NOAA • NESDIS JPSS Joint Polar Satellite System

SUOMI NPP/VIIRS: Improve drought watch, crop losses prediction and food security

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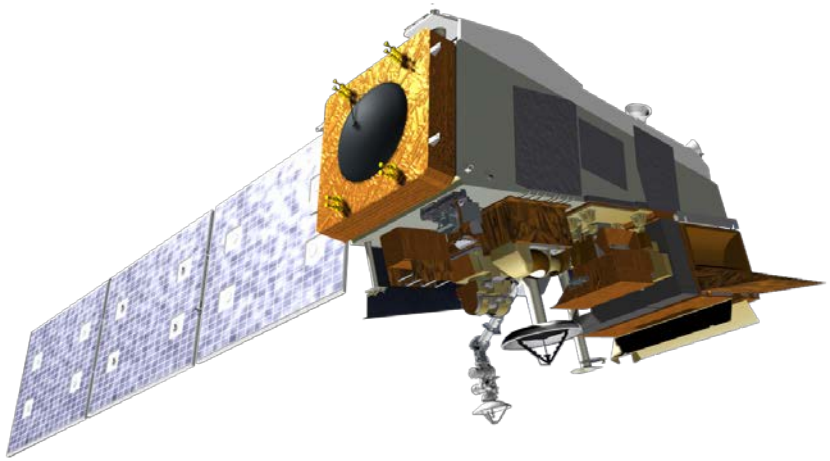
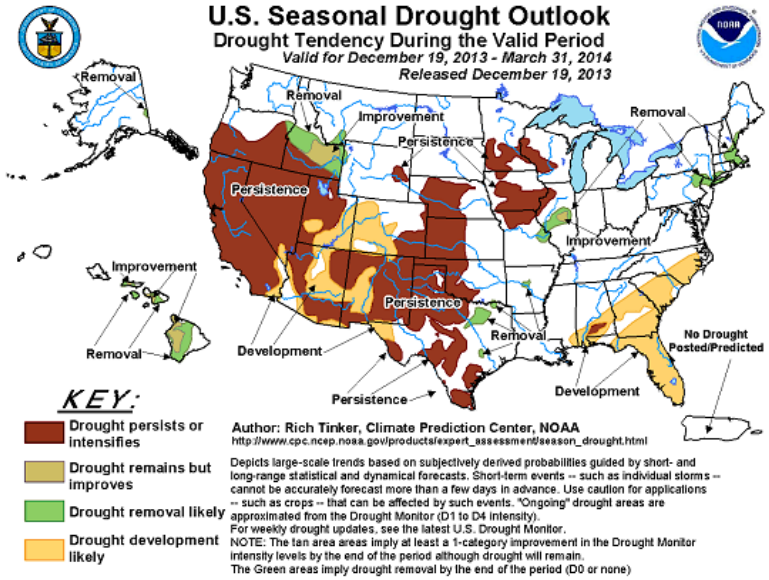


Lake Oroville looks more like a puddle than a lake these days. (All Photos: California Department of Water Resources)

Information drives decisions

- A bad environmental decision can impact lives, property and segments of the economy for years.
- What if there were no weather warnings or forecasts, tsunami and flood alerts, fire and drought reports and predictions, ice monitoring or harmful algal bloom assessments?
- Better information is usually tied to better observations, modeling and computer resources.
- Decision support tools are essential and information must be easy to comprehend.



From Satellites to Agricultural Decisions

Satellite Products that Support Agricultural Decisions

- Vegetation health products
- Soil moisture, land surface temperature
- Land type
  - arid vs. semi arid
- Snow cover and snow water equivalent
  - water resources
- Precipitation
  - especially important for areas without radar
- Global assessments and historical perspective

Drought affects Global Food Security by reducing agricultural production below consumption. Since 2000, this occurred 8 years out of 15.

Examples of Decisions from Drought Assessments and Predictions

Farmers

- When and what to plant
- Plant density
- Irrigation timing and amount
- Pesticides and fertilization
- Expected yield and harvesting decisions
- Impacts on livestock

Buyers

- Anticipate productivity
- Global, Regional vs. local purchasing

Humanitarians

- Anticipated drought regions
- Impact on communities
- Planning relief efforts

Characteristics of a Drought

- Affects the largest number of people
- Has the largest impact in costs
- Natural part of the earth's climate
- Occurs every year
- Does not recognize borders, political & economic differences

- Unique features
  - –Starts unnoticeably
  - –Builds-up slowly
  - –Develop cumulatively
  - –Impact cumulative & not immediate observable
  - –When damage is evident its too late mitigate the consequences
  - –Drought type: Meteorological, Agricultural, Hydrological, Socio-economic

1967 – 1991 : 2.8 billion people impacted by Natural Disasters, 3.5 million killed

Drought 51% affected, 38% killed; Flood (38, 9), Hurricanes (8, 27), Earthquake (2, 18)

Drought - Data and statistics

A 'pre-designed' summary and profile of disasters reported for a particular hazard including a summary of events from 1980 to September 2008 , as well as the top 10 disasters.

Data related to human and economic losses from disasters that have occurred between 1980 and 2008.

Please see also Drought Risk profile

Drought disasters from 1980 - 2008

Overview

No of events:	410
No of people killed:	558,565
Average people killed per year:	19,261
No of people affected:	1,551,455,112
Average people affected per year:	53,498,452
Ecomomic Damage (US$ X 1,000):	76,949,488
Ecomomic Damage per year (US$ X 1,000):	2,653,431

Top 10 Disasters Reported

Affected people

Disaster	Date	Affected (no. of people)
India	2002	300,000,000
India	1987	300,000,000
India	1982	100,000,000
China P Rep	1994	82,000,000
China P Rep	2002	60,000,000
India	2000	50,000,000
China P Rep	1988	49,000,000
China P Rep	2003	48,000,000
Iran Islam Rep	1999	37,000,000
Kenya	1999	23,000,000

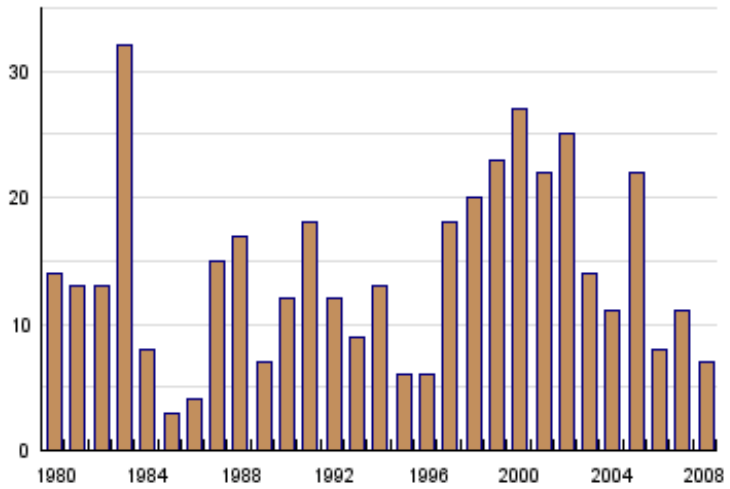
Killed people

Disaster	Date	Killed (no. of people)
Ethiopia	1983	300,000
Sudan	1983	150,000
Mozambique	1981	100,000
China P Rep	1991	2,000
China P Rep	1988	1,400
Indonesia	1997	672
Somalia	1987	600
Malawi	2002	500
Swaziland	1981	500
Ethiopia	1987	367

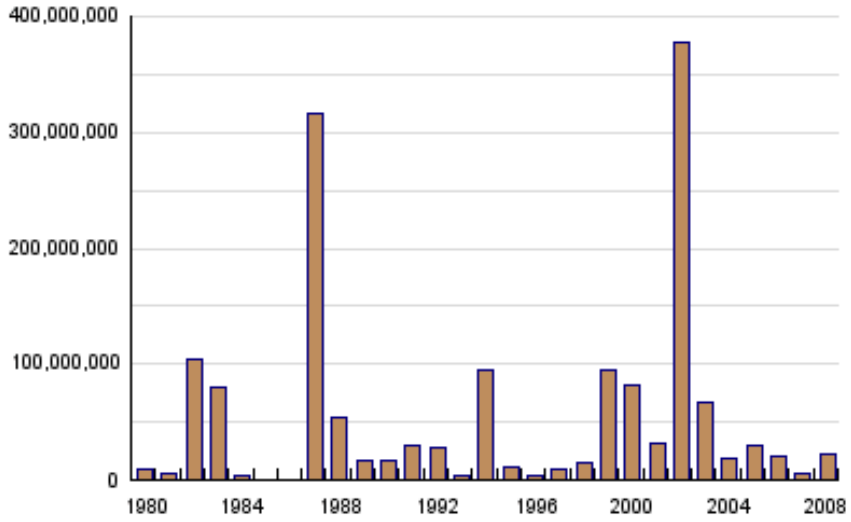
Economic damages

Disaster	Date	Cost (US$ X 1,000)
China P Rep	1994	13,755,200
Australia	1981	6,000,000
Spain	1990	4,500,000
United States	2002	3,300,000
Iran Islam Rep	1999	3,300,000
Spain	1999	3,200,000
China P Rep	2006	2,910,000
Zimbabwe	1981	2,500,000
Australia	2002	2,000,000
Brazil	2004	1,650,000

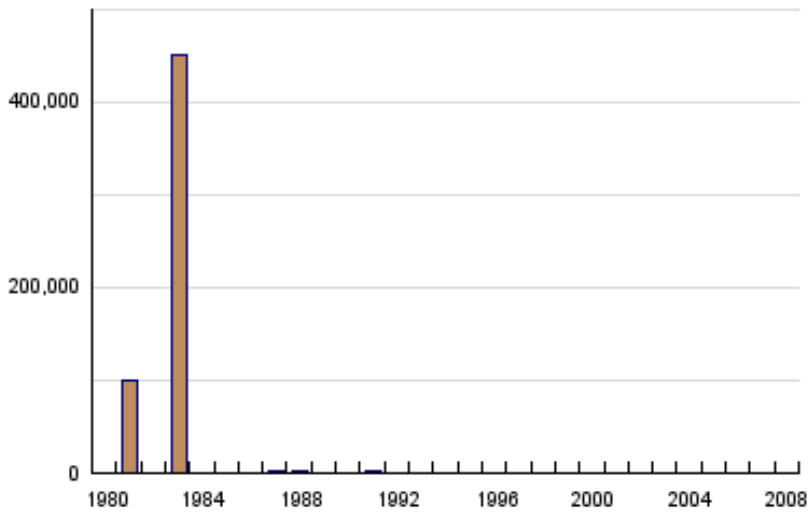
Number of events reported



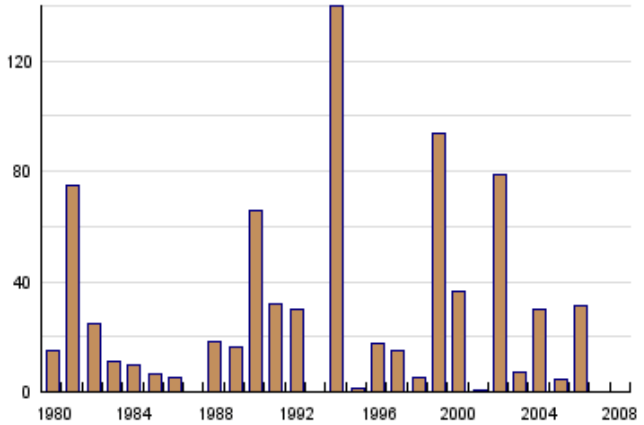
Number of people affected



Number of people killed



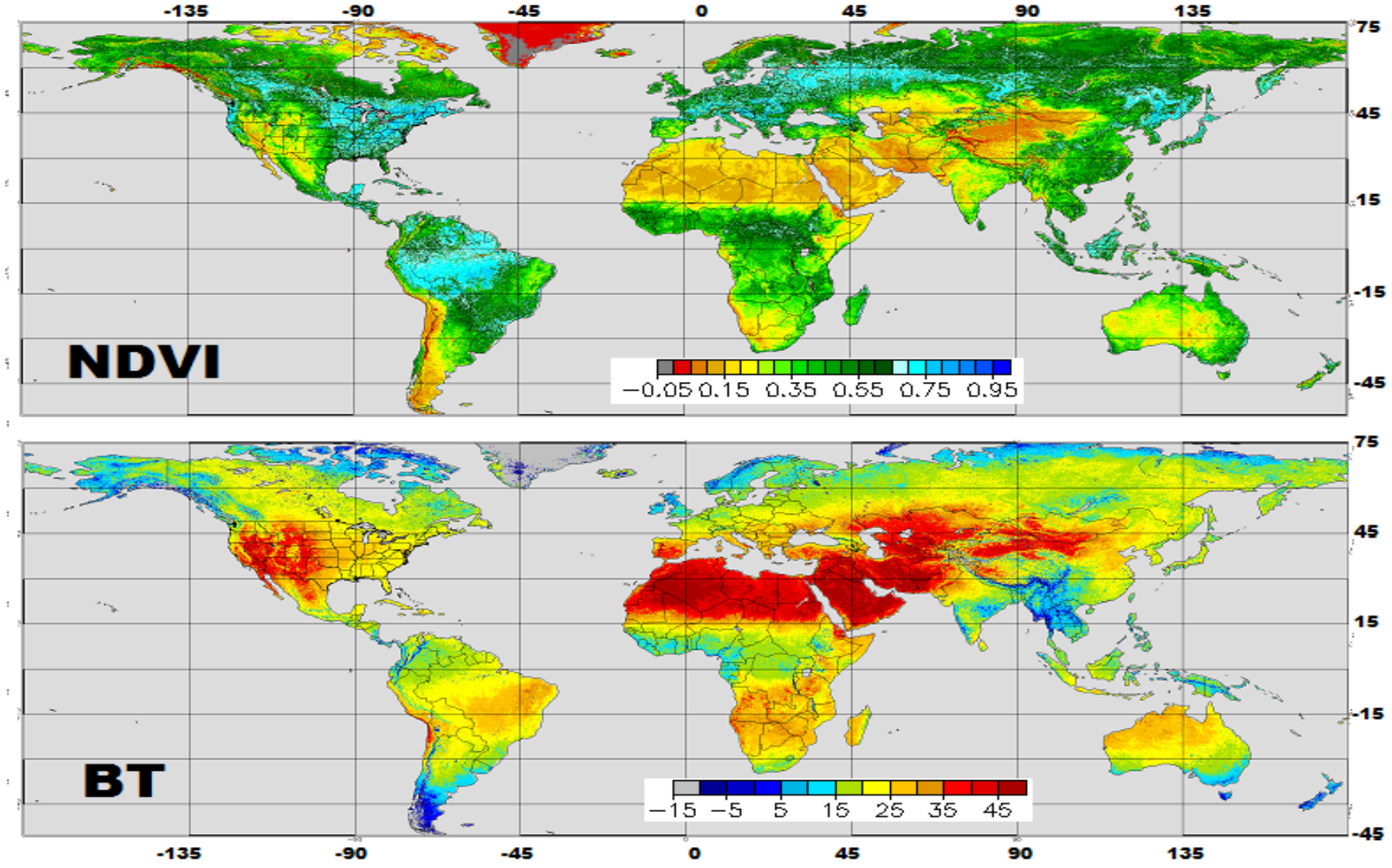
Reported economic damages (US$ in billion)



More information and data on: www.emdat.be/

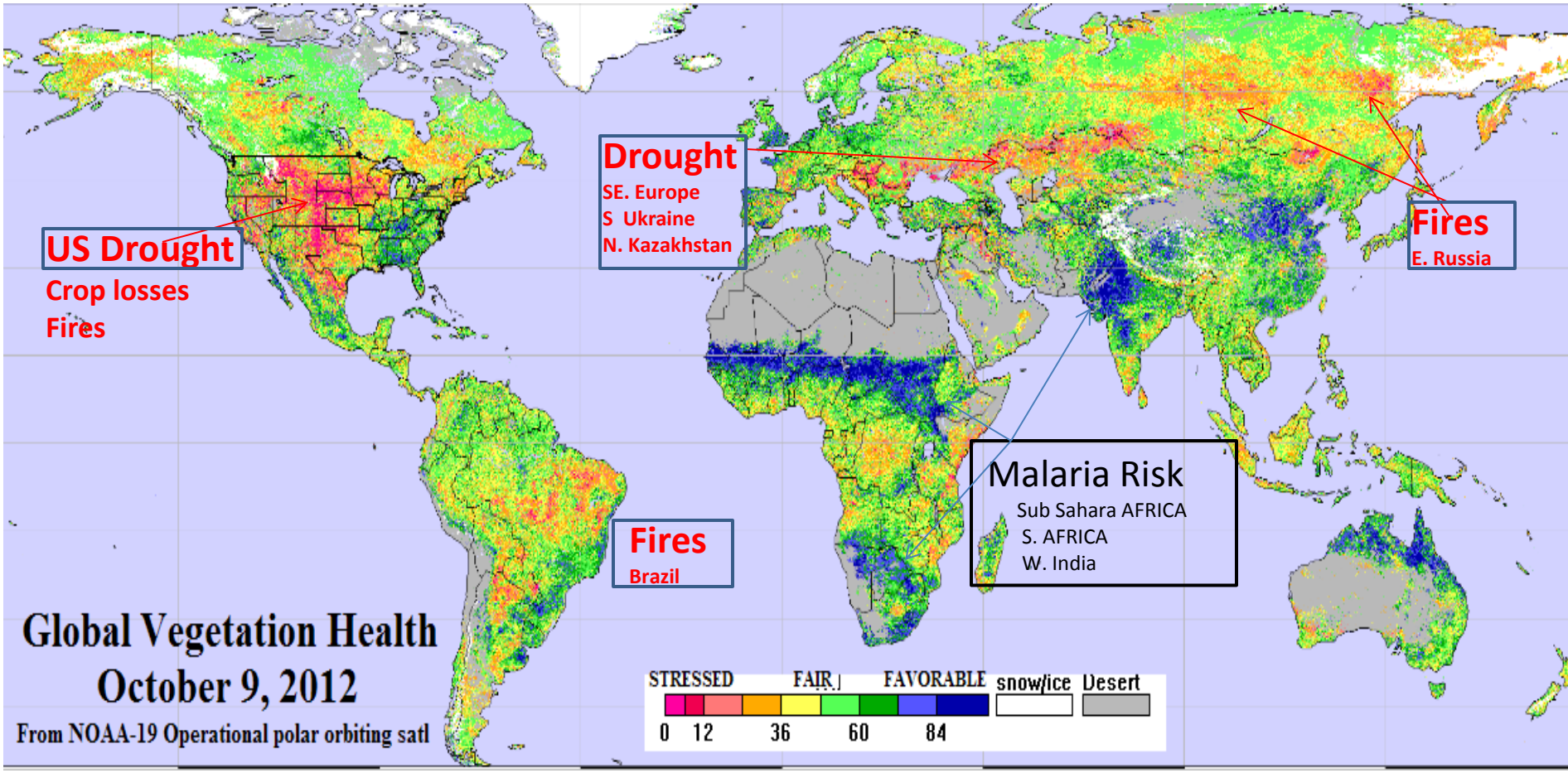
Source of data: "EM-DAT: The OFDA/CRED International Disaster Database, Universit◆ catholique de Louvain, Brussels, Bel."
Data version: v11.08

WE START FROM: Normalized Difference Vegetation Index (NDVI) & Brightness Temperature (BT)



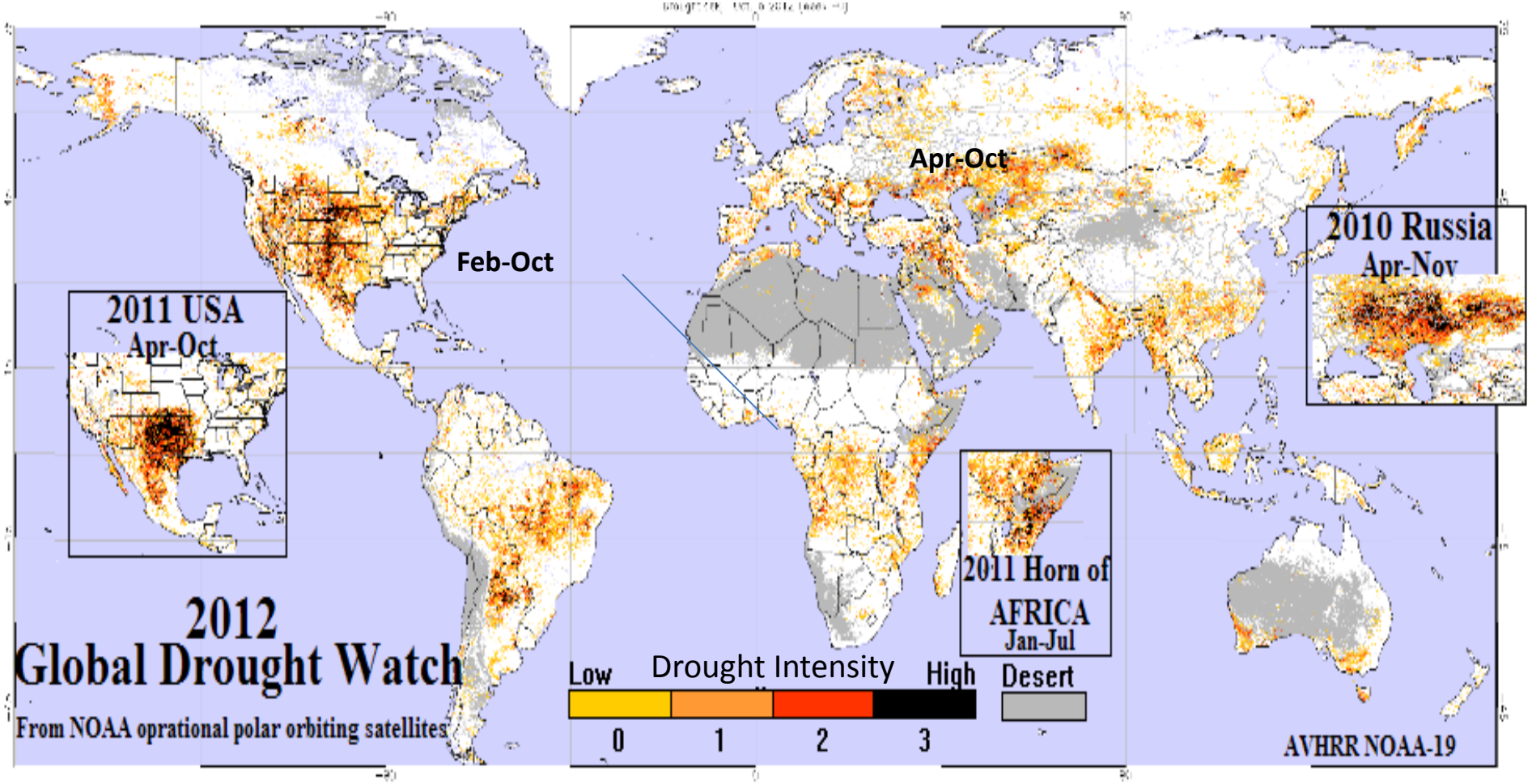
WE PRODUCE: Global Vegetation Health (VH)

From AVHRR/NOAA-19 Operational Polar Orbiting Satellite



http://www.star.nesdis.noaa.gov/smcd/emb/vci/VH/index.php

EXAMPLE: Global Droughts from operational satellites



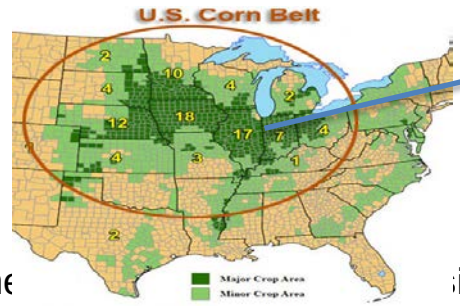
2012- Extreme drought in the USA, southern UKRAINE, northern KAZAKHSTAN,
- Severe drought in eastern INDIA, Kenya & South Americe

2011 – Exceptional drought in Texas (USA) and the Horn of AFRICA

2010 - Exceptional drought in RUSSIA and UKRAINE

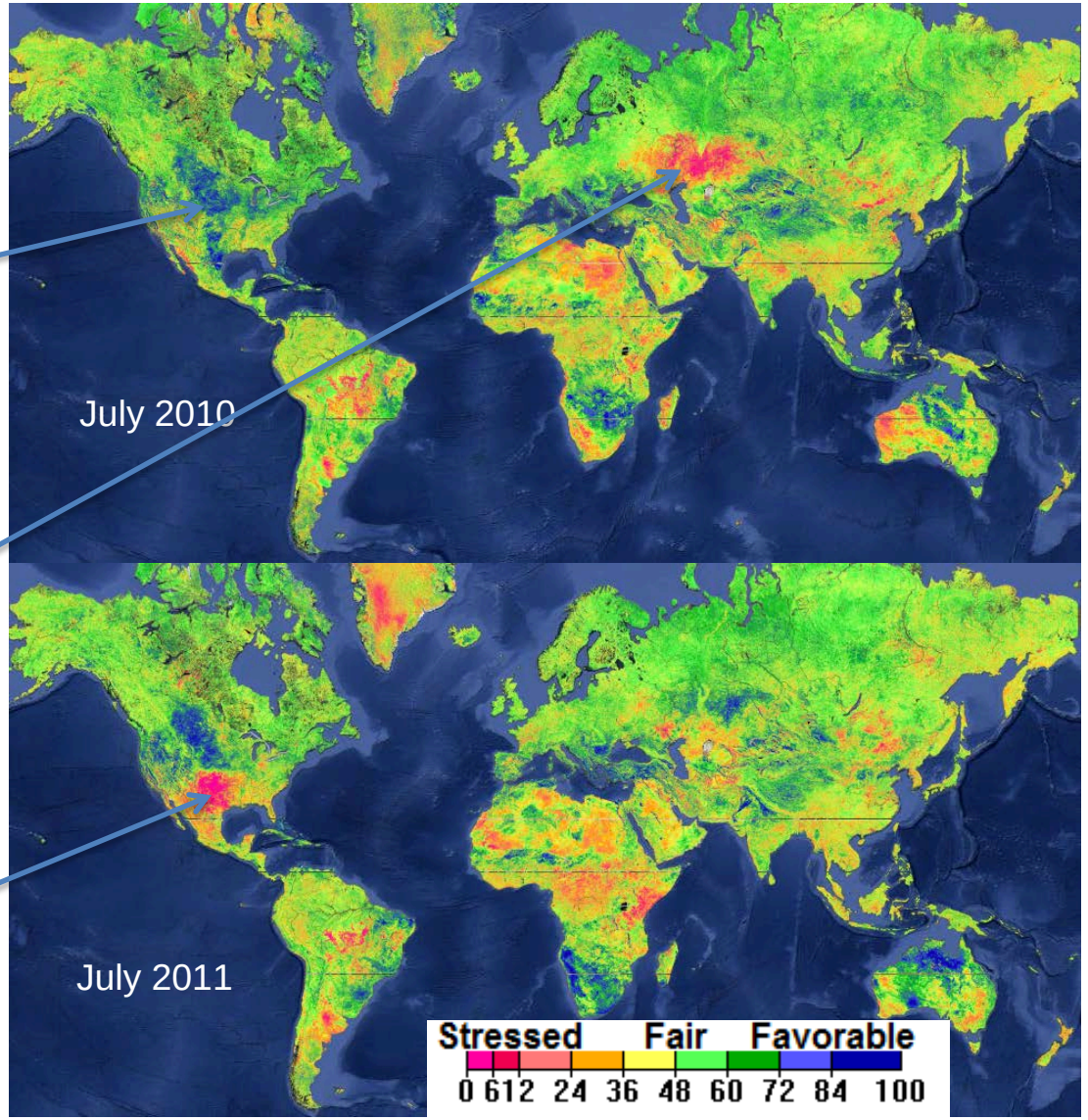
Vegetation Health from AVHRR

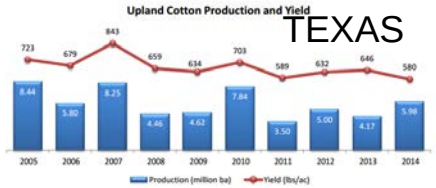
IMPACTS:
U.S. corn production in 2010
Hit a record high.



Whe **ia**,
32% in
the **Ukraine**.

Texas cotton production fell by more than half, from 7.84 million bales in 2010 to 3.5 million in 2011.





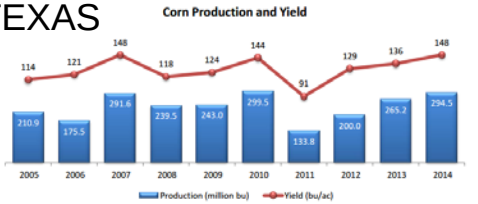
TEXAS

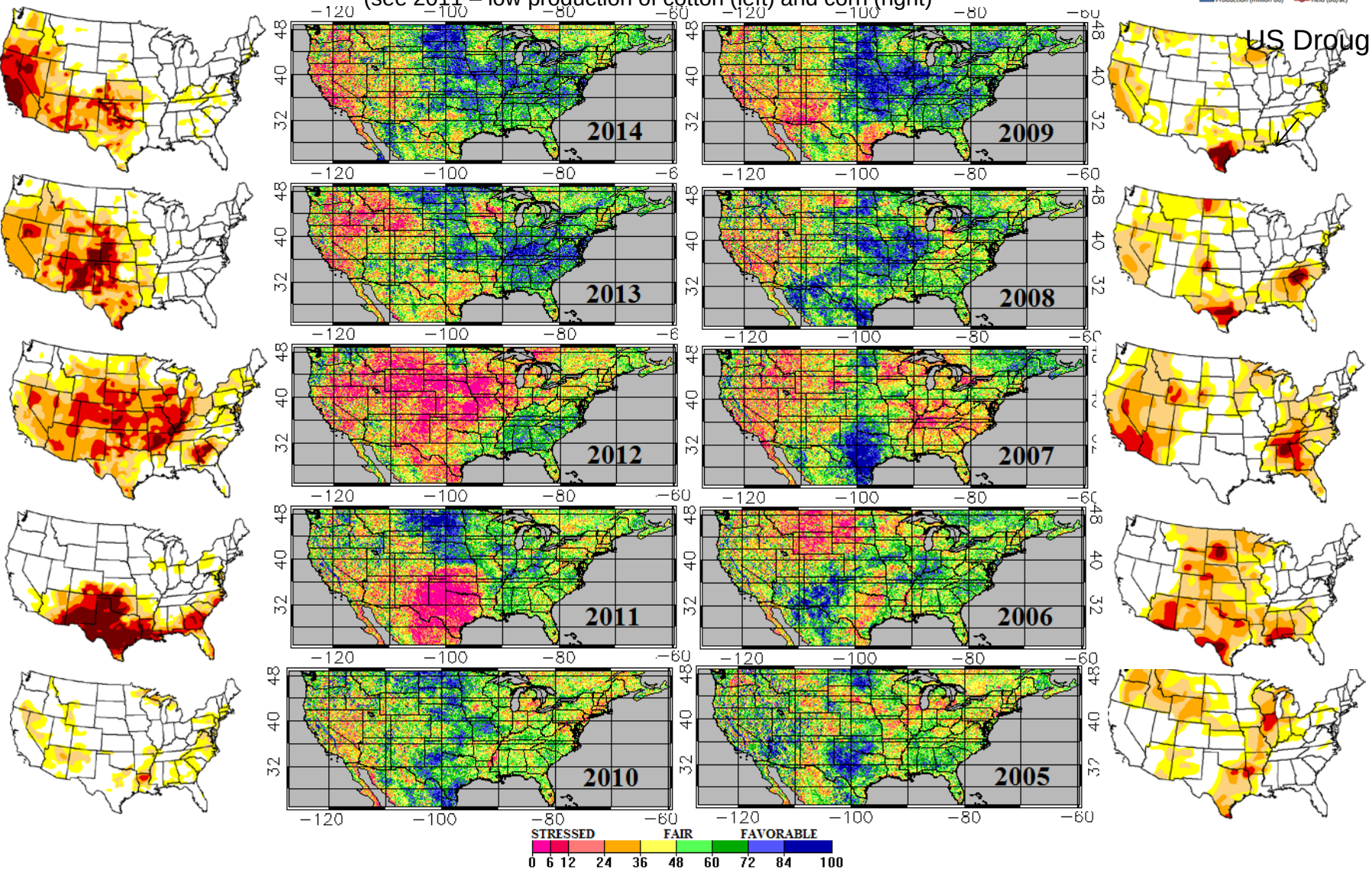
This slide shows a comparison of the US Drought Monitor vs AVHRR vegetation health (VH) (Magenta is high vegetation stress, and blue is excellent –favorable vegetation health.

Often the US Drought Monitor and VH agree

The VH over Texas correlate well with agriculture productivity (see 2011 – low production of cotton (left) and corn (right)

TEXAS

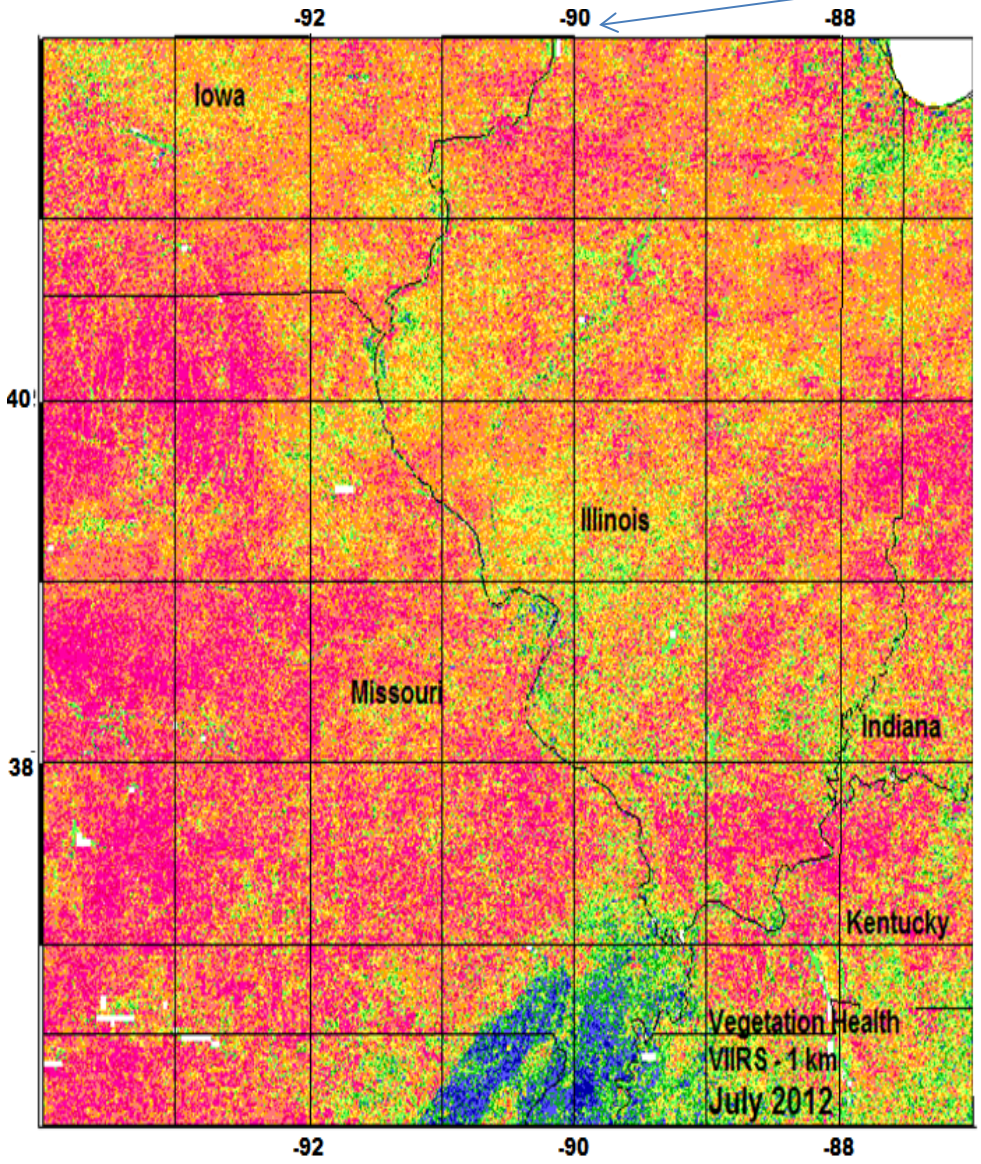


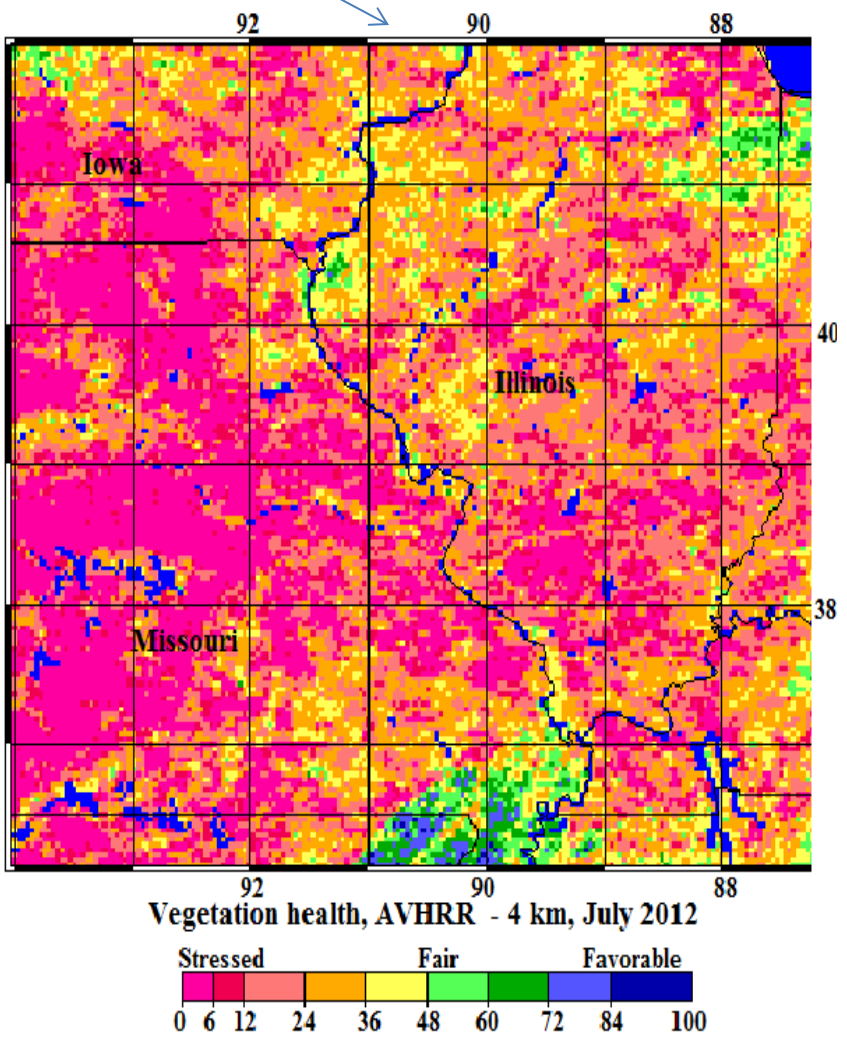


US Drought Monit

Vegetation Health

Vegetation Health AVHRR vs VIIRS





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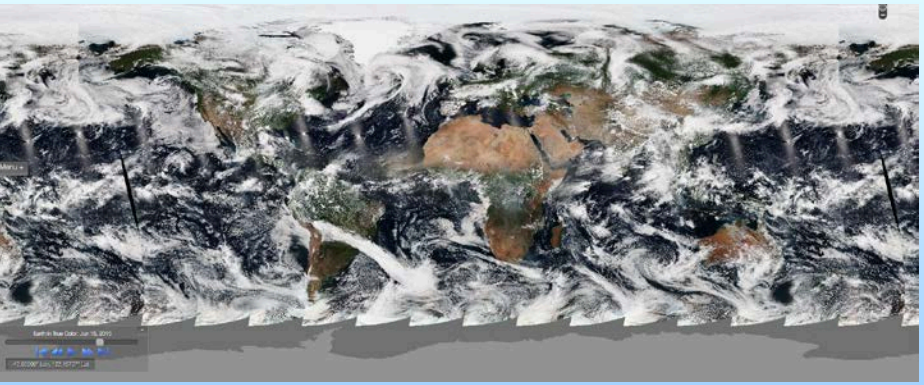
Irrigated vegetation is clearly seen in the imagery.

What is needed is the departure from climatology

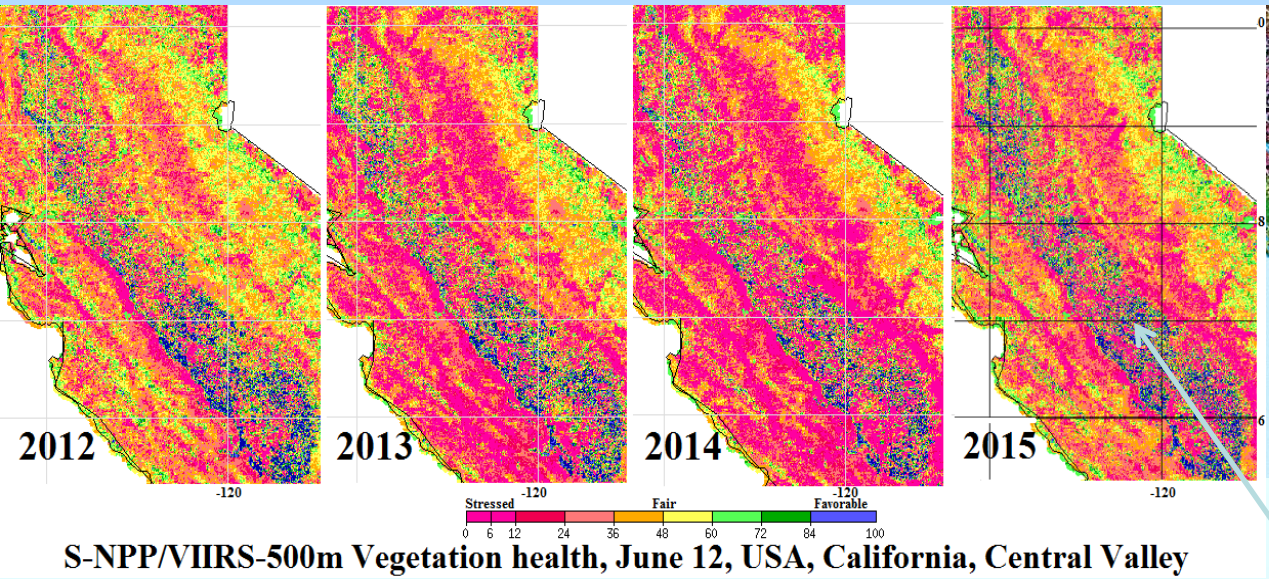
This is provided by the vegetation health product



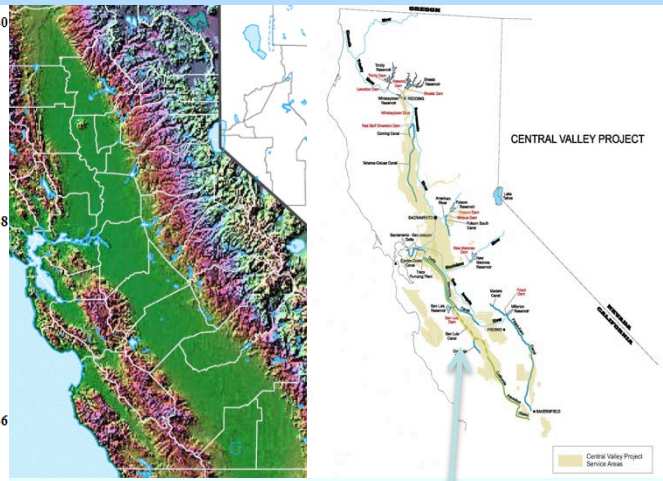
http://www.nnvl.noaa.gov/view/#TRUE

VIIRS True Color Imagery June 11, 2015

VIIRS 500m resolution gridded vegetation health (VH) provides indication of vegetation stress - VH is a departure index from a 30 year climatology based on AVHRR



S-NPP/VIIRS-500m Vegetation health, June 12, USA, California, Central Valley



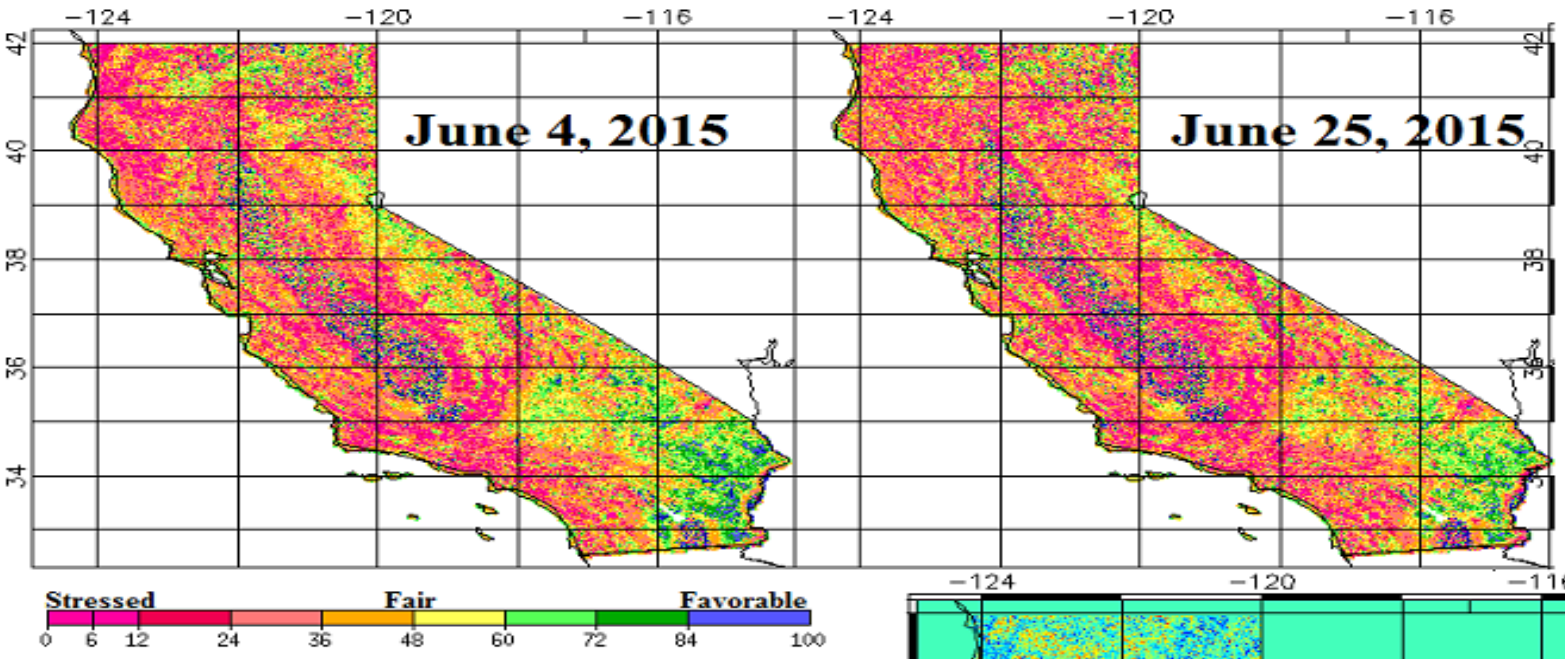
June 2012 -2015 Vegetation Health – Note improvement in 2015 due to late spring precipitation which increased vegetation. (temporary reprieve since snow pack is low and dry summer setting up).

NOAA Service Report on the 2014 California Drought included the need to use remote sensing for assessments of temporal changes in the Central Valley configuration, channel shapes, vegetation cover….

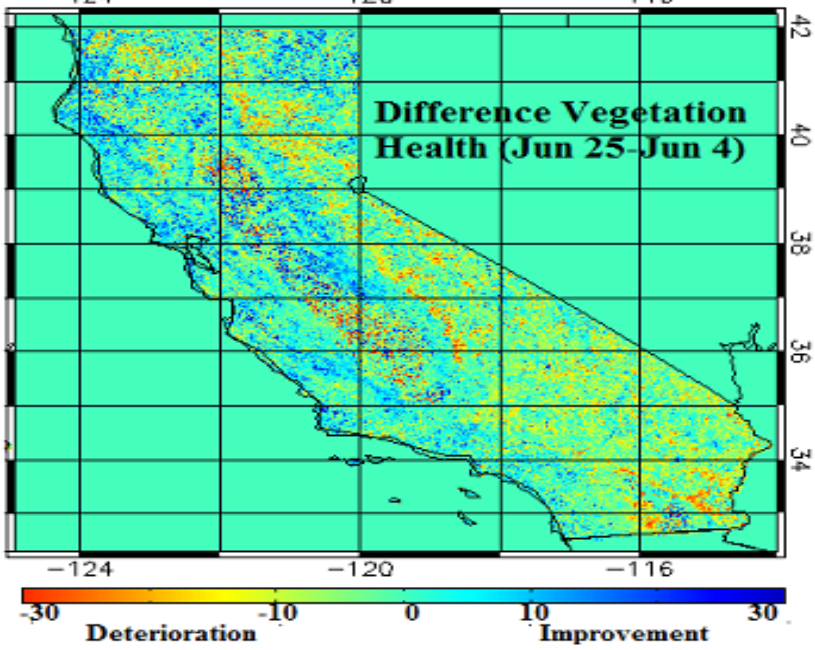
Blue areas show irrigation, If irrigation is cutback, depending on the magnitude, VIIRS VH maps in the central valley can be used for monitoring

Irrigation areas shown in upper right map

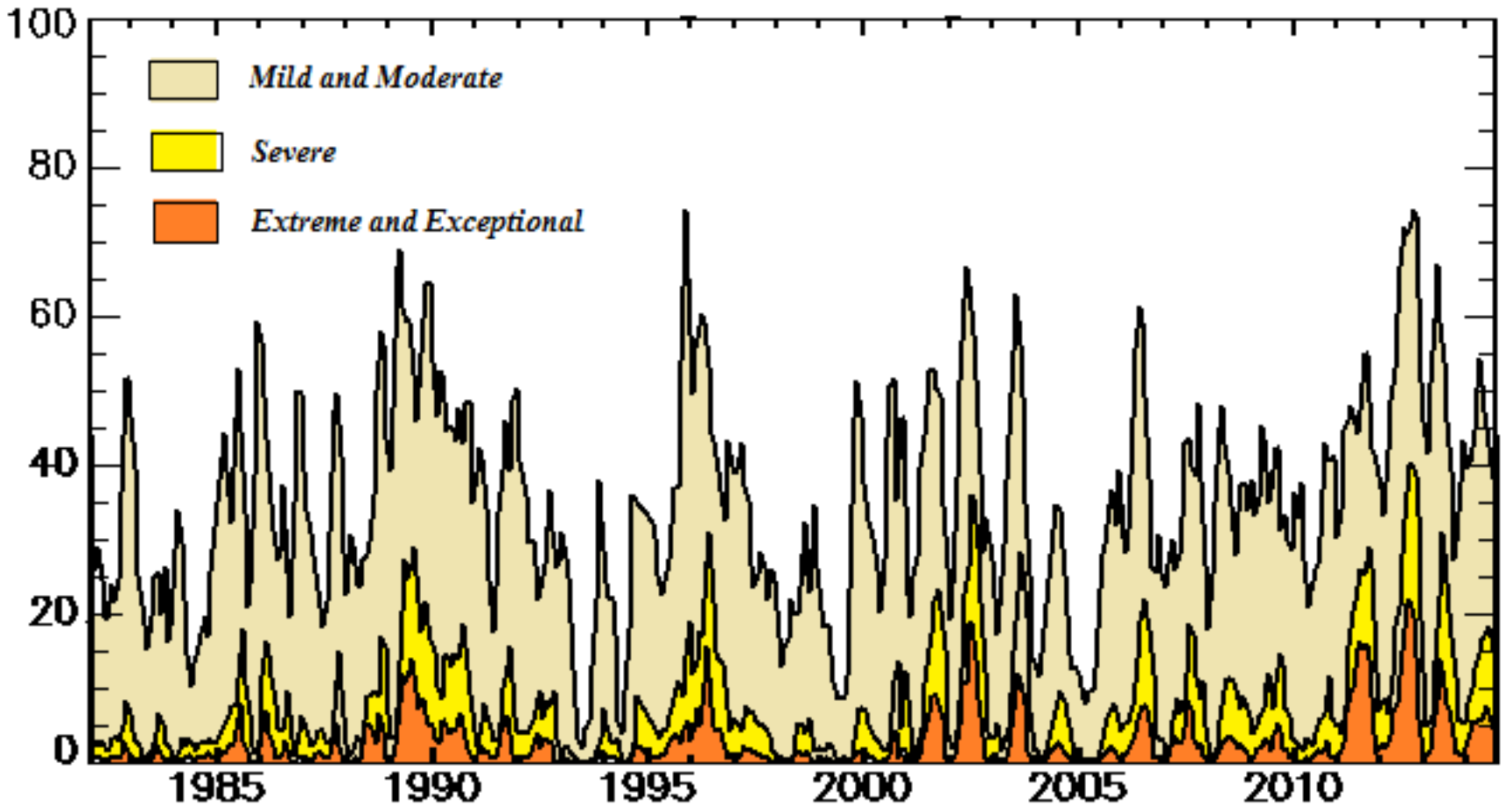
Vegetation Health California June 2015



Vegetation Health
S-NPP/VIIRS 500 m
California

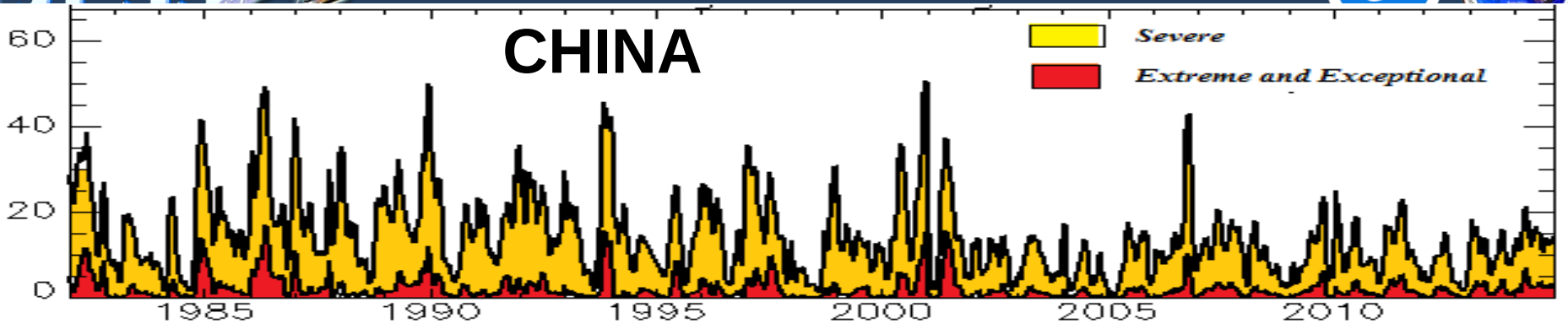


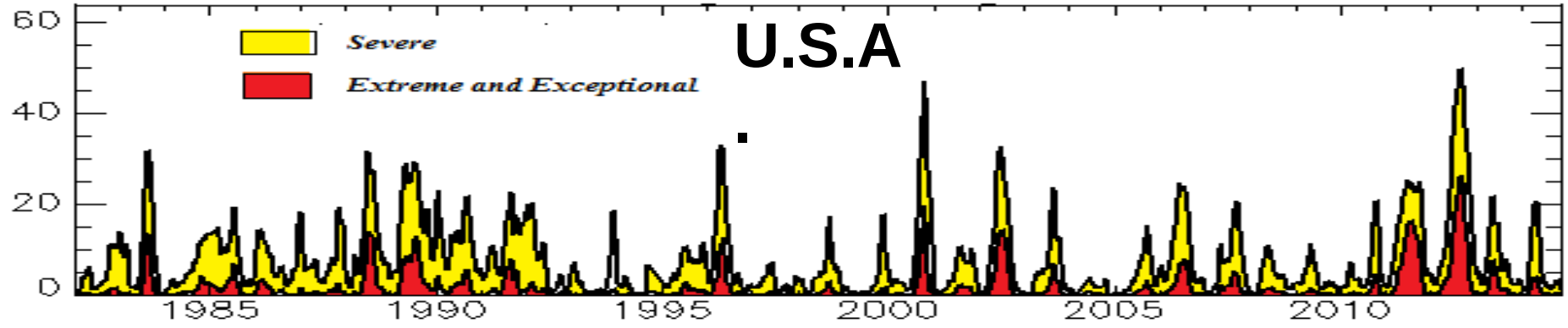
Percent Western US under Drought

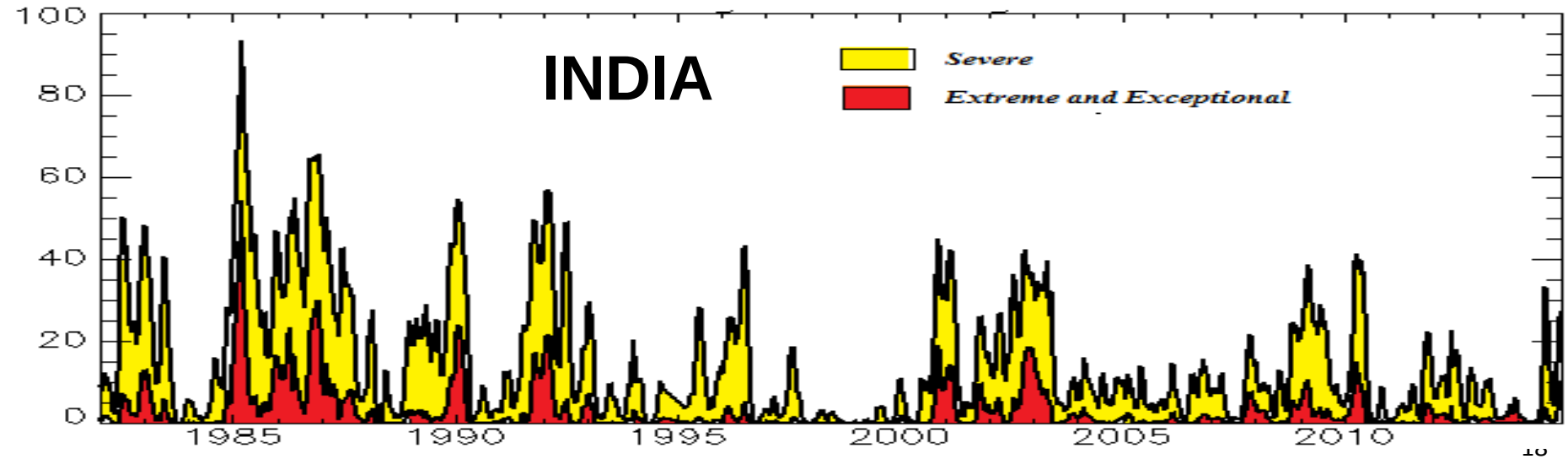


Drought Area & Intensity by weeks: Western United States, 1982-2014

Percent Drought-affected Grain Crop Area







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  - CMORPH Rain Rate Daily
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  - Snow Map Weekly
  - Equatorial Crossing Time
  - META data in XML
  - Monitor Product Quality
- Team Members

»VH from S-NPP/VIIRS Study

»AQUA/MODIS VH

»Sensitivity Study

News

NPP first images for land cover was obtained on 11/21/2011

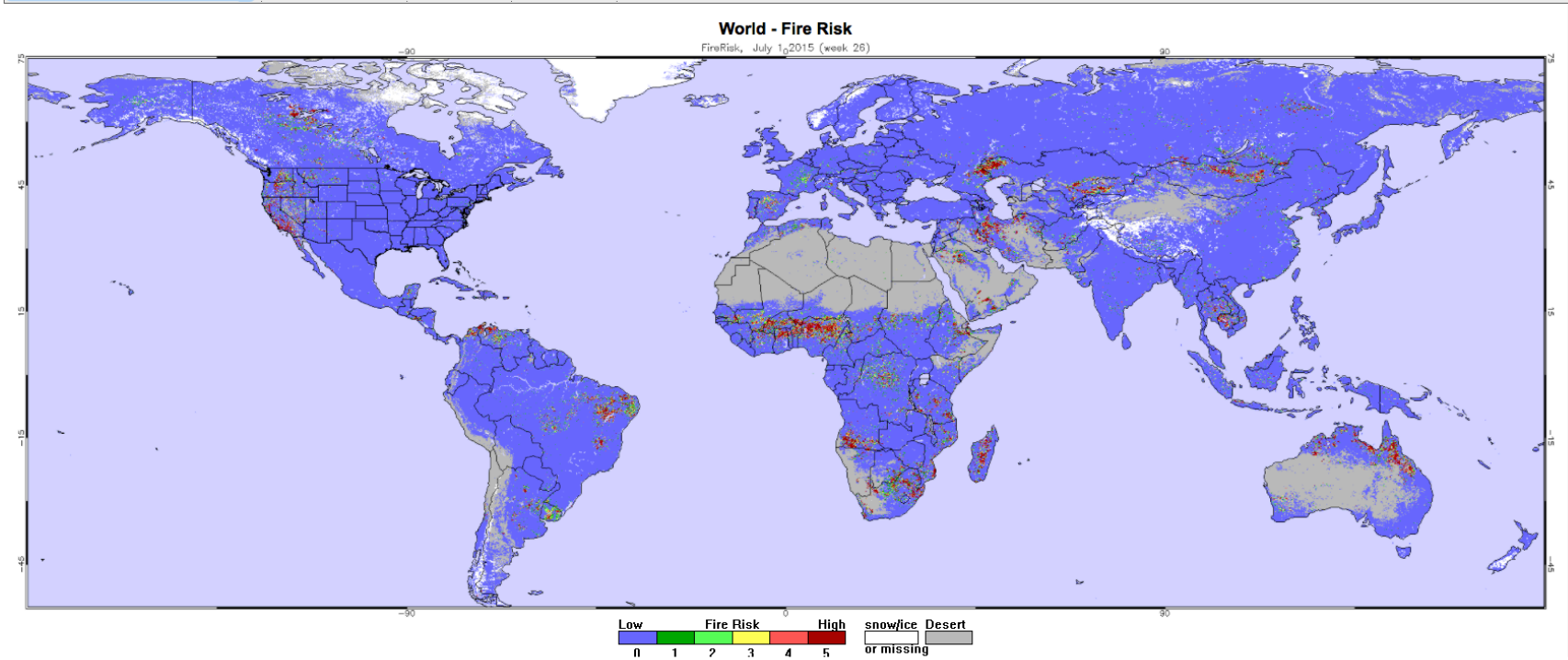
NPP VIIRS 500m GVI data were produced since May 2, 2012 to now

Data and images displayed on STAR sites are provided for experimental use only and are not official operational NOAA products. More information>>

STAR - Global Vegetation Health Products :

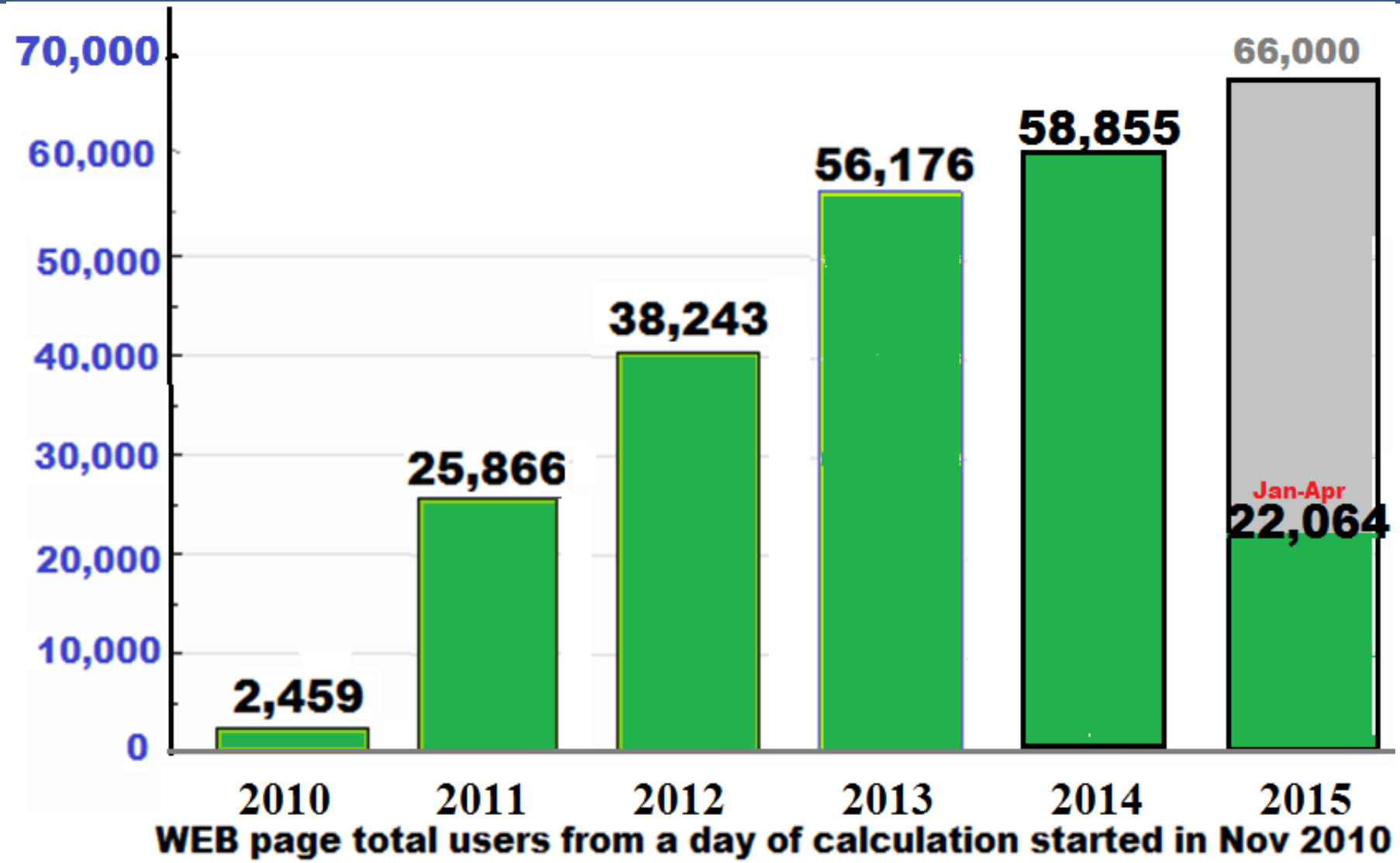
Browse Archived Images: Please select an **Image Type**, **Region**, **Year** and **Week**.

Data type	Region	Year	Week
Fire Risk	World	2015	26



http://www.star.nesdis.noaa.gov/smcd/emb/vci/VH/index.php

Global Users: Vegetation Health WEB



http://www.star.nesdis.noaa.gov/smcd/emb/vci/VH/index.php

Remarks

Severe Droughts - Reduces Global Grain Production 4-7% every 4-6 years; Moderate Drought – Reduces Grain 1-3% every 2-3 years

Satellite-based Vegetation Health (VH) Technology Provide Tools for Drought Monitoring & 1-2 Month Advanced Prediction of its Start/End, Area, Intensity, Duration and Impacts

VH Provide Prediction of Drought-related Crop & Pasture Losses: (a) 1-2 Months in Advance of Harvest, (b) During ENSO years 3-4 months prediction

Drought Area & Intensity has not Changed during the Period of Strong Global Warming