Assessing Agricultural Drought Risk

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Risk	=	**Hazard**	x	**Exposure**	x	**Vulnerability**
Likelihood of drought impact.		Probability of exceeding a drought event with a certain severity.		Amount of population and assets (e.g., crops, livestock) in regions where the probability of drought occurrence is not null.		Propensity of individuals or communities to suffer adverse effects when impacted by a drought event.

Drought Hazard:

- Duration
- Intensity (total deficit divided by duration)
- Severity (accumulated deficit for entire event)

- Timing! → growing season, phenology

Key Variables:

- Precipitation (rainfall, snow)
- Evapotranspiration (temperature, wind, radiation, …)
- Soil moisture
- Vegetation condition (e.g., fAPAR, NDVI, …)?

Drought Exposure:

- Presence of agricultural land
  - Rainfed
  - Irrigated
  - by crop type?

- Presence of livestock
  - Grazing
  - Fodder crops
  - Stocking density

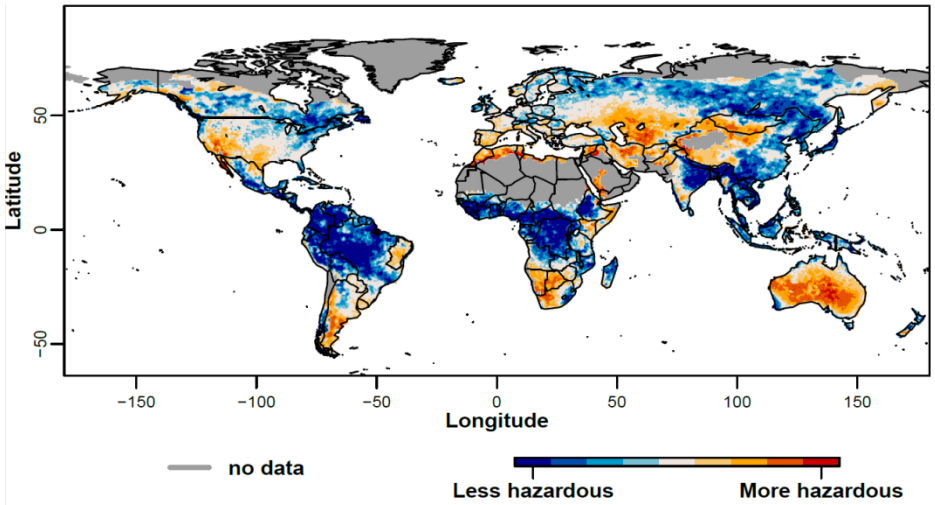
Drought Vulnerability:

- Social
  - Rural population (% of total population)
  - Improved water source (% of rural population)
  - Education level (Literacy rate in % of people aged 15 and above)
  - Population aged 15-64 (% of total population)
  - Investment in Disaster Prevention & Preparedness (US$/Year/capita)
- Economic
  - Agricultural % of GDP
  - Poverty headcount ratio at $1.25 a day (→ dependency on agriculture)
  - Access to international food markets
  - GDP per capita (current US$)
- Infrastructural
  - Agricultural irrigated land (% of total agricultural land)
  - % of retained renewable water (reservoirs)
  - Access to and sustainability of groundwater resources
  - Accessibility (e.g., road density, distance to nearest center)
  - Use of drought resistant crop types and/or varieties
  - Use of Fertilizer

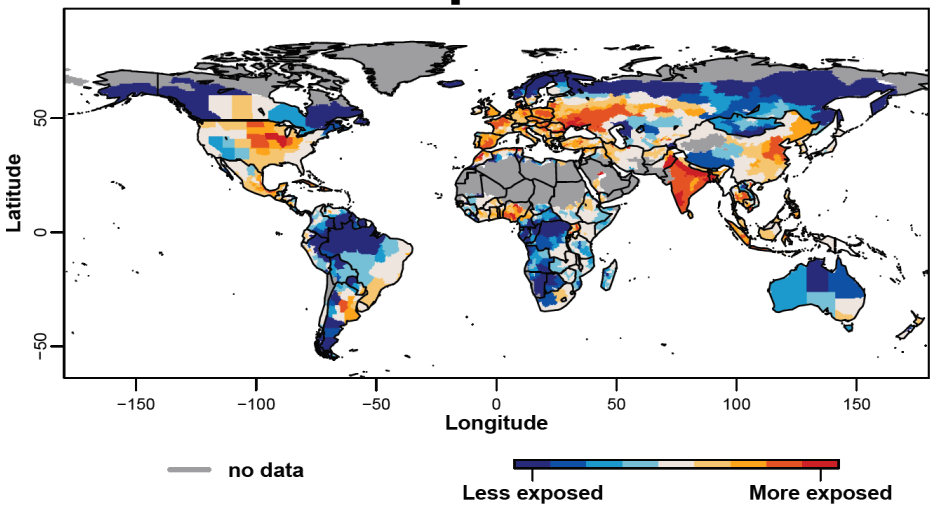
- **Resolution**
- **Availability**
- **Accuracy/ Confidence**

Example of GDO Drought Risk Evaluation

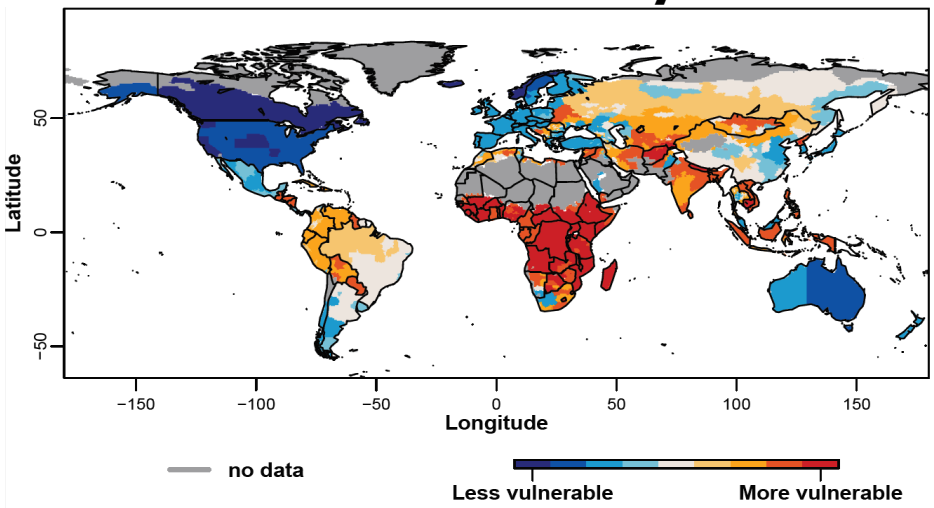
Hazard



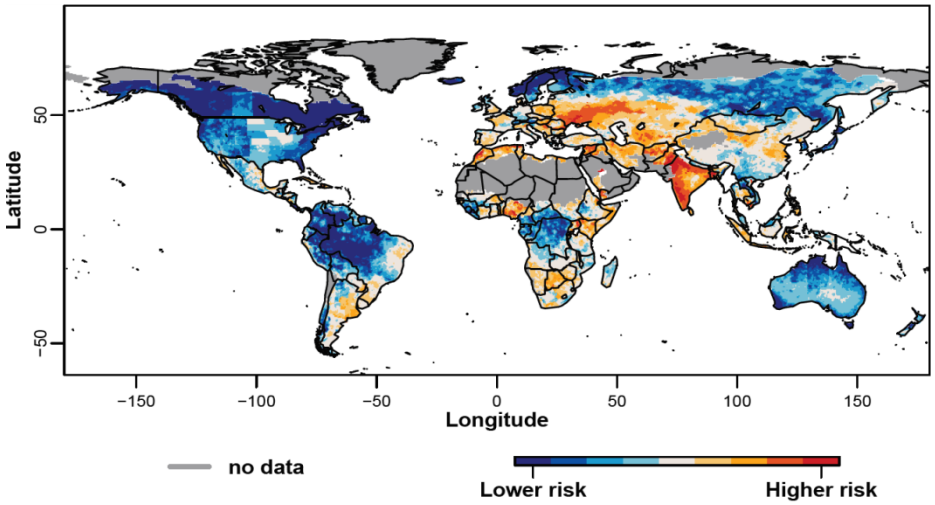
Exposure



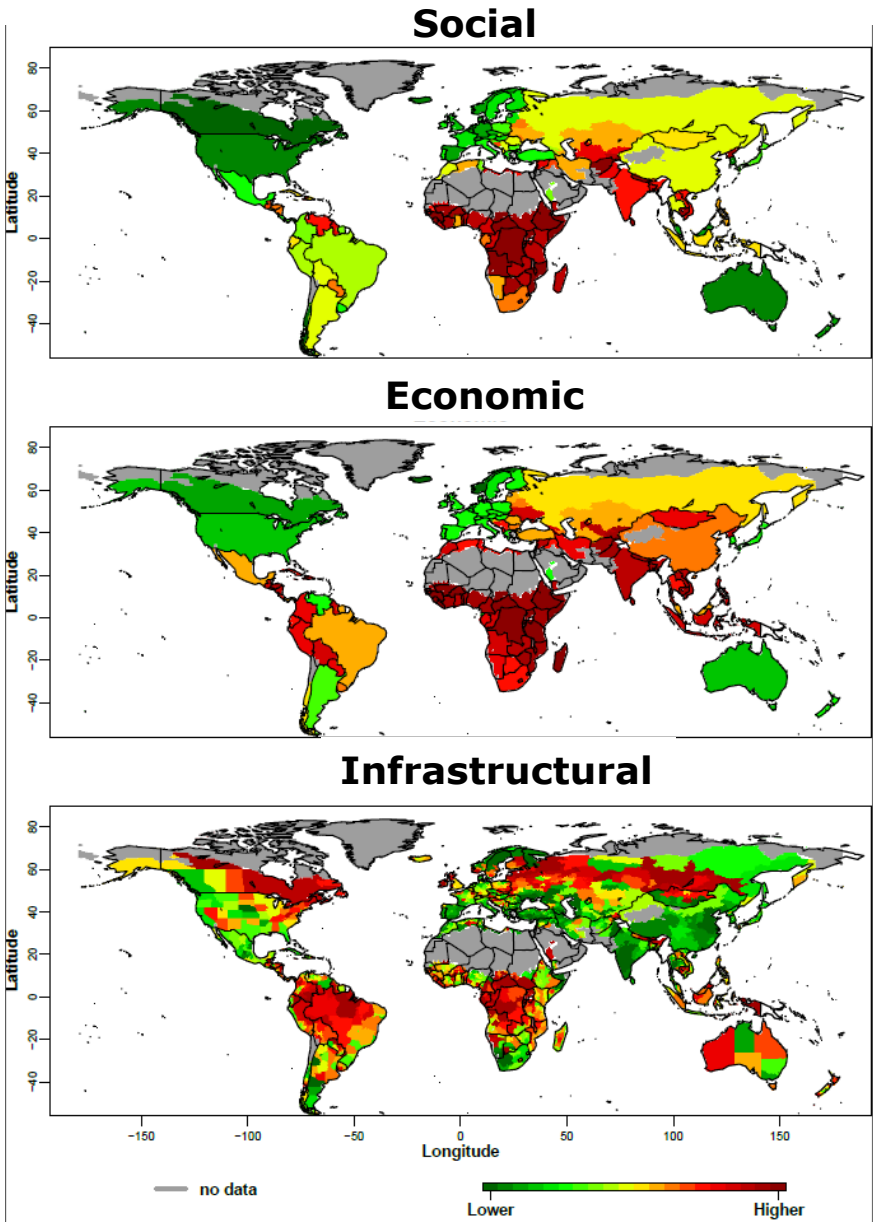
Vulnerability



Risk



Example of GDO
Evaluating the Vulnerability



- Rural population (% of total population); World Bank
- Literacy rate (% of people ages 15 and above); World Bank
- Improved water source (% of rural population); World Bank
- Life expectancy at birth (years); World Bank
- Population ages 15-64 (% of total population); World Bank
- Refugee population (% of total population); World Bank
- Government Effectiveness; WGI
- Disaster Prevention & Preparedness (US$/Year/capita); OECD

Indicators at Country Level

- Energy Consumption per Capita (Million Btu per Person); U.S. EIA
- Agriculture (% of GDP); World Bank
- GDP per capita (current US$); World Bank
- Poverty headcount ratio at $1.25 a day (PPP) (% of total population); World Bank

Indicators at Subnational Level

- Agricultural irrigated land (% of total agricultural land); FAO
- % of retained renewable water; Aquastat
- Road density (km of road per 100 sq. km of land area), gROADSv1

Carrão, H., Naumann, G., Barbosa, P. (2016). Mapping global patterns of drought risk: An empirical framework based on sub-national estimates of hazard, exposure and vulnerability. Global Environmental Change, 39, 108-124.

Naumann, G., Barbosa, P., Garrote, L., Iglesias, A., Vogt, J. (2014). Exploring drought vulnerability in Africa: an indicator based analysis to be used in early warning systems. Hydrology and Earth System Sciences, 18, 1591–1604.