

Table of Contents

Executive summary	1
Risk of drought impact for agriculture (RDrl-Agri).....	1
Precipitation.....	2
Standardized Precipitation Index (SPI)	4
SPI outlook	6
fAPAR anomaly.....	7
Soil moisture anomaly	8
Reported impacts.....	10
Information sources.....	12

Executive summary

- From the beginning of the wet season (April), a short and intense dry spell hit a large area across Laos, southern China (Yunnan and Sichuan), Myanmar and Thailand, including the upper Mekong basin.
- Impacts have been reported especially from China, where the region of Yunnan is heavily affected. Much less information is available from mainland Southeast Asia countries, but farmers are likely to be affected, given the high reliance on rainfed crops. Central and northern Thailand suffered from dry conditions in late 2018 already.
- July and August are at the core of annual rainfall balance over the area. The outlook is positive, with July expected to be about normal and above average precipitation until September.

Risk of drought impact for agriculture (RDrl-Agri)

The indicator RDrl-Agri shows the risk of having impacts from a drought, by taking into account the exposure and socio-economic vulnerability of the area, with particular focus to the agricultural impacts.

The trimester June to August, or July to September, depending on the location, usually records at least 50% of the annual total precipitation over most of mainland Southeast Asia and south-west China. Therefore, an underwhelming or failed wet season could hamper severely the yearly water balance.

The RDri for the second dekad of June shows a wide region under moderate risk, with peaks across the boundaries of Myanmar, Thailand, Laos and China (Figure 1). Over these four countries, the total population living in the area currently under drought is in the order of tens of millions. Agriculture is the major source of income and subsistence for the population, while the great majority of crops are rainfed and strictly depend on the precipitation during the wet season. Planting for the main crop season starts between end of April and late July, depending on location, to take full advantage of the wettest months. The river Mekong is the main freshwater body in the region and of utmost importance for its water supply and economy. About 75% of the Mekong's annual flow falls within the monsoon between July and October with hundreds of dams scattered along the river.

Despite abundant precipitation in the season 2018, in agricultural terms a dry spell at a critical time is highly detrimental for crops, regardless the cumulated surplus in rainfall, especially in rainfed crops.

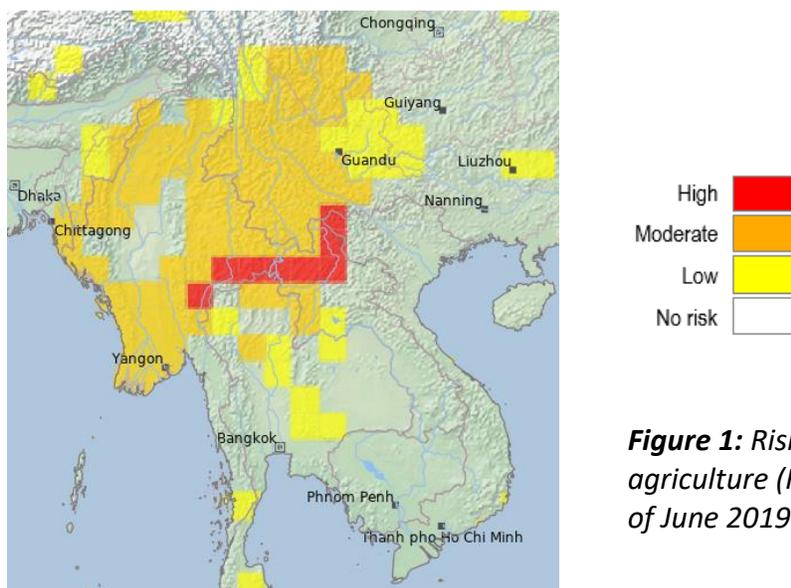


Figure 1: Risk of drought impact for agriculture (RDri-Agri), between 11th and 20th of June 2019.

Precipitation

Precipitation includes total monthly of both rainfall and snow. The four months between June and September usually record at least 60% of the annual total precipitation over most of mainland Southeast Asia and south-west China, defining a strong seasonality. The dry spell started at the very beginning of the 2019 rainy season, recording rainfall amounts under the average and below the natural variation (Figure 2). Previously, precipitation fluctuated widely around the normal, with both negative and positive excesses, which might be summarized as an

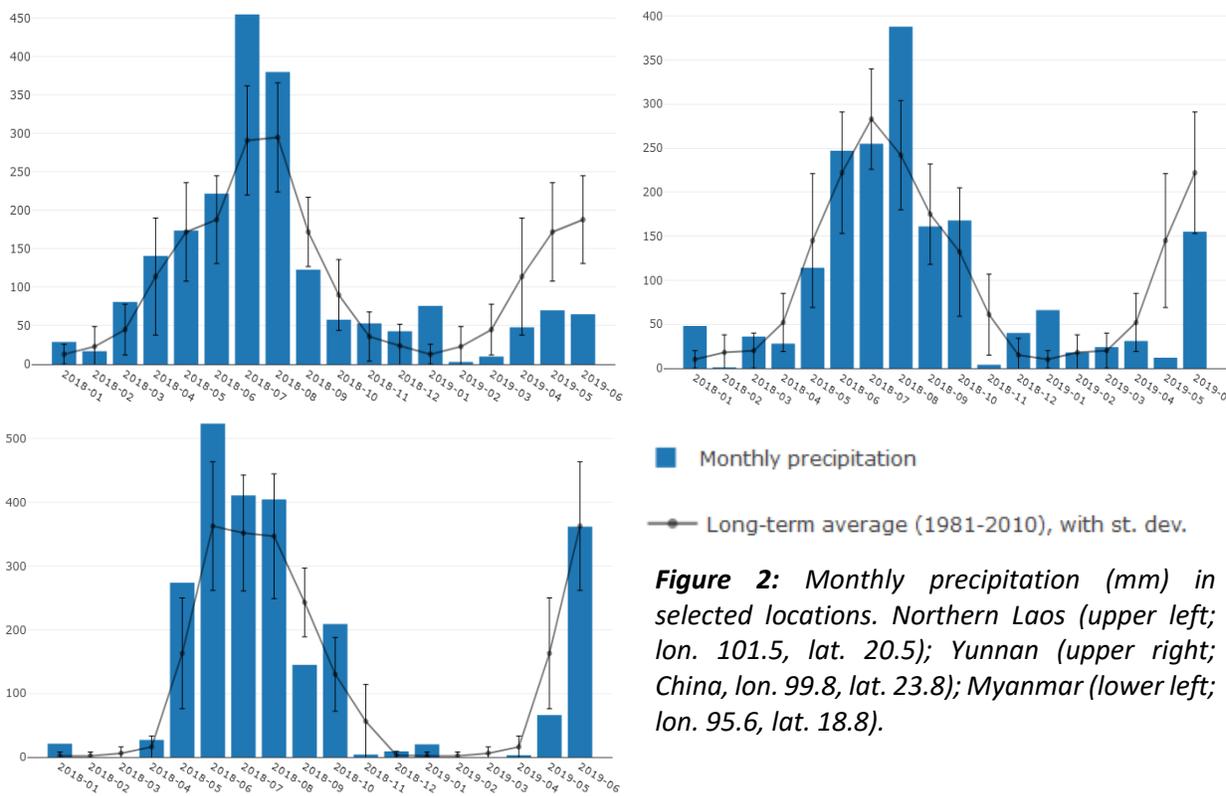
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08/07/2019 (ADDENDUM: 23/07/2019)



intense but shorter rainy season in 2018. Over the last one and a half year, precipitation surplus was still slightly predominant, but almost cancelled out by later deficits (Figure 3). It is difficult to anticipate the cumulated effects of these large variations of rainfall deficit/surpluses at the ground, but the disruption of the expected cycle is more likely than not to cause short-term imbalances in water availability.



■ Monthly precipitation
—● Long-term average (1981-2010), with st. dev.

Figure 2: Monthly precipitation (mm) in selected locations. Northern Laos (upper left; lon. 101.5, lat. 20.5); Yunnan (upper right; China, lon. 99.8, lat. 23.8); Myanmar (lower left; lon. 95.6, lat. 18.8).

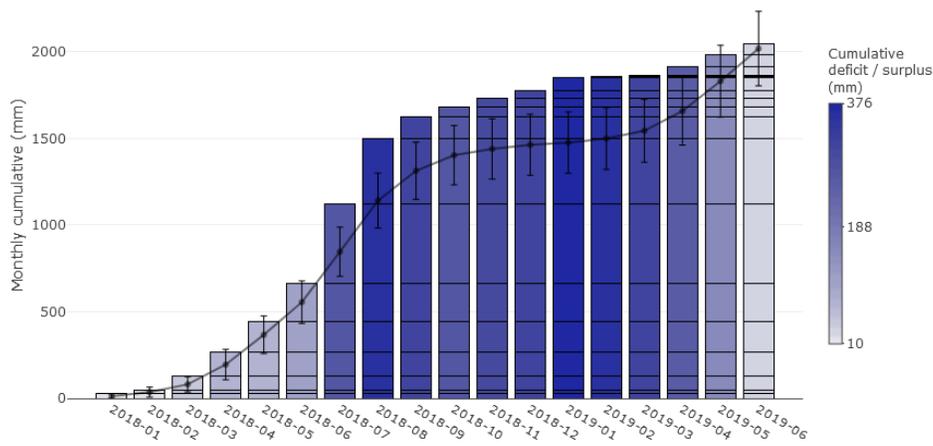


Figure 3: Cumulated rainfall from January 2018 to May 2019, over northern Laos. Cumulated surpluses in neighboring regions are very similar.

Standardized Precipitation Index (SPI)

The SPI indicator is used to monitor the occurrence of meteorological drought. The lower (i.e., more negative) the SPI, the more intense is the drought.

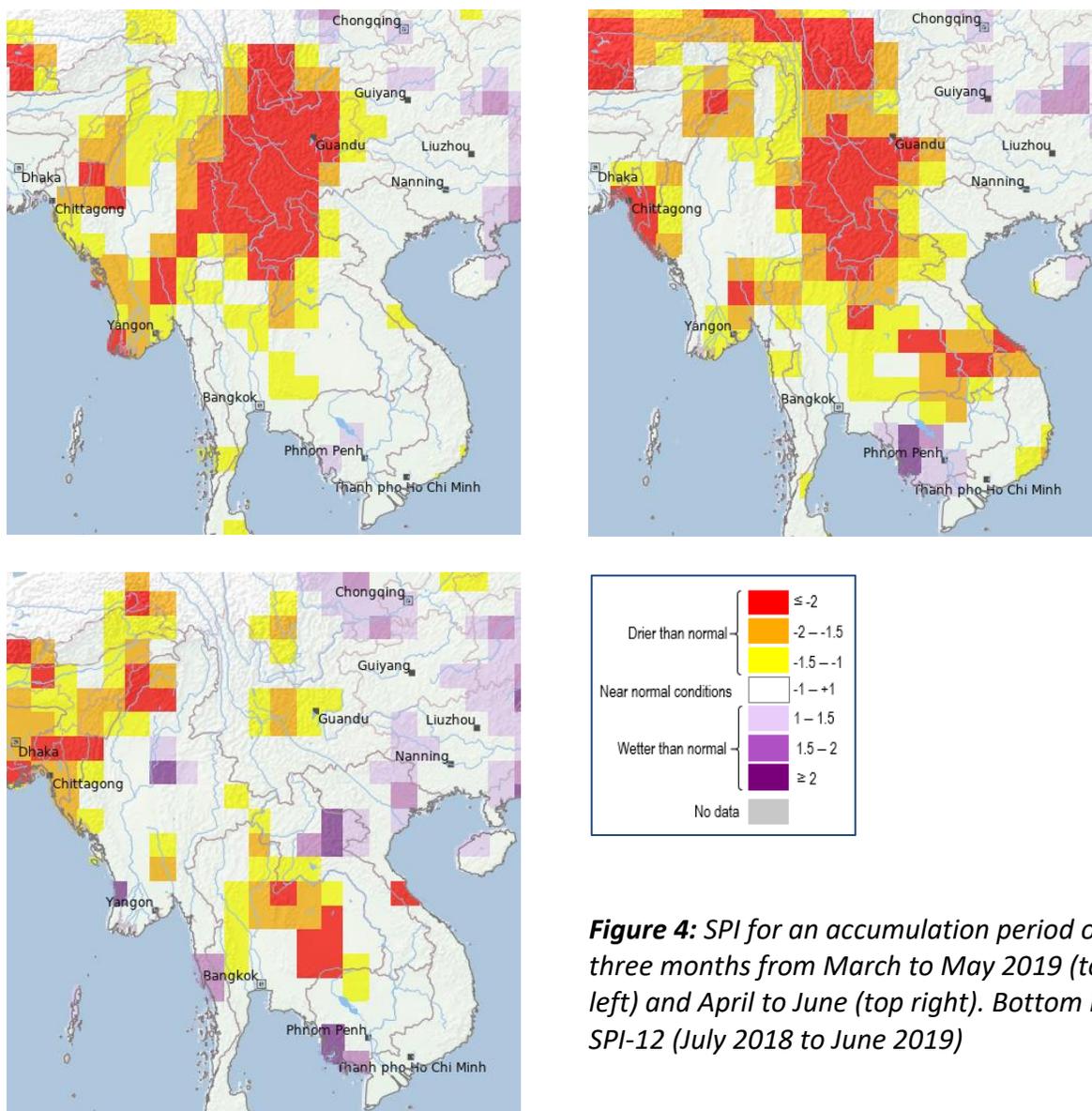


Figure 4: SPI for an accumulation period of three months from March to May 2019 (top left) and April to June (top right). Bottom left: SPI-12 (July 2018 to June 2019)

The short-term SPI-3 shows best the precipitation anomalies driving the current dry spell, while longer cumulative periods turn into positive anomalies almost invariably at the 12 months benchmark, filling up deficits. This is due to the abundant above average precipitation at the peak

GDO Analytical Report

Drought in mainland Southeast Asia – July 2019

JRC Global Drought Observatory (GDO) and ERCC Analytical Team
08/07/2019 (ADDENDUM: 23/07/2019)



of the last rainy season. Until May 2019, the drought affected area could be identified starkly inside a defined perimeter (figure 4, top left), but with June precipitation the 3-months deficits spread over a much wider area, involving mainland Southeast Asia and further north to the Himalayan chain and Sichuan (figure 4, top right). The SPI-12, with the positive effect of the last rainy season fading away, will inevitably get worse, in absence of above average precipitation. Central Thailand and north-west of Myanmar already display longer-term precipitation deficit (Figure 4, lower left). The former is still marked by the drought event between June and November 2018, the latter by a yearly-long streak of below average precipitation.

In northern Laos (figure 5) the dry spell is the strongest of the last ten years, despite cancelling out at the 12 months cumulative window. There is a stark contrast between the current event and the longer-lasting one back in 2010.

Likewise, Yunnan (China) shows no meteorological drought from the yearly cumulative window, but strong deficits in the last three months, as well as Sichuan region further north (Figure 6).

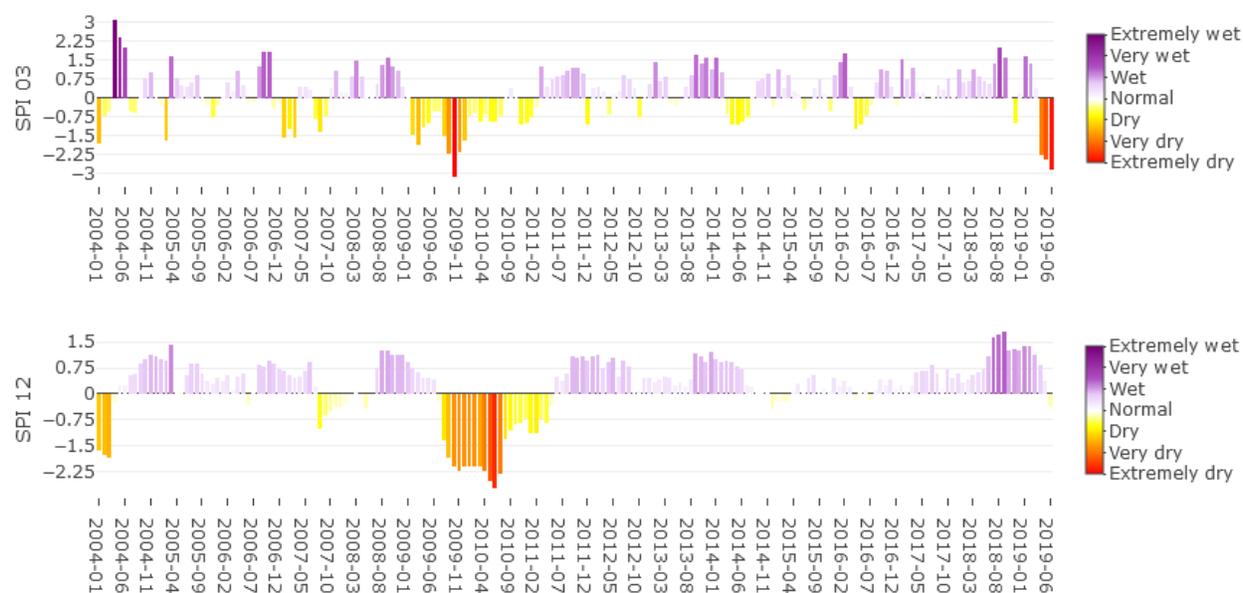


Figure 5: northern Laos, monthly SPI for a cumulative period of 3 months (SPI-3, upper chart) and 12 months (SPI-12, lower chart).

GDO Analytical Report

Drought in mainland Southeast Asia – July 2019

JRC Global Drought Observatory (GDO) and ERCC Analytical Team
08/07/2019 (ADDENDUM: 23/07/2019)



Figure 6: Yunnan (China), monthly SPI for a cumulative period of 3 months (SPI-3, upper chart) and 12 months (SPI-12, lower chart).

SPI outlook

The forecasts of SPI are based on the ECMWF probabilistic seasonal model of precipitation (S5) and the map shows warnings only where the forecast is relatively robust.

According to the SPI forecast for July (figure 7, left), normal seasonal conditions may be expected overall, with above average rainfall only at marginal areas of the dry spell (western Myanmar and south Sichuan, China). This is positive, as July is a key month in the annual precipitation balance. The trimester outlook up to September 2019 (figure 7, right) shows rainfall widely in excess over the entire region, suggesting above average monsoon. The picture is rather patchy, with some key areas affected by drought not being covered by rain surplus (northern Laos, central Yunnan, northern Myanmar). This is likely due to uncertainties in model ensemble forecasting rather than specific rainfall forecasts, especially if the forecasts over the neighboring regions will be confirmed.

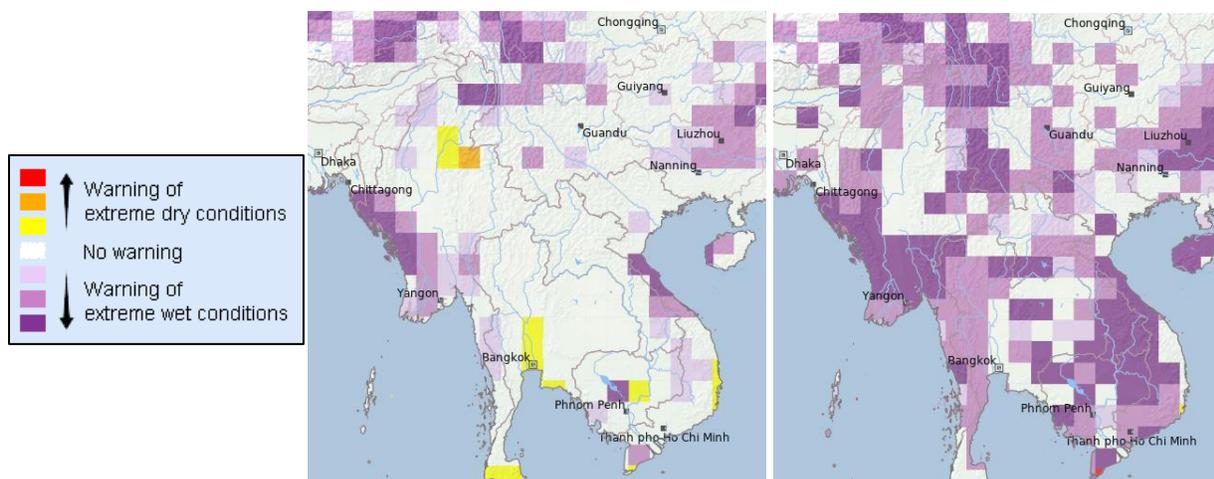


Figure 7: SPI forecast for July 2019 (left) and July to September (SPI-3, right), based on ECMWF S5 ensemble forecasts.

fAPAR anomaly

The fraction of Absorbed Photosynthetically Active Radiation (fAPAR) represents the fraction of the solar energy absorbed by leaves. fAPAR anomalies, specifically the negative deviations from the long term average over the same period, are a good indicator of drought impacts on vegetation.

Figure 8 shows a patchy but consistent area of lower than normal photosynthetic activity, overlapping well with the strongest precipitation deficits, and suggesting an ongoing vegetation stress, on both natural vegetation and crops.

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JRC Global Drought Observatory (GDO) and ERCC Analytical Team
08/07/2019 (ADDENDUM: 23/07/2019)

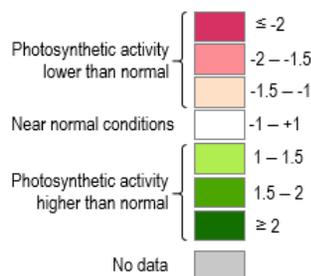
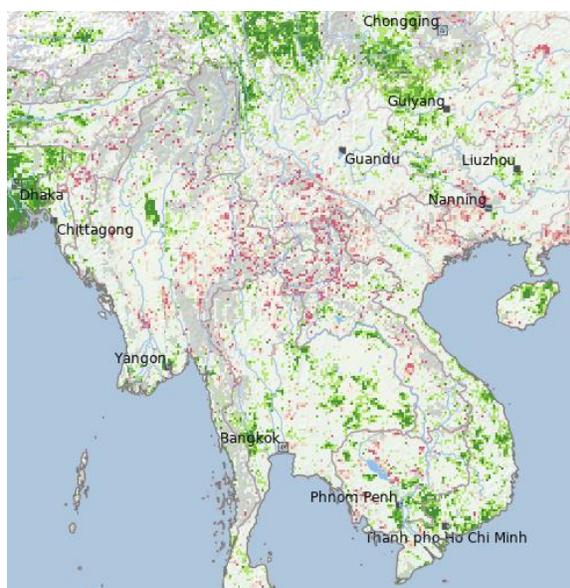
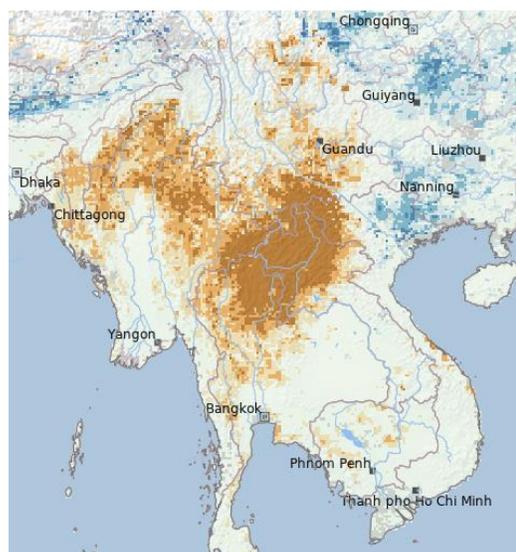
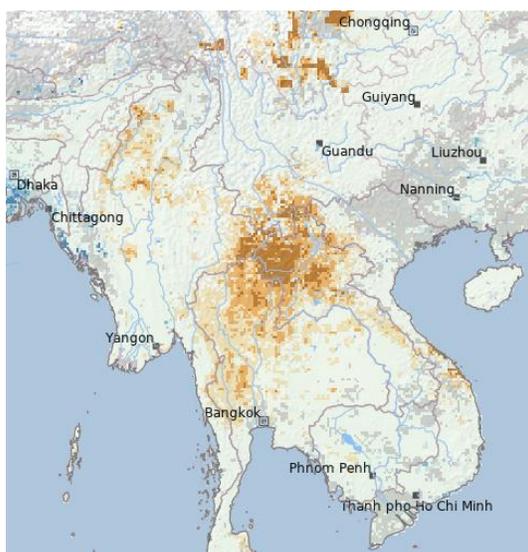


Figure 8: fAPAR anomaly, dekad from 11th to 20th of the month June 2019 (left).

Soil moisture anomaly

The aim of this indicator is to provide an assessment of the top soil water content, which is a direct measure of drought conditions, specifically the difficulty for plants to extract water from the soil.

Figure 9 displays a growing nucleus of soil moisture anomaly expanding from April onwards, notably over most of Myanmar and northwards to Sichuan through Yunnan (China). The most extreme class for soil moisture anomaly is dominant.



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Drought in mainland Southeast Asia – July 2019

JRC Global Drought Observatory (GDO) and ERCC Analytical Team
08/07/2019 (ADDENDUM: 23/07/2019)

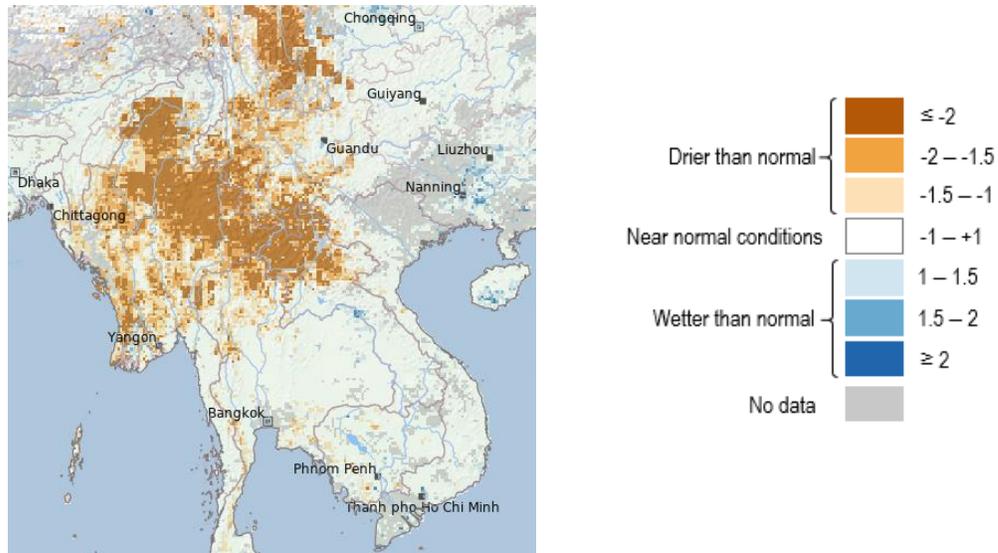
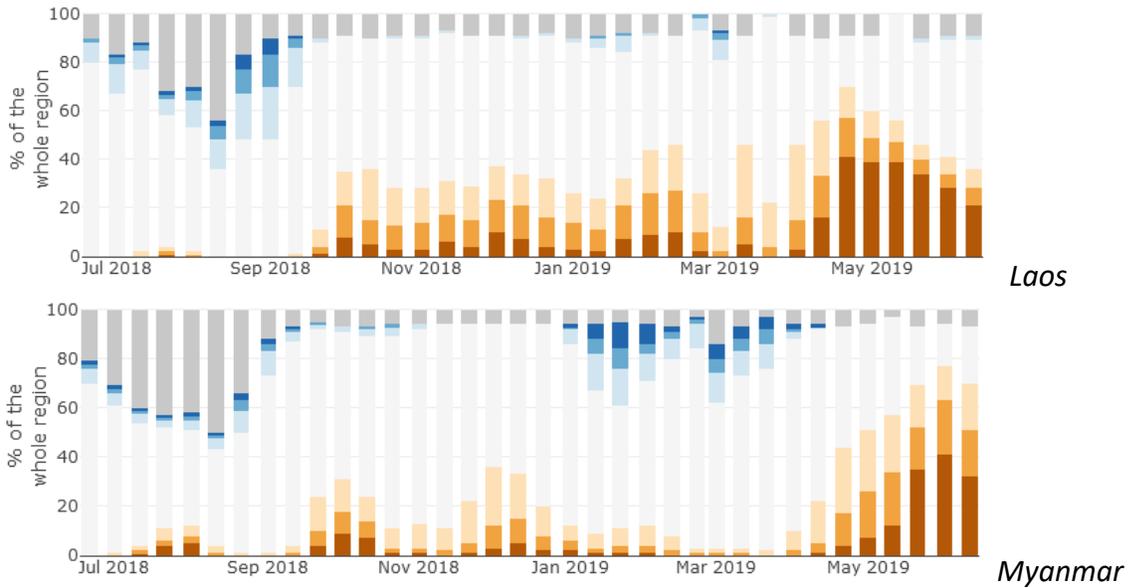


Figure 9: Soil moisture anomaly, evolution during three selected monthly intervals. Top left: mid-March to mid-April 2019; top right: mid-April to mid-May 2019; bottom left: mid-May to mid-June.

From a chronological perspective, figure 10 illustrates the trend of soil moisture anomalies, peaking between May and June so far.



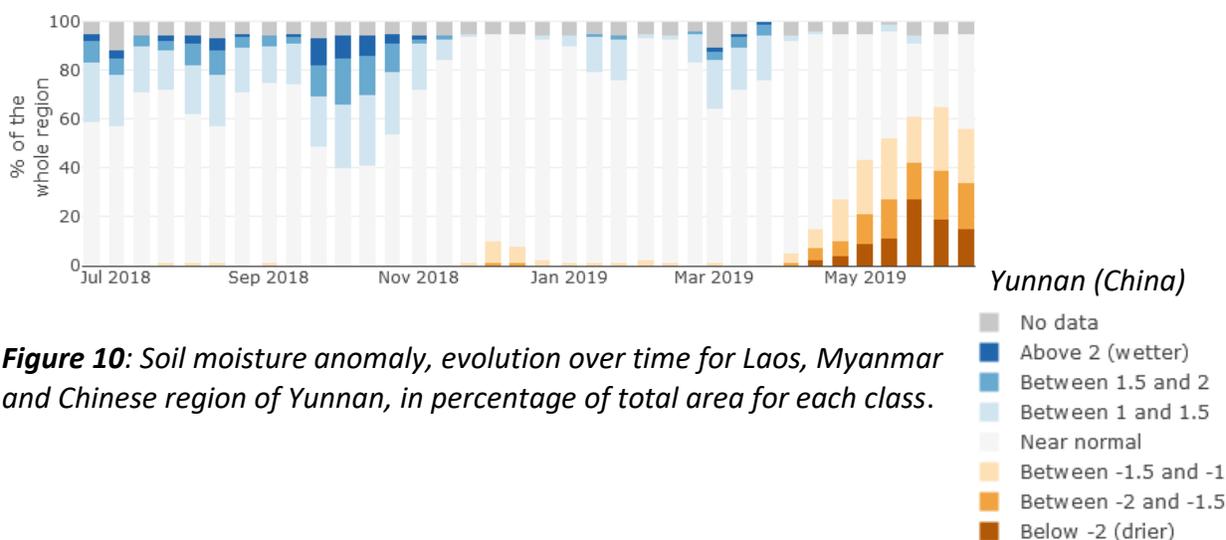


Figure 10: Soil moisture anomaly, evolution over time for Laos, Myanmar and Chinese region of Yunnan, in percentage of total area for each class.

Reported impacts

In China, mining operations were halted due to the lack of water in regions of Yunnan and Sichuan¹. Yunnan region experienced a devastating drought around 2010 and again a severe dry spell in 2014, so the government funded big projects to enhance coping capacity since, mostly based on rivers diversion². Chinese authorities are seriously engaged in providing safe drinking water to the exposed population, estimated as 300.000 at the least^{3 4}. Crops and livestock are affected too⁵. Cloud seeding operations are reportedly ongoing since May and emergency funds were dispatched for drought (and other disasters) relief⁶.

Up to date reports on the drought situation from mainland Southeast Asia were not found. Central and northern Thailand experienced drought conditions at the end of 2018, and related issues were reported already in the first half of 2019^{7 8}.

All links accessed 04/07/2019, unless indicated otherwise:

¹ <https://news.metal.com/newscontent/100937696/south-west-drought-ore-shortage-lower-operating-rates-at-silicon-producers-in-may/>

² <https://www.gokunming.com/en/blog/item/3594/china-initiates-enormous-yangtze-water-diversion-scheme>

³ <http://www.ecns.cn/hd/2019-06-14/detail-ifzkezvn2343474.shtml>

⁴ <https://www.thestar.com.my/news/regional/2019/05/23/yunnan-jilin-provinces-hit-by-drought/>

⁵ <https://www.gokunming.com/en/blog/item/4289/its-official-yunnan-facing-serious-drought>

⁶ http://www.xinhuanet.com/english/2019-06/28/c_138182039.htm

⁷ <https://www.bangkokpost.com/thailand/special-reports/1653944/drought-dries-up-hope>

⁸ <https://www.bloomberg.com/news/articles/2019-04-09/spreading-drought-adds-to-risks-for-thailand-s-cooling-economy>

No information about food security issues were found for any country involved. However, given the population exposed and the low-income status of most rural population across the affected regions, it is possible that in limited locations such risk is relevant.

The river Mekong is the main freshwater body in the region and of utmost importance for its water supply. Drought tends to lower the level of Mekong, with consequent saline intrusion downstream at the delta, a recurring problem for the coastal areas⁹. Currently there are no issue related to that*, with the river levels actually increasing, due to the release of water from Chinese dams^{10 11}.

*ADDENDUM 23/07/2019

Mekong river authorities and news are now reporting very low levels, amongst the lowest on record, with meters below the average for the period^{12 13}. The water levels descended quickly (figure 11) and the situation may be ascribed to both drought (i.e. lack of rain and low groundwater) and water management from upstream Chinese provinces.

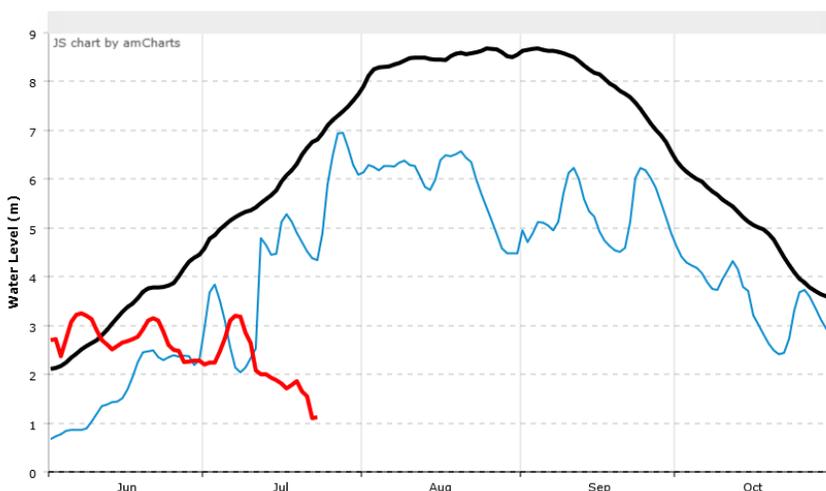


Figure 11: water levels at the monitoring station of Savannakhet¹⁴ (Thailand). The red line refers to the 2019 levels; the black line to the long-term average; for reference, the blue line indicates water levels during the 1992 severe drought event.

⁹ <https://www.sciencedirect.com/science/article/pii/S0048969719326178>

¹⁰ <http://www.mrcmekong.org/mekong-flood-forecasting>

¹¹ <https://www.rfa.org/english/news/laos/china-dam-mekong-laos-thailand-07032019151600.html>

¹² <http://www.mrcmekong.org/news-and-events/news/mekong-water-levels-reach-low-record/> (accessed 23/07/2019)

¹³ <https://www.bangkokpost.com/thailand/general/1712416/mekong-water-level-lowest-in-10-years> (accessed 23/07/2019)

¹⁴ <http://ffw.mrcmekong.org/stations.php?StCode=SAV&StName=Savannakhet> (accessed 23/07/2019)

Information sources

Global Drought Observatory (GDO) - Joint Research Centre of European Commission

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Authors: D. Masanteⁱ, C. Cammalleriⁱⁱ, P. Barbosaⁱⁱ

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ⁱ External consultant for the European Commission (Arcadia SIT, 27029 Vigevano, Italy)

ⁱⁱ European Commission, Joint Research Centre, Ispra (VA), Italy