Cyclone Houses, Living Heritage and Climate Change in Vanuatu

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Introduction

Vanuatu presents a paradox because it is more exposed than most countries in the world to natural hazard disasters, and especially to extreme meteorological events, and yet experiences much lower loss of life than might be expected. The national impact from the largest cyclones can be considerable, with single events leading to the loss of as much as 64% of Vanuatu's GDP (CSIRO 2023), and yet the country's human population is often largely spared (Handmer and Iveson 2017). From 2011, Vanuatu was identified annually by the World Risk Report as the country most at risk from natural hazards (e.g. Bündnis Entwicklung Hilft 2021) but reconsideration by the Report's publishers of the contrast between exposure to risk and actual loss of life led to Vanuatu being "demoted" to 49th place in 2022 and subsequently (Bündnis Entwicklung Hilft 2022). How are we to understand Vanuatu's extraordinary exposure to meteorological risk and climate change, together with its capacity to limit losses to human life?

As a Pacific Islands nation composed of an archipelago of islands of greatly varying sizes and vertical profiles, Vanuatu is also particularly exposed to the current and anticipated effects of climate change, which include local changes to the frequency and intensity of cyclones. On a global scale, the IPCC's Assessment Report 6 forecasts a distinct increase in the frequency of higher-intensity cyclone events, even though overall event numbers may show no sign of increase (Seneviratne et al. 2021). In the recent experience of Vanuatu, a seemingly exceptional series of devastating cyclones over the past 10 years has elevated awareness of the perils of climate change. Consequently, Vanuatu's national government has led moves to push the international community towards acknowledgment of the consequences for the world's most vulnerable countries of the global failure to reduce carbon emissions (Wewerinke-Singh and Salili 2020).

One of the key reasons for Vanuatu's relative success in managing the impacts of an exceptional range of natural hazard threats is the continued functioning of its traditional knowledge systems or intangible cultural heritage relating to the management of natural hazards and reduction of disaster risk. In this chapter, we address the role of a particular form of this living heritage that relates to cyclones: the cyclone houses, traditional or vernacular architectural forms in Vanuatu that serve both as spaces for the transmission of living heritage, and as communal shelters from damaging cyclone events. These houses are found throughout Vanuatu, because the entire archipelago is exposed to the effects of cyclones (Siméoni 2009), but they vary considerably in size, form and construction, even though they recognisably meet the same basic needs. To some extent, this variability amongst cyclone houses reflects Vanuatu's exceptional cultural and linguistic variation: with an estimated 138 languages spoken amongst a population of just 330,000, Vanuatu has the highest linguistic diversity per capita of any country in the world (François, Franjieh, Lacrampe and Schnell 2015).

Here, we explore what this cultural specificity looks like on the ground through focus on a case study

from just one island, the *nimo norop* houses of the island of Erromango in the southern Vanuatu province of Tafea. A detailed description not just of the materials and design of *nimo norop* houses but also of the broader social and cultural contexts for their construction and use, including the role of local customary governance, illustrates Vanuatu's use of traditional cyclone houses as a critical adaptation to a cyclonic environment, and as a platform for further innovation in the face of climate change.

Cyclone knowledge and cyclone houses in Vanuatu

Cyclones have been a feature of life in Vanuatu for the entirety of its 3,000-year human history, and the country's many cultures have been profoundly formed by their experience of cyclones. Vanuatu typically experiences two to three cyclones every year, though not all of these make landfall (Vanuatu Meteorological Service 1994). In the past, cyclones have occurred within a relatively narrow seasonal band, between December and March. Each decade, on average, some three to five cyclones cause significant damage in one part or another of the archipelago (Vanuatu Meteorological and Geohazards Department n.d.).

Throughout the archipelago, communities are always in a state of either planning for, experiencing, or recovering from the effects of cyclones; local knowledge systems, agricultural practices, and patterns of marriage and alliance all reflect this experience. Examples of this evolution of local culture in the context of a cyclonic climate include detailed knowledge and prediction of cyclone conditions and behaviour, preparedness measures put in place ahead of cyclone seasons such as the planting of certain durable food crops, specific methods of preparation of stored foods and management of gardens in the days before a cyclone strikes, and regional networks managed by local leaders as a form of social safety net for individual islands affected by cyclones.

Most communities in Vanuatu possess both general and specialist forms of knowledge relating to weather, including monitoring and predicting conditions, and even seeking to influence the paths and outcomes of cyclones (Rodman 2007). Forecasts can be short-term, based on observations of cloud cover, wind speed and direction, and the behaviour of animal species, or longer-term, using changes in the position of the setting sun relative to landscape features to predict the likelihood of a cyclone later in the year. Cyclone risk reduction measures range from maintaining gardens and stock of hardy species (such as wild yams) that can endure high winds or be replanted quickly, to the annual preparation of stored foods such as breadfruit placed in pits to ferment. As a cyclone approaches, houses are strengthened, and gardens are made more secure, for example by cutting off the branches of banana trees to prevent them from being blown over.

Local knowledge practices that operate over even longer time frames have included extensive inter-island support networks managed by local leaders as a form of social safety net for individual islands affected by cyclones, distributing the risk across a wider region, such as the *suque* grade system of leadership and inter-island exchange of the northern Banks Islands (Campbell 1990). A deep-time form of local knowledge relates to the positioning of settlements in locations that are not exposed to cyclones, building on centuries of experience of local conditions and topography. On Tongoa Island, in central Vanuatu, settlements were formerly positioned within deep ravines, limiting exposure to winds from most directions; however post-missionization amalgamation and relocation of all settlements onto the high plateau, exposed in all directions, has considerably increased the vulnerability of both the communities and their communal cyclone houses.

Traditional cyclone knowledge is confronted by new challenges as a result of climate change, including expansion of the cyclone season and an apparent increase in cyclone intensity (Cyclone Pam in 2015 was the most severe event ever recorded in Vanuatu). What was formerly a regular hazard that formed part of the annual cycle is also now treated by the government and aid agencies as a disaster, ignoring the wealth of traditional knowledge about risk reduction and hazard management and strip]ping communities of much of their agency (Calandra 2020). The supply by international agencies of inappropriate food aid and construction materials, along with interventions in local systems of governance and hazard management, act to undermine what have been very efficient mechanisms for risk reduction,

developed sustainably over thousands of years.

Across Vanuatu, the traditional communal meeting house, known as *nakamal* in the national language of Bislama and by a variety of terms in local languages, is significant as a central site for chiefs, customary (*kastom*) governance, the curation of tangible forms of heritage, and the performance and transmission of living heritage (Coiffier 1988, 1996). As stated by the first President of the Malvatumauri National Council of Chiefs, the late Chief Willie Bongmatur, "A chief without a *nakamal* is nothing" (Christie 2017: xi). *Nakamal* houses are central to community life, especially in the context of cyclones when they serve as communal shelters and places of refuge (Christie 2017, 2018). Construction of the *nakamal* draws on local materials; trees for posts and beams, bamboo for walls, thatching from the pandanus, wild cane or coconut leaves, and fibrous vine-ropes to bind the parts together. Tree species used in traditional construction vary widely across the islands, with *namariu* (Acacia spirorbis), whitewood (Endospermum medullosum) and *natora* (Intsia bijuga) amongst the more commonly favoured hardwoods (Wheatley 1992: 282).

In each community, specific customary protocols are observed in the construction of the *nakamal*, which in turn reinforces social codes and maintains traditional knowledge, including through song (Christie 2017: 9). A common feature of most *nakamal* is a dome-shaped roof that extends from the central ridge down to ground level, often thought of as an inverted canoe, that is able to withstand high winds. Traditional *nakamal* have continued to serve as evacuation centres during the more severe tropical cyclones, such as Cyclone Pam in 2015 (Government of Vanuatu 2015: 52). However, the availability of local plant materials for *nakamal* construction, as well as for other traditional construction, is under considerable stress due to the increased intensity of cyclones in recent years (Ahmed and Parrack 2022). Especially after Cyclone Pam in 2015, there has been a marked revival of interest in traditional *nakamal* architecture amongst many of Vanuatu's communities (Christie 2017, Plunkett and Balick 2018, Fujieda, Nishijima and Kobayashi 2021, Letman 2021).

Nimo Norop houses of Erromango Island

Knowledge of the construction and use of traditional *nimo norop* cyclone houses on Erromango Island has survived a devastating history of intense cultural disruption and depopulation over the past 150 years, precipitated by sustained European contact in the early 1800s from the sandalwood trade and followed by Christian conversion and active suppression of many cultural practices. From the mid-1800s to 1932, the population of Erromango declined by 93%, from approximately 6,000 to just 381 people (McArthur and Yaxley 1968). There was significant loss of cultural knowledge associated with this mass mortality of cultural bearers. In the 1970s, a sense of this loss prompted formation of the island community-based Erromango Cultural Association (ECA), initially to document disappearing languages, and subsequently to document, revive and promote the island's linguistic and cultural heritage before another generation of culture bearers passed on (Naupa 2011).

Erromango is one of the more remote and isolated islands in the Vanuatu archipelago due to poor transport connectivity. To ensure community disaster resilience, the people of Erromango must draw on their cultural knowledge, such as traditional food and water preservation techniques, and building resilient shelters. The increased intensity of severe cyclone damage, and fresh memories of cyclone Pam in 2015 and the twin severe cyclones of Judy and Kevin in 2023 triggered a community reawakening of the value of traditional cyclone shelters. Safeguarding traditional knowledge relating to resilient shelter is a key means of ensuring that people's homes are built to withstand severe tropical cyclones, using locally available materials.

When the ECA embarked on a project[1] to revive cultural knowledge of the *nimo norop* traditional cyclone shelters in 2023, interest from the community was initially half-hearted. Vernacular architecture is in competition today with the prestige and other drivers associated with modern buildings

1 The 'Omurep Erromango' Project (meaning 'Erromango stands up') was a partnership between the ECA, the Simanlou Natmonuk Island Council of Chiefs and the Vanuatu Department of Forestry's TAFEA Provincial Office, with generous funding assistance from the Canadian Fund for Local Initiatives.

Table 1. Different types of *nimo* (houses) on Erromango

Type of traditional shelter	Purpose
Nimo orog	Traditional meeting house of *nompunorop* (clan head, small chief) – located within a *nompunorop's* compound on their ancestral land. Sleeping quarters for young men also.
Nimo val	Traditional meeting house of *ovatmonuk* (chiefs) – for the *nompunlou* (high chief of the people). Large enough to host numerous vistors
Nimo pat / nimo ilvuc	Housing for a husband and wife only. It is forbidden for anyone else to enter this house.
Nimo netortor	Temporary shelter used post-cyclone as well as during yam planting season in food gardens.
Nimo norop	Traditional cyclone shelter, sturdy build.
Nimo itcovki	Dedicated women-only house, used during seclusion.

Source: Helen Naupa, February 2024

and materials. However, the Erromango Natmonuk Simanlou (Island Council of Chiefs) was very supportive, recognising that revival of vernacular architectural knowledge served two purposes: the inter-generational knowledge transfer of traditional technologies that will enhance climate resilience; and the safeguarding of traditional resource management through ensuring that the local tree and plant species used in building materials are sustainably replanted. *Nimo norop* is one of a range of *nimo* (housing structures) found in traditional Erromangan culture (Table 1), all of which face challenges of continued cultural practice.

Planting for resilience

As one of the largest islands in Vanuatu, Erromango has a rich forest environment comprising native and endemic tree and plant species alongside introduced forest species that have become increasingly invasive. Over 30 types of hardwood, palm, cane and vine species are used in building *nimo norop* (see Table 2). However, the project found that it is becoming harder to find sufficient stocks due to a combination of deforestation and climate change impacts; this was confirmed by the Forestry Department's own monitoring of forest health over a 40-year period. TAFEA Forestry Officer Simon Naupa (November 2023) observed:

There's quite a lot of species for *nimo norop* ... mostly hardwood species, some are highlands, some are coastal (*natora*)... *kwila* is a trade name, the main standpost of the *nimo norop*. It is a bit limited now... Most of the hardwoods up in the regions, up in the mountains, like the *moron* and the *noi* and other species are more limited ... Cordia [introduced in a forestry project in the 1990s] is becoming invasive and deforesting all the natural species.

The regular damage and destruction of Erromango's forests through frequent severe tropical cyclone events creates spaces in which invasive species like Cordia can thrive; in southern Erromango it now out-competes the native species. While Cordia is employed in *nimo norop* construction, the project found that increasing dependence on it may undermine traditional knowledge of the treatment of native woods in construction. Similarly, the reduced availability of wild cane, an essential thatching material in *nimo norop*, is a concern. Whereas, two to three decades prior, communities would ensure that fields of wild cane were planted near settlements, today wild cane is mainly found far from settlements due to the changing preference for modern forms of building. For this reason, under the project, the TAFEA Forestry team conducted community workshops to encourage home nurseries to also include native building materials, and for these to be sustainably planted and managed close to community settlements.

Figure 1. Mori (Acacia spirobis) tree species, before and after felling for construction of a *nimo norop*, Dillons Bay, Erromango, November 2023.
© Simon Naupa (Vanuatu Forestry for ECA)

Table 2. Some native forest species used in the construction of *nimo norop**

	Erromango name (Bislama / English)	Use in *nimo norop* construction
Hardwoods		
Acacia spirobis	Mori (Bisl. Namariu)	King posts; *norop* rafters (due to pliability)
Casuarina equisetifolia	Yorset (Bisl. Si-ok)	King posts
Callophyllum neo-ebudicum	Pocur (Bisl. Tamanu)	King posts; *movoc* beams
Agathis macrophylla	Nendu (Bisl. Kauri)	King posts; *movoc* beams
Hibiscus sp.	Renvau (Bisl. Burao)	*Norop* rafters (due to pliability)
Instia bijuga	Neiyemtau (Bisl. Kwila/Natora)	King posts
Vines		
	Nousori	Grows mainly in northern Erromango, popular in Ralifati area
Salacia aneityensis	Nousangal	Used for fastening king posts and *helnivi* centre beam
Calamus spp.	Ndru (Eng. Rattan)	Used for fastening *movoc* to *norop*
Grasses and Palms		
Miscanthus spp. (wild cane)	Nenyung / Nelesi (the latter is cleaned of leaves)	Used to weave the *netrihong* wall (end wall), and side walls. Long-lasting.
Bambusa spp. (bamboo)	Nau	Similar use to *nenyung*, increasingly popular due to easy availability
Saccharum spp. (sugar cane)	Nulpai (dried leaves)	Used as extra insulation for the *nimo norop*
Cocos nucifera (coconut)	Noki (the coconut leaves)	Can be used as both a base layer and final layer of thatch

**This is a preliminary list subject to revision through ongoing traditional naming and classification work by Vanuatu Forestry.*

Table 3. Steps in building *nimo norop*

Step	Activity Focus	Other information
1	Site selection	The location must not be too exposed to winds or too close to rivers or the coast where there may be flooding during severe weather, like a cyclone.
2	Gathering materials: Posts for structure Materials for walls and thatch	Different natural materials are used for different parts of the *nimo norop* construction, each requiring specific preparation. For the posts and beams, the bark is removed and posts are soaked in saltwater for up to 3 weeks to seal the wood against pests. Walls and thatch are crafted from bamboo, wild cane (*nelesi*) and coconut leaves. Women help to gather weaving materials and weave them in readiness for their use in the roof thatching. Men typically weave the walls of the *nimo norop*.
3	Preparing the foundation: Clearing the land Digging postholes	Clearing and leveling of the land is done by both men and women. The layout of the floor and posts is also prepared. The postholes for the king posts and main posts are dug at least 1 metre deep. The posts are anchored with coral and stones for additional strength.
4	Building the main structure Installing the king posts (*neturpum, netentu* and *neturtur*) Installing the *norop* (main posts) and *helnivi* (central beam)	The basic structure of the *nimo norop* reflects Erromango's customary governance protocols: the *neturpum* denotes the entrance to the structure, where visitors may be greeted; the *netentu* in the centre houses the fireplace, and is where cooking occurs, women occupy both this zone and the *neturpum*; the *neturtur* on the back wall of the *nimo norop* is restricted to *the npau unam* or *natmonuk* (chief) and his selected council. The structure reflects the speaking zones of the community within the *nimoval* (traditional meeting house). Erromango women have a designated space to participate in community meetings alongside a chief and his council. The *helnivi* beam symbolises the main customary "road" along which inter-clan and inter-community engagement occurs. Each *norop* represents the clans that form the council within the *nimoval.*
5	Installing the secondary structure: The *movoc* The *netan*	This step requires lots of rope* to install rafters and purlins, referred to as *netan* and *movoc. Netan* are installed in between the *norop*, or main posts, and do not reach all the way to the ground. Thatch will be attached to the *netan. Movoc* are the horizontal beams in the roof, between the top or central beam and the side walls. The *netan* and *movoc* are fastened in place by rope. Once the *netan* and *movoc* are fastened in place by the *nos*, the next stage of construction can commence.
6	Wall installation	The rear wall is installed first, with the *neturtur* post and *netan* posts providing the support structure. Men weave layers of bamboo and wild cane panels, which are anchored into the ground. Each weaving pattern is named: *nivau, nevri,* or *novar.* The side walls extend from the ground to the first *movoc* or side beam.
7	Thatching	Coconut leaves are a key roof base in thatching. Women weave the coconut leaves in preparation and dry them in the sun prior to thatching. Once the coconut leaf layer is installed and fastened to the *netan* and *movoc* with rope, the main roof thatch of *nelesi*, or wild cane, is installed. This requires *nelesi* to be cleaned of leaves and bundled prior to use. The *nelesi* is fed into the spaces of coconut leaf ribs and folded at the middle around the rib of the roofing base. The *nimo norop* also has thatching along the front side, with only a low entrance into the building.

* Erromangans use a rich variety of forest lianas and vines in construction, called *nos*. *Nos-angal* is a popular traditional rope. It is found in the deep forest and is collected on the day or one day before its use. It is heated over a fire to soften it for binding. It is important not to dry out the rope or it becomes too brittle to use.

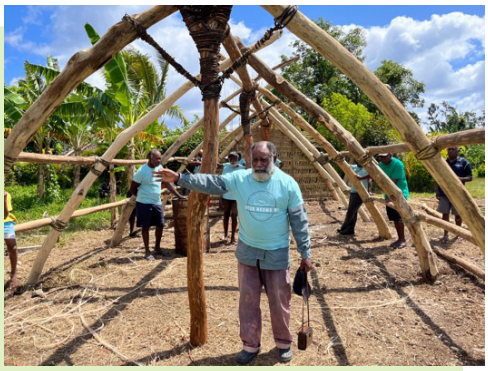

Figure 2. Traditional master builder Nacumsu explains the significance of the *nimo norop* structure in relation to socio-political relationships within Erromango's customary governance system (at Ipota, Erromango).
© Anna Naupa (ECA)

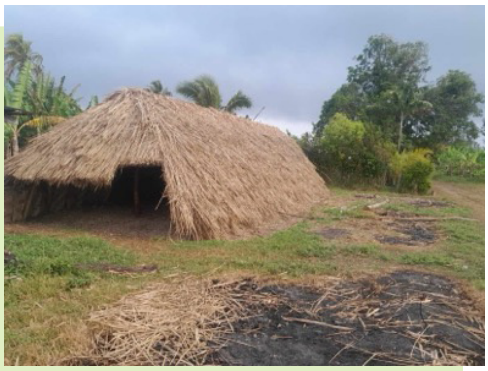

Figure 3a. The completed *nimo norop*, Ipota, Erromango, December 2023.
Figure 3b. Interior thatching is closely woven, with additional smoking to create a seal against wind and rain.
© Jonah Molou (ECA)

Building for resilience

Construction of the *nimo norop* structure is a communal endeavour that draws extensively on traditional knowledge. The sequence of construction is summarized in Table 3, which outlines the knowledge, materials and community roles needed to advance each stage.

Conclusions

Two major lessons have emerged from community efforts on Erromango to safeguard intangible cultural heritage that has the potential to play a key role in climate change adaptation. Firstly, by facilitating an inter-generational community-based approach across all stages of construction, sustaining vernacular architecture is a critical strategy for promoting the transmission of customary governance knowledge. The structure of the *nimo norop* mirrors social-political organisation across the island landscape, a physical reminder of the cultural structures essential for customary land tenure, conflict mediation and peace-making. For many of the youth on Erromango, the revival project was their first opportunity to see and learn about *nimo norop* (see and Figure 3).

Secondly, climate-related environmental stress is both transforming the frequency and intensity of cyclone and other meteorological hazards, and compounding the challenges experienced in accessing cultural ecological resources. Regular stress from tropical cyclones and other extreme weather events (flooding, drought) constrains optimal forest growth that is already curtailed by deforestation. Invasive forest species that flourish in the harsher climatic conditions are displacing the traditionally valuable hardwoods and threatening associated traditional knowledge. The difficulty in sourcing sufficient stocks of key culturally significant species for building the *nimo norop* during the project period highlighted the importance of ecological revival efforts in safeguarding the resources for the reproduction of cultural heritage. Conservation of native and endemic species in the face of climate change is therefore also essential for safeguarding intangible cultural heritage.

The immediate challenge of climate change impacts to Vanuatu's islands underscores the critical importance of safeguarding community knowledge of cyclone preparedness, to ensure community resilience to future climate-related disasters. As the *nimo norop* project revealed, reviving traditional knowledge is more than simply safeguarding the cultural heritage of cyclone shelters, it is also about safeguarding customary governance knowledge and systems, ensuring the maintenance of inter-generational transfer and practice.

Erromango's *nimo norop* are more than just traditional cyclone shelters. Their structure embodies cyclone resilience, and their spatial organisation reflects Erromango's traditional socio-political organisation. The construction process observes specific cultural protocols that in turn underpin social order and knowledge of the traditional governance system. As sites of both tangible and intangible cultural heritage knowledge

production, enactment and transfer, preservation of *nimo norop* in the face of multiple climate change impacts and other transformational processes is key to the continuity of Erromango's culture. Contrary to expectation, however, the emergence of climate-change fuelled cyclones presents an opportunity for communities across Vanuatu to reflect on and re-engage with their intangible cultural heritage, and to harness it in adapting to these new challenges (Ballard et al. 2020).

Bibliography

Ahmed, I. and C. Parrack 2022. 'Shelter Self-Recovery: The Experience of Vanuatu.' *Architecture* 2(2): 434–445. https://doi.org/10.3390/architecture2020024

Ballard, Chris, Meredith Wilson, Yoko Nojima, Richard Matanik and Richard Shing 2020. Disaster as Opportunity? Cyclone Pam and the Transmission of Cultural Heritage. *Anthropological Forum,* 30 (1-2): 91-107. https://doi.org/10.1080/00664677.2019.1647825

Bündnis Entwicklung Hilft 2021. *World Risk Report 2021 – Focus: Social Protection.* Berlin: Bündnis Entwicklung Hilft and Institute for International Law of Peace and Armed Conflict (IFHV), Ruhr University Bochum.

Bündnis Entwicklung Hilft 2022. *World Risk Report 2022 – Focus: Digitalization.* Berlin: Bündnis Entwicklung Hilft and Institute for International Law of Peace and Armed Conflict (IFHV), Ruhr University Bochum.

Calandra, Maëlle 2020. 'Disasta: Rethinking the Notion of Disaster in the Wake of Cyclone Pam.' *Anthropological Forum* 30(1-2): 42–54. https://doi.org/10.1080/00664677.2019.1647826

Calandra, Maëlle 2021. 'Humanitarian aid and local responses: the aftermath of the rebuilding effort on Tongoa island, Vanuatu.' *Disasters*, 47(1): 3-22. https://doi.org/10.1111/disa.12522

Campbell, J.R. 1990. 'Disasters and Development in Historical Context: Tropical Cyclone Response in the Banks Islands, Northern Vanuatu.' *International Journal of Mass Emergencies and Disasters* 8(3): 401-424.

Christie, Wendy 2017. *Safeguarding Indigenous Architecture in Vanuatu*. UNESCO, Paris. http://www.unesco.org/open-access/terms-use-ccbysa-en

Christie, Wendy 2018. 'Housing and climate change resilience: Vanuatu.' In A. Nelson and F. Schneider (eds) *Housing for Degrowth: principles, models, challenges and opportunities*. Taylor and Francis, pp. 80-95.

Coiffier, Christian 1988. *Traditional Architecture in Vanuatu.* University of the South Pacific, Institute of Pacific Studies, Suva.

Coiffier, Christian, 1996. 'Traditional Housing and Architecture of Vanuatu.' In J, Bonnemaison, K. Huffman, C. Kaufmann and D. Tryon (eds) *Arts of Vanuatu.* Bathurst, NSW: Crawford House, pp. 217-225.

CSIRO 2023. *Tropical Cyclone Observations, Trends and Projections for Vanuatu*. A report to the Van-KIRAP project. Commonwealth Scientific and Industrial Research Organisation (CSIRO) Technical Report, Melbourne.

François, Alexandre, Michael Franjieh, Sébastien Lacrampe and Stefan Schnell 2015. 'The exceptional linguistic density of Vanuatu.' In Alexandre François, Sébastien Lacrampe, Michael Franjieh and Stefan Schnell (eds) *The Languages of Vanuatu: Unity and Diversity.* Canberra: Asia–Pacific Linguistics, pp. 1-21.

Fujieda, A., K. Nishijima and H. Kobayashi 2021. 'Comprehensive approach to sustaining vernacular architecture in local context: Case study in Tanna Island, Vanuatu.' In ICOMOS International Conference on Earthen and Wood Vernacular Heritage and Climate Change, Webinar (Malmo University and Kulturen Museum), pp. 110–115. https://researchmap.jp/read0096639/published_papers/43079229

Government of Vanuatu 2015. *Vanuatu Post-Disaster Needs Assessment, Tropical Cyclone Pam, March 2015.* Port Vila: Government of Vanuatu. https://www.gfdrr.org/sites/default/files/publication/pda-2015-vanuatu.pdf

Handmer, John and Hannah Iveson 2017. 'Cyclone Pam in Vanuatu: Learning from the low death toll.' *Australian Journal of Emergency Management* 32(2): 60-65.

Letman, J. 2021. 'The house that can withstand a cyclone: How traditional dwellings are making a comeback in Vanuatu.' *The Guardian*, Monday 9 August 2021. https://www.theguardian.com/world/2021/aug/09/the-house-that-can-withstand-a-cyclone-how-traditional-dwellings-are-making-a-comeback-in-vanuatu

McArthur, Norma, and John Francis Yaxley 1968. *Condominium of the New Hebrides: A Report on the First Census of the Population, 1967*. Sydney: V.C.N. Blight, Government Printer.

Naupa, Anna 2011. *Nompi en Ovotome Erromango, Kastom and Culture of Erromango.* Port Vila, Vanuatu: Erromango Cultural Association.

Plunkett, G.M. and M.J. Balick 2018. Traditional Shelters, Cyclone Houses, and the Temptations of Modern Construction. New York Botanical Garden, https://www.nybg.org/blogs/science-talk/2018/09/traditional-shelters-cyclone-houses-and-the-temptations-of-modern-construction/

Rodman, Margaret C. 2007. 'Tempestuous landscapes: persons, places and memory in two Vanuatu hurricanes.' In Jürg Wassmann and Katharina Stockhaus (eds) *Experiencing New Worlds*. New York: Berghahn Books, pp. 165-175.

Seneviratne, S.I. et al. 2021. Weather and Climate Extreme Events in a Changing Climate. In *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press, pp.1513–1766. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter11.pdf

Siméoni, Patricia 2009. *Atlas de Vanouatou (Vanuatu)*. Éditions Géo-Consulte.

Vanuatu Meteorological Service 1994. *Tropical Cyclones in Vanuatu, 1847 to 1994*. Port Vila, Vanuatu.

Vanuatu Meteorological and Geohazards Department n.d. Tropical Cyclone Info. https://www.vmgd.gov.vu/learn-more/tropical-cyclone-info

Wentworth, C. 2020. 'Unhealthy aid: Food security programming and disaster responses to Cyclone Pam in Vanuatu.' *Anthropological Forum* 30(1-2): 73-90. https://10.1080/00664677.2019.1647830

Wewerinke-Singh, M. and D.H. Salili 2020. 'Between negotiations and litigation: Vanuatu's perspective on loss and damage from climate change.' *Climate Policy* 20(6): 681–692. https://doi.org/10.1080/14693062.2019.1623166

Wheatley, J.I. 1992. *A Guide to the Common Trees of Vanuatu, with Lists of Their Traditional Uses and ni-Vanuatu Names*. Port Vila: Department of Forestry.