

# Impacts of Saltwater Inundation on Agriculture

The low-lying coastal areas of most Pacific Island countries are highly vulnerable to salinity issues. This may happen due to periodic flooding during cyclones, tsunamis or other related disaster events, with saltwater inundation of groundwater.

## What is saltwater inundation?

Saltwater inundation happens where gardens are flooded with seawater, blackish water (with higher salt content than freshwater) or tidal surge water. It will significantly affect agricultural land in the long term. Salt contaminated soils will have a number of negative effects on crops.

## Impacts on soil and its functions

- The accumulation of sodium chloride (NaCl) is the main reason for salinisation in agricultural soil exposed to salt water. Sodium ions ( $\text{Na}^+$ ) can attach to clay particles that have a negative charge. Chloride ( $\text{Cl}^-$ ) does not associate strongly with soil and is easily washed out by rainfall.
- Extended periods of soil saturation by saltwater can result in significant negative impacts such as loss of soil permeability, loss of aeration and the ability of the soil to hold and filter nutrients.
- High salt levels in soil solution (the liquid in soils held between soil aggregates) prevent plants taking up water.
- Soil pH increase makes the soil more alkaline, which causes some nutrients (e.g phosphorus) to become unavailable to plants even if it is present in the soil.
- Soil microbial communities shift, resulting in a loss of soil biodiversity.

## Effects of salt on crops

- Saltwater damage to crops is mostly caused by the sodium chloride (salt) in ocean water.
- Excess sodium is toxic to plants.
- Ability of plant roots to absorb water is reduced.
- It burns plants, which is more significant on leaves
- Crop growth and yield is reduced.
- Sodium or chloride ions can affect important processes such as photosynthesis (the process of making food in the plant leaf).



## Rehabilitation

### Soil

#### **Addressing salinity**

##### *Assess soils*

- Soils should be tested for salinity, nutrients and physical conditions to ensure farmers avoid sowing or planting crops in unproductive soils.
- Use rapid assessment techniques to assess soil salinity, water salinity and soil nutrient status.
- Volcanic ash with sulphur content can moderate soil pH from increasing after seawater inundation caused by a tsunami or similar event.

##### *Irrigate soil*

- Irrigate soil with fresh water to leach out salt.
- Rainfall can naturally irrigate the soil and leach out salt.

##### *Train agricultural staff and farmers*

- Train local staff to assess soil salinity.
- Farmers should be involved whenever possible to improve their understanding of changes in soil conditions after saltwater inundation.

##### *Monitoring soil salinity*

- Periodic monitoring of salinity ensures that farmers do not commence cropping before salinity levels have dropped to acceptable levels.

## Crops

Successful crops are an important part of the recovery process after a disaster.

##### *Provide high quality planting material*

- Supply planting materials free of pests and diseases to farmers to ensure that the first post-disaster crops do not fail.
- Test the quality of seed and other materials before they are provided to farmers.

##### *Salt tolerant crops*

- Crops differ in their sensitivity to high salt and sodium exposure.
- Salt-tolerant accessions of taro (4), sweet potato (60) and banana (6) accessions are available at SPC's Centre for Pacific Crops and Trees (CePaCT).
- Tonga received taro, banana and cassava accessions from CePaCT in 2013. After field evaluation, a total of 11 taro, 10 banana and 8 cassava accessions were selected. The accessions with good-preferred eating quality (taste) were found to perform well and produce high yields under Tongan agroecological conditions.
- Accessions of sweet potato (125), taro (129), yam (20), cassava (12) and breadfruit (12) can grow well in soils with pH ranges of 5.5 (acidic) to 7.5 (alkaline). These accessions will increase on-farm crop diversity.
- Tested elsewhere, some herbaceous crops with moderate levels of tolerance or susceptibility to salt include eggplant, pepper, winged bean, head cabbage, broccoli, peanut, cucumber, and cowpea. However, locally available varieties of these crops may require evaluation for salt-tolerance under local conditions.

##### *Assess seed security*

- Supply certified seed

## Who can farmers contact for further information?

Farmers can contact staff of their local Ministry of Agriculture. For additional technical assistance, contact SPC Land Resources Division staff for soil health: [elleni@spc.int](mailto:elleni@spc.int) and crops: [logow@spc.int](mailto:logow@spc.int).