

Satellite data offers new hope for flood-stricken farmers in India



Climate change threatens to unleash more frequent floods. Satellite-verified flood insurance can underpin smallholder farmers' livelihoods, as well as helping nations meet sustainable development goals.

Climate change magnifies the risk of disasters and increases their costs. As the climate system has warmed, the number of weather-related hazards globally has tripled, and the number of people living in flood-prone areas and cyclone-exposed coastlines has doubled – and this trend is expected to increase. **Dr Giriraj Amarnath** and **Dr Alok Sikka** of **International Water Management Institute** (IWMI), discuss.



Dr Giriraj Amarnath



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In South Asia, many of the region's vulnerable people live in the vast agrarian belts along the Indus, Ganges, Brahmaputra-Meghna basins which are subject to periods of widespread and seasonal flooding. Monsoon variabilities, El Niño and La Niña, and other extreme weather events often result in large-scale flooding, which has significant impacts, especially on the poor and vulnerable populations who depend on subsistence agriculture.

Of US\$140 billion reported for damages in all economic sectors between 2003 and 2013, agriculture has been estimated to account for \$30 billion of losses, with floods accounting for 60% of crop damages.

In June 2017, torrential monsoon rains triggered floods and landslides in Bangladesh, India and Nepal. This killed more than 900 people, and affected 41 million people. Many areas became inaccessible due to damage to roads, bridges, railways and airports (Relief Web, 2017). See Table 1.

Insurance schemes

Many countries are realising that insurance is one way to manage the floods.

In India, some 30 million smallholder farmers are affected by floods every year. The government is currently subsidising the largest crop insurance scheme in the world – *Pradhan Mantri Fasal Bima Yojana* (Prime Minister's Crop Insurance Scheme) – with the aim to cover more than half of all farmers within the next two or three years.

However, some of India's most vulnerable states are home to its poorest farmers. In Bihar, which loses between \$0.5-120 million to floods every year, 78% of the population earn less than US\$2 per day (World Bank, 2003). How can the poorest farmers with meagre incomes experience the peace of mind that is enjoyed by the insured educated classes?

Index-based flood insurance

IWMI, CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) and the CGAIR Research Program on Water, Land and Ecosystem (WLE) and the support of Indian Council of Agricultural Research

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Table 1 - Summary of flood statistics for South Asia

	Bangladesh	India	Nepal
Deaths	114	Over 600	143
People affected	6.9 million	32.1 million	461,000
Areas affected	31 out of 64 districts	4 States (Bihar, West Bengal, Uttar Pradesh, Assam)	35 out of 75 districts

(ICAR), have been working to develop crop insurance that can accurately predict yield loss of smallholder farmers using satellite and public data – thus reducing the transactional costs of providing insurance and making insurance for smallholders a viable product.

Collaborating with insurance companies, government agencies and research institutions, we have developed and successfully tested an insurance scheme called Index-Based Flood Insurance (IBFI) in Bihar, India after a flood in July 2017.

In order to develop effective payout schemes for low-income, flood-prone communities, IBFI integrates hi-tech modelling, satellite imagery, and on-the-ground information to pre-determine environmental risks to

farmers in an accurate, cost effective, and speedy manner. See Figure 1.

How it works

IBFI uses combination of satellite images and flood modelling tools that combines inputs on satellite rainfall estimates, river characteristics, digital elevation model to generate flood depth and flood duration to develop pre-determined thresholds based on the historical flood events and economic losses.

More than 200 farming households in Bihar have signed up for a pilot index-based flood insurance (IBFI) scheme, which went live in July 2017. Villages in three locations were selected for the pilot; one in an area at high risk of flooding, one at medium risk

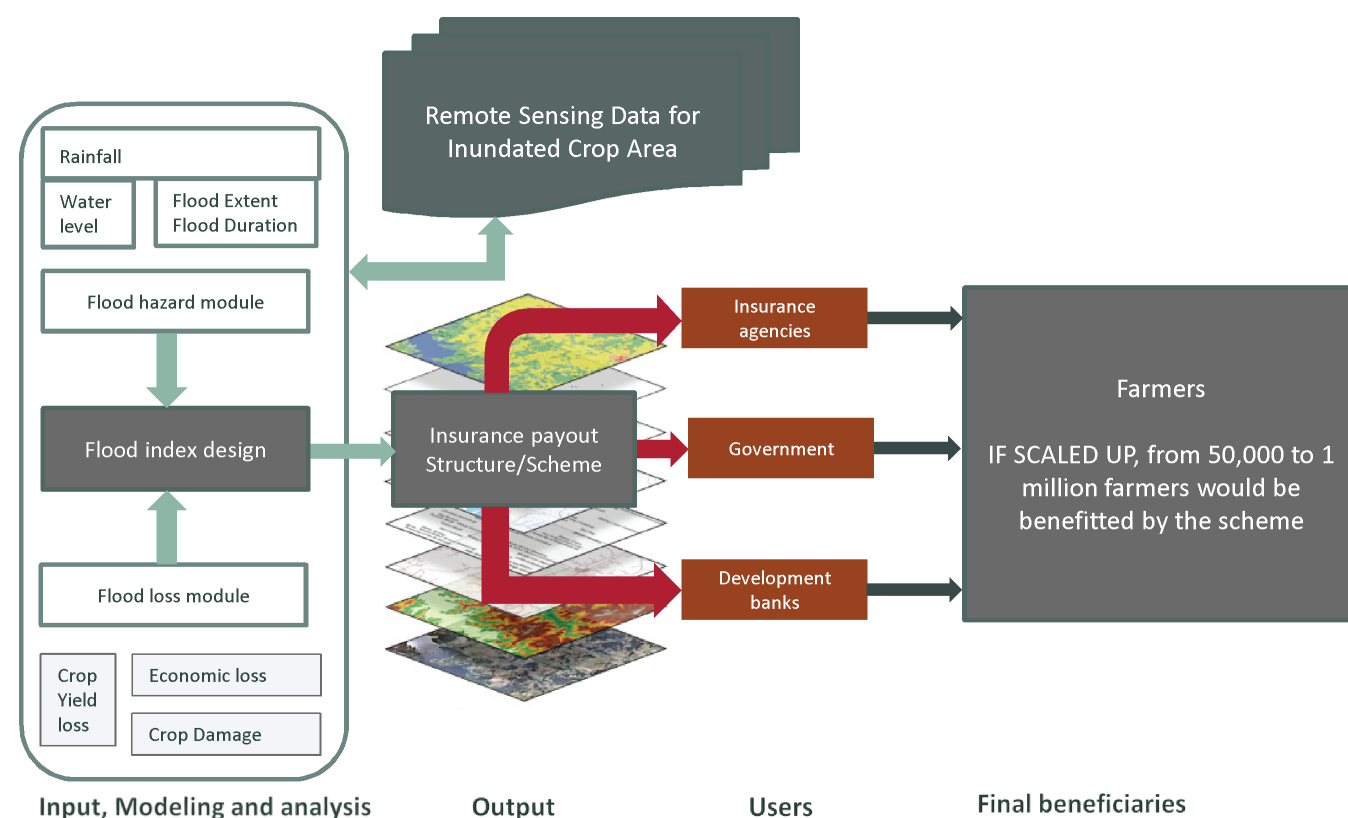
and one with a low risk of inundation. The participating farmers have insured crops worth a total sum of around INR5 million (approximately US\$78,000). In case of crop damage due to floods, registered farmers will receive pay-outs from the insurance company directly into their bank accounts, circumventing agents and other middlemen.

What it means using satellite data and open software

Determining crop yield using satellite images has been a real breakthrough. Being able to calculate how much crop yield a farmer will have allows insurance companies to cheaply and quickly: a) determine how much to insure for; b) how much has been lost after a disaster and; c) how much to pay affected farmers.

By using multiple sources – including remote sensing data, plot-specific geo-tagged (ie GPS) crop growth information, and crop production data from government departments – to create this vegetation index, the potential crop yield of huge swaths of land can be precisely determined. All of this

Figure 1: Concept of Index Based Flood Insurance (IBFI) integrated flood hazard model, economic loss data and satellite images for index development



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can be done using freely available satellite data and open software, like Google Earth.

This means that insurance companies and governments can quickly and accurately determine the amount of potential crop yield on a farm. Thus they can set the premiums for the crop insurance by looking at the vegetation coverage on a farm or in a village.

It also means that the insurance companies can quickly determine how much potential crop was damaged and lost after a flood, drought, or other disaster event. They can not only measure the extent of the crop damage, but also the specific location at the village or farm level. This allows them to determine the insurance payout for each area.

The role of Big Data

Without high quality data, insurance companies cannot offer reliable and cost-effective protection, which is particularly critical for poorer, vulnerable smallholder farmers. Governments have a key role to play in collecting the data and developing market infrastructure by making investments in data as a public good. This has historically not been particularly strong in India.

The private sector can contribute to improved data collection and management, either by taking on specific data collection tasks or by paying to use the data collected by the public sector.

The latter can provide the incentive

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needed for governments to invest in public databases. Since indices can be based on a combination of yield, satellite and weather data, and each data type has advantages and disadvantages, combining different types of data can lead to products that offer both speed and reliability in a cost effective manner.


Moving ahead

Crop insurance has become critical, particularly in view of increased agricultural shocks due to vagaries of nature, and it is not only vital for smallholders' wellbeing, but also for the national food security and stability.

IBFI has the potential to give 1 million farmers access agricultural flood insurance by 2025 and create a market of INR10 billion in flood risk management. Scaling up this initiative can increase the resilience of smallholder farmers and contribute to

the sustainability of agri-food system in the future.

In order for this to become a reality, data quality needs to be good and well audited; otherwise, it would not be useful to insurance companies that have high standards for data verifiability.

Governments can also show support for crop insurance schemes by subsidising agriculture insurance programmes when they first start, and while investments are being made in data infrastructure. The government can then offload the risk to insurance markets over time as data quality improves. By working together, the public and private sector can create a more secure future for their important food producers. 

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