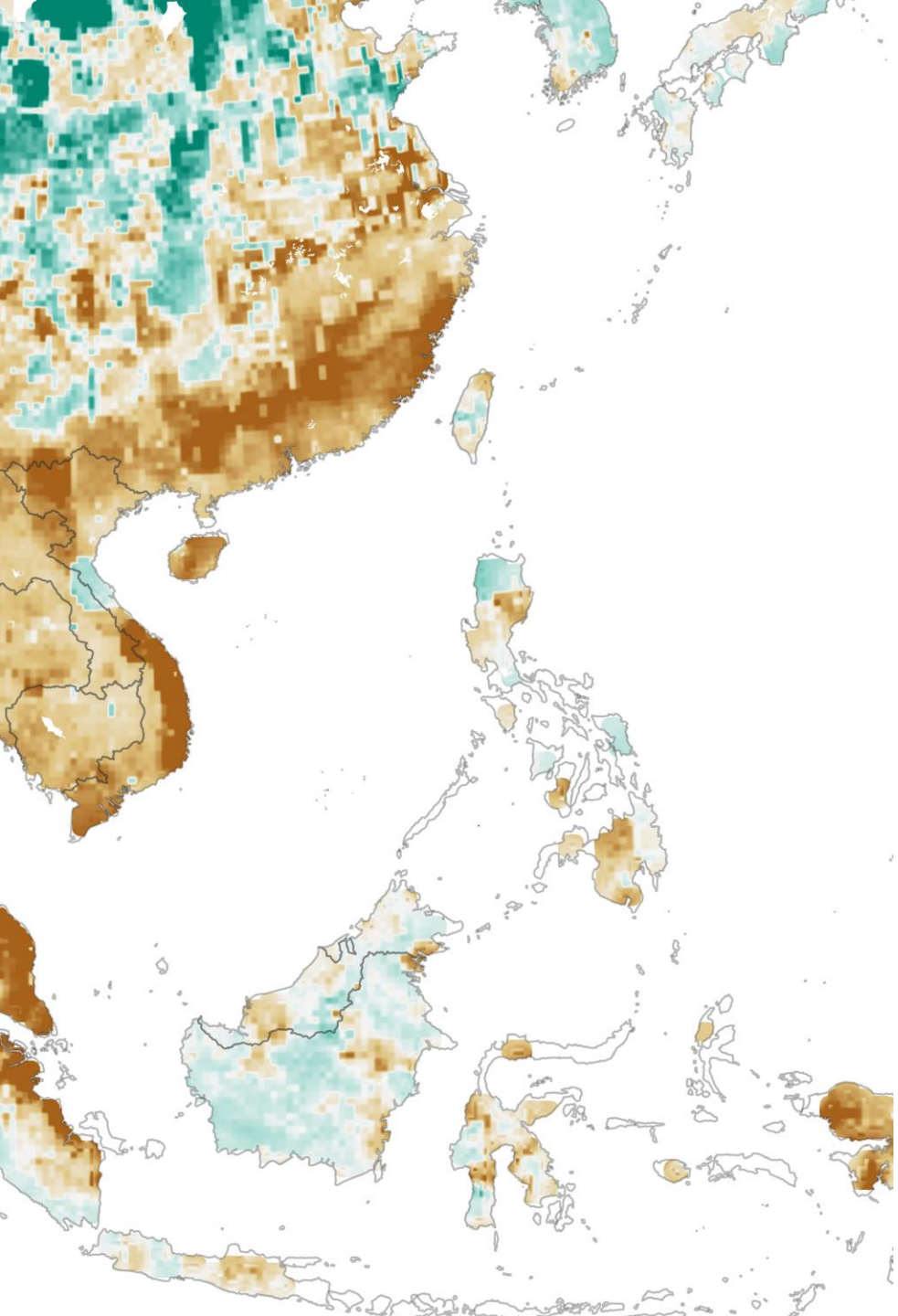






https://geowb.maps.arcgis.com/apps/MapJournal/index.html?appid=cb0fc8aa450f4b35a018f7e0115867be





Takeaway messages

- It is important to strengthen regional drought monitoring and management (e.g. SADMS) is an important step towards **proactively enhance drought resilience** and mitigate risks.
- **Ensure countries in region** are promoting integrated drought management programme and managing sectors impacts to increase resilience to droughts
- Future efforts to develop robust **decision support information products** and rapid dissemination among users and importantly able to predict and detect droughts early.
- Linking **operational knowledge services** towards climate resilient agriculture and improving water resources management can help in achieving resilient society
- **Dynamic drought risk impact assessments** are the need of the hour for quantifying sector impact and develop proactive drought action plans.
- **Integrated drought management** requires a collaborative approach within and between levels of government and with the private sector.

IWMI International Water Management Institute

Thank you

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