Archaeology, indigenous and local knowledge, and climate change in the Caribbean: select case studies among the Kalinago, Macushi and Maroon communities in the Windward Islands and the Guianas

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Abstract

Within the geographic space known as the Caribbean, vulnerability to and because of climate-induced hazards is commonplace. Contributing to this are the various geophysical features and historical land use issues which define the region, some of which have contributed to how traditional communities are both impacted by and respond to the changing climate. These hazards are experienced through rising sea levels, coastal inundation and storm surges, and increasingly severe and erratic weather events, impacting, for example, wet and dry

seasons, water and food security, and infrastructure. Although the region's vulnerability has increased, climatic challenges are not a 21st century phenomena. Its first inhabitants several millennia ago experienced climate-induced and other natural hazards, requiring ongoing adaptation to constantly changing environments. Our traditional communities have had long relationships with their natural environment and so play a critical role in studying this human-environment dynamic through a long-term perspective. Not only are they exposed to these hazards contributing to vulnerability at the community level, but their heritage is also exposed. Through their traditional knowledge and archaeological data from their ancient villages, knowledge is passed down today as a guide for climate action and providing essential indicators for past and future resilience.

This paper examines how the changing climate intersects with archaeology, Indigenous and local knowledge in relation to ongoing and future climate action and narratives in the Caribbean. This is approached through a focus on case studies among the Kalinago of Dominica and Saint Vincent, the Macushi from Guyana, and Maroon communities from Suriname, highlighting how traditional knowledge and archaeological research can provide valuable data concerning past climate adaptation and a better understanding of Indigenous and local responses. This paper emanates from a knowledge-exchange event held in Aruba in November 2022, which brought together communities, researchers, and students to discuss the role that archaeology and traditional knowledge can play in the region's response to the changing climate.

Introduction

Archaeological research in the Caribbean Basin has provided valuable information regarding how the region and its peoples have been impacted and responded to the changing climate over several millennia (e.g., Perdikaris and Boger 2022; Cooper 2012; Fitzpatrick 2012; Hofman and Hoogland 2015, 2016; Plew and Daggers 2022; Rivera-Collazo 2019; Whitehead et al. 2010). This research has highlighted adaptation strategies utilised by past populations which have been transmitted over generations and are evidenced in the archaeological and the traditional knowledge and practices record of Indigenous and local communities living in the Caribbean today, and manifested in the placement, organisation and relocation of settlements, housing construction, water and food procurement and management methods, and the development of resilience networks across islands (Cooper and Peros 2010; Hofman et al. 2021; Hofman and Hoogland 2015; Samson et al. 2015; Versteeg and Schinkel 1992).

Although the region has benefited from research on past climate variability and reconstruction demonstrating climate instability over the last several thousand years (Curtis et al. 2001; Hodell et al. 1991; Beets et al. 2006; Malaizé et al. 2011), there is still much to be learned about human-climate relationships over time.In the Guianas component of the Caribbean in particular, much is still relatively unknown or inconclusive despite the support from regional palynological data (Boomert 1980; Bush et al. 2013; De Grandville 1982; Flautua et al. 2016; Hoock 1971; Roeleveld 1969; Rull 1999; Van der Hammen et al. 1964; Williams 2003). Holocene climatic data also offers some insight into past human adaptation to environments and demonstrates that past populations (particularly during the archaic age) played an essential role in shaping their landscape to increase resilience to the impacts of climate variability (Beets et al. 2006; Daggers et al. 2018; Daggers et al. 2022; Hofman et al. 2021; Williams 1985).

Although we can infer based on scientific data regarding these adaptations, archaeology and traditional knowledge relating to climate change management provides an alternative and complementary means of understanding adaptation from the past to the present. This important intersection between archaeology, traditional knowledge and climate change is acknowledged, and was the focus of the workshop on 'Traditional Knowledge Solutions for Present and Future Climate Change Adaptation and Resilience in the Caribbean,' held in Aruba from November to December 2022 (see Figure 1).

It brought together traditional and local communities, students, archaeologists, anthropologists, and other researchers from or working throughout the Caribbean, for a knowledge exchange and an initial "*where are we?*" discussion on how archaeological and traditional knowledge can support the elaboration of solutions and strategies for future climate change adaptation in the region. This initial discussion was deemed critical, as this nexus of archaeology and traditional knowledge for climate change adaptation is a relatively understudied area in the region, and so it was important to have insights on where things were at the regional level. Invitations were therefore sent to traditional communities, researchers and institutions known to be undertaking relevant research, with the aim being to have at least one

Fig 1. The Aruba workshop: Traditional Knowledge Solutions for Present and Future Climate Change Adaptation and Resilience in the Caribbean, November 2022

researcher and one Indigenous or local community member from each participating country.

The workshop provided an opportunity for the presentation of research in relation to traditional knowledge, archaeology and climate change adaptation intersections, support communities in articulating how they experienced and responded to climate change, discuss adaptation strategies, as well as the challenges preventing the availability and use of this knowledge at a wider society level. Importantly, it discussed the limited voice of Indigenous and local communities in climate change discourse in the Caribbean, and issues with the documentation of this knowledge in a free and informed manner that gives agency to these communities instead of merely extracting information.

This was undoubtedly the beginning of a process where researchers and

communities combined their efforts in identifying the need for further research on these strategies, their documentation, and the eventual development of relevant case studies of traditional knowledge solutions and building greater awareness of the value of this intervention at the national and local levels.

It is important to note that throughout this paper, the words Indigenous, traditional, and local knowledge are used. The term 'traditional knowledge' is used and is meant to convey knowledge, skills, and practices developed, sustained and passed on from generation to generation within a community' and expressed through science, technology, ecology (and biodiversity), medicinal, and expressions[1].

Uses of the term Indigenous connote tribal or nativeness, and formal international definitions focus on historic continuity, distinctiveness, marginalisation, self-identity, and self-governance (Dove 2006: 192). The ILO (1989) for example, defines Indigenous as tribal peoples in independent countries whose social, cultural, and economic conditions distinguish them from other sections of the national community, and whose status is regulated wholly or partially by their own customs or traditions or by special laws or regulations; (b) peoples in independent countries who are regarded as Indigenous on account of their descent from populations which inhabited the country, or a geographical region to which the country belongs, at the time of conquest or colonisation or the establishment of present state boundaries and who, irrespective of their legal status, retain some or all their own social, economic, cultural and political institutions. [ILO 1989: Article 1.1][2]

From the definitions provided, it can be inferred that while all Indigenous and local knowledge is traditional, not all traditional knowledge is Indigenous.

The aim of this paper is not to debate who should be considered as

1 World Intellectual Property Office

2 Convention C169 - Indigenous and Tribal Peoples Convention, 1989 (No. 169) (ilo.org)

Indigenous in the Caribbean Basin, the indigeneity of the selected case study communities or even to interrogate the use of the word Indigenous by these communities. It instead recognizes the right of these communities to self-identify as Indigenous or traditional. Nevertheless, the word has been contested in the Caribbean when used by the Maroon and Garifuna communities who are mentioned throughout this paper.

The case studies selected from the workshop for this paper include the Macushi in Guyana, Maroons in Suriname, and the Kalinago in Saint Vincent and the Grenadines and Dominica (see Figure 2). Although other identified Indigenous communities such as the Santa Rosa First Peoples from Trinidad and Tobago were present at the workshop in Aruba, it was not possible to include their case study within the context of this paper.

The narrative elaborated by each case study demonstrates in some instances a stronger reliance on archaeological data or traditional knowledge and identifies differences in how data is understood and applied in each country. Therefore, the perspectives presented in these case studies are not

Fig 2. Location of case studies within the Caribbean Basin

uniformed and are discussed from the approach taken by researchers and communities and their chosen areas of focus. They nevertheless represent the diverse stories of social adaptation through the combined voice of researchers and traditional communities.

The case study from Guyana focuses on the importance of archaeology in identifying past adaptation strategies and examines complementarity with traditional knowledge, the Suriname case study discusses the experience of Maroon communities in relation to climate change and the application of their traditional knowledge, and finally, the Dominica and Saint Vincent case study highlights this human-environment and climate change dynamic through the temporal lens of the past, the present, and the future and specifically the loss of their archaeological heritage.

Broader issues concerning public engagement in relation to Indigenous approaches, presented cases of social adaptation, strategies impacting public discourse, as well as workshop insights are discussed later in the paper.

The Lokono, Macushi and Wapishana in Guyana

Traditional knowledge systems of the Indigenous populations of Guyana complement the archaeological record by providing deep insights into the human-environmental relationships of the past and present and reinforce the importance of anthropogenic manipulation of the landscape for human adaptation to long-term ecological instability. An example of this is the clear demonstration of Indigenous land use actions in coastal adaptation practices during the Middle and Late Holocene human occupations.

The anthropogenically built environment of northeastern Guyana with its habitation mounds and raised fields (see Figure 3) were engineered to adapt to local environmental conditions emerging during the Mid-Holocene, which saw rising river levels and seasonal savannah inundation with increasing rainfall (Plew and Daggers 2022; Williams 2003). This is supported by recent stable isotope composition data of human and faunal remains along the coast (Daggers et al. 2018, 2022). The human environment interaction and

material evidence produced in the Berbice, suggest a long-term influence on the area's ecology, ecosystem, and productivity, resulting from extensive landscape domestication, and interestingly, archaeological findings from the Berbice presented to coastal farmers in recent years have led to the adaptation of similar strategies for resilience building among vulnerable communities and has renewed the interest of such practices among the Indigenous communities along the Berbice river.

Fig 3. Past Holocene cultural adaptation in Guyana:
A - Image of Shell Midden Adaptation along the Northwestern Coast © Louisa Daggers, 2019
B - Raised Field Adaptation in the Berbice © George Simon, 1994

Recent isotopic analysis of human and faunal remains across seven shell-midden sites (between 7500 cal. BP and 270 cal BP) in the northwestern littoral suggest warmer intervals in the early Holocene and stabilisation of the environment around 4000 BP (Daggers et al. 2018, 2022; Plew and Daggers 2022). These conditions appear to have influenced seasonal mobility and the increasing use of multiple resources supporting an increasingly sedentary way of life. Data from charcoal in sediments transported to four sites suggest a drier, more combustible environment (Daggers et al. 2018), as reported in South America, and possible anthropogenic fires for resource manipulation.

As reflected in the archaeology of Northern Amazonia, anthropogenic activities and fire were important tools for adaptation by past populations to environmental change, though the extent of anthropogenic influences on landscape and resource management is not yet fully understood (McMichael et al. 2014; Pyne 1997; Walker 2012; Watling et al. 2018).

To some degree human impacts on the Holocene landscape have been inferred based on the presence, absence and density of charcoal presented in dated stratigraphy of the Amazon and Guyana, suggesting increased fire regimens possibly because of landscape domestication resulting in vegetation changes (Daggers et al., 2018; Flautua et al. 2016; Hammond et al. 2006; Mayle and Power 2008, 2013; Tardy 1998).

Many similar strategies identified in the archaeological record exist within contemporary Indigenous communities. The Lokono, Macushi and Wapishana continue to occupy and adapt savannah type environments and flood plains and rely heavily on traditional knowledge systems which constitute an essential aspect of social memory that is undervalued and quickly disappearing in Guyana. Landscape modification exhibited in the archaeological record remains critical to contemporary adaptations to unpredictable climatic conditions which continue to challenge adaptation practices among Indigenous and local communities.

As highlighted by co-author Annalisa Edwards[3] from the Macushi Indigenous community, 'our relationships with the environment enhance the overall health, resilience, and well-being of the Macushi people, and this knowledge has been transmitted and evolved from each generation to the next. It is through traditional knowledge systems that Indigenous people developed their unique way of life and have adapted to their local environment. This knowledge continues to be of great value to our survival as it is a part of who we are, our identity and culture, thus it also plays a vital role in areas such as food security and conservation amongst others.'

The Maroons of Suriname

In the tropical rainforest interior of Suriname, Maroons, descendants of escaped enslaved Africans (see Figure 4), continue to live in areas negatively impacted by the effects of climate disasters (Jabini 2020: 4). However, the loss of food, the damage to and degradation of living areas and places of historical memory, has seemingly not affected the collective decision to remain in their traditional territory.

This is perhaps connected to long-held traditional knowledge and practices that allowed for a swift recovery from crop and land degradation and settlement reconstruction in relation to climate-induced hazards (Hammond 2005). To explore this phenomenon, we consider the migration and settlement strategies the Maroons employed in the colonial period, and the role that traditional knowledge plays in how they adjusted to changes in climate and in identifying adaptation strategies in the archaeological record.

In Suriname, 73% of deforestation is caused by illegal and legal gold mining (see Figure 5) (AAE 2017: 15). The consequences are the loss of biodiversity, damage from heavy rainfall, flooding, landslides in the interior, and other environmental effects (GoS 2019-2029). The accumulation of

3 Annalisa Edwards, personal communication 2023 to co-author Louisa Daggers

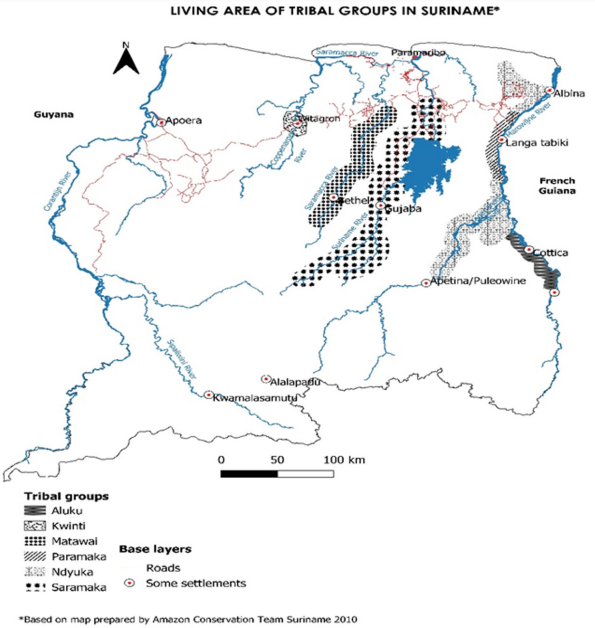

Fig. 4. Map of Maroon tribes in Suriname

these issues means that Suriname must contend with the ongoing effects of climate-induced hazards exacerbated by the afore-mentioned issues. However, a significant issue in the management of the impacts of climate change is a lack of data (IDB 2021). To close this data gap, Maroons and Amerindian peoples have been identified as a mitigation proxy to encourage the promotion and awareness of non-timber forest products, ecotourism, medicinal plants, and agroforestry practices. The success of this strategy however requires an understanding of the historical ecological ties these communities have with their landscape.

The choice of a settlement can be derived from two historical factors. The first was safety from the colonial onslaught, and the second was sustainability. Safe locations could be clandestine transient locales or abandoned Amerindian settlements appropriated by the escaping enslaved between 1680 and 1720 (Scholtens 1994:16). Tributaries deep in the primary forests provided terrestrial

Fig. 5. Deforestation due to small-scale mining (Source: Amazon Conservation Team website)

resources that served as escape routes (Hublin 1989). In the late eighteenth to nineteenth centuries, sustainable settlements fostered a sedentary way of life. They can be characterised by the accessibility to a broader variety of terrestrial and aquatic resources, subsistence farming, surplus storage, and high-ground settlements to avoid flooding. In an interesting juxtaposition of safety and sustainability and as an adaptation strategy, Maroon women ensured food security – particularly in times of flooding - by storing surplus food in a different location from the primary village, as well as maintaining auxiliary farmlands (De Groot 1978:17-18; Dragtenstein 2002: 122-123; Jagdew 2014: 48).

Maroons also believe that settlements were determined by the *apuku* (forest spirits). More importantly, the matrilineal and matrilocal descent order determines that the clans within a tribe ascribe to a permanent geographic area, utilising the resources therein and establishing fixed ancestral territories. These would have serious implications for how relocation would be pursued

in times of severe environmental or climate-related events as centuries of traditional knowledge connect people with areas.

This socio-cultural development contributes to why Maroon tribes do not leave flooded areas (Jabini 2020: 4-5; Scholtens 1994: 148). The 1960s forced relocation of twenty-eight Maroon villages to construct the van Blommenstein hydroelectric dam in the Suriname River was an exception, destroying a portion of Saamaka's traditional territory and likely some land use traditions in the process (Scholtens 1994: 153).

During the nineteenth century, bush meat and timber trade became dependent on seasonality (Boomgaard 1992). At this time, the cyclical nature of the climate and its predictability meant communities could prepare and plan. In the late eighteenth and nineteenth centuries, Saamaka Maroons of the Upper Suriname River logged primary forest hardwood in the wet season. At this time, the high-water levels allowed felled timber to be easily transported by a river raft. Felling and transport was a collective kin-based activity (Boomgaard 1992). Conversely, episodes of dry period forest fires overlap with eighteenth century Maroon sedentism. In 1746, 1769, 1779, 1797, and 1825, large forest fires lasting for a month or more may have destroyed more forest vegetation than felling (Boomgaard 1992: 217). Slash and burn shifting cultivation would have also increased during this period but was not harmful to the environment (ibid). All these activities would become a part of the Maroon collective traditional culture, as traditional knowledge is passed from one generation to another through oral testimony and is the root of cultural behaviour.

Some Maroons have immortalised climate phenomena. Historically, the Ndjuka of the Tapanahony River interpreted the exposed portion of rock outcrops in the river as a sign of an impending water level rise. The watermark level was a notification that abnormal flooding would occur, prompting villagers to temporarily retreat to sloped planting grounds kilometres inland

Fig 6. Inscription of the 1949 flooding event in the village Abenaston on the Suriname River © Cheryl White, 2022

from the river[4]. In the village Abenaston, the Saamaka acknowledge a 1949 flooding event with an inscription that reads 'bigie watra' meaning high water level (see Figure 6). In the early 1970s, the Pamaka of the Marowijne River experienced an unusual flooding event which they refer to as '*a kon kii mi*' (it's come to kill me) (Jabini 2020). Their response was to retreat to their sloped planting grounds or reside in outboard motorboats until the water receded. After flooding, rituals restored the significance of cemeteries, worship sites, and medicine houses. These traditional responses have helped Maroons anticipate climate events and determine alternate landscape use.

Maroons and their landscape-based kinship have strategically adapted within a narrow geographical and topographical scope. The distribution of Maroon communities reflects some measure of a geographic selection process. Archaeological evidence suggests that in their formative period, Maroons were appropriating pre-Columbian ring ditch sites located at the confluence

4 Personal Communication of Malonti (2022) to co-author Cheryl White

of low-lying creeks in the densely forested interior and used defensively for the historical purpose of being clandestinely safe. Radiometric dating suggests a late archaic pre-Columbian presence, and an eighteenth-century Maroon occupation, further substantiated by oral historical testimonials (Versteeg 2003; White 2010). We know that Maroons exist close to their ancestral settlements, which reflect the collective decision for ecological exploitation based primarily on nuclear and affinal kin affiliation.

Sustainable living areas near riverbanks may characterise the broader settlement landscape. Here, phytolith analysis of non-Indigenous plant species of banana (*Musaceae*) and rice (*Oryza*) with mixed pre-Columbian and historic period ceramic assemblages indicates crop variation and possible trade (Witteveen et al. 2023). The shifting cultivation plots with extra storage on the slopes of low mountains of the heavily forested interior would indicate the use of more traditional ground provisions, like manioc, susceptible to root rot if left in standing water. During flash flooding, ground provisions are harvested, and there is reliance on extended kin from neighbouring villages as all wait for the normalisation of water levels. At that time, household tasks such as washing, and food preparation are sometimes performed from boats.

As drought and flooding are the main climatic challenges experienced by Maroons living in their traditional territory, there is an increased likelihood of inaccessibility due to dependency on boat or plane travel. Moreover, episodes of drought can lead to poor harvest and lack of terrestrial resources that migrate elsewhere in the forest. As access to potable water food resources decreases, government dependence for food distribution will increase (Headley 2023). Co-author Thanya Soké Fonkel of the Saamaka Maroon Tribe notes that 'adaptation strategies to severe changes in nature are the bedrock of the existence of Maroon communities. Climate change is a somewhat new concept for us, and it is unimaginable that it has the potential to make nature our enemy and that we may be in danger of losing our ancestral bond to it.'

Maroons are also affected by a globalising western world, exacerbating acculturation and enculturation within the broader Surinamese society, and as a result, the transfer of traditional knowledge within communities cannot

be assumed (Granderson 2017; Scholtens 1994). Despite the destruction of property and loss of food resources, responses to recent flooding events in 2006, 2007, 2008, 2017, 2021 and 2022 demonstrate that each tribe is affixed to a prescribed landscape. Combining traditional knowledge with the geographic modelling of historic landscape choices (seasonal exploitation sites, variegated vegetation, and diverse settlement types with an Amerindian and historic component) may also help identify threatened archaeological sites and expand our knowledge of the Maroon landscape. The

Indigenous people of Wai'tukubuli and Youloumain

The present-day Indigenous Kalinago of the Commonwealth of Dominica (Wai'tukubuli) and St. Vincent (Youloumain) and the Grenadines are the descendants of the Island Carib or Kalinago people who are widely believed to have occupied the islands of the Lesser Antilles in the late pre-colonial and early colonial times. Although migrations and habitation in this archipelago are subject to ongoing debates, archaeological research points to human groups living in this part of the Lesser Antilles by c. 4000 cal. BP (Keegan and Hofman 2017). It is generally believed that the Island Carib originated from the coastal areas of the Guianas and moved in to and subsequently inhabited the Lesser Antillean archipelago and specifically the Windward Islands (southern portion of the Lesser Antilles) before European colonisation and onward (Boomert 1995; Bright 2011; Whitehead and Hulme 1992).

From the early seventeenth century, European powers through the French, English, and Dutch, colonised the Lesser Antilles which contributed to a significant reduction in the number of Indigenous people and resulted in their loss of control over much of the archipelago, leading to the Indigenous presence remaining only in Saint Vincent and the Grenadines and Dominica (Honychurch 2000; Wilson 1997). In the case of Dominica, the Kalinago were relegated to the Carib (Kalinago) Territory, which was formed by the colonial administration in 1903 (Hulme and Whitehead 1992).

As archaeological research contributes to the availability of more information on these Indigenous societies, so too are present-day

archaeological research programmes and studies contributing to new ways of examining the relationship of the Kalinago with their natural environment through reviewing the impacts of climate change. In this context, the archaeology, traditional knowledge, and climate action dynamic are examined through the loss of Kalinago archaeological sites due to climate change phenomena, how these communities experience and respond to this loss, the utilisation of Indigenous knowledge to respond to the changing climate, and opportunities where this 'heritage connection' contributes to climate awareness and/or advocacy. Another important consideration is that the loss of these archaeological sites prevents research on examining adaptation strategies utilised by coastal communities.

Archaeological research has provided evidence of the extent of impacts of climate-induced hazards on coastal archaeological sites along the Dominican and Vincentian coastline. In many cases, the process of coastal erosion is exacerbated by sand mining and other development activities (Hofman and Hoogland 2016), the site of Brighton Beach in Saint Vincent being one such example. Here, the first-hand accounts of co-authors Sardo Sutherland (Kalinago from Saint Vincent) and Irvince Nanichi Auguiste (Kalinago from Dominica) are transmitted through two examples in discussing this human-environment and climate change relationship through the temporal lens of the past, the present, and the future.

Brighton Beach is a Kalinago settlement site located on the Atlantic south-eastern portion of the island of Saint Vincent. In addition to co-authors Sardo Sutherland and Irvince Nanichi Auguiste, other members of the Saint Vincent Kalinago and Garifuna communities collaborated with local and international researchers in surveys at the site in 2019 and 2023 (see Figure 7). This collaboration would also feature at the airport development threatened Argyle site, also in Saint Vincent.

Here, Sardo and Irvince provide their accounts regarding participating in an activity concerning one of their sites being impacted by climate change. The site has been described as essential to learning about the island's socio-cultural pre-contact processes and contributing to reconstructing the

Fig 7. Sardo Sutherland and Irvince Naniche Auguiste participating in rescue archaeology at the eroding Brighton Beach pre-Columbian site in Saint Vincent
© Corinne Hofman, 2019

pre-Columbian past of the Windward Islands and Saint Vincent and the Grenadines archipelago specifically (Boomert et al. 2017).

Sardo Sutherland:

After the 1979 eruption of La Soufrière, I moved to attend school in Brighton. I learned of the beach and the site from history lessons and used to go there to cut grass. I saw many artefacts and the coastal erosion taking place. I was interested but did not get seriously involved till excavations at another Kalinago site - Argyle[5]*. There, my horizon widened about the work*

5 Excavations at Argyle were undertaken in response to the site being impacted by the construc-

of archaeologists. During these excavations at Argyle and Brighton, many schools and other community members came to see the excavations. I felt honoured to participate in an excavation at a settlement site of my ancestors. Unfortunately, in the case of Brighton, we have lost this site that I interacted with as a young man. I am sure we have also lost many more to the encroaching sea and waves.

Irvince Nanichi Auguiste:

I became involved with Brighton Beach while working at the Argyle site. Archaeology and examining our sites has taught us so much about our Indigenous history. However, more research is needed, particularly in palynology. We need to learn more about how our ancestors lived in their spaces and interacted more keenly with their landscapes. We cannot make the critical connections if we continue losing these sites to coastal erosion, flooding, and rising sea levels. We also need to participate in activities to better monitor and protect these sites.

Both Sardo and Irvince acknowledge that their experience at Brighton Beach has increased their awareness of other sites impacted by climate phenomena.

Sardo:

The coastal Kalinago village of Sandy Bay was previously relocated due to severe and ongoing flooding. The area we are now located is called New Sandy Bay, and unfortunately, it is also being impacted by severe coastal erosion and the encroaching sea.

In this case, the New Sandy Bay Kalinago community has observed these ongoing effects, reflected on past events, and continues to document present

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tion of the new airport. This activity was truly a collaborative effort including the Garifuna, Kalinago, heritage managers in Saint Vincent and international research partners.

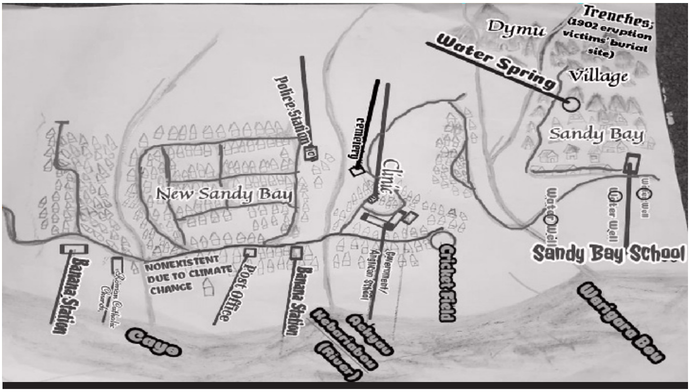

Fig 8. Community map initiative highlighting areas lost or impacted by climate-induced and other natural hazards © Augustine 'Sardo' Sutherland

impact. With these actions, the community seeks to build advocacy for measures to protect their coastline and society, starting with a map (see Figure 8) that details coastal areas caught up between volcanic eruptions and coastal erosion (Sutherland 2021)[6].

The government is now building a sea defence extending from Georgetown to Sandy Bay, with some consultations being organised for persons who needed to evacuate homes along the coast. However, there has been no widespread consultation regarding the approach to protecting the coastline and whether the community might have cultural solutions or mitigation strategies based on their traditional knowledge having co-existed in that environment for a long time.

Irvince highlights that 'Indigenous knowledge could be better integrated and using excavated archaeological information could be better promoted. Indigenous knowledge is not lost as it is naturally occurring and 'hidden in the brain,' although there has been a decrease in environmental observations.

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6 Co-author Sutherland, Augustine 'Sardo' of the Sandy Bay Kalinago community in discussion with lead author Andrea Richards, 2021

This is due to Kalinago students moving out of communities for secondary education (see also Auguiste and Hofman 2022).

Both highlight that traditional practices used to adapt to the changing climate could be better illustrated, documented, and promoted for use by the wider society. One example of this is traditional building practices in relation to houses, which are durable or easily reconstructed when faced with severe weather events such as tropical cyclones. These houses featured (among other elements) high-pitched roofs that enabled fast rainwater run-off and minimal hurricane-wind lifting (see Figure 9)

Discussion

A discussion of archaeology's intersection with the changing climate in the Caribbean and, by extension, our climate action and narrative requires not just an examination of past adaptation strategies but also an interrogation of how these past responses can inform present-day strategies, how Indigenous and local communities experience the loss of their sites from climate-induced hazards and are empowered to safeguard them, and the community-centred narratives which can emanate from this dynamic contributing to climate change actions, literacy, and advocacy.

The research presented here by Caribbean researchers and Indigenous communities demonstrates that there is a critical place for archaeology and traditional knowledge in building our resilience and surmounting environmental instability as a region from the deep past to the present and also highlighting that through archaeology, there are varied opportunities to identify the factors that promoted the development of adaptation strategies in the past, which apply to us in the region and provide alternative solutions as we face a future of severe climate variability. Presenting this data to present day coastal communities led to renewed interest in these adaptation strategies, which would also be further adapted as it enters the social memory of present-day communities. These areas nevertheless require further research and documentation while encouraging more transformative knowledge exchange with Indigenous and local communities. There is also the unfortunate context

of some of these adaptation strategies being lost from the social memory of Indigenous, coastal, and other local communities

In addition to a compilation of some of the useful adaptation strategies being utilised by traditional communities within the Caribbean Basin, an important highlight emanating from the workshop was the need for improved documentation of these strategies or solutions and their conversion into formats for use by non-culture actors. This was identified as the next steps in this ongoing process to be actioned during future collaborations and through the established online platform combining communities and researchers. As such, another activity will be planned which addresses documentation and conversion into a usable format with case studies for non-culture actors.

As it relates to other societal sectors, there are indeed areas where the data from climate change archaeology can prove valuable in the elaboration of local strategies in relation to agriculture, food security and water management, housing construction, and settlement location. This culturally focused research is an important place to better engage with those responsible for policy and climate action programming, thereby ensuring a more holistic environmental approach geared towards sustainability in the Caribbean Basin

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Fig 9. Example of 'A-Frame': Hurricane hits on one side of the building © Andrea Richards, 2018

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