Forecast-based Financing

Changing the paradigm, acting faster

El Niño in Peru
WHAT IS EL NIÑO?

El Niño is a complex interaction of the tropical Pacific and the atmosphere, resulting in cyclical episodes (every four to seven years) of changes in ocean and weather patterns in many parts of the world. Often these episodes have considerable impacts occurring over several months, such as altered marine habitats, rainfall, floods, droughts and changes in storm patterns.¹

In both the 1982-1983 and 1997-1998 El Niño, northern Peru (Tumbes, Piura and Lambayeque) suffered flooding from heavy rains, while the south of the country suffered severe droughts. In this context, the Peruvian Red Cross (PRC), the German Red Cross (GRC) and the Red Cross Red Crescent Climate Centre, designed a project which uses scientific (observations and forecasts) to implement early action in the most vulnerable areas. Forecast-based financing (FbF) is still in its pilot phase, and the latest 2015-16 El Niño was one of the first applications of the mechanism.

¹ Definition taken from UNISDR | ² Taken from http://iri.columbia.edu/enso | ³ Information recorded by INDECI.
FbF CONCEPT

Some preparedness and humanitarian aid can be secured between a forecast and the impact of an event. Most hazards related to weather can be predicted. Thus, the humanitarian community can get information and know where and when to act, if a storm, flood or drought is expected.

FbF develops new processes and methodologies to prepare, deliver and respond in a more effective and efficient manner, based on national and international hydro-meteorological forecasts. It formulates defined danger levels and early actions. These actions are triggered when a forecast exceeds a danger level in a vulnerable intervention area (e.g. a specified amount of rain that make rivers and communities flood). Hence, actions can be taken before the impact of the disaster and strengthen resilience, of both communities and institutions.

Applying FbF during El Niño in 2015-2016 proved that you can establish a system that triggers the use of funds to implement preparedness actions before a predicted disaster occurs. In this way suffering and losses can be avoided, and aid funds more efficiently used. Moreover it improves resilience and community preparedness.

What do we want to change in the Peruvian context?

Historical data from 1982-1983 and 1997-1998, show that a strong El Niño has a great impact on health, drinking water, food security and housing. FbF seeks to act before the disaster, with early action to build and enforce resilience, reducing the impact of an El Niño Event and ensuring that basic needs are available at the time that families and communities need them most.

In which field do we take early action?

- Food security
- First Aid
- Safe drinking water
- Health and hygiene during emergencies
- Strengthening and protecting housing
- Community based Early warning
HOW IMPLEMENTED?

WHAT ARE THE KEY ASPECTS OF THE PROJECT?

1. To understand the risk scenarios
   The risk scenarios are consulted to analysing threats including historical impact data and level of vulnerability.

2. To identify available forecasts
   - Use of national and international data.
   - Taking into consideration the probability, intensity and time prior to the occurrence of an event.

3. To formulate early actions
   Such as:
   - Awareness raising campaign on hygiene or safe drinking water
   - Strengthening of houses.

4. To identify danger levels
   - Define the threshold for a specific hazard.
   - Identify the critical character, analysing vulnerability and the historical impact in the area of intervention.
   - Consider institutional capacity to act.

Between August and September 2015, the Red Cross, local government, disaster risk management authorities (INDECI and CENEPRED), the Met Office (SENAMHI) and agencies in the health, agriculture, housing and transport sectors, jointly analysed risk scenarios, historical impact and vulnerability. As a result, relevant early actions were selected. The project also defined very specific danger levels based on thresholds of available forecasts, historical data and vulnerability in the intervention area.
To create a Standard Operating Procedure (SOP or early action guidelines)

- Responsibilities
- When to act
- Where to act
- Funds to be made available

Validate SOP with key actors

- Met. service
- Local governments
- Members of the national disaster risk management system.

Monitoring hydro meteorological forecasts

YES

The danger level is exceeded

Early actions are to be implemented (according to the SOP)

No

The danger level is not exceeded

No early actions are to be implemented
**EL NIÑO 2015-2016**

**FBF TIMELINE**

**CLIMATE FORECAST**

- ECMWF
- IRI
- ENFEN

**Probability Forecast**

**NATIONAL CONTEXT**

- Niño Godzilla
- INDECI “SOS El Niño”
- Regional Government asked to implement FbF for El Niño with comprehensive approach
- National Government declares state of emergency

- Fear of strong similarity El Niño 1997 - 1998
- Donor accepts to formulate FbF El Niño

**ACTIONS**

- Early actions identified in Piura and Lambayeque
- Available forecast identified

**January 25th:** Medium Probability Trigger

**January 28th:** Medium Probability Trigger
IRI ENFEN

No “Clear” Signal

CLIMATE FORECAST

ECMWF INDECI

“SOS El Niño”

Godzilla

Donor accepts to formulate FbF El Niño

Identifying of hazard levels

Deployment field team

Training on key practice volunteers. Awareness raising in community. Establish brigades in the communities for early warning and First Aid

Start of purchasing process

Start construction and reinforcement housing process

Kit distribution on water and hygiene

ACTIONS

NOVEMBER 28TH: Low Probability Trigger | Low Impact

JANUARY 25TH: Medium Probability Trigger | 1 month

JANUARY 28TH: Medium Probability Trigger | 7 days

Regional Government asked to implement FbF for El Niño with comprehensive approach

National Government declares state of emergency

Available forecast identified

Training on key practice volunteers.

Awareness raising in community. Establish brigades in the communities for early warning and First Aid

Start of purchasing process

Start construction and reinforcement housing process

Kit distribution on water and hygiene

Fear of strong similarity El Niño 1997 - 1998

Rainy Season
The next matrix shows forecasts of various national and international sources (EU, CFS, NOAA, NOAA-GFS-ENFEN-PERU, IRI-Columbia University, Eurosip, ECMWF, GloFAS), organized by time of forecast, impact and probability, according to the levels of danger to the population. The arrows indicate how forecasts could be translated into actions that could be triggered, if danger levels were exceeded.

### Lead time

<table>
<thead>
<tr>
<th>PROBABILITY / IMPACT</th>
<th>Seasonal</th>
<th>Monthly</th>
<th>Weekly</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>El Niño 1+2 SST* anomaly: 2°C</td>
<td>• ENFEN: 10% probability of 'extraordinary'</td>
<td>• IRI: 20% probability of top 10% precipitation</td>
<td>• EUROSIIP: 40-50% probability of top 20% precipitation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Forecast precipitation 1 month (NOAA.CFSv2) (4-6 mm/day anomaly)</td>
<td></td>
</tr>
</tbody>
</table>

| **Medium**           |          |         |        |
| Niño 1+2 SST* anomaly: 2.5°C | • ENFEN: 15% probability of 'extraordinary' | • IRI: 30% probability of top 10% precipitation | • EUROSIIP: 50-70% probability of top 20% precipitation |
|                      | • Forecast precipitation 1 month (NOAA.CFSv2) (6-10 mm/day anomaly) | | • 66% probability of exceeding the 10 year return period threshold of GloFAS* model (for Bajo Piura) |

| **High**             |          |         |        |
| El Niño 1+2 SST anomaly: 3°C | • ENFEN: 20% probability of 'extraordinary' | • IRI: 40% probability of top 10% precipitation | • EUROSIIP: 70-100% probability of top 20% precipitation |
|                      | • Forecast precipitation 1 month (NOAA.CFSv2) (10 or + mm/day anomaly) | | • 68% probability of exceeding the 10 year return period threshold of GloFAS* model (for Bajo Piura) |

### FROM SCIENCE... TO ACTION

The arrows indicate how forecasts could be translated into actions that could be triggered, if danger levels were exceeded.

**Surface sea water is warmer (>3°C) and a lot more rain than normal (P90).**

- Provide communities with 100 temporary housing for 100 families.
- Support for seed storage.
- Equip 18 units of first aid.
- Provide drinking water for 2,000 families.
- Strengthen and protect homes at risk of collapse for 300 families.
- Early evacuation.

**Surface sea water is warmer (>2.5°C) and a lot more rain than normal (P90).**

- Provide communities with 100 temporary housing for 100 families.
- Support for seed storage.
- Equip 18 first aid units.
- Provide drinking water for 2,000 families.
- Strengthen and protect homes at risk of collapse for 300 families.
- Wetter than normal (>6 mm/day).

**Surface sea water is warmer (>2°C) and a lot more rain than normal (P90).**

- Community awareness and installation of brigades for early warning.
- Distribution of buckets, chlorine, installation of water reservoirs, temporary water tanks, distribution of hygiene kit.
- 68% chance of flood (Glofas) or very heavy rainfall with short-term forecasts (>30 mm/day).
- 66% chance of exceeding the 10 year return period threshold of GloFAS* model (for Bajo Piura).
- Forecast precipitation: Percentile 85 of ECMWF and GFS –NOAA (> 20 mm/day absolute values) (Piura and Lambayeque).

**SST:** Sea Surface Temperature

**GloFAS:** Global Flood Awareness System
The FbF project builds a bridge between scientific information and early action, firstly to use available forecasts effectively, then to take actions and make decisions to be better prepared for disasters and increase resilience to floods and heavy rain.

**Lead time**

- **Surface sea water is warmer (>3ºC) and a lot more rain than normal (P90).**
  - Community awareness brigades and installation of early warning.
  - Equip 18 units of first aid
  - Provide drinking water for 2,000 families
  - 2,000 assist families in healthcare
  - Strengthen and protect homes at risk of collapse for 300 families

- **Wetter than normal (>6mm/day).**
  - Community awareness and installation of brigades for early warning.
  - Equip 18 first aid units
  - Provide drinking water for 2,000 families
  - Strengthen and protect homes at risk of collapse for 300 families.

- **66% chance of flood (Glofas) or very heavy rainfall with short-term forecasts (>20mm/day)**
  - Distribution of buckets, chlorine, installation of water reservoirs, temporary water tanks, distribution of hygiene kit.

- **Surface sea water is warmer (>2.5ºC) and a lot more rain than normal (P90).**
  - Provide communities with 100 temporary housing for 100 families
  - Support for seed storage.

- **A lot more rain than normal (>10mm/day).**
  - Provide communities with 100 temporary housing for 100 families
  - Support for seed storage.

- **68% chance of flood (Glofas) or very heavy rainfall with short-term forecasts (>30mm/day).**
  - (Early) evacuation.

*SST: Sea Surface Temperature
*GloFAS: Global Flood Awareness System

The level of preparedness in communities remains low.

WHY USE FORECASTS IN LAMBAYEQUE AND PIURA?

GENERAL PREPAREDNESS AT THE BEGINNING OF THE SEASON

40 volunteers trained from Peruvian Red Cross branches.

18 vulnerability and capability assessments conducted.

18 early warning established committees.

SOP confirmed by key actors.

HUMANITARIAN EL NIÑO INTERVENTIONS

FORECAST

3 MONTHS lead time

If the forecast exceeds the danger level

The following early actions will be implemented with low or medium probability:

2000 families will receive awareness raising sessions on water and hygiene.

18 community brigades will be constituted, equipped and trained.

1 MONTH lead time

If the forecast exceeds the danger level

The following early actions will be implemented with medium probability forecast:

Distribute 18 first aid kits.

Preposition 2000 buckets and chlorine tablets

Preposition 06 15lt water tanks each.

7 DAYS lead time

If the forecast exceeds the danger level

The following early actions will be implemented:

Distribute 1000 buckets, chlorine tablets and hygiene kits (for 1 family during 1 month)

In case of an extreme weather forecast event with high impact

The following early actions will be implemented:

Build 1000 shelters.

Build 1000 latrines.

Provide assistance to store seeds and food items

Reinforcing 300 houses.
CONCLUSIONS

Forecast-based financing for El Niño in Peru is a unique initiative with an innovative approach. The use by the Red Cross of probabilistic forecasts for humanitarian early action is a first in Latin America. It is worth exploring what possibilities FbF can offer for other hydrometeorological events, and whether the probability, the impact, or the intensity of event, or a combination of all three, is important to consider.

Although, scientific signs predicting El Niño are improving, the local and international scientific communities still face a challenge to achieve forecast accuracy on both the probability and intensity of the phenomenon. It also remains extremely challenging to predict how it will influence local weather patterns.

In 2015-2016, El Niño in Peru was not a strong or extreme event. It should be noted that not all El Niños are equal, and a single El Niño does not impact in all places with the same intensity. In 2016 Argentina, Paraguay, Uruguay and Brazil suffered heavy rains and flooding, while in Colombia, Venezuela and much of Central America suffered severe droughts.

Some actions were taken in vain, but most were beneficial in the long run, contributing to building the capacity for early action of the National Society and local communities. The project also improved the housing stock. Moreover, in very vulnerable rural areas, awareness raising was done in the field of health, safe drinking water, and hygiene and early warning. These are long-term benefits that increase resilience and contribute to being prepared for other events.

Droughts associated with El Niño and La Niña do not appear overnight. A combination of observation (e.g. sea-surface temperature) and forecasts with a longer lead-time provide humanitarians with several months’ advance warning.

FbF interventions in Piura and Lambayeque will be measured through an impact study and analysed in an inter-agency workshop. Lessons will be identified and guidelines developed to scale up FbF in other countries and for other hazards.

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IDENTIFYING DANGER LEVELS

> Climate threshold defined.

> The critical danger level was identified by analysing the vulnerability and impact in the target area.

> It took into account the capacity of institutional performance.

DEVELOP EARLY ACTION

> Community awareness campaigns.

> Distributing equipment and first aid kits.

> Strengthening and protecting housing.

> Humanitarian aid prepared.

MONITORING FORECASTS IF DANGER LEVELS WERE EXCEEDED

<table>
<thead>
<tr>
<th>FORECASTED AND TRIGGERED</th>
<th>FORECASTED AND TRIGGERED</th>
<th>FORECASTED AND TRIGGERED</th>
<th>WAS NOT FORECASTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER IS WARMER</td>
<td>&gt; 6 TO 10 MM OF RAIN PER DAY.</td>
<td>&gt; 20 MM OF RAIN PER DAY.</td>
<td>&gt; 30 MM OF RAIN PER DAY.</td>
</tr>
<tr>
<td>&gt; 2°C THAN NORMAL.</td>
<td></td>
<td></td>
<td>FLOODS CAUSED BY RIVER OVERFLOW.</td>
</tr>
<tr>
<td>LOT MORE RAIN THAN NORMAL AND POSSIBLE FLOODS.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 2000 families will receive awareness raising sessions
- 40 trained volunteers
- 18 community brigades will be constituted, equipped and trained
- 18 first aid kits were distributed
- 300 reinforced houses
- 1000 families access to clean drinking water in Piura
- 1000 hygiene kits
- 2000 families could access to clean drinking water

18 community brigades
1000 hygiene kits
300 reinforced houses
2000 families could access to clean drinking water
18 first aid kits were distributed
2000 families will receive awareness raising sessions
40 trained volunteers
100 shelters built

1. Mónropon
2. Bajo Piura
3. Morrope
4. Picsi

Design: Javi Domínguez | Juan José Vásquez