Climate and environmental

Anticipating climate risks in Nicaragua

Audilio Echavarria is a farmer in the coffee region of Jinotega, Nicaragua. Climate change is forcing many coffee farmers like him to diversify into cocoa.

The risks and opportunities

Climate and environmental risks and opportunities concern the potential effects of environmental change and degradation. These include the loss of natural resources, pollution from effluents and energy use, and hydro-meteorological and geophysical change.

In practice

Nicaragua is one of the countries in the Americas most vulnerable to climate change, according to the 2015 Germanwatch *Global Climate Risk Index*. It is the second-poorest, with 40% of the population living on less than $2 a day, and significantly reliant on agriculture for employment and livelihoods.

Agriculture provides 30% of GNP and 60% of employment, so strengthening agricultural resilience and capacity to adapt is an economic priority as well as vital for food security. This reliance exposes vulnerable communities to a variety of shocks and stresses which are only expected to intensify.

They include cyclones from both the Pacific and Atlantic, usually occurring during the second half of the rainy season, which runs from May to October. The El Niño phenomenon, a climate oscillation that warms the eastern half of the equatorial Pacific, brings a reduction in hurricanes but an increase in drought risks. These are particularly acute in the 'drought corridor' that runs from western Nicaragua into Honduras, El Salvador and finally Guatemala.

Regional climate model

Building on existing work that increased communities' use of early warning systems for hurricanes, we supported our partner Centro Humboldt to develop a regional climate model for Nicaragua. This combines climate data with crop characteristics and requirements for the three main crops – maize, beans and rice – to generate forecast maps for five-year periods up to 2039. These show how the evolving climate would affect the areas suitable for growing these crops.

For example, the 2035-39 scenario for beans indicates that the suitable range would contract and fragment substantially. Cultivation would cease in the drought corridor and many of the areas currently considered optimal for beans in the central highlands would become marginal. This suggests that a change to more sustainable, moisture-conserving soil management practices is vital, together with new, earlier-maturing and drought-resilient bean varieties, increased access to irrigation and consideration of other, more resilient pulses.

Community-managed rain gauges

The development and use of these model-based scenarios have involved an initial network of 27 community-managed rain gauges, later replicated in more communities, which are situated in areas relatively less well covered by formal climate stations. This local information has been used to improve the calibration of the climate model to increase its accuracy regarding local climate conditions.

So, with the community involved in their development, the crop scenarios are also used for the existing planning process first developed to manage hurricane risk, but expanded to include other risk categories. The maps provide community action plans, and farmers in given locations gain general information on likely future climate change but also more specific guidance; for example, switching from a maize variety that needs 110 days to reach harvest, to one that needs 100 days or less can improve resilience to drought risks, where there is a likelihood of the growing season being cut short by low or erratic rainfall.

Matching farmer priorities and plans for production with applied climate scenarios for their main crops provides important planning guidance. For example, identifying crop options to meet future conditions for communities and individual farmers, especially where these include perennial crops such as coffee that have a 15-year production cycle.

Communities have now been collecting rainfall records since 2011, recording daily rainfall and meteorological characteristics for a variety of local decision-making processes, including:

- matching rainfall to the growing requirements of crops to guide crop management measures
- using day-to-day and historical community data to determine the type and variety of crops (maize, beans, sesame, etc) to plant
- better estimation of the planting date, based on the seed type to be used and the rainfall accumulated
- early warning of drought conditions; for example, if only 1-5mm is recorded for three–five days, planting is restricted and irrigation measures can be used (if available) to reduce moisture stress
- early warning of flood risks – if more than 100mm falls in 24 hours, the community is advised of flood possibilities; if more than 200mm falls, this indicates a high likelihood of local flood risk
- reviewing harvest prospects based on rainfall records to give an early indication of harvest expectations.

Where a formal climate station is absent, local government's capacity to respond to drought or flood can be constrained as it lacks the rainfall data to make an accurate assessment. Communities have therefore sought to ensure that their rain gauge data is officially recognised as reliable and can be used to trigger drought relief, even if formal rainfall figures suggest drought has not occurred.

Early indications of impact

In terms of productivity improvements, crop yield data from all 400 producers suggests that a combination of the following factors, as attributed by farmers, has had a significant impact, improving staple crop yields by 50-100%, depending on the crop (75% on average):

- increased knowledge and application of organic fertilisers and pesticides
- better access to seeds, through seed banks
- improved agricultural understanding achieved through training provided on what to plant and when
- the application of climate information through use of rain gauges.

Producers not only report better yields of basic crops but diversification into other plants including fruit, vegetables and medicinal plants; 100% of producers agree they are now eating better or much better (more; more healthily) and that the health of their families is either better or much better. Based on a 2013-2014 assessment, 92% now have food to sell after feeding their families compared to 37% at the beginning of the project, and 98% report improved access to markets since the beginning of the project, with low yields no longer cited as one of the biggest barriers to resilience.

In Nicaragua, rain gauges are helping communities to plan what and when to plant, and give early warning of flood and drought.