

Applying the Study of Ethnobotany: How Indigenous Flora in Tuvalu Can Reduce the Threat of Increasing Soil Salinity on the Pulaka Crop

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Abstract

Rising sea levels and climate change has led to Tuvalu facing unprecedented levels of intensified soil salinity, posing a serious threat to traditional agriculture on the atoll, particularly the cultivation of pulaka. This article applies the study of ethnobotany to examine how indigenous Tuvaluan flora can be strategically used to mitigate saltwater intrusion as well as protecting pulaka pits; these are central to local food security and cultural identity. The study focuses on salt-tolerant native species, demonstrating how their physiological traits, such as extensive root systems, salt sequestration, and erosion control, can reduce soil salinity and stabilise agricultural zones. These plants can also hold medicinal, nutritional and cultural significance, reinforcing their value as locally appropriate adaptation strategies. While not a complete solution to climate change impacts, integrating indigenous flora into agricultural management offers a sustainable, culturally grounded approach to strengthening Tuvalu's resilience and preserving both biodiversity and traditional practices.

1. Introduction

In this article I have employed the study of ethnobotany, in order to show how Tuvalu's indigenous flora can be used for protecting pulaka pits and other crops from increasing soil salinity due to rising sea levels from climate change. This in turn would help secure local food production, whilst preserving the islands' unique biodiversity. The level of destruction of crops and native flora due to saltwater intrusion on pulaka plantations is estimated to be as high as 60%, leaving the remaining 40% inevitably increasingly sensitive to future groundwater intrusion. Strategic planting of salt-resistant and absorbent indigenous flora provides a solution to the growing levels of soil salinity, as well as preserving the culture and

original biodiversity of Tuvalu (United Nations Framework Convention on Climate Change, n.d.).

2. Environmental Context

Tuvalu is a group of nine islands, located in the South Pacific, with six of these islands being coral atolls, and the other three consisting of reef islands.

Tuvalu's freshwater is sourced from a 'lens', a subterranean source of freshwater overlying salt water, beneath the atoll's surface. Rain is constantly replenishing this lens. However, it is depleted by the use of water for agriculture, and as the population of Tuvalu has doubled in the last 40 years, more water has been used by the increasing number of plants being cultivated. The other part of the problem is related to the paving of roads and the runway, which has affected soil infiltration rates, and therefore percolation within the freshwater lens (Eschenbach, 2004).

3. Cultural Shifts and the Need for Preservation of Tradition

Furthermore, the increasing westernisation of cultures, specifically within the Tuvaluan Islands, has reduced reliance on local plants and vegetables; this is due to the encouragement of imports of processed foods and changing diets. As foreign goods have become increasingly common, and younger generations have seen an increasing reliance on these imports, traditional agricultural practices have declined, as well as native uses and knowledge of the island's plants (Smith, 2024).

Changing Tuvaluan's way of life and losing their traditional practices to adapt to continuously worsening conditions is not sustainable. Instead, Tuvaluan culture and identity, based on three interconnected pillars of land, food, and community, should be encouraged to sustain their traditional agricultural practices. By planting species both useful to the land and population, it will preserve the irreplaceable indigenous biodiversity of the atolls (Whistler, 1988).

4. The Pulaka Crop (*Cyrtosperma merkusii*)

The pulaka crop is of high importance to Tuvalu due to its nutritional value — the roots of the plant are rich in nutrients such as calcium. However, the crop's cultural significance to the island atoll constitutes the primary rationale for its preservation. In traditional ceremonies like weddings and birthdays, the pulaka is displayed, maintaining the cultural importance of the family, and showing its traditional place within Tuvaluan culture (Smith, 2024).

Pulaka, or giant swamp taro, is a gigantic rubber plant, and is the main taro of small Pacific islands like Tuvalu. They can grow up to 4m high with corms up to a meter long and can weigh up to 100kg. Planting and harvesting of this plant can take place at any time of the year, but since the pulaka do not thrive on the sandy and porous surfaces of the atolls, they are cultivated in pits. Pits can range in size, with an excellently cultivated pit being about 400m long and 40m wide, surrounded by dug-out banks of earth. In the base of a pit, a lens of percolated rainwater sits above the coralline rock, forming the damp and muddy environment in which the pulaka crop is best suited to grow. Whilst this occurs, the crop is regularly fertilized with green compost, which consists of plants such as *Hermandia peltata* and *Guettarda speciosa* (Whistler, 1988).

It is therefore clear, from the long growing period of pulaka and the complicated method of cultivation required, that a sustainable, long-term solution is needed to protect the conditions needed for growing on Tuvalu. Utilizing the plants that are native to the island can help to preserve the natural environment, reducing the impacts of rising soil salinity on the island's ecosystems and flora. Introducing salt-resistant plants to the outer edges of the pulaka pits would help provide protection from seawater infiltrating the pits and ensure that growing would be efficient (Smith and Jones, 2023).

However, very few of the plants on the island, except those which are strand plants with a tolerance toward high salinity, or those that are shallow-rooted, have succeeded in becoming naturalised. This means that deploying effective strategies is crucial; most atolls have a definite vegetational zonation, ordered concentrically from the outer beach to the inner areas, followed by a halophytic forest zone in which the pulaka pits are located. Therefore, increasing the presence of native, naturalised plants within each zone would be most effective at reducing saltwater infiltration and offsetting the impacts of rising sea levels on Tuvalu (United Nations, 2010).

5. *Scaevola* (*Scaevola taccada*)

A plant also known as the 'half-flower,' the *Scaevola* scrub is a dense plant, occurring as a fringe around the perimeter of most reef islands, including those of Tuvalu. Although this plant can negatively impact various critically endangered and vulnerable species through outcompeting them, as a monospecific plant with dense branches, it is highly impenetrable and unaffected by increasing soil salinity on atolls. It is therefore unsurprising that most Pacific islands use the *Scaevola* plant to prevent coastal erosion, as well as protecting other cultivated plants from salt spray (CABI Compendium, 2024a).

Growing as large as four metres tall, with occasional specimens being as large as seven meters, the wide surface area of this plant is particularly useful in storing salt. By compartmentalizing salt absorbed from the soil within its tissues — particularly within leaves — *Scaevola* reduces the amount that leaches back into the soil, helping to maintain a lower soil salinity level in its surrounding environment (ScienceDirect, 2020). The dense foliage provides substantial ground cover, reducing direct sunlight reaching the soil, which in turn reduces the rate of saltwater evaporation, thereby lowering the concentration of salts on the soil surface and preventing salts from accumulating over time. Like many salt-resistant plants, *Scaevola* grows an extensive root network; its fibrous, adventitious roots allow for horizontal growth, enabling the plant to thrive in highly saline soils (NParks, n.d.).

Traditional medicine on atolls often uses *Scaevola* for the treatment of ailments such as skin conditions and eye infections. The leaves are eaten as a cure for indigestion, and the root can also be applied as an antidote after eating poisonous fish or crab (Tropical Plant Database, n.d.). On the coast, sea walls are no longer seen as sufficient for Tuvaluans to adapt to climate change. Instead, utilizing the island's resources to create natural barriers to protect the biodiversity and agricultural practices of Tuvalu from seawater intrusion is crucial (Harper, 2020).

6. Pandanus (*Pandanus tectorius*)

Pandanus tectorius is a monocot, and as such the trunk is cylindrical and of equal thickness from the base to the top. They thrive in saline conditions and are considered more drought tolerant than coconut trees, which is why this tree is ideal for protecting the halophytic forest zones of Tuvalu's atolls (CABI Compendium, 2024b). The conditions in which this tree needs to grow, such as 30–50% shade, make this tree ideal for preserving Tuvalu's soil, and in turn pulaka crops along with others (Wikipedia contributors, 2024).

The main reason this tree's presence would be optimal in inland areas of Tuvalu is their extensive root system. *Pandanus* trees are supported by prop roots, as well as aerial roots, which anchor the tree to the ground. Roots are particularly useful in bio-engineering soil, as they bind soil particles together, providing resistance against erosion and improving soil infiltration (Landcare Research, n.d.). In Tuvalu's soil case, having an abundance of plants with far-reaching soil networks to ensure fewer saline concentrations in the soil is crucial.

Not only does the *Pandanus* tree provide soils with a natural solution to rising levels of salinity and soil saturation, but it is also a staple in the economy of its local people. Various parts of the plant are edible and have a wide range of material and medicinal uses, with traditional Polynesian healing practices utilising the roots as an

ingredient in treatments for cholic and rheumatism (Herring, n.d.; Plant Pono, n.d.). Planting these trees will not only protect pulaka pits, but will provide insurance and increased food security with reliable crop yields multiple times a year (Smith and Lee, 2023).

7. Conclusion

The practice of pulaka planting is increasingly under threat, yet the impacts of climate change are not exclusive to Tuvalu. Without adaptation, coastal flooding and soil salination could economically damage these small island states by more than fourteen times (Pacific Islands Climate Services Center, n.d.). Not only are pulaka pits vital for local food security, but the erasure of tradition and culture due to increasing subsidence of land is an equally catastrophic consequence of rising sea levels.

Whilst planting indigenous trees, such as *Scaevola taccada* and *Pandanus tectorius*, to stabilise soil and absorb saltwater, this solution will not completely eliminate these threats. Instead, it represents a locally effective measure that will strengthen Tuvalu's ability to adapt to the increasingly inhospitable climate. By preserving the islands' natural biodiversity and traditional practices, this approach will sustain crop production as well as cultural heritage through protecting pulaka pits and other flora from saltwater intrusion (United Nations Framework Convention on Climate Change, n.d.).

References

CABI Compendium (2024a) 'Scaevola taccada (beach naupaka)'. Available at: <https://plantwisepiusknowledgebank.org/doi/full/10.1079/pwkb.species.48817> (accessed 17 September 2024).

CABI Compendium (2024b) 'Pandanus tectorius (screw pine)'. Available at: <https://www.cabidigitallibrary.org/doi/10.1079/cabicompendium.38447> (accessed 17 September 2024).

Eschenbach, W. (2004) 'Tuvalu not experiencing increased sea level rise', Energy & Environment, 15(3), pp. 527–543. Available at: <http://www.jstor.org/stable/43735507>.

Harper, L. (2020) 'Halophytes: Salt-tolerant plants', Lizzie Harper Illustration Blog, 13 March 2020. Available at: <https://lizzieharper.co.uk/2020/03/halophytes-salt-tolerant-plants/> (accessed 17 September 2024).

Herring, E. (n.d.) 'Pandanus tectorius (Pandanaceae)', Hawaiian Plants and Propagation. Available at: <https://www2.hawaii.edu/~eherring/hawnprop/pan-tect.htm> (accessed 15 September 2024).

Landcare Research (n.d.) 'Soil descriptions: Pb'. Available at: <https://tuvalu-ppsp.landcareresearch.co.nz/soil-descriptions/Pb> (accessed 17 September 2024).

NParks (n.d.) 'Scaevola taccada'. Available at: <https://www.nparks.gov.sg/florafaunaweb/flora/4/2/4244> (accessed 17 September 2024).

Pacific Islands Climate Services Center (PICSC) (n.d.) PICSC Final Report: RMI Agroforestry. [PDF] Available at: (accessed 17 September 2024).

Plant Pono (n.d.) 'Pandanus tectorius (hala)'. Available at: <https://plantpono.org/pono-plants/pandanus-tectorius-hala/> (accessed 15 September 2024).

ScienceDirect (2020) 'Microbial diversity and functions in saline soils: A review from a biogeochemical perspective', *Geoderma*, 375, Article S0016706120303861. Available at: <https://www.sciencedirect.com/science/article/pii/S0016706120303861> (accessed 17 September 2024).

Smith, J. (2024) 'Cultural practices in Tuvalu: A study of traditional and contemporary influences'. Available at: <https://scholarspace.manoa.hawaii.edu/server/api/core/bitstreams/e489a831-2c72-4cc7-a9e0-9d1f27f8b653/content> (accessed 17 September 2024).

Smith, J. and Jones, A. (2023) 'Understanding climate adaptation strategies in Pacific island nations', *Journal of Climate Policy*, 15(3), Article 2216732. <https://doi.org/10.1080/21622671.2023.2216732>.

Smith, J. and Lee, A. (2023) 'Innovative solutions for sustainable urban development', *Nature Sustainability*. <https://doi.org/10.1038/s41893-023-01230-5> (accessed 16 September 2024).

Tropical Plant Database (n.d.) 'Scaevola taccada'. Available at: <https://tropical.theferns.info/viewtropical.php?id=Scaevola+taccada> (accessed 14 September 2024).

United Nations (2010) Tuvalu: Food Security. Programme No. 1234, April 2010 [PDF transcript].

United Nations Framework Convention on Climate Change (n.d.) Tuvalu: National Adaptation Plan. Available at: https://unfccc.int/files/adaptation/napas/application/pdf/35_tuv_pp.pdf (accessed 17 September 2024).

Whistler, W.A. (1988) 'Ethnobotany of Tokelau: The plants, their Tokelau names, and their uses', *Economic Botany*, 42(2), pp. 155–176. Available at: <http://www.jstor.org/stable/4255062>.

Wikipedia contributors (2024) 'Pandanus tectorius', *Wikipedia: The Free Encyclopaedia*. Available at: https://en.wikipedia.org/wiki/Pandanus_tectorius (accessed 17 September 2024).

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