

Drought Shocks: A force to be reckoned with

MARK SVOBODA, PH.D., DIRECTOR
NATIONAL DROUGHT MITIGATION CENTER
UNIVERSITY OF NEBRASKA-LINCOLN

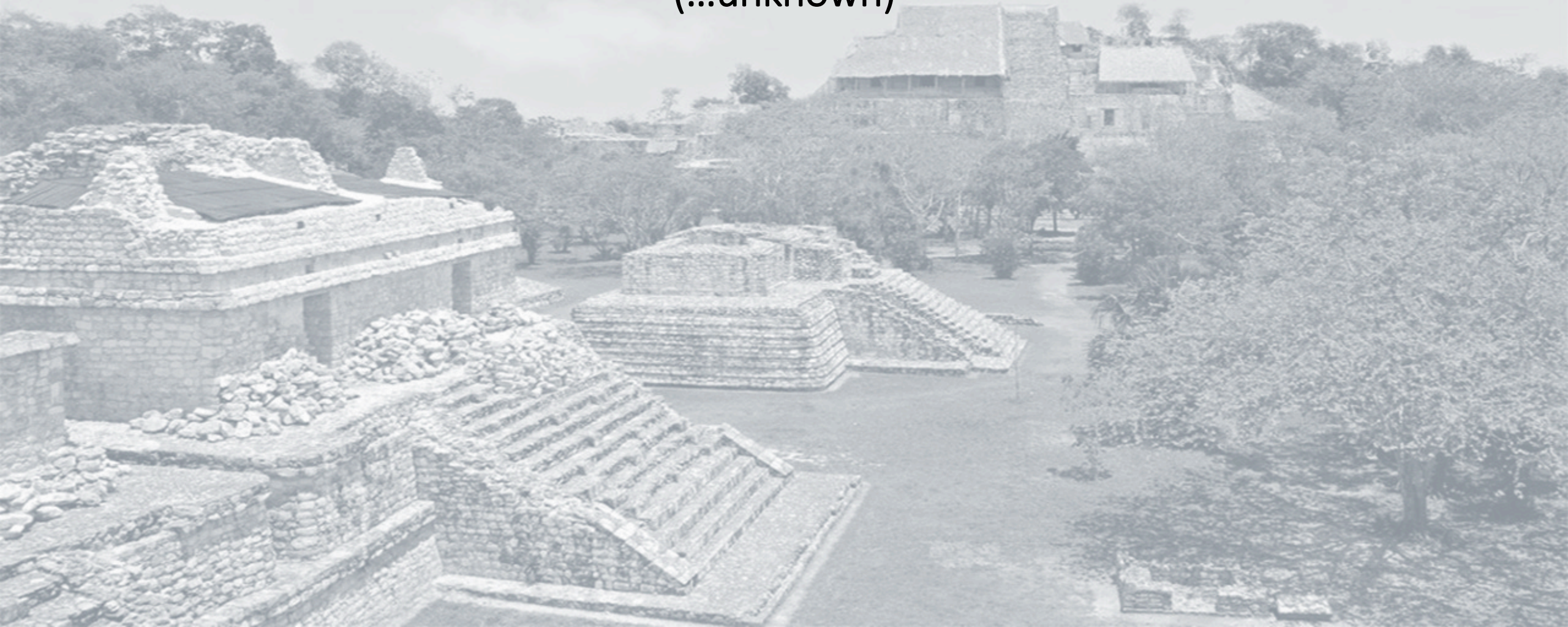


NATIONAL DROUGHT MITIGATION CENTER
UNIVERSITY OF NEBRASKA

Next-Generation Food Shock Modeling
Aspen Global Change Institute, Aspen, CO, May 20-24, 2019

“Floods kill people, but droughts destroy civilizations.”

(...unknown)



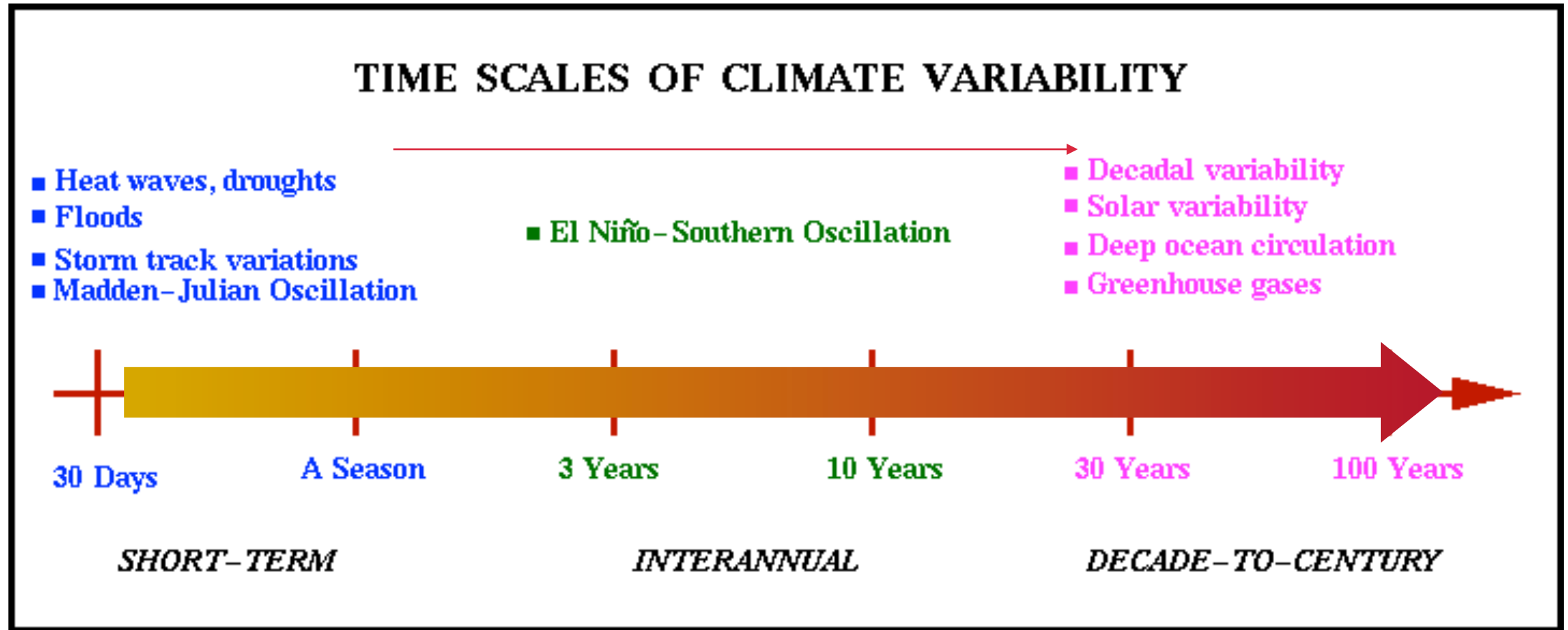
Drought: “a force for truth”

“Societies will manage climate change in the same way they will manage droughts (for better or worse)” (Daniel Connell, Australian National University, 2010)

Stress from drought highlights:

- ***Strengths and weaknesses*** that are usually hidden
- ***Political priorities and underlying cultural values*** revealed by difficult choices

Why Drought?



Droughts span an enormous range of temporal and spatial scales....not at all unlike the anticipated behavior of climate change...



**When the Rain Stops:
Drought on Subseasonal and Longer Timescales**

AGENDA
(090718)

September 9-14, 2018
Aspen, CO

Co-Chairs: Angeline Pendergrass¹, Roger Pulwarty², Gerald Meehl¹

¹National Center for Atmospheric Research (NCAR)

²National Oceanic and Atmospheric Administration (NOAA)

Important note to speakers: Each presentation is allotted 15 minutes followed by 5 minutes for questions.

Meeting Location: Annabelle Inn, 232 W. Main St., Aspen, CO 81611

Breakfast provided at hotels. Coffee & snacks provided at meeting throughout the day.



ESSAY

FLASH DROUGHTS

A Review and Assessment of the Challenges Imposed
by Rapid-Onset Droughts in the United States

JASON A. OTKIN, MARK SVOBODA, ERIC D. HUNT, TRENT W. FORD, MARTHA C. ANDERSON,
CHRISTOPHER HAIN, AND JEFFREY B. BASARA

It is recommended that the climate features referred to ambiguously as "flash droughts" in the scientific literature be identified based on how rapidly they intensify.

Otkin et al., June 2018 BAMS

Flash droughts: High-impact events that present a new challenge for S2S prediction. (White Paper currently under development)

Context: Why Plan Ahead and Prepare for Natural Disasters?

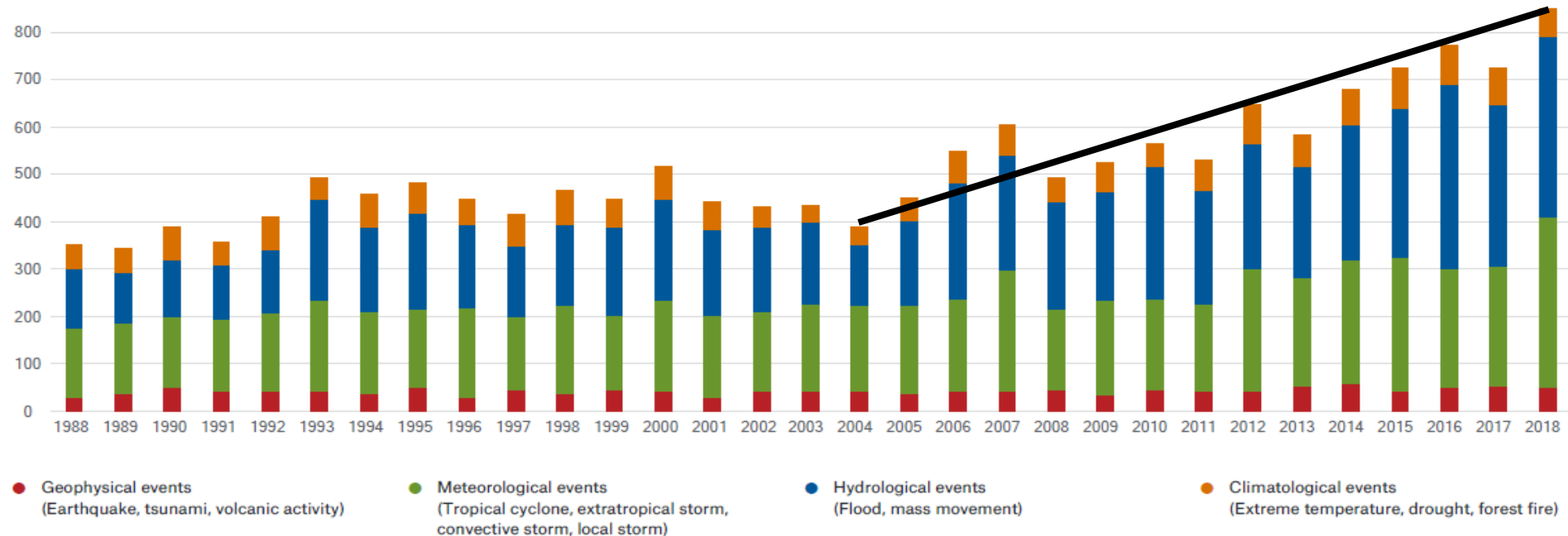
NatCatSERVICE

Munich RE 

Number of events

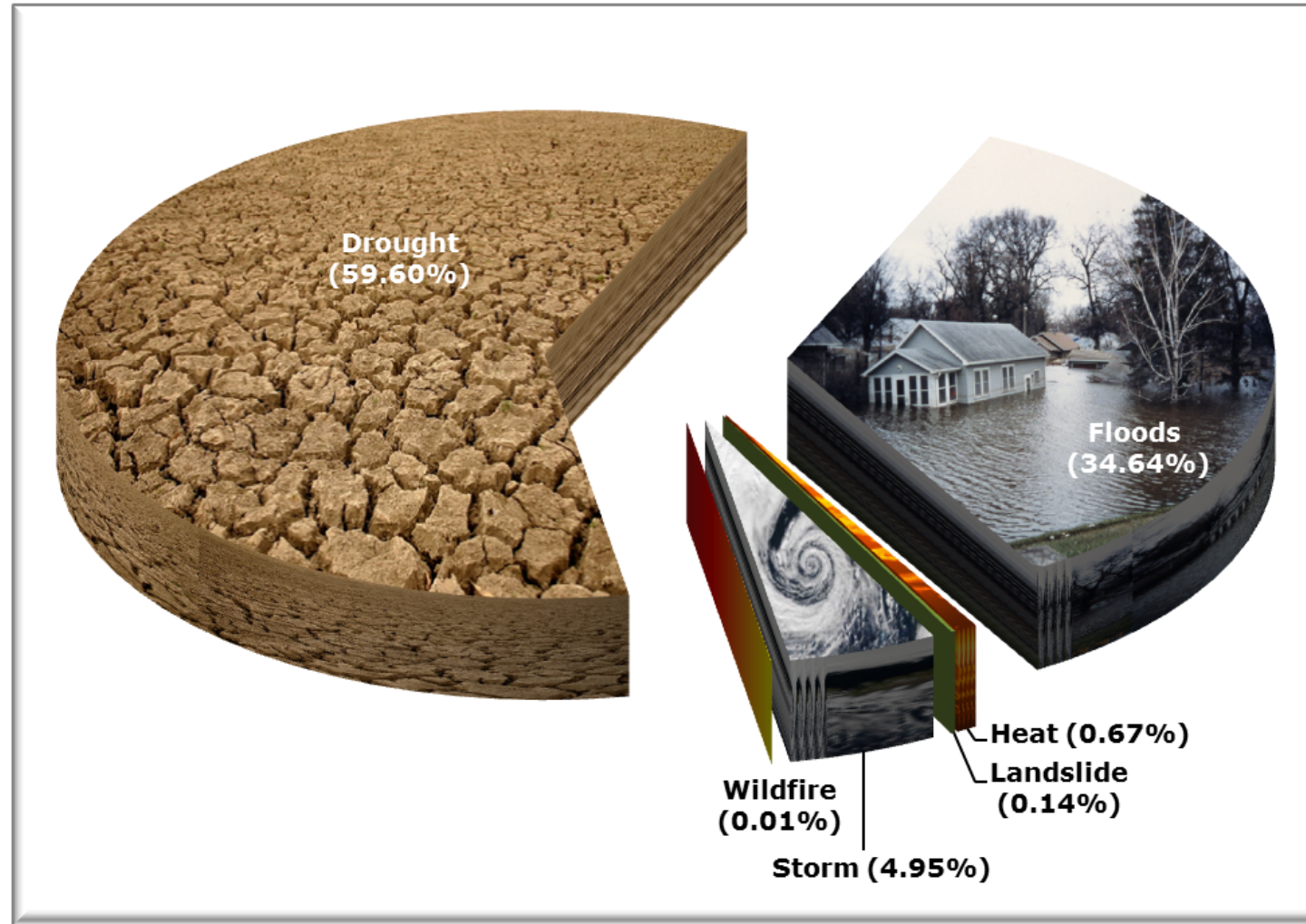
Relevant natural loss events
worldwide 1988 – 2018

Number











Accounted events have caused at least one fatality and/or produced normalised losses \geq US\$ 100k, 300k, 1m, or 3m (depending on the assigned World Bank income group of the affected country).

Percentage of disaster-deaths worldwide according to each category of climate-related hazard, (1900-2013)



Source: Adapted from EM-DAT: The OFDA/CRED International Database, Belgium 2012
Keim, ME Extreme Weather Events: the role of public health

Billion-dollar events to affect the U.S. from 1980 to 2019* (CPI-Adjusted)

DISASTER TYPE	NUMBER OF EVENTS	PERCENT FREQUENCY	CPI-ADJUSTED LOSSES (BILLIONS OF DOLLARS)	PERCENT OF TOTAL LOSSES	AVERAGE EVENT COST (BILLIONS OF DOLLARS)	DEATHS
 Drought	26	10.6%	\$247.0 ^{CI}	14.6%	\$9.5	2,993 [†]
 Flooding	30	12.2%	\$124.7 [‡] ^{CI}	7.4% [‡]	\$4.3 [‡]	546
 Freeze	9	3.7%	\$30.2 ^{CI}	1.8%	\$3.4	162
 Severe Storm	106	43.1%	\$232.6 ^{CI}	13.8%	\$2.2	1,630
 Tropical Cyclone	42	17.1%	\$927.5 ^{CI}	54.9%	\$22.1	6,487
 Wildfire	16	6.5%	\$79.5 ^{CI}	4.7%	\$5.0	344
 Winter Storm	17	6.9%	\$48.9 ^{CI}	2.9%	\$2.9	1,048
 All Disasters	246	100.0%	\$1,690.4 [‡] ^{CI}	100.0%	\$6.9 [‡]	13,210

*Statistics valid as of April 9, 2019

[†]Deaths associated with drought are the result of heat waves. (Not all droughts are accompanied by extreme heat waves.)

[‡]Cost statistics not included for Midwest Flooding (March 2019)

Source: NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2019). <https://www.ncdc.noaa.gov/billions/>NCEI

Recent Droughts in Africa: Key Observations

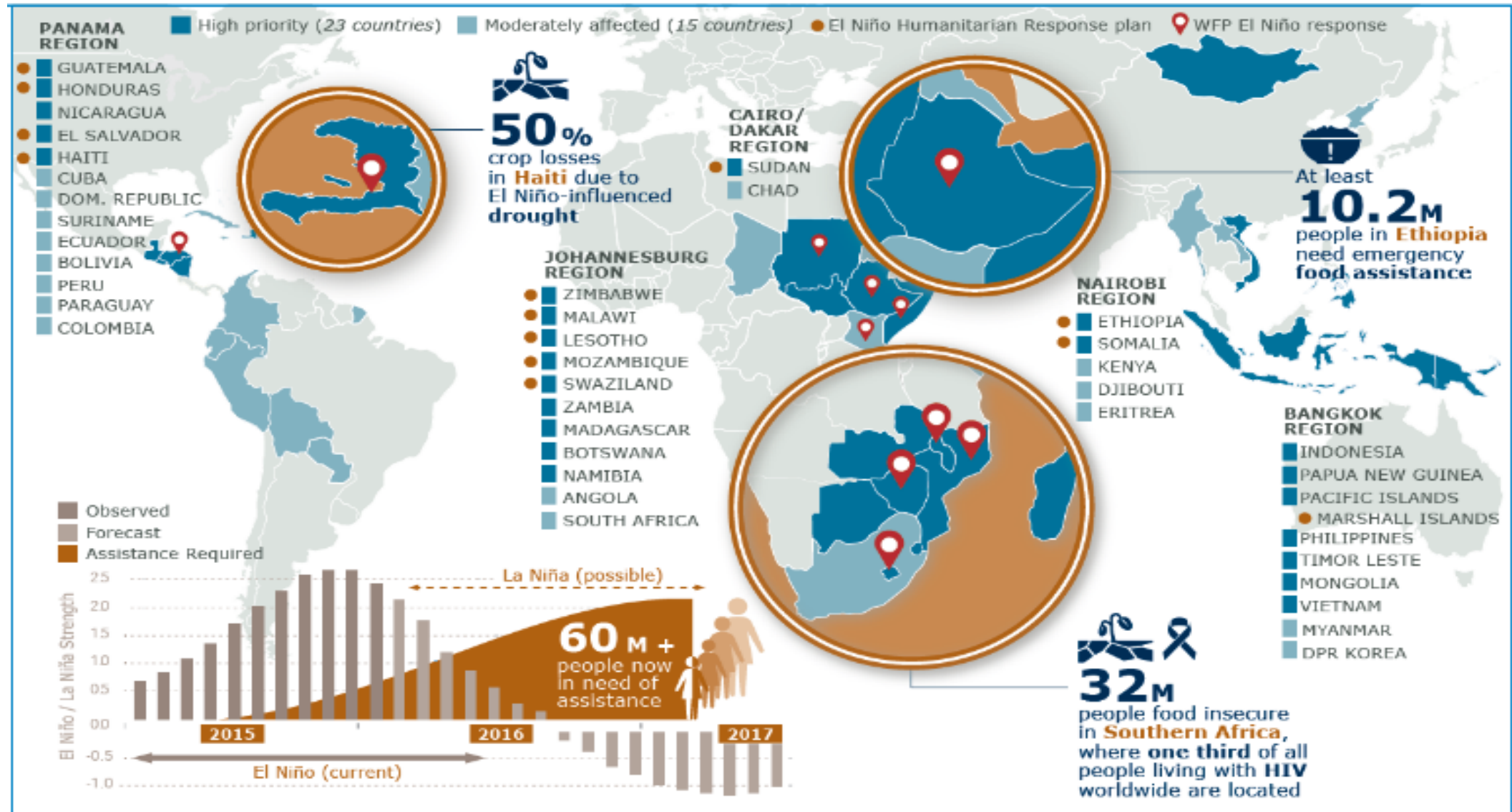
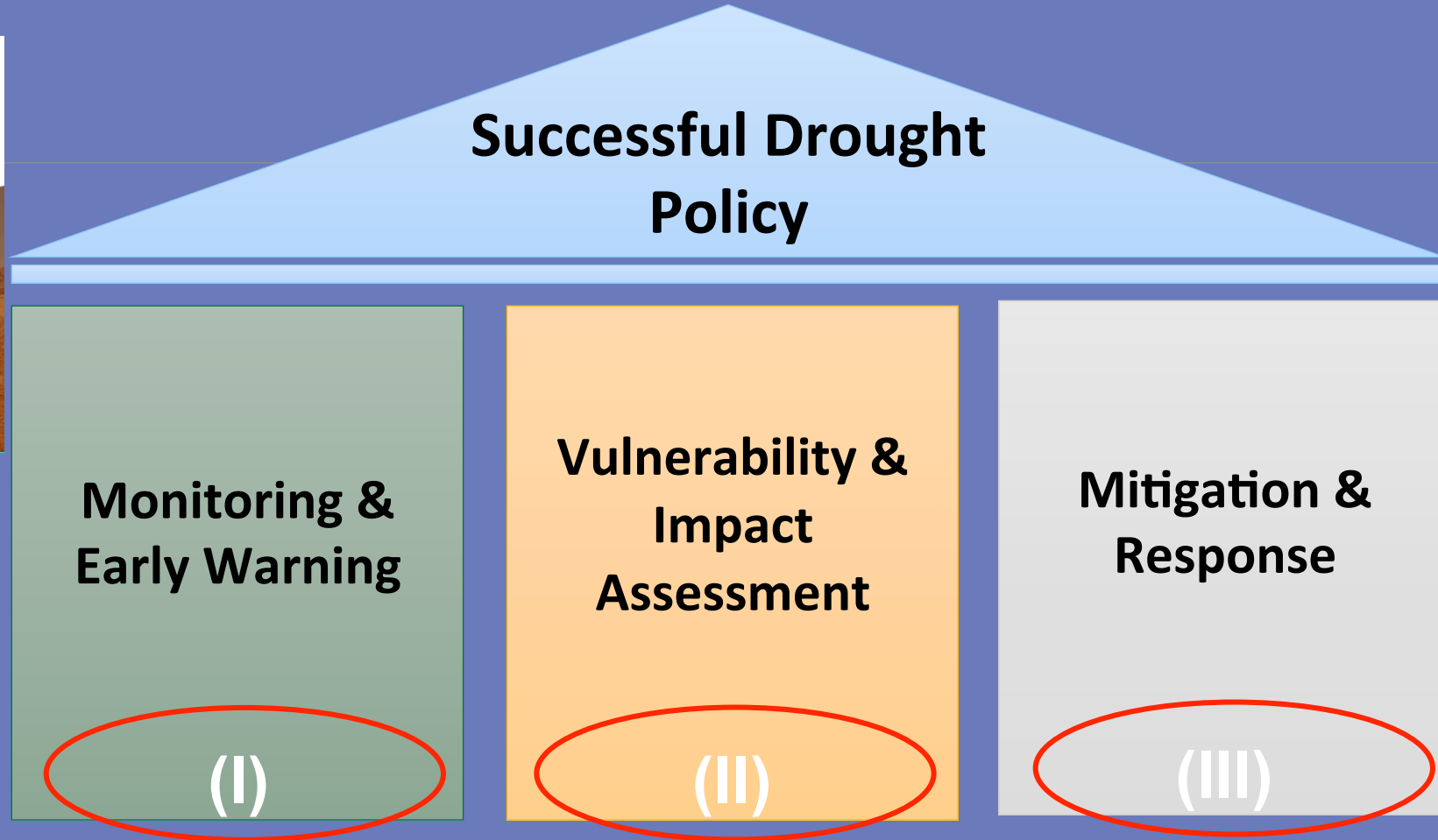
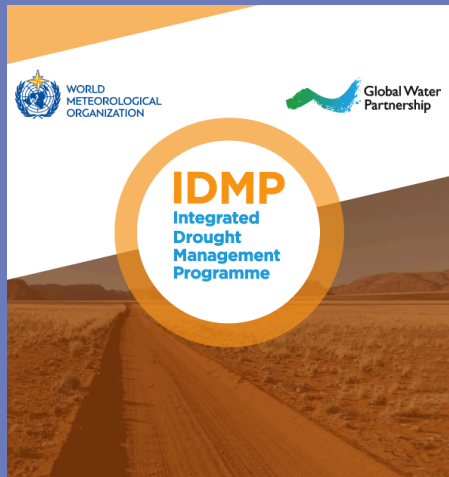


Figure 3. Recent (2016) El Niño-related food security impact in the world. Over 50% of the people affected are in Africa. **Source: WFP, 2016.**

Drought Risk Management: The Three Pillars



Overall purpose: preparedness planning based on these pillars of risk reduction.

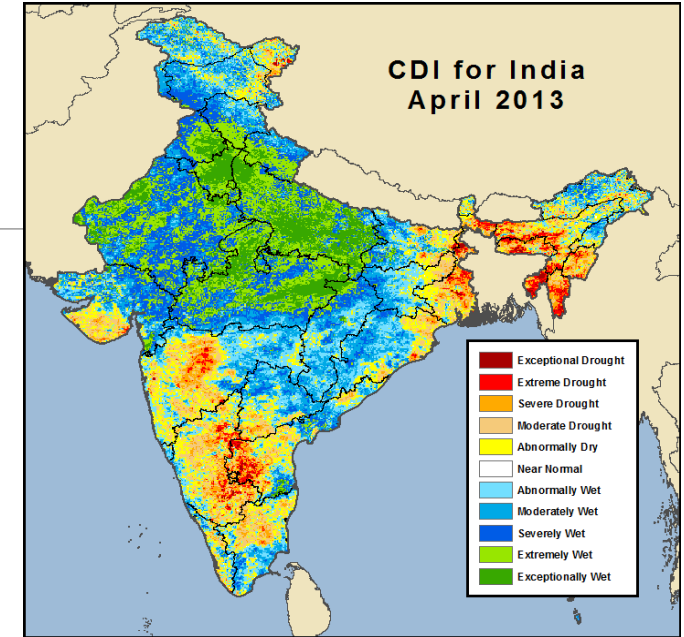
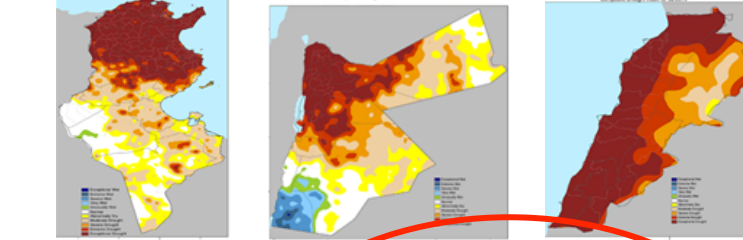
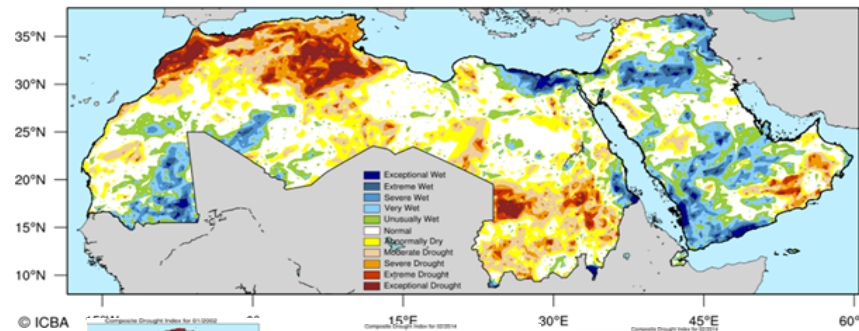
NDMC International DRMS Activities



Caribbean (I, II, III)

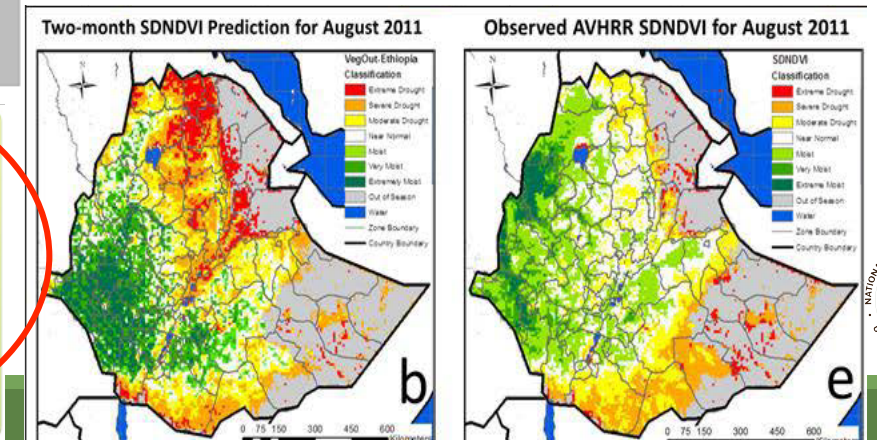


MENA (I, II, III)
Composite Drought Index for January 2016

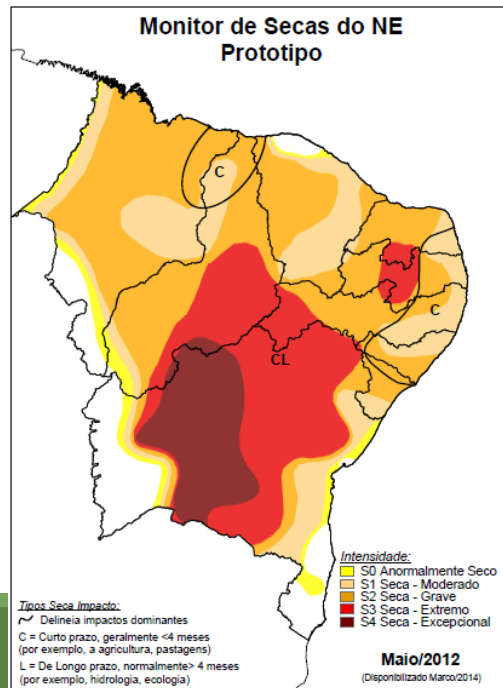


India (I)

Greater Horn of Africa (I)

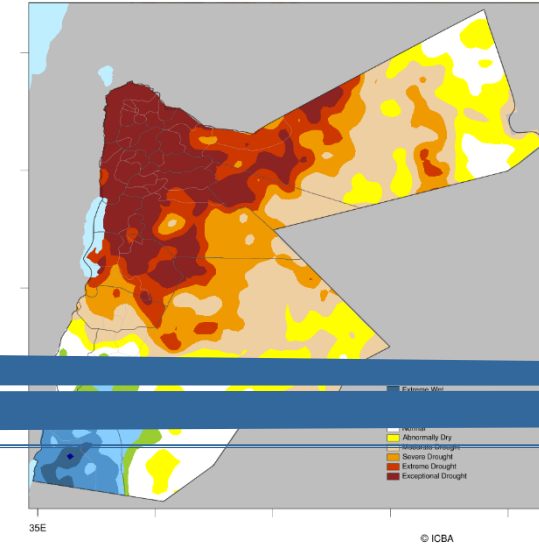
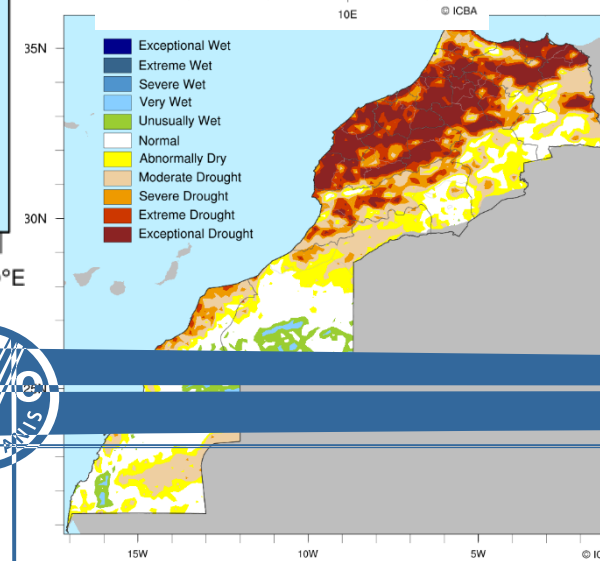
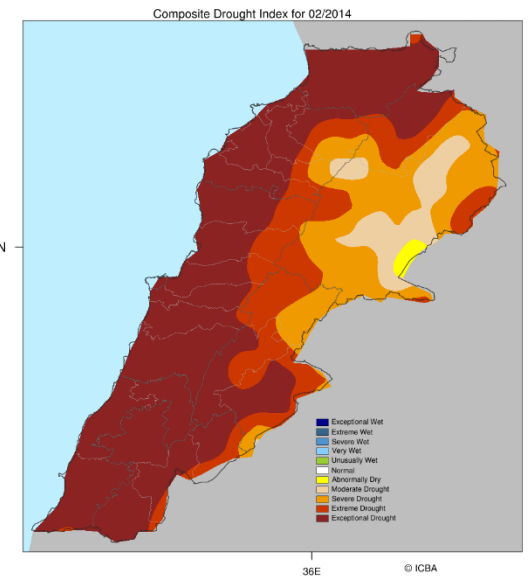
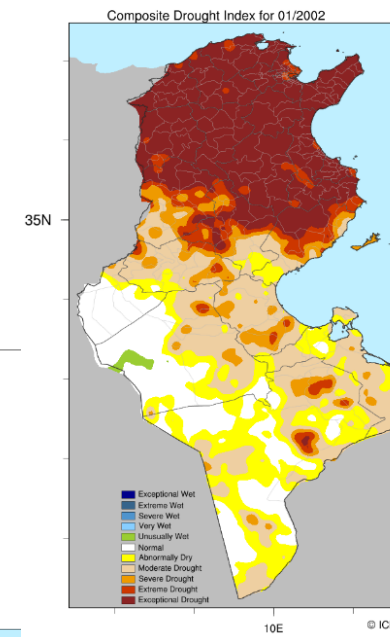
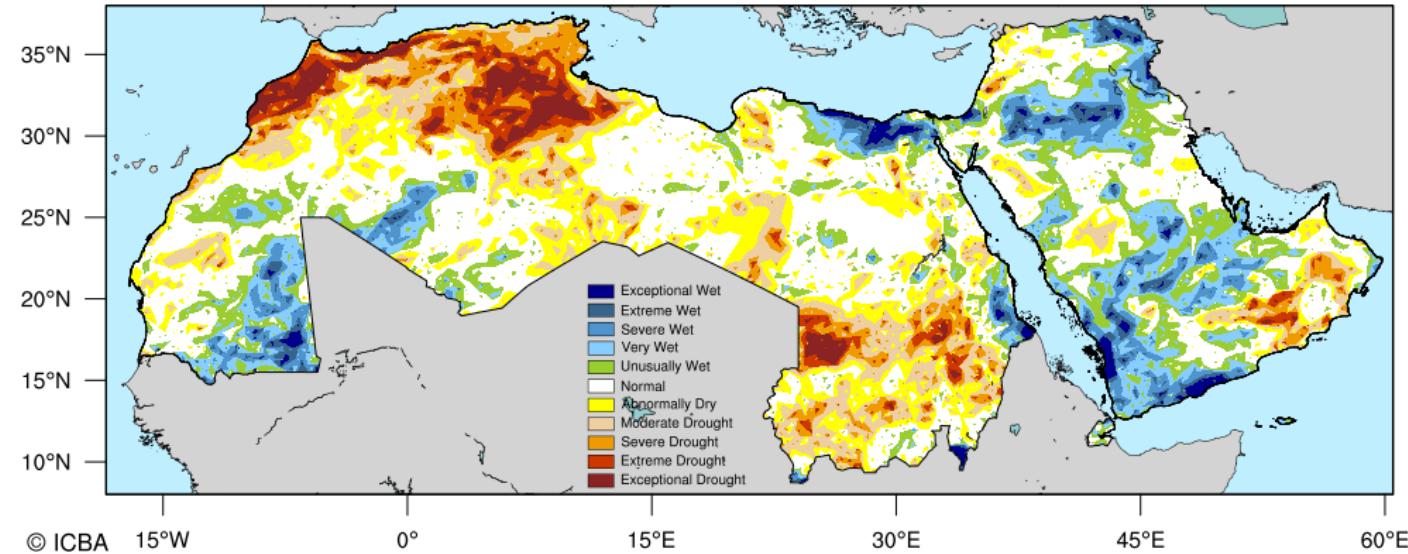


Brazil (I)



Operational CDI-based drought monitoring

Composite Drought Index for January 2016



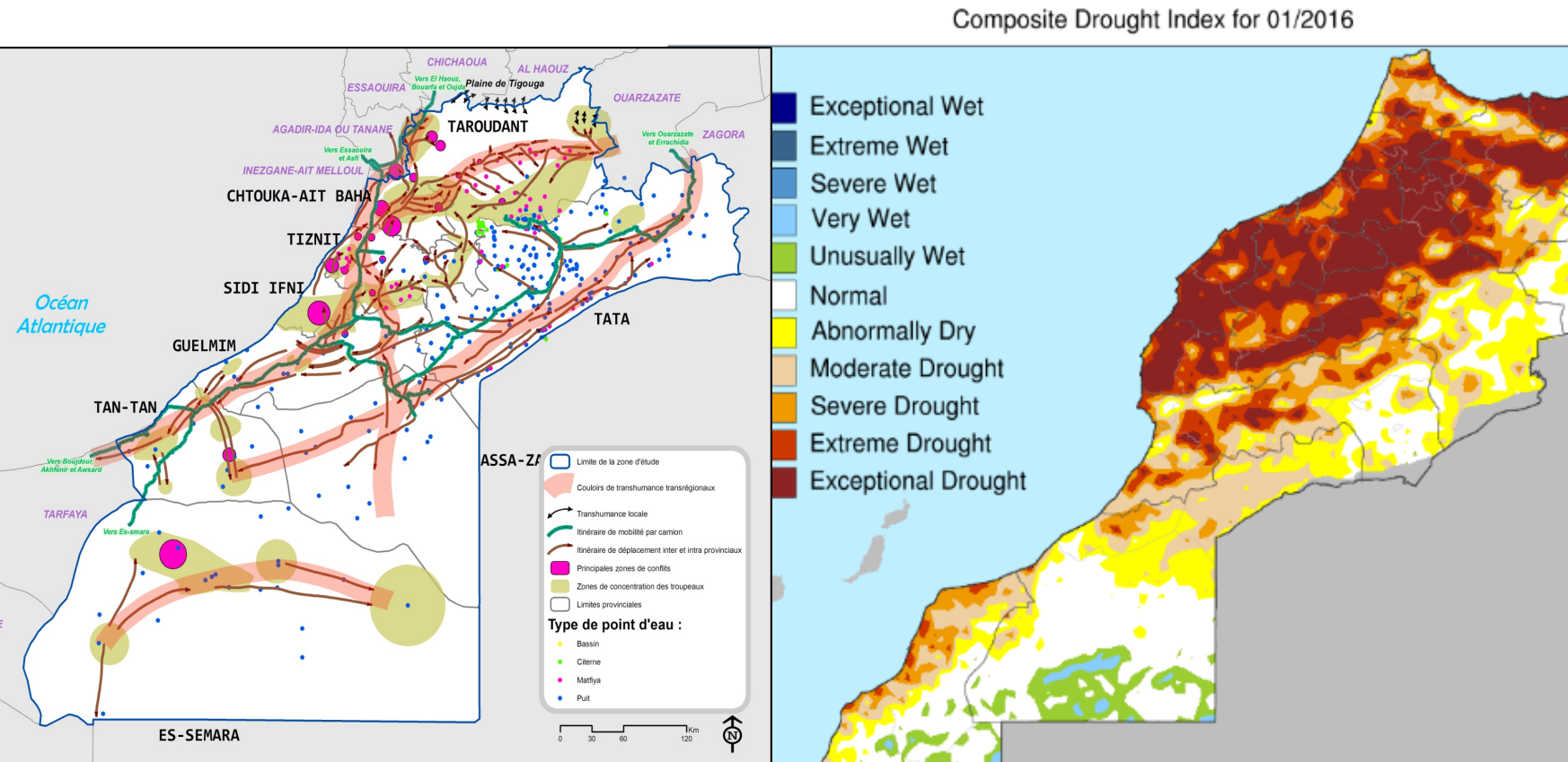
USAID
FROM THE AMERICAN PEOPLE



Slide courtesy of Dr. Rachael McDonnell, 2019, IWMI



Supporting Morocco manage drought tensions between agro-pastoralists and farmers



Tensions exacerbated by recent droughts in 2015-16, winter of 2017/18

Law passed to manage the rangelands and the movements of the pastoralists – drought maps to trigger actions

Slide courtesy of Dr. Rachael McDonnell, 2019, IWMI

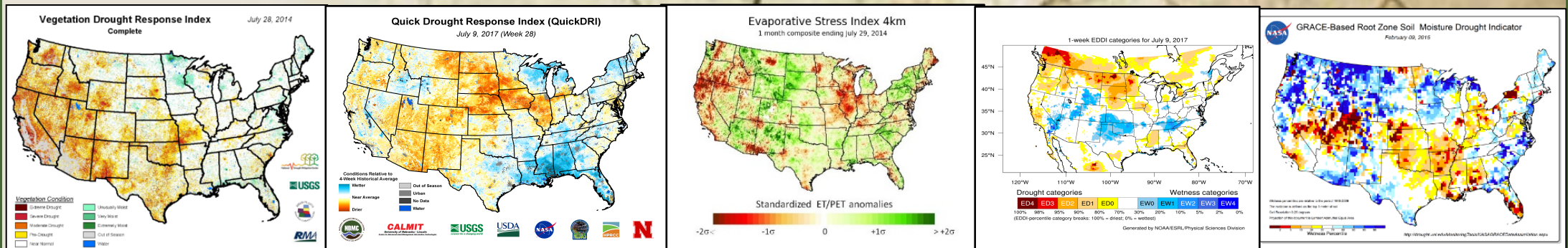
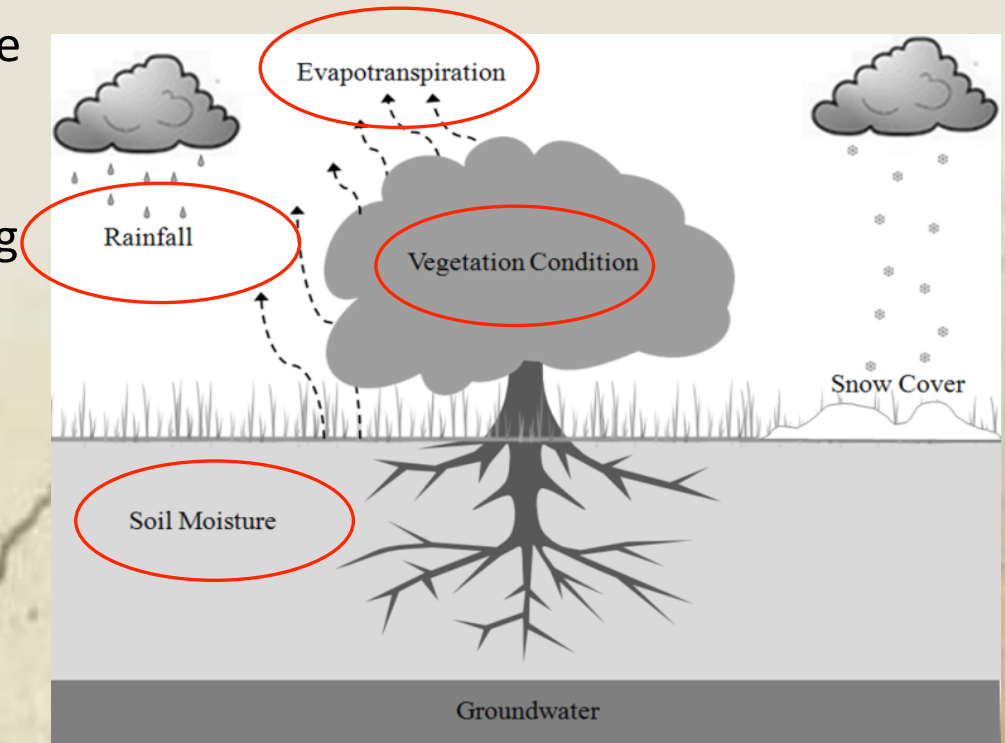


Emerging Satellite-based Observations and Products

Over just the past 5+ years, a number of satellite remote sensing-based tools and **products characterizing different parts of the hydrologic cycle that influence drought conditions** allowing new composite drought indicators to be developed.

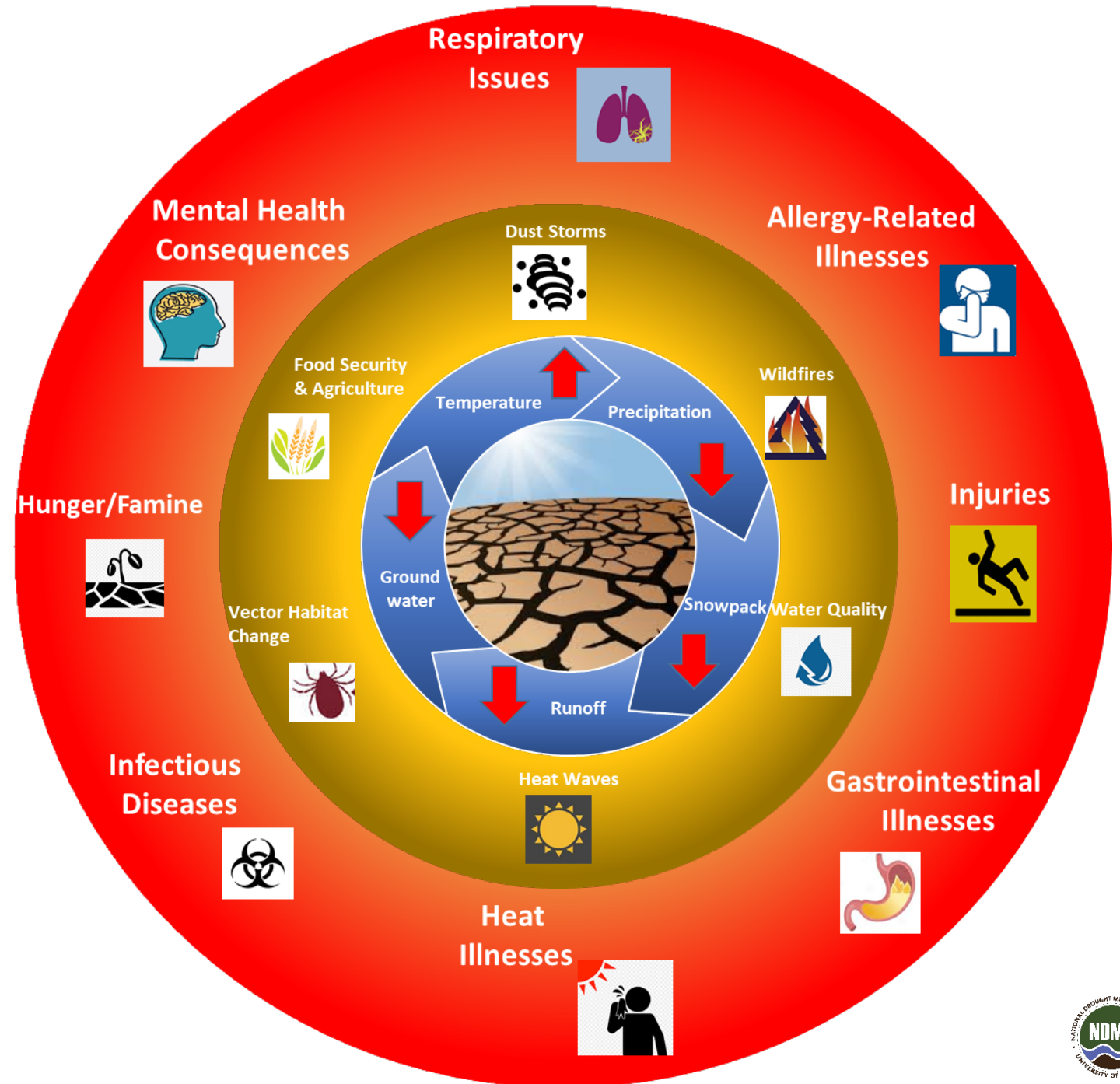
Examples

- Evaporative Stress Index (ESI)
- Quick Drought Response Index (QuickDRI)
- Evaporative Demand Drought Index (EDDI)
- GRACE soil moisture and groundwater anomalies
- Vegetation Drought Response Index (VegDRI)



Drought and Health Effects in a warming world...

Slide courtesy of Dr. Jesse Bell, University of Nebraska Medical Center



Droughtreporter.unl.edu

Launched in 2005 as nation's on-line archive of drought impacts:
>75,000 reports and >35,000 impacts in our database.

Reports from media, individual observers ("Users," CoCoRaHS), agencies

Searchable by time, place, scale, category, term

Establish a drought impact **"baseline":**

- Face of drought
- Risk/vulnerability
- Climate change

Moderated @ NDMC

Wilhite, Donald A., Mark D. Svoboda, and Michael J. Hayes. "Understanding the complex impacts of drought: a key to enhancing drought mitigation and preparedness." *Water resources management* 21.5 (2007): 763-774. <http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1042&context=droughtfacpub>

NDMC NATIONAL DROUGHT MITIGATION CENTER

NDMC Drought Impact Reporter

Map | **Advanced Search** | **Submit a Report** | **About the DIR** | **Help**

Refresh

Impacts & Reports | **Overlays**

Scales

- ☐ National
- ☐ Multistate
- ☐ State
- ☒ County
- ☐ City

Impacts

- ☒ Impacts
- ☐ Reports
- ☐ Drought Declarations

Time Period

Customize

Start: 01-01-2012

End: 12-31-2012

Location

State: All States

Categories

Report Types

All States | 01-01-2012 - 12-31-2012

Impact Counts | **Impacts List | Page 1/174** | **Report Counts** | **Reports List | Page 1/324**

County Impacts | All States 1731

Category	
<input checked="" type="checkbox"/> Agriculture	1038
<input checked="" type="checkbox"/> Energy	17
<input checked="" type="checkbox"/> Plants & Wildlife	537
<input checked="" type="checkbox"/> Society & Public Health	187
<input checked="" type="checkbox"/> Water Supply & Quality	579
<input checked="" type="checkbox"/> Business & Industry	76
<input checked="" type="checkbox"/> Fire	324
<input checked="" type="checkbox"/> Relief, Response & Restrictions	388
<input checked="" type="checkbox"/> Tourism & Recreation	143

Report Source

<input checked="" type="checkbox"/> Media	838	<input checked="" type="checkbox"/> User	241
<input checked="" type="checkbox"/> Other Agency	47	<input checked="" type="checkbox"/> NWS	24
<input checked="" type="checkbox"/> Hawaii	13	<input checked="" type="checkbox"/> CoCoRaHS	579

Current/Future Drought Management Concerns

Past drought management efforts have been **reactive** (costly, untimely, ineffective & poorly coordinated).

Impacts are increasing and becoming **increasingly complex** across sectors, demonstrating increasing vulnerabilities...yet, impact assessments are lacking and/or no consistent methodology is present, therefore the **costs/losses of drought are not well documented**.

How do we tie together (e.g., **“triggers”**) the 3 pillars of Drought Risk Management elements?

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?**



Take away message...

The linkages between drought, water and food security, energy and climate change illustrates a nexus of complex problems....and ***solutions are going to depend on a combination of technology and integrated information that partnerships and networks provide.***



Thank You! Any Questions?



DROUGHT.UNL.EDU

e | ndmc@unl.edu

f /NationalDroughtMitigationCenter

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Mark Svoboda
msvoboda2@unl.edu
402-472-8238

