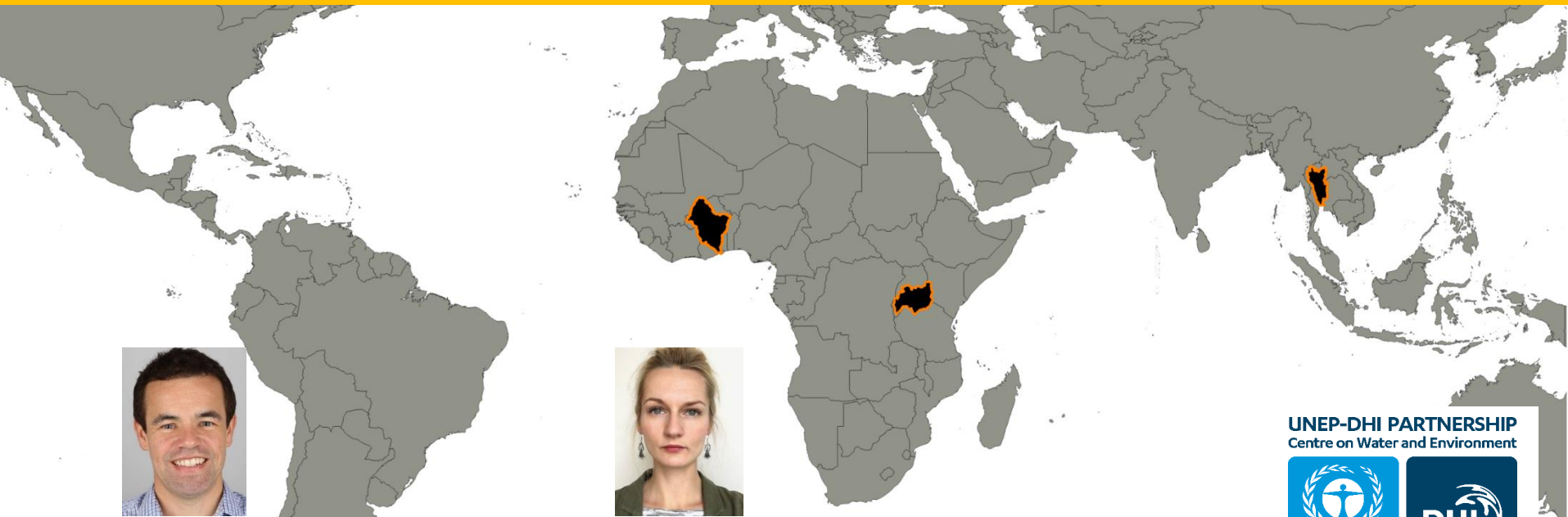


Flood and Drought Webinar #3  
February 28<sup>th</sup>, 2017

## Drought early warning and assessment, experiences from Africa



Facilitator: Gareth James Lloyd  
Senior Advisor  
UNEP-DHI Partnership



Technical support: Maija Bertule  
and coordination Programme Advisor  
UNEP-DHI Partnership

UNEP-DHI PARTNERSHIP  
Centre on Water and Environment



UNEP-DHI Water Webinar series  
Flood and Drought Management Webinars

# Flood and Drought Management Tools project



- Implemented by UNEP and executed by IWA and DHI
- Duration 2014 to 2018
- Development of technical tools to improve the ability to address floods and droughts in the planning process at basin and local scale.



Project web-page: <http://fdmt.iwlearn.org>

# Agenda



1. ***Drought early warning and monitoring in Africa*** by Chris Shitote, FEWS NET
2. ***Improving resiliency of crops to drought through strengthened early warning in Ghana*** by Oluf Jessen, DHI
3. Additional questions from the audience
4. Info on upcoming webinars

# FEWS NET drought early warning approach



Chris Shitote  
Assistant Regional Scientist  
FEWSNET East Africa

# OUTLINE

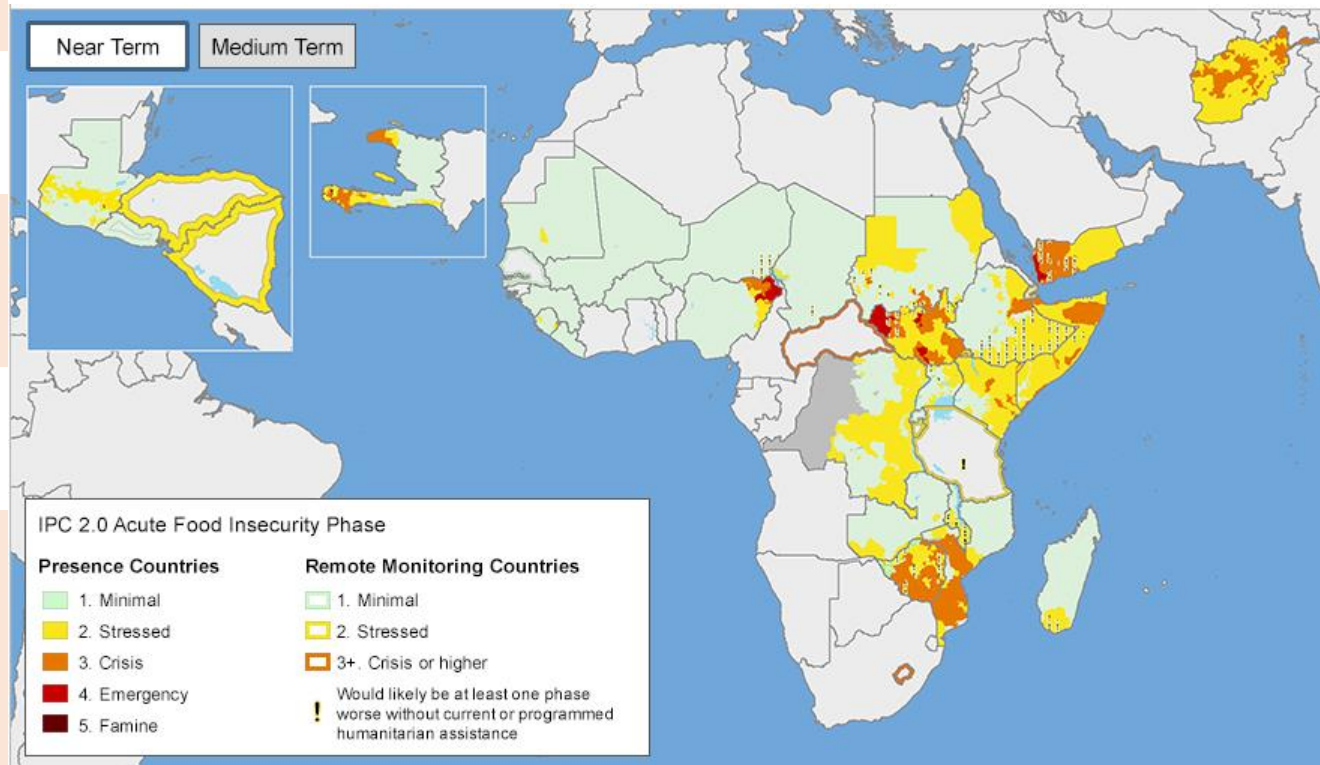
- FEWS NET coverage
- Before the season
- During the season
- After the season
- Discussion

# FEWS NET GLOBAL COVERAGE

→ FEWS NET started in 1981 in Africa and is now Global – Africa, Afghanistan and Central America

→ Food Availability  
→ Food Accessibility  
→ Food utilization

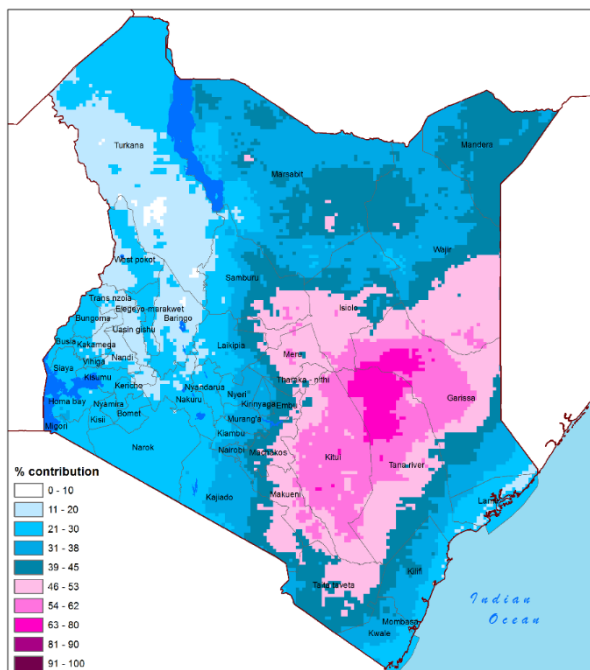
→ Agroclimatology  
→ Livelihoods  
→ Markets and Trade  
→ Nutrition



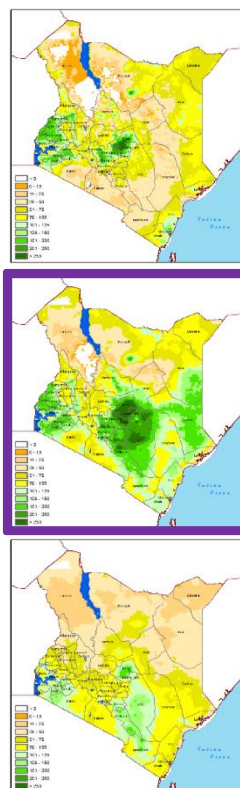
Before the season

# Understanding a Season: OND

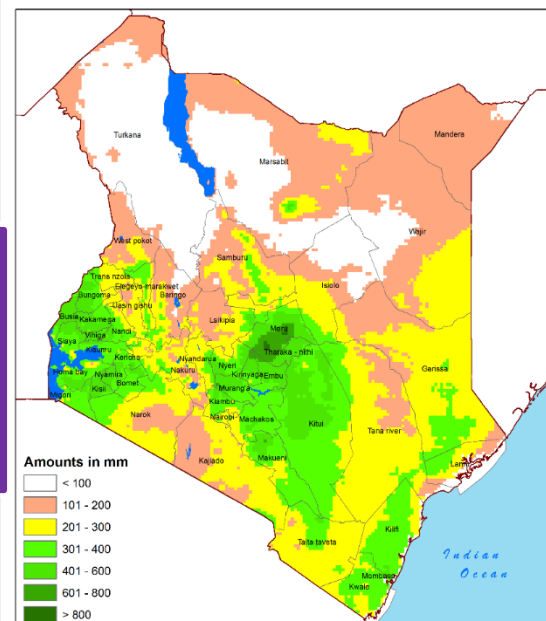
Significance of the OND rainfall  
(% of annual)



Monthly Totals



Average seasonal rainfall totals (mm)  
30-years CHIRPS

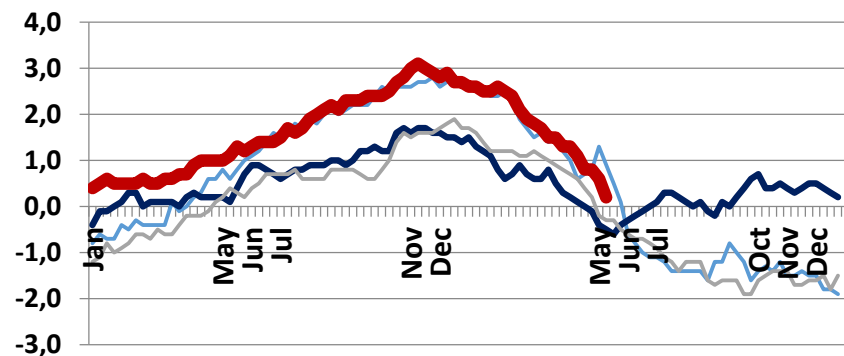
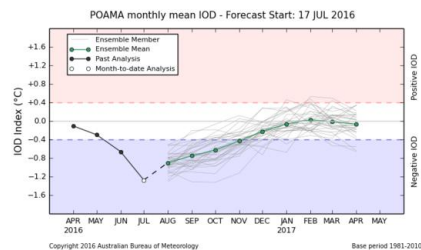
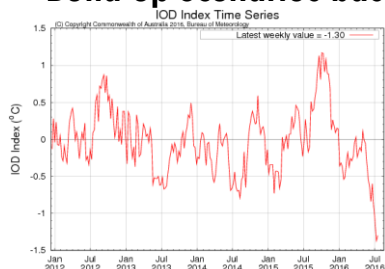


- Major Season for South East Region
- November is the peak month



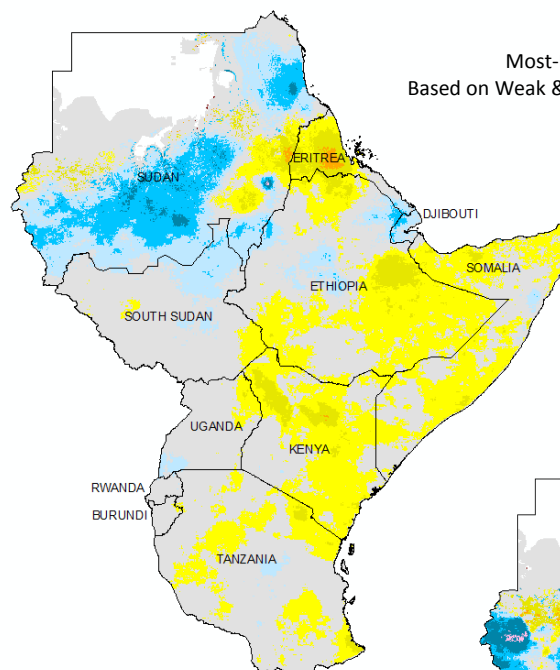
Before the season

## Build up Scenarios based on climatic drivers

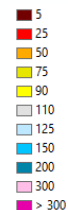
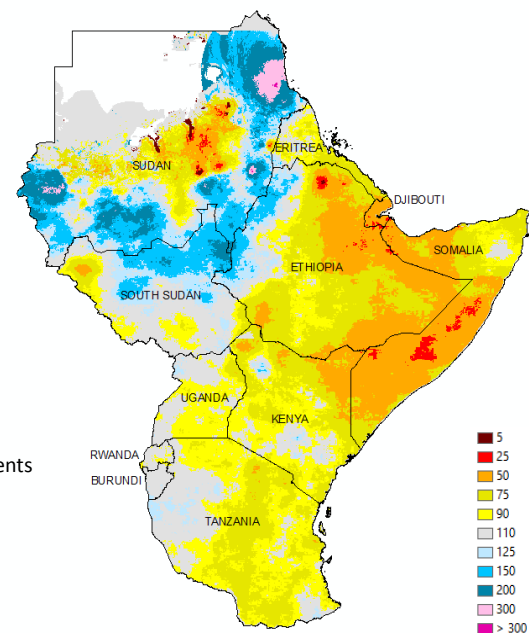


El Niño				La Niña		
Weak	Mod	Strong	Very Strong	Weak	Mod	Strong
1951-52	1963-64	1957-58	1982-83	1950-51	1955-56	1973-74
1952-53	1986-87	1965-66	1997-98	1954-55	1970-71	1975-76
1953-54	1987-88	1972-73	2015-16	1964-65	1998-99	1988-89
1958-59	1991-92			1967-68	1999-00	
1968-69	2002-03			1971-72	2007-08	
1969-70	2009-10			1974-75	2010-11	
1976-77				1983-84		
1977-78				1984-85		
1979-80				1995-96		
1994-95				2000-01		
2004-05				2011-12		
2006-07						

Most-Likely Scenario  
Based on Weak & Moderate La-Niña Event



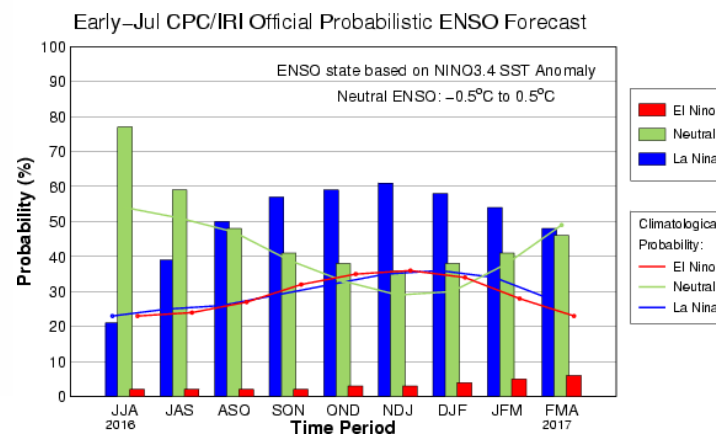
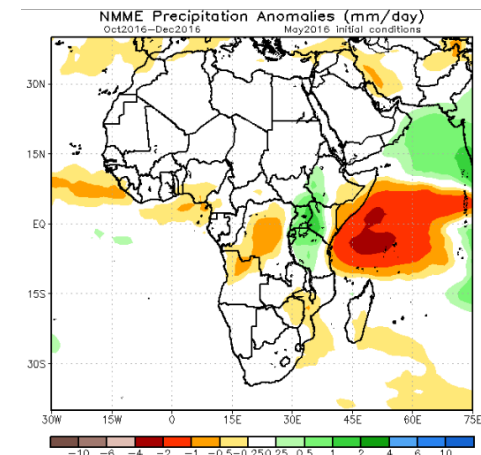
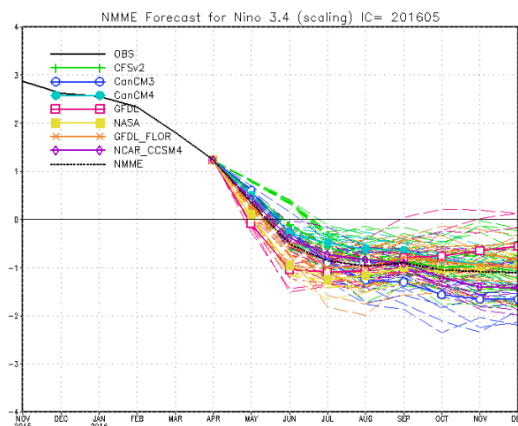
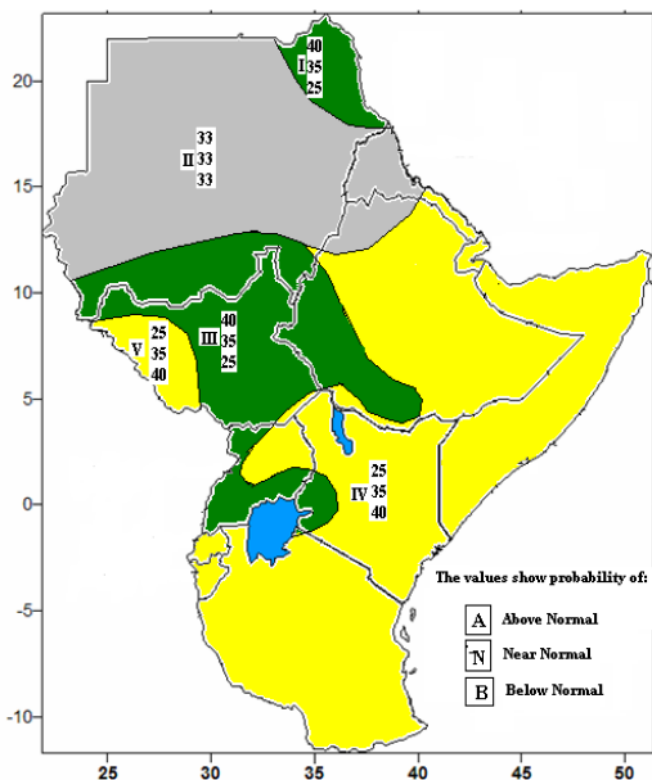
Worst Case Scenario  
Based on Strong La-Niña Events





Before the season

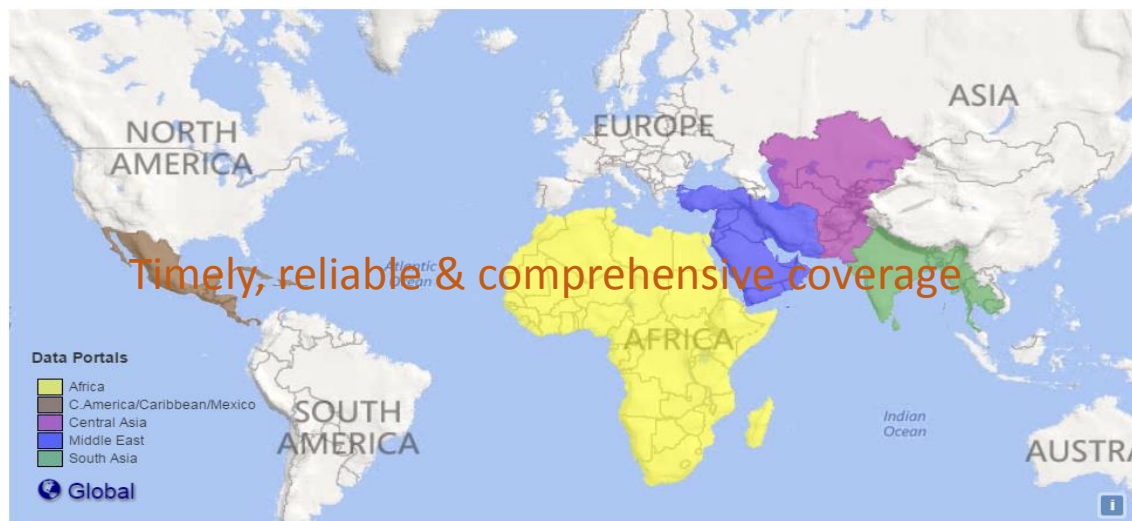
## As the season nears...forecast from different climate centers



During the season

## FEWS NET: Remotely Sensed Products & Tools

<http://earlywarning.usgs.gov/fews/>



Map Viewer



Web-based analytical tools

EWX



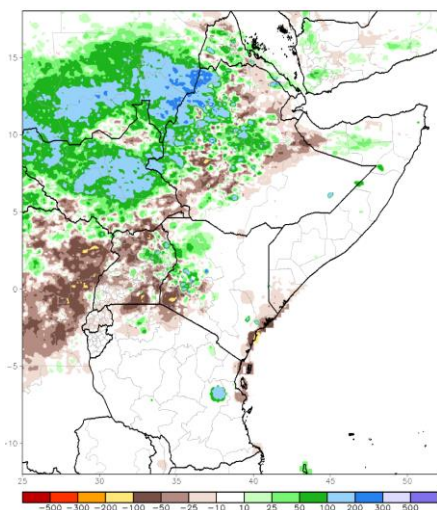
<http://www.cpc.ncep.noaa.gov/products/fews/africa/briefing.html>

During the season

## Rainfall Monitoring & Forecasts for Next 2 - weeks

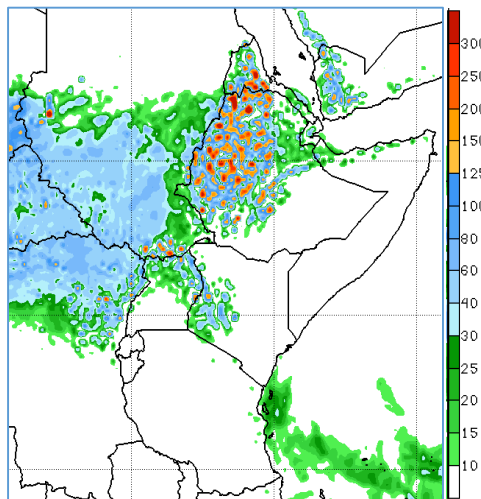
Rainfall Anomalies (mm): 1 June. – 18 July 2016

ARC2 Jun-Sep Total Rainfall Anomaly (mm)  
Period: 01Jun2016 - 17Jul2016

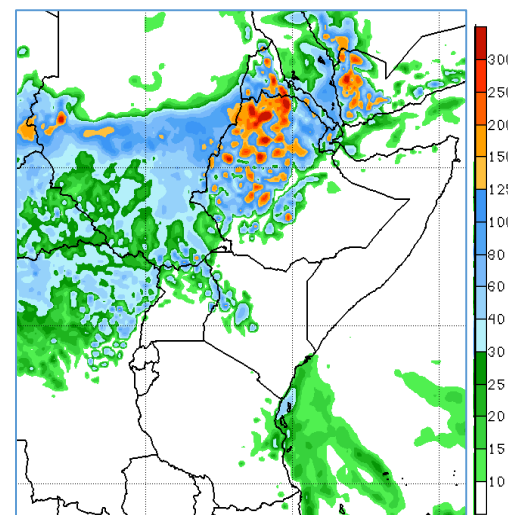


+

1-weeks GFS rainfall forecast:  
valid upto 25 July 2016



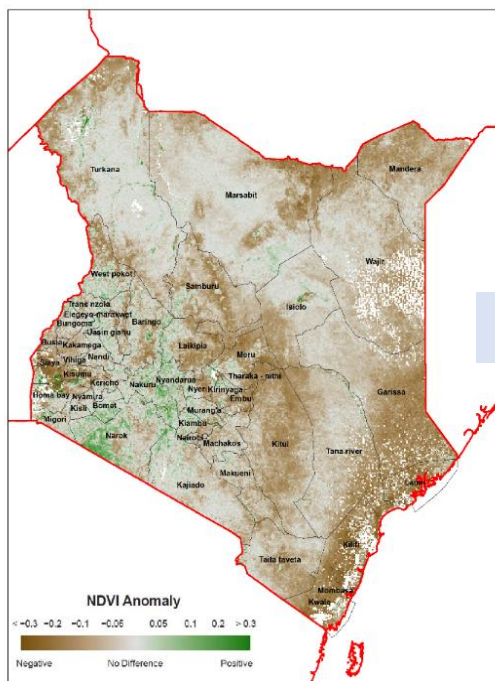
2nd weeks GFS rainfall forecast:  
valid upto 1 August. 2016



- **Seasonal rains expected to intensify over western and central Ethiopia, much of Sudan, S. Sudan, Eritrea, Djibouti and Yemen, which are expected to help ease current localized rainfall deficits.**
- **Rainfall deficits likely persist in Uganda, Rwanda and parts of the lake Victoria in the coming weeks, as little or no rainfall forecast in the coming weeks.**
- **Eastern and southern sectors of the Horn, expected to remain normally sunny and dry, with highlands remaining rainfall cooler than normal.**

# Agro-Climatic Drought Monitoring & Early Warning

## Impacts of Rainfall on Vegetation



**Croplands**

October Maize WRSI indicates no start. Going to be very hard to have a decent crop

Well-prolonged lean season resulted in abnormal dryness

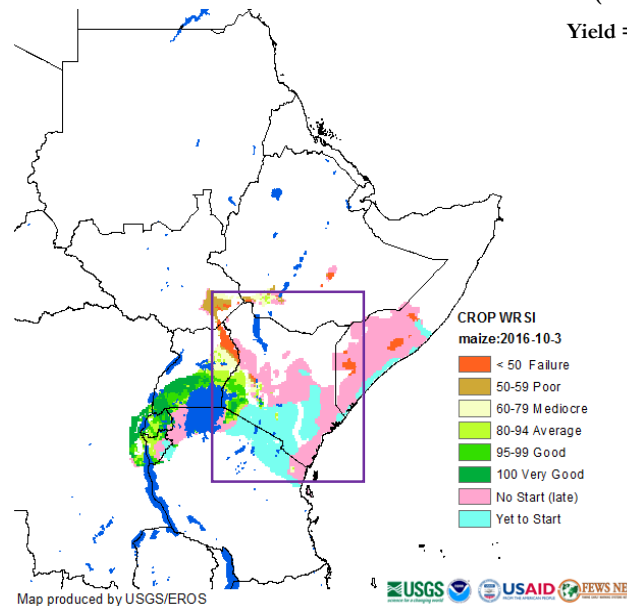
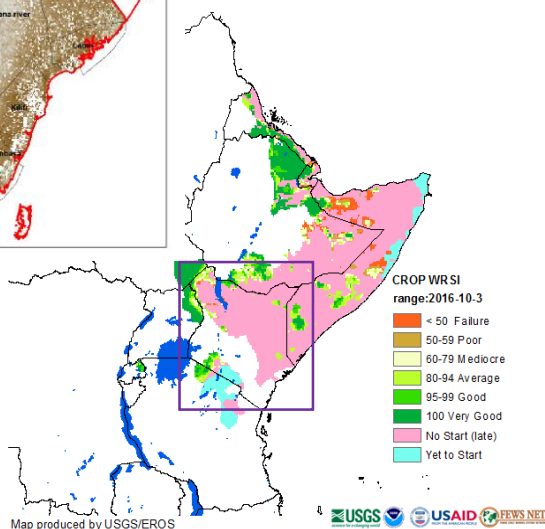
WRSI Extended  
October 2016 Dekad 3

WRSI Extended  
October 2016 Dekad 3

Crop Production (tons) = f (Yield, Area)  
Yield (tons/ha) = f (WRSI)  
Yield = f (crop conditions)

**Rangelands**

October Rangeland WRSI no start



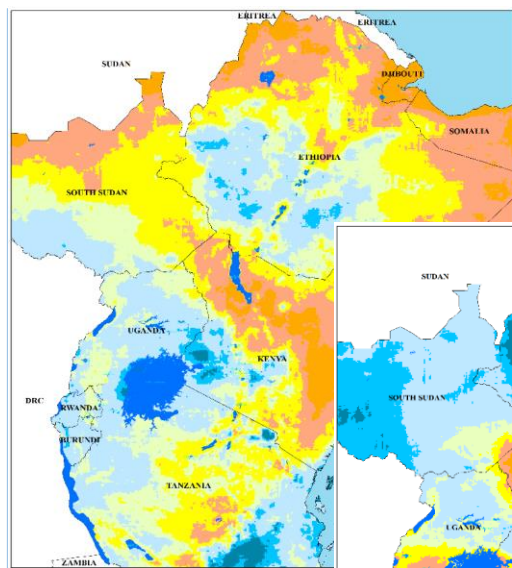
Map produced by USGS/EROS

Map produced by USGS/EROS

After the season

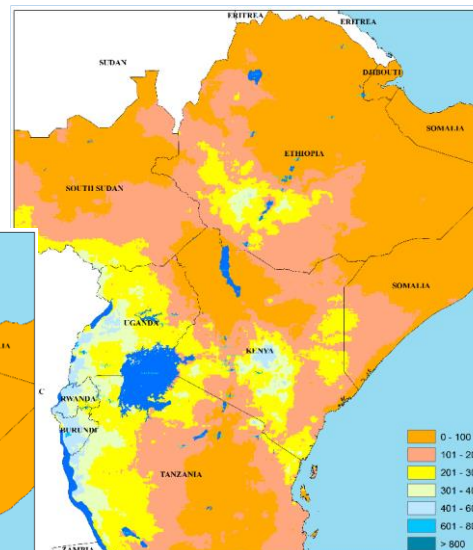
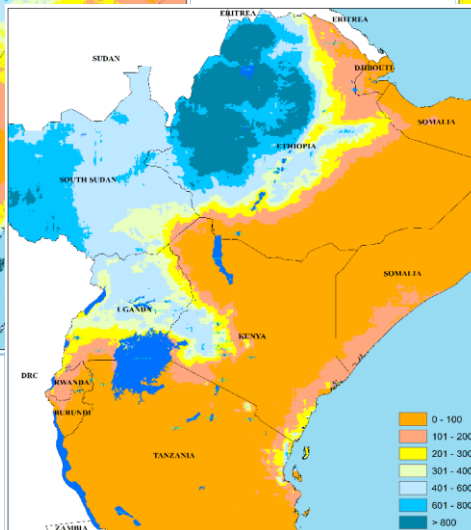
# Agro-Climatic Drought Monitoring & Early Warning

**Rainfall, the main driver???**



MAM cumulative rainfall

JJAS cumulative rainfall



OND cumulative rainfall

Prolonged dry spell across the region

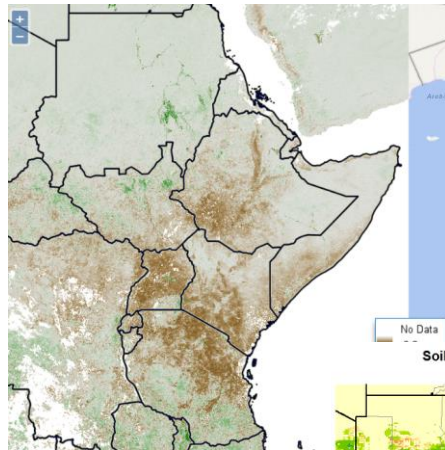
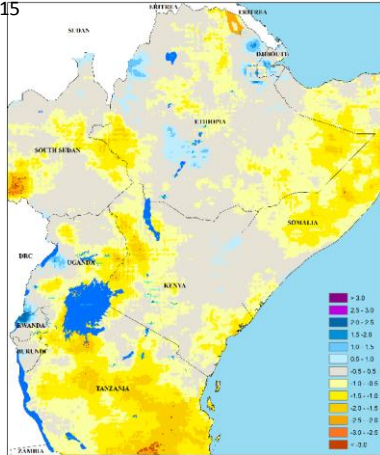
<http://earlywarning.usgs.gov/fews/africa/web/imgbrowsc2.php?extent=eazd>



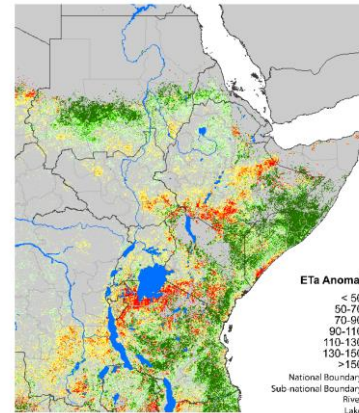
## Convergence of Evidence

### From independent data streams, RFE, NDVI and ET<sub>a</sub>

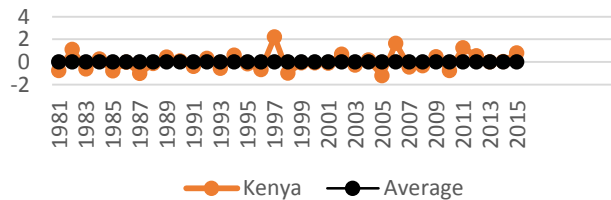
GHA Standard Precipitation  
Index (SPI) as of December  
2015



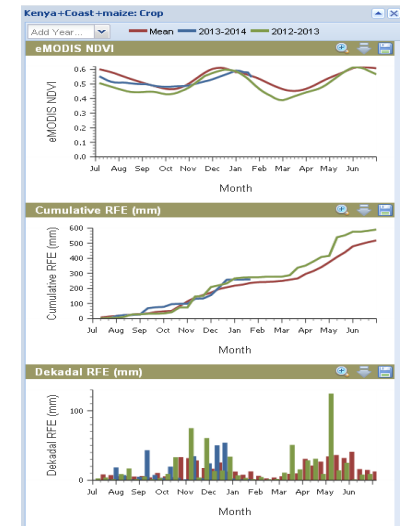
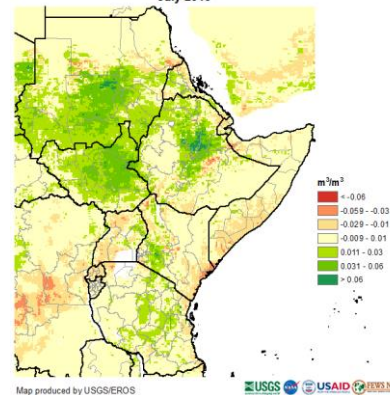
Cumulative ETa Anomaly: Aug Dekad 1 - Sep Dekad 3, 2016  
Percent of Median (2003-2013)



### Drought Frequency

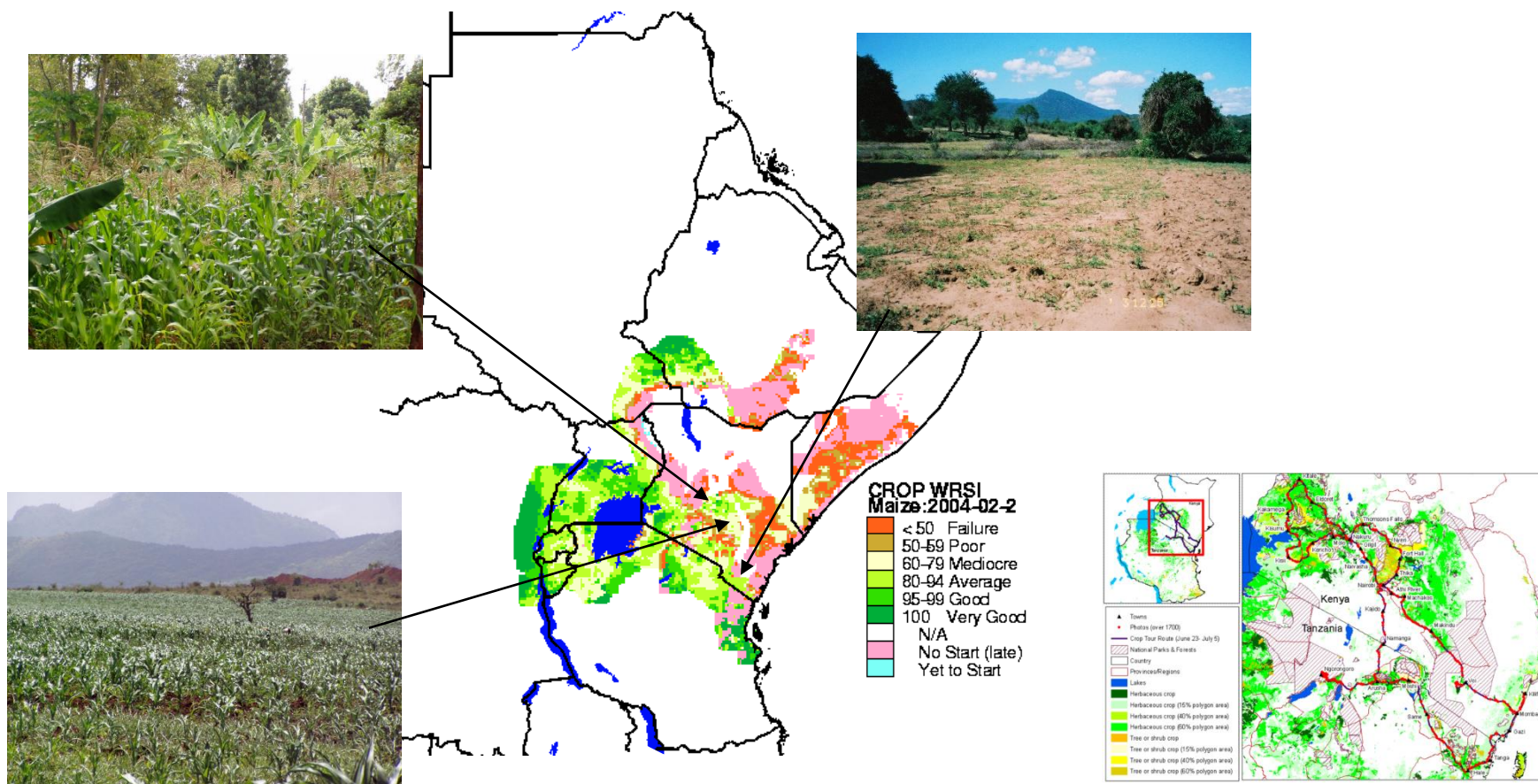


Soil Moisture (0-10 cm) Anomaly  
July 2016



# Agricultural Drought Monitoring & Early Warning

(Based on regular WRSI/Crop and Rangeland models and Field Assessments)





1. **Regular assessments** at dekadal, monthly, seasonal & inter-annual basis
2. **Convergence of evidence** based on data from various sources (field & remotely sensed information)
3. **Impact assessments** at different scales; regional to sub-national

# Improving resiliency of crops to drought and changing climate through strengthened early warning

*February 2017*

**Oluf Jessen – DHI**

Project manager

[ozj@dhigroup.com](mailto:ozj@dhigroup.com)



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# Project overview

Request from **Water Resources Commission** in Ghana through the Climate Technology Network Center for technical assistance with the objective to:

- **Improve resiliency to drought and changing climate in Ghana**
- **Enhance the capacity** of relevant local government agencies to address drought related issues
- **Provide scientific based technology** for drought early warning and forecasting within Ghana \*)

\*) *To be scaled up to a global scale within the Flood & Drought Management tools project*  
(<http://fdmt.iwlearn.org>)

A map of the African continent is shown in a light blue box. The country of Ghana is highlighted in a darker shade of blue, indicating its location in West Africa.

**Ghana**

**Applicant:** Water Resource Commission

**National Designated Entity:** Mr. Joseph Amankwa Baffoe, Environment Protection Agency

**Duration:** 12 months

**Status:** Under implementation

**Technical Assistance Planned by:** UNEP-DHI Partnership

**Implemented by:** UNEP-DHI Partnership

# Country status – dependency on the agriculture sector

- > 50% of the work force is employed in the agriculture sector
- Agricultural production is predominantly rain-fed (> 80%)

Very high vulnerability towards climate variability and change

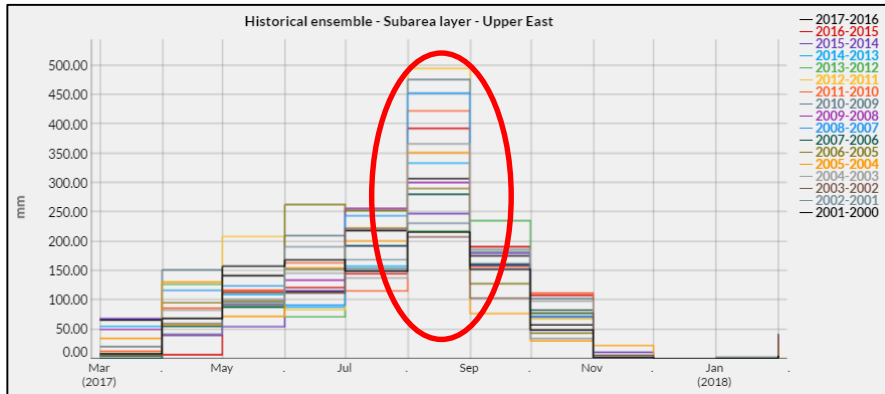
- Increased poverty
- Increased land degradation and desertification



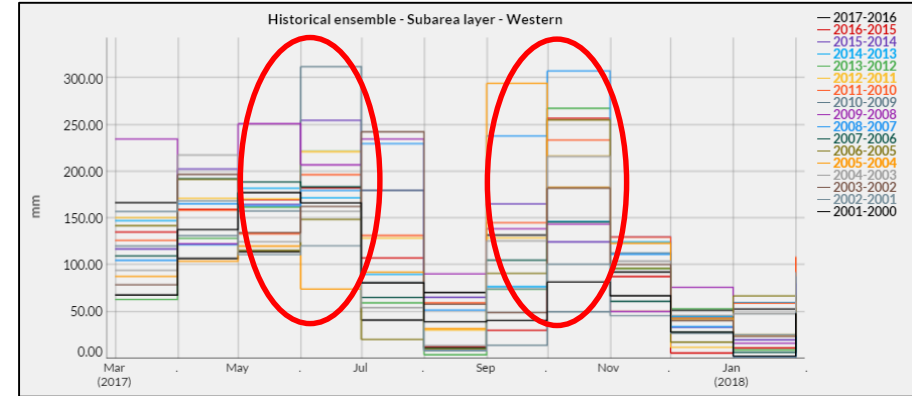
# Country status – rainfall pattern

- Seasonal pattern but large variability from year to year
- Northern part of the country very vulnerable to climate variability
- Observations of areas in the south turning towards a unimodal pattern

Unimodal rainfall distribution in the north

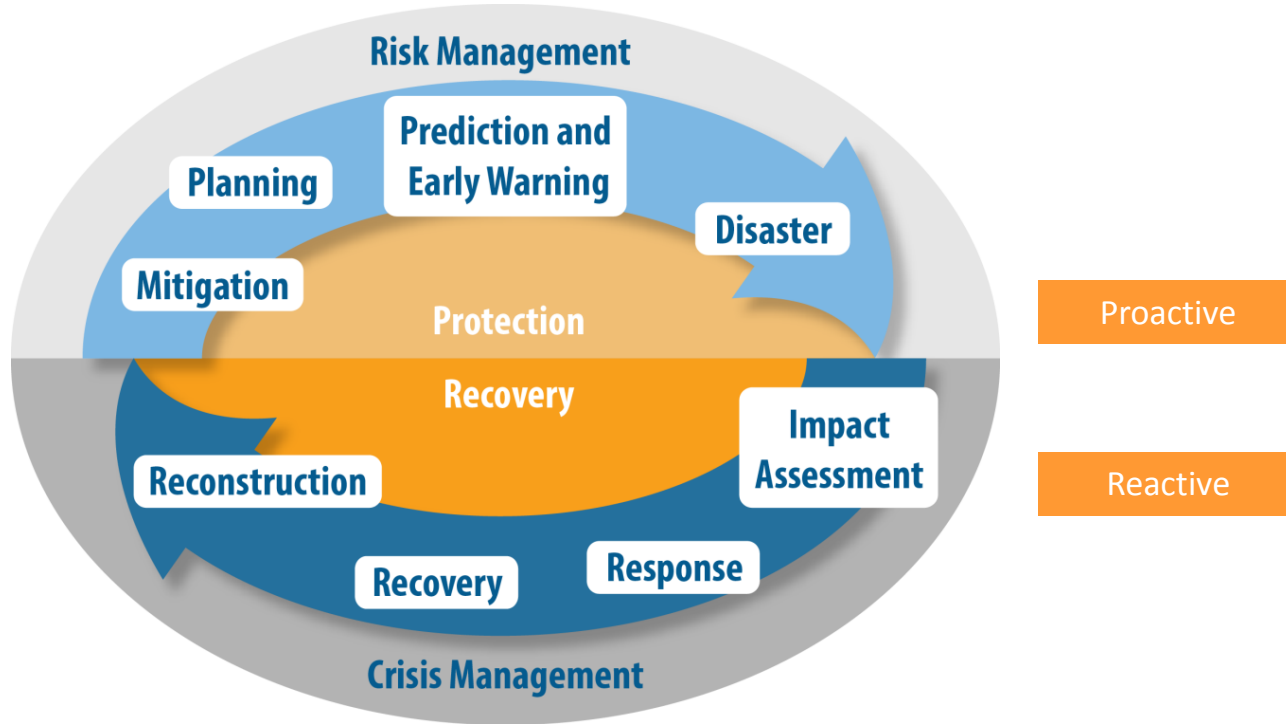


Bimodal rainfall distribution in the south



# Early warning and detection as part of a risk based approach

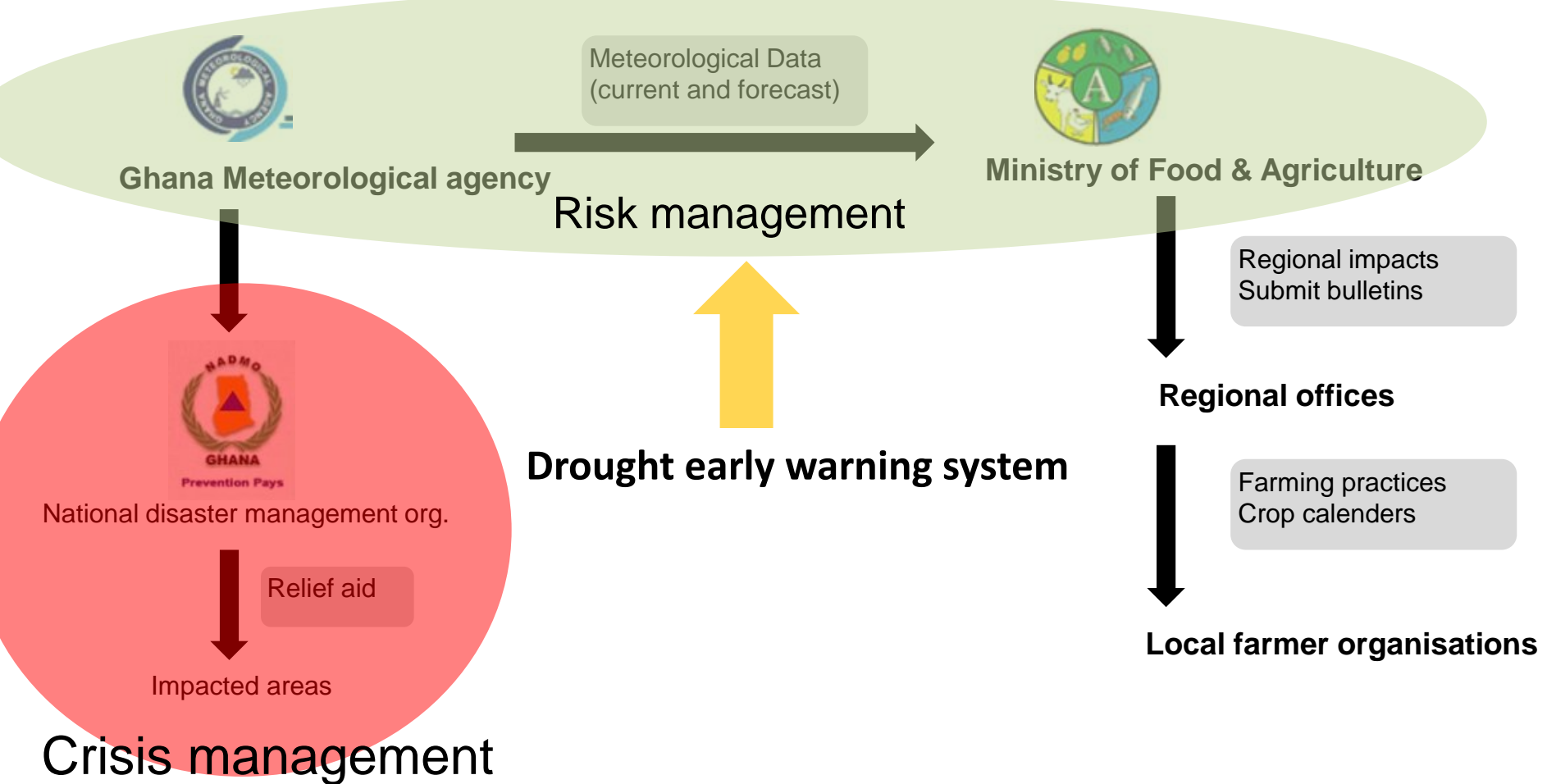
From crisis to risk management



A need to develop risk-based drought management policies

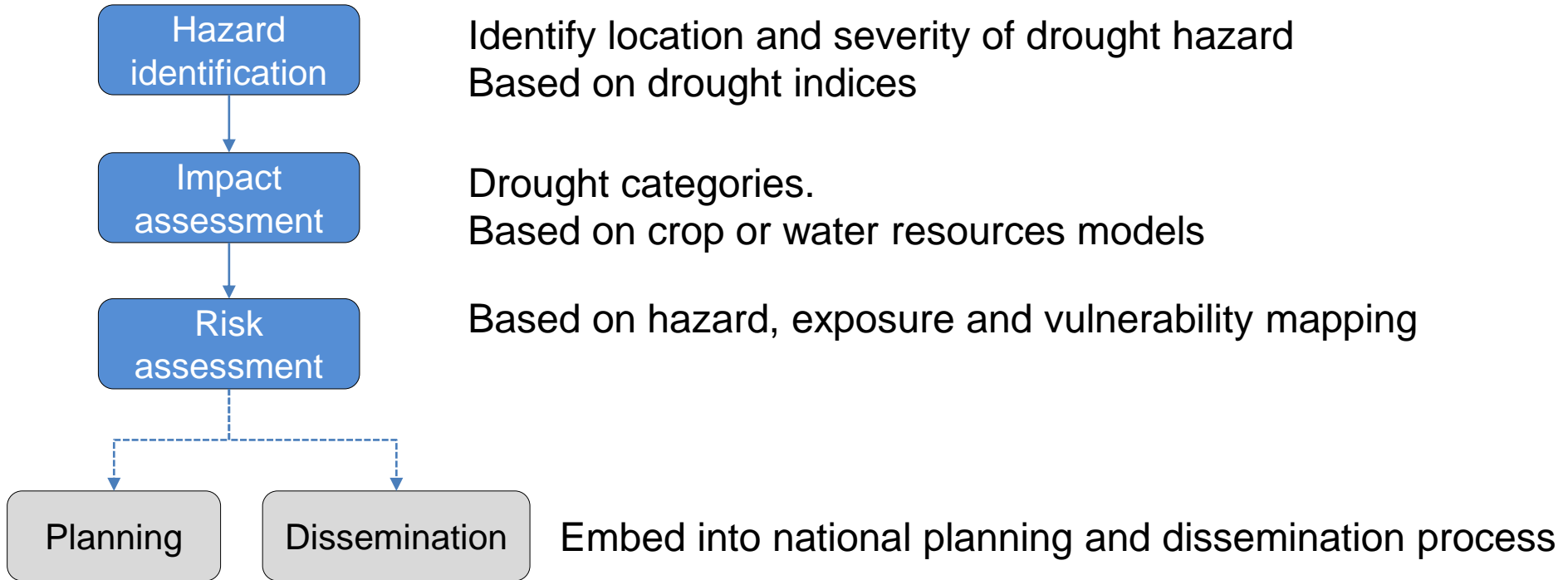
Source: Adapted from National Drought Mitigation Center, <http://drought.unl.edu>

# Current drought warning or management workflow





# Early warning concept



***Drought early warning provides timely and effective information to related sectors or organisations allowing these to take actions to mitigate impacts of upcoming droughts***

# Hazard identification

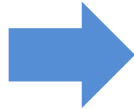
Based on near real time updated and forecasted drought indices

## Data



Satellite data

Seasonal  
forecast



## Drought indices

### Climate:

- SPI
- Rainfall deviation

### Vegetation:

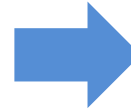
Vegetation condition index

### Soil moisture:

SWI percentile

### Combined:

Agricultural stress index



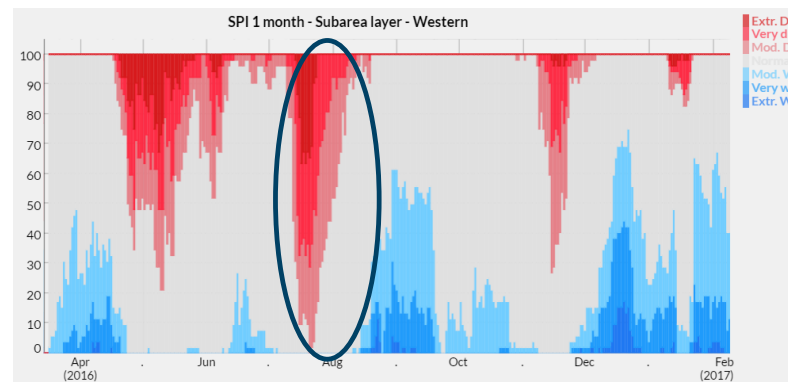
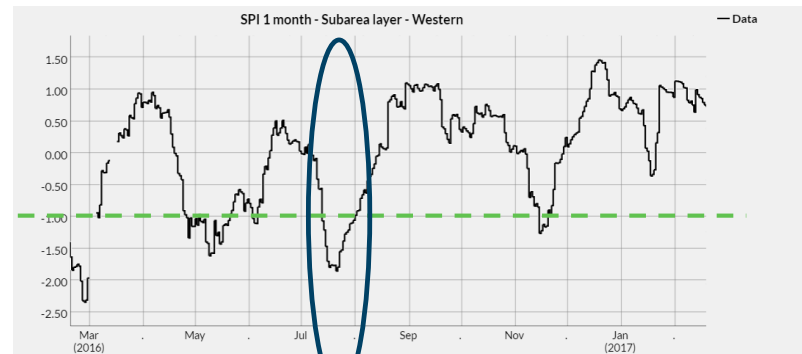
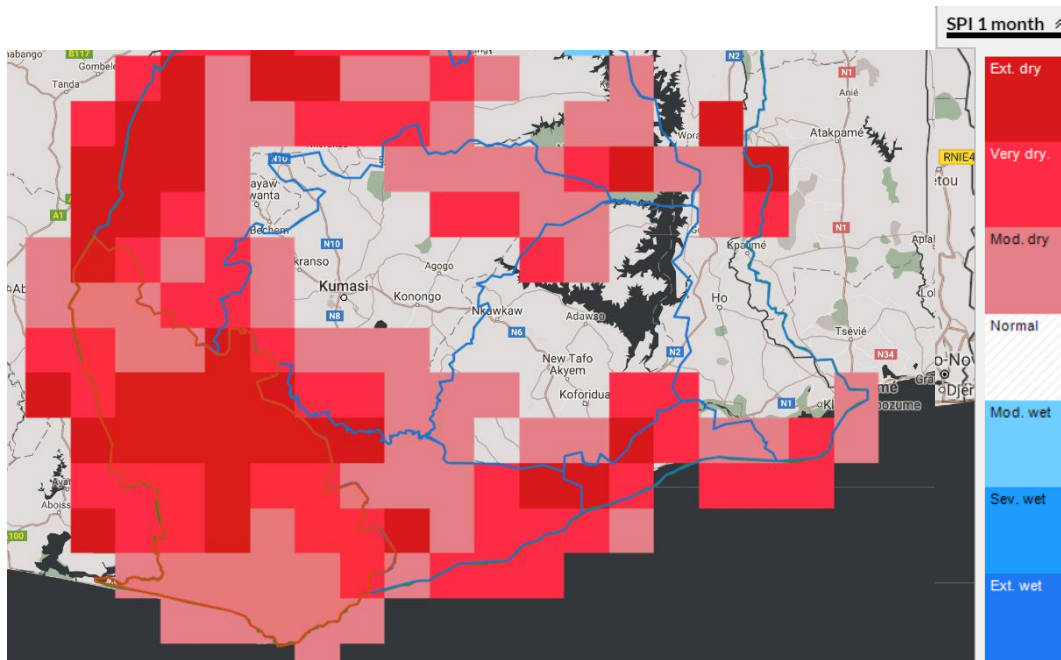
## Hazard categories

Category	Description	Impact
Normal	Normal	Normal conditions
D0	Abnormally Dry	Short-term dryness some water deficit
D1	Moderate Drought	Some damage to crops
D2	Severe Drought	Crop or pasture losses likely; water shortages common
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses

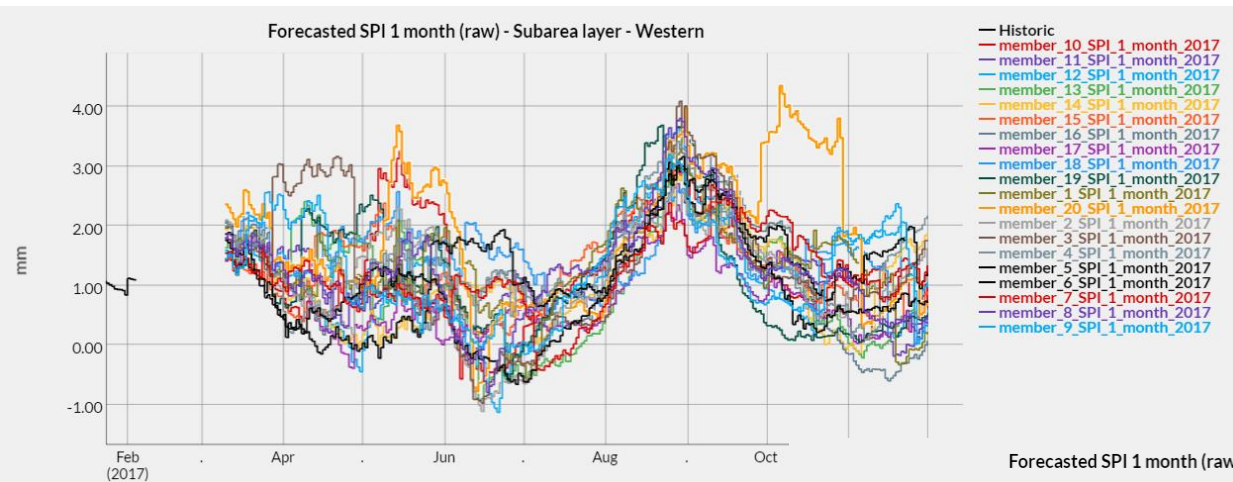
Source: U.S. Drought Monitor Classification Scheme

# Hazard identification

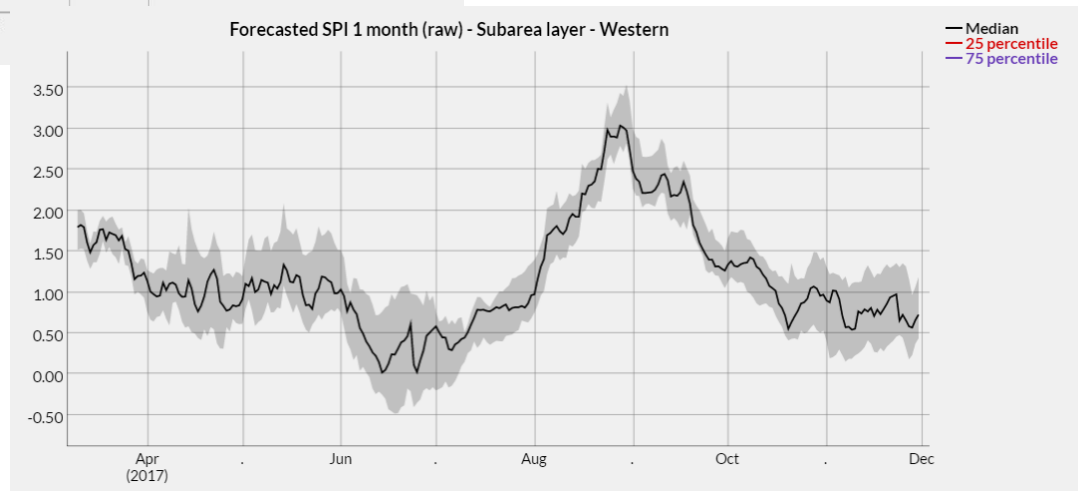
## Spatial and temporal information



# Hazard identification

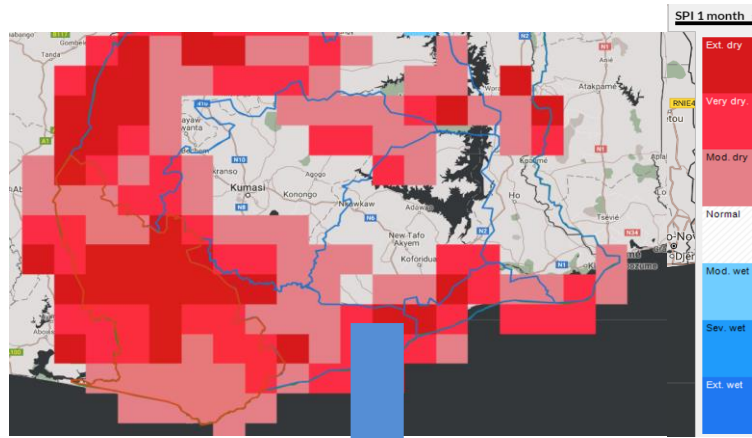


*Probabilistic forecast with 20 members*



# Impact assessment

Calculation of impact on exposed areas or sectors, eg. rainfed areas



Correlation analysis  
between hazard  
categories and impact

Area covered within each hazard category

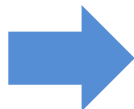
Date:	Normal	D0	D1	D2	D3	D4
8/13/2015	41.9	39.4	13.1	3.9	1.1	0.5
7/28/2015	57.4	31.2	8.8	1.8	0.4	0.3
7/12/2015	64.9	28.5	5	1	0.3	0.3
6/26/2015	76.6	17.1	4.3	1.3	0.4	0.3

# Impact assessment

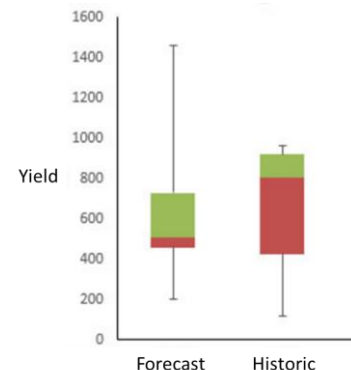
Calculation of impact on exposed areas or sectors, eg. rainfed areas

Hazard  
identification

Current climate  
Forecasted climate



Evaluate likely impact on crop production  
within the coming season



Crop	Soil	Area	Planting	Yield (forecast)			Yield (historic)
				25%	Median	75%	Median
Maize	Clay	Western	01-05	90	98	100	95
Wheat	Sand	Western	01-05	78	89	100	95
Wheat	Clay	Western	01-05	90	97	100	93
Wheat	Loam	Western	01-05	90	96	100	98

# Risk assessment

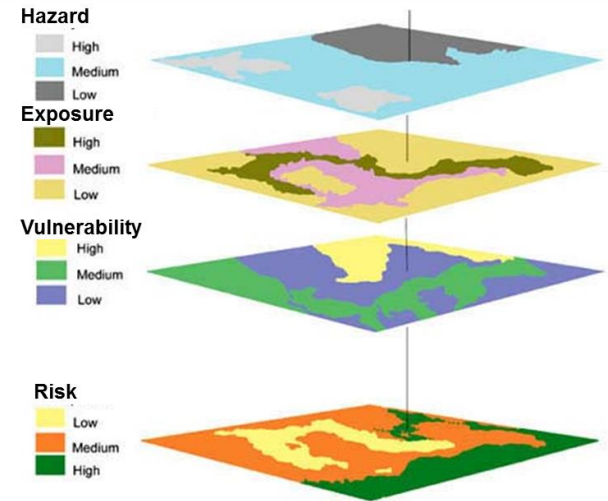
Risk will be expressed based on the vulnerability towards the impact from a specific hazard

Targets for the following adaptation or mitigation planning

*Risk = Vulnerability x Exposure x Hazard*

*Vulnerability = the cause behind the impact*

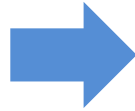
***Input to drought action plans or long term investments aiming at mitigating the risk***



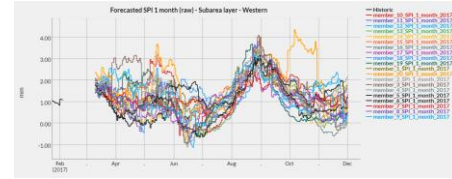


# Drought early warning

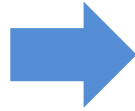
Hazard  
identification



Hazard warning  
General warning



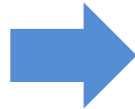
Impact  
assessment



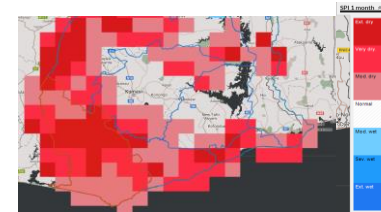
Crop impact (likelihood)  
Specific warning

Crop	Soil	Area	Planting	Yield (forecast)			Yield (historic)	
				25%	Median	75%	Median	
Maize	Clay	Western	01-05	90	98	100		95
Wheat	Sand	Western	01-05	78	89	100		95
Wheat	Clay	Western	01-05	90	97	100		93
Wheat	Loam	Western	01-05	90	96	100		98

Risk  
assessment



Sector specific  
Input to mitigation and planning  
process at higher level



# Improving resiliency of crops to drought and changing climate through strengthened early warning

*February 2017*

**Oluf Jessen – DHI**

Project manager

[ozj@dhigroup.com](mailto:ozj@dhigroup.com)



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# Audience questions

# Upcoming FD webinars

- #1: Use of satellite data for drought and flood management (Technical presentation)
- #2: Drought management today - cases from Asia (January 12, 2017)
- #3: Drought early warning and assessment, experiences from Ghana (February 28, 2017)
- #4: Water Safety Plans –link water utilities with basin planning processes (March 15, 2017)
- #5: Basin planning – the climate change challenge (April 25, 2017)
- #++++!

Dates and recordings on  
<http://www.unepdhi.org/fd-webinars>

- Questions/comments to Maija Bertule [mabe@dhigroup.com](mailto:mabe@dhigroup.com)
- Webinar recording and slides on YouTube (UNEP-DHI) and <http://www.unepdhi.org/fd-webinars>
- Short feedback survey in follow-up email – please take 5 minutes to fill in – we value your opinion!

### **Future webinars in the series**

- Feedback and suggestions for future topics welcome!

# **Thank you for attending!**