

A LANDSCAPE 360 INFO SHEET

Modeling the Impacts of El Niño and La Nina on the Indonesian Economy with ENSONINAID26

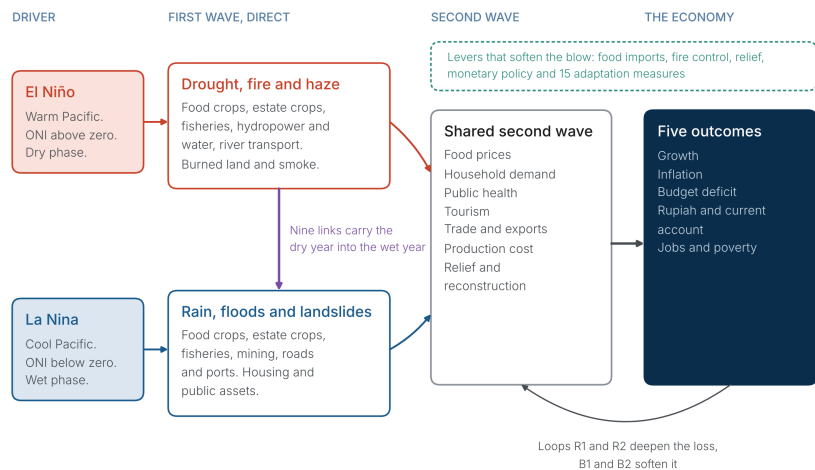


Figure 1. The causal loop diagram of ENSONINAID26 in simple form. Ocean signals set off a first wave of direct losses. A second wave spreads them through prices, spending and budgets, and both land on five economic outcomes. Source: Landscape Advisory.

Table 1. The levers a user can move, with their default settings.

LEVER	DEFAULT	EFFECT
OCEAN SIGNAL		
El Niño strength (ONI)	+3.1°C	Sets drought and fire
La Nina strength (ONI)	-1.5°C	Sets rain and floods
Peak quarters	2026 Q4, 2027 Q4	Places each peak on the calendar
LOCAL CONDITIONS		
Drought and rain links	1.00	Strength of the local effect
Cyclones and watersheds	0.40, 1.00	Add flood risk
CUSHIONS		
Food imports	40 percent	Share of a food gap filled abroad
Fire control and peat	100 percent	Lower means less fire
Relief spending	30 percent	Social aid and price stabilization
ADAPTATION		
Fifteen measures	0 to 100	Four groups of measures

The Model in Brief

ENSONINAID26 is a system dynamics model built by Landscape Advisory. It estimates what a strong El Niño, and the La Nina that often follows, would cost Indonesia, and it traces cause and effect step by step. Anyone can run it in a web browser on Landscape's website at <https://landscape.id/docs/ENSONINAID26.html>. Each slider move updates every chart.



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ADAPTATION MEASURES

15

In four groups, each set from 0 to 100 percent of its potential.

LINKS BETWEEN PHASES

9

They carry damage from the dry year into the wet year.

COST OF A SUPER CYCLE

\$63 billion

4.6 percent of GDP over the two years.

Assumptions and Results

The model is calibrated on past events and gives scenarios, not forecasts. An El Niño followed by a La Nina costs more than the two years taken apart.

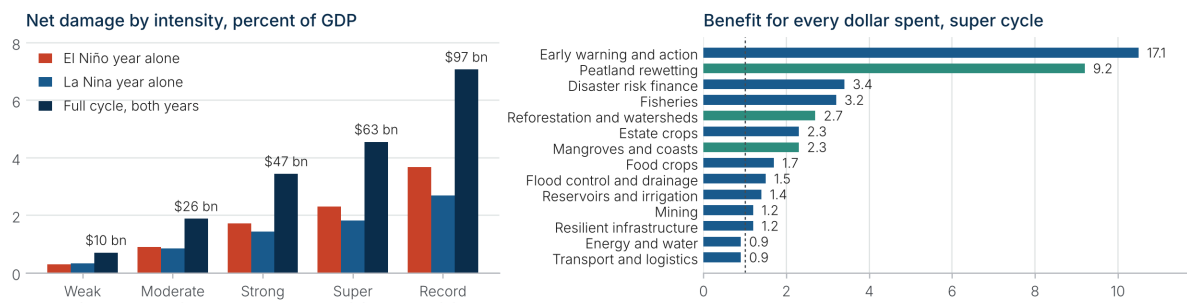


Figure 2. Left, net damage for each phase alone and for the full two-year cycle, with the cushions at moderate settings and no added adaptation. Right, damage avoided for every dollar spent on each measure run alone in a super cycle. The early warning bar is cut at 10.5, and the dotted line marks a ratio of one. Source: ENSONINAID26.

The Working of the Model

An El Niño dries Indonesia. Drought, fire and haze cut output in crops, fisheries, hydropower and river transport. A La Nina brings heavy rain, floods and landslides that damage crops, mines, roads and homes. Both feed a second wave of food prices, weaker spending, illness, lost trade and relief costs, which the model adds up as growth, inflation, the deficit, the rupiah, jobs and poverty. Nine links carry damage from the dry year into the wet year.

Key Assumptions

The model is anchored to real events. The 2015 fires cost \$16.1 billion, 1.9 percent of GDP, and the model matches this at an El Niño of $+2.4^{\circ}\text{C}$. Floods and landslides in a La Nina of -1.5°C , as strong as 2010 to 2011, damage assets worth about 0.45 percent of GDP. A drought at $+2.0^{\circ}\text{C}$ cuts food crop output by about 10 percent.

Fire damage stops growing near $+2.8^{\circ}\text{C}$, because fires have responded less to drought since 2016. Each season has its own weight, so fire peaks from July to October and floods from January to March. Harvest losses arrive one to three quarters after the shock. Several coefficients are illustrative and will be recalibrated as new data arrive.

The Limits of the Model

The figures are scenarios. The model overstates price rises when rice stocks are high and understates the return on infrastructure. No agency forecasts a La Nina yet.

Sources and method

Model: ENSONINAID26, Landscape Advisory, <https://landscape.id/docs/ENSONINAID26.html>. Paper: Sari, A.P., 2026, *Floods After Fires*, Climate Change Series #2, landscape.id/floods-after-fires.html. Dollar figures at about Rp16,060 per dollar.

The Results

A strong cycle costs \$47 billion, 3.5 percent of GDP. A super cycle costs \$63 billion, 4.6 percent, and a record cycle \$97 billion, 7.1 percent. Growth falls by 1.1 to 2.1 points over the two years, the deficit widens by 1.1 to 1.6 points of GDP, and 3.2 to 7.7 million more people fall below the poverty line. The links between the two years add about a tenth to the cost of the cycle.

The Current Run

The default setting reflects October 2026, with an El Niño peaking at $+3.1^{\circ}\text{C}$ late in 2026 and a La Nina of -1.5°C a year later. The run puts the damage at about \$70 billion, 5.1 percent of GDP. About \$18.5 billion of it has already been incurred. Another \$12.8 billion falls in the rest of 2026, \$25.1 billion in 2027 and \$13.1 billion from 2028. Inflation peaks at 9.5 percent in the second quarter of 2027, when a wet year spoils perishable food.

The Payoff of Adaptation

A full package with every measure at 70 percent avoids \$29 billion in a super cycle, close to half of the damage. It costs about \$5.1 billion a year and returns 1.7 to 2.5 times its cost. It cuts the number of additional poor from 4.5 million to 1.3 million. Early warning returns about 17 times its cost and peatland rewetting about 9 times.

Calibration: NOAA CPC; BPS; Bank Indonesia; World Bank, 2016, *The Cost of Fire*; Bappenas; BNPB; Adaro Energy, 2011; Global Commission on Adaptation, 2019; World Bank, 2022; World Resources Institute, 2025.