Indonesia

Food Security Monitoring Bulletin

Special Focus: La Niña

Volume 3
August 2016

Key messages

1. A La Niña will likely start in August or September 2016[1] and will continue into the last quarter of 2016[2], causing wetter than normal weather conditions.

2. The Indonesia Weather and Meteorology Bureau (BMKG) predicts unusually high rainfall will continue until September 2016 in most of the country. Rainfall levels in Java, the eastern areas of Sulawesi, central Papua and southern Kalimantan and Sumatra may increase significantly by up to 200 percent.

3. During past La Niña events, Indonesia experienced above normal rainfall, especially across Java, Maluku, Sulawesi and the southern areas of Sumatra, Kalimantan and Papua, causing heavy rains and higher than normal rainfall that led to increased occurrence of floods and landslides events. During the 2010 and 2011 La Niña, 779 people lost their life and 2857 were injured due to floods.

4. The impact of weather changes associated with La Niña on food security is difficult to predict. Historically, increased rainfall negatively impacted agricultural production in some areas and positively in others. However, the weather changes tend to weigh heavily on food access, stressing food and livelihoods security situation of the most vulnerable groups.

5. Current weather and the possible La Niña conditions increase the risk of more frequent and intense flood events and landslides. In the coming rainy season this may mean more causalities and damage, and may impact food access by disrupting travel networks and food storage, and health and nutrition status by higher risk of water-borne diseases.

[1] http://iri.columbia.edu/our-expertise/climate/forecasts/enso/current
[2] Based on the NINO 3.4 region, where changes in local sea-surface temperature are important for shifting the large region of rainfall typically located in the far western Pacific. http://iridl.ldeo.columbia.edu/maproom/ENSO/Diagnostics.html
[3] http://bmkg.go.id/BMKG_Pusat/Informasi_Iklim/Prakiraan_Iklim/Prakiraan_Hujan_Bulanan.bmkg

Introduction

This is the third of a series of quarterly monitoring bulletins on the impact of weather extremes on food security in Indonesia. The first and second bulletin are available online: http://www.wfp.org/content/indonesia-food-security-monitoring-2015 and the current issue is available online: http://www.bmkg.go.id/BMKG_Pusat/Informasi_Iklim/Buletin.bmkg.

In the first section of this issue, current and historical climate events and their impact on weather in Indonesia between July and September are examined. A significant portion of the current analysis is derived from the Indonesian Agency for Meteorology, Climatology and Geophysics (BMKG) and Columbia University's International Research Institute for Climate and Society.

The next section focuses on historical impacts of weather changes associated with La Niña on disasters occurrence. The following section then examines other historical impacts such as on agricultural production and rice prices.

Finally, a weather outlook section for the next three months concludes this round of the bulletin.

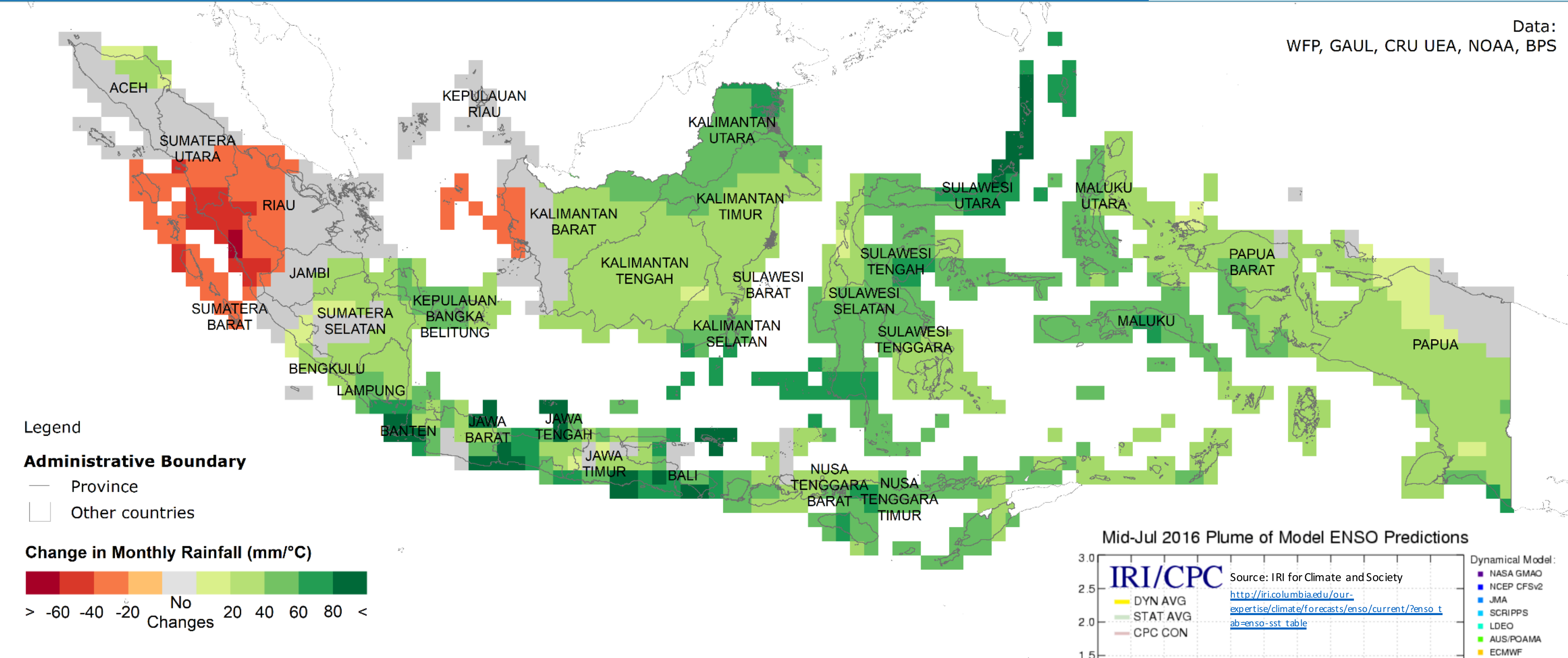
List of maps and analysis

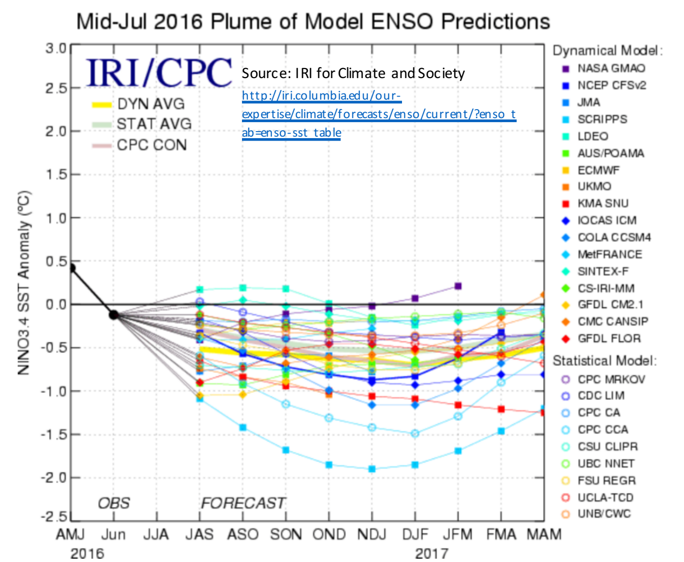
The bulletin contains the following maps and analyses:

1. Change in rainfall associated with a decrease in sea surface temperature
2. Historical La Niña events
3. La Niña 1998 and 2010 and rainfall anomaly for July-August –September
4. Rainfall anomaly for July 2016
5. Number of days since last rainfall for July 2016
6. Flood and landslides events
7. Historical impact of La Niña on rice and maize
8. Historical impact on coffee and price of rice during La Niña years
9. Potential planting areas in August 2016
10. Rainfall outlook for the next three months

La Niña and the Indonesian context

Change in monthly rainfall with 1^0C decrease in sea surface temperature in NINO 3.4 region





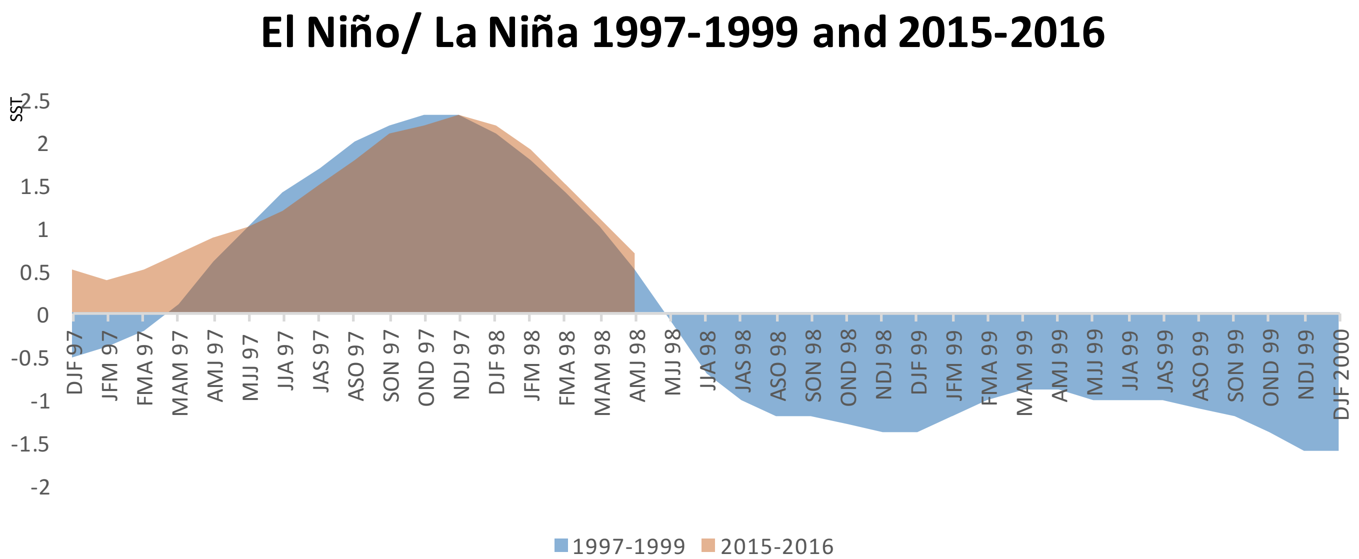
After a very strong El Niño event in 2015 and early 2016, current analysis of the El Niño Southern Oscillation (ENSO) indicates a likely La Niña event with weak intensity in the second half of 2016. Historical trend shows there is a 40 percent chance La Niña develops after an El Niño event. Typically, La Niña matures from July and peaks between December and February. La Niña conditions can last up to 2 years, though commonly persist between 9 to 17 months.

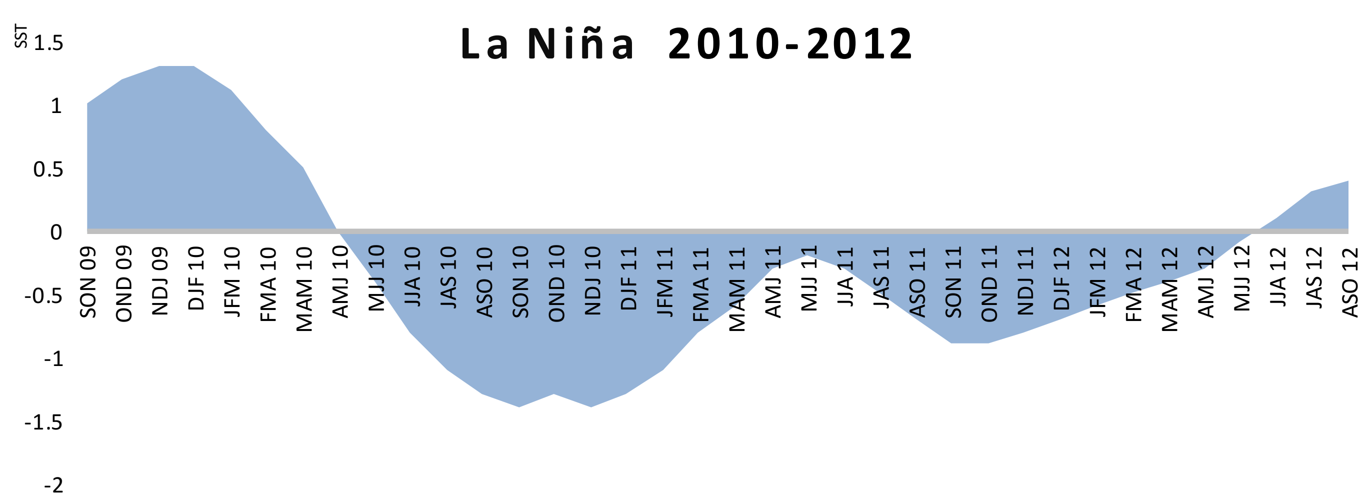
A decrease in sea surface temperature (SST) in the Pacific Ocean, which associates with La Niña events, heavily affects weather conditions in Indonesia. The map above shows changes in rainfall levels with a one degree decline in SST. Dark green areas represent an 80 mm increase in monthly precipitation levels.

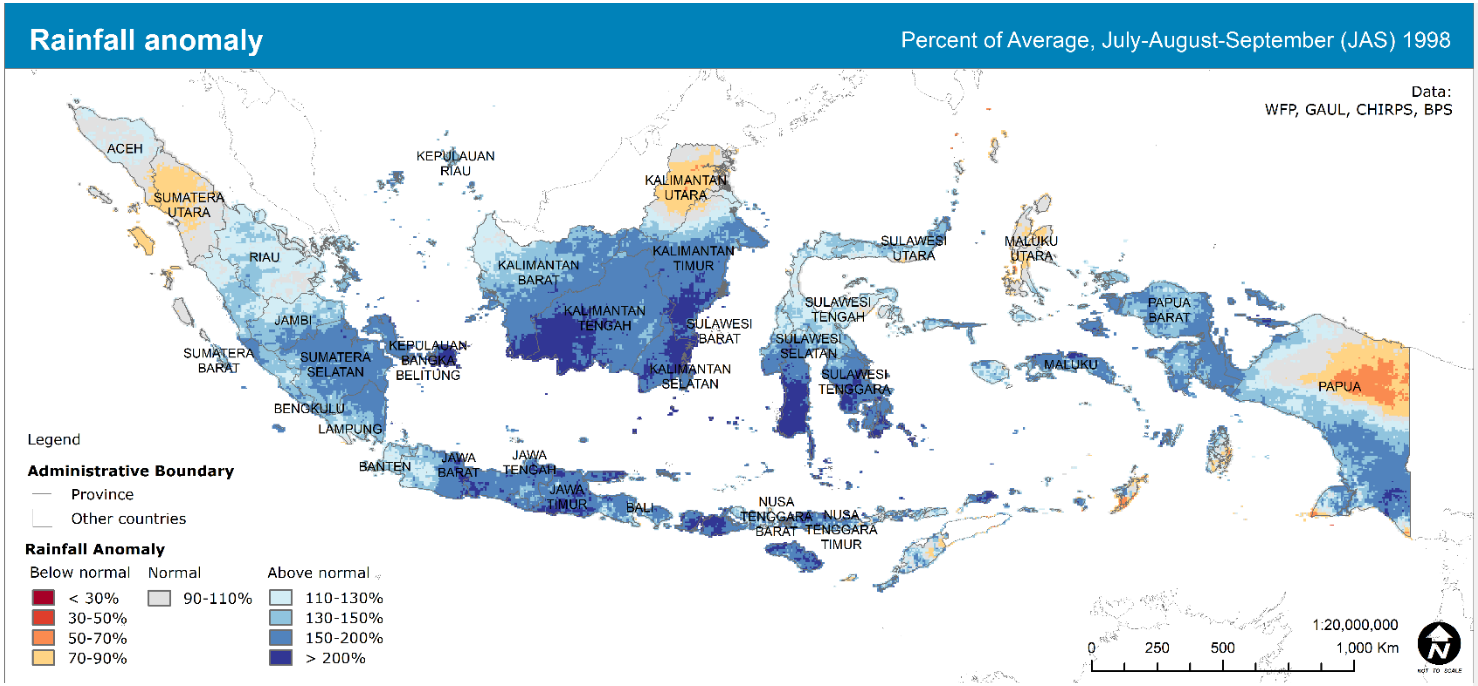
La Niña in Indonesia- current conditions and historical trends

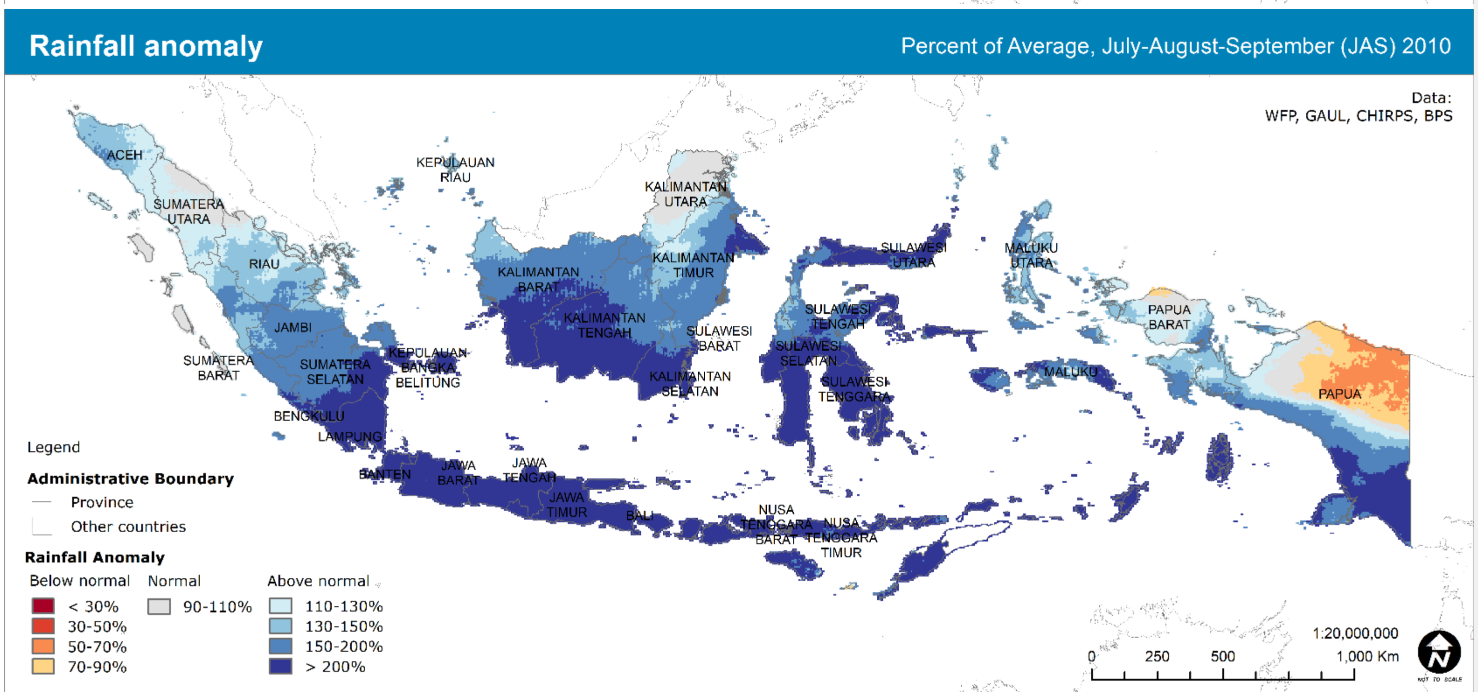
Early July STT values were just below zero, indicating neutral conditions. The current ENSO prediction models show that ENSO neutral conditions will likely persist throughout July and transition into La Niña in late August or September. These developments resemble a transition from El Niño to La Niña in 1998, a year when a very strong El Niño was followed by a moderate La Niña. The graph on the right shows a comparison of sea surface temperatures in 1997/1998 and 2015/2016.

The most recent La Niña event occurred in 2010-2011, when after a moderate and short El Niño, a moderate La Niña developed in 2010, transitioned into weak and neutral ENSO conditions and returned to weak La Niña in the second half of 2011.









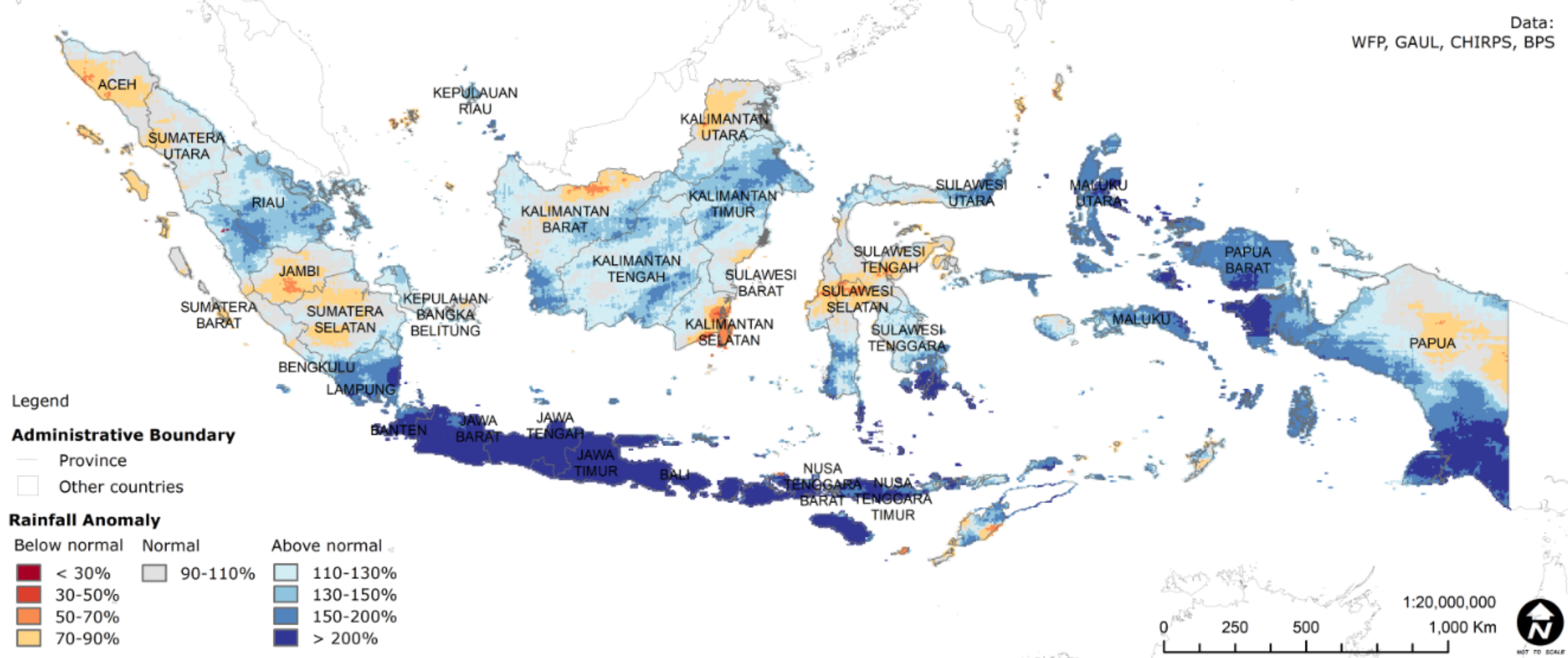
1998 and 2010 La Niña events and rainfall anomaly

Typically, La Niña is associated with increased rainfall, higher storm surges and high tides. In 1998 and 2010 Indonesia was affected by La Niña events, which developed after an El Niño in both years.

The La Niña events in both years brought more rainfall from July and wetter than normal conditions persisted until December. During the rainy season, normally starting in October, the rainfall could increase two times.

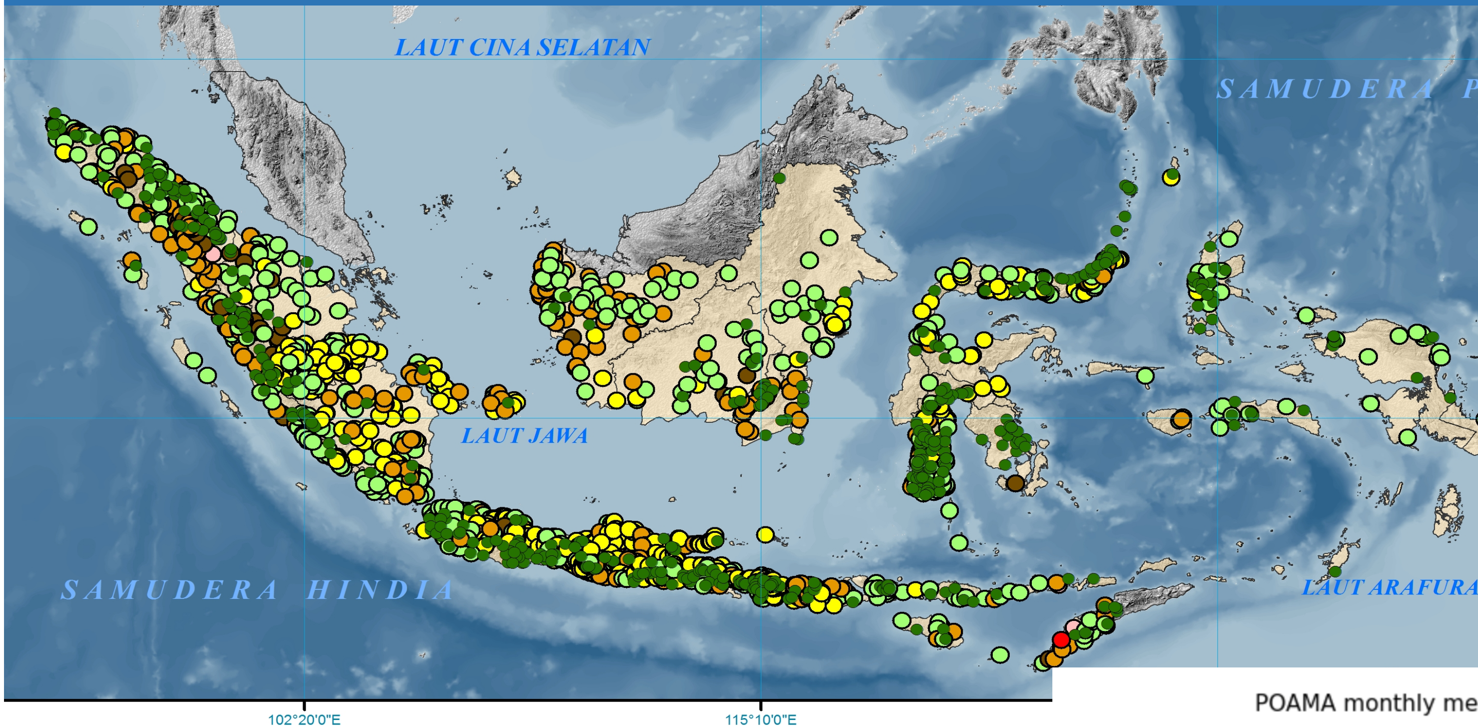
Rainfall anomaly

Percent of Average, July 2016



This year, parts of Indonesia have already been wetter than normal since May and unusually high rainfall continued until July as demonstrated on the map above. The 2016 dry season has started 1 to 2 months late in almost half the country and many areas have been experiencing a so-called 'wet dry season'. Southern parts of Indonesia have been affected by abnormally high tides and large waves, reaching up to 5 meters. The map on the following page, showing the number of days without rain, indicates that there were very few days without rainfall, in spite of this normally being the dry season for most of the country. La Niña conditions are likely to persist until early next year and this may lead to more intense storms and heavy rains in the coming rainy season, causing more flooding, land erosion and landslides.

Number of days since last rainfall as of 10 July 2016



Tropical weather and climate patterns such Madden-Julian Oscillation, monsoon and negative Indian Ocean Dipole are contributing to the weather anomalies currently affecting Indonesia.

In the second half of 2016, apart from the potential La Niña, Indian Ocean Dipole (IOD) is likely to remain negative. The IOD has been negative since June and the latest forecasts show these conditions are likely to persist until November 2016. A negative IOD typically brings more rains from the west.

MONITORING HARI TANPA HUJAN BERTURUT-TURUT
MONITORING OF CONSECUTIVE NO RAIN DAYS

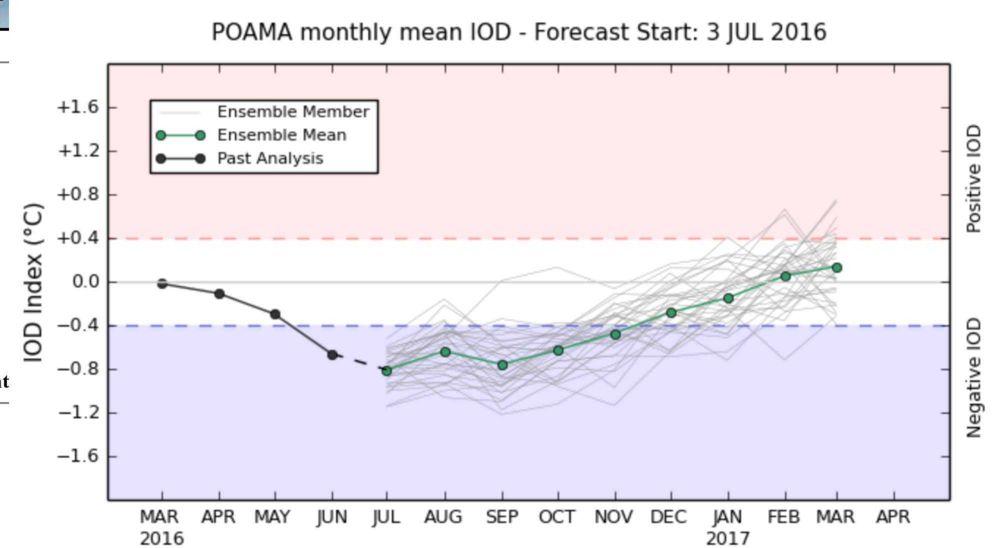
UPDATED 10 JULI 2016

INDONESIA

BMKG

KLASIFIKASI (Jumlah Hari)
Classification (Days)*

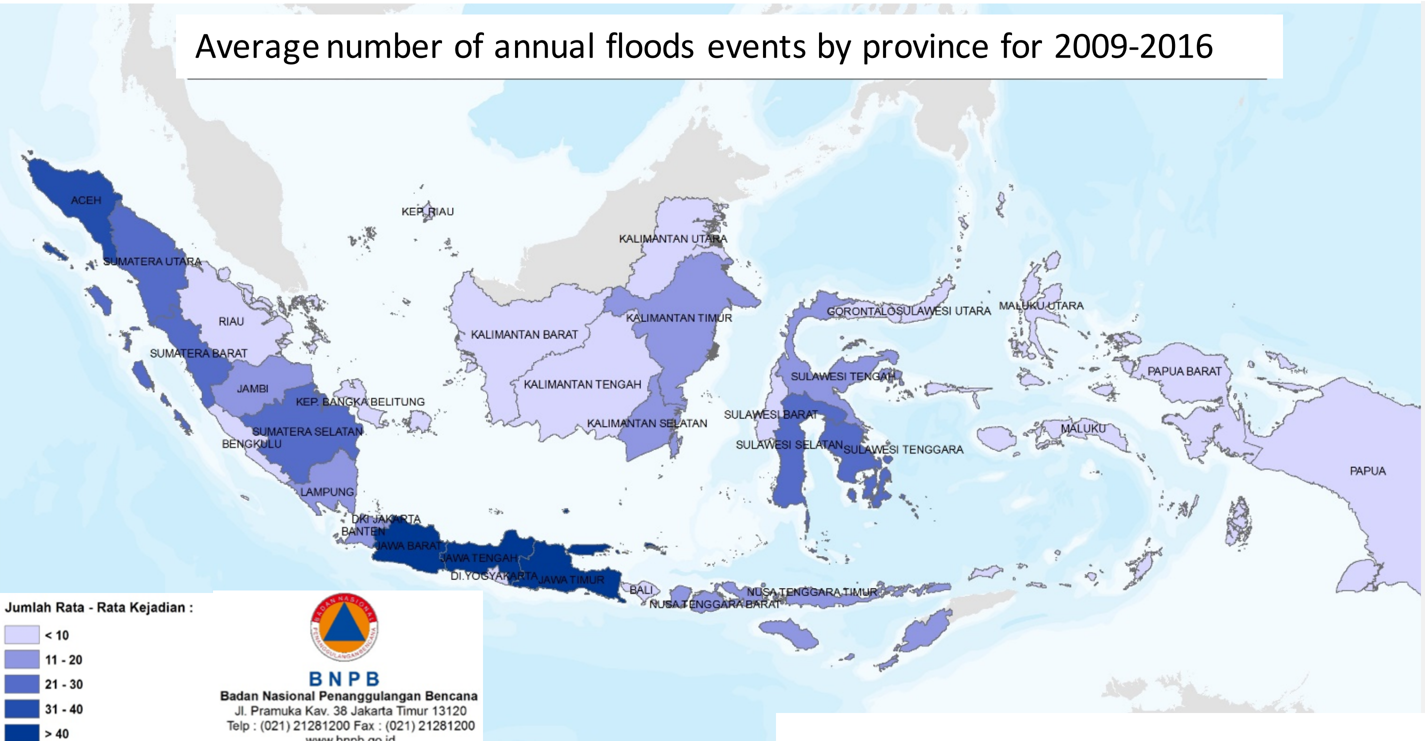
1 - 5	Sangat Pendek (Very Short)
6 - 10	Pendek (Short)
11 - 20	Menengah (Moderate)
21 - 30	Panjang (Long)
31 - 60	Sangat Panjang (Very Long)
> 60	Kekeringan Ekstrim (Extreme Drought)
	Masih ada hujan s/d updating (No Drought



* Each point on the map represents an observation at BMKG field station

Impacts of previous La Niña

La Niña and impact on livelihoods



Average number of annual floods events by province for 2009-2016

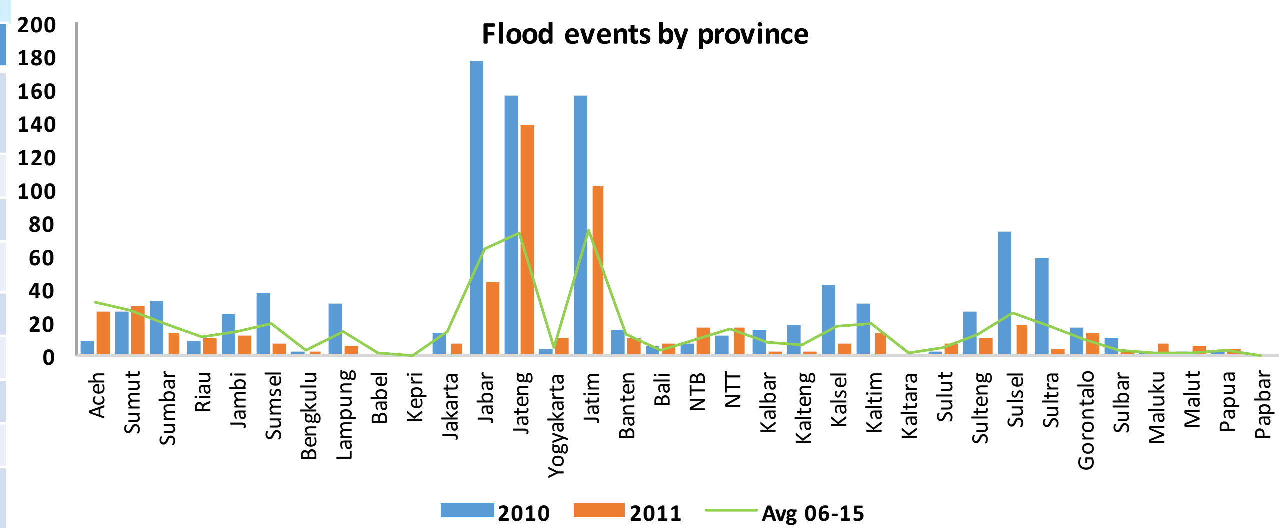
During the most recent La Niña in 2010-2011, the weather extremes related to the phenomenon led to an increased occurrence of flood events. In late 2010, when La Niña was at its strongest, the number of floods increased 1.7 times compared to the average number of floods since 2009. The number of dead and missing was 3 times higher (607), and the number of injured people rose to 2 588, while the average is 471.

This year, the number of flood events (442) as of 26 July has almost reached the annual average of floods since 2009. The increased occurrence of floods this year is not associated with La Niña yet, but with other weather and climate events presented in the previous section. However, the rainfall anomaly map for the 2010-2011 La Niña event on page 5 shows a correlation between the increased number of floods and the areas with above normal rainfall.

In the areas with inadequate sanitation, more flood events and heavy rains may result in outbreaks of water-borne diseases, increasing health and nutrition risks.

Impacts of floods in Indonesia

Year	Flood events	Dead & missing	Injured
2009	381	309	383
2010	990	608	2 588
2011	554	171	269
2012	540	108	77
2013	683	184	105
2014	559	107	254
2015	492	39	15
2016 (as of 26 July)	**442**	**62**	**84**



La Niña and impact on livelihoods

Average number of annual landslides events by province for 2009-2016

Occurrence of landslides during the 2010-2011 La Niña also increased, though not as significantly as floods. In late 2010, the number of landslides reached 400 while the average occurrence of landslides since 2009 is 379. The number of injured people doubled, from the average 153 to 300 and the number of dead was 1.4 times higher in 2010.

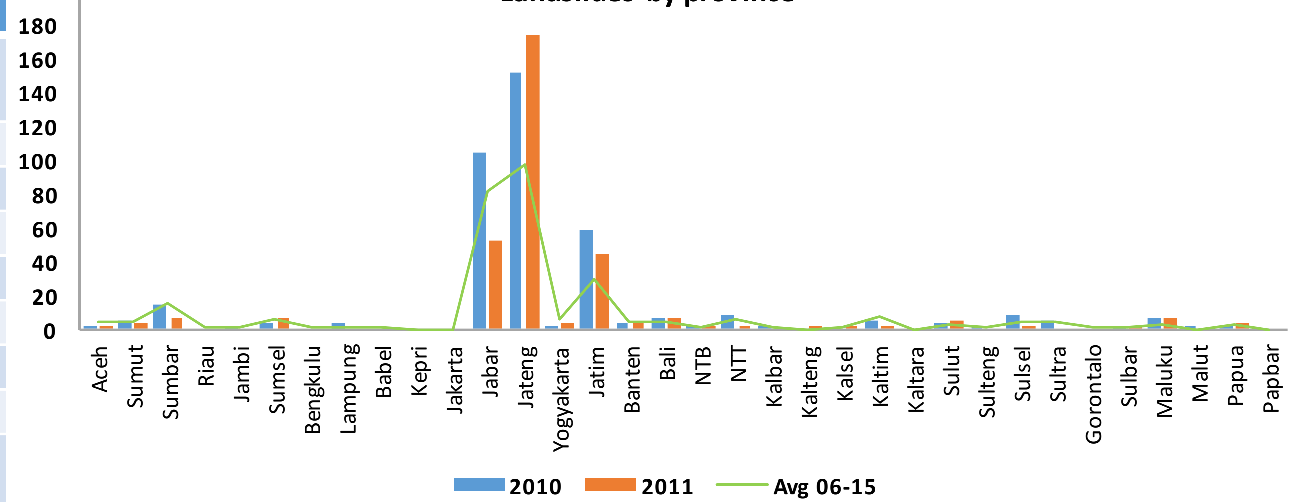
The graphs on this and the previous page show that the most significant increase in the occurrence of floods and landslide events, both in total number of events and compared to 10 years average, was in Central, East and West Java provinces. South Sumatra, South Sulawesi and Sulawesi Tenggara, and South Kalimantan also show higher occurrence of floods during La Niña years.

This year, as of 26 July 2016, 261 landslides occurred across Indonesia. The increasing probability of La Niña starting in August/ September 2016 might mean more floods and landslides events will occur, causing further losses.

Impacts of landslides in Indonesia

Year	Landslides events	Dead & missing	Injured
2009	238	76	206
2010	400	266	308
2011	329	171	111
2012	291	119	80
2013	296	190	133
2014	600	372	221
2015	504	157	120
2016 (until 26 July)	**261**	**111**	**46**

Landslides by province



La Niña and impact on livelihoods and food security

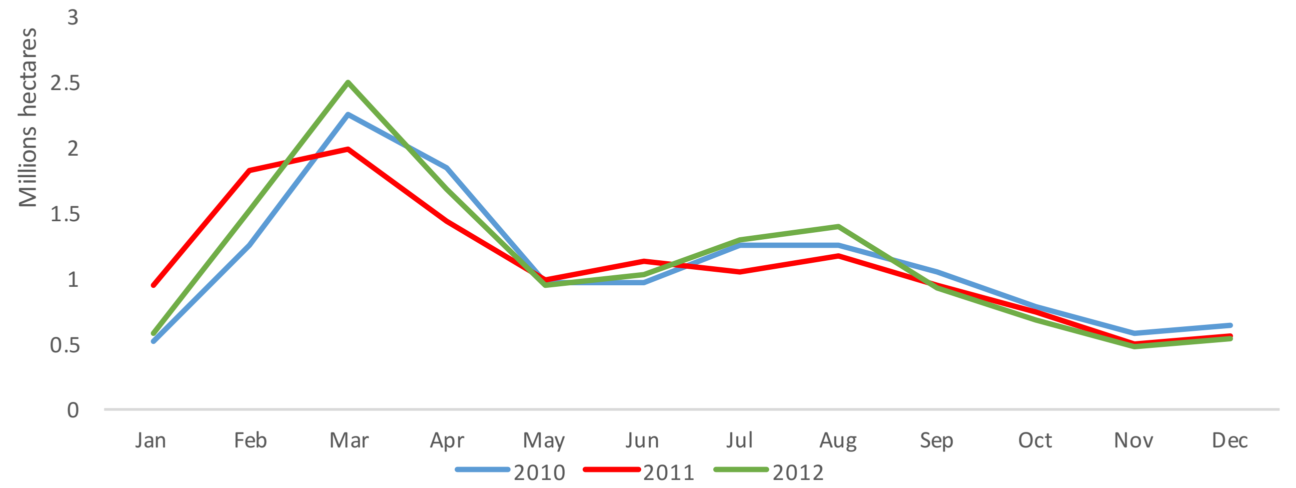
Rice

The increased rainfall in 2011 and late 2010, coinciding with planting for the 2011 main paddy season, had an overall negative but relatively small impact on the 2011 national paddy production. The total 2011 paddy production was only 2 percent (1.1 million tons) lower than the 2010 production, and 5 percent (3.4 million tons) lower than the planned production.

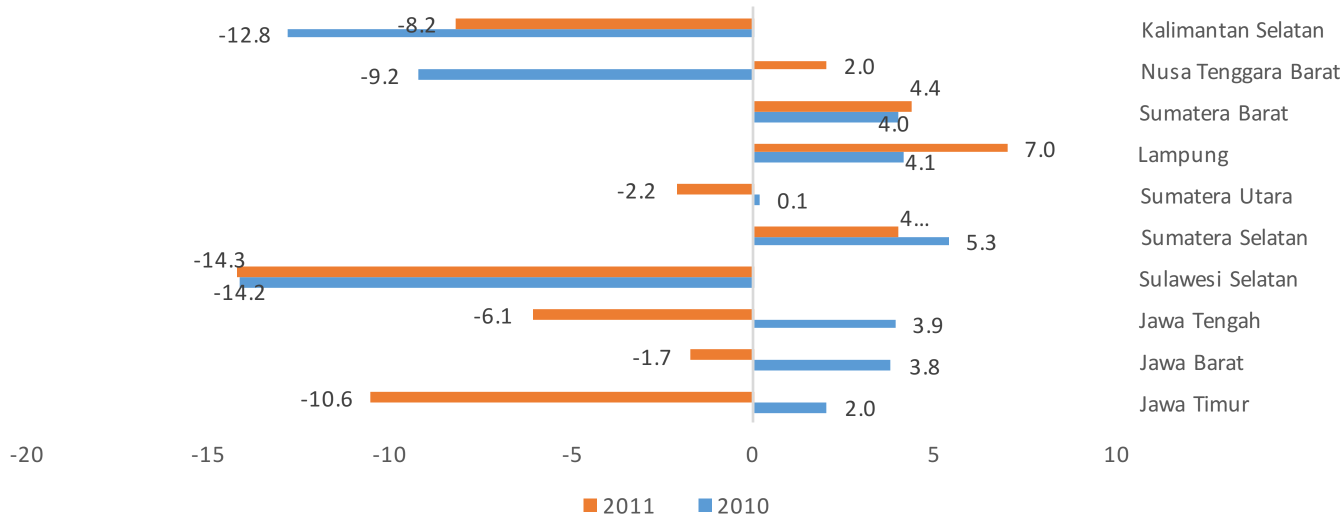
Smaller harvested area, lower yields and more pest outbreaks are the key contributing factors for this decline. Attacks by brown grass hopper, a major rice pest which thrives in wetter conditions, are normally widespread during La Niña years[1]. In total, floods and pests and diseases in 2011 damaged around 1.13 million ha of paddy. In 2009 it was 0.9 million ha.

The higher precipitation levels also had a positive impact on production- especially for drier areas. Nusa Tenggara Barat, which normally receives less than 2000mm of rain on cropland annually, produced surplus in 2011, while in 2010 there was a significant deficit.

Paddy area harvested, 2010-2012



The gap between actual and planned paddy production in 2010 and 2011, top paddy producing provinces, percentage



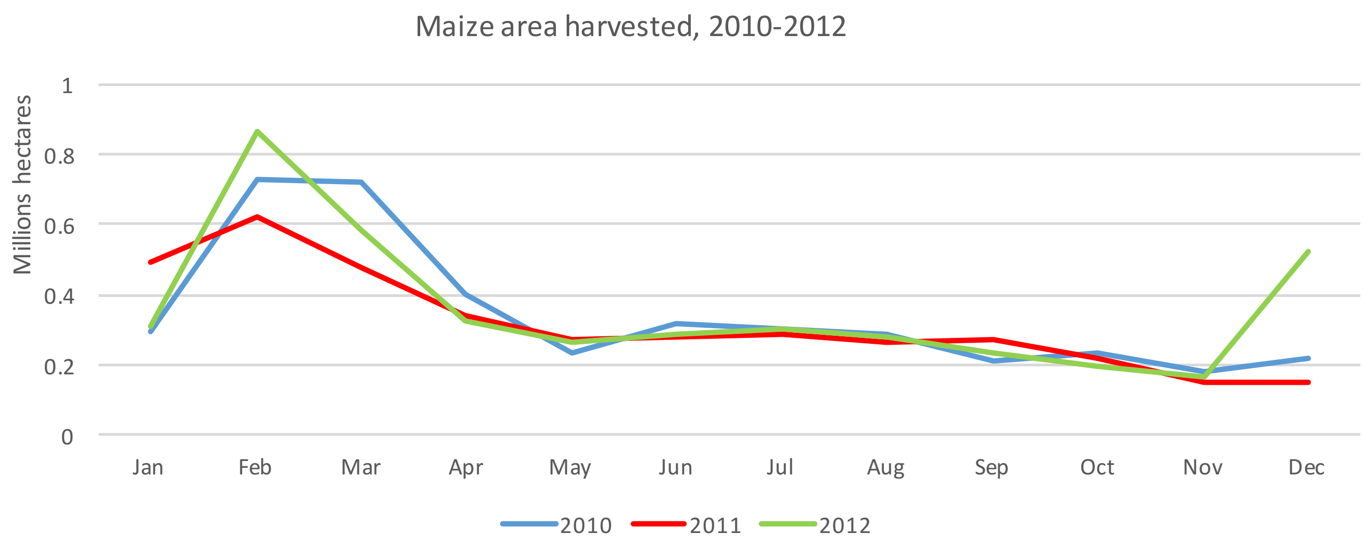
[1] Susanti, E. et al. (2010) Utilization of Climate Information for Development of Early Warning System for Brown Plant Hopper Attacks on Rice. Indonesian Journal of Agriculture, Vol 3 (1), 2010

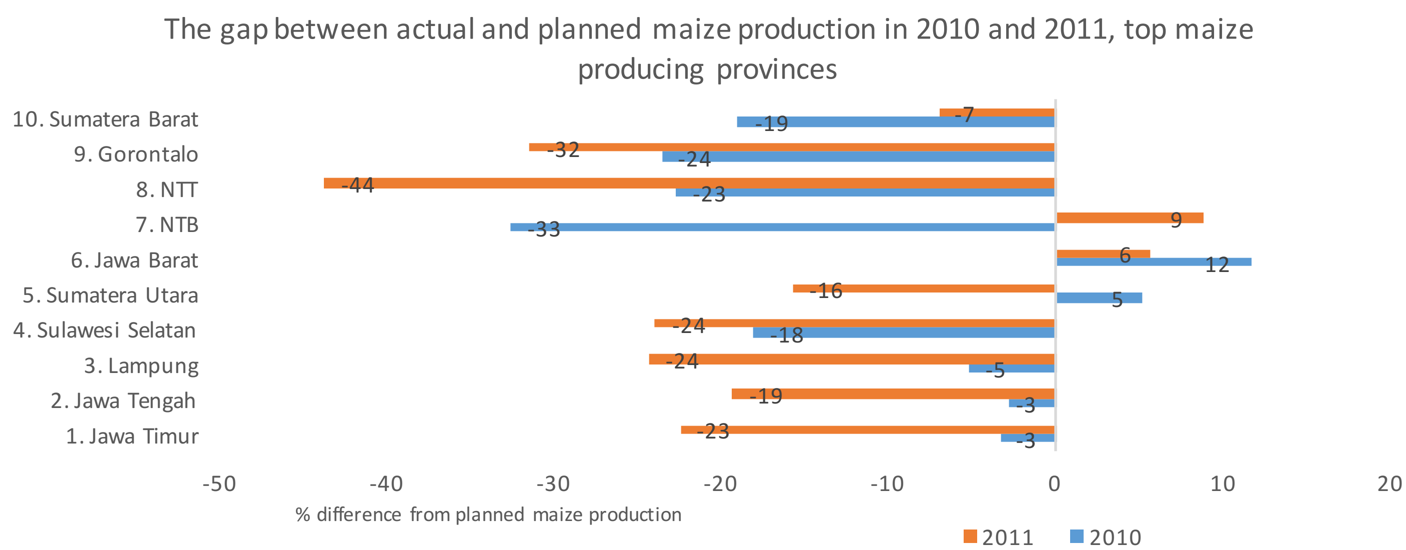
La Niña and impact on livelihoods and food security Maize

The decrease in 2011 national maize production was slightly higher, reaching 6 percent compared to the 2010 maize production. Higher rainfall resulting in smaller planted area, with more than 400.000 hectares (10 percent) reduction in the area planted and more pest and disease outbreaks are the main reasons for the lower 2011 production levels.

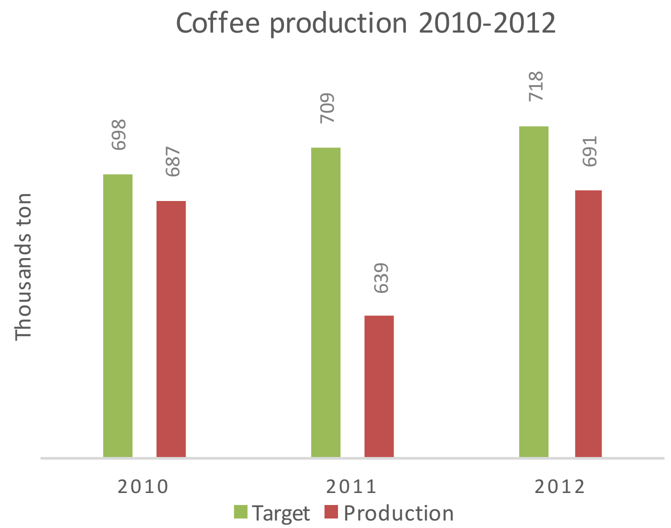
The actual maize production in 2011 was 21.7 percent, equivalent to 4.8 million tons, behind the planned production. Java island, producing more than 50 percent of Indonesia's maize, cultivated 19.5 percent (2.2 million tons) less maize than planned in 2011. In 2010 the gap was 1.9 percent.

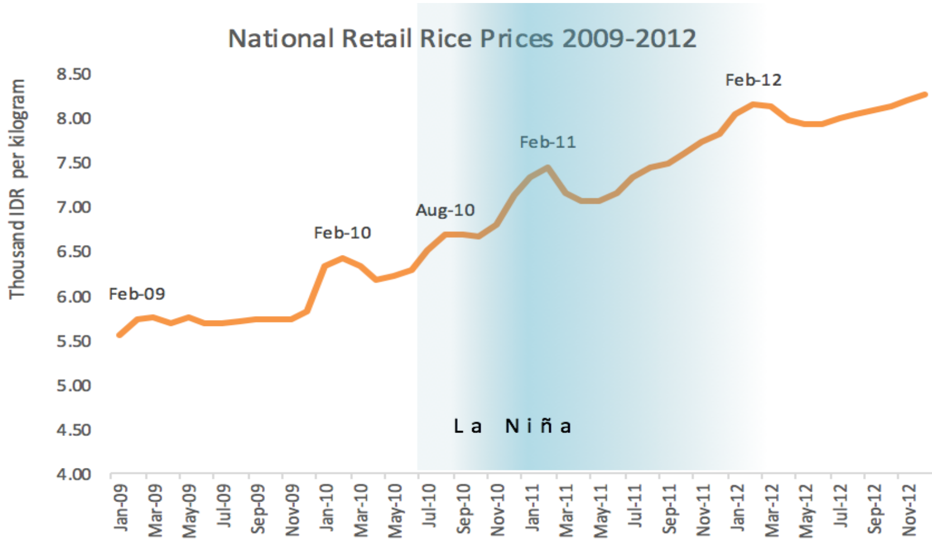
As with rice, Nusa Tenggara Barat shows positive production trend, with 8.7 percent, or 35.4 thousand tons more maize produced than planned. A year before, the province was 30 percent behind the planned target.





La Niña and impact on livelihoods and food security





Coffee Production

The weather changes in late 2010 and 2011 negatively affected the 2011 coffee production, which declined by 7 percent compared to the previous year, and was 10 percent behind the planned production. Higher rainfall and cloud coverage impacted the critical phases of coffee growing- blooming in late 2010, following cherry ripening and harvesting in the first half of 2011. Large planted areas remained immature (15 percent, 186 000 ha) and were damaged (11 percent, 139 000ha), and the matured plants produced beans of lower quality.

Coffee production is a primary income source for around 1.9 million farming households and average coffee exports in the last 5 years reached around 1.08 billion USD annually.

Prices of Rice

In the previous La Niña episodes, prices of rice rose more steeply around seasonal peaks than in normal years. Another unusual price increase occurred between May and August 2010 and 2011, when retail rice prices rose by 7.5 percent and 5.4 respectively. Typically, the increase between May and August would be very small, around 1 percent.

The combined effects of the reduced agricultural production and higher rice prices are indicative of a negative impact of weather changes associated with La Niña on agricultural livelihoods. Agriculture is a primary source of income for 32.88 percent Indonesians and of these 41.33 percent eat food from own production. Decrease in production and higher prices mean food for consumption and income of agricultural households may be reduced and can negatively affect livelihoods and food security of vulnerable groups.

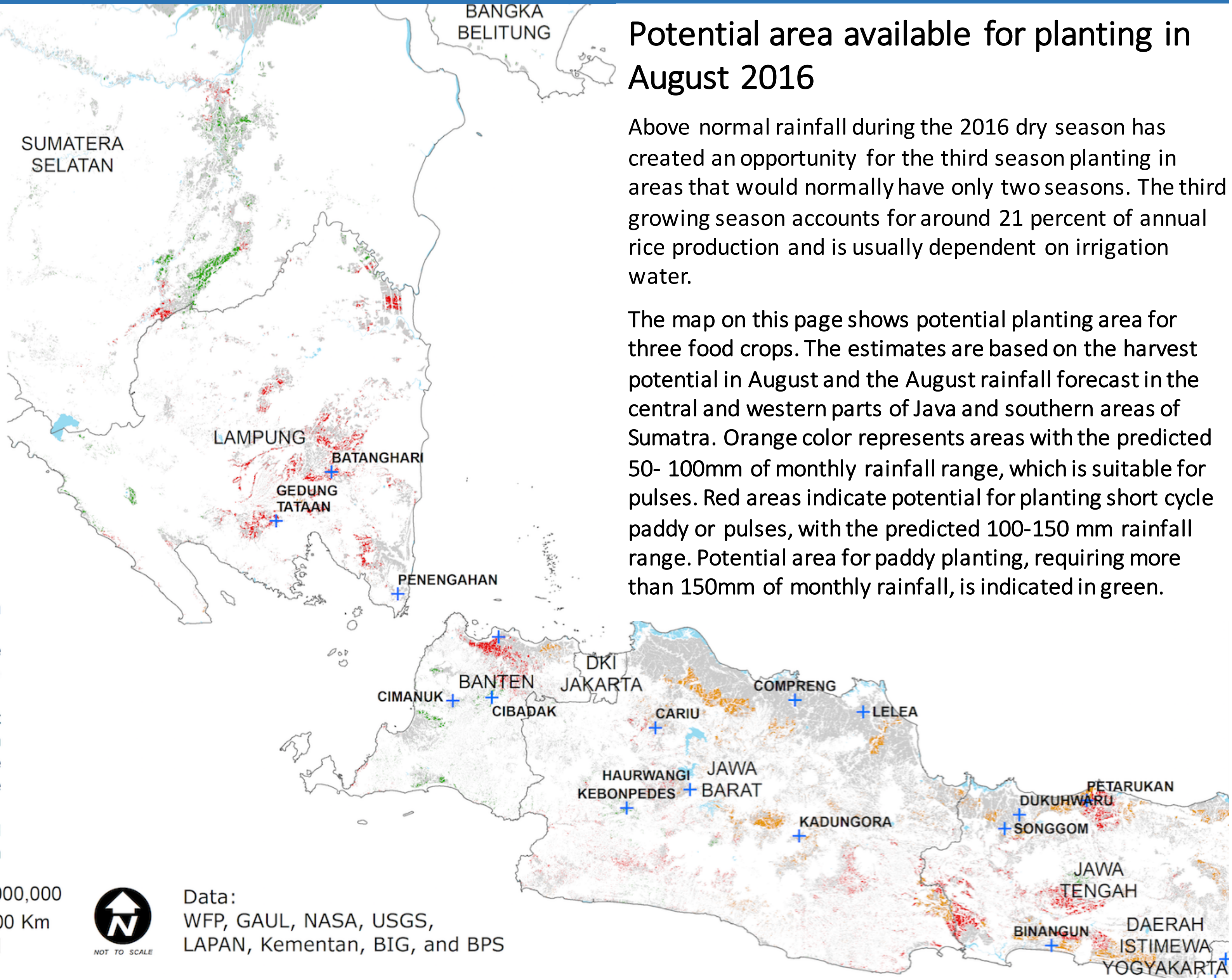
Planting potential in August 2016

Estimates of planting potential in the 2016 third season

Potential area available for planting in August 2016

Above normal rainfall during the 2016 dry season has created an opportunity for the third season planting in areas that would normally have only two seasons. The third growing season accounts for around 21 percent of annual rice production and is usually dependent on irrigation water.

The map on this page shows potential planting area for three food crops. The estimates are based on the harvest potential in August and the August rainfall forecast in the central and western parts of Java and southern areas of Sumatra. Orange color represents areas with the predicted 50- 100mm of monthly rainfall range, which is suitable for pulses. Red areas indicate potential for planting short cycle paddy or pulses, with the predicted 100-150 mm rainfall range. Potential area for paddy planting, requiring more than 150mm of monthly rainfall, is indicated in green.



Legend

Administrative Boundary

Province

Other countries

Potential areas

Secondary crops (Palawija)

Secondary crops (palawija) or Fast growing rice

Rice

Non-potential areas

Water/Lake

CCTV Katam

Optimum harvest potential in August 2016

The optimum harvest potential areas are estimated based on Start of Season Time (SOST) and End of Season Time (EOST)
The SOST estimates the day of the year at the beginning of a consistent upward trend in timeseries EVI and is interpreted as the beginning measurable photosynthesis in the vegetation canopy.
And the EOST estimates day of year identified at the end of a consistent downward trend in time series EVI

1:4,000,000

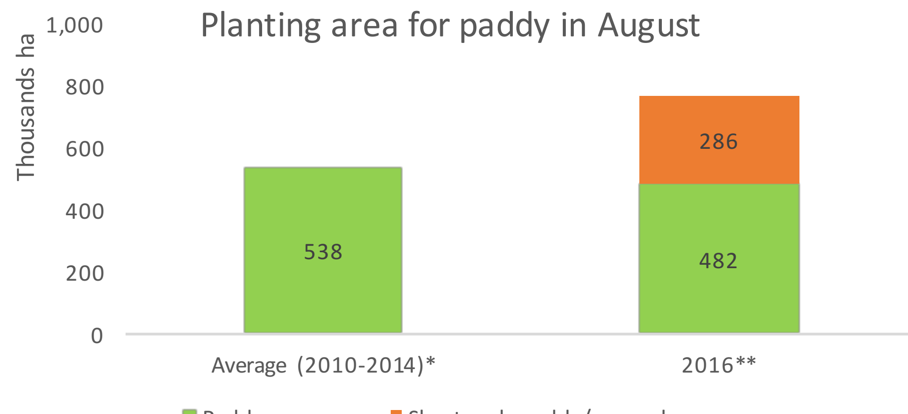
0 50 100 200 Km

NOT TO SCALE

Data:
WFP, GAUL, NASA, USGS, LAPAN, Kementan, BIG, and BPS

Estimates of planting potential in the 2016 third season

Province	Secondary crops	Short cycle paddy/ secondary crops	Paddy
	Hectares		
Aceh	16,662	17,458	20,561
Sumatera Utara	0	295	34,347
Sumatera Barat	635	2,791	23,007
Riau	0	0	6,201
Jambi	0	608	10,722
Sumatera Selatan	0	12,019	88,609
Bengkulu	0	27	12,367
Lampung	1,287	71,612	8,796
Jawa Barat	83,695	46,865	5,689
Jawa Tengah	65,900	59,425	1,882
Jawa Timur	3,616	0	0
Banten	2,802	23,051	14,271
Bali	4,387	0	0
Kalimantan Barat	0	0	29,741
Kalimantan Tengah	0	35	23,060
Kalimantan Selatan	0	186	39,580
Kalimantan Timur	0	110	6,835
Sulawesi Utara	3,220	7,630	754
Sulawesi Tengah	540	4,424	10,873
Sulawesi Selatan	14,675	26,468	126,982
Sulawesi Tenggara	526	4,038	4,510
Gorontalo	794	4,531	2,139
Sulawesi Barat	83	3,323	5,516
Maluku	357	563	1,361
Maluku Utara	0	0	1,755



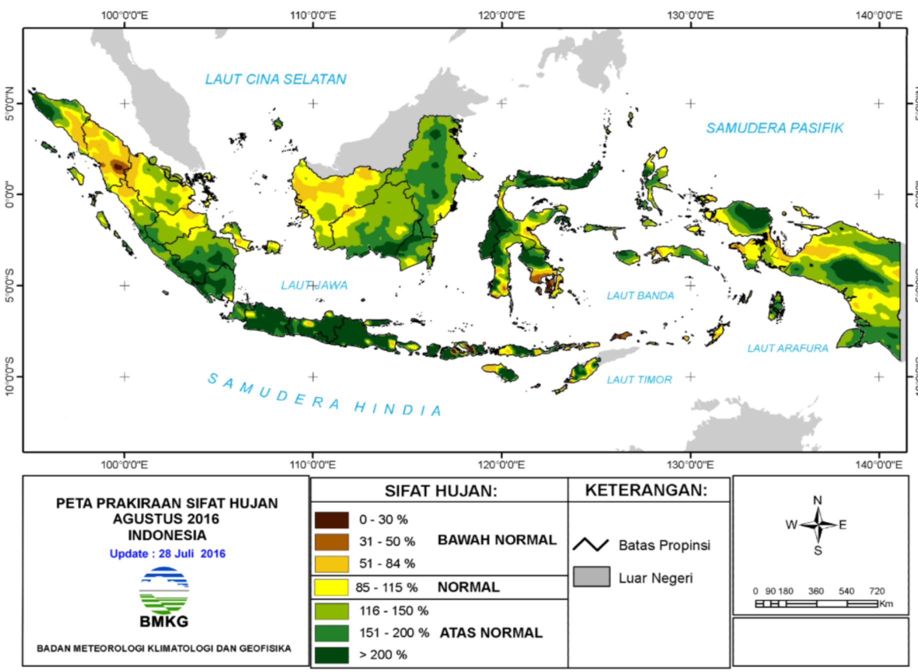
*Data source: BPS
**Estimated planting potential using satellite imagery

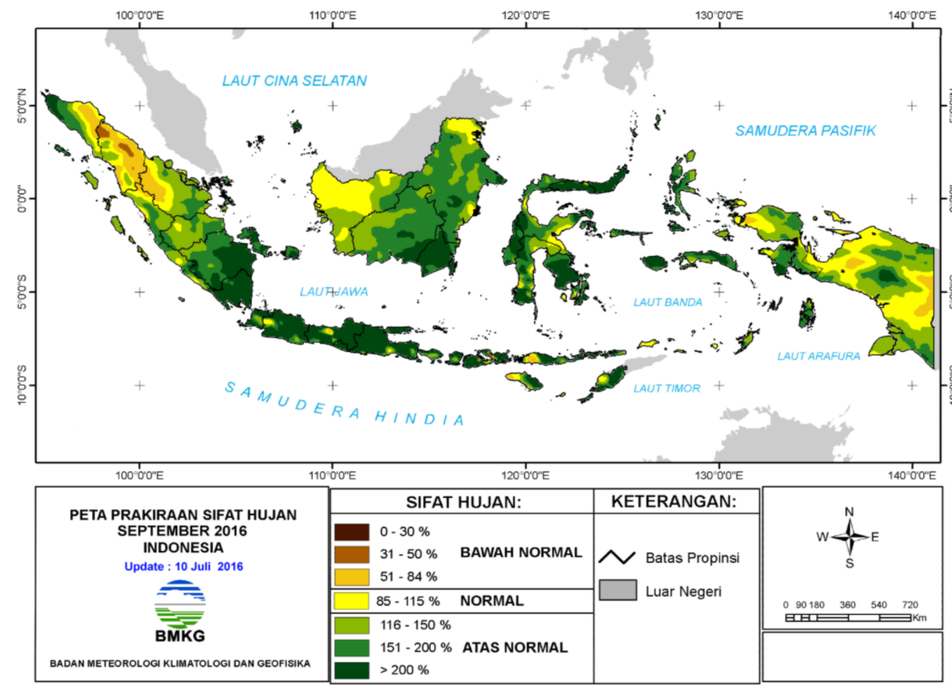
Using satellite imagery to estimate planting potential in August 2016

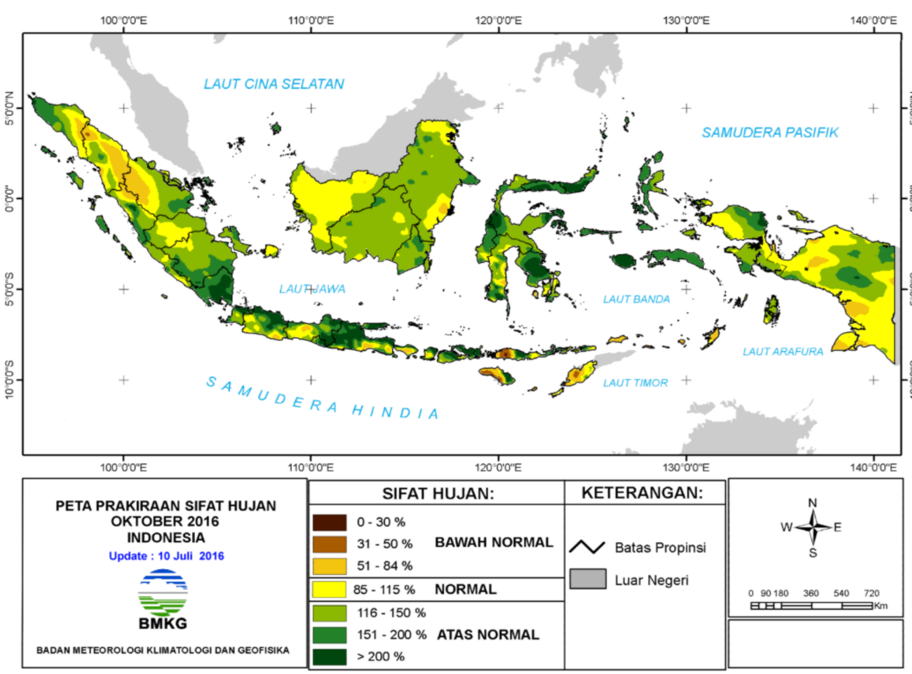
By analyzing satellite images of the growing season in April, estimates of harvesting potential in August for all of Indonesia are made. Combined with the August rainfall forecast, planting potential is identified for the three food crops, using the specific water requirement for each crops group. At national level, August planting potential for paddy and short cycle paddy variety is around 220 thousand hectares higher compared to the 5-years average. The actual planting area will however depend on other variables not captured in this estimates, such as water and pest and diseases management and availability of short cycle paddy seeds in August.

The table on the right lists provinces with more than 1 thousand hectares of planting potential for the three food crops as estimated by using the above methodology.

Weather outlook

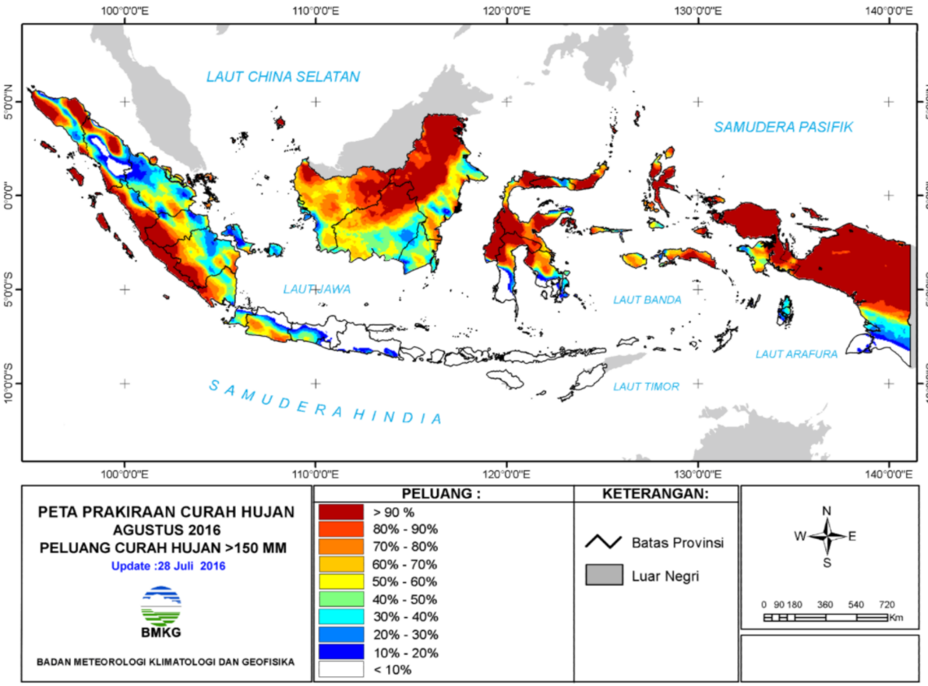


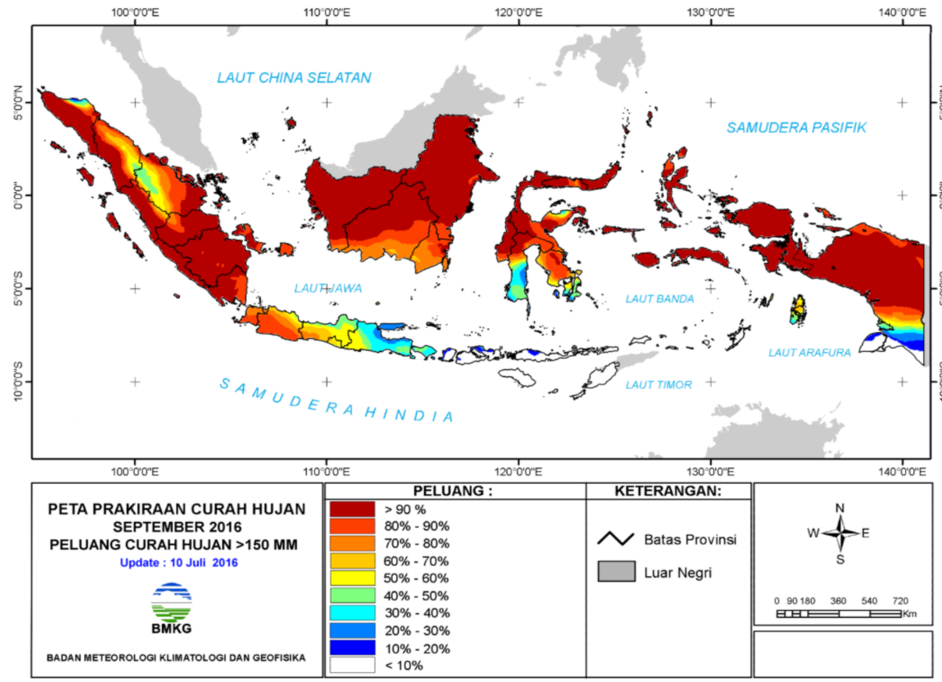


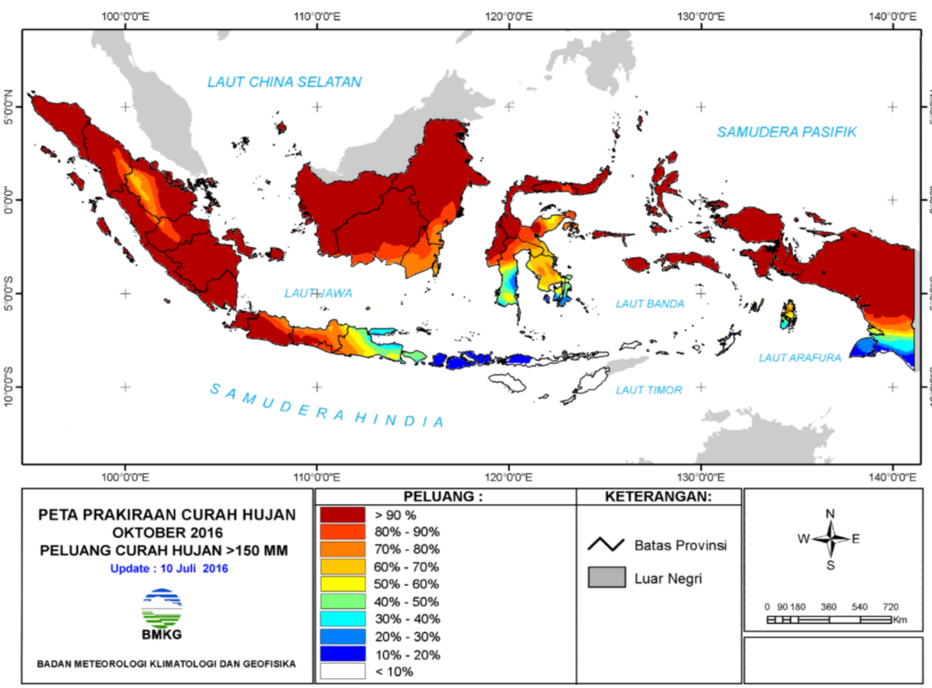


Rainfall anomaly prediction for August- October 2016

These maps are produced by the Indonesian Agency for Meteorology, Climatology and Geophysics (BMKG). They show predictions of rainfall anomaly where yellow represents normal rainfall and light green to dark green shows above normal rainfall. The month of August shows a continuing trend of wetter than normal conditions across large parts of Indonesia with the largest deviations across Java, the eastern areas of Sulawesi, central Papua and southern Kalimantan and Sumatra. In September and October above normal rainfall is predicted to spread all across Indonesia with an exception parts of Papua, the Nusa Tenggaras, and northern Sumatra and Kalimantan.





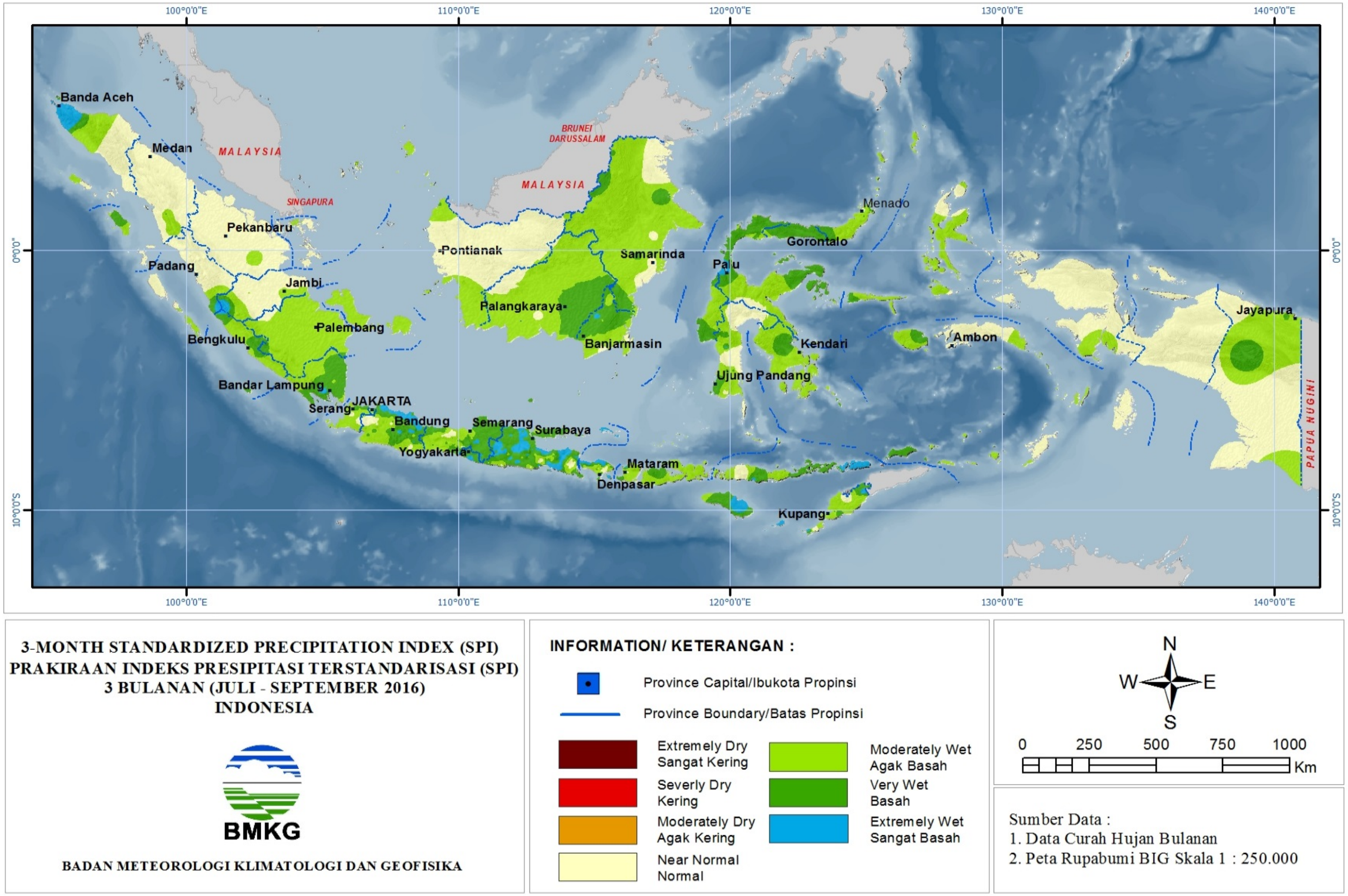


Probability of more than 150 mm of rainfall for August-October 2016

These maps area also produced by BMKG and indicate predictions of rainfall greater than 150 mm per month. 150 mm is the monthly rainfall level required for paddy production. In these maps, dark red indicates a higher probability of rainfall greater than 150 mm while dark blue indicates a lower probability and white indicates no chance of rainfall greater than 150 mm. In August, there is a very high probability of significant rainfall predicted for Kalimantan, Sulawesi, Papua and western areas of Sumatra. By October, BMKG forecasts that the northern parts of Indonesia and western areas of Java will experience rainfall accumulation greater than 150 mm. However the Nusa Tenggaras are unlikely to reach more than 150 mm of monthly rainfall.

Standardized Precipitation Index

July- September 2016



The standardized precipitation Index (SPI) on the map above shows significant probability of changes in rainfall levels between July and September 2016, compared to longer-term average for the same time period.

SPI, which identifies both probability and intensity of dry or wet spells, is normally used to detect areas at higher risk of drought, but can be also used for flood-risk identification.

The SPI for July, August and September 2016 shows that large parts of Indonesia are likely to experience greater than normal rainfall levels, except for northern parts of Sumatra, western Kalimantan, and Papua, where normal is likely.

Methodology

The maps in this bulletin are largely based on satellite data which is the processed and used to create various indicators relating to weather extremes and rainfall deviations.

Rainfall anomaly is a measure of lack or excess rainfall in a period compared to the average. Data is derived from the University of California, Santa Barbara and used to compute the anomaly. Thresholds for anomaly follow a standard protocol. Data for rainfall anomaly is derived from CHIRPS, a global precipitation dataset with high spatial and temporal resolution acquired through the University of California, Santa Barbara.

Days without rainfall is based BMKG dataset from direct observation. This data is processed to determine the number of days since the last rainfall (were a day with rainfall is noted as one where more than 0.5mm of precipitation as observed). The number of days since the last rain is determined using a standard classification, also used by the Indonesia Weather and Meteorology Bureau (BMKG).

Standardized Precipitation Index (SPI) is a normalized measure of rainfall anomaly which shows probabilistic significance of estimated rainfall in a location. SPI presented in this bulletin uses direct observation data and forecast data from BMKG datasets and is calculated using standardized method for SPI.

Impact of weather changes associated with La Niña on crop and coffee production is assessed through a trend analysis, utilizing official data from Central Statistics Agency (BPS). Analysis of rice prices during La Niña years is a trend analysis, utilizing retail prices of medium quality rice from the Ministry of Trade data. Assessment on flood events and their impact is also a trend analysis, using data from National Disaster Management Agency database.

Potential planting in August 2016 was estimated by importing MODIS data into TIMESAT- a program for analyzing time-series satellite data. The program conducts pixel-by-pixel classification of satellite images to determine growing stage of crops. To estimate planting potential in August 2016, harvesting status was combined with rainfall forecast for August 2016 for all of Indonesia. The potential planting area for the three analyzed crops is classified based on specific water requirement for each crop group. Rainfall forecast data is provided by BMKG.

Contributors

This bulletin is produced by a technical working group led by the Indonesian Agency for Meteorology, Climatology and Geophysics (BMKG) and consisting of the Ministry of Agriculture (Food Security Agency, Food Crops Department, Indonesian Agency for Agricultural Research and Development, Information and Data Center, Horticulture Department), the National Institute of Aeronautics and Space (LAPAN), National Disaster Management Authority (BNPB) and the Central Bureau of Statistics (BPS). The bulletin is directed by Professor Rizaldi Boer of the Bogor Agricultural University (IPB). The World Food Programme and Food and Agriculture Organization of the United Nations provide technical support, including the generation of maps and data analysis.

All content within this bulletin is based upon the most current available data. Weather conditions are a dynamic situation, hence the current realities may differ from what is depicted in this document.

Flood and Landslides Response

1. In total the National Disaster Management Agency (BNPB) provided more than IDR 1.13 billion to respond to floods and landslides disasters in June 2016.

2. In West Sumatra, BNPB handed over IDR 500 million (USD 37 thousand) for emergency response operations.

3. Purworejo and Banjarnegara districts in Central Java declared emergency for period between 19 June and 18 July. BNPB handed over the disaster on-call funds of IDR 250 million (USD 19 thousand)and the Ministry of Social Affairs distributed cash assistance for the families of the deceased at IDR 15 million (USD 1,124) per person and IDR 2.5 million (USD 187) for injured persons.

3. Head of Sangihe District in North Sulawesi declared emergency between 21 June and 4 July. BNPB distributed their on call funds of IDR 350 million (USD 26 thousand) and the Ministry of Social Affairs distributed cash assistance for the family of the deceased at IDR 15 million (USD 1,124) per person.

4. In the declared emergency areas, the Ministry of Social Affairs will also provide meals for the evacuees three times a day, until the emergency response phase is deactivated.

Recommended Action

1. Continue monitoring of:
    a) Weather patterns and related disasters, its impact on livelihoods and nutritional and health status in at risk and affected areas
    b) Access to food and purchasing power, through impacts on infrastructure, food prices (rice and other commodities) and wages / income
    c) Pest and disease outbreaks

2. Share information to the at risk and affected communities:
    a) Accurate and actionable weather information
    b) Early warnings for unusual flooding and landslides

3. Provide services at community level for at risk and affected areas:
    a) Improve irrigation system to prepare for management of excess water
    b) Agricultural extension services to provide advice on most appropriate crop varieties
    c) Improve management of sanitation facilities

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