Mapping target domains for flood-tolerant rice varieties in Nigeria using MODIS time series

Sander Zwart
Mohamed Hamady, Olusola Adefurin
Africa Rice Center

- African organization
- Research for development
- Member of the CGIAR
Major research domains @ AfricaRice

1. **Varietal improvement**: increasing yields; improving quality; increasing nutritional value; tolerance to environmental stresses

2. **Agronomy and post-harvest technology**: sustainable agricultural practices; site-specific advise; mechanization; reducing yield losses

3. **Rice value-chain**: access to markets; rice marketing; gender-relations; policy advice
Activity domains @ GIS Unit / AfricaRice

1. Providing high-quality baseline maps of the current rice area and growing environments;

2. Support the effective diffusion of scalable rice technologies by characterizing rice production systems; and

3. Support agriculture investment by mapping high potential areas for rice development.
1. Providing high-quality baseline maps of the current rice area and growing environments;

2. **Support the effective diffusion of scalable rice technologies** by characterizing rice production systems; and

3. Support agriculture investment by mapping high potential areas for rice development.
Flood threatens Nigeria’s hope of rice self-sufficiency

October 15, 2012 Premium Times

Floods destroy rice farms in Kano

October 3, 2012 Premium Times

35 villages, farmlands destroyed in Ebonyi

October 2, 2012 Pulse News

Angry River Niger

1st everything in one night • Schools, shops hit in Atomi, Ogokepala • Residents flee

From EMMAKARSI UZOR, October

nothing can be better described on the evil of the Naira. • As the rainy season approaches, many communities in the Niger Delta, in Bayelsa State, especially Offa, excited about the rains, are worried about the possible effects of heavy rains on their farmlands and homes.

The Offa shadow district agriculture officer, Mr. Osiyevwen, said, "The rains will cause flooding in our area, and we are not sure what will happen to our homes and farmlands."

The Offa residents, Gomina Osi, said, "We are worried about the possible effects of heavy rains on our farmlands and homes."

In Kebbi

45,000 farmers lose crops worth ₦3bn to flood - AFAN

"Unless the farmers are assisted to massively engage in dry season farming, the state and its neighbors will face food scarcity next year.

In Jigawa

Government disburses N7.6m to flood victims

In Northern Nigeria 11 die, 96, 710 hectares of farmland destroyed by flood in Sokoto, Kebbi, Zamfara - NEMA

In Adamawa Flood kills 6-year-old boy, submerges 116 Communities

The Secretary, Kebbi chapter of the All Farmers Association of Nigeria (AFAN), Alhaji Muhammad Idris, said on Friday that 45,000 farmers had lost crops worth ₦3 billion to flood.

Idris, who made the disclosure in an interview with the Agency of Nigeria (NAN) in Birnin Kebbi, said that the case was unprecedented.

He said that the association had enlisted its members to help the farmers that they should vacate from the flood-prone zone.

"We told them what to do, but they did not heed to our advice," he said.

"We have given them food and drinks, but they did not heed to our advice.

"We have given them food and drinks, but they did not heed to our advice."

"We have given them food and drinks, but they did not heed to our advice."
Floods and rice production

Floods:

... threaten rice farmer’s incomes
... increase regional market prices for rice
... threaten food security
... are likely to occur more frequently due to climate change
A solution? Flood-tolerant rice varieties

Targeting and scaling sub-1 rice varieties

Sub1 varieties after 17 days of submergence in the field at IRRI
Mapping location and duration of floods...

...for targeting and scaling sub-1 rice varieties

- MODIS time series of NDVI, EVI and LSWI
- Assess agricultural season (NDVI vegetation development, TRMM rainfall, GoogleEarth rice fields)
- Assessing “flooding hotspots” between 2001 and 2015 and…
- … assessing flood events nog lasting longer than 16 days.
Methodology

16-day MODIS LSWI 2001-2015
16-day MODIS EVI 2001-2015
16-day MODIS NDVI 2001-2015
16-day TRMM precipitation 2001-2015

Decision rules

Permanent water bodies mask
16-day flooded pixels 2001-2015

agriculture / rice seasons 2001-2015

GoogleEarth

16-day flooded land pixels during the agricultural seasons 2001-2015

Number of years with one period flood events 2001-2015

Number of years with multiple period flood events 2001-2015
Results

Number of years with flood events between 2001-2015

- 1-2 years
- 3-4 years
- 5-6 years
- >7 years

Upper Niger River and Sokoto tributary
Middle and lower Niger River
Benue
Hadejia

Number of years with multiple period flood events
Upper Niger River and Sokoto tributary

Middle and lower Niger River

Hadejia

Benue

Only floods observed on one MODIS image (16 d) during agricultural season

Number of years with flood events between 2001-2015

- 1-2 years
- 3-4 years
- 5-6 years
- >7 years

www.AfricaRice.org
All floods events during the agricultural season

Only floods observed on one MODIS image (16 d) during agricultural season

Area affected (hectare)

Number of years with flood events between 2001-2015
- 1-2 years
- 3-4 years
- 5-6 years
- >7 years

AfricaRice
www.AfricaRice.org
Limitations of the approach

• Use of MODIS composite images only provides an approximation of the flood duration

• Approach is only applicable for flood plain and lowland landscapes due to pixel size (6.25 ha)

• Flashfloods are unlikely to be captured
Next steps

- Validate with local news reports
- Assess rice production areas and existing adaptation strategies such as deepwater rice
- Support state governments and extension services in defining scaling areas for sub1-varieties