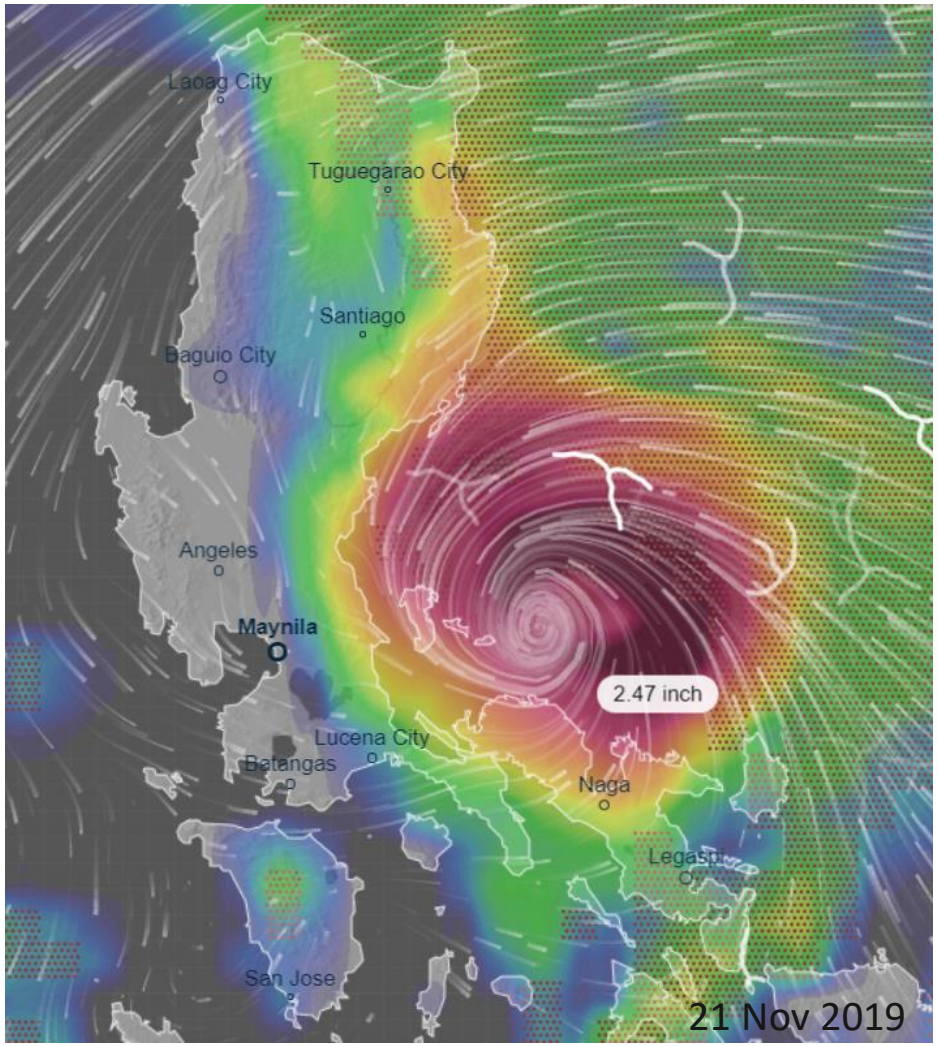
Promoting use of space technology in addressing Agriculture-Disaster Risk Management

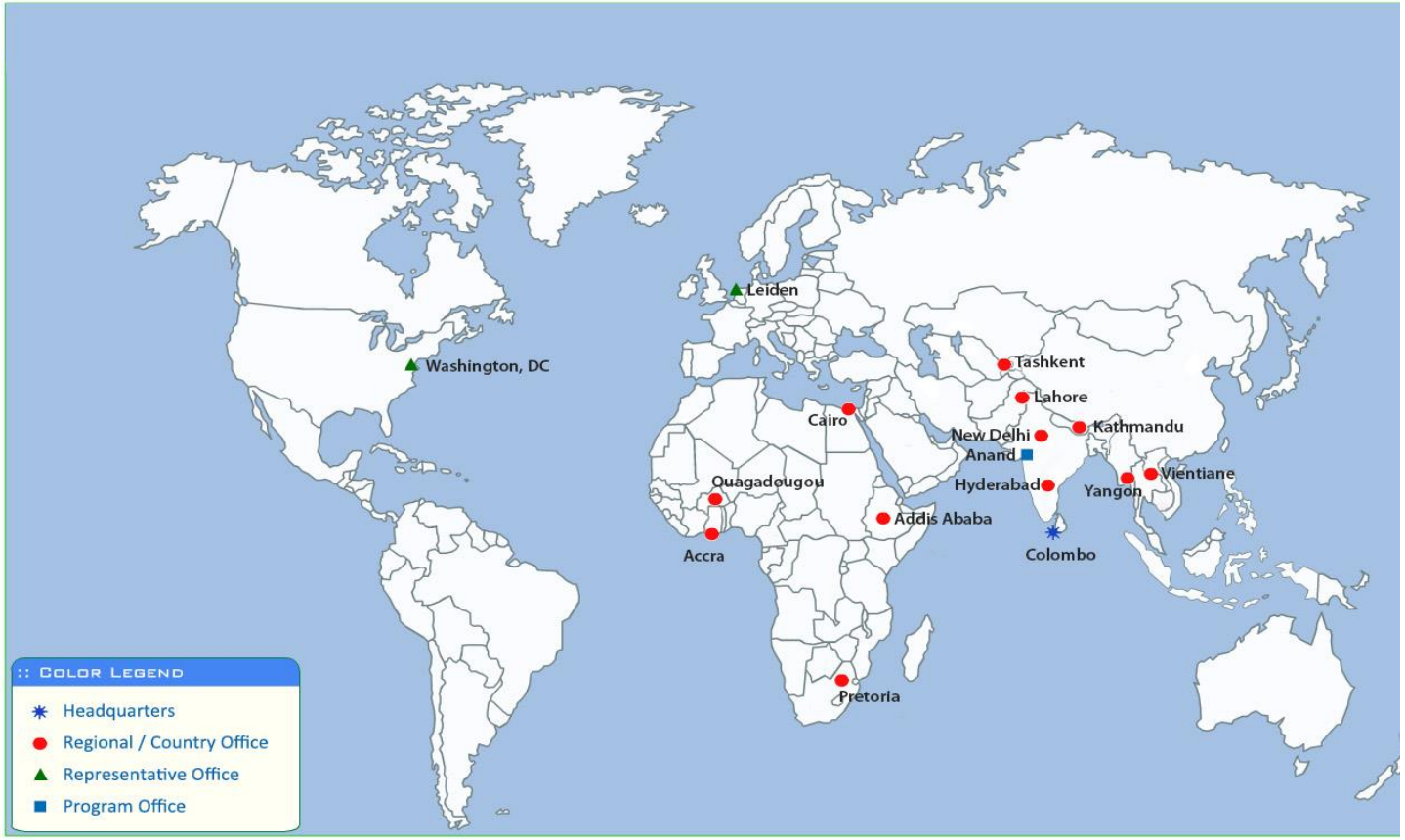


7th Joint Project Team Meeting for Sentinel Asia
Nov 12, 2019, Bangkok

Giriraj Amarnath, Ph.D. and Niranga Alahacoon
International Water Management Institute (IWMI), Sri Lanka

Our roles and where

- **Think tank** conducting research to generative innovative solutions
- **Provider** of science-based products and tools
- **Facilitator** of learning to strengthen capacity and achieve uptake of research findings



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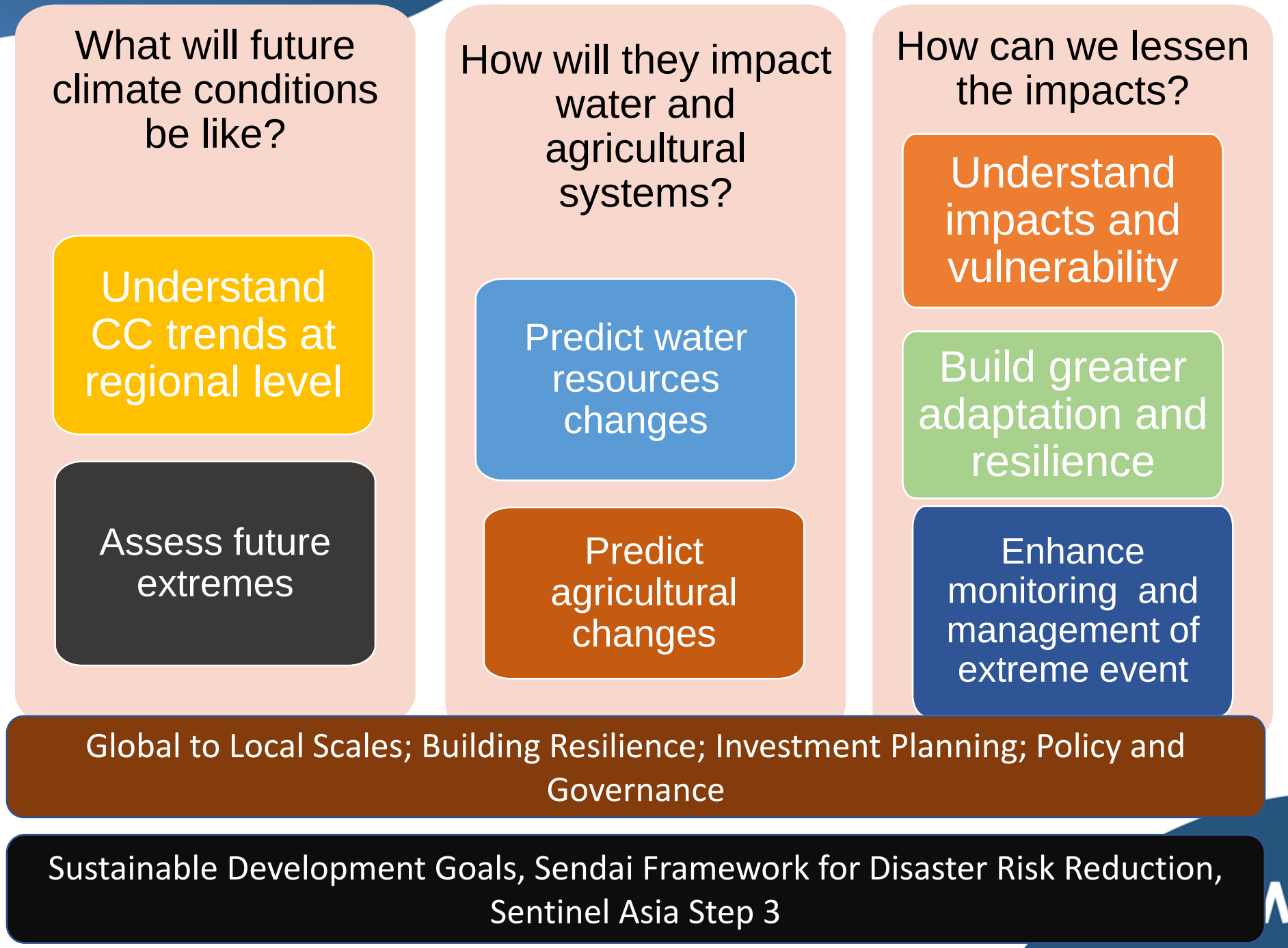

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User Case : Impact across stakeholders to manage agriculture-disaster risks

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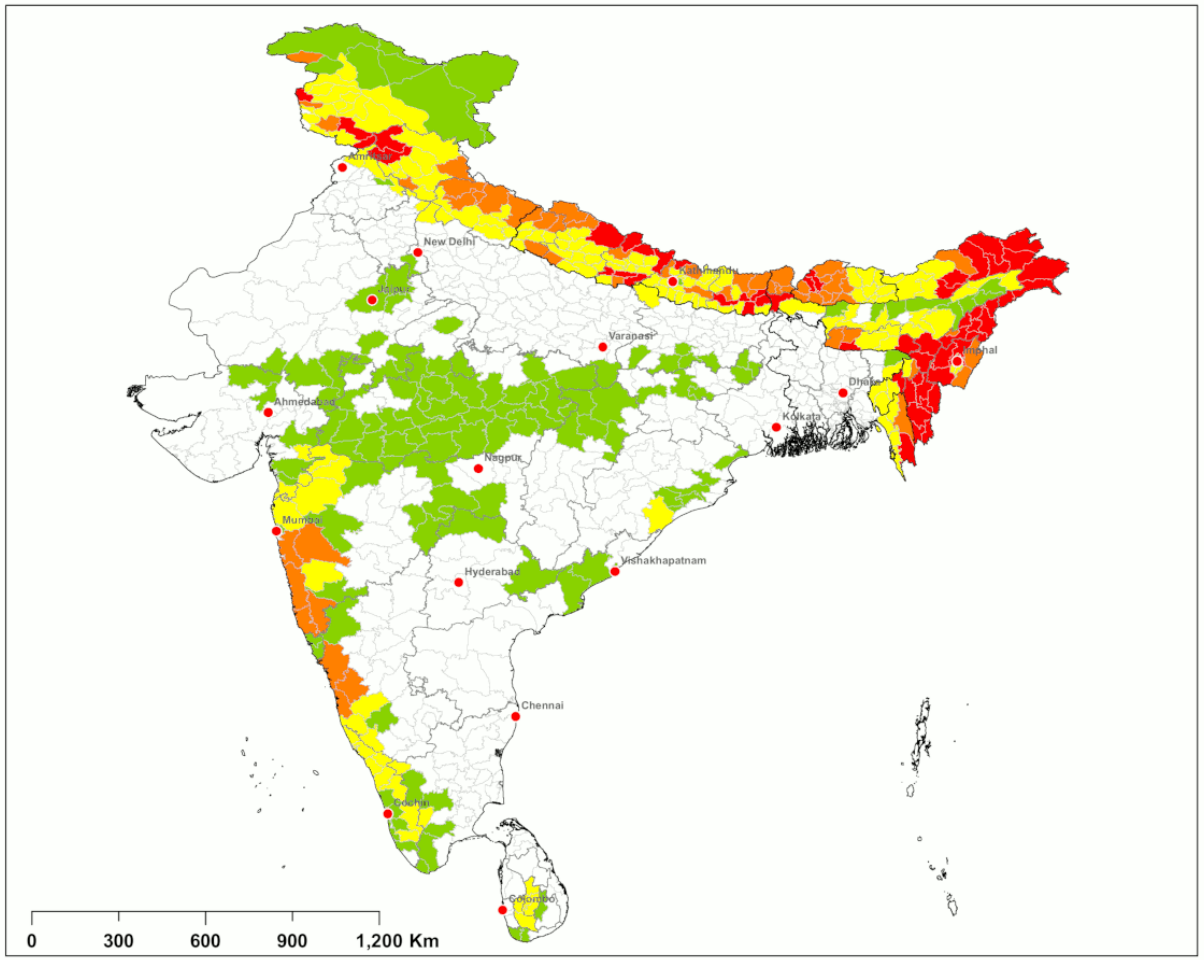
User Case 1: Risk Assessment and Investment

IWMI International Water Management Institute

Climate Screening products for investing in disaster resilience

Landslide Map



1. Data

This dataset includes an estimate of the annual frequency of landslides triggered by precipitation. It depends on the combination of trigger and susceptibility defined by six parameters: slope factor, lithological (or geological) conditions, soil moisture condition, vegetation cover, precipitation and seismic conditions.

2. Legend

Landslide hazard level in South Asia

- Very Low
- Low
- Medium
- High
- Very High
- Country boundary
- State/Province boundary

3.Sources

This data was modeled using global data bases of slope factor, geological conditions, vegetation cover, soil moisture condition, precipitation and seismic condition.

4. Feedback

a.giriraj@cgiar.org and erik.kjaergaard@adb.org

5. Disclaimer

The depiction and use of boundaries, geographic names and data shown here are not warranted to be error-free nor do they imply official endorsement or acceptance by the ADB, IWMI or the governments in South Asia region.

Date created 05 September 2018

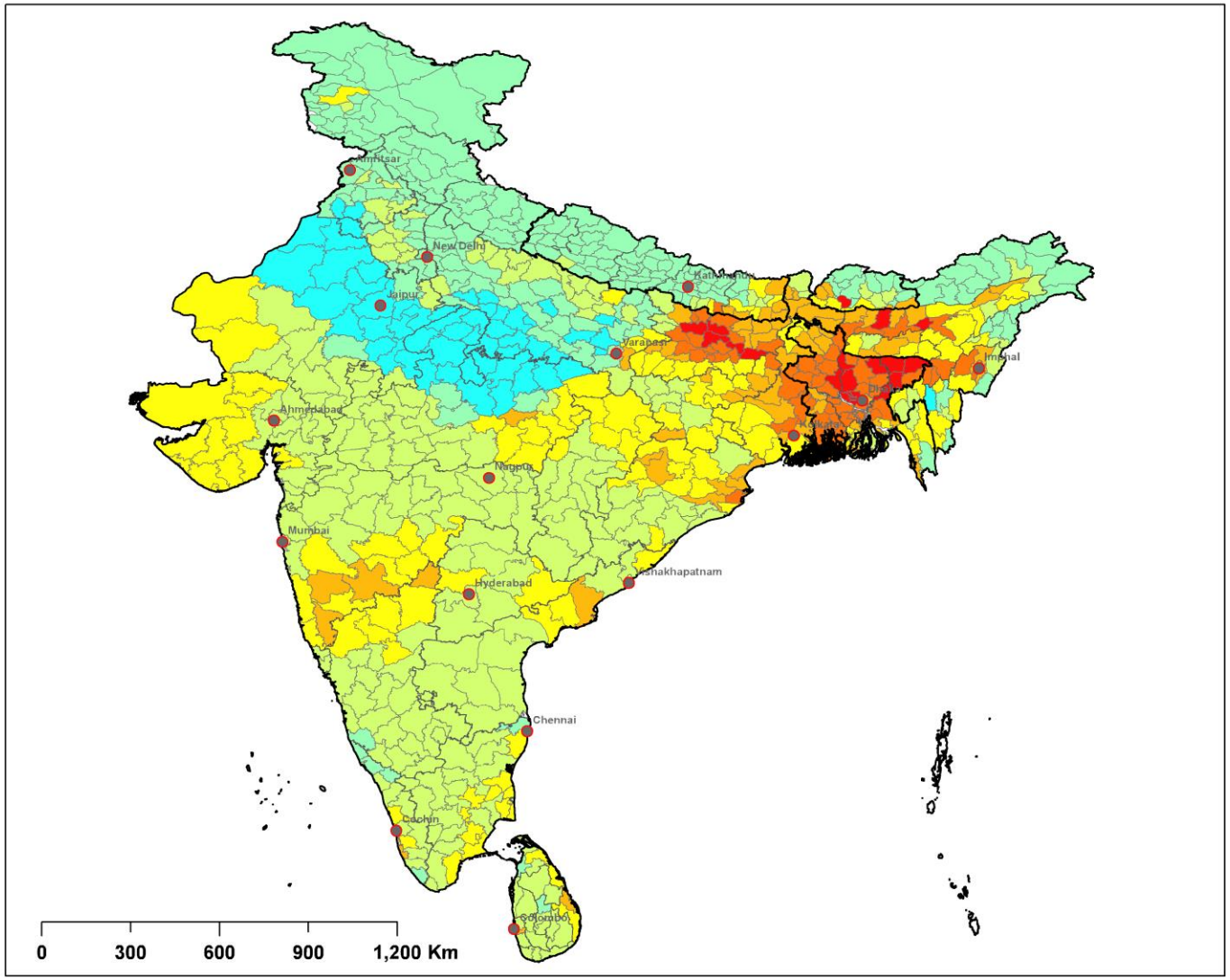
Not validated and atlas will be published in 2020

Source: IWMI

- Mapping individual hazards (Flood, Drought, Landslides, Coastal inundation, Cyclone, Forest fires, Earthquake, Extreme rainfall, Heatwaves and Sea level rise);
- Multi-hazard Risk Assessment to support in developing DRM policies and financial investment portfolio for building resilience

Multi-hazard Economic Exposure Map

Geospatial Intelligence Analysis



1. Data

This multi-hazard economic exposure map is based on different data sources including four individual hazard maps (flood, storm, earthquake and drought) and the 2015 Gross Domestic Product. The first step involved extraction of GDP values exposed to individual hazards and the second step applied weightage on the economic exposure using historical disaster losses from hazard events in the region year 1900-2017 obtained from EM-DAT. The weightage to individual hazards were: flood 62%, storm 23%, earthquake 11% and drought 4%. The final step consisted in normalizing the exposure of GDP with the total district GDP to identify the economic losses from multiple hazards across South Asia. The colour gradients indicate the relative economic exposure to multiple hazards at district level in South Asia.

2. Legend

Multi-hazard economic exposure in South Asia. Applied natural breaks (Jenks) classification method.

- < 9.5
- 9.6 - 20.3
- 20.4 - 30.9
- 31 - 40.6
- 40.7 - 53.6
- 53.7 - 74.5
- > 74.5
- Country boundary
- State/Province boundary
- District boundary

3. Sources

IWMI

4. Feedback

a.giriraj@cgiar.org and erikkjaergaard@hotmail.com

5. Disclaimer

The depiction and use of boundaries, geographic names, and data shown here are not warranted to be error-free nor do they imply official endorsement or acceptance by the IWMI, or the governments in South Asia.

Version 5
02 April 2019

IWMI International Water Management Institute

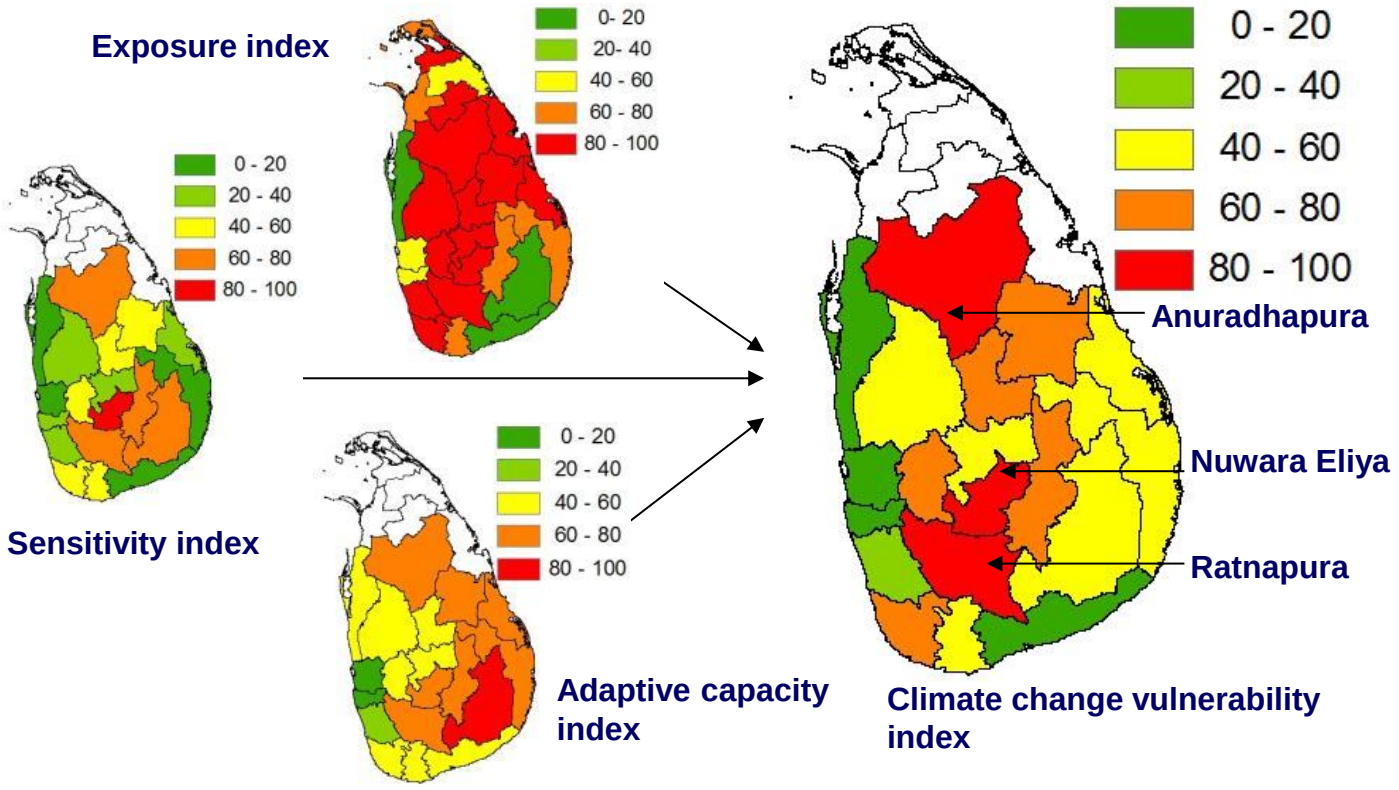
Multi-hazard Data
+
Population Exposure
+
Gross Domestic Product (GDP)
+
Historical loss and event database

=

Multi-hazard Economic Exposure Map for disaster insurance and DRM policy perspective

Some areas will be more affected than others:

Identifying vulnerability hot spots for climate change to design locally relevant adaptation measures



User Case 2 : Drought monitoring to management and relief efforts

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FOOD AVAILABILITY

Indian governments make the leap to drought relief for farmers using real-time data

RESEARCH THEMES

Variability, Risks and Competing Uses

REGIONS

South Asia

Governments in India are using satellite data combined with ground measurements to assess and mitigate drought damage to crops. The data improved drought response in three districts and fed into development of 620 district-level drought plans.

Throughout 2017-2018, the South Asia Drought Monitoring System (SADMS) provided an index that integrates rainfall data with data on vegetation, soil moisture and temperature. Every eight days, the system publishes drought bulletins with detailed maps showing drought severity across Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka.

Sri Lanka – Climate and Food Security Bulletin (UN WFP and IWMI/WLE)

Climate & Food Security Monitoring Bulletin

July - August 2019

August 2019

A joint bulletin by the United Nations World Food Programme & International Water Management Institute

WFP World Food Programme | PRISM | IWMI International Water Management Institute | CGIAR RESEARCH PROGRAM ON Water, Land and Ecosystems

1. Bulletin Highlights

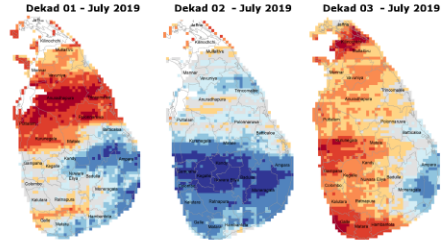
- First half of 2019, total rainfall has been below average, despite the fact that June, July and the first ten days of August experienced considerable rainfall, confined mostly to the South-Western Regions. Meteorological forecasts suggest areas in the dry-zone are expected to remain dry through to September.
- Abnormally dry and moderate drought conditions remain in pockets of North, North-Western, North-Central, Uva and Eastern Provinces. Focus must be placed on risk reduction, adaption measures, and preparedness for drought response interventions; including integrated drought resilience programs to promote improved drought resilience strategies from climate shocks.
- Major water reservoirs are becoming dangerously low at only 19% capacity, compared with 33% at the same time last year. Water assistance is being provided to 177,173 households across 17 Districts.
- Surplus Maha (2018/19) and Yala (2019) paddy production means there is no immediate food shortage, and total rice availability is sufficient to meet demand until January 2020 (Department of Agriculture). However, dry conditions and pest attacks in pockets of Kurunagala, Batticaloa, Ampara, Puttalam and Trincomalee caused the destruction of 4,362 ha of paddy. This will not have a major impact on overall paddy production, but will have adverse localised impacts.

Following forecasts issued in the previous bulletin (June 2019), July was set to be warm and relatively dry for most of the country. While total rainfall was slightly higher than the average, the Northern and North Central Provinces were dry and rainfall in these areas was below average. Majority of the rainfall fell across the Central, Western, Sabaragamuwa and Southern Provinces, however; it was concentrated in short bursts during the second dekad of July, and resulted in landslips and flash floods to areas in Nurwara Eliya (Figure 1).

Most of the regions that received below average rainfall have also been exposed to prolonged dry conditions and are in need of targeted and timely intervention. The probabilistic forecasts issued by the Department of Meteorology in July suggests below normal rainfall is likely to continue through August and September in the Northern, North Central, North Western and Eastern Provinces. Lower rainfall will put further stress on access to water and soil conditions. So far, rains received during the first ten days of August show above normal rainfall in many regions of the country.

This bulletin highlights recent key climatic seasonal trends across the country, and how these have, and will, impact the population's access to water for consumption, domestic, and agricultural purposes.

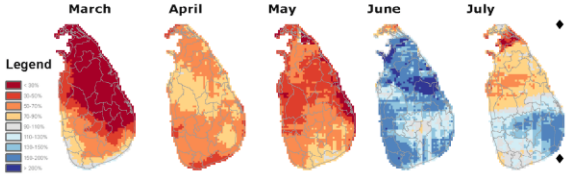
Figure 01: July Rainfall Anomaly – 10-Day Analysis



Source: Platform for Real-time Information and Situation Monitoring (PRISM) (CHIRPS Data)

2. Seasonal Observations

Figure 02: Rainfall Anomaly March – July 2019



Source: PRISM (CHIRPS data)

- Following dry conditions in March, April and May, parts of the country, particularly in the Central, Western, Southern, and areas in the Uva Provinces experienced above normal rain conditions throughout June (Figure 02).
- In July, the North Central, North and Eastern Provinces remained dry due to the fact that the concentration of rain over the last two months has been predominately in the southern parts of the country.

3. Agricultural Conditions and Food Security

- Soil Water Anomaly Drought Index (SWADI) is a measure of moisture held in the soil. From the map shown in Figure 06, it becomes clear that water stress and dry conditions are persistent through much of the country, particularly in Kilinochchi, Mannar, Vavuniya, Anuradhapura, Trincomalee, Polonnaruwa, Batticaloa, and Matale.
- This information is further confirmed by the Vegetation Health Index (VHI) in 16 Day lapses (Figure 07). While the persisting dry conditions have improved slightly over the 32 day period, the health of vegetation has been adversely impacted in the same districts.
- No immediate food security emergencies are predicted due to Maha paddy cultivation of 2,397,000 Mt and predictions of a Yala season of 1,471,000 Mt (slightly lower than season 2017/18).
- According to Department of Agriculture, paddy production for season 2018/19 is expected to meet domestic rice demand until January 2020. Total rice production is set to be 2.73 million Mt this year (Figure 08).
- Rice production has, however; been impacted by drought conditions with 4,266 ha being damaged in Kurunagala, Batticaloa, Ampara, Puttalam and Trincomalee as a direct result of the prolonged dry conditions.

Figure 06: Soil Water Anomaly Drought Index (SWADI) - 11-20 July 2019

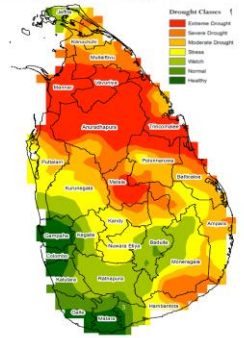
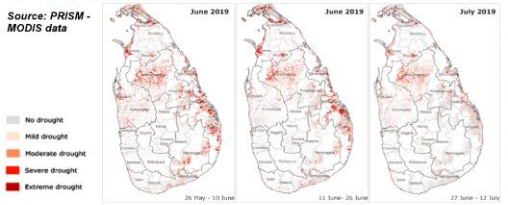


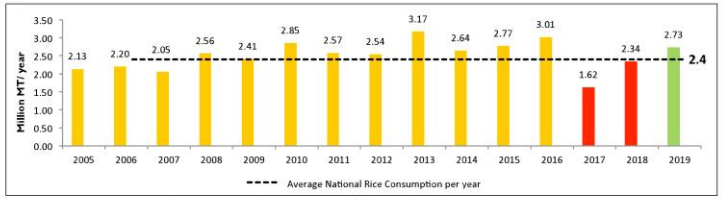
Figure 07: 16 Day Vegetation Health Index (VHI) – June to Mid-July 2019



Agricultural Market Shifts

- Average price of rice has fallen significantly from roughly 120 rupees per kg to under 100 rupees compared with this time last year. This price has remained relatively constant since April 2019, after the Maha harvest and the positive projections in rice yields this year (Figure 08).
- The price of most vegetables have decreased from the same time last year; conversely, important protein sources including fish, meat and eggs have all increased.
- Due to the country's economic challenges, particularly the downturn in tourism industry due to the Easter bombing incident, depreciation of the rupee and increased rates of indirect taxes, affordability of a nutritious food basket is challenging for vast majority of people, in spite of the lower cost of staples.

Figure 08: Total Rice Production Outlook



Source: Socio Economic Planning Centre of Department of Agriculture
Note: Total 2019 Rice Production includes forecasts for Yala 2019

User Case 3 : Parametric Insurance cover for natural catasphore risks

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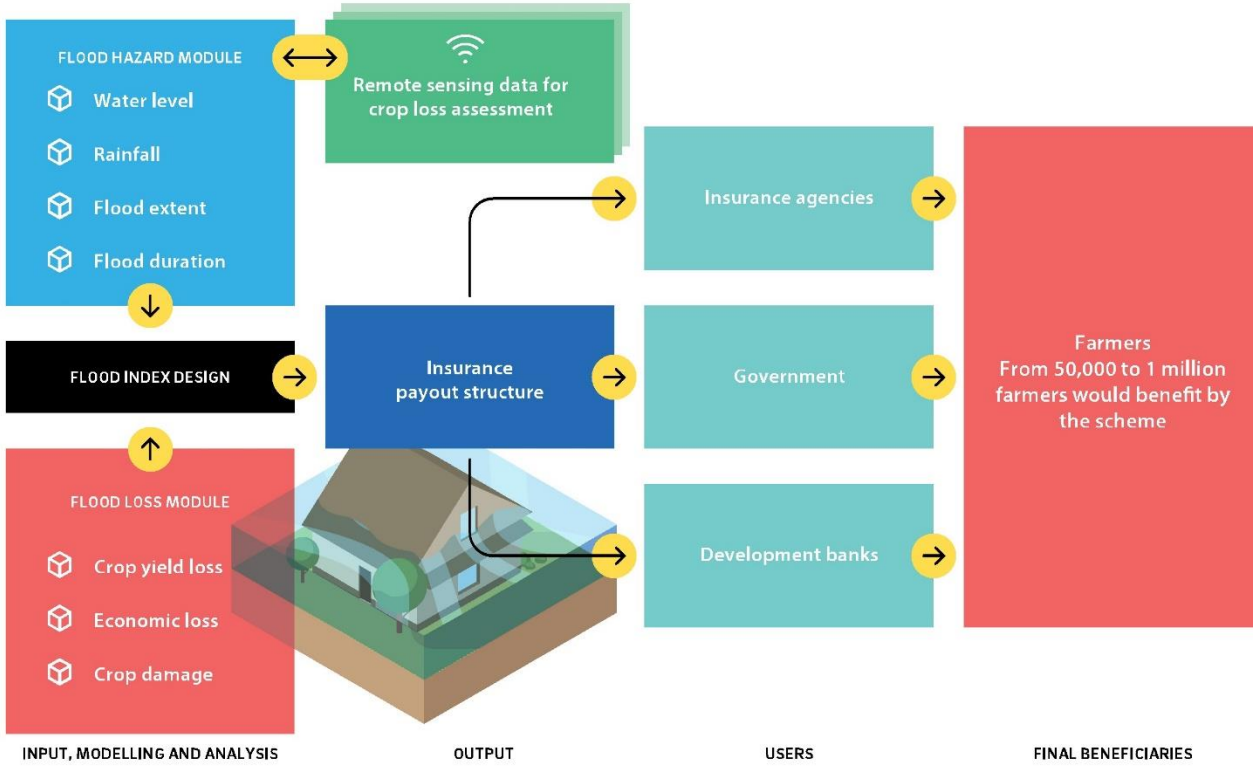
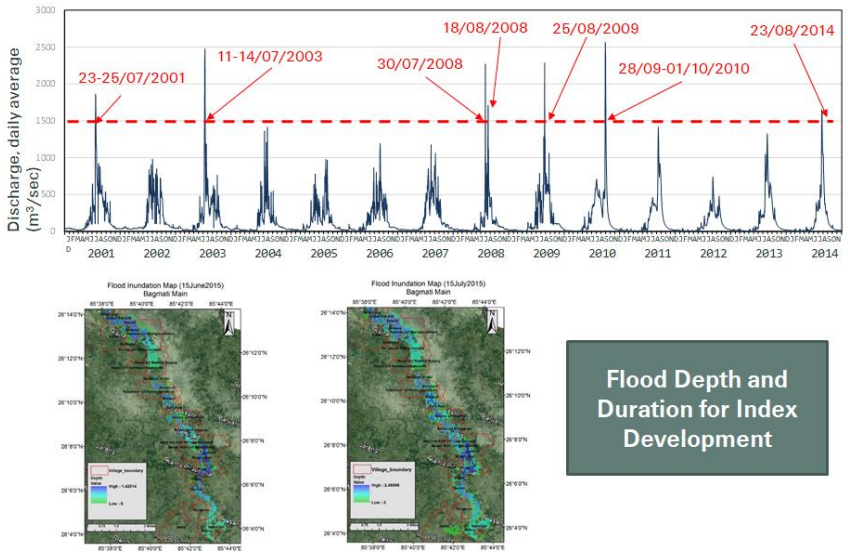
IBFI – Flood proofing communities and agriculture resilience…

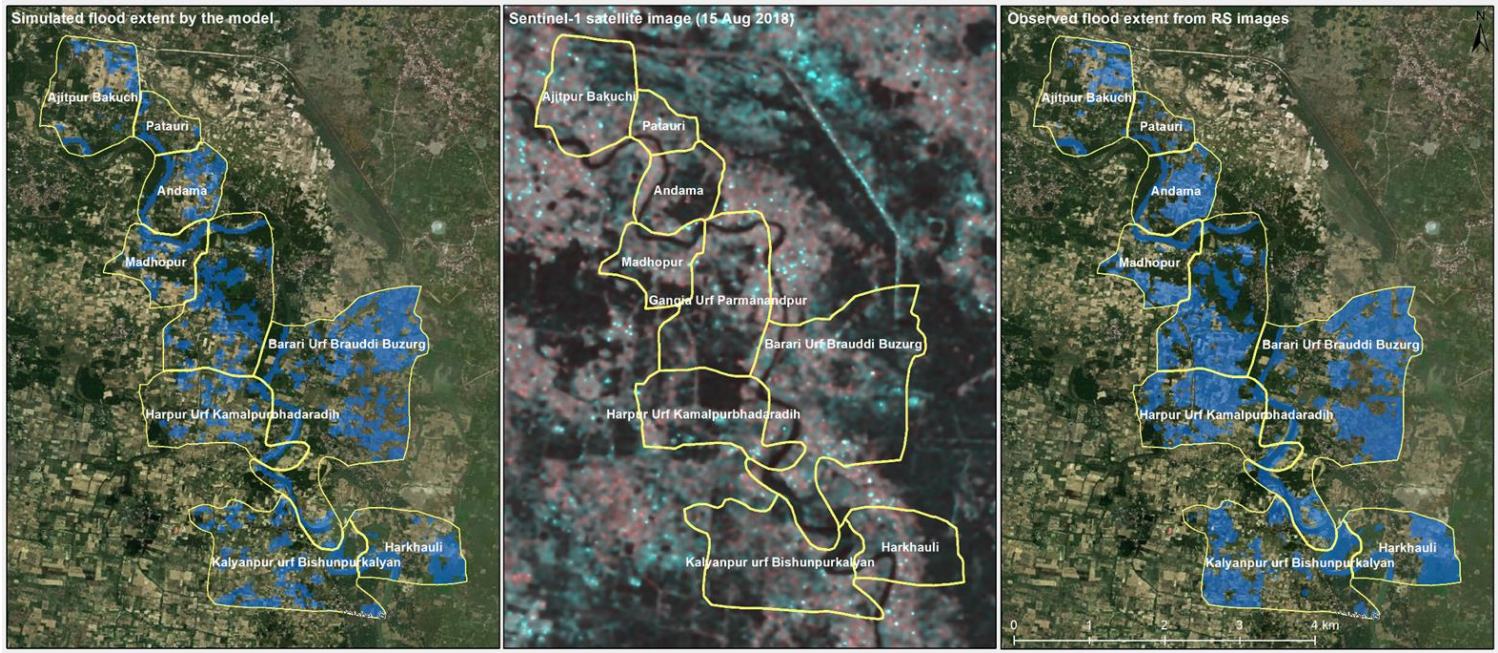


Source: Amarnath, 2017.

Flood Depth and Duration



Comparison of flood model and satellite data



Three years of successful IBFI pilot (2017 – 2019)

User Case 4 : Integrated technologies for CCA and DRR

Space technology to strengthen CCA and DRR policies

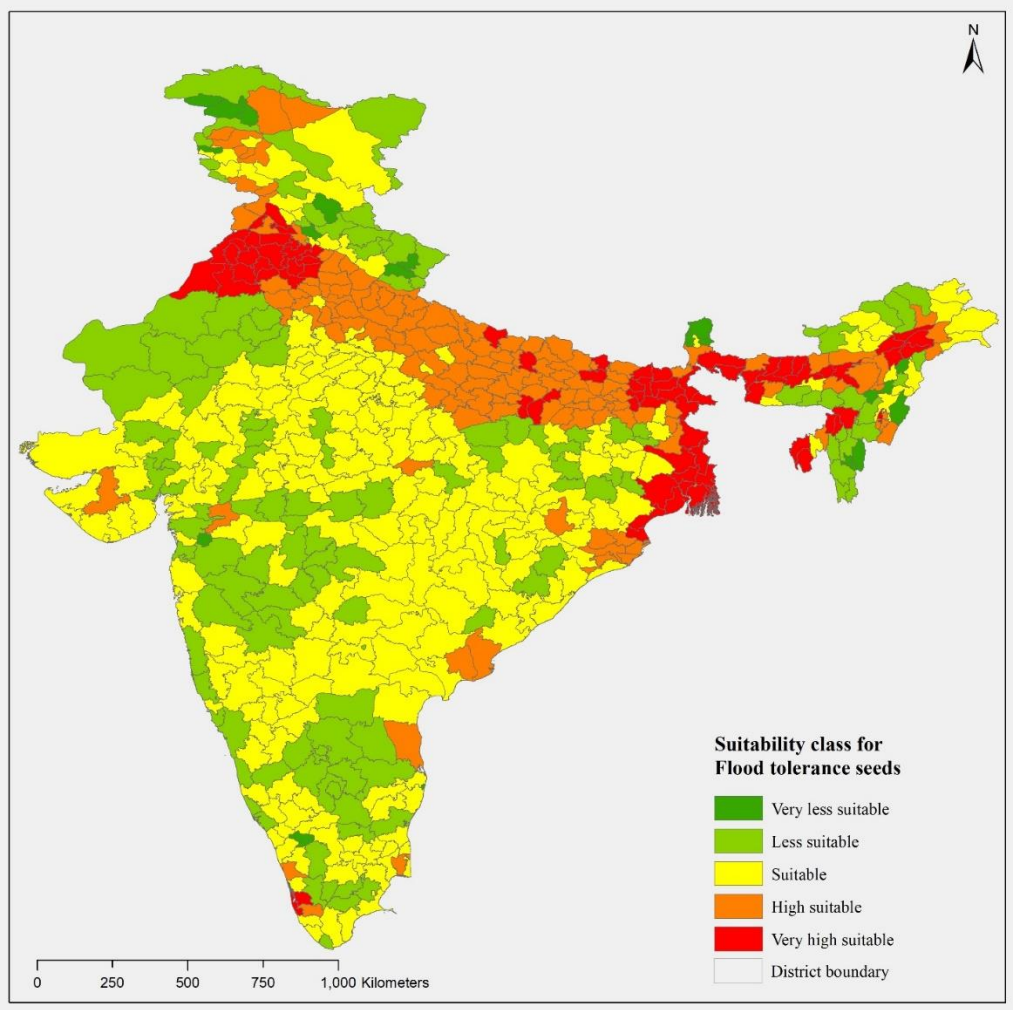
- Climate change is posing increased flood risks
- Climate adaptation and resilience (A&R) is a new challenge

- **Policy**

  Introducing flood resilient seeds to cope with climate variability using historical flood frequency, depth and duration with biophysical information namely Soil type, Soil organic matter and pH, land use and drainage condition to help the disaster affected farmers with the climate resilient seeds;

- Bihar (India) a flood-prone region, the assessment estimated approx. 23,388 ton (@0.05 seed rate) for a flood affected Kharif-paddy area of 467,757 ha with estimated cost of 935 million INR;

- Thus, risk information contributes to climate resilience policies.



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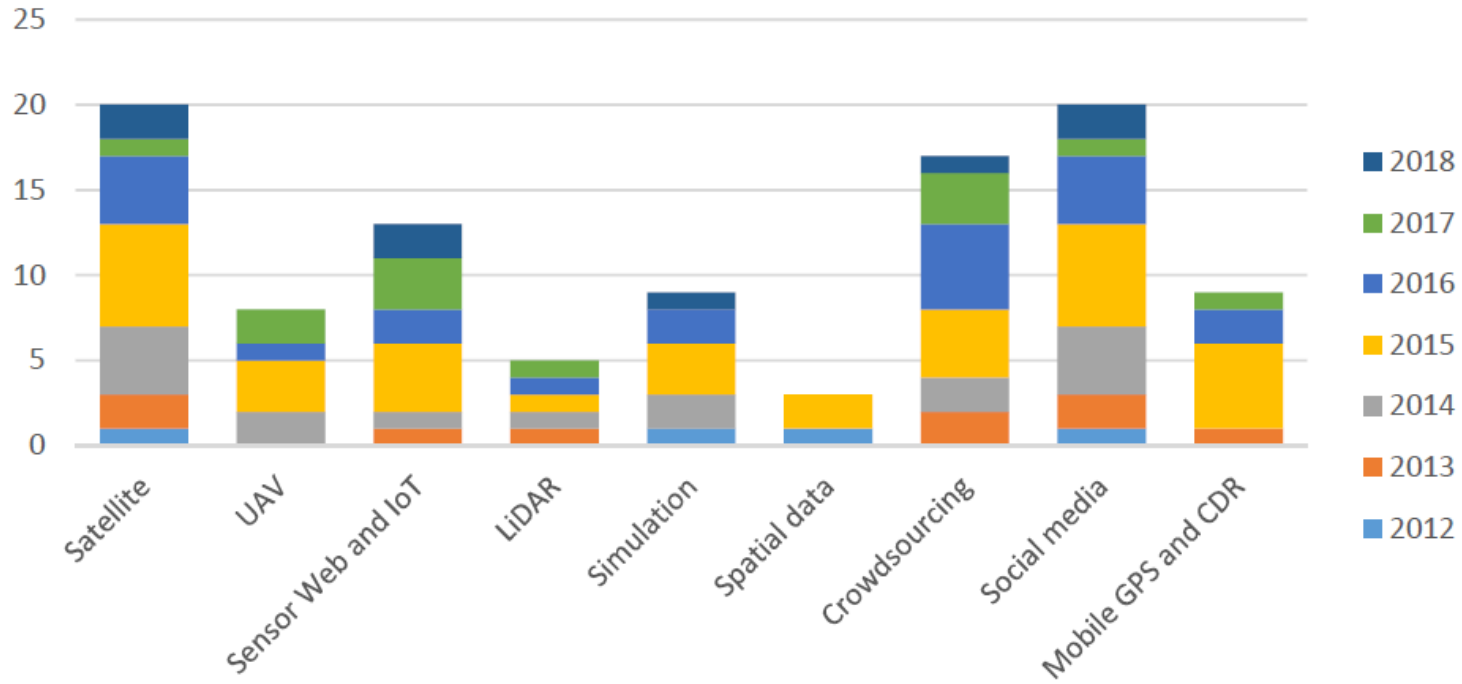
RESEARCH PROGRAM ON Water, Land and Ecosystems

Big Data or "*Fat Data*"



Mapping disaster management phases with major data sources and application fields

Disaster Management Phase	Data Source	Reviewed Application Fields
	1. Mitigation/Prevention	
Long-term risk assessment and reduction	Satellite, 33% Crowdsourcing, 17% Sensor web and IoT, 17% Social media, 13% Mobile GPS and CDR, 12% Simulation, 8%	General natural disaster [10] Earthquake [88,91] Oil spill [92] Flood [15,93,94]
Forecasting and Predicting	Simulation, 50% Satellite, 25% Sensor web and IoT, 13% Social media, 12%	Hurricane [52,54,95–100] Flood [101–103]
	2. Preparedness	
Monitoring and detection	Social Media, 31% Sensor web and IoT, 31% Satellite, 13% Combination of various data types, 9% Spatial data, 4% Lidar, 4% Mobile GPS and CDR, 4% Crowdsourcing, 4%	Wildfire [104] Flood [105–109] Earthquake [108,110] Landslide [111] Volcano [45,46]

Yu et al. 2018

International Water Management Institute

Contd….

Early warning	Social media, 29% Sensor web and IoT, 29% Simulation 14% Crowdsourcing 14% Satellite, 14%	Flood [112] Tsunami [76,112]
3. Response		
Damage Assessment	Satellite, 53% UAV, 21% Social media, 16% Sensor web and IoT, 5% Crowdsourcing, 5%	Earthquake [19,20,113–115] Flood [116] Typhoon [117] Hurricane [118]
Post-disaster Coordination and Response	Social media, 25% Satellite, 16% Sensor web and IoT, 16% Crowdsourcing, 10% UAV, 9% Simulation, 6% Spatial data, 6% Lidar, 6% Mobile GPS and CDR, 3% Combination of various data types, 3%	General natural disaster [117–119] Flood [89,108] Earthquake [19,83–85,120]
4. Recovery		
	Combination of various data types, 60% Crowdsourcing, 30% Satellite, 10%	Earthquake [121–123] Hurricane [124] Typhoon [125]

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Key messages : Investing in disaster resilience in reference to Sentinel Asia Step3 implementation aligned to global framework

Policy Change

Risk Assessment

Financing

Private Sector Engagement

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Thank You

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