



# Developmental Impacts of La Nina

*Anna Louise Strachan  
Consultant  
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## Question

*What evidence exists of past developmental impacts of La Niña events?*

## Contents

1. Summary
2. Developmental Impacts of La Nina
3. Case Studies
4. References

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## 1. Summary

La Niña has a number of both positive and negative developmental impacts. These include impacts on health, livelihoods, infrastructure, water security and economic growth. La Niña is part of ENSO (El Niño-Southern Oscillation), a climate phenomenon, consisting of the El Niño, neutral, and La Niña phases. La Niña usually occurs following an El Niño event. La Niña causes opposite conditions to those associated with El Niño. Thus, areas experiencing drought during El Niño are likely to experience flooding during La Niña. Likewise, areas that have experienced excessive rainfall during El Niño, are likely to experience drought during La Niña. According to a paper produced for DFID, ‘no two La Niña events will be the same – the timing and magnitude of events differs considerably.’ The same paper highlights the fact that La Niña events have different impacts due to other concurrent local, physical, and social factors (Hirons & Klingaman, 2016).

The impacts of La Niña appear to be less well researched than the impacts of El Niño. Key findings from the research undertaken for the purposes of this report include:

- There is a relatively robust body of evidence on the link between La Niña and an increased prevalence of vector-borne diseases.
- The impact of La Niña on planting, crop yields and agricultural prices varies according to geographical location. There is some evidence to suggest that La Niña generally has a positive impact on agricultural production in much of Southeast Asia, whereas it has a detrimental impact on agricultural production in East Africa.
- The evidence on the impact of La Niña on economic growth is inconsistent, with some studies suggesting that La Niña events result in economic growth whereas other studies suggest that La Niña results in a drop in GDP (Gross Domestic Product).

Geographically, the majority of the literature on the impact of La Niña identified during this rapid literature review focuses on countries in Southeast Asia. In particular, there are several rigorous research studies on the linkages between La Niña and agricultural production. There is less coverage of Sub-Saharan Africa and the MENA (Middle East and North Africa) region. The literature on the impacts of La Niña focuses predominantly on the humanitarian impacts of the phenomenon, rather than on the developmental impacts. Moreover, there is limited evidence of causality, suggesting a need for more rigorous studies on the linkages between La Niña and development impacts. A significant number of the studies available are quantitative, suggesting that there is also a need for more mixed methods research to enable a more in-depth understanding of the correlations identified by the existing quantitative research. In addition, a number of the studies on this topic are of low quality. The existing literature is gender and disability blind. Gaps in the literature include:

- Long-term impacts on urban areas, and in particular informal settlements
- Impact on education, including school attendance
- Gendered differences in development impacts
- Impact on the most marginalised, including persons with disabilities
- Potential development opportunities associated with La Niña
- Impact of La Niña on livestock and fisheries
- Any possible impact on existing peacebuilding/resilience building projects in areas affected by La Niña
- The interrelationship between the effects of La Niña and the effects of the desert locust outbreaks in East Africa
- The interrelationship between the effects of La Niña and the effects of COVID-19

## 2. Developmental Impacts of La Nina

This section provides an overview of the developmental impacts of La Niña by sector. Education is not covered below, as no evidence of a relationship between La Niña events and education was found during the research undertaken for this report.

### Health

There is some evidence directly linking La Niña to long-term health impacts. A recent study published by Harvard School of Public Health finds that there is a link between La Niña events and influenza pandemics. The study argues that La Niña can result in an altered migratory pattern for birds. It goes on to argue that this may bring together birds that typically would not mix, and can also change their contact with domestic animals.<sup>1</sup> It states that such conditions 'favour the genetic mixing that occurs when an animal is infected with multiple forms of the influenza virus, and can ultimately lead to the development of dangerous novel pandemic strains.'<sup>2</sup> The study notes that not all La Niña events result in the emergence of a new influenza strain, however all four of the pandemics studied were preceded by a La Niña event.<sup>3</sup>

Several peer-reviewed journal articles and publications by the WHO suggest that there is a link between La Niña and vector-borne diseases. In particular, the connection has been made between La Niña and zika virus, dengue, and malaria. For example, the WHO has found a correlation between La Niña and dengue epidemics in Southeast Asia.<sup>4</sup> According to an evidence review produced for DFID, there is an increased risk of dengue in Indonesia during La Niña (Hirons & Klingaman, 2016, p.15). The same study finds strong evidence of an increased risk of malaria in Southern Africa and in Southern Asia. It also finds that there is some evidence in the existing literature that suggests that La Niña is associated with a reduced risk of Rift Valley Fever in East Africa (Hirons & Klingaman, 2016, p.13).

There is also some evidence to suggest that malnutrition and water-borne diseases can increase as a consequence of La Niña's impact on food security and weather patterns. For example, there is strong evidence that La Niña is associated with an increase in the risk of cholera outbreaks in Southern Asia (Hirons & Klingaman, 2016, p. 15). IGAD posits the theory that increased malnutrition due to La Niña related crop shortages could result in increased vulnerability to COVID-19 among poor and vulnerable populations in the Horn of Africa and East Africa.<sup>5</sup> However, the article in question is a press release and does not constitute rigorous research.

### Livelihoods/ Food security

The majority of the existing literature on the long-term development impacts of La Niña focuses on the impact on livelihoods and food security. This is due to the relatively well-evidenced impact of changing weather patterns, and extreme weather events on agriculture, and in particular on planting, and crop yields.

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<sup>1</sup> <https://www.hsph.harvard.edu/news/hsph-in-the-news/la-nina-flu-pandemics/>

<sup>2</sup> <https://www.hsph.harvard.edu/news/hsph-in-the-news/la-nina-flu-pandemics/>

<sup>3</sup> <https://www.hsph.harvard.edu/news/hsph-in-the-news/la-nina-flu-pandemics/>

<sup>4</sup> <https://www.nationalgeographic.com/news/2016/08/will-la-nina-affect-the-spread-of-zika/>

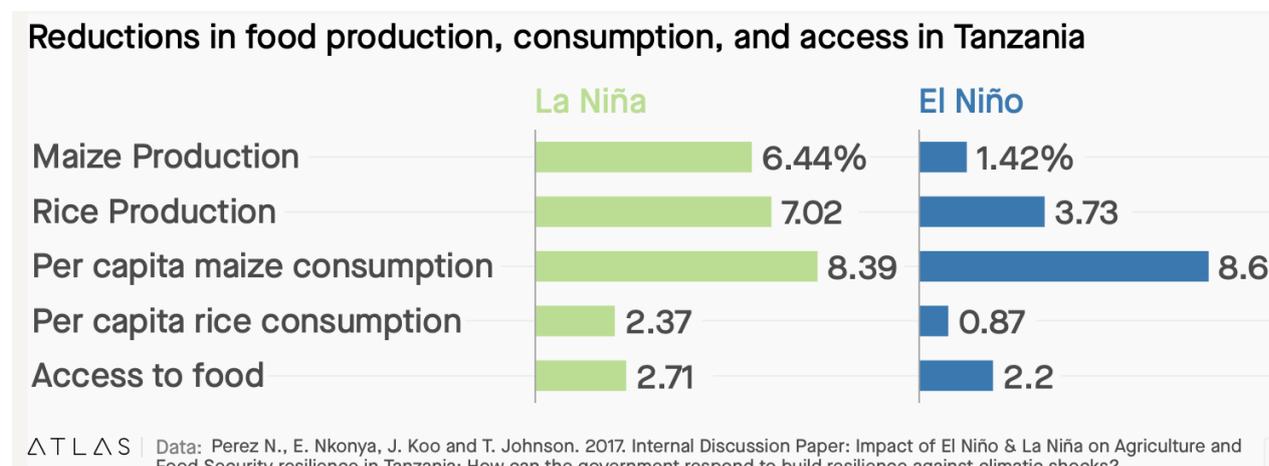
<sup>5</sup> ICPAC (11 November, 2020). *La Niña: forecasted drier than usual season poses risks to crops and livestock in some parts of the region* (Press Release). <https://www.icpac.net/news/la-niña-forecasted-drier-than-usual-season-poses-risks-to-crops-and-livestock-in-some-parts-of-the-region/>

The evidence on the impact of La Niña on crop yields differs according to geographical region. One study finds that the global average yields of major crops, such as maize, rice, and wheat, tend to be lower than normal during both El Niño and La Niña events (Nobre et al, 2019). However, according to a World Bank study on the effects of El Niño and La Niña on agriculture in Cambodia, La Niña events have a slightly positive effect on agricultural production in the country. The study finds that, on average, rice production increases by five percent during La Niña (World Bank, 2019a, p. xiv). Maize and tomato crops increase the most during La Niña events in Cambodia. The research study looks at differences across coastal, plain, lake, and mountainous regions, and shows that there are significant differences in how production of various crops is affected in different regions (World Bank, 2019a, p. 17). In countries which are dependent on agriculture for a significant proportion of GDP, ENSO's impacts on agriculture affect the entire economy, such as in Myanmar and Cambodia.

A quantitative study focusing specifically on paddy plantations, finds that a moderate La Niña and strong El Niño during the paddy plantation period significantly reduces Southeast Asia's paddy production in the long-term. This study also found that a moderate La Niña event during the paddy plantation period has a more significant impact on paddy reduction than a strong El Niño event in the long-term (Ismail & Chan, 2019, pp. 7-8).

A blog on La Niña in Tanzania, published by IFPRI (International Food Policy Research Institute), makes the connection between the 2011 La Niña event and food shortages, attributing an approximate 3 per cent reduced access to food to the event. It reports that La Niña had a much larger impact on production than El Niño, as it reduced maize and rice production by 6 percent and 7 percent respectively, compared with a reduction of 1 and 4 percent due to El Niño (see Figure 1 below).<sup>6</sup>

**Figure 1**



Source: Nkonya, E. Perez, N. & Koo, J. (2017). *El Niño, La Niña, and climate resilience in Tanzania* (International Food Policy Research Institute Blog). Reproduced with permission.

<sup>6</sup> Nkonya, E. Perez, N. & Koo, J. (2017). *El Niño, La Niña, and climate resilience in Tanzania* (International Food Policy Research Institute Blog). <https://www.ifpri.org/blog/el-niño-la-niña-and-climate-resilience-tanzania>

There is less evidence on the linkages between La Niña and livestock and fisheries than there is on the effect of La Niña and agriculture. The World Bank study on La Niña in Cambodia finds that La Niña can cause heat stress on livestock, which can result in slower growth or declining milk productivity (World Bank, 2019a, p.21). However, the study notes that it is unclear to what extent this occurs (World Bank, 2019a, p. 21).

## **Economic growth**

Evidence on the relationship between La Niña and economic growth in FCAS (Fragile and Conflict Affected States) and LICs (Lower Income Countries) is limited and inconsistent. A quantitative study published by Eesti Pank finds that both El Niño and La Niña events can hurt economic growth. However, the authors state that this effect occurs 'in different locations, through different local weather conditions, under different climate regimes, and at different times, with some effects direct or immediate and some emerging over a longer time' (Couharde et al, 2019, p.2). The same study finds that La Niña has 'stronger adverse effects on economic growth in the year following its occurrence in wet areas of the arid or temperate zone' (Couharde et al, 2019, p.3). However, a peer-reviewed journal article using quantitative methods finds that while the El Niño events considerably reduce economic growth, the effect of La Niña events is much less clear (Smith & Ubilava, 2017, pp.159-160).

A World Bank report on the impacts of ENSO in Cambodia finds that during a typical La Niña event, the economy grows. It uses simulations to show national GDP is USD 55 million more during La Niña events than in a neutral year (World Bank, 2019a, p. xvi). Similar World Bank reports find that other Southeast Asian countries also experience economic growth during La Niña events.

A quantitative study on the link between El Niño, La Niña and price levels in the Philippines finds that La Niña has a statistically significant impact on price levels in the country, causing them to rise (Arcenas, 2018, p. 15). However, the authors highlight the need for further examination of the relationship between La Niña and price levels to be able to draw sound conclusions on the nature of this. In the case of Indonesia, one study finds that the La Niña phase results in increasing rice prices, but does not affect soybean and corn prices (Cahyaning et al, 2019).

## **Infrastructure/Power**

There is limited evidence of La Niña affecting infrastructure. The link between La Niña and damage to infrastructure largely appears to stem from extreme weather events. One example presented in a journal article on climate change in the Pacific, finds that in 2008, a series of tidal surges (from wind waves) at the end of a La Niña period washed away kitchens, flooded homes, and destroyed churches on Takuu, in Bougainville, Papua New Guinea (Connell, 2018, p. 167). However, the author notes that the wind waves mentioned are not well understood. Moreover, the effect of the wind waves was compounded by the fact that sea levels were already elevated due to La Niña conditions and sea level rise, and so the damage caused was not directly attributable to La Niña (Connell, 2018, p. 167). There is some evidence of a link between La Niña and hydropower in Kenya. This is discussed in the case studies section of this report.

## **Stability**

A quantitative study finds that La Niña is associated with a reduction in civil unrest, with the effect being most strongly observed in Latin American countries. This effect occurs both for unrest onset and for civil unrest frequency (Hicks & Maldonado, 2015, p. 13). No other evidence of linkages between La Niña and stability was found during the course of the research undertaken for this report.

## Water Security

There is very little evidence on the impact of La Niña on water security. However, there is a discussion of La Niña's impact on groundwater levels in Kenya in the case studies section of this report.

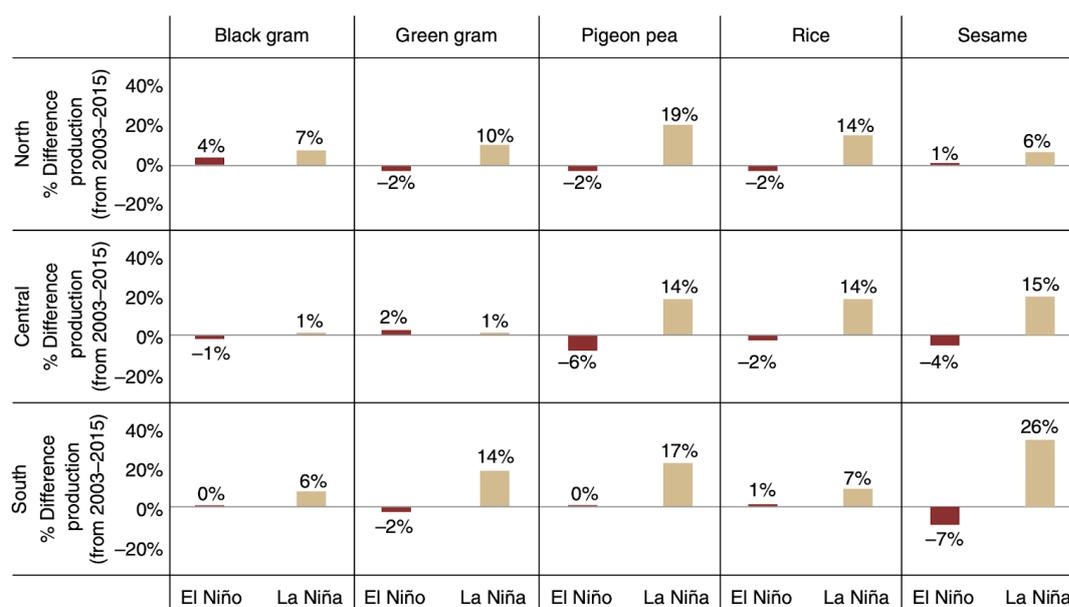
## 3. Case Studies

### Myanmar

A study by the World Bank finds that while El Niño's negative effects on agricultural production tend to outweigh the positive effects of La Niña in other countries, Myanmar stands out as an exception to the rule. The study finds that crop yield gains during La Niña are slightly larger than the reductions in crop yields experienced during El Niño, in percentage terms (World Bank, 2019b, p. xiv)

**Figure 2**

Percentage Difference of Average Crop Production between El Niño and La Niña Years from 2003–2015.



Source: World Bank. (2019b). *Striking a Balance: Managing El Niño and La Niña in Myanmar's Agriculture*. Washington D.C.: World Bank. Licensed under [Attribution 3.0 IGO \(CC BY 3.0 IGO\)](https://creativecommons.org/licenses/by/3.0/).

The same report uses simulations to show the impact of La Nina events on GDP. These simulations show that national GDP gains during La Niña (USD400 million) almost offset GDP losses during El Niño (USD421 million), with the agricultural sector gaining the most (USD444 million). Moreover, they show that GDP gains in the agriculture sector during La Niña are higher than losses in the agriculture sector during EL Niño (See Figure 3). The report finds that this positive net effect is most evident in the North and South regions of Myanmar, where agriculture is most prevalent (World Bank, 2019b, p.xv). In terms of agricultural prices, La Niña causes these to drop slightly, while food prices remain largely unchanged (World Bank, 2019b, p.23).

Figure 3

### GDP Changes During Typical ENSO Events.

	El Niño events	La Niña events
<b>Percentage change in GDP (%)</b>		
National	-0.84	0.80
AFS	-2.10	1.99
Agriculture	-2.71	3.05
Crops and livestock	-3.63	4.10
North	-2.04	3.16
Central	-7.18	5.16
South	-1.71	2.36
<b>Absolute change in GDP (US\$ million)</b>		
National	-420.9	400.4
AFS	-443.1	419.3
Agriculture	-395.9	444.4
Crops and livestock	-397.1	448.2
North	-81.5	126.2
Central	-174.8	125.5
South	-139.6	192.7

Source: World Bank. (2019b). *Striking a Balance: Managing El Niño and La Niña in Myanmar's Agriculture*. Washington D.C.: World Bank. Licensed under [Attribution 3.0 IGO \(CC BY 3.0 IGO\)](#).

Recent La Niña events led to excessive rainfall and flooding in Myanmar. This resulted in damaged crops and soil degradation. This was most common near coastal areas and river systems, such as the Ayeyarwaddy Delta. For example, according to the World Bank, about 1.7 million tonnes of rice were lost in the Mon, Bago, Rakhine, and Ayeyarwaddy Divisions during the July–October 2011 La Niña event (2019b, p.14).

There is some evidence of a link between the destruction of infrastructure and La Niña in Myanmar. Severe floods during the La Niña following the 2015-2016 El Niño event damaged farmland. Extreme rains combined with Cyclone Komen caused severe floods in four states and destroyed 40,000 hectares of farmland. Moreover, 1.6 million households lost their homes in July and August, and thousands of irrigation canals were reportedly destroyed during the cyclone and La Niña event (World Bank, 2019b, p.9).

## Kenya

In contrast to the somewhat positive effects of La Niña on agriculture experienced in Southeast Asian countries, Kenya faced a number of detrimental impacts. Drought caused by La Niña in 2010-2011 led to encroachment on agricultural lands in parts of Kenya, due to a reduction in green cover and deforestation (Mwaniki, 2015, p. 16). In other parts of the country the heavy

rains resulted in an increase in grasslands in semi-arid areas, which in turn increased livestock. However, this increase in livestock resulted in overgrazing (Mwaniki, 2015, p. 10). A report published by the Quantum Global Research Lab finds that the fact that Kenya's western and southern agricultural zones are susceptible to droughts during La Niña can curb hydropower production (Wakeford, 2017, pp.11-12).

A peer-reviewed journal article examining the effect of La Nina on aquifers in Kwale County, Kenya found that the La Niña drought of 2016/2017 resulted in an extended dry season from the end of 2015 to the middle of 2017. This resulted in a decrease in aquifer water levels and an increase in saline intrusion. The authors note that for successful long-term management of water resources, the effects of long drought periods should be considered in combination with the effects of intensification of agriculture, industrialisation and population growth, as these 'may act in damaging synergy' on Africa's groundwater systems (Ferrer et al, 2019, p. 596).

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