POLICY BRIEF

CGIAR RESEARCH PROGRAM ON Water, Land and Ecosystems

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Insurance as an agricultural disaster risk management tool: Evidence and lessons learned from South Asia

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OVERVIEW

Pilot projects in India and Bangladesh demonstrate that index-based weather insurance products, developed using satellite technology, can reduce the financial risks to smallholder farmers from floods and droughts. Scaling up such schemes has the potential to meet the needs of very vulnerable groups, especially women and assist governments in meeting global development goals.

CLIMATE CONTEXT

Climate change magnifies the risk and cost of disasters. The economic impact of environment-related disasters has risen from around USD $25 billion per year in the 1980s to USD $160 billion in 2018 (Baur and Parker, 2015; Munich Re, 2018). In South Asia, climate change is already increasing the frequency and intensity of disasters, contributing to population displacement, exacerbating conflicts and affecting efforts to reduce poverty and inequality. Both sudden-onset disasters (floods) and slow-onset events (drought) have impacts on livelihoods, health and agricultural yields (Amarnath et al. 2017).

Many of the region's most vulnerable people live in vast agrarian belts within the Indus, Ganges and Brahmaputra-Meghna river basins. Variation in the annual monsoon, and natural phenomenon such as El Niño and La Niña, can cause catastrophic flood and drought events. These affect poor and vulnerable populations who depend on agriculture for livelihoods and subsistence. In 2019, torrential monsoon rains triggered

Aerial view of 2016 flooding in Patna, Bihar (India). Credit: Dakshina Murthy

RECOMMENDATIONS

Action points by which regional organizations such as the South Asian Association for Regional Cooperation (SAARC) can strengthen disaster insurance programs:

Advise governments on 1) how best to reform policies and regulations around index-based weather insurance (e.g. financial incentives, premium subsidies), and 2) ways to develop effective and inclusive products, so that insurance can be readily incorporated into disaster risk management strategies for many different people

Strengthen microfinance institutions to boost smallholders' access to credit

Promote best practice in design and policy aspects of index-based weather insurance, including south-south learning, to promote wider use of such products within disaster risk management

floods and landslides in Bangladesh, India and Nepal, killing more than 2,000 people and affecting 19.5 million (ReliefWeb, 2019a).

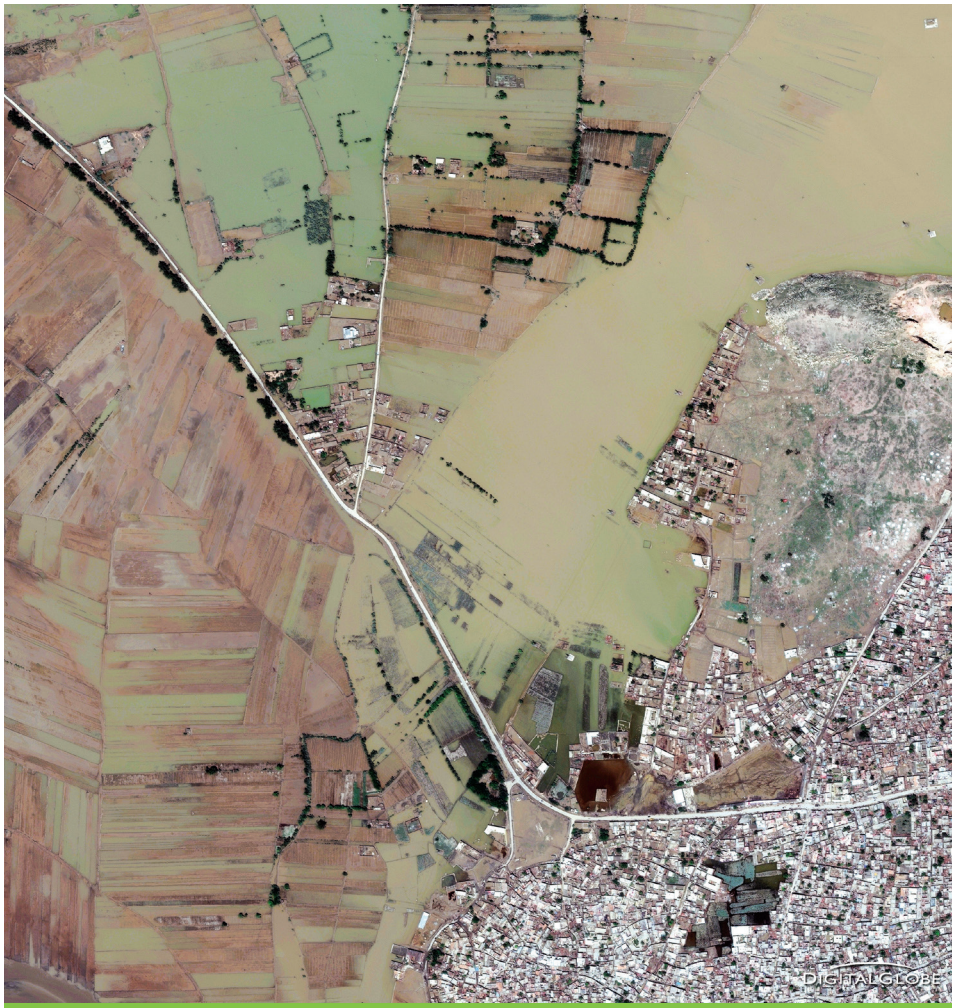
The economic cost and humanitarian consequences of drought are equally enormous. Twenty- one major drought events reported between 1990 and 2019 affected more than 720 million people, with economic losses exceeding USD $6.5 billion (EM-DAT, 2019). The drought of 2018 was particularly severe, affecting 250 million people. An estimated 66.5 million hectares (ha) of agricultural area were exposed to severe drought in South Asia (SADMS Bulletin, 2018).

USING INSURANCE TO INCREASE SMALL-SCALE FARMERS' RESILIENCE

Index-based weather insurance involves using satellite data to generate maps to identify where smallholder farmers' crops have been affected by floods and droughts. This means claims can be verified without the need for wide-ranging ground checks, so premium rates can be kept to within more affordable limits.

TAKING AN INTEGRATED APPROACH

In the past, managing weather-related disasters tended to focus on building preventative infrastructure (such as dams and flood walls) or post-event rebuilding and compensation. Less attention was paid to assessing the vulnerability of communities in locations at risk and trying to enhance their resilience ahead of any events occurring. However, evidence from recent decades has shown that a more integrated approach, encompassing planning, building regulations and early warning schemes, can significantly reduce losses from floods and drought.



Satellite image of flooding in Nowshera, Pakistan, captured on August 5, 2010

THE BENEFITS OF INSURANCE

Disaster risk insurance schemes provide a cost-effective way to enhance preparedness and better target post-disaster relief. Such schemes cover, against a premium, costs incurred by the insured from extreme weather and natural disasters. If an event such as flooding or drought occurs, the insurer refunds a percentage of the insured's losses.

Many governments are realizing the benefits of using insurance in this way. In India, where some 30 million smallholder farmers are affected by floods every year, the government is subsidizing the largest crop insurance scheme in the world to help bring relief. Known as Pradhan Mantri Fasal Bima Yojana (Prime Minister's Crop Insurance Scheme), the aim is to cover more than half of all the nation's farmers within the next two or three years.

However, some of India's most vulnerable states are home to its poorest farmers. In Bihar, the estimated losses from floods each year are between USD $500,000-120 million and this is in a state where 78% of the population earns less than US $2 per day. The administrative costs of insurance must be kept low if these poorest farmers are not to be excluded.

This is where index-based weather insurance comes in, as it provides effective payout schemes for low-income, disaster-prone communities. The International Water Management Institute (IWMI); CGIAR Research Programs on Climate Change, Agriculture and Food Security (CCAFS) and on Water, Land and Ecosystems (WLE); the Indian Council of Agricultural Research (ICAR), and Disaster Management Agencies in Bihar (India) and Bangladesh have developed an Index-Based Flood Insurance (IBFI) tool that, using satellite and public data, accurately estimates income losses from flooding of crops. This approach reduces the transactional costs of providing insurance, making insurance viable for smallholders. Pilots of the IBFI conducted so far appear very promising.

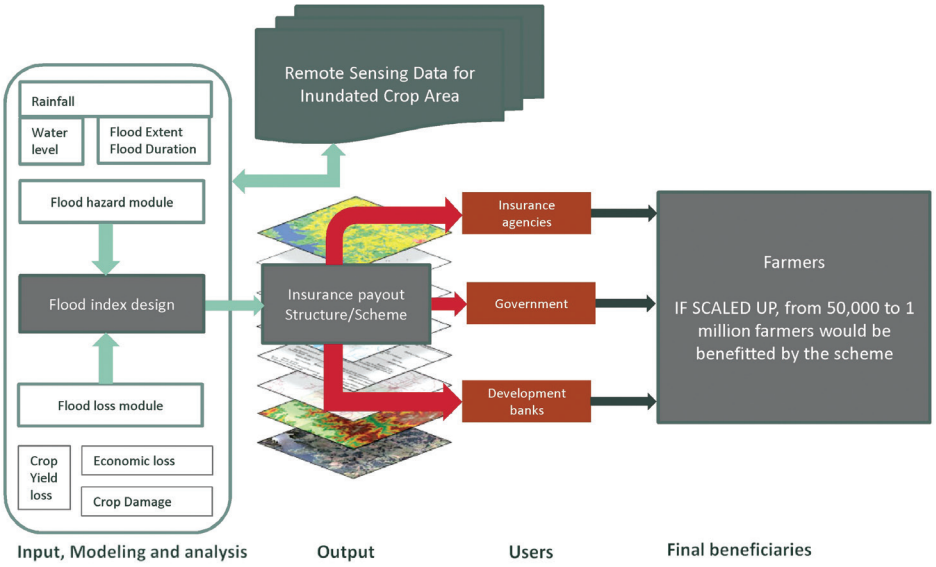
DEVELOPING THE IBFI PRODUCT

Based on hi-tech digital modelling and satellite imagery, the partnership's IBFI product recognizes when the depth and duration of flooding exceed pre-defined limits, triggering automatic payouts of compensation. Developing an IBFI involves undertaking flood hazard mapping (Matheswaran et al. 2019) and modeling, delineating zones for different levels of risk, designing a flood index and calculating affordable pricing levels, so that farmers at higher risk pay higher premiums.

Modeling flood hazards and defining risk zones

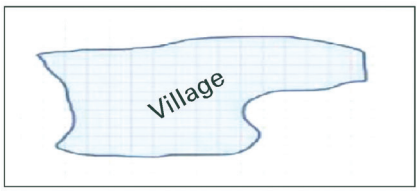
The primary aim for flood hazard models is to estimate the frequency and intensity of damaging floods. Analyzing the flood hazard facing an area involves using satellite technology and computer modeling to understand the movements of water following heavy rains. Risks analysis by combining hazard, vulnerability and exposure indices can help in identifying risk coverage, exposure to basis risk, level of simplicity and scalability (Amarnath and Rajah, 2016; Amarnath et al. 2017).

An IBFI is based on two parameters: the water depth and duration of any inundation. Rainfall data for a catchment is added to the model, and the amount of water flow that travels and collects is generated. If a trigger level is reached (calculated using 32 years of hydrological data, starting from 1982), satellite images are then used to verify the depth and duration of the flood. This accurately identifies those farmers eligible for compensation.



Index-Based Flood Insurance (IBFI) combines an integrated flood hazard model, developed using satellite imagery, with economic loss data

Parameters of a Typical Product



Payout = *f (L, T)*
L = Average Flood Water Level
T = Across Different Days

Flood Level	Index Level
0	0
X (unit dist)	1

0 = No breach, 1 = Breach

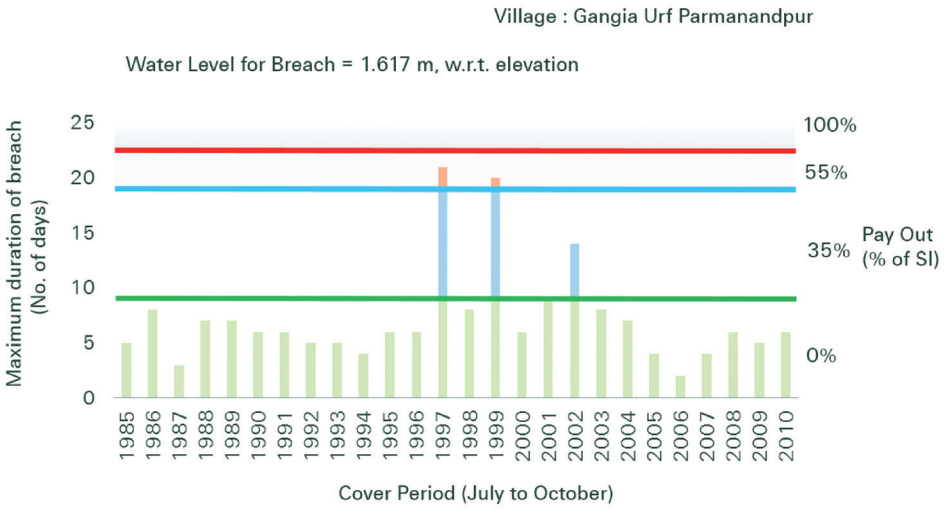
Duration	Level	Payout
0	1	0
9	1	0.35
19	1	0.55
23	1	1

Example

Assumed Trigger – 1.1 m

Date	Level (m)	Breach
Sept 09	1.078570	No
Sept 10	1.096616	No
Sept 11	1.103798	Yes

Sample Historical "as if" Payout



Specific flood index for a sample village, showing duration and depth triggers, and payout conditions

PUTTING IBFI TO THE TEST

Three variations of the IBFI developed by IWMI and partners were piloted in India and Bangladesh, in the first attempt to use such a product on a large scale (Table 1).

Table 1: Insurance and risk-transfer tools tested by IWMI and partners

Product	Index Based Flood Insurance (IBFI) v1	Index Based Flood Insurance (IBFI) v2	Bundled Insurance with Climate information and Seed Systems for Agricultural Resilience (BICSA)
Peril	Flood	Flood	Flood and Drought
Pilot area	Muzaffarpur District, Bihar, India	Gaibandha District, Bangladesh	Muzaffarpur and Gaya Districts, Bihar, India
Approach	Hydrological and hydraulic modeling combined with remotely sensed data to assess flood duration and depth	Multi-source and multi-scale remotely sensed data used to estimate flood extent	Multi-sensor, multi-source and multi-scale remotely sensed data used to identify flooding and/or drought condition
Data used	Rainfall, water level, ESA Sentinel-1 satellite data	NASA MODIS & ESA Sentinel-1 satellite data	Rainfall, MODIS, Sentinel-1, ESA ASCAT Soil Moisture
Trigger information	Flood depth, Duration	Flood extent (area approach)	Flood extent and Drought Severity Index
Triggering measurement for indexed variable	Village specific average values	Block wise using area approach	Block wise average values
Advantage	Combining model simulation and remotely sensed data achieves highest level of accuracy	Classical approach generates quick flood map with minimum data requirement	Combining Earth observation satellite products, index-based insurance and appropriate flood and drought tolerant seeds offers most effective strategy for building climate resilience
Crop covered	Rice	Rice	Rice, wheat and lentils
Period covered	July – October (Kharif)	July – October (Kharif)	July – October (Kharif) Nov – March (Rabi)
Payout structure	Lump sum directly to farmer's bank account	Lump sum directly to farmer's bank account	Lump sum directly to farmer's bank account and/or seeds for next season with insurance premium paid
No of villages/block	15 villages	2 upazila (sub- districts)	12 villages
Household insured	1,200	750	1,100
Total payout (No. households)	INR 814,030 (USD $ 11,350) (606)	BDT 2,672,400 (USD $ 31,500) (750)	INR 481,250 (USD $7,077) (254)

IBFI PROCESS

Using data from the past to simulate historic major flood events, scientists were able to calculate 'possible payouts' had the insurance been in place in earlier years. These findings were shared with local communities prior to implementing pilot projects, to show them the potential value of the schemes. IWMI also conducted a 'Willingness to Pay' survey among random participants in the pilot areas, to tailor the products to local capabilities. Most participants wished to be part of the pilot schemes, while expressing the need for affordable insurance premiums in line with their incomes. Initially, a fully subsidized product was piloted at micro level (where individual farmers subscribed to the insurance product) and in 2018 and 2019 farmers contributed to the premium amount of USD $8-10.

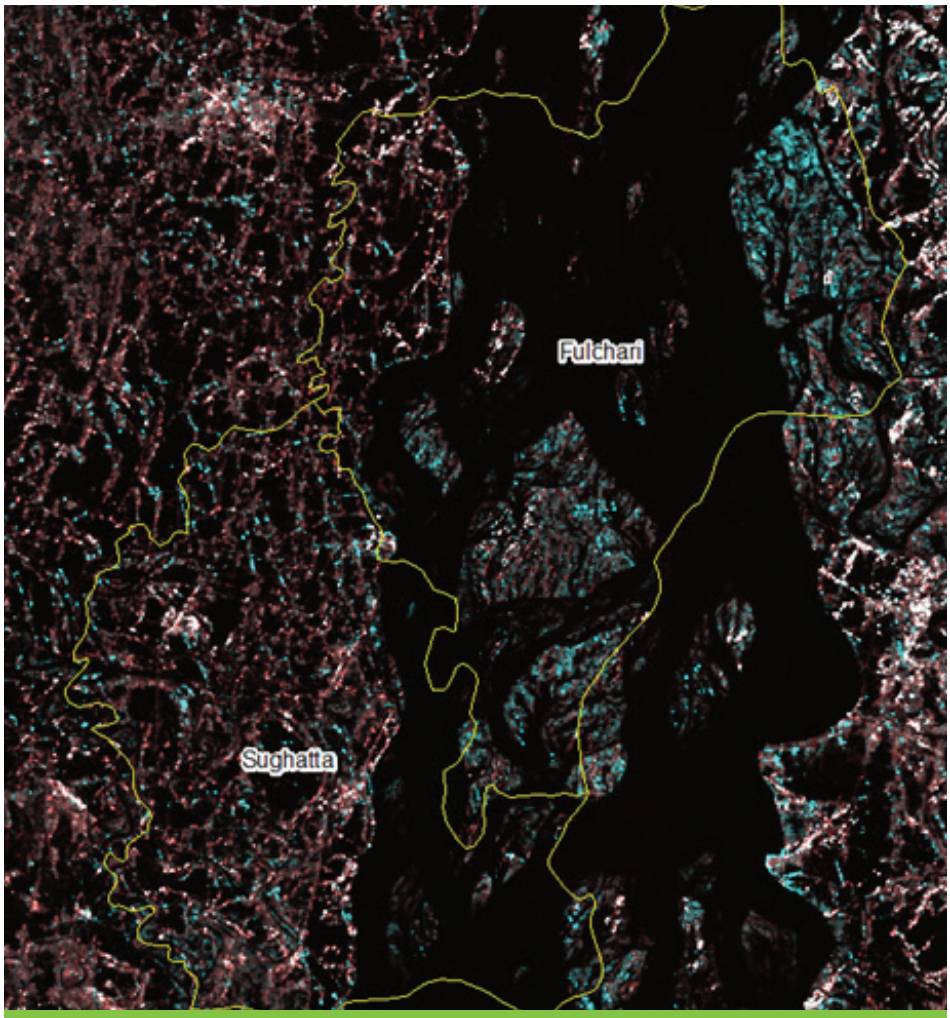
1st pilot project: IBFI v1

Between 2017 and 2018, the IBFIv1 product was tested in more than 1,200 households within 15 villages in Muzaffapur District, Bihar, India. Farmers were insured by the Agricultural Insurance Company of India Ltd (AICI) and HDFC Ergo General Insurance Company, with Swiss Re Pvt. Ltd. as (re)insurer. In all, 650 households were entitled to receive insurance payouts totaling INR 814,030 (USD $11,971). More than 110 households, who suffered total crop loss, received the full insured amount of INR 20,000 (USD $295) per hectare and other farmers received insured amount of INR 3,500 (USD $52) to INR 14,000 ((USD $205), depending on the loss of crop . All the eligible farmers subsequently received the payouts through their individual bank accounts.

2nd pilot project: IBFI v2

A successful trial of the satellite-based IBFIv2 was conducted across 750 households in Gaibandha District of Bangladesh. This calculated the percentage of inundated area (Amarnath and Rajah 2016) from the total geographical area for each participating upazila (sub-district). In 2019, heavy rain battered Bangladesh from early July. Some 7.3 million people were affected by monsoon floods throughout the country, with an estimated 308,000 people displaced. Nine districts were severely impacted: Bogra, Jamalpur, Kurigram, Sirajganj, Sunamganj, Sylhet, Tangail, Bandarban and Gaibandha. At least 119 people died as a result of the floods (ReliefWeb, 2019b). Using satellite data, IWMI and partners Oxfam, Green Delta Insurance Company and Swiss Re, calculated that households in the two participating Upazila of Fulchari and Sughatta were eligible to claim flood damages totaling BDT 2,672,400 (USD $31,500).

2018 IBFI Payout ceremony for farmers held in ICAR Eastern Region. Patna, India



Satellite image showing the extent of flooding in 2019 across two upazila in Gaibandha districts, Bangladesh. Credit: IWMI

3rd pilot project: BICSA

The third product tested a bundled insurance and seed package in over 600 households within Muzaffarpur and Gaya Districts of Bihar, India. In all, 200 ha were insured for a total premium of USD $4,000. Each farmer paid approximately USD $9 for the insurance, which was provided by Reliance General Insurance, a private company in India. This trial promoted integrated complementary solutions, including drought and flood insurance, improved seed varieties, weather forecasting services and climate-smart farming practices aimed at helping the farmer to recover as quickly as possible. A total of 170 farmers received compensation to the value of INR 481,250 (around USD $7,077). Therefore, on this occasion, the insurer made a loss. Meanwhile, IWMI distributed nearly 50kg of seeds to 63 farmers. Seeds of moisture-tolerant crop varieties were provided by Borlaug Institute for South Asia (BISA). The idea was to ensure good access to seeds just after the flood season, enabling farmers to take advantage of excess soil moisture for new crop production.

NEXT STEPS

The pilot projects show that insurance can contribute to effective disaster risk management. Moreover, member states striving to achieve the Sendai Framework for Disaster Risk Reduction and the United Nations Sustainable Development Goals are increasingly recognizing insurance as an important topic in global policy conversations. The benefits of insurance to managing disaster risk are more likely to be maximized if it is incorporated within an integrated disaster and agriculture risk management framework. Through such an integrated approach it is possible to identify opportunities for insurance to contribute to all areas of disaster management – including the management of residual risk, risk prevention, and disaster preparedness, response and recovery. A role for regional organizations – namely SAARC, the Association of Southeast Asian Nations (ASEAN) and UN Platforms such as United Nations Office for Outer Space Affairs (UNOOSA), United Nations Office for Disaster Risk Reduction (UNDRR) and United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), along with development partners and national disaster management agencies – is to strengthen the link between insurance and disaster risk management in developing countries by promoting more tailored and inclusive products for uptake and impacts on response and recovery.

Scaling up pilot insurance schemes so that they can cover several states, or even countries, will require data sharing between water resources, disaster management and agricultural coordination departments, both within states and potentially across state or national boundaries. Insurance products therefore have the potential to promote cooperation between departments, states and countries, as well as between public- and private-sector organizations.

There is a need to capitalize on a seamlessly integrated system that comprises big data, digital identity, and geospatial data to scale up parametric insurance penetration. It helps reduce the vulnerability of support small and marginal farmers to recurrent floods and droughts (Asia-Pacific Disaster Report, 2019).

Governments and the private sector both stand to benefit from successful large-scale public-private partnership insurance schemes. By building farmers' resilience to climate shocks, governments will have a greater chance of reducing risk from disasters and promoting economic growth. The private sector will gain from up-scaled agricultural insurance schemes, as it will have a much wider pool of potential clients to sell policies to. And the more people insured, the lower premiums will be, so government subsidies can be reduced too. It's a win-win situation.

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FURTHER READING

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