



Food and Agriculture  
Organization of the  
United Nations

**Hunga Tonga–Hunga Ha’apai Volcano Eruption**  
Data in Emergencies  
Hazard Impact Assessment  
(DIEM-Impact) – Update No. 1

17 February 2022

## Context

The Hunga Tonga–Hunga Ha’apai undersea volcano in the Kingdom of Tonga erupted on 15 January 2022 at 17.10 local time in a blast that was felt across the entire Pacific region. The eruption resulted in two events with potential impact on agriculture livelihoods and all agriculture sub-sectors: (i) a volcanic ash cloud; and (ii) a tsunami. The Government declared a state of emergency on 16 January 2022.

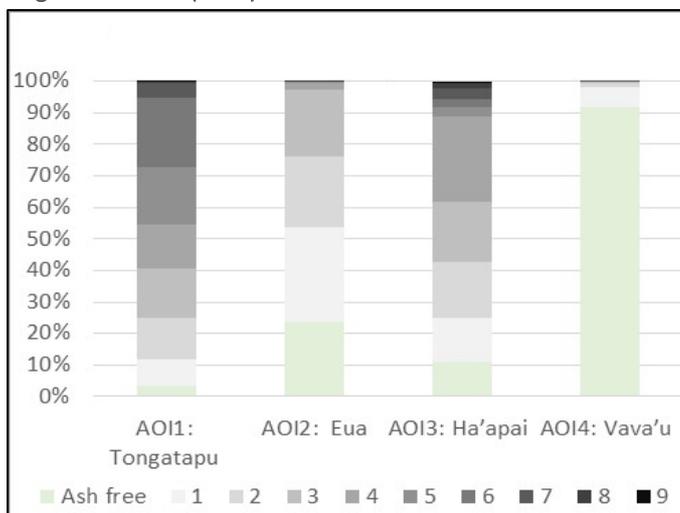
This initial impact assessment draws on the analysis of optical satellite imagery performed by the FAO Geospatial Unit. While providing critical information in the context of communication disruptions, the results have some limitations, due to cloud cover, and need to be verified.

The Government’s initial damage assessment is still ongoing and the report is forthcoming. Movements and communication between islands remain a challenge due to ash, debris and broken undersea communication cables, hampering data collection and consolidation. Additionally, two community COVID-19 cases have been identified and the country is in lockdown as of 2 February 2022.

Three people were reported dead, 293 houses were damaged and 1 525 people were displaced by the impacts of the volcanic eruption and resulting tsunami (Office for the Coordination of Humanitarian Affairs [OCHA], 2022). Initial estimates are that roughly 12 000 agricultural households – 85 percent of the total population – were affected by the disaster (Food and Agriculture Organization of the United Nations [FAO], 2022a). Additionally, two community COVID-19 cases have been identified and the country is in lockdown as of 2 February 2022.

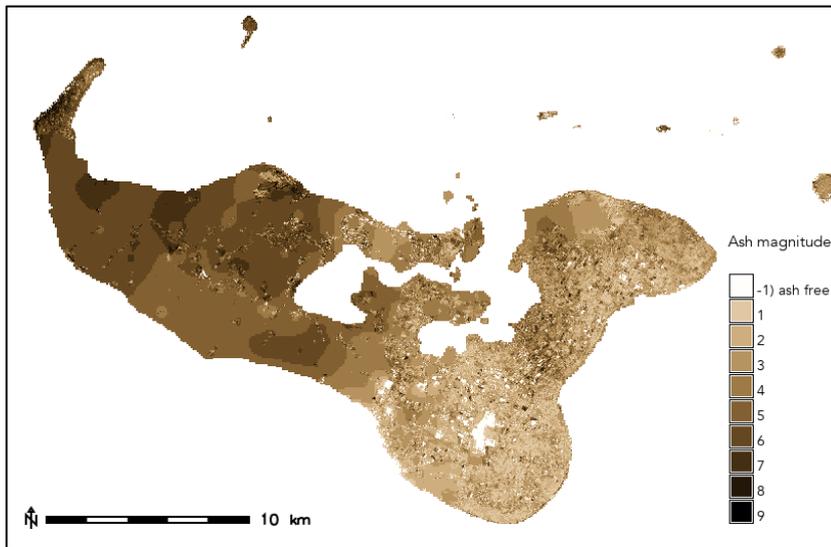
The ash cover measured the greatest extent and depth in Tongatapu and Ha’apai divisions, followed by ‘Eua division. Vava’u and Niua divisions are largely unaffected by ash. Tongatapu’s western half received nearly twice as much ash as the eastern part of the island (FAO, 2022b). Ash depth was reported to be between 20 mm and 60 mm across different locations (Stewart *et al.*, 2022; P. Likiliki, personal conversation, 3 February 2022).

Figure 1. Proportion of land by thickness of ash cover in Normalized Difference Vegetation Index (NDVI) class



Source: FAO, 2022b

Figure 2. Ash covered areas in Tongatapu as estimated from change in NDVI class



Source: FAO, 2022b

The tsunami waves largely affected the western coastal areas of Tongatapu and Ha'apai divisions, with Mango Island (Ha'apai) the only island to be entirely evacuated to Tongatapu. 'Eua, Vava'u and Niuas were less affected. Flooding appears limited, with 3.5 percent of the total land area in the four priority divisions inundated in the days immediately following the tsunami, although satellite imagery is inconsistent (FAO, 2022b).

Figure 3. Coastline and land damages on Mango Island, Ha'apai, 17 August 2020 (top) versus 20 January 2022 (bottom)



Source: FAO, 2022; Maxar Technologies, 2022.

Chemical ash analysis indicates no toxic or poisonous content damaging to humans or animals, with low levels of fluorides. However, it contains high levels of salt and sulphur, which can create elevated levels of acidity – especially with precipitation. This is a source of concern for impacts on crops, livestock and the marine ecosystems affected by the ash concentration in the ocean water. Additional analyses are ongoing (Stewart *et al.*, 2022; FAO, 2022c).

## Crops

Impact on crops is expected to be mostly from the ash cover (blocking sunlight and photosynthesis) – weight of ash on leaves and acidity when mixed with light rain, causing burning of leaves, trees, grasslands and plants. Precipitation has been unusually low, and as a result the ash has not been washed off the vegetation nor have acid rains been reported. Dry conditions also add stress to the vegetation, hampering its recovery from leaf damage. A drought alert has been in effect for Tonga since September 2021 (Government of Tonga, 2021). Current reported damages range between 30 and 95 percent on Tongatapu, depending on the crop and location (Ministry of Agriculture, Food and Forests, 2022a, 2022b).

Since the rainy season in Tonga runs from November to April, annual crops, such as vegetables, and tubers, like cassava, yams and sweet potato, were at the beginning of their production cycle and were therefore particularly vulnerable to leaf damage. Fruit trees, such as breadfruit, were also significantly affected by the ash and burn, and are reported to be dropping fruit. Root crops, such as taro, appear to be less affected since their roots are well protected in the soil (Ministry of Agriculture, Food and Forests, 2022b). These plants are therefore expected to recover and the roots can be left in the soil for later consumption.

Cash crops, such as kava, vanilla and paper mulberry, were also affected. Damage to coconut plantations and stands are expected to be limited, mostly confined to Ha'apai and the western parts of Tongatapu due to the level of tsunami waves (FAO, 2022b). Immediate support should focus on land preparation (equipment and machinery) to clear debris, plough and incorporate ash into the soil, as well as quick-maturing and salt-tolerant planting materials to support the recovery of crop production before the end of the rainy season in April. Such support is especially important for vegetables and short-cycled tubers such as sweet potato. Biosecurity issues are a source of concern for any importations.

## Livestock

Impacts on livestock are expected to derive mostly from ingestion of ash, albeit not poisonous. However, significant ingestion of ash and high salt content can cause gastrointestinal issues as well as abrasion of tooth material. The lack of feed and water could also affect animal health.

Current reported damage is extremely patchy: only 52 pigs and cattle have been reported dead on Tongatapu (Ministry of Agriculture, Food and Forests, 2022b). However, more animal deaths – especially of poultry – are expected. The Government is already managing safe carcass removal. Immediate assistance should concentrate on supplementary feed, fresh water and veterinary care for surviving livestock. The recovery of pastures affected by ash and the capacity to feed remaining livestock need to be monitored. Restocking of lost livestock should be considered once pasture carry capacity, feed and water supply, and volcanic activity have stabilized.

## Fisheries and aquaculture

Impact on fisheries and aquaculture remains largely unclear. From a damage proxy map developed by FAO based on satellite imagery, damage has been noted in the port of Nukualofa. However, from past experience with ash and tsunami events, significant impacts on coastal infrastructure (wharfs, piers, marinas, etc.), fishing vessels and equipment (engines, aquaculture, fish aggregating devices, etc.) are expected (FAO, 2022b).

Additionally, significant changes to the reef and underwater morphology are expected, causing concern for the safety of fishers in the near shore and reef fishing areas, as well as for environmental protection. Immediate assistance should focus on repair and replacement of small-scale fishing and aquaculture equipment and vessels, as well as any damage to cooling and processing facilities in the coastal areas. Reef assessments should be considered.

## Forestry

Impacts on forestry need to be more rigorously assessed. Analysis using satellite imagery by FAO indicates that forests and mangroves are the land cover areas most affected by flooding (FAO, 2022b). Damage is expected to timber, sandalwood and other high value trees. Damage to mangroves needs to be further investigated.

Immediate assistance should include forest and plantation trimming, forest clearance and processing of felled or trimmed trees for the safety of local populations, and their use in reconstruction and rehabilitation. Replantation of forests, mangroves and orchards will likely be needed at a later stage.

## Markets

Markets are reported to largely function normally in Tongatapu, with low levels of damage (P. Likiliki, personal conversation, 3 February 2022). The damage proxy map indicates that fish markets located near the wharfs in Tongatapu, 'Eua and Ha'apai may have been affected (FAO, 2022b). Food and non-food items are available through the usual supply chain and importers. Market connections and functioning in the outer islands remain unclear.

Fresh foods, especially vegetables, are not readily available due the impacts of the ash and a hesitation to wash and peel before consumption (P. Likiliki, personal conversation, 3 February 2022). Additional communication and food-safety advisory support may be required. Fruits appear to be available from the usual supply chains through importers.

## Food Security

Even before this latest eruption of the Hunga Tonga–Hunga Ha’apai volcano, 23 percent of Tonga’s population was affected by moderate to severe food insecurity (FAO, 2019). This disaster also compounds the effects of recent tropical cyclones Gita (2018) and Harold (2020), and the global COVID-19 crisis, which has affected the seasonal work programmes abroad and the critical flow of remittances to Tonga.

The Government has requested food assistance for the most affected 4 241 people (OCHA, 2022). However, with 86 percent of the Tongan population engaged in agriculture (Tonga Statistics Department, 2015), the effects of the disaster on the agriculture production and livelihoods pose a threat to food security, and will need to be monitored closely in line with the evolution of the situation and disaster response. The availability of fresh foods like vegetables and fruits is essential and should be ensured. In addition, it will be critical to monitor economic access to food based on food-price changes and financial constraints to ensure that foods and healthy diets remain accessible to all Tongans through local markets.

## Recommendations

- > Continue data collection and sharing in order to achieve a more comprehensive understanding of damage and loss across the most affected areas (Tongatapu, Ha’apai and ‘Eua divisions).
- > Volcano activity, ash emission, receding flood waters and the drought alert need to be monitored carefully over the next few months to fully understand possible confounding impacts on the agriculture system and its livelihoods. A possible agriculture livelihoods impact assessment with household-level data collection should be considered for implementation when communication and movement are possible, to inform the longer-term investment and rehabilitation needs.

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