GDO Analytical Report

Drought in Central America and Caribbean – March 2019

JRC Global Drought Observatory (GDO) and ERCC Analytical Team

29/03/2019

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Executive summary

- A drought is affecting the mainland and islands surrounding the Caribbean Sea. The event shows a patchy pattern distributed over several countries, in particular Guatemala, Honduras, Costa Rica, Panama, Colombia, Haiti, Dominican Republic, Cuba, Jamaica.
- The drought follows a strong dry spell in mid-2018, hitting primarily Central America and the "dry corridor", now revived by weak El Niño conditions.
- Impacts are multifold and, depending on the location, concern food security, water supply, agricultural production (crops and livestock), power generation, water transportation.
- The outlook is negative for all continental regions south of the Caribbean Sea, while within average or above for the islands at north.

Geographical context

The lands surrounding the Caribbean Sea exhibit two main precipitation patterns. The continental regions at the south and west, spanning from Mexico to Colombia, receive abundant rainfall between May and November, followed by a shorter dry period. However, the Pacific side of Central America, also known ecologically as "dry corridor" and encompassing primarily Guatemala, El Salvador, Nicaragua and Honduras, has an erratic rainfall pattern, periodically subject to strong dry spells.

The ensemble of Antilles at the north of the Caribbean Sea (Cuba, Hispaniola, Jamaica, Lesser Antilles, etc.) and some coastal areas of northern Colombia and Venezuela have a bimodal precipitation pattern, with peaks in May and October.

Typically, under El Niño conditions both macro-regions experience rainfall deficits and consequent drought[1]. Currently, conditions correspond to a weak El Niño[2].

Coping capacity differs within and among countries, with some regions particularly vulnerable and the poorest in the western hemisphere. With employment in agriculture above 20% of total workforce in several of them, many people are heavily dependent on rainfed crops and highly exposed to climate fluctuations. More than 30 millions live inside the "dry corridor" alone.

Risk of drought impact for agriculture (RDrI-Agri)

The indicator RDrI-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 RDrI for mid-March does not look very negative (Figure 1), due to the normally dry patterns of the earlier months of the year and some good rainfall in the last quarter of 2018. However, the dry spell in mid-2018 determined a long lasting deficit, which is now summing to the current dry spell. The drought involves overall more than 40 million people distributed across all the affected countries.

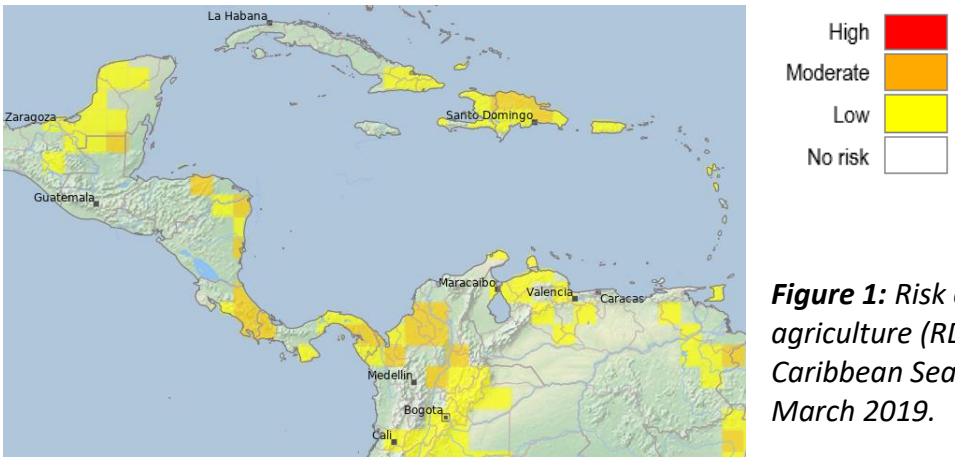

Figure 1: *Risk of drought impact for agriculture (RDrI-Agri) around the Caribbean Sea, from 1st until 10th of March 2019.*

[1] A.C. Ravelo, A.M. Planchuelo, R. Aroche, J. C. Douriet Cárdenas, M. Hallack Alegría, R. Jimenez, H. Maureira, T. Peña Paz, G. Tiscornia, R. Zanvettor y R. Zimmermann (2016); Monitoreo y Evaluación de las Sequías en América Central; Editores: H. Carrão y P. Barbosa; EUR 27974 ES; doi:10.2788/65166.

[2] http://www.wmo.int/pages/prog/wcp/wcasp/enso_update_latest.html

Precipitation

Precipitation includes total monthly of both rainfall and snow. Barcharts of Figure 2 show one year of precipitation against the long-term average and variability for three different locations. In all of them, despite different patterns, precipitation were overall scant, explaining the cumulative deficits linking mid-2018 to early 2019.

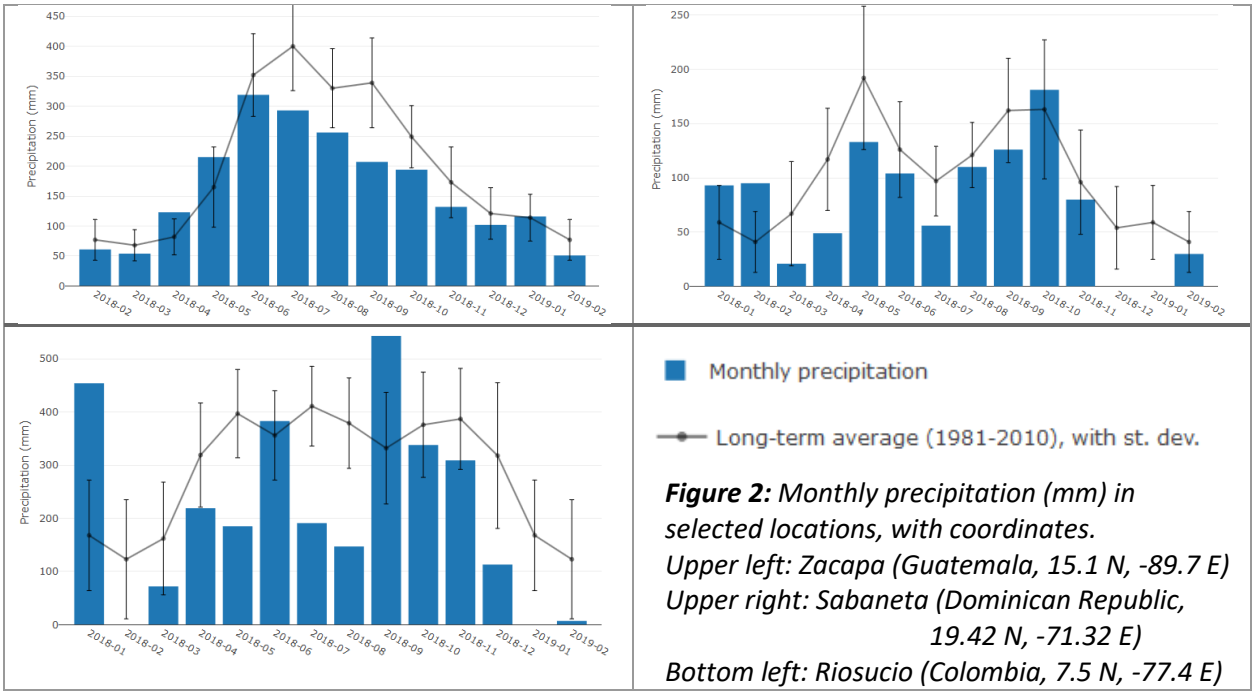

Figure 2: *Monthly precipitation (mm) in selected locations, with coordinates.*
Upper left: Zacapa (Guatemala, 15.1 N, -89.7 E)
Upper right: Sabaneta (Dominican Republic, 19.42 N, -71.32 E)
Bottom left: Riosucio (Colombia, 7.5 N, -77.4 E)

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.

The picture from SPI 3 is patchy (Figure 3), with relevant precipitation deficits in the trimester until February limited to localized areas, including Caribbean islands, Costa Rica, Panama and Colombia. Normally, the first trimester of the year in the "dry corridor" of Central America does not see much rainfall, hence negative SPI anomalies are missing there, even in absence of precipitation. However, the SPI-9 (Figure 4), which includes cumulative precipitation since June 2018, shows how the same region of Central America is still in deep deficit, due to the 2018 dry spell in the usually wettest third of the year (June to September). The multi-year perspective of SPI-9 in Figure 5 presents a stronger anomaly than during the strong event of 2015/2016. It does, however, display a positive balance for centre-west Panama over the same period. In both SPI maps, Hispaniola exhibits severe precipitation deficits, lasting since about May 2018 and getting closer or worse than the values reached in 2015/2016 (Figure 6).

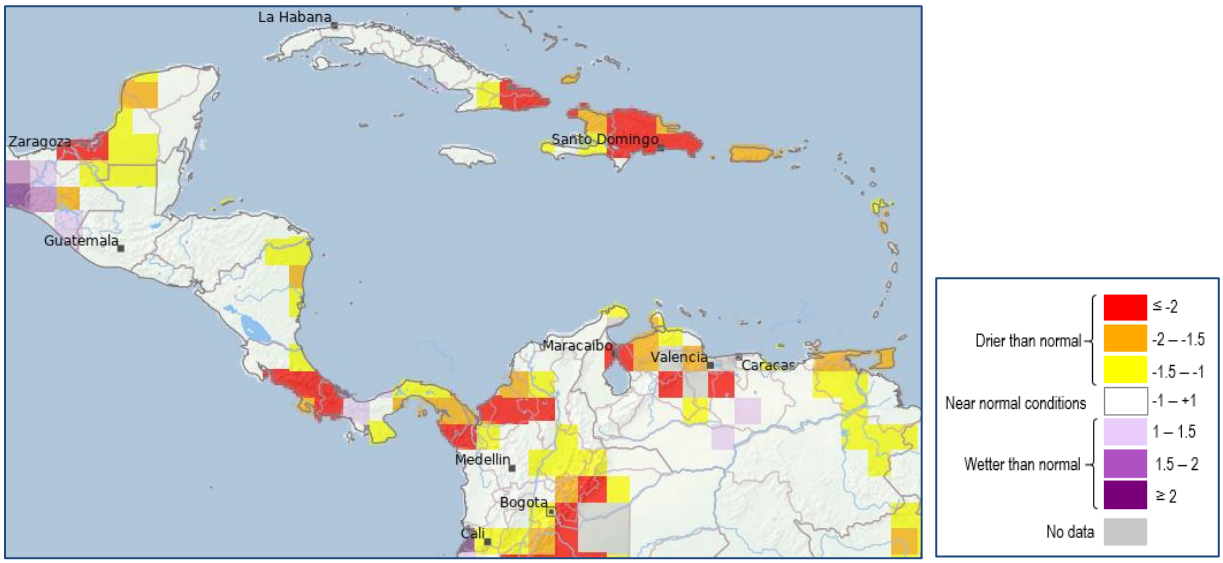

Figure 3: *SPI for the accumulation period December 2018 to February 2019 (SPI-3).*

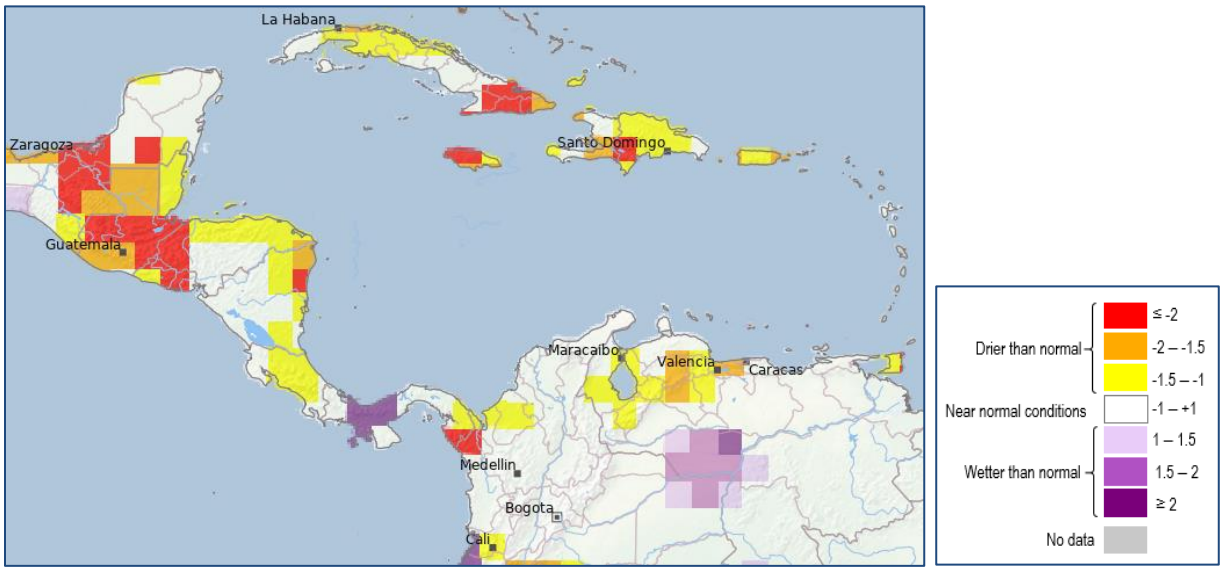

Figure 4: *SPI for the accumulation period June 2018 to February 2019 (SPI-9).*

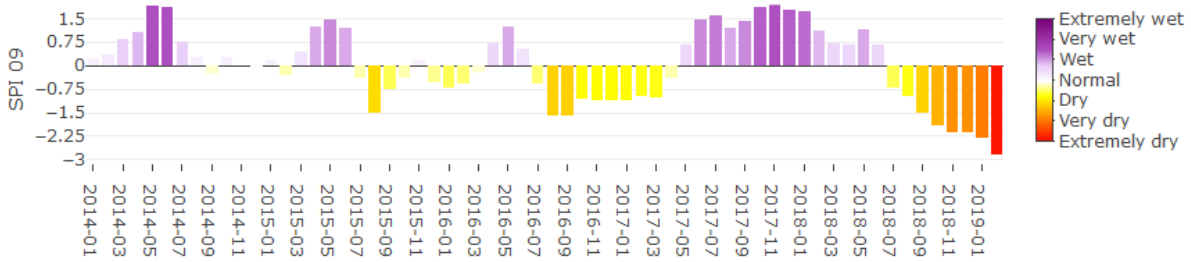

Figure 5: *SPI for a period of 9 months near Zacapa (Guatemala, coordinates: 15.1 N, -89.7 E).*

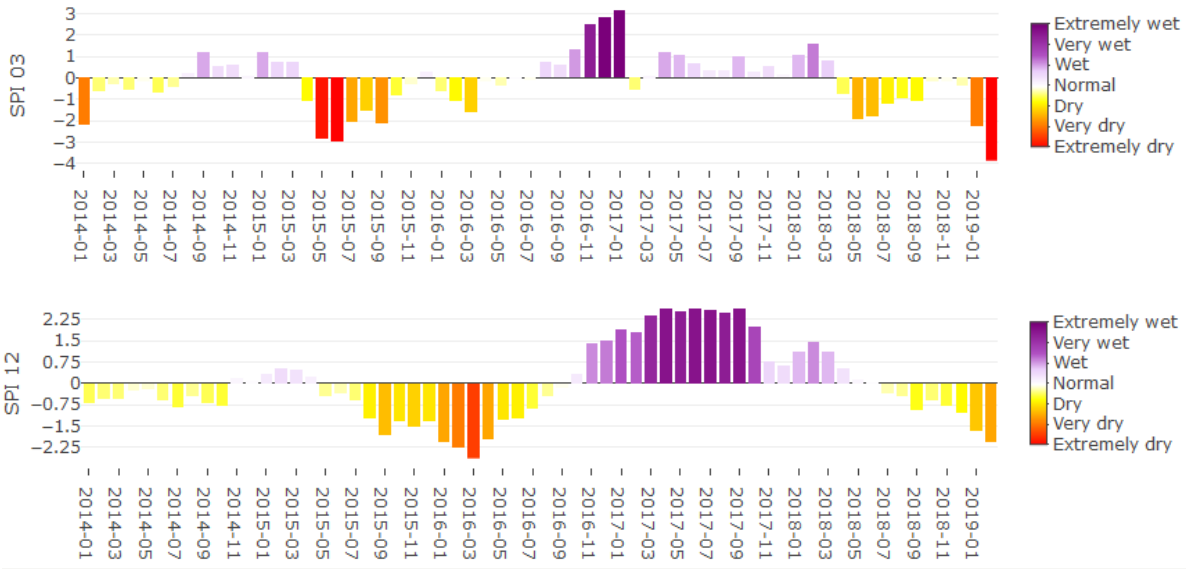

Figure 6: *SPI for a cumulative period of 3 and 12 months near Sabaneta (Hispaniola, Dominican Republic, coordinates: 19.4 N, -71.3 E).*

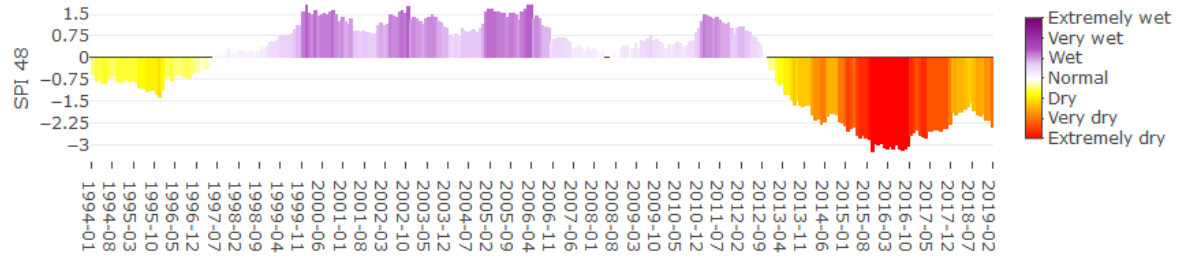

Figure 7: *SPI for a cumulative period of 4 years (SPI-48) near Sanisidro (Costa Rica, 9.6N, -83.4E).*

In Costa Rica, the stark drop of SPI in the long-term view (Figure 7) signals a sequence of underperforming rainfall over the past several years, leading to a remarkable cumulative deficit, particularly deep during the drought of 2015 and mostly unmitigated since. This situation is not common to the entire Caribbean region, but the drought of 2015/2016 is still recent and likely to stockpile its effects over current water resources.

SPI outlook

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

According to the SPI forecast for the trimester March to May (Figure 8), further dry conditions may be expected in all continental regions south of the Caribbean Sea, while normal or wetter conditions are expected for the islands at north. In the longer outlook until August (not shown), despite higher uncertainty, the situation does not change much, if not for an overall drier than normal situation again on Hispaniola and Puerto Rico. This suggests a detrimental counter balancing of earlier precipitations, when looking at the expected cumulated precipitation for the entire semester. The map predicts drier conditions over Venezuela and Guyana as well.

The situation is quite concerning, as for the affected countries on the continent the current dry conditions will extend into the wetter season, piling up on the existing deficits and entailing a longer recovery period. In the Caribbean islands, although normal rainfall during April would be highly beneficial, May and June will be pivotal, thus the six months outlook is particularly meaningful.

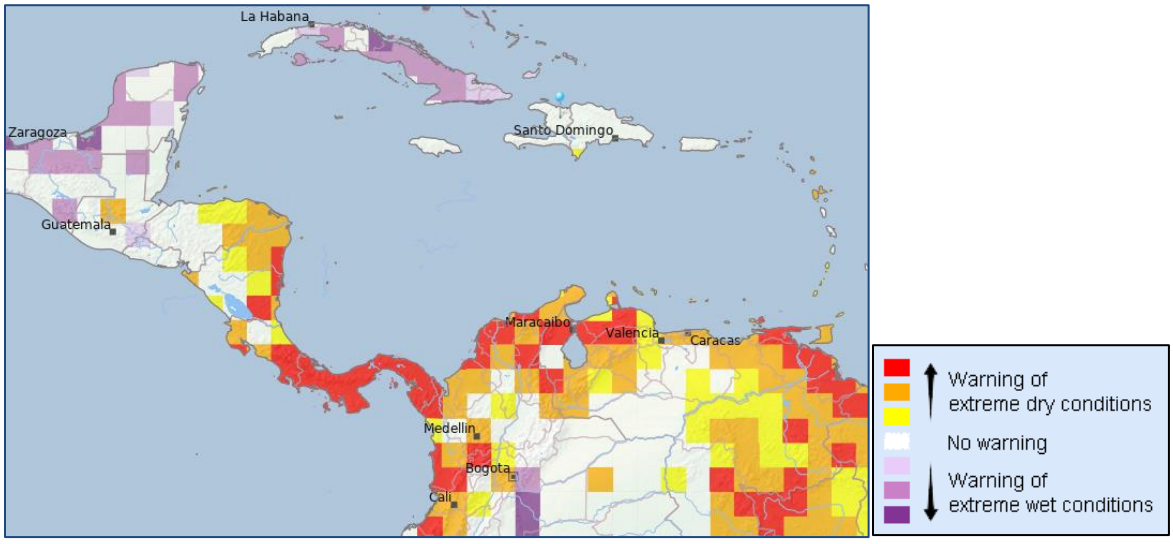

Figure 8: *SPI forecast for the trimester March to May 2019 (SPI-3) over Central America and northern Colombia and Venezuela (based on ECMWF S5 ensemble forecasts).*

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 9 shows the worsening of fAPAR anomaly over the whole region, particularly in Colombia, over the isthmus of Panama, parts of Honduras, Guatemala and the island of Hispaniola. The negative trend of photosynthetic activity highlights a vegetation stress, involving both natural vegetation and croplands, in agreement with other indicators over the same time interval.

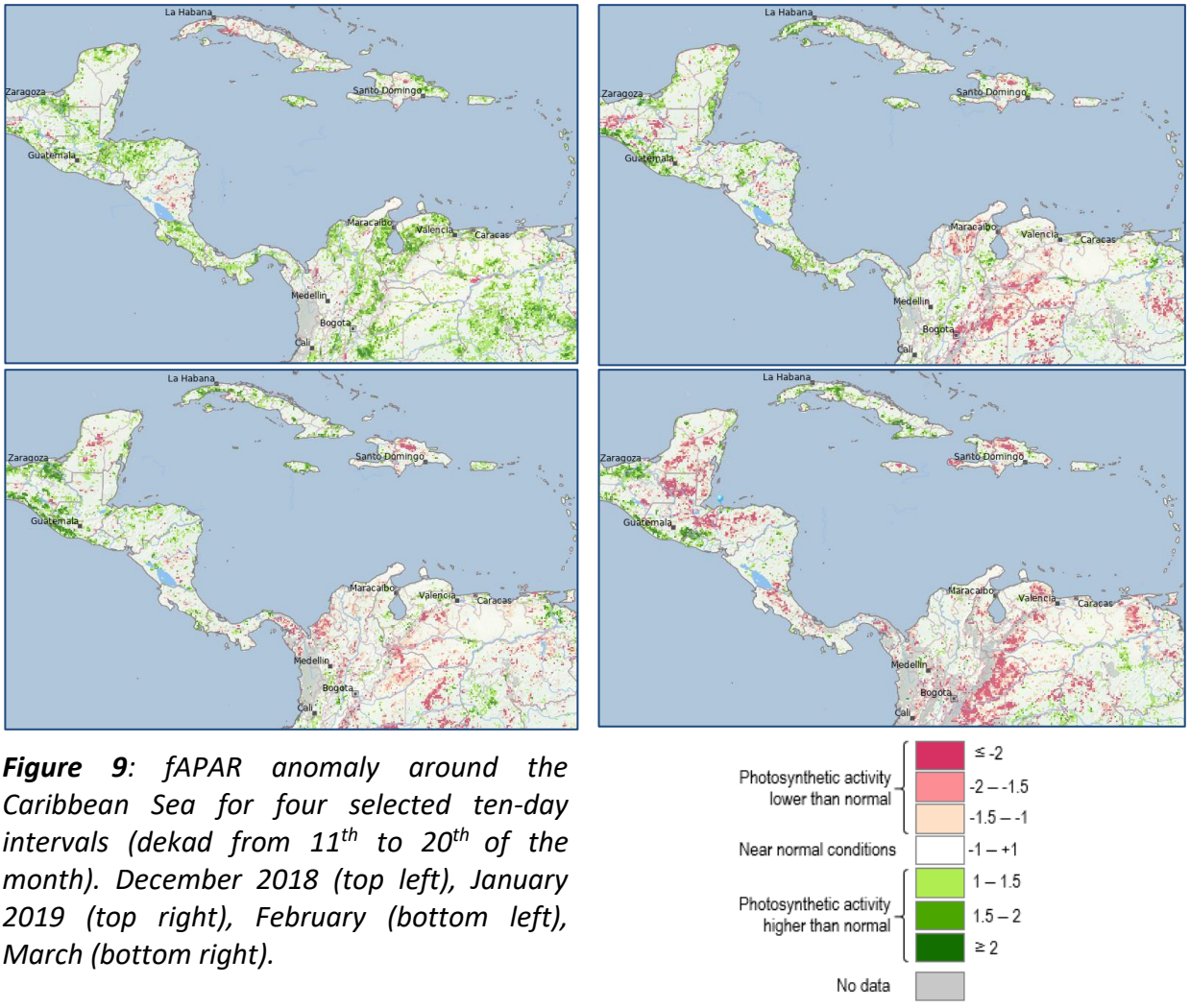

***Figure 9**: fAPAR anomaly around the Caribbean Sea for four selected ten-day intervals (dekad from 11th to 20th of the month). December 2018 (top left), January 2019 (top right), February (bottom left), March (bottom right).*

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.

Soil moisture displays persistent dry anomalies over the affected regions since December 2018, particularly over Dominican Republic, Honduras, Guatemala, Costa Rica, Panama and northern Colombia, and a distinct peak in mid-January (Figure 10).

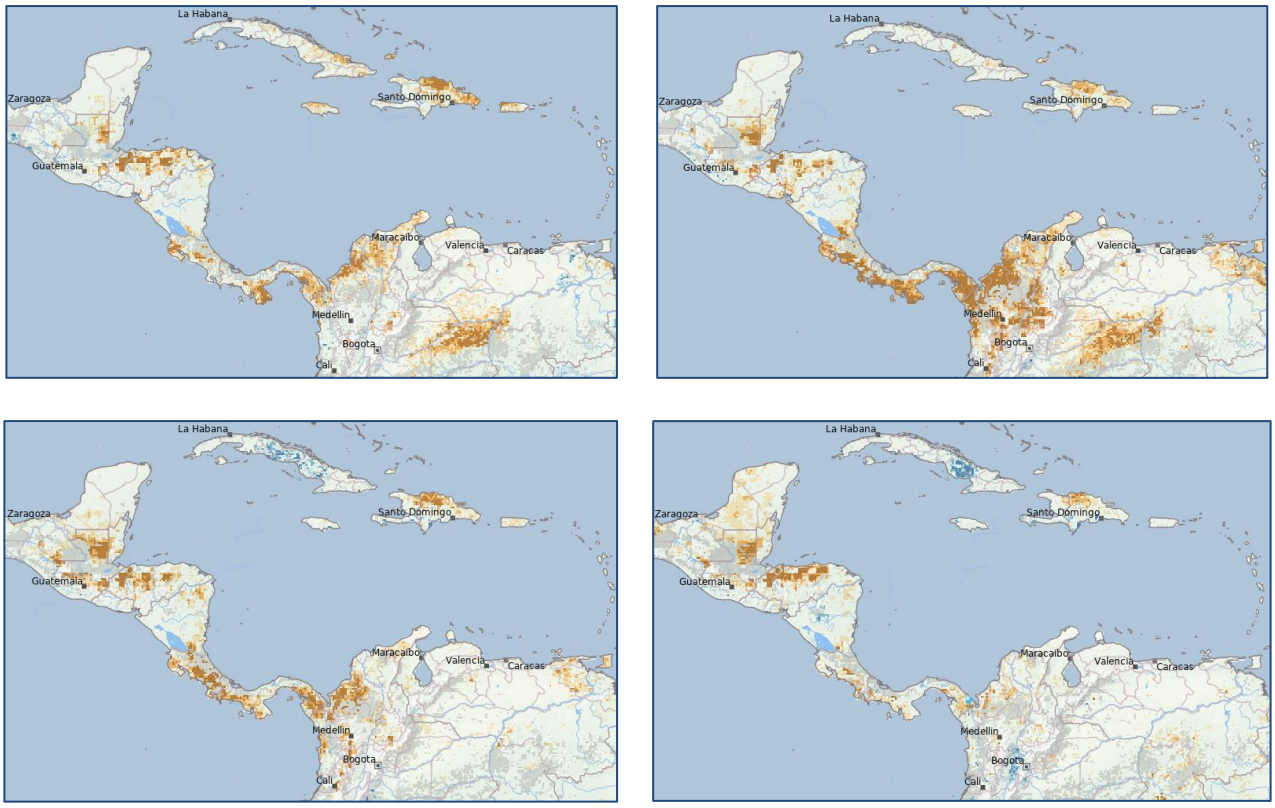

***Figure 10**: Soil moisture anomaly around the Caribbean Sea, for four selected monthly intervals:*

top left: mid-November to mid-December 2018
top right: mid-December 2018 to mid-January 2019
bottom left: mid-January to mid-February 2019
bottom right: mid-February to mid-March 2019

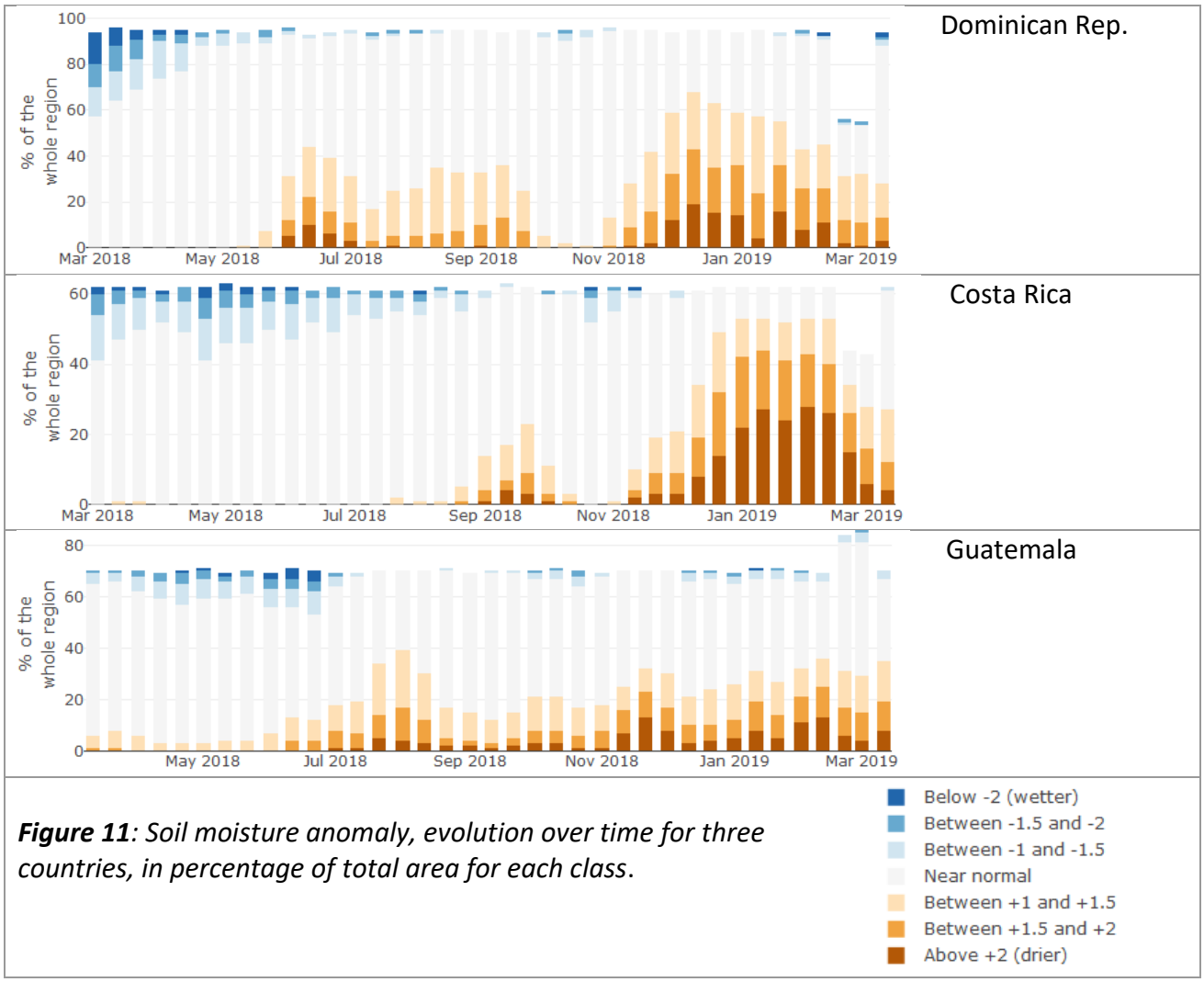

***Figure 11**: Soil moisture anomaly, evolution over time for three countries, in percentage of total area for each class.*

In Figure 11, the January anomaly peak and the earlier mid-2018 dry spell are clearly visible for Costa Rica and Dominican Republic, while for Guatemala further north has a more constant pattern, with the anomaly concentrated and persisting all along over the same area at the north-east of the country.

Reported impacts

Central American countries and some of the Caribbean islands were experiencing drought conditions already in mid-2018, before the onset of El Niño at the end of 2018[3]. In the last quarter of 2018, precipitation improved and pushed forward the risk of impacts, which are now in sight again after an underperforming beginning of the year. The following is only a partial review of reported impacts, with the drought encompassing 10 countries and a variety of smaller regional climate variants. In early March FAO released its quarterly survey with ground information about agricultural commodities and expressing concerns for the area under analysis in this report[4].

Food security is of primary concern in **Haiti**, due to the combination of low coping capacity and high frequency of natural disasters. According to FAO[5], about 2.6 million Haitians are expected to be food insecure during the lean season (March–June 2019). Water supply issues were reported for specific areas[6].

Meteorological authorities of the **Dominican Republic** released drought alerts[7] after recording drought situations in the majority of monitoring stations[8]. Plans for water rationing in major cities are in place[9]. Both livestock and crops are affected severely[10] [11] [12], with related prices increase[13].

In **Honduras**, there are claims for emergency plans to cope with the drought[14] amid concerns about the situation and food security[15] [16]. Fire hazard is a concrete issue as well[17]. Drought was associated to overseas migrations according to some analysis[18].

All links accessed on 25/03/2019

3 https://mars.jrc.ec.europa.eu/asap/
4 http://www.fao.org/3/ca3696en/ca3696en.pdf
5 http://www.fao.org/3/ca3648en/ca3648en.pdf
6 https://www.vantbefinfo.com/penurie-deau-a-cornillon-grand-bois-le-maire-principal-jean-balaguel-bertho-lance-un-sos/
7 http://onamet.gov.do/m/alerta/alerta.php
8 http://onamet.gov.do/m/pdto/03w-wagro/03w-wbalance-hidrico/ano-2019/12w-wenero/3era%20decada%20balance%20%20%20hidrico%20%20enero%20%202019.pdf
9 https://www.efeverde.com/noticias/sequia-afecta-suministro-agua-dominicana/
10 https://en.tempo.co/photo/71160/dominican-farmer-struggle-to-stay-afloat-amidst-crippling-drought
11 https://uk.mobile.reuters.com/news/picture/dominican-republic-faces-worst-drought-i-idUSRTS2DT2W
12 https://diariodigital.com.do/2019/03/17/sequia-en-la-region-noroeste-diezmo-la-agricultura-ganaderia-y-ahora-amenaza-a-los-humanos.html
13 http://telecentro.com.do/sequia-en-rd-provoca-incremento-de-rubros-agricolas/
14 https://hondudiario.com/2019/03/02/ganaderos-de-honduras-piden-decretar-alerta-por-sequia/
15 https://www.prensa-latina.cu/index.php?o=rn&id=263252&SEO=sequia-afecta-a-mas-del-50-por-ciento-de-las-familias-en-honduras
16 https://www.laopinion.com.co/mundo/crisis-alimentaria-por-sequia-en-honduras-debe-ser-tema-principal-del-gobierno-173417#OP
17 https://www.elheraldo.hn/pais/1267877-466/cada-d%C3%ADa-se-registran-dos-incendios-forestales-en-honduras
18 https://www.eluniversal.com.mx/mundo/explosivo-coctel-socioeconomico-obliga-los-hondurenos-migrar-eu

The government of **Guatemala** recognized the situation of drought and is acting to provide support to farmers and stocking grains[19]. Big fires have been associated to the drought[20].

The drought in northern **Colombia** affected water supply for thousands of people in Cordoba[21] as well as agriculture[22]. A drought crisis was declared[23]. Fire hazard was reported at peak due to the drought[24]. Power generation however, is currently considered safe from the drought[25].

In **Costa Rica**, impacts were reported for agriculture[26] and energy[27] [28] sectors.

In **Panama** the drought put in jeopardy power and water supply[29] [30]. Restrictions to ships draft crossing the Panama Canal were introduced, due to the lowering levels of supplying lakes[31] [32]. Issues for agriculture production were reported too[33].

Only the easternmost parts of **Cuba** are currently experiencing a severe drought, with lowering water levels in reservoirs[34] and fire related hazards[35].

Jamaica already suffered from drought in mid-2018, with a slight recover towards the end of the year. Jamaican farmers were advised to brace for drought[36], and water supply disruptions were

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19 https://radiotgw.gob.gt/maga-evalua-medidas-para-afrontar-sequia-en-la-region-de-centroamerica-en-el-2019/
20 https://www.elcomercio.com/actualidad/guatemala-amenaza-bosques-incendios-activos.html
21 https://www.eltiempo.com/colombia/otras-ciudades/desolador-panorama-por-fuerte-sequia-en-cordoba-338734
22 https://www.eltiempo.com/colombia/otras-ciudades/intensa-sequia-causa-la-muerte-de-animales-en-casanare-336274
23 http://globovision.com/article/declaran-calamidad-publica-a-46-municipios-de-colombia-por-temporada-de-sequia
24 https://www.eltiempo.com/colombia/otras-ciudades/alerta-en-san-jose-del-guaviare-por-incendios-forestales-334804
25 https://www.rcnradio.com/colombia/antioquia/empresarios-descartaron-riesgo-de-apagones-por-sequia-o-hidroituango
26 https://www.eleconomista.net/actualidad/Costa-Rica-sequia-causa-perdidas-de-hasta-50--en-hortalizas-20190312-0031.html
27 https://delfino.cr/2019/03/ice-recurre-a-importaciones-geotermia-y-combustibles-para-generar-electricidad-ante-inusual-sequia/
28 https://www.prensa-latina.cu/index.php?o=rn&id=262457&SEO=instituto-tico-adelanta-integracion-de-planta-geotermica-ante-sequia
29 http://www.radiopanama.com.pa/noticias/actualidad/panama-genera-mayor-energia-termica-que-hidroelectrica-por-sequia/20190225/nota/3868632.aspx
30 https://www.panamaamerica.com.pa/sociedad/fenomeno-de-el-nino-agudiza-el-problema-de-agua-potable-en-el-pais-1130249
31 https://www.pancanal.com/common/maritime/advisories/index.html (4th update 2019)
32 https://www.tvn-2.com/nacionales/Establecen-restricciones-calado-busques-transitan-Canal-Panama_0_5263723678.html
33 https://impresa.prensa.com/panorama/Produccion-agricola-caera-sequia_0_5245725556.html
34 http://www.radioguantanamo.icrt.cu/noticias/guantanamo/8148-continua-intensa-sequia-en-guantanamo
35 https://www.cibercuba.com/noticias/2019-03-22-u1-e199556-s27061-incendio-guantanamo-tras-larga-sequia
36 http://www.jamaicaobserver.com/latestnews/CARDI_urges_regional_farmers_to_implement_measures_to_adapt_to_drought?profile=1228

foreseen[37]. A summary of the hydrological situation for Jamaica (unverified) reports lowering levels of reservoirs, at about 50% capacity[38].

Information sources

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

***Distribution**: for ERCC and related partners use*

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

[37] http://jamaica-gleaner.com/article/news/20190226/drought-conditions-affecting-water-supply-sections-manchester-st-elizabeth
[38] http://jamaica-gleaner.com/article/news/20190310/water-availability-projections-2019