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Forum for Agricultural Risk Management in Development

WEBINAR SERIES

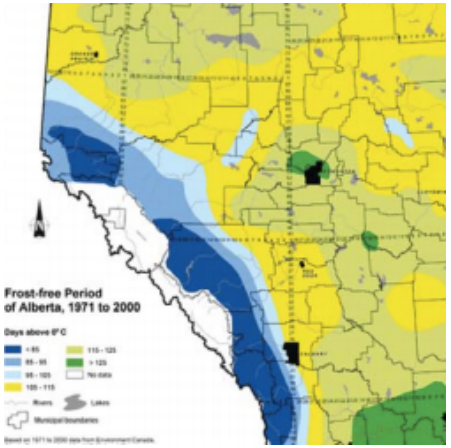
MANAGING VULNERABILITY AND BOOSTING PRODUCTIVITY IN AGRICULTURE THROUGH WEATHER RISK MAPPING

By Carlos Arce & Edgar Uribe

Washington DC, United States, April 8th , 2015

WORLD BANK GROUP

Managing Vulnerability and Boosting Productivity in Agriculture Through Weather Risk Mapping



Agricultural Risk Management Team
Agriculture Global Practice
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Swiss Confederation

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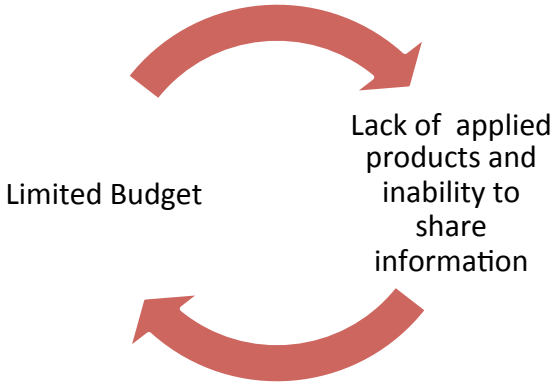
Objective and current situation

- Developing countries have limited information
  - Limited data and infrastructure
  - Quality issues
  - Reluctance to share information due to cultural and technical restrictions
- National Weather Services (NWSs) invest most of their time in day-to-day operations
  - NWSs lack resources to develop and disseminate applied products
  - Farmers frequently report lack of support from NWSs.
- Most development practitioners focus on a few risk management strategies
- This paper identifies:
  - Alternative datasets
  - Mapping products

Vicious cycle in weather services from some Developing Countries



Datasets Proxies Examples

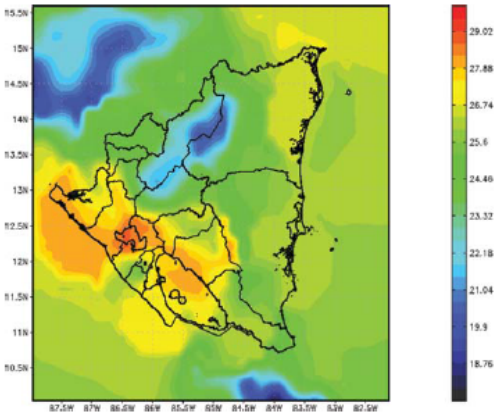
- Strongest advantage is, of course, availability.
  - Most of these datasets are free and publicly available online

Proxy	Type	Name	Strongest disadvantages
Satellite	Rainfall	TRMM	Running out of fuel; low resolution
Satellite	Rainfall	GPM	Backstory processing pending
Satellite	Vegetation Indices	LANDSAT, AVHRR, MODIS	Inconsistency (difficult to build complete time-series for some satellites)
Reanalysis (Models)	Climate	MERRA, NARR, ERA	Low resolution; ERA is not publicly available
Objective Analysis (Grids)	Climate	Weather Stations +Proxy	Weather station's data is difficult to be acquired
Satellite	Topography	SRTM, ASTER	Relatively low resolution (90m and 30m)
Crop Models	Yield	WRSI, AquaCrop, DNDC, EPIC, DSSAT	Info requirements increase with model complexity
Combination	Soil	Harmonized World Soil Database	Relatively low resolution
Combination	Land Cover	GLCC	Based on information from the 90's

Historical analysis

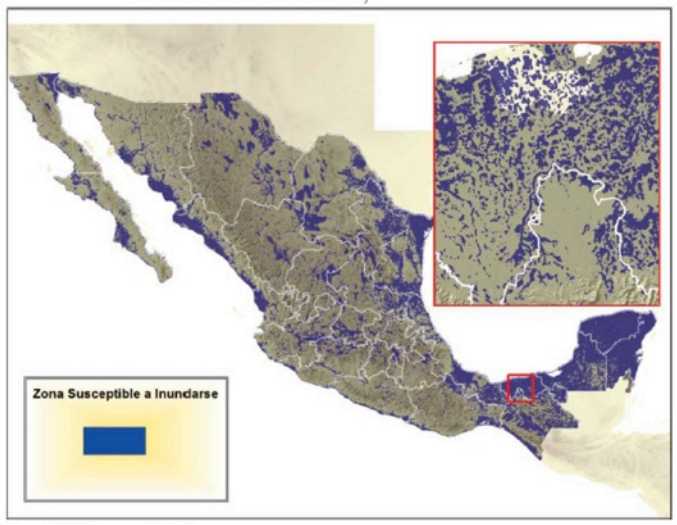
- Climatologies
  - Expected weather conditions (average)
  - Agricultural activities are strongly related to climatologies: sowing windows, crop periods, harvesting
- Hazard Maps
  - Probabilities, intensities or exposure to a given hazard
  - What regions (e.g. administrative units) are exposed to what hazards?

FIGURE 4.2. CLIMATOLOGY (1979–2008) OF AVERAGE TEMPERATURE (°C) OF NICARAGUA BASED ON AN OBJECTIVE ANALYSIS FROM THE WORLD BANK



Source: World Bank.

FIGURE 4.6. FLOOD-PRONE REGIONS OF MEXICO (URIBE ALCÁNTARA ET AL. 2010)

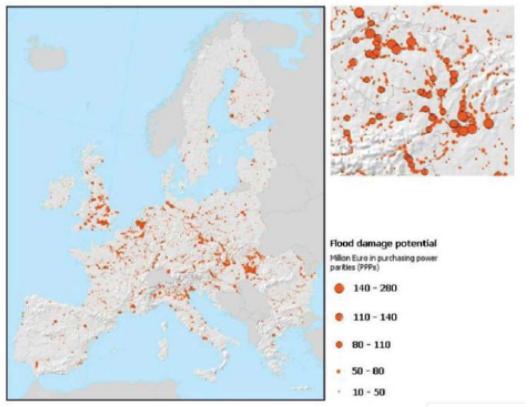


Source: Uribe Alcántara et al. 2010.

Historical analysis

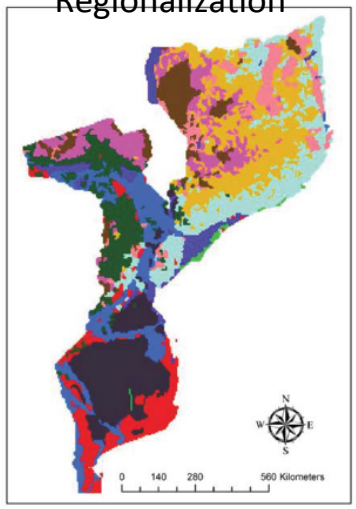
- Risk Maps
  - Probabilities of losing an asset due to a given hazard
  - Very infrequent because they need information about all the risk components:
    - Hazard, vulnerability and asset values ($)
- Regionalizations
  - Identify land units with similar properties (climatological, agronomic, etc.)
- All these maps help us associate a given condition to a region, which can help stakeholders in policy making and risk management.

FIGURE 4.7. MAP OF FLOOD DAMAGE POTENTIAL (MILLIONS OF EUROS IN PURCHASING POWER PARITIES) OF THE EUROPEAN UNION



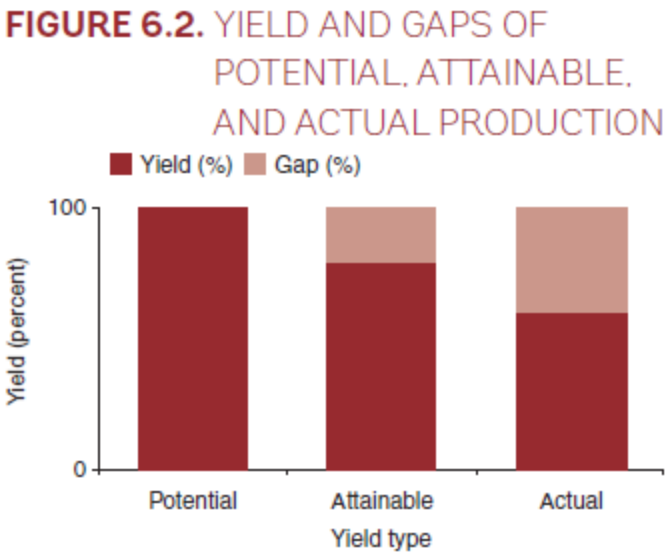
Source: European Commission Joint Research Centre Floods Portal (http://floods.jrc.ec.europa.eu/flood-risk.html).

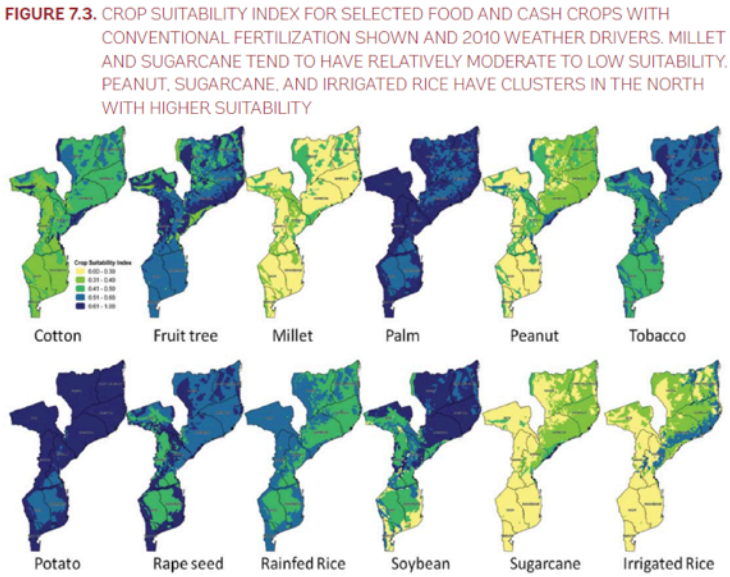
Regionalization



Historical Analysis: Agro-Ecological Zones

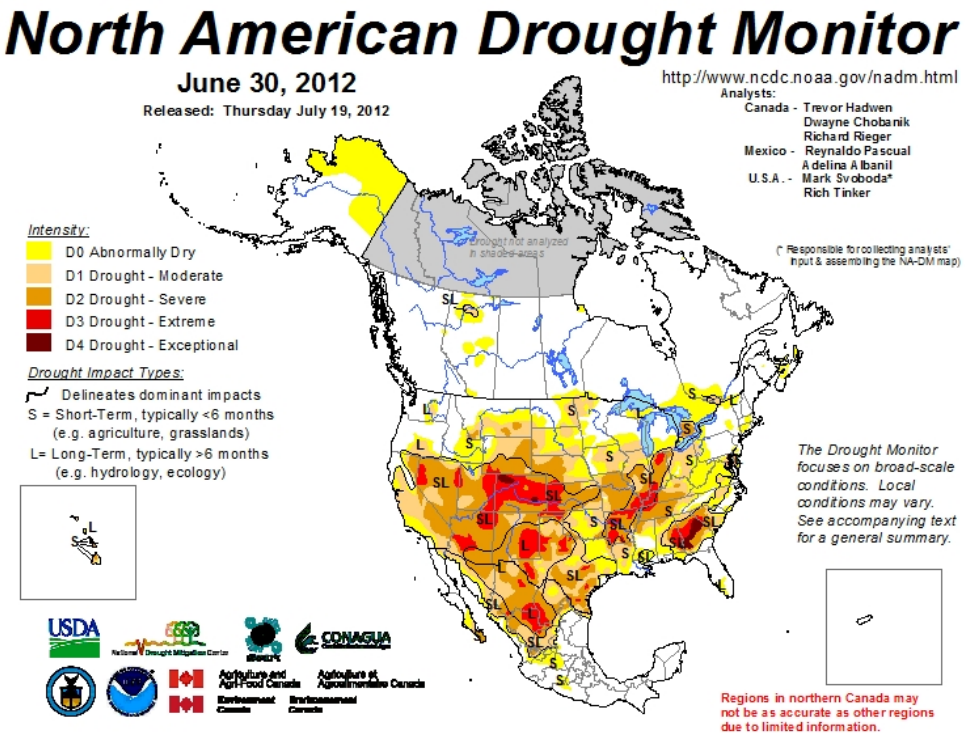
- Identification of land units with similar (FAO/IIASA, 1991):
  - Land suitability (crops)
  - Potential yield
  - Future conditions (e.g. climate change)
- Useful to asses and improve agricultural policy making and land use





Diagnostic and Forecasting Analyses (1/2)

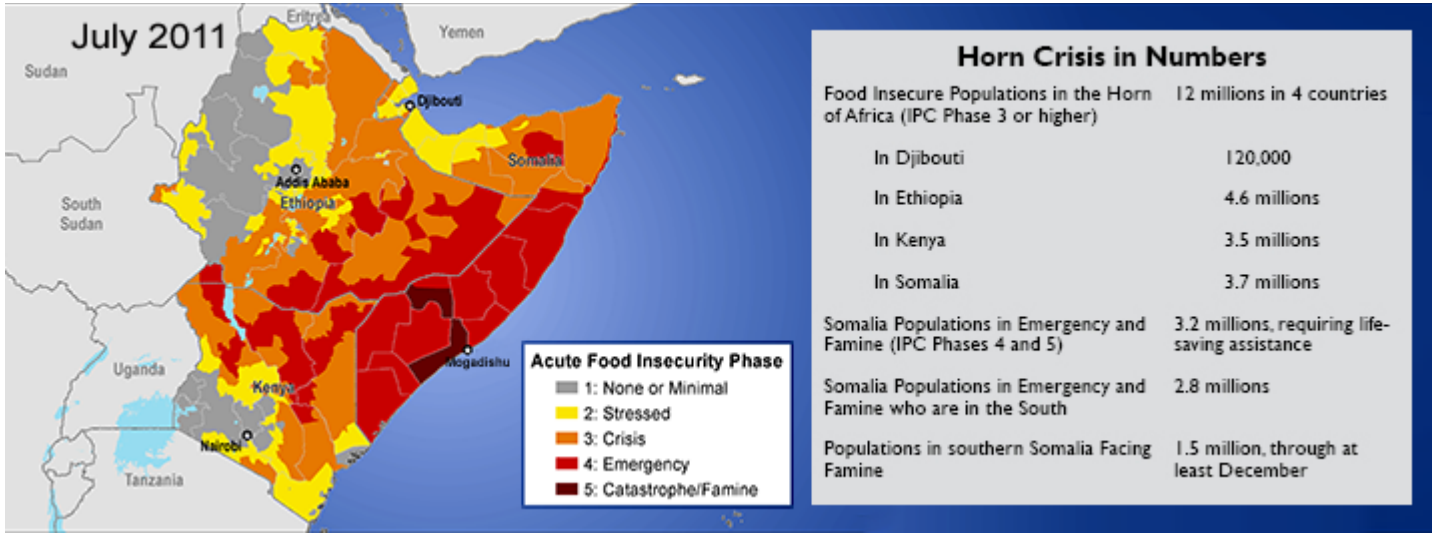
- Monitors
  - Diagnostic maps (based on current conditions)
  - Hazards: drought, pests and diseases, floods
  - Examples: North American Drought Monitor (US, Canada and Mexico)



http://www.ncdc.noaa.gov/temp-and-precip/drought/nadm/maps/en/201206#map-selection

Diagnostic and Forecasting Analyses (2/2)

- Early Warning Systems
  - Adverse future conditions alert
  - Hazards: drought, frost, pests and diseases, floods, famine
  - Examples: FEWS NET (LAC, Africa, Central Asia)
- Forecasts
  - Attempt to guess future conditions
  - Based on models (statistical, physical, mathematical)
    - Short and Medium Range (hours to days)
    - Seasonal (monthly to seasonal)



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FEWS NET FAMINE EARLY WARNING SYSTEMS NETWORK

http://upload.wikimedia.org/wikipedia/en/e/e4/FEWS_NET_Horn_of_Africa_crisis_July_2011.png

Agro-meteorological bulletins

- Issued by National Weather Services and Ministries of Agriculture
- Most developing countries lack this product
- Bulletins are the best place to disseminate all the products previously described on regular basis.

FIGURE 5.6. FORECAST OF CHANCE OF EXCEEDING TRIMESTRAL MEDIAN RAINFALL (JUNE TO AUGUST, 2012) IN AUSTRALIA AND HISTORICAL CONSISTENCY OF THE FORECASTING SCHEME (PERCENTAGE OF TIMES THE SCHEME HAS FORECASTED CORRECTLY)

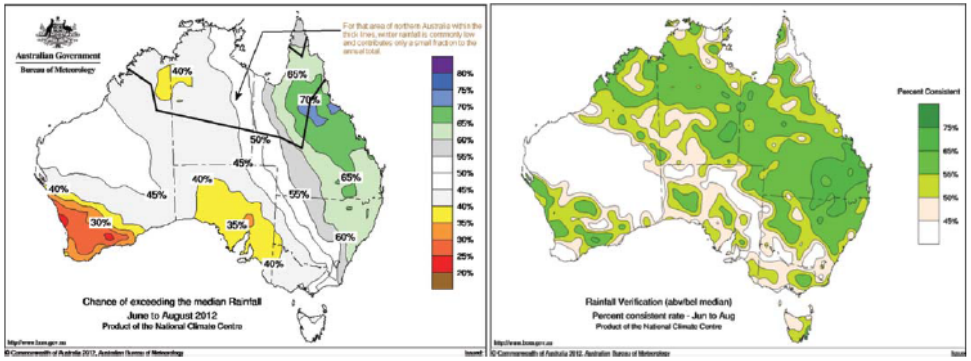
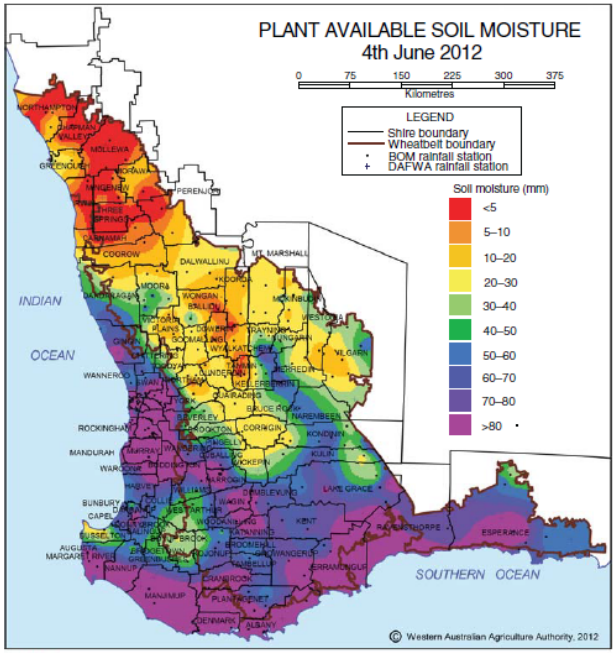


FIGURE 5.9. MAP FROM THE COVER OF AN AGROMETEOROLOGICAL BULLETIN



Source: Copyright © Western Australian Agriculture Authority.

Summary & Conclusions

- Data for agrometeorological mapping in developing countries is limited and there is a need to take advantage of scientific developments in designing applications useful for risk management purposes.
- The use of proxies and for changing data sharing practices promise to bridge the data limitations.
- Several agrometeorological mappings are presented
  - Historical products are expected to identify spatially a given condition to support risk management design and policy making in general
  - Diagnostic and forecasting products are expected to improve risk preparedness on regular basis
- There is no blueprint for these applications, and we present here useful information and illustrations in a rapid developing field.
- Their implementation is challenging because they involve multiple stakeholders, institutions, disciplines, etc.

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