A GIS-Model to Identify Flood Affected Zones Using Landsat Images

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Outline

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River Dynamics

Not considering flood history in rural and urban planning could cause serious problems.

Lateral + Temporal Dimension = FLOOD
GENERAL OVERVIEW

Colombia is one of the richest countries in terms of water resources.

- About 1,900 swamps and wetlands covering more than 7,800 km².
- Thousands of rivers drain into five basins:
  - Caribbean
  - Pacific
  - Orinoco
  - Amazonian
  - Catacumbo

Lack of knowledge of river dynamics and management.

- Less than 15% of river data has been published.
- Of this, less than 1% contains long-term data.
What was the motive to develop a GIS model to assess the flood risk in Colombia?
What was the motive to develop a GIS model to assess the flood risk in Colombia?

Colombia Lacks 4 Things:

- Knowledge of Flood History
- Good Urban Planning
- High-Resolution Satellite Images
- Public Data and Published Info
IT WAS NECESSARY TO DEVELOP A MODEL WITH 5 REQUIREMENTS:

- Simple
- Low-Cost
- Efficient
- Flood History
- Publicly Available
MODEL CHARACTERISTICS

• Flood Return Period.

• Real Past Flood Events.
  - Most of them related to “La Niña”.

• Multitemporal Data:
  - Satellite Images from LANDSAT 5 – 8.
  - Years 1984 to 2015.
MODEL CHARACTERISTICS

- Only band 5 was used:
  - Near-Infrared (1.55 – 1.75)
  - Pixel Resolution 30m.

Band 5 has proven to be very useful in water bodies delimitation (Frazier & Page, 2000)
MODEL CHARACTERISTICS

- Flood History
- Simple
- Low-Cost
- Efficient
- Publicly Available

- Landsat Images from the USGS Repository.
- No Field Validation Necessary.
MODEL CHARACTERISTICS

- Flood History
- Simple
- Low-Cost
- Efficient
- Publicly Available

- Only Asks for Repository or Folder where the Images are Located.
- Doesn’t need any Parameter Specification.
- Runs in less than 10 minutes (Depending of the number of images)
MODEL CHARACTERISTICS

- **Flood History**
- **Simple**
- **Low-Cost**
- **Efficient**
- **Publicly Available**

- After some adjustments, the model will be uploaded onto the Web.
- Every person with ArcGIS can download the model and use it.
A BRIEF SCHEME OF THE MODEL

USGS server

Repository of Lansdat Images

Band 5 Extraction

AOI Selection

Band 5 Reclassification

Permanent Water Body Extraction (1:100,000 map scale)

Reports

Raster map rendering

Estimation of Flood Risk Zones

Urban planning

Decision makers

Raster to Vector

Raster calculations others
RESULTS

Gamarra, César
Temporal Range
1990 - 2014
RESULTS

Fontibón, Bogotá D.C.
Temporal Range
2000 - 2014
RESULTS

Cajicá, Cundinamarca
Temporal Range
2000 - 2014
Model Advantages

• Produces a simple, understandable map useful for urban planning.

• Gives data essential to understanding the flood dynamics of Colombian rivers.

• With some adjustments, the model can produce real-time flood risk data.

• Will work with Near-Infrared Images.
Model Limitations

- Model Accuracy depends on the Number of Images.
  Only accurate in zones with many images over a long period of time.

- Low Image Resolution (30 m²).

- Damaged Landsat 7 Images.

- High cloud cover.
Other Applications

• Can be used to identify Riverscape and Floodscape.

• Can help with River and Wetland Management.
THANKS!