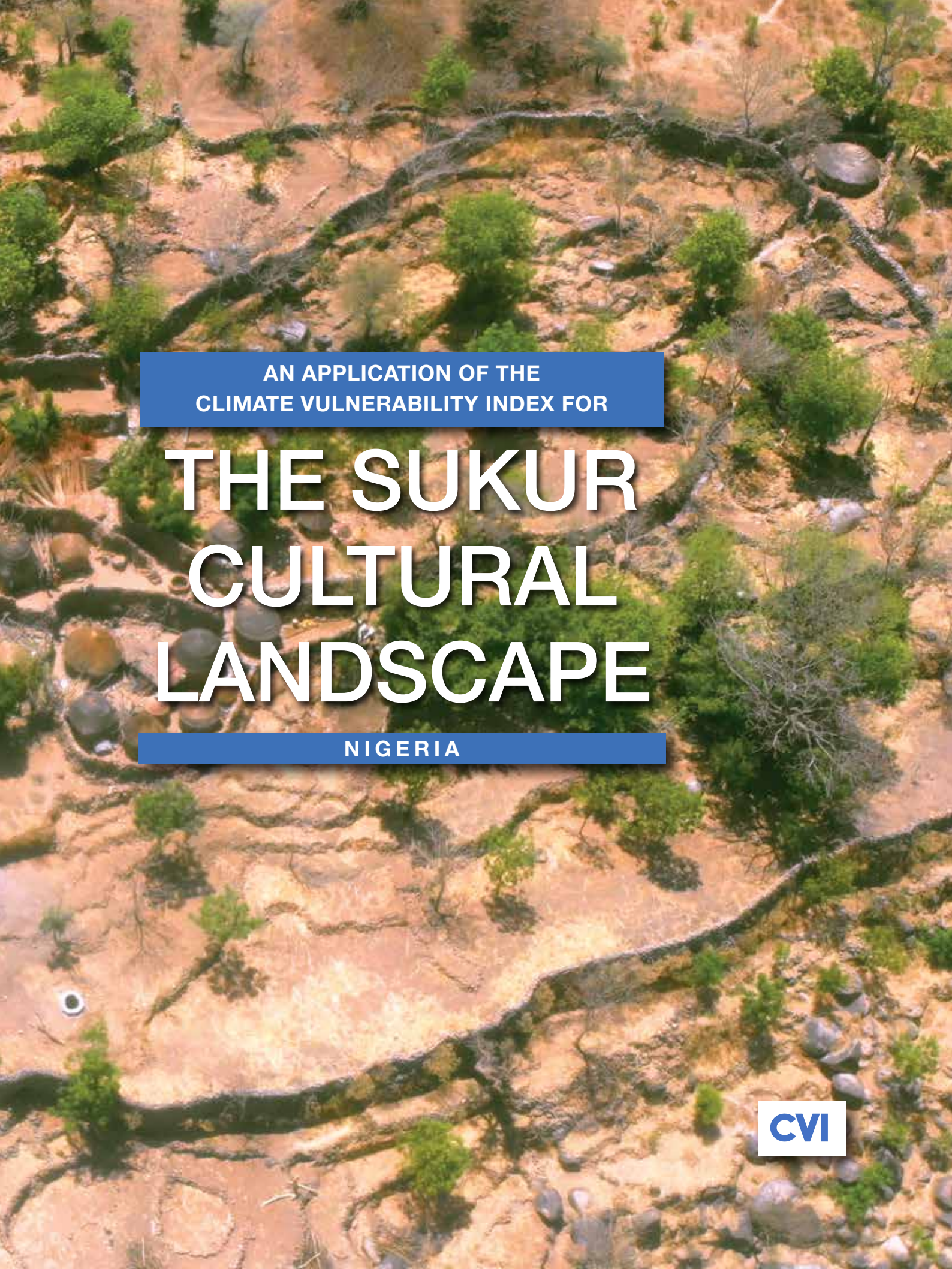

AN APPLICATION OF THE
CLIMATE VULNERABILITY INDEX FOR

THE SUKUR CULTURAL LANDSCAPE

NIGERIA

CVI

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Citation
Day JC, Heron SF, Odiaua I, Downes J, Itua E, Abdu AL, Ekwurzel B, Sham A, Megarry W (2022).
An application of the Climate Vulnerability Index for the Sukur Cultural Landscape. ICOMOS-Nigeria, Abuja, Nigeria.

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Cover Photo: Aerial view of Sukur © AFIDFF
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Funding for the CVI Africa project was provided by the UK Arts and Humanities Research Council and the Department for Digital, Culture Media and Sport
(The Arts and Humanities Research Council funds world-class researchers in a wide-range of arts and humanities areas to address some of society's biggest challenges)

The CVI-Africa project is a partnership of the following institutions

Sukur male initiates on Dlyang rocky hill on Sukur plateau. Mountains of Cameroon in background. August 1992.
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Foreword

National Commission for Museums and Monuments

Climate change is a phenomenon that has become a fast growing threat to the global community and their heritage. This has propelled the heritage community to seeking solutions through the initiation of appropriate actions like climate risk assessment, climate adaptation, climate mitigation, and knowledge sharing, capacity building and awareness of heritage.

Monuments and sites in Nigeria have been negatively impacted by climate change at various degrees. In the recent past, the Sukur Cultural Landscape World Heritage property has been experiencing changes occasioned by the interplay of climate stressors and the political economy. This has resulted in limited availability of grass for thatch, a culturally-significant building material for homesteads.

The recent application of the Climate Vulnerability Index (CVI), a value-based climate change vulnerability rapid assessment tool, on the Sukur Cultural Landscape World Heritage Site is a welcome development. This has set the pace for the National Commission for Museums and Monuments (NCMM) to initiate further action around the climate-heritage nexus in the management of National and World Heritage properties. This we hope to achieve through enhanced collaboration in the implementation of local, national and international climate policy instruments.

One of the outcomes of the workshop was the establishment, by the NCMM in collaboration with ICOMOS-Nigeria, of a mini-weather station on the Sukur Cultural Landscape. This is a first step to enhancing the systematic collation of climate data and monitoring for the site. Through enhanced partnerships and collaboration, the NCMM will extend this initiative to other heritage sites in Nigeria.

I appreciate the support of our various partners in the CVI-Sukur project: the Arts and Humanities Research Council of the United Kingdom for its generous financial support; ICOMOS-Nigeria and the American University of Nigeria in Yola.

Prof. Abba Isa Tijani
Director General
National Commission for Museums and Monuments
Nigeria

Mukaddima

Hukumar Adana Kayan Tarihi ta Kasar

Sauyin yanayi wani abu ne da ke saurin haifar da barazana ga al'ummun duniya da al'adunsu na gado. Wannan dalili ya sa yankuna da dama suka tsiri wasu dabarun rage barazana da sauyin yanayi yake haifarwa kasa. Kamar tantance irin illolin da sauyin yanayin ke haifarwa, da dab'antuwa da yanayin, da hanyoyin rage illolin da musayar ilmi, da qara wa juna sani kan al'adun gargajiya.

Wannan yanayi ya sanya qarancin ciyawar da ake amfani da ita don samar da jinkan dakuna da ake buqata a gina muhallin zama.

Amfani da Fihirin illar yanayi (CVI), hanya ce da ke taimakawa a tantance barazanar da sauyin yanayi ke yi wa kebabben yankin Sukur na raya al'adun gargajiya yake da matukar fa'ida. Wannan ya bai wa hukumar adana kayan tarihi ta qasa (NCMM) wata damar daukar sabon mataki a kan inda sauyin yanayi ya fi kamari a yankunan da aka kebe don raya al'adu. Mun sa ran cimma wannan manufa ta hanyar ingantancciyar hadaka don kaddamar da tsare-tsare a kan yanayi a mataki na kananan hukumomi da jihohi da kuma taraiyya da kasa-kasa.

Daya daga cikin sakamakon taron bitar shi ne kafa karamar tashar lura da yanayi a kebabben yankin raya ala'dun gargajiya na Sukur wanda hukumar adana kayan tarihi (NCMM) da kungiyar kula da kare muhallin gargajiya ta ICOMOS a kasar Nijeriya suka yi. Wannan shi ne tsararren mataki na farko da aka cimmawa don lura da yankin da kuma tattara bayanai kan sauyin yanayi. Wannan hukumar NCMM za ta fadada wadannan matakai zuwa sauran yankunan raya al'adun gargajiya na cikin kasar Nijeriya.

Ina amfani da wannan dama don nuna gamsuwata da gudumawa da hadin kan da wayannan abokan huldarmu suka bayar, sune: Majalisar bincike kan abubuwan da suka shafi fasaha ta kasar Ingila wacce ta ba da gudunmawar kudi mai tsoka da kungiyar kula da kare muhallan gargajiya ta ta kasa Nijeriya, ICOMOS - Nigeria) da kuma Jami'ar Amurka ta Nigeria da ke garin Yola.

A tarayyar Nijeriya birane da wuraren tarihi sun fuskanci illoli da dama da sauyin yanayi ya haifar a matakai daban-daban. A baya-bayan nan, Kebabben Muhallin tarihi da al'adu na duniya da ke Sukur na fuskantar wasu matsaloli a dalilin illolin matsalar tattalin arziki da sauyin yanayi.

Farfesa Abba Isa Tijjani
Darekta
Hukumar Adana Kayan Tarihi ta Kasar Nijeriya (NCMM)

Foreword

American University of Nigeria

The American University of Nigeria is committed to supporting climate action in northeastern Nigeria, where the university is located. The northeast of Nigeria is witnessing of deteriorating climatic conditions leading to increasing droughts, pestilence, falling harvests, reduced forest cover, and drastic falls in water flows in major rivers. These have impacted the livelihoods of thousands of people living in the region.

As an academic institution with a development focus, AUN supports research on the drivers of adverse climate change to find solutions to address its impacts and delay the onset of drastic climatic episodes. We carry out climate awareness campaigns through advocacy walks, school talks, social media engagement, seminars and conferences as and funded projects that seek to share innovative solutions to address climate change, and the intersection of sustainable development and adaptive agricultural practices. With donor funding, we have supported over 3000 local farmers, empowering them with sustainable farming skills, leading to improved yields and efficiency on the farms. We also have partnerships to diversify the livelihoods of people living in the Kiri dam area of Shelleng local government area of Adamawa state so that they will not hunt hippopotamus, but rather learn to live them and benefit from the income that tourism will bring to the area.

The CVI-Sukur workshop brought together experts in climate change, cultural heritage and academia in Nigeria. It was an opportunity to carry out a rapid vulnerability assessment and to evaluate the adaptive capacity of the community to the top three climate stressors that have been identified for this part of the Mandara Mountains. This report sets the pace for future work on climate vulnerability assessments in Nigeria. It also confirms the trend in north-east Nigeria—as reported in the 2021 Nigeria National Adaptation Communication - of both the decline in precipitation and rising heat. There are lessons to be learnt from how the people of the Sukur Cultural Landscape have adapted to changes in climatic conditions over the past centuries. In recognition of the relevance of traditional knowledge to adaptation, and in line with its international climate change commitments, the Nigerian National Adaptation Plan (2020) recommends the creation of adaptation and Indigenous knowledge units at state level and coordinated at the national level.

AUN looks forward to deepening its collaboration with national partners such as ICOMOS-Nigeria and the National Commission for Museums and Monuments in order to move forward on developing adaptation strategies founded on age-old traditional practices and on addressing the threats posed by climate change to our Nigerian cultural heritage.

Dr Margee Ensign
President/Vice-Chancellor

Mukaddima

Daga Jami'ar Amurka da keTarayyar Nijeriya (AUN)

A koda yaushe Jami'ar Amurka da ke tarayyar Nijeriya a shirye take ta taimakawa duk wani yunkuri na kyautata yanayi a shiyyar da jami'ar take wato arewa maso gabas da ke tarayyar Nijeriya. Akwai barazanar tabarbarewar yanayi da shiyyar arewa maso gabas take fuskanta wanda ke haifar da karuwar fari da cuce-cuce da koma-bayar amfanin gona da karancin dazuzzuka da karancin ruwan sama da ke sauka a manyan kogunan shiyyar. Wadannan duka sun yi tasiri a rayuwar dubban jama'a mazauna shiyyar.

Jami'ar a matsayin ta na cibiyar ilmi mai kokarin kawo cigaba, tana gudanar da bincike a kan abubuwan da ke haddasa tabarbarewar yanayi da samar da hanyoyin da za a bi a sha kan wannan babbar illa da jinkirta aukuwar mummunan yanayi a shiyyar. Mun kaddamar da gangamin wayar da kan al'umma kan sauyin yanayi ta hanyar kai ziyara muhimman wurare da shiga kafar sadarwa al'umma ta wayar hannu da shirya bita da tarurruka da daukar nauyin shirye-shirye masu kawo dabaru kan yadda za a kyautata muhalli da ba da gudunmawa don kawo cigaba mai dorewa da inganta noma da kiwo a shiyyar. Da taimakon gudunmawar kudi da muka samu daga wasu wurare, mun taimakawa kananan manoma dubu 3000 a shiyyar da horaswa kan dabarun noma masu dorewa da samar da amfanin gona da inganta yanayin gonakansu. Haka nan munyi hadin gwiwa daban daban don inganta rayuwar al'umma mazauna kewayen gulbin Kiri da ke yankin Karamar Hukumar Shelleng ta jihar Adamawa. Ta wannan horaswa, an kwadaitar da su rayuwa da dabbobin ruwa kamar su dorina wadanda za su ci moriyarsu ta hanyar samun kudin shiga daga masu zuwa yawon bude ido don kallonsu a maimakon farautarsu da sukeyi.

Bitar amfani da fihirin yanayi na Sukur ya hada kan masana sauyin yanayi da al'adun gargajiya da malamai daga wurare daban-daban na kasan Nijeriya. Bitar ta bayar da damar tattaunawa don fito da hanyoyi da tantance barazanar yanayi da iya juriyar da yankin zai iyayi a kan manyan abubuwan guda uku masu mummunan tasiri ga yanayi da aka gano ke shafar yankunan da ke kewaye da duwatsun Mandara. Wannan rahotoya share fagen ayyuka da za aci gaba da yi nan gaba kan tantance barazanar yanayi a tarayyar Nijeriya. Rahoton ya kuma tabbatar da yanayin da shiyyar arewa maso gabas ta tarayyar Nijeriya take ciki kamar yadda ya zo a rahton shekara ta 2021 na masu lura da sadarwa na kasa Nijeriya kan koma-baya na karuwar zafi da ke faruwa a kai- a kai. Akwai darussa da dama da za a koya daga yadda al'umma mazauna kebabben yankin tarihi da al'ada ta Sukur suka zauna kuma suka jure wa sauye-sauyen yanayi tsawon karni-karni da suka gabata. Bisa la'akari da muhimmancin ilmi a gargajiyance na jurewa da sakewa da Sauyin yanayi da gudunmawar kasa da kasa kan sauye-sauyen yanayi, shirin kasan Nijeriya kan dabarun juriya da sakewa da yanayi (na shekara ta 2020) ya ba da shawarar kirkiro ofisoshin bayar da ilmi kan juriya da sakewa a mataki na jiha da kuma ofishi mai kula da su a mataki na kasa.

Jami'ar AUN na maraba da abokan hulda a mataki na kasa kamar ICOMOS da Hukumar ajiye kayan tarihi ta kasa don zurfafa hadin gwiwa da aiki tare don ciyar da dabarun juriya da sakewa na gargajiya da aka gano daga hanyoyin aal'ada da al'umma take amfani da su tsawon shekaru don magance barazanar da Sauyin yanayi yake haifarwa a kan yankunanmu na gado a kasan Nijeriya.

Dakta Margee Ensign
Shugaba/Mataimakin Shugaban Jami'ar.

Contents

EXECUTIVE SUMMARY

Chief Priest of Mbizifuyi Shrine. May 2006
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Executive Summary

Climate change is a major risk to World Heritage (WH) and many sites are already experiencing impacts from climate change related hazards. As the climate crisis intensifies, the need to understand the vulnerability of heritage sites becomes urgent. This report outlines the results of applying the Climate Vulnerability Index (CVI) to Sukur Cultural Landscape, a WH property in northeastern Nigeria. The CVI methodology is a technique to assess rapidly the vulnerability of cultural and natural WH by identifying realised and potential impacts of climate change to both Outstanding Universal Value (OUV) and the associated community.

The application of the CVI for Sukur provided many important precedents, being the first time that the CVI was applied in an African WH property and in a cultural landscape-inscribed property. It was also the first using a 'blended workshop' format whereby most workshop participants were at the American University of Nigeria in Yola, whilst other participants joined the workshop online. The CVI workshop took place 19th-24th September 2021 and involved site managers, academics, community representatives, Non-Governmental Organisations (NGOs) and responsible management agencies. The workshop was preceded by preparatory webinars examining key values, climate change, and economic and social information.

For the CVI, six key values were drawn from the Sukur Statement of OUV, recognising the: exceptional cultural landscape; ancient settlement that still flourishes; Hidi spirituality; traditional indigenous architecture; cultural continuity/living culture; and iron smelting technology.

Within the CVI process, participants selected the year 2050 as the future timescale on which to assess vulnerability. Under a high-emissions scenario (Shared Socioeconomic Pathway, SSP5-8.5) in which greenhouse gas emissions continue to increase through fossil-fuel based social and economic development, annual average daily-maximum temperature is projected to increase by 1.1-1.4°C (ca. 2050) from the historical period (1995-2014). By mid-century, an additional 1-1.5 months of hot days (>35°C) are projected to occur each year, compared with the historical period. Annual rainfall for the region is projected to increase by 7-11% (ca. 2050) from the historical period, with rainfall during the wettest 5-day period showing a similar increase (10-17%). The mid-century projected annual maximum number of consecutive dry days is consistent with the historical period (136 days).

Participants identified the three climate stressors likely to have the greatest impact on the OUV for Sukur as:

- Drought (severity, duration, frequency);
- Temperature trend (air); and
- Storm intensity and frequency.

An example of actual and further potential impact of drought and increased temperature is desertification which has reportedly led to plant biodiversity loss, in turn affecting the availability of vegetation for traditional construction.

It was determined that the OUV Vulnerability for Sukur Cultural Landscape was Low, indicating that while some loss of some attributes is expected to occur, it is unlikely to cause persistent or lasting effects on the OUV of the property. The Community Vulnerability was assessed as Low, acknowledging the high level of adaptive capacity within the community. It was concluded the changes that might be expected over the next 30 years (ca. 2050 scenario) may not have a big effect on the values that convey the OUV of the property or upon the Sukur community in terms of the potential impact upon economic, social and cultural connections to those values.

The application of the CVI for Sukur demonstrated the value of the process for cultural properties in identifying key points of vulnerability to climate change as well as opportunities to manage impacts to both the landscape and the associated community.

Takaicecen Ingantancen Bayani

Sauyin yanayi babban hadari ne ga abubuwan tarihi na duniya (WH) kuma yawancin yankuna sun fara fuskantar matsalolin canjin yanayin. Yayin da canjin yanayin ke karuwa, bukatar fahintar da mutanen yankin ya zama cikin gaggawa. Wannan rahoton ya zayyana sakamakon amfani da ma'aunin yanayi (CVI) don tantance yanayin al'adun shimfidar kasar Sukur kebebben wurin tarihi mallakar duniya (WH) a arewa maso gabashin Najeria. Hanyar amfani da ma'aunin yanayi wata dabarace ta tantance raunin Sauyin al'aduda na halitta a wurin tarihi mallakar duniya ta hanyar gano hakikanin tasirin canjin yanayi ga dukan fitattun kimar duniya (OUV) da kuma al'ummar da ked a alaka da yankin.

Amfani da ma'aunin yanayi (CVI) a kan Sukur ya samar da muhimman bayanai masu yawa, kasancewar karo na farko da aka fara amfani das hi akan wani yanki na wurin tarihi mallakar duniya (WH) a kasar Afirka da kuma cikin al'adu da aka rubuta. Shine kuma na farko da yayi amfani da bitar hadin gwiwa (workshop) tsarin wanda mafi yawan mahalarta bitar sun kasance a Jamiyar Amirka ta Najeriya da ke Yola, yayin da sauran mahalarta suka shiga bitar ta yanar gizo. Bitar amfani da ma'auninyanayi ya gudana ne daga ran 19 zuwa 24 ga Satumba 2021, kuma ya kunshi manajoji, malaman jamiyoyi, wakilan al'umma, kungiyoyin sa kai da hukumomi. Kafin a fara bitar, anyi amfani da shafukan yanan gizo don gano muhimman dabi'u Sauyin yanayi, da bayanan tattalin arziki da zamanta kewa.

Saboda amfani da ma'aunin yanayi, an fitar da muhimman abubuwan guda shida daga bayanin Sukur na fitattun kimar duniya tare da gano yanayin al'adu na musamman dadadden matsuguni wanda har yanzu yana bunkasa, ruhin Hidi, gine-gine yan asali na gargajiya, ci gaban al'adu/al'adun rayuwa, da fasahar narkewar karfe.

A cikin tsarin CVI, mahalarta sun zabi shekara ta 2050 a matsayin ma'aunin lokaci da za a tantance raunin yankin a karkashin babbar hanyar raba tattalin arziki, SSP5-8.5, inda hayaki mai gurbata yanayi ke ci gaba da karuwa ta hanyar bunkasar zamantakewa da tattalin arziki. Ana harsashen karuwar matsakaicin zafi na shekara-shekara zai karu da kashi 1.1-1.4°C (dab da 2050) na ma'aunin salshiyos bisa la'akari da lokacin da ya gabata (1995-2014). A sakiyar karni, ana harsashen karuwar kwanakin zafi a watanin da kashi 1-1.5 (zai dara degiri talatin da biyar 35) a ma'aunin salshiyos. Ana harsashen hakan zai iya faruwa kowache shekara idan akayi la'akari da shekaru da suka wuce. Ana kuma harsashen karuwar ruwan sama na shekara-shekara a yankin da kashi 7-11 bisa dari (dab da 2050) daga shekaru da suka wuce, ruwan sama a ranaku biyar na marko wanda ya nuna karuwarsu bai daya (10-17%). A tsakiyar karni na shekara an kiyasta yawan kwanaki (136) na zafi yana nan daram ba canji.

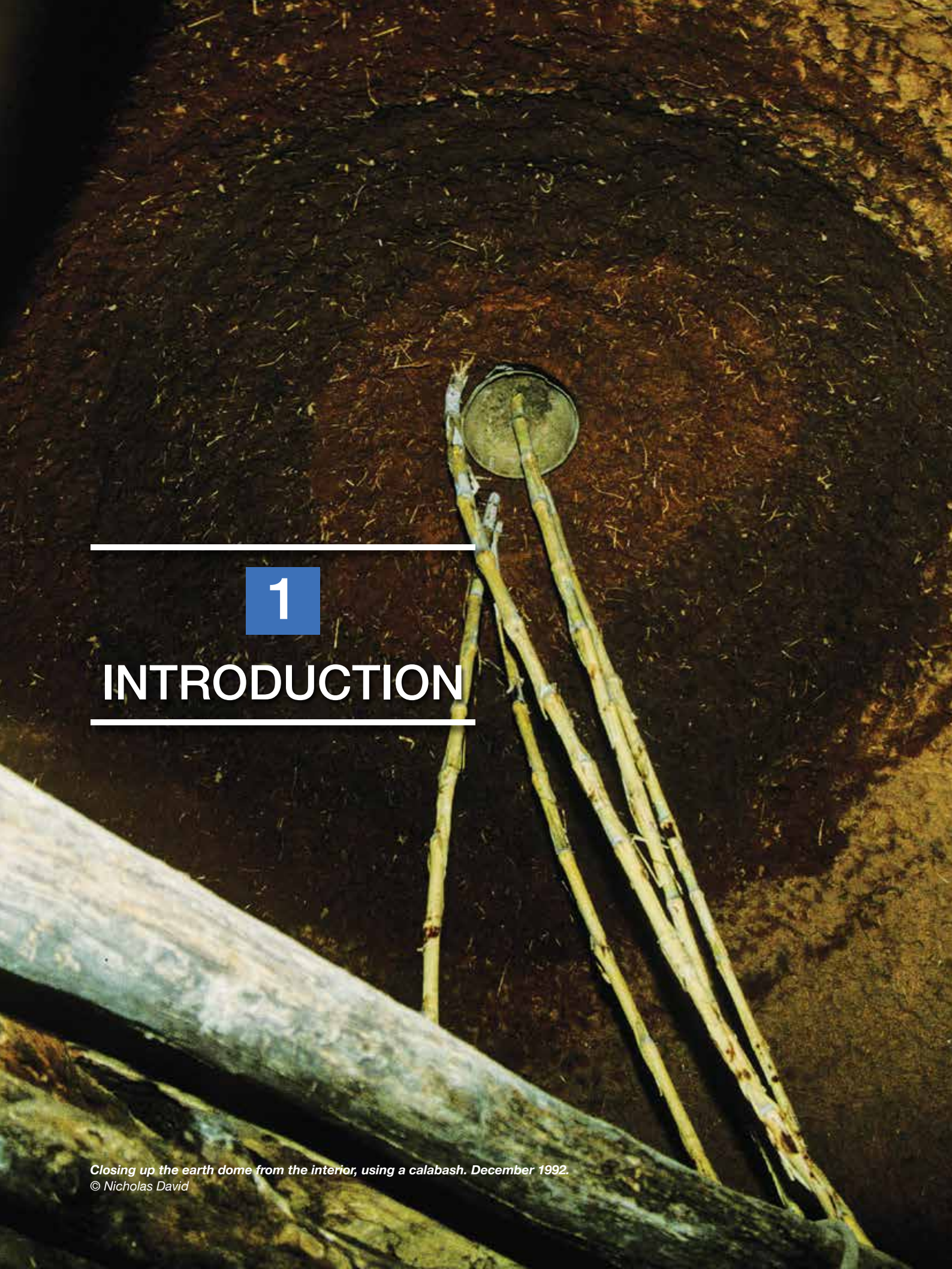
Mahalarta taron sun ganomatsalolin Sauyin yanayi guda uku da zasu iya yin illa mafi girma akan fitattun kimar duniya (OUV) na Sukur kamar haka:

- Fari (Tsananinsa, tsawon lokaci da yawan aukuwarsa)
- Tsananin zafi (iska da/ko ruwa)
- Guguwa mai karfi da yawan aukuwarta

Misali na hakikanin illar fari da Karin zafi zai iya haifarwa Hamada wanda rahotanni suka nuna ya haifar da asarar shukar halittu, wanda hakan ke shafar samar da ciyayi na gine-ginen gargajiya.

An tabbatar da cewa raunin fitattun kimar duniya (OUV) ga yanayin al'adun Sukur yayi kasa, wanda ke nuni da cewa za a yi asarar wasu halittu da wuya ya haifar da tasiri mai dorewa akan dukiyar fitattun kimar duniya. An gano cewa raunin al'umman kadan ne, tare da amincewa da babban matakin iya daidaitawa a cikin al'umma. Ana harsashen sauye-sauyen da suka yi hijira sam da shekaru talatin (dab da 2050 yadda abubuwan zasu iya kasancewa) ba zai yi wani babban tasiri akan dabi'u da ke isar da dukiyar duniya ko a kan al'ummar Sukur ba dangane da tasirin da zai iya haifar da tattalin arziki, zamantakewa da alakar al'adu da wadannan dabi'u.

Aikace-aikacen ma'aunin yanayi (CVI) akan Sukur ya nuna darajar tsari don kadarorin al'adu wajen gano muhimman abubuwan da ke da rauni ga sauyin yanayi da kuma gano hanyoyi da kuma gano hanyoyin magance matsalolin yanayin kasar da kuma al'umar dake da alaka da kasar.



1

INTRODUCTION

Closing up the earth dome from the interior, using a calabash. December 1992.
© Nicholas David

1. Introduction

1.1 Background to this report

This report outlines the results of applying the Climate Vulnerability Index (CVI) to the UNESCO World Heritage (WH) listed property of the Sukur Cultural Landscape in Nigeria.

Climate change is a growing global risk to most WH properties, many of which – natural, cultural, and mixed – are already being impacted. The International Council on Monuments and Sites (ICOMOS) stated in 2019: "The impacts of [climate-related] changes are already damaging infrastructure, ecosystems and social systems – including cultural heritage – that provide essential benefits and quality of life to communities" (ICOMOS, 2019). The Intergovernmental Panel on Climate Change (IPCC) has predicted with 'high confidence' that "global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate".

"…climate change has become one of the most significant and fastest growing threats to people and their heritage worldwide…"

- ICOMOS 2017

The urgency for climate action demands an assessment of the wider implications of heritage as a driver and/or constraint for development, and of climate change impacts on cultural heritage. This requires identifying, understanding and assessing interactions between heritage, development and the alleviation of poverty and how cultural heritage management can have positive or negative impacts on these while addressing climate action. Heritage methodologies such as CVI that utilize inclusive solutions supported by stakeholder consultation and adaptive management can bolster participatory governance in communities that further support economic and social sustainability.

The Report on the results of the Third Cycle of Periodic Reporting in the Africa Region (UNESCO, 2021) identified climate change and severe weather events among the top six factors affecting WH properties in the region. The top climate stressors identified were temperature change, drought, flooding and storm intensity and frequency. One of the management priorities identified in the report includes the integration of climate change risks in the disaster risk reduction strategy of sites. This point is addressed in the accompanying regional action plan (2021-2027) from perspectives of strategic management and capacity building.

The CVI process, outlined in section 1.2, is best undertaken through a workshop of diverse stakeholders (including site managers, researchers, community representatives, management agency representatives, and other stakeholders). Due to the pandemic and time zone differences between Sukur and Australia (where the workshop facilitators were based), a blended format workshop was undertaken over six days (see workshop schedule in Appendix 5) with 26 participants in Nigeria (see workshop participants' list in Appendix 4) from different sectors engaged in the process. A further 10 participants joined in the online workshop from different parts of the world: CVI-Africa project team members from Canada, UK and Australia; and trainees from a separate training course run by the CVI-Africa Project who joined remotely from Cabo Verde, Kenya, Tanzania, Tunisia and Uganda.

This application of the CVI for Sukur provided many important precedents, being the first time the CVI had been applied in:

- an African WH property
- a cultural landscape
- the format of a 'blended workshop' with most workshop participants at the American University of Nigeria in Yola and other participants joining online.

1.2 Overview of the Climate Vulnerability Index (CVI)

The CVI is a systematic and rapid assessment tool that is values-based, science-driven and community-focused. It was initially developed to assess the impacts of climate change upon WH properties, considering the Outstanding Universal Value (OUV) and the associated community.

The CVI process works sequentially through the steps outlined in Section 5, enabling a systematic evaluation of the threats of climate change. Unlike many other risk assessment approaches, the CVI comprises two distinct primary outcomes (see Figure 5.1), assessing:

- **OUV Vulnerability,** evaluating potential impacts to the values and attributes for which the property has been internationally recognised; and
- **Community Vulnerability,** assessing the level of economic, social, and cultural dependence that associated communities (local, national, and international) have on the WH property (collectively referred to as "ESC dependencies") and their adaptive capacity to cope with climate change-related loss of WH values.

Both of these assessments of vulnerability are highly relevant for key stakeholders, including the local communities that live in and around the property, site managers, responsible management agencies. Through its application, the CVI enables managers and stakeholders to consider what may be appropriate adaptive capacities for the management of their natural, cultural and community assets.

While the CVI was initially developed in Australia, input and guidance for the CVI has subsequently come from many experts around the world. This includes the International Council on Monuments and Sites (ICOMOS) and the International Union for Conservation of Nature (IUCN), two of the advisory bodies to the WH Committee. A key part of the CVI-Africa Project was to assess its utility in an African context and identify ways to further refine it and make it more broadly applicable.

1.3 Why was Sukur chosen for the CVI?

In May 2020, a bid for funding to the UK Arts and Humanities Research Council's Global Challenges Research Fund scheme was submitted by an international consortium led by Queen's University Belfast (Principal Investigator William Megarry), with University of the Highlands and Islands (Co-Investigator Jane Downes), African World Heritage Fund (Co-Investigator Albino Jopela) and Historic Environment Scotland (Co-Investigator Ewan Hyslop), partnering with various organisations including ICOMOS-Nigeria (Ishanlosen Odiaua) and James Cook University (CVI developers Jon Day and Scott Heron). The project, *Values-based Climate Change Risk Assessment: Piloting the Climate Vulnerability Index for Cultural Heritage in Africa* (CVI-Africa), included proposed workshops in two African WH properties, namely:

- Kilwa Kisiwani and Songo Mnara (Tanzania) a coastal site where sea level rise in the Indian Ocean and increasingly intense storm activity is causing loss of archaeological deposits and of land, exacerbating other socio-economic and ecological stresses including land management practices; and

- Sukur Cultural Landscape (Nigeria), an inhabited landscape representing a continuum of human occupation, threatened by changing rainfall patterns, windstorms and reduced vegetation cover which is impacting agricultural production and the availability of culturally significant traditional building material.

Sukur was selected for the CVI for the following reasons:

- Combined cultural and natural attributes present particular management issues;
- Inland site located in a high plateau in Mandara Mountains range in West Africa;
- Rural site with no history of urbanisation, yet historically active in the urban economies of past kingdoms in this part of Africa;
- Living site with strong cultural practices that are closely intertwined with the surrounding landscape and; relationship could be affected by changing climate factors; and
- Complex range of direct and indirect climate stressors and impacts, different to other sites where the CVI has been applied.

Figure 1.1 *Participants at the Yola workshop*
© Daniel Mwada

2

SUKUR CULTURAL LANDSCAPE

Hldi's Palace
© Oise Ayeni

2. Sukur Cultural Landscape

2.1 Location and Climate

The Sukur Cultural Landscape is located in north-eastern Nigeria (10°44′26″N, 13°34′19″E), in the administrative region of Madagali local government area of Adamawa State some 290km from Yola, the Adamawa state capital. It is situated in the Mandara Mountains range that borders Nigeria and Cameroon, at an elevation of 1045m (Figure 2.1). It lies within the Lake Chad Drainage basin, an area that is known to have been affected by drastic climate and environmental change (Pham-Duc et al. 2020). Those most vivid changes can be traced to the mid Holocene associated with the desiccation of the Sahara Desert and the retreat and shrinkage of Lake Chad. Various factors have further contributed to the environmental degradation, which has worsened in recent times with a shift towards more arid environmental conditions. A direct result of this degradation is the decrease in vegetation cover. In some instances, erosion has increased due to lack of vegetation cover. The 1970s and 1980s saw periods of dry weather when compared to earlier records; however, since 1970 there has been a distinct increase in extreme rainfall logged in rain gauges in the West African Sahel region (Panthou et al. 2014). Another regional storm trend to note is the Sahel mesoscale convective systems (MCS) that have intensified along a narrow band south of the Sahara desert (Pham-Duc et al. 2020).

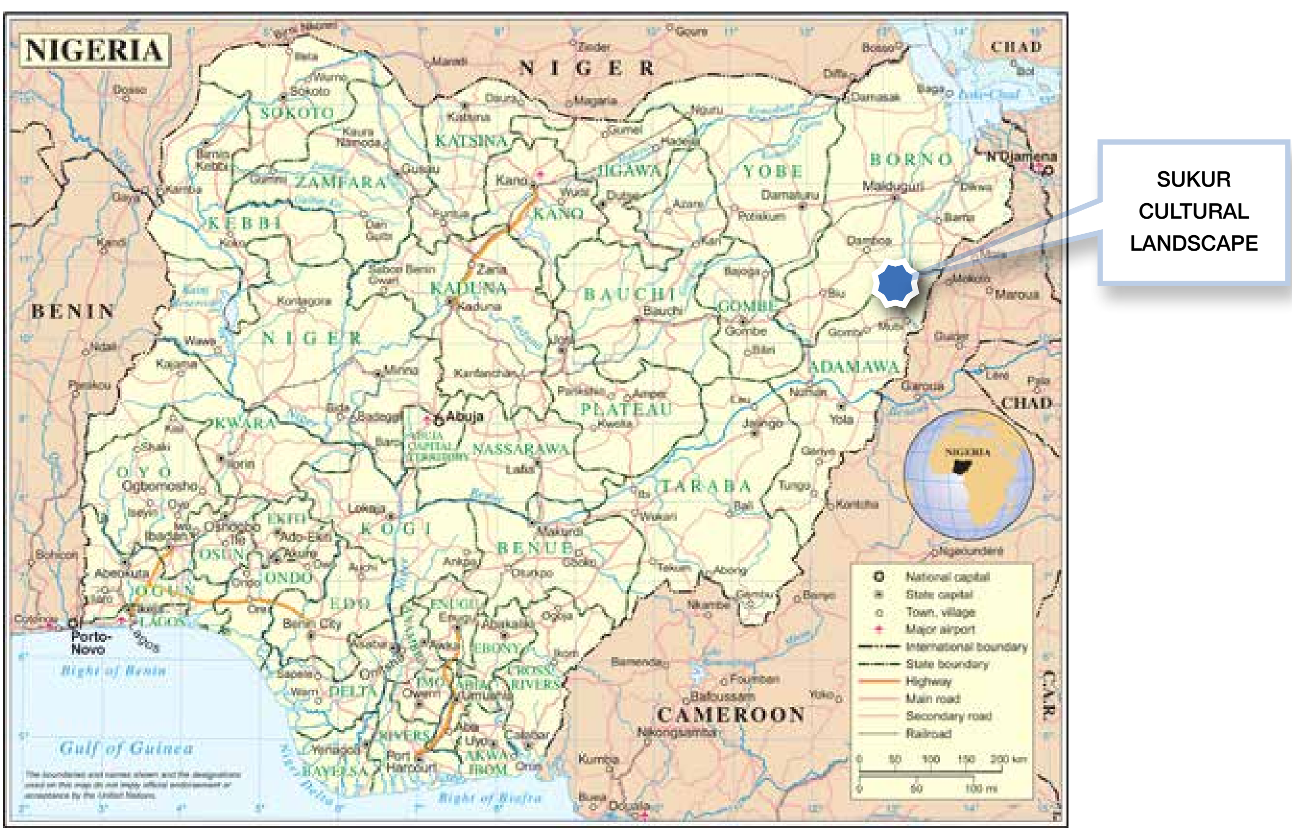


Figure 2.1 Location of Sukur Cultural Landscape in Adamawa State, Nigeria

Adapted from: WikiMedia https://commons.wikimedia.org/wiki/File:Political_map_of_Nigeria.svg

2.2 The Sukur Cultural Landscape

The Sukur Cultural Landscape consists of the core area (called Sakur Sama) where the Palace of the Hidi (Chief) is located, and the buffer zone (also called Sukur Kasa). The WH property covers 764.40ha surrounded by a buffer zone of 1,178.10 ha (see Figure 2.2).

The revered position of the Hidi as the political and spiritual head of the community is underscored by the impressive dry stone architecture of his palace, in and around which are a concentration of shrines, some of which are made from ceramic. The palace complex (*Ghai* Hidi), which is the residence of the Hidi, consists of various structures encircled by a wall of granite stones extracted from the surrounding landscape and used to make dry stone walls and niches. The *Ghai* Hidi complex represents a socio-political landscape whose spatial organisation is symbolic of the relationship between the Hidi and his people. The entrance to the palace complex is characterised by a gate flanked by two large monolithic granite blocks fitted with gates. The complex includes residential areas and spaces for animal husbandry, religious ceremonies and festivals.

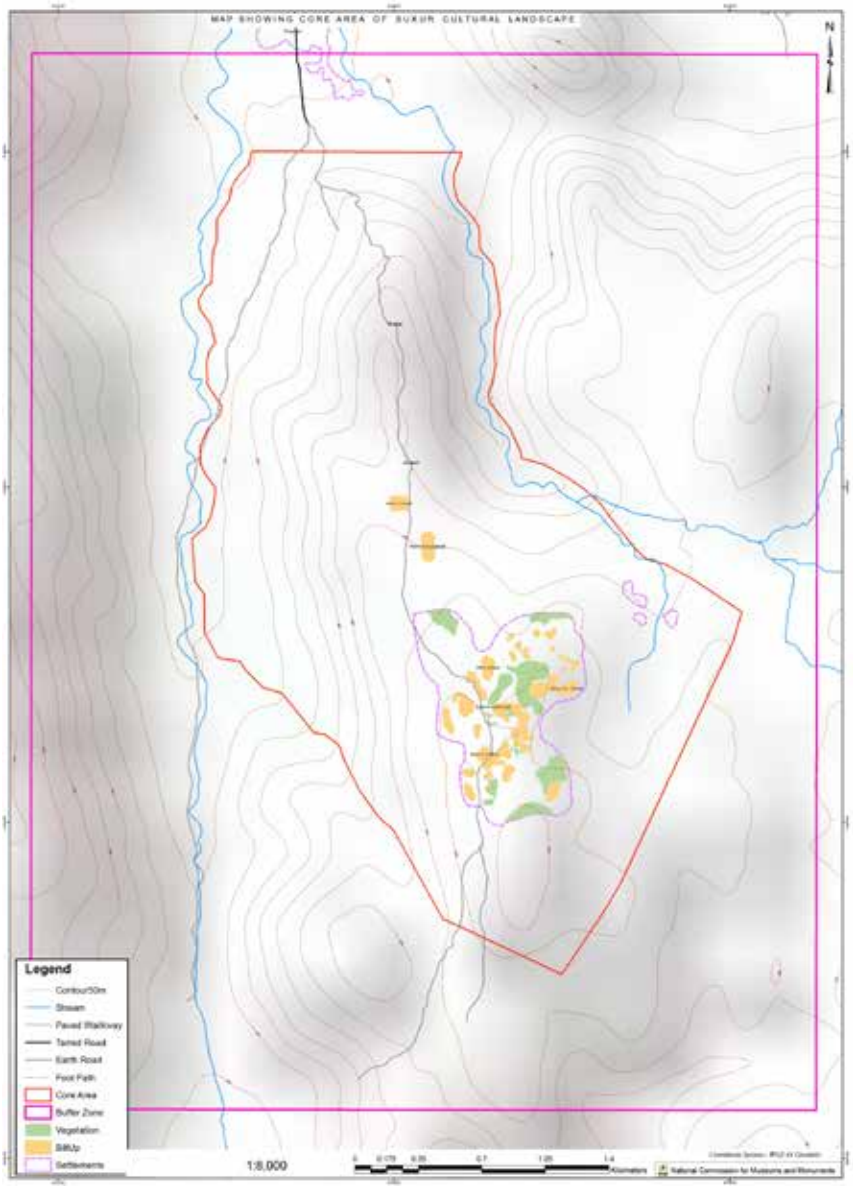


Figure 2.2 Map showing Sukur Cultural Landscape. The red (inner) boundary marks the core area of the property, whilst the pink (outer) boundary is the buffer zone)

Source: NCMM

Sukur is accessed from the low-lying plains, through two main access walkways (Figure 2.3), 5-7 m wide, parts of which are paved with granite stone slabs. These paths were constructed on the steep sides of the hillside in a manner to minimize erosion and facilitate the ascent for people and animals.

The Sukur landscape is characterised by extensive agricultural terraces that stabilise the soil and prevent the loss of water, necessary for the crop cultivation. The terraces also have a spiritual quality as they are home to other spiritual features such as sacred trees, sacred entrances or 'gates', and festival or ritual grounds, which together embody the continuity of traditions.

The villages on low-lying ground have their own characteristic architecture, the product of endogenous building technology including stone walls topped with earthen domes and thatch roofs, enclosed within dry stone walls (Odiaua 2013). Other distinctive features are sunken animal pens (principally used for raising bulls), granaries, and threshing floors. The sunken animal pens are surmounted by conical stone structures in which cattle and sheep are fattened, either for consumption by the family, for sale or for use as prestige and status symbols used in gift and marriage exchanges.

Sukur's history is marked by its control of the iron production industry and trade in this part of West Africa. The remains of many disused iron-smelting furnaces can still be found across the landscape. These shaft-type furnaces, blown with bellows, were usually sited close to the houses of their owners. Iron production involved complex socio-economic relationships and considerable ritual activities. This industry involved all members of the community – men and women – including the specialist smiths.

Figure 2.3 The footpath providing access to the Sukur Cultural Landscape.
© Dipo Alafiatayo

The traditional cemeteries are in the hills. The tombs are simple stone structures, and different clans and social groups had their own cemeteries. The only exceptions were for the Hidi, whose bodies were buried within their own palace complexes, and children, who were buried close to the settlement.

Together, all these features are integrated into the landscape, symbolising the economic and political structure of Sukur society. Authority, in the form of the Hidi, is located in an elevated position overlooking the people in their villages on the surrounding plateau. Complex social relationships can be observed in the disposition of the cemeteries, whilst the relationships between iron furnaces and settlements and within the agricultural terraces illustrate an elaborate economic pattern of production and distribution.

Sukur faces several heritage conservation challenges. The population of Sukur is increasing due to various factors, including the arrival of refugees who have been displaced due to conflict in the neighbouring areas. This has increased pressure on the natural and cultural resources of Sukur due to the opening of new farmlands and homesteads. This pressure is contributing to an increase in bush clearing for farming and wood harvesting for fuel, and there is a scarcity of materials such as grasses for local thatch roofs and the increase in the use of corrugated iron sheets for roofing. To address the issue of deforestation, the Kinjir Foundation has led annual tree planting campaigns since 2012 (with a break between 2014 and 2017 due to security concerns). There are mixed results with more of the trees surviving within Sukur *sama* than along the paved ways – several seedlings having been affected by farming activities.

The changing lifestyles - as some members of the Sukur community aspire to contemporary models of housing - is perceived as a threat to traditional practices which is a key component of the property defined by criterion (vi). The impact of large crowds during festivals is also considered a threat to some features on the cultural landscape.

2.3 Identifying the values of Sukur Cultural Landscape

The landscape at Sukur, with all the social, political and cultural features that intersect on the property, is a remarkably intact physical expression of a traditional society and its spiritual and material culture. In addition, it has exceptional features, notably the use of stone paved tracks (Figure 2.3) and the spiritual aspects of the terraces, with their ritual features such as sacred trees.

In 1999, ICOMOS, an advisory body to the WH Committee, recommended listing the property on the WH List on the basis of criteria (iii), (v), and (vi), as follows:

- **Criterion (iii)** - Sukur is an exceptional landscape which graphically illustrates a form of land-use that marks a critical stage in human settlement and its relationship with its environment.
- **Criterion (v)** - The cultural landscape of Sukur has survived unchanged for many centuries and continues to do so at a period when this form of traditional human settlement is under threat in many parts of the world.
- **Criterion (vi)** - The cultural landscape of Sukur is eloquent testimony to a strong and continuing cultural tradition that has endured for many centuries.

The WH Committee adopted the Retrospective Statement of Outstanding Universal Value (SOUV) for Sukur Cultural Landscape in 2013 (Appendix 1).

Prior to the CVI workshop in Yola, key excerpts from the Sukur SOUV were identified and grouped together in a tabular form to develop a list of 'key values' (see Table 2.1).

The six key values derived from the SOUV are:

- exceptional cultural landscape;
- ancient settlement that still flourishes;
- Hidi spirituality;
- traditional Indigenous architecture;
- cultural continuity/living culture;
- iron smelting technology.

These 'key values' were the basis for the heritage vulnerability assessments made throughout the CVI process as they reflect the detail behind the OUV (Figure 2.5). Excerpts from the SOUV and examples of the attributes (tangible and intangible) associated with these key values are provided in Appendix 2.

Figure 2.4 *Megalithic throne room on ceremonial area (Patla). Nov 1992.*
© Nicholas David

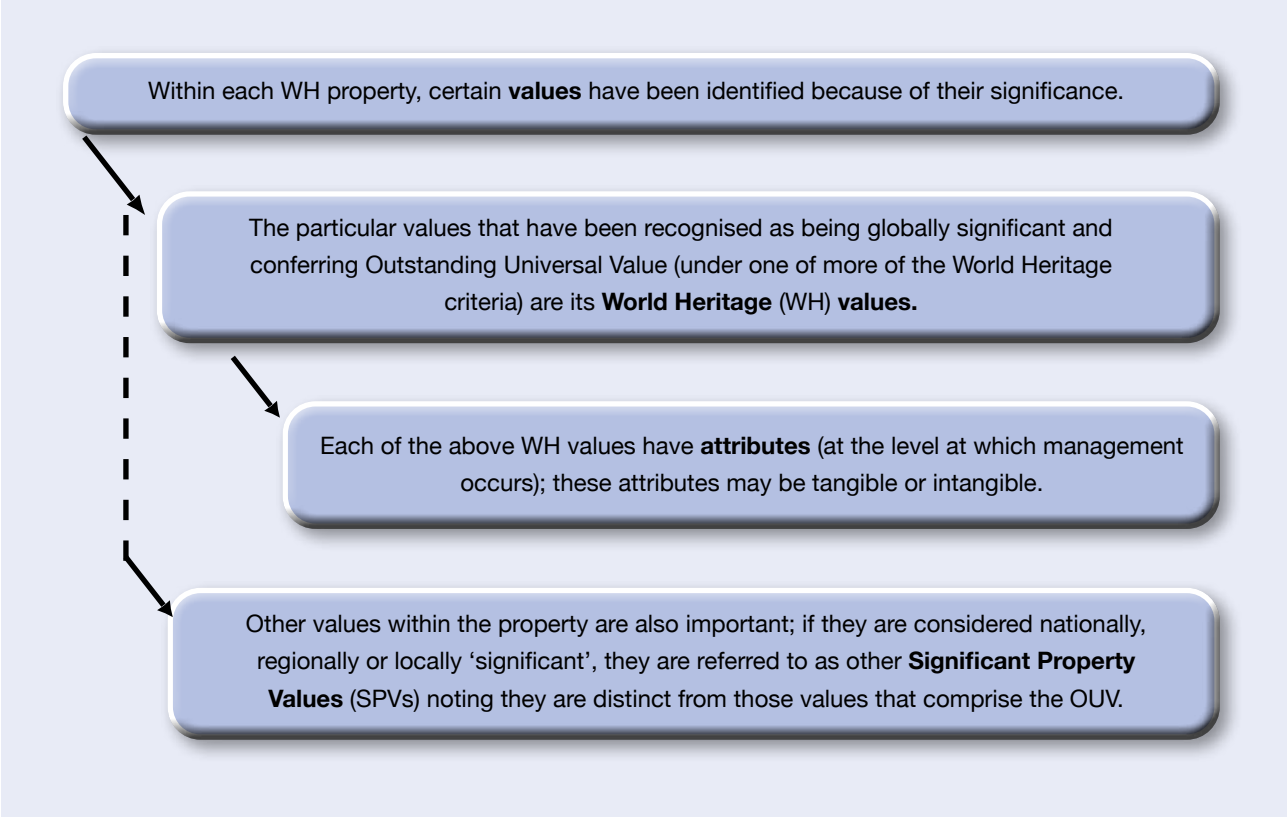


Figure 2.5 Hierarchy of World Heritage terminology as used in this CVI assessment *(after Fig. 2.2 of Heron et al. 2020)*

2.4 Other Significant Property Values

In addition to the values that are within the SOUV, there are other values that are not considered in the SOUV but are of significance at a local, regional and/or national level (Figure 2.5). These are termed other Significant Property Values (SPVs). Climate change also impacts these other SPVs, examples of which may be categorised as:

- other cultural aspects, especially intangible characteristics (such as stories, legends);
- archaeological or historic locations/features;
- special species of fauna or flora;
- social or economic values: tourist site, modern cultural significance;
- tangible features: key locations, scenery;
- intangible features: aesthetics, serenity, special sounds.

A list of other SPVs that are locally, regionally or nationally significant for Sukur Cultural Landscape was developed prior to and during the workshop (Appendix 3).

2.5 Managing the World Heritage property

The Sukur Cultural Landscape is managed as a WH property through a participatory management framework comprising of the three tiers of the Nigerian government – Federal, State and Local – and the Sukur community, represented by the Hidi and District Head of Sukur. At the Federal level, the property is a national monument declared under the aegis of the National Commission for Museums and Monuments (NCMM) Act, Cap 242 of 2000 (formerly Decree No 77 of 1979) and the subsequent legal authority of the Adamawa State Government (Gazette No. 47 Vol. 7, 20 November 1997), and the written consent of the Hidi-in-Council, responsible for customary law and traditional practices of the Sukur people.

The Sukur Management Committee was established and inaugurated by the Minister of Culture, Tourism and National Orientation in 2010. Its primary responsibility is to harmonise the collective responsibilities of managing the property as WH by the key stakeholders. This collaboration was formalised within the cyclical conservation management plans that have since been developed for the property (1999-2004; 2006-2011; 2012-2016; 2017-2021). The management plans clearly outline the roles and responsibilities of the different tiers of government, as well as the traditional custodians of the property, along with guiding principles for site conservation, promotion and management. The NCMM represents the Federal Government on the management committee and is also the State Party's focal agency responsible for the implementation of the 1972 WH Convention in Nigeria. Together, the various partners ensure proper protection and conservation of all the attributes that convey the OUV for which the property was inscribed.

The 2019 State of Conservation report by the State Party (NCMM 2019) provides the most recent summary of the state of the conservation of the values and attributes for the property. Several restoration works have been carried out using traditional construction materials and methods. Along with festival sites and other sacred places, the Hidi Palace complex is properly maintained because of its continuous usage and relevance in the community lives of Sukur people. Domestic farmlands are developed and maintained with the creation of agricultural terraces adapted to hill farming. The age long tradition of communal labour is still used to maintain paved walkways, gates, water sources, graveyards, and homesteads. It is hoped that the results of the CVI will feed into subsequent conservation management plans and periodic reporting.

2.6 Evaluation of current condition and recent trend of the key World Heritage values

During the workshop, an assessment of the current condition and recent trend (since the year of inscription, 1999) of the key values was undertaken (Table 2.1). This provides a benchmark for the WH property and also helped the workshop participants to understand the list of key values and attributes.

Table 2.1 Current condition and recent trend of the key values for Sukur Cultural Landscape since its inscription in 1999
(as assessed during the CVI workshop, September 2021)

Key values	Excerpts taken directly from the Statement of OUV	Attributes for each key value	Current condition and recent trend
exceptional cultural landscape	hilltop settlement ... at an elevation of 1045 m characterized by terraces on the farmlands, dry stone structures and stone paved walkways terraced landscape at Sukur with its hierarchical structure and combination of intensive and extensive farming is remarkable graphically illustrates a form of land-use that marks a critical stage in human settlement and its relationship with its environment certain exceptional features that are not to be found elsewhere, notably the use of paved tracks villages situated on low lying ground below the Hidi Palace	**Tangible attributes** • dry stone structures • stone terraces • stone paved walkways **Intangible attributes** • cultural landscape	→
ancient settlement that still flourishes	ancient settlement with a recorded history ... flourishing trade, and strong political institution dating back to the 16th century The traditional terraced system of agriculture and its associated ritual systems are still flourishing Within the compound are pens where domestic animals such as cattle and sheep are fattened, either for consumption by the family or for use as prestige and status symbols used in gift and marriage exchanges cultural landscape of Sukur has survived unchanged for many centuries, and continues to do so at a period when this form of traditional human settlement is under threat in many parts of the world key features of the cultural landscape have not been significantly modified since they were laid down maintained since that time has been in traditional form using traditional materials and techniques	**Tangible attributes** • Intensive farming practices (e.g., animal pens) • Extensive farming practices (e.g., terraces) **Intangible attributes** • Ritual systems • Cultural landscape that has survived unchanged for centuries	→
Hidi spirituality	the spiritual content of the terraces, with their ritual features such as sacred trees. revered position of the Hidi as the political and spiritual head of the community is underscored by the magnificent dry stone architectural work of his palace, ... around which is a concentration of shrines, some of which were ceramic eloquent testimony to a strong and continuing spiritual and cultural tradition that has endured for many centuries. Along with shrines and other sacred places, the Hidi Palace Complex is properly maintained because they are currently in use.	**Tangible attributes** • Hidi Palace • Sacred trees • Shrines (some ceramic) **Intangible attributes** • Ritual systems • Spiritual and cultural traditions	→
traditional Indigenous	notably the use of paved tracks characteristic indigenous architecture dry stone walls, used as social markers and defensive enclosures, sunken animal (principally bull) pens, granaries, and threshing floors mud walled thatched roofed houses are integrated by low stone walls Of considerable social and economic importance are the wells. .... below-ground structures surmounted by conical stone structures and surrounded by an enclosure wall	**Tangible attributes** • Paved tracks • Dry stone walls • Sunken animal pens • Thatched roofed houses • Below ground wells **Intangible attributes** • Social and economic importance of wells	↘
cultural continuity/living	eloquent testimony to a strong and continuing spiritual and cultural tradition that has endured for many centuries The cultural components are still actively present among the community since they are part of their living culture The regular observance of festivals and ceremonies are evidence of cultural continuity. Annual restoration work has been carried out using traditional construction materials The age long tradition of communal labour is still used to maintain paved walkways, gates, graveyards, homesteads and house compounds. eloquent testimony to a strong and continuing spiritual and cultural tradition that has endured for many centuries	**Tangible attributes** • Festivals • Ceremonies • Communal labour • Traditional construction materials (e.g. thatched roofs) **Intangible attributes** • Spiritual and cultural traditions • Cultural continuity	→
iron smelting technology	a recorded history of iron smelting technology remains of many disused iron-smelting furnaces shaft-type furnaces, blown with bellows, were usually sited close to the houses of their owners Iron production involved complex socio-economic relationships and there was a considerable ritual associated with it.	**Tangible attributes** • Remains of iron-smelting structures **Intangible attributes** • Complex socio-economic relationships	↘

Legend for Table 2.1: **Recent trend** → STABLE ↗ IMPROVED ↘ DETERIORATED ? UNKNOWN

Current condition

Rating	Criteria
Good	The site's values are in good condition and are likely to be maintained for the forseeable future, provided that current conservation measures are maintained.
Good with some concerns	While some concerns exists, with minor additional conservation measures the site's values are likely to be essentially maintained over the long-term.
Significant concern	The site's values are threatened and/or may be showing signs of deterioration. Significant additional conservation measures are needed to maintain and/or to restore values over the medium to long term.
Critical	The site's values are severely threatened and/or deteriorating. Immediate large scale additional conservation measures are needed to maintain and/or restore the site's values over the short to medium-term or the values may be lost.

3

THE CURRENT CONTEXT FOR SUKUR

Overview of the architecture of Sukur landscape
© Oise Ayeni

3. The Current Context for Sukur

3.1 Social and cultural context

The Sukur Cultural Landscape is an 'organically evolved landscape'[1] that faithfully reflects the social structure, religious beliefs, and economic base of the society that created it centuries ago and continues to live within it. The settlement and landscape of Sukur are representative of the traditional societies of this region of West Africa. Sukur is a remarkably intact physical expression of a society and its spiritual and material culture. The cultural landscape is an unusual symbiotic interaction between nature and culture, both past and the present, exemplifying unique spiritual and physical resilience and adaptive skills of an African people.

The landscape contains remnants of a past that continues to influence contemporary Sukur society with the strong symbols of the social and cultural organisation of its people. An example of this is clearly demonstrated through the location of the palace of the Hidi – or chief – who embodies spiritual and political authority on Sukur. His palace is located in an elevated position overlooking the mass of the people in their low-lying villages. Complex social relationships can be observed in the disposition of the cemeteries across the landscape, whilst the relationships between iron furnaces and settlements and within the agricultural terraces illustrate an elaborate economic pattern of production and distribution.

A key component that defines the Sukur Cultural Landscape is its intangible heritage. This comprises activities at the shrines, rituals, festivals and ceremonies. Associated with these are knowledge, memory, beliefs, and norms and values that are associated with human adaptation to the hill terrain. These are conveyed through language, music, dance and performances.
The population of Sukur is said to have increased significantly over the past two decades and – in the absence of any formal census – was estimated as between 15,000 and 16,000 inhabitants in September 2021.
According to community members that attended the CVI workshop, this number includes nearly 1,000 Internally Displaced Persons (IDPs) fleeing from insurgency attacks in neighbouring areas.

Sukur society is organized along clan lines. Belonging to a clan is critical to Sukur identity as clan membership bestows critical rights and obligations, including those related to marriage and access to a means of subsistence. Clans are also an important feature of the support systems in place for maintaining peace and mobilizing resources for important communal rites and ceremonies.

Sukur cultural life was organized around primary economic activities of iron smelting/smithing and agriculture. Smelting furnaces were also the stage for carrying out furnace sacrifices at the beginning of the smelting season. Catalysts, derived from three wild plants, were required for smelting as they were believed to have specific effects on the smelting and its products.

[1] An organically evolved landscape results from an initial social, economic, administrative, and/or religious imperative and has developed its present form by association with and in response to its natural environment. Such landscapes reflect that process of evolution in their form and component features. They fall into two sub-types: (a) a relict (or fossil) landscape in which an evolutionary process came to an end at some time in the past….; or (b) a continuing landscape which retains an active social role in contemporary society closely associated with the traditional way of life, and in which the evolutionary process is still in progress. At the same time it exhibits significant material evidence of its evolution over time. (Operational Guidelines for the Implementation of the World Heritage Convention, July 2021, paragraph 47bis.ii).

This cultural life is structured by the 13 months of the Sukur lunar landscape. Some festivals, such as the male initiation and bull festivals, are not held on an annual basis (Table 3.1).

Table 3.1 Key ceremonies/festivals at Sukur
Source: David (n.d.) http://sukur.info/Cult/cultindex.htm

Moon *(Tiya)*	Approx. month	Major Community Ceremonies	Iron smelting (in the past) & House building	Agricultural Round
1. Tiya zuŋ	April		iron smelting	begin clearing fields
2. T. bak	May			plant if enough rain
3. T. makən	June			plant, start first weeding
4. T. fwaɗ	June/July		women collect ore	1st weeding continues
5. T. dlam	July/Aug.	Initiation - ***Bər*** (26-30/8/92) (even years)	women collect ore	2nd weeding, 1st maize harvest
6. T. məkwa	Aug./Sept.	Purification - ***Zwaku*** (annual) (23/09/92)	women collect ore	2nd weeding, 1st maize harvest
7. T. maɗaf	Sept./Oct.		women collect ore	weed bean fields, clear land for next year, harvest early sorghum
8. T. təkuz	Oct./Nov.		women collect ore, cut thatching grass	harvest beans, groundnuts
9. T. mətli	Nov./Dec.	***Yama pə Patla*** 28/11/92 (annual)		start main sorghum harvest
10. T. waŋ	Dec./Jan.			harvest continues
11. T. Yawal	Jan./Feb.	Chief's festival - ***Yawal*** (20-23/2/93) (held irregularly)	men fell trees, build houses, make mats	threshing
12. T. Hən dlə	Feb./Mar.	Bull festival - ***Hən dlə*** (even years)	men cut up & pile trees, build houses, make mats; women gather firewood	threshing
13. T. Dzava da Fa	Mar./Apr.	***Dzava da Fa*** (in odd years) marriages finalized	men prepare and family transports charcoal	

3.2 Recent disruptions to the social and cultural aspects of Sukur

In December 2014, Boko Haram attacked Sukur, destroying the Hidi's palace and houses and places of worship, as well as livestock and farm produce (NCMM 2016). This attack negatively affected some attributes that convey the OUV of the property. The disturbance disrupted terrace agriculture, associated infrastructure and related cultural practices until it became safe again for residents to return. Farming and the traditional maintenance of stone terraces were also impacted by the attacks, but the community has worked hard to restore the terraces and revive traditional practices. The threat of terrorist attacks from extremist militant movements remains.

3.3 Economic context

Today, the economic options in Sukur Cultural Landscape can be categorized into climate dependent and non-climate dependent livelihoods. Climate dependent livelihoods, such as crop and livestock production are the dominant activities in the area while non-climate dependent livelihoods include petty trading and tailoring (see Figure 3.1).

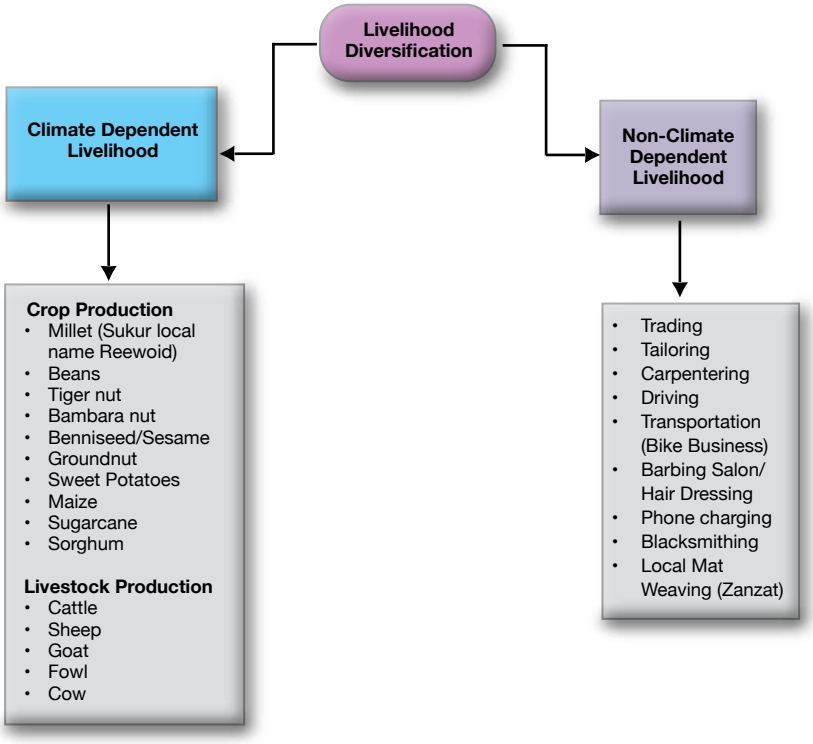


Figure 3.1 *Examples of climate and non-climate dependent livelihood areas in Sukur*

Iron industry: The iron industry, along with farming and pottery, has long been a significant part of the economy of Sukur. Sukur produced and exported iron on an industrial scale, supplying its neighbours and other groups (including the Kanuri) further north. Conservative estimates by Smith and David (1995) indicate that the annual quantity of iron exported was sufficient to manufacture over 50,000 hoes. This trade continued till the 1950s when Sukur bloomery iron was gradually replaced by imported metal and scrap. Iron was extracted from the magnetite (iron ore) that abounds on the landscape. This iron was used in the manufacture of tools and a variety of weapons, ornaments and ritual objects, and iron bars were exchanged and traded during social events such as marriages. The Hidi had ultimate responsibility for managing inter-community relations on behalf of his people, for the smooth functioning of the iron market, and for the security of the traders who came to exchange various goods for iron.

While the iron smelting has reduced significantly, iron smithing remains an important economic activity in Sukur. Smiths produce hoes, sickles, axes and cutlasses for sale for subsistence farming. During the period when iron smelting was the principal economic activity, Sukur was an importer of food produce, exchanging iron for grain, chickens and other livestock with neighbours, and for dried fish and other products with northern traders.

Agriculture: Since the decline of smelting activities from the 1950s, Sukur's agricultural activity has increased, and it has become an exporter of agricultural produce. Sukur agriculture is carried out through a terraced farming system on the landscape which helps to retain water for the cultivated plants. Crop rotation is not uncommon. Much of the agriculture within the property is at subsistence level. Crops like beans, groundnuts and sesame

seed (beniseed) are grown for external markets while crops like guinea corn, maize, millet and sweet potatoes are grown for local consumption. Chemical fertilisers are now employed, which have affected both flora and faunal diversity.

Men, women and youths participate in farming and there are no restrictions to access to farmlands; they can have their own farmlands and control the production. For animal husbandry, the people raise cattle, goats, sheep and livestock for commercial and local consumption. Up to 65% of the population are engaged in intensive cattle fattening, in sub-basement pens.

The annual family income from subsistence agriculture varies and is dependent on family size and weather conditions. Yearly incomes from farming range from ₦300,000 (approx. US$730) to ₦900,000 (approx. US$2,150). Income from cattle fattening could reach up to ₦500,000 (approx. US$1,220).

These climate-dependent agricultural activities are often affected by drought conditions when delayed rains lead to reduction in yield and reduced fodder for feeding animals. This ultimately leads to a reduction in the annual household income. Given the diversification of the Sukur economy, more research is needed to establish the relationship between the climatic conditions and impacts on household incomes.

Tourism: Prior to the December 2014 Boko Haram attack, Sukur received between 4,000 and 5,000 visitors annually. Visitors to the property fall in various categories, such as researchers, school trips and cultural tourists. Income from tourism was generated from motorbike transportation up and down the mountain, and the purchase of food and drinks from the community. Tourism has significantly decreased due to the security conditions in the northeast of Nigeria.

Transportation Services: This activity mostly involves the youth who offer motorbike transport services to convey people and goods to nearby markets in Mildu, Madagali, Tokiya and Michika.

Small businesses: Several community members supplement their income through other activities, such as tailoring, carpentry, small restaurants and barbers' salons.

Architecture: One of the attributes of Sukur is its architecture, including the unique stone-lined walk-in wells. Male children are responsible for fetching the grass for thatch roofs of the houses (Figure 3.3). If there are no children in the family, the household head will fetch the thatch. Childless widows or elderly persons organize communal work for children in their neighbourhood who help fetch thatch for them free of charge in exchange for food. Since 2009, there has been a steady increase in the use of corrugated iron sheets for roofing. This has been attributed to: (i) scarcity of grass due to over-farming and the use of chemical fertilisers; (ii) desire for change due to contemporary trends; (iii) change in lifestyle with children going to school; (iv) population pressure; and (v) overgrazing.

Figure 3.2 *The use of traditional building materials (stone structures and thatched roofs are significant features of the Sukur Cultural Landscape.*
© Dipo Alafiatayo

Figure 3.3 **Stone-lined well located in an orchard, Fa subward of Dzuvok ward (April 2008)**
© Nicholas David

4

CLIMATE AND ITS INFLUENCE ON SUKUR

Agricultural terraces of Sukur. February 2010
© Michael Thomas

4. Climate and its influence on Sukur

Climate is a key factor that governs human comfort, food production and inter-annual variabilities in socioeconomic and environmental systems. Climate change has the potential to significantly impact the Sukur Cultural Landscape. Desertification is of regional importance, linked to low rainfall, high temperature and biodiversity loss. These factors negatively impact the conservation and preservation of WH values and attributes. Here, we present an overview of historical and projected climate conditions.

4.1 Data sources and methods

Historical data were obtained from the Adamawa State University, Mubi, approximately 60 km to the south and west of Sukur. These data included monthly data of climate parameters of minimum and maximum temperature (°C), wind speed (m/s), precipitation (mm) and relative humidity (%).

Seasonal patterns and trends were investigated within the time domain specific to each dataset: minimum and maximum temperature, 1987-2019; wind speed and relative humidity, 1987-2017; and rainfall, 1987-2016.

Mid-century and end-of-century projected climate scenarios for Adamawa State were drawn from the World Bank's Climate Change Knowledge Portal (CCKP). Model output from the Coupled Model Intercomparison Project Phase 6 (CMIP6) were examined, as used in the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6; IPCC 2021, 2022). Different projected emission scenarios that incorporate various global emissions and global policy directions (such as Shared Socioeconomic Pathways, SSPs) each include multi-model ensembles to represent the range and distribution of projected outcomes. Model projections were available at a grid resolution of 1° × 1° (~100 km x 100 km). The historical reference period for CMIP6 projections is 1995-2014.

4.2 Current climate

Sukur is located at a relatively high altitude (1045 m) and has a tropical continental climate characterized by strong seasonality and influence from the nearby Sahel region. Daily-maximum air temperature is seasonally highest in February at nearly 40°C, compared with around 28°C in August (seasonality shown in Figure 4.1). The warmest months (February-May) nearly coincide with the period of highest winds (December-March) for which the long-term monthly average speed peaks at 3 m/s in February, contrasting with typically low winds in October (~1.8 m/s; Figure 4.1). Rainfall is highly seasonal – the wet season begins in April, peaking in August and ending in late October, while the dry period from November to March typically has zero (or near-zero) rainfall. This aligns with the seasonality in relative humidity, which peaks above 80% during the wet season and drops below 20% during the dry season.

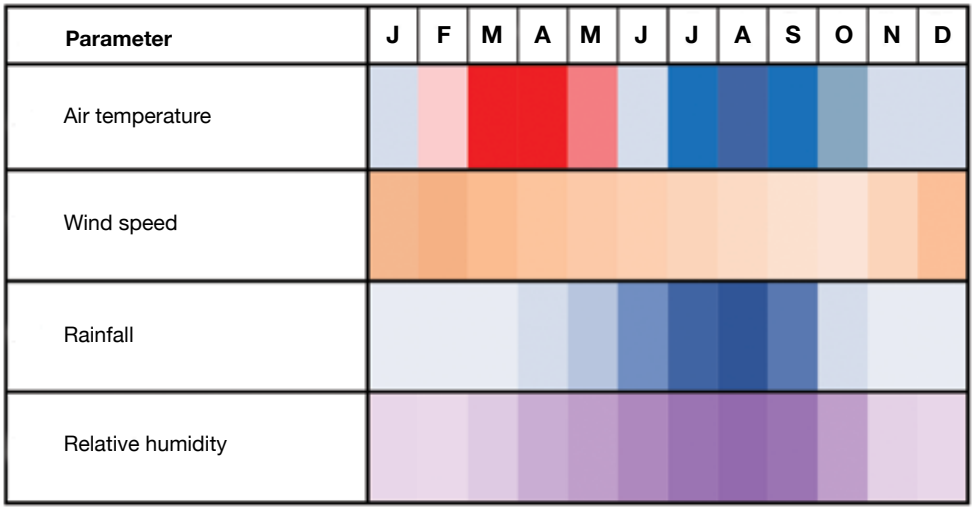


Figure 4.1 *Seasonal variation in climate variables for the region around Sukur. Darker shades indicate higher values of each parameter, except temperature for which the deepest red and blue shades indicate the warmest and coolest, respectively.*

4.3 Observed climate trends

Temperature: Annual average of daily-maximum temperature ranged 28-37°C and decreased during the period analysed (1987-2019, though not significant statistically). Daily-minimum temperature also declined, though also not significantly. The coldest years in the record occurred since 2015. Long-term average daily-maximum and daily-minimum temperatures were 34.4°C and 18.7°C, respectively. There appears to be no consistent pattern in rainfall variation with phases of El Niño/ Southern Oscillation (ENSO) – four of the 10 hottest years (1998-2007) coincided with El Niño events and two with La Niña conditions.

Wind: Annual-average wind speed decreased by approximately 10% during the 31-year period analysed. Annual wind speeds during 2011-2014 (1.8 m/s) were distinctly lower than other years in the record (typically around 2.5 m/s).

Rainfall: Annual rainfall at Adamawa State University, Mubi ranged from 200-1000 mm with a long-term average of 455 mm and no significant trend during the period analysed (Figure 4.2). For crops to thrive at least 455 mm should fall during the growing season for most of those cultivated in the region. The dry season accounted for only 13 mm of rainfall, on average. There was no significant trend in the number of rainy days (>0.2 mm) annually or seasonally. There appears to be no consistent pattern in rainfall variation with ENSO phases – El Niño periods are associated with both drier and wetter conditions, while La Niña may be most-associated with drier conditions.

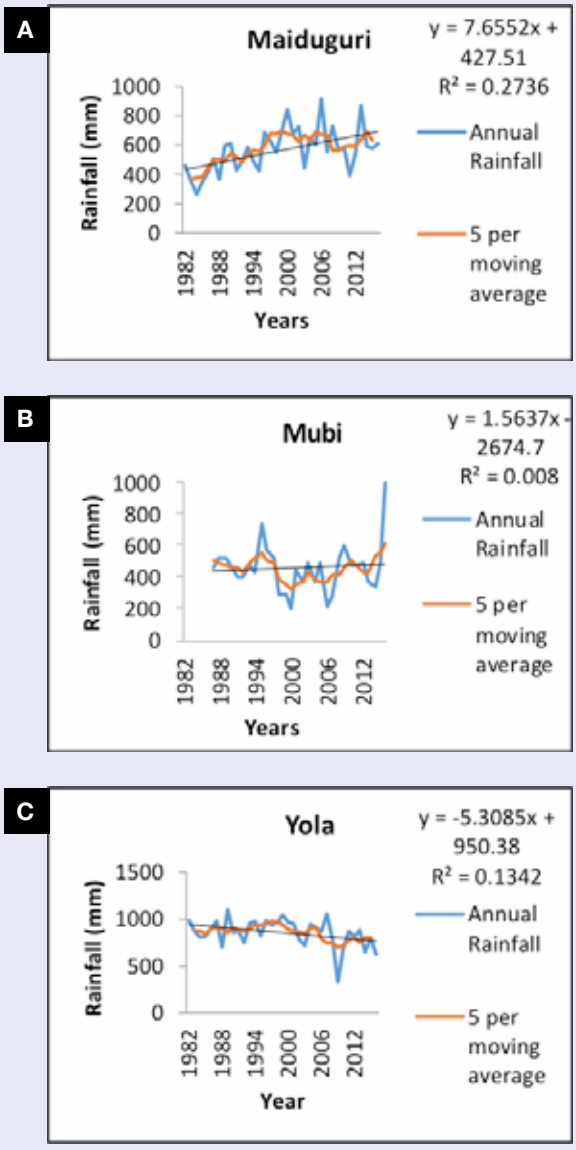


Figure 4.2 *Annual rainfall, five-year averages and trends from (A) Maiduguri [130 km north and west of Sukur], (B) Mubi [60 km south and west of Sukur] and (C) Yola [200 km southwest of Sukur]. Panels A and C are Figures 16 and 21 from Ezra et al. (2020); panel B data from Adamawa State University, Mubi*

Annual rainfall had no significant trend over the length of the Mubi dataset that is closest to Sukur Cultural Landscape. There is however, the potential for spatial variability in rainfall, which may influence livelihoods or physical structures at the Sukur Cultural Landscape. An indication of the spatial variability is provided by including rainfall data from two other northern Nigeria stations, Maiduguri and Yola (Figure 4.2; Ezra et al. 2020). Maiduguri, approximately 130 km to Borno State, had six consecutive dry spell years and was among the northern Nigeria stations investigated by Ezra et al. (2020) with the longest multi-year drought. Yola, the capital of Adamawa State (located approximately 200 km southwest of Sukur), experienced the most severe drought year among the northern Nigeria stations investigated (Ezra et al. 2020). An analysis of the western Sahel region, which includes the region around Sukur Cultural Landscape, found a tendency for rain events being more intense in the early 2000s than in the decades immediately prior (Panthou et al. 2014).

Relative Humidity: Annual-average relative humidity was very stable during the period analysed with a long-term mean of 45% (range: 36-50%). Humidity was lower than average during 1998-2007, coinciding with the 10 hottest years in the record. As with other variables, there is no consistent pattern with ENSO phases.

4.4 Anticipated climate change

Climate projections related to temperature and rainfall for mid-century (2040-2059) and end-of-century (2080-2099) were evaluated for Adamawa State. Two climate scenarios were examined: (i) SSP2-4.5, which is an intermediate scenario in which reductions in greenhouse gas (GHG) emissions lead to a stabilisation of climate forcing by the end of this century; and (ii) SSP5-8.5, which is a high emissions scenario in which GHG emissions and atmospheric concentration continues to increase. Values cited for each scenario and time period reflect the median among a multi-model ensemble.

In addition to considering climate variables (e.g. temperature, rainfall), projections of extreme conditions can be useful indicators, especially if extreme events that are currently rare become more frequent.

It is important to note that the CCKP projections for Adamawa State serve as a regional reference. Comparisons of modelled climate projections with observations in the Sukur region (Mubi, reported previously) must be made with caution given the difference in spatial representations of these (1° × 1° model grid and measurement at a single point, respectively). This spatial difference also needs to be considered when interpreting broad-scale climate projections for Sukur.

Temperature: Modelled annual average of daily-maximum temperature for Adamawa State (Figure 4.3A) was 33°C in the reference period (1995-2014), lower than the point measurements from Mubi described previously (34.4°C, 1987-2019). As such, future projected temperature is considered here as differences from the model reference period (rather than absolute values) to inform future conditions that may be relevant for Sukur. By mid-century, daily-maximum temperature for Adamawa State is projected to be 1.1°C (SSP2-4.5) to 1.4°C (SSP5-8.5) warmer than the historical reference period (Figure 4.3A). By the end-of-century, the daily maximum is projected to increase from the reference period by 2.0°C (SSP2-4.5) to 3.6°C (SSP5-8.5).

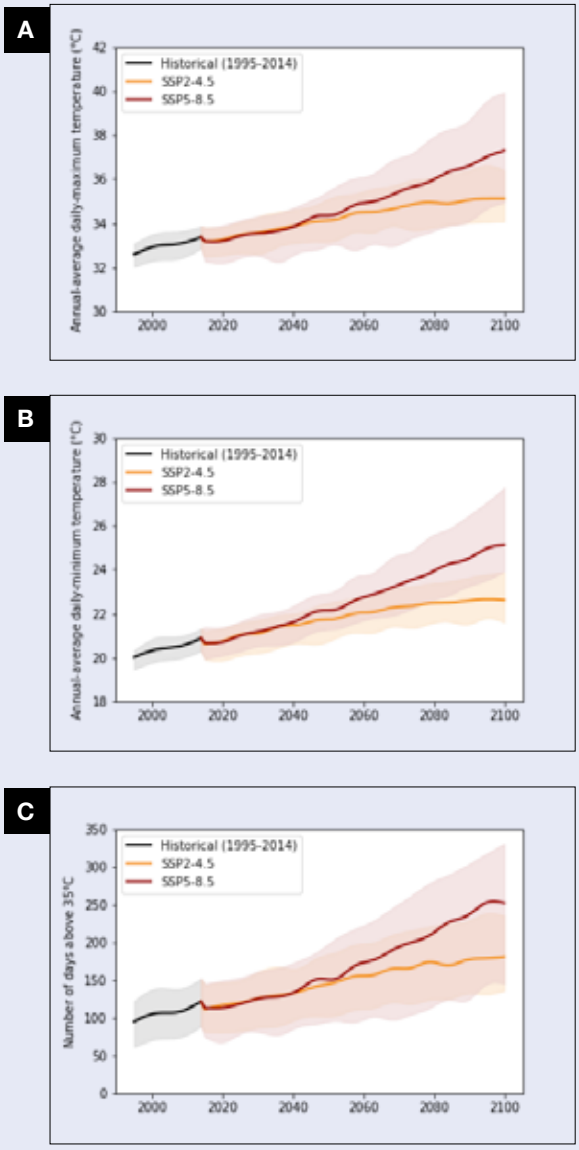


Figure 4.3 *Projected temperature metrics for Adamawa State (data from the Climate Change Knowledge Portal). (A) annual-average daily maximum; (B) annual-average daily minimum; and (C) annual number of days above 35°C.*

Annual average of daily-minimum temperature for Adamawa State during the reference period was 20.4°C (Figure 4.3B), which is 1.7°C above the Mubi observations. The modelled daily temperature range is smaller than that of the observations, which is typical for model output (and including the different spatial scales). Again considering differences in projections rather than absolute values, mid-century daily-minimum temperature for Adamawa is projected to increase by 1.3°C (SSP2-4.5) to 1.7 °C (SSP5-8.5) from the reference period, whilst for the end-of-century the corresponding increases are projected to be 2.2°C and 4.1°C, respectively (Figure 4.3B).

Extreme temperature events can be evaluated using the number of days annually for which temperature is projected to exceed 35°C, which is available from the CCKP. For the historical reference period, the modelled occurrence was 107 days per year (Figure 4.3C). Mid-century projections indicate an additional 1-1.5 months of these 'hot days' per year (144 days per year, SSP2-4.5; 151 days per year, SSP5-8.5). By end-of-century, the regional occurrence is projected to be 175 (SSP2-4.5) to 236 (SSP5-8.5) hot days per year, amounting to 2-4 months more than the reference period (Figure 4.3C).

Under the high emissions scenario (SSP5.85), warmer temperature and increased number of hot days could have consequences for people's health, livestock, and vegetation, especially during the dry season.

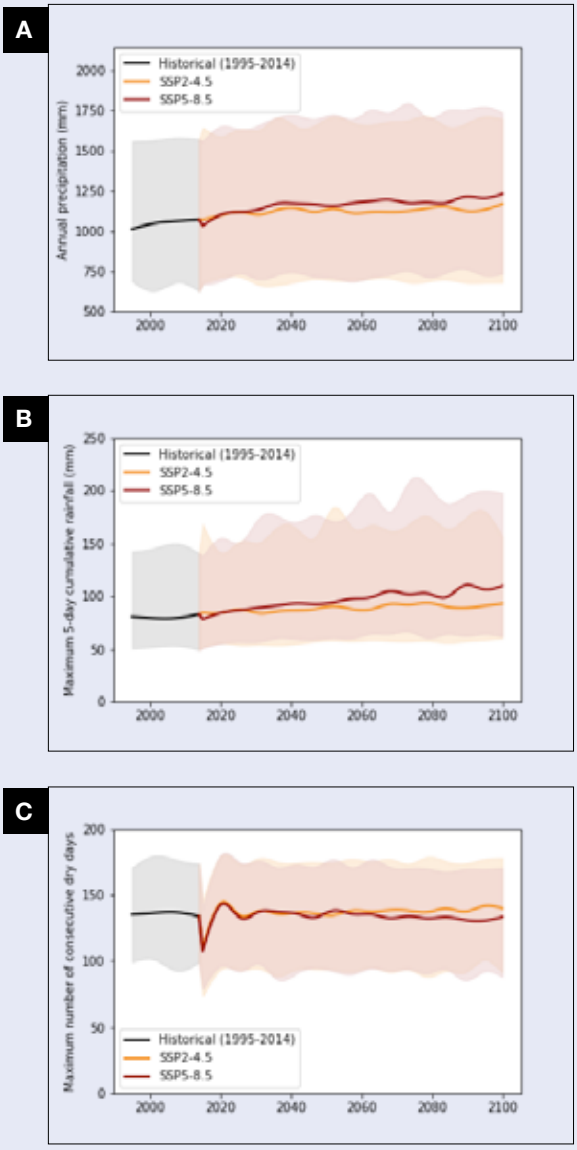


Figure 4.4 *Projected rainfall metrics for Adamawa State (data from the Climate Change Knowledge Portal). (A) annual precipitation; (B) annual maximum 5-day cumulative rainfall; and (C) annual maximum number of consecutive dry days.*

Rainfall: Modelled annual precipitation for Adamawa State (Figure 4.4A) was 1052 mm in the reference period (1995-2014), more than twice the observation from Mubi reported previously (455 mm, 1987-2016). Similar to temperature, changes in future projections from the model reference period are considered here (rather than absolute values) to inform what the future conditions may be for Sukur. By mid-century, precipitation for Adamawa State is projected to be 7-11% greater than the historical reference period (Figure 4.4A; 1129 mm, SSP2-4.5 and 1168 mm, SSP5-8.5, respectively). By the end-of-century, the projected rainfall increase from the reference period is 8-14% (1141 mm, SSP2-4.5 and 1201 mm, SSP5-8.5, respectively).

Extreme rainfall events can be evaluated by considering changes to the cumulative total in the wettest 5-day period each year (for heavy extremes; Figure 4.4B) and using the maximum number of consecutive dry days annually (an indicator for drought; Figure 4.4C), each of which are provided in the CCKP suite. The average largest 5-day cumulative rainfall from the historical reference period was 80 mm; the range of mid-century projected values (88 and 94 mm for SSP 2-4.5 and 5-8.5, respectively) reveal a slight increase on the same order of magnitude as the projected increase in annual precipitation (10-17%; Figure 4.4B). The end-of-century projections (90 and 105 mm for SSP 2-4.5 and 5-8.5, respectively), suggest a greater increase in rainfall during heavy rain events under the high emissions scenario. In contrast, the maximum number of consecutive dry days each year was projected to be consistent across the three time periods (Figure 4.4C) – 136 days historically and for mid-century under both climate scenarios, with end-of-century durations of 140 days (SSP2-4.5) and 132 days (SSP5-8.5).

4.5 Possible impacts of anticipated changes on the Sukur Cultural Landscape

Increased temperature could affect the distribution of flora and fauna that are not able to adapt, and locals and tourists may experience discomfort. This may limit activities during the day and affect sleep patterns at night. Warmer conditions may also increase pressure on water resources.

Changes in and variability of rainfall could also affect the environment and community. Periods of reduced rainfall could negatively impact ecosystem diversity or lead to changes in the migratory patterns of some birds and other wildlife. In contrast, years with high rainfall may render the roads leading to Sukur unusable and the area inaccessible, affecting locals as well as reducing tourism. Furthermore, runoff during periods of heavy rainfall could result in crop damage or destruction, although the continued practice of terrace farming could slow runoff and mitigate impacts, particularly from erosion. Increased rainfall variability from year to year may affect other agricultural practices.

Figure 4.5 *Threshing grain. February 2006.*
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5

APPLYING THE CLIMATE VULNERABILITY INDEX TO SUKUR

Sukur Cultural Landscape. 2021.
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5. Applying the Climate Vulnerability Index to Sukur

5.1 Background

The Climate Vulnerability Index (CVI) is a systematic and rapid assessment tool. It can be applied to assess the impacts of climate change upon all types of WH properties, considering the OUV and the associated 'community' (local, domestic, and international).

The CVI framework builds upon the vulnerability framework approach described in the 4th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). The Community Vulnerability component of the CVI, however, is an integral and fundamental component, and is one key aspect that distinguishes the CVI from the IPCC and other risk assessment approaches. A more detailed outline of the CVI methodology is provided by Day et al. (2020).

The foundation for the CVI process is the Statement of OUV for a property (Appendix 1), from which key WH values are summarised (Table 2.1). The key climate stressors most likely to impact the key attributes are identified for a defined and agreed time scale (e.g., by 2050) from a list of possible stressors (Table 5.1).

The first phase of the CVI process (assessing the OUV Vulnerability) is determined by assessing the exposure, sensitivity and adaptive capacity (Figure 5.1) with respect to three chosen key climate stressors. The OUV Vulnerability then becomes the exposure term to assess the vulnerability of the community associated with the property (the second phase), combining with assessments of economic-social-cultural dependency (sensitivity) and adaptive capacity.

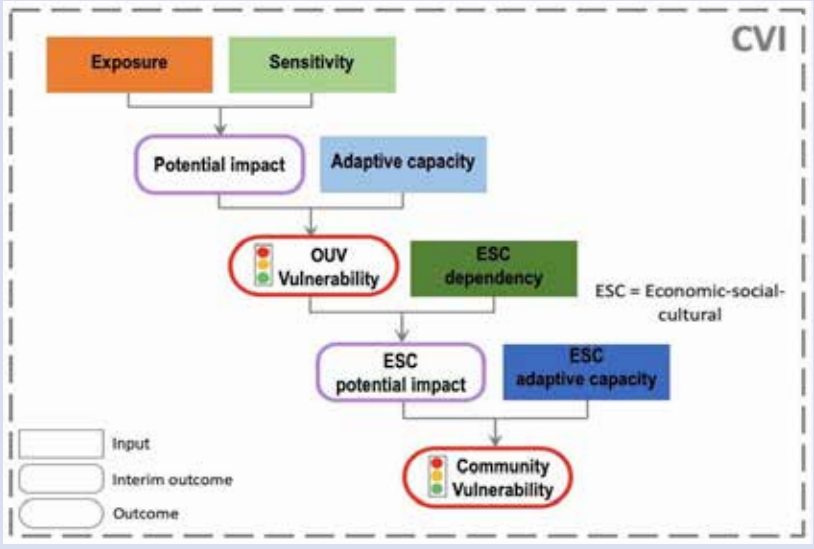

Figure 5.1 *The CVI framework used to undertake rapid assessment of climate change vulnerability of World Heritage properties and the associated community.*

5.2 The CVI process for Sukur

The CVI methodology was undertaken for Sukur during a workshop conducted 19th-24th September 2021. The 20 workshop participants who attended the workshop at the American University of Nigeria (AUN) in Yola came from a range of backgrounds (see Appendix 4); seven of whom are Sukur community members, a past and current Sukur site manager, and several who had visited Sukur in the past.

Due to the prevailing global COVID pandemic in 2021, this was a 'blended workshop' which meant that designated workshop participants gathered together at AUN while facilitators and coordinators joined in by Zoom from around the world.

During the workshop, participants confirmed the key values and attributes for Sukur (Appendix 2) that had been derived from the Statement of OUV (Appendix 1); participants also identified other SPVs (Appendix 3).

Information was presented during plenary sessions and discussions

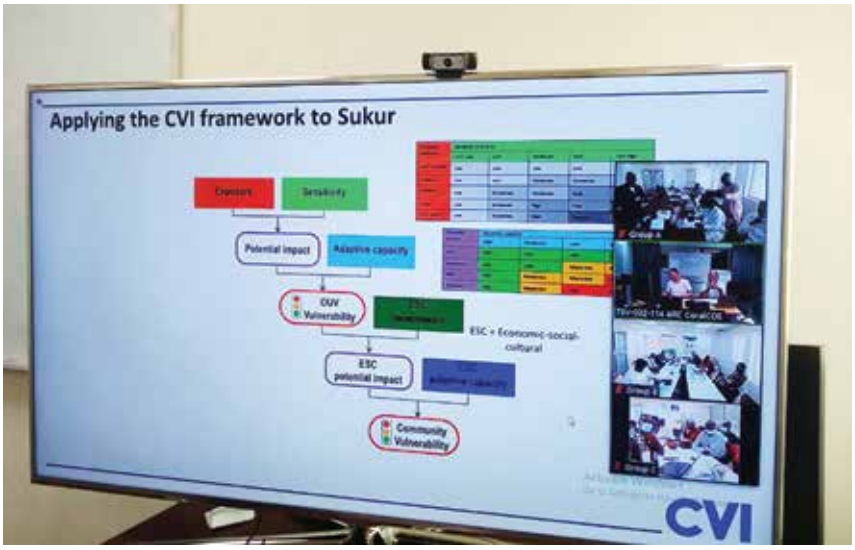

Figure 5.2 *Deliberations and groupwork at the Yola Workshop*
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conducted. Three breakout groups were tasked to undertake assessments – OUV economic, social and cultural assessments – for the various components. The assessed outputs were reported back to subsequent plenary sessions for synthesis which then led to the final outcomes. A customised spreadsheet-based worksheet was used to determine outcomes based on participants' inputs.

Those in Yola were present for 5.5 full days of the workshop (see workshop agenda, Appendix 5). The time difference between Nigeria and Australia, however, meant the online facilitators (in Australia) were only able to join the workshop during Nigerian mornings (8:30am -12:30pm in Nigeria = 5:30pm-9:30pm in Australia). This format required the workshop participants to undertake preparatory reading and watch pre-recorded videos prior to each facilitated session; participate in discussions and other group items in the afternoons in preparation for the following morning; and complete online surveys that introduced workshop topics undertaken subsequently.

Table 5.1 *The CVI framework used to undertake rapid assessment of climate change vulnerability of World Heritage properties and the associated community.*

	Climate Stressor	Synonyms and associated terms	Examples of physical impacts	Examples of social/cultural impacts	Timeframe
Temperature	Temperature trend (air and/or water)	warming; hotter than average weather; sea surface temperature (sst),	wildfires, spread of invasives, elevation shifts (flora/fauna), changes in migration, earlier flowering of plants; increased evaporation; ocean warming; desiccation	deterioration of art sites, changes in disease transmission; increase in communicable disease (eg. bacterial diarrhoea); impacts on diet if reliance on native animals or food plants (eg turtle eggs)	Gradual/slow/ chronic change
	Extreme temperature events	heatwaves, bleaching; hot spell,	coral bleaching, seagrass die-off, marine heatwaves; increased wildfire intensity, loss of wetlands, fish kills	health impacts (heat stress), greater reliance on air conditioning; damage to infrastructure (power, transport, water); harder for students to concentrate; impacts on elderly and labour productivity;	Sudden/abrupt/ acute events
Water cycle	Precipitation trend	rainfall; rainstorms; showers; drizzle; heavy dew; hailstorms	increases in arboviruses becoming the most common type of disease	increase in mosquito-borne diseases (eg dengue) as well as water- and foodborne infectious diseases (eg. salmonella); increase rates of melioidosis (associated with mud and pooled surface water).	Gradual/slow/ chronic change
	Intense precipitation events	rainstorms, tropical cyclones, storminess; extreme rainfall; downpour		damage to houses and infrastructure (roads/bridges); livestock drowning; landslides; increase in injuries,	Sudden/abrupt/ acute events
	Flooding (fluvial, pluvial)	runoff; soil absorption; flash flood; intermittent waterways	flash flooding can damage buildings, water supplies, telecommunication & transport infrastructure; impacts on access to/from remote communities;	water contamination from sewage and other wastes (e.g. giardia); increased anxiety, distress, and depression	Sudden/abrupt/ acute events
	Drought (severity, duration, frequency)	aridity; dehydration; below average rainfall, prolonged water shortage; low soil moisture	greater wildfire intensity, ecosystem decline, river flow, soil moisture; slower recharge speed for groundwater supplies, fauna mortality	physical and mental health issues; changes to growing season for crops/bush tucker; higher dust levels; increased risk of bushfires, reductions in quality and supply of food and drinking water (contamination/loss)	Gradual/slow/ chronic change
Wind & Storms	Mean wind trend	gale; wind gusts; change in wind direction	increase in wildfire intensity, storm damage, wave-associated coastal erosion, severe dust storms	coastal infrastructure damage, health problems (dust, pollution) leading to hearing, eyesight, respiratory issues	Gradual/slow/ chronic change
	Storm intensity and frequency	tropical cyclone; hurricane; tornado; storminess, extreme rainfall; lightning strikes	more intense and destructive cyclones; cyclones strengthening more rapidly but moving more slowly	less warning of impending cyclones; more sustained wind damage over longer periods (fallen trees; repairs to infrastructure; fishers caught out at sea)	Sudden/abrupt/ acute events
Coastal	Sea level rise (trend)	flooding; subsidence; post-glacial rebound;	sea level rise; coastal vulnerability; impacting water potability and ability to support a freshwater ecosystem	gradual inundation of burial sites or sacred sites; inability to maintain the health of land and sea country; encroachment by brackish water	Gradual/slow/ chronic change
	Coastal flood	coastal inundation, nuisance flooding;	coastal flooding, saltwater intrusion	sudden inundation of burial sites or sacred sites; impacts on physical and mental health	Sudden/abrupt/ acute events
	Storm surge	storm foods; storm tides; coastal flooding; cyclones; hurricanes	extreme erosion, wildlife stranding (e.g. dugong/ turtle)	property damage, infrastructure impacts	Sudden/abrupt/ acute events
	Coastal erosion	wave action; accretion; deposition.	sediment transport, wave action causing accretion or deposition	community displacement	Gradual/slow/ chronic change
	Changing currents	ocean circulation; ocean dynamics; ocean conveyor-belt	altered ocean patterns; changes in species distribution	impacts on availability of some species?	Gradual/slow/ chronic change
Context-specific	e.g., Ocean acidification	change in ph; acidity; ocean chemistry; chemical reaction	changes in calcification rate (e.g. loss of shell thickness)	some traditional foods (shellfish) less healthy	Gradual/slow/ chronic change
	e.g., Wildfire risk	bushfire; forest fire	change in fuel moisture content; increased flammability	fires impacting areas never previously burnt; respiratory problems from smoke; reduction in natural filtration due to loss of vegetated catchment leading to algal blooms (affecting taste, odour and toxins)	Sudden/abrupt /acute events

5.3 Key climate stressors

Prior to the workshop, the Steering Committee agreed to exclude, from the list of 15 typically considered in the CVI process (Table 5.1), the climate stressors related to coastal areas, snow and ice, as these were not relevant to the WH property. A list of eight climate stressors was thus provided to participants at the workshop. Workshop participants analysed those likely to have the most impact on each of the key values of OUV (Table 2.1). The time scale selected by the workshop to consider impacts was ca. 2050. The climate stressors appearing in the top three for each value (including equal-third) were used to rank the stressors (Table 5.2; Figure 5.2). From this, the three climate stressors assessed as likely to have the greatest impact on the OUV for Sukur were determined as:

- Drought (severity, duration, frequency);
- Temperature trend (air and/or water); and
- Storm intensity and frequency.

Table 5.2 *Climate stressors identified as likely to have the greatest impact for each of eight attributes of OUV. Marked cells indicate that the climate stressor was in the top three responses (including equal-third) for each key value. Stressor impacts were assessed for ca. 2050.*

Key values of OUV	Temperature trend (air and/or water)	Extreme temperature events	Precipitation trend	Intense precipitation events	Flooding (fluvial, pluvial)	Drought (severity, duration, frequency)	Mean wind trend	Storm intensity and frequency
	Climate stressors							
Exceptional cultural landscape	X	X				X		X
Ancient settlement that still flourishes	X	X	X			X	X	X
Hidi spirituality	X					X		X
Traditional Indigenous architecture	X	X	X	X		X	X	X
Cultural continuity/living culture	X					X		X
Iron smelting technology	X					X		X
Total	6	3	2	1	0	6	2	6

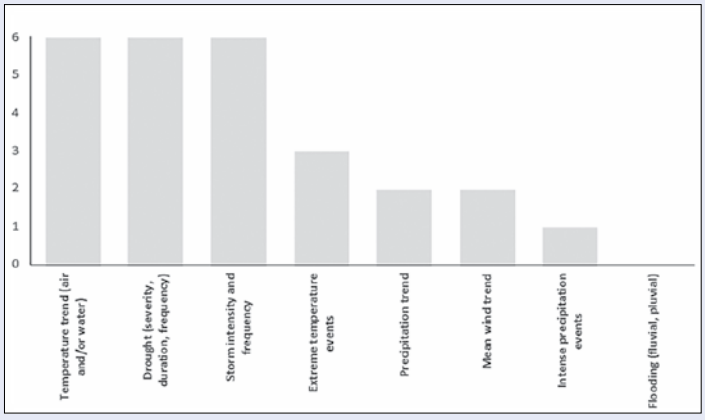

Figure 5.3 *Histogram of impacts on six key values of OUV for Sukur from eight climate stressors whose impacts were assessed for ca. 2050*

5.4 OUV Vulnerability

For the identified three key climate stressors, assessments of **exposure** and **sensitivity** of the OUV system to each stressor were undertaken using a five-point categorical scale, adapted from categories used by IPCC and IUCN analyses (see Day et al. 2020 for details). Modifiers were applied to the initial assessments to include effects of temporal scale and trend (for exposure), and spatial scale and compounding factors (for sensitivity).

The compounding factors were identified as: Boko Haram and other militant groups operating in the Sahel and its effect of an increase in the population of Sukur and the decline in tourism; and changes in agricultural practices affecting species diversity and availability of traditional materials for construction. Desertification associated with the combined effects of low rainfall and increased temperature has reportedly led to plant biodiversity loss, which has compounded losses due to increased harvesting of vegetation for construction.

The exposure and sensitivity assessments were undertaken in small breakout groups, which provided the potential for a range of responses that were then discussed in plenary to resolve the final selections.

Exposure to Drought, Temperature trend and Storm intensity and frequency were each determined as likely (67-90%, second highest category; Table 5.3). Sensitivity of OUV to Drought was determined as moderate (middle category), indicating potential for some loss of some of key WH values, whilst sensitivity to Temperature trend and to Storm intensity and frequency were each determined as low (second lowest category), indicating that loss or alteration of few key WH values will occur. Each of these assessments reflects the expectation that there will be no significant nor persistent impact on OUV. The application of the modifiers resulted in no change to the initial assessments (Table 5.3).

The **potential impact**, derived from exposure and sensitivity, was determined as high (second highest on a four-point scale, low to extreme) for Drought and moderate (second lowest) for Temperature trend and Storm intensity and frequency (Table 5.3).

Key Climate Stressors:	Drought (severity, duration, frequency)	Temperature trend (air and/or water)	Storm intensity and frequency
Exposure	Likely	Possible	Likely
Temporal scale	Periodic	Frequent	Frequent
Trend	Slow increase	Slow increase	Slow increase
Exposure	**Likely**	**Likely**	**Likely**
Sensitivity	Moderate	Low	Low
Spatial scale	Extensive	Extensive	Localised
Compounding factors	Low probability	Low probability	Low probability
Sensitivity	**Moderate**	**Low**	**Low**
Potential impact	**High**	**Moderate**	**Moderate**
Local management response	Moderate	Moderate	Low
Scientific/technical support	Low	Low	Low
Effectiveness	Moderate	Moderate	Moderate
Adaptive capacity	**Moderate**	**Moderate**	**Moderate**
OUV Vulnerability	**Moderate**	**Low**	**Low**
Combined OUV Vulnerability	**Low**		

Table 5.3 *Rapid assessment of OUV Vulnerability to identified three key climate stressors. Assessed values of exposure, sensitivity and adaptive capacity contribute to derived outcomes for potential impact and OUV Vulnerability.*

The capacity of a system to adapt to stress can mitigate (reduce) the potential impacts of that stress. Adaptive capacity of the OUV system was assessed for each key climate stressor by considering the levels of local management response and scientific/ technical support (fourpoint scale), as well as the effectiveness of these to address impacts from each stressor (fourpoint scale). For each key climate stressor, the adaptive capacity was determined to be moderate (second highest on a four-point scale, very low to high), though assessments of the individual components considered varied between the stressors.

OUV Vulnerability (three-point scale, low to high) was determined to be moderate for Drought and low for Temperature trend and Storm intensity and frequency. The combined OUV Vulnerability for Sukur Cultural Landscape was determined as Low (Table 5.3).

5.5 Community Vulnerability

Community Vulnerability is evaluated by considering the economic, social, and cultural (ESC) aspects of the community associated with the property using two metrics. Dependency reflects the extent to which the loss of WH values will affect ESC indicators in the future. These effects can be positive or negative. Separate assessments for economic, social and cultural dependency are combined to give an overall ESC dependency. Adaptive capacity reflects the current level of capacity within each component to adapt in the face of loss of WH values due to key climate stressors, and only has a positive directionality. As for dependency, separate assessments for economic, social and cultural adaptive capacity are combined to give an overall ESC adaptive capacity.

Assessments were undertaken in small breakout groups, which again resulted in a spectrum of responses for each that was resolved in plenary.

Assessed values of economic, social and cultural (ESC) dependency (sensitivity, ranging from negative to positive) and adaptive capacity contribute to derived outcomes for ESC potential impact and Community Vulnerability.

Table 5.4 *Rapid assessment of Community Vulnerability to identified three key climate stressors.*

Economic	Low-negative
Social	Moderate-negative
Cultural	Low-negative
ESC dependency	**[-] Low-negative [+]**
ESC potential impact	**Low**
Economic	Low
Social	Moderate
Cultural	Moderate
ESC adaptive capacity	**Moderate**
Community Vulnerability	**Low**

A specific scenario was provided to participants to guide assessment of likely climate change impacts on the economic, social and cultural aspects. The selected ca. 2050 scenario elements were (i) Drought: 1-5 severe droughts per decade; (ii) Temperature trend: a 1°C increase in air temperature from present conditions; and (iii) Storm intensity and frequency: at least 1-2 severe windstorms per year.

The economic component includes only economic effects on businesses that are directly dependent upon the WH property. These were grouped into six business types for assessment: Agriculture; Transportation services; Arts & crafts markets; Blacksmithing; Government and non-government activity; and Tourism. For the final assessment, workshop participants considered Agriculture (including subsistence, barter, cash crop and livestock components) to be the most important business type. Economic dependency was assessed as low-negative (i.e., a negative impact at a moderate level), whilst the adaptive capacity was low (Table 5.4).

Social indicators used to inform the assessments were considered within four categories:
Human capital; Social capital; Natural capital; and Built capital (after Costanza et al., 2007). Social dependency was considered by the workshop to be predominated by local people and this was taken into consideration for the final assessment. Social dependency was assessed as moderate-negative, whilst the adaptive capacity was moderate (Table 5.4).

Cultural indicators can also be considered within four categories: Self-centric; People-centric;
Environment-centric; and Pleasure-centric (after Marshall et al. 2019). Cultural dependency was considered by the workshop to be predominated by local people and this was taken into consideration for the final assessment. Cultural dependency was assessed as low-negative, whilst the adaptive capacity was moderate (Table 5.4).

Combining the three components, the overall ESC dependency was determined as lownegative, which, combined with the OUV Vulnerability (as the exposure term), resulted in the ESC potential impact being assessed as moderate (three-point scale, low to high; Table 5.4).
The combined ESC adaptive capacity was assessed as moderate (three-point scale, low to high). These outcomes determined the Community Vulnerability as low (three-point scale, low to high; Table 5.4).

5.6 Summary

Drought (severity, duration, frequency), Temperature trend (air and/or water), and Storm intensity and frequency were identified as the three climate stressors likely to most impact the WH values of the Sukur Cultural Landscape. Potential impact from each of these key stressors was scored in the moderate-to-high categories, with adaptive capacity to mitigate impacts being assessed as moderate. As a result, the OUV Vulnerability was determined to be in the lowest category (Low). Impacts from the key climate stressors were judged as likely to lead to a negative future impact at a low level on the economic, social and cultural aspects of the Sukur community. As the adaptive capacity of the community to the climate stressors was determined to be at a moderate level, the overall Community Vulnerability was assessed to be in the lowest category (Low).

The workshop results indicate the changes that might be expected over the next 30 years (ca. 2050 scenario) may not have a big effect on the values that comprise the OUV of the property or upon the Sukur community in terms of the economy, society or culture potential impact.

6

NEXT STEPS

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6. Next Steps

6.1 Next steps for assessing impacts of climate on Sukur Cultural Landscape

The CVI process provided a rapid assessment that identified key points of vulnerability, therefore forming a step along the path of action in response to climate change in the Sukur Cultural Landscape.

The rapid assessment approach of the CVI means that it may be regularly repeated based on changes to the condition of attributes or improved knowledge of potential impacts, and how these may affect the vulnerability of OUV and/or the community associated with the Sukur Cultural Landscape. It can also be used to evaluate the effect of management actions to reduce vulnerability. Re-assessment could align with WH Periodic Reporting (approximately every six years) or with any updated release of climate change projections.

Given there is widespread interest and a need to plan/improve measures to address vulnerability due to climate change, it is recommended that the Sukur Management Committee consider the collation of improved baseline information associated with key knowledge gaps followed by subsequent, more comprehensive, analyses of climate impacts.

6.1.1 Potential climate issues

Of major concern is the synergistic or combined impacts of multiple stressors, climate or other, that are expected to be greater than the impacts of individual stressors for all WH properties. Processes that cause extreme events often interact and are spatially and/or temporally dependent. While traditional risk assessment methods typically only consider one climate stressor and/or hazard at a time, the CVI process incorporates the potential for these via the compounding effects modifier to the Sensitivity assessments. However, the magnitude of synergistic effects may be greater than is accounted for within the CVI process and, if considered relevant, should be further examined.

6.1.2 Potential Economic, Social and Cultural Issues

Economic opportunities in Sukur are limited and there is a need to diversify the economy. The lack of electricity in Sukur constrains the range of economic activities and the main sources of drinking water are hand dug wells that are fed through underground aquifers and are at varying levels year-round.

The reduction in vegetation cover due to increased human activity on the landscape could have an impact on biodiversity and agriculture. The recent growth in population from internally displaced persons – the scale of which is to be determined – is indicative of how Sukur continues to serve as a place of refuge for people fleeing attacks in the surrounding lowland areas.

However, the increased pressure on natural resources, particularly water, and the aspirations of the youth for new social and economic opportunities, could lead to people leaving the site.

6.2 Gaps Identified

Key research needs and policy gaps were identified during the workshops included:

Research needs

- Sukur climate data – the workshop was informed by data obtained from a weather station located approximately 60km from Sukur. Following the workshop, the NCMM and ICOMOS-Nigeria collaborated to install some basic elements of a weather station in Sukur, and also trained some community members to monitor the station (Figure 6.1);
- Carry out further research by obtaining data from the region to refine the outcome of the CVI and provide more insight into the impacts of climate change at the site;
- More research needed on the impacts of climate change already experienced at the site
- Understanding the compounding socio-economic factors that exacerbate climate impacts and affect the community and ultimately the OUV of the site;
- Improved documentation of the attributes – tangible and intangible – of OUV and other Significant Property Values of the site, recognising the vulnerability of each value to climate change;
- Encourage the sustainability of traditional building practices by ensuring the availability of relevant materials such as thatch;
- Expand the baseline data of flora and fauna and research into ecological change since inscription; and
- Study the flora, particularly those used for smelting and medicinal purposes.

Policy and guidance gaps

In November 2021, the Nigerian Climate Change Act was signed into law. This presents an opportunity to strengthen the national framework regarding the intersections between climate change and cultural heritage. It will be necessary to develop national regulations to guide the implementation of the Climate Change Act regarding cultural heritage. These could include:

- Inclusion of climate change impacts and climate change adaption into heritage management planning;
- Continued engagement at state and national level to explore the intersections between local knowledge and adaptation strategies for climate change;
- The inclusion of assessments such as CVI into conservation management plans and periodic reporting at heritage sites.

Installation of a weather station in response to the need for climate data collection at Sukur. (left) Dr Haruna Omar with the Hidi Sukur, having completed construction of the weather station. 2021.
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Figure 6.2 *Dr Haruna Omar training site manager (l) and site guide (r) on data entry after collection; bottom: station installed in a secured space*

6.3 Management implications

Impacts of climate change are not just something to be addressed at the local scale by property managers; more than ever there is a need for planning and appropriate responses at regional and national scales in addition to taking greater action to reduce greenhouse gas emissions responsible for climate change.

There is a relatively marked difference in the climate of across Nigeria and its diverse cultural landscapes thus the key climate drivers are likely to differ across the geographical areas. The determination and management of the impact of climate change on cultural landscapes in the country would require independent climatic and socio-economic data as well as different management and adaptation measures.

The findings of the CVI have some implications for the management of the Sukur Cultural Landscape. These include:

- enhancing the protection of the site to wind pressure by planting indigenous trees and providing alternatives to firewood for cooking purposes;
- Actively promote, and support, traditional measures for the maintenance of agricultural terraces to enhance resistance to erosion from surface runoff due to anticipated increase in rainfall;
- Protecting critical attributes of OUV from the impacts of fire by creating fire starvation zones through site planning; and
- Encouraging the continued use of earth as a primary construction material, over cement blocks, to leverage the thermal properties of earth for cool interiors as temperatures rise, and to ensure that the traditional architecture of the site is protected.

6.4 Lessons for other African WH Properties

The CVI workshop for Sukur provided an opportunity for representatives associated with various other WH properties in Africa (the six trainees from the CVI-Africa Project) to experience the CVI process.

The success of the CVI application for Sukur demonstrated the value of the process for cultural properties in identifying key points of vulnerability to climate change as well as opportunities to manage impacts to both the landscape and the associated community.

The CVI concept is a values-based assessment tool that is easy to comprehend. Its future application in Africa would require that more African experts are trained to appropriately localise the concept for effective results. As there are many climate and cultural experts in the region, the CVI workshop has demonstrated the need to have experts from these two sectors actively engaged in a working dialogue to promote the application of climate vulnerability assessments to cultural heritage sites. As previously described in Section 5, the CVI methodology can be replicated and adapted to different properties. It is expected that its application at Sukur and Kilwa, under the CVI-Africa Project, will have opened up possibilities to expand the pool of African experts who can rapidly deploy an assessment at any WHS in the region.

The various outcomes from the activities at the Sukur CVI workshop revealed that climate change poses serious threat to heritage properties in Nigeria and thus the need for national action towards its application to other World and National Heritage Sites in the country.

6.5 Revisiting the CVI Process in Sukur

The systematic assessment approach of the CVI means that it should be repeated to determine if changes have occurred to the condition of attributes, or to the vulnerability of OUV and the community associated with Sukur. Re-assessment should follow release of updated climate change projections or other relevant knowledge to provide up-to-date information for WH Periodic Reports (approximately every six years). Ideally, this reassessment should be undertaken at local and national levels, ensuring that the capacities and expertise necessary exist.

The application of the CVI lays the foundation for further investigations on the impact of climate on the OUV of the WHS, particularly given its location and complexity. It could also allow for a similar assessment of other important values not included within the SOUV. Such investigations should also establish baseline for the flora and fauna of the site, reported at the workshop as being increasingly affected by changes in weather patterns and human activity.

6.6 Lessons learned from the Sukur workshop

The format of a 'blended workshop' provided some challenges that were exacerbated by problems with the internet and connectivity issues from Yola. Given the Covid-19 pandemic and the resulting travel restrictions, these issues were inevitable. The involvement of participants in a range of different time zones across continents provided challenges in the way the workshop had to be adapted, and was the reason why the workshop was held over five half days in the mornings, with discussion and preparation for the following day in the afternoons. However, the online platform also made it possible to hold the workshop, despite the travel restrictions of the pandemic period. It should also be noted that whilst accessibility and technological issues were exacerbated in this instance by the global pandemic, they are not unique to it. They remain challenges shared by many WH properties around the world.

Future CVI workshops could aim to have all participants in the same location. Nevertheless, this workshop provided a useful model for how a hybrid online/face-to-face platform could be developed with refinements. The development of capacity in-country and in Africa was part of the overall CVI-Africa Project aims, with the future prospect of expertise within Africa to assess climate impacts on heritage. The online model should be further explored to roll out the tool across this vast region.

Figure 6.3 *Opening ceremony: Representatives of ICOMOS-Nigeria, American University of Nigeria, Adamawa State government, National Commission for Museums and Monuments and other invitees. September 2021. © Oise Ayeni*

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Roof thatching over earth dome; placing roofcap. April 2008
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World Bank's Climate Change Knowledge Portal (CCKP): Coupled Model Intercomparison Project, Phase 6 (CMIP6).

ACKNOWLEDGEMENTS

Hidi Sukur at Yawal festival. 2010.
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Acknowledgements

Various people and organisations contributed to the success of the Sukur CVI workshop and the production of this report. These include:

- The American University of Nigeria (AUN), Yola, under the leadership of Dr Margee Ensign, where the CVI workshop was held. The support provided by Dr Audu Liman, Prof Sa'ad, Ms Lois Ibrahim and Ms Jane Amos from AUN is appreciated.
- The support of the Nigerian National Commission for Museums and Monuments, the statutory national institution responsible for the management of Sukur Cultural Landscape as a World Heritage Property, is appreciated.
- Given the Zoom format and the complexities of using both breakout groups and plenary sessions, major technical assistance was provided during the workshop by Musaddiq Zango and the IT support staff at AUN, Yola.
- The participation in the CVI workshop of the Hidi Sukur (Mr Luka Gizik), assisted by Dr Abraham Zira, is appreciated
- Background information and presentations prior to, and during the workshop, were provided by:
  - Dr Eugene Itua (Natural Eco Capital, Nigeria)
  - Dr Brenda Ekwurzel (Union of Concerned Scientists, USA)
  - Mr Adam Markham (Union of Concerned Scientists, USA)
  - Prof Ambrose Zemba (Modibo Adama University, Nigeria)
  - Mr Anthony Sham (Site Manager, Sukur Cultural Landscape)
- Riccardo Losciale and Taruna Venkatachalam provided technical assistance in Australia during the online workshop.
- Thanks to the notetakers whose notes from the workshop subsequently assisted with the compilation of this report, and to Daniel Ishaya Mwada who brought these notes together.
- The Steering Committee, chaired by Mr Aliyu Abdu, formed for the workshops (names indicated in Appendix 4) provided oversight for all preparations and arrangements to ensure success in applying the CVI process.
- Thanks to Mr Friday Awonusi for the logistical support in the preparation of this report
- Dr Ewan Hyslop (Historic Environment Scotland) for proofreading the English language text and Dr Audu Haruna Omar for proofreading the Hausa language text.
- The guidance of the CVI-Africa Project Investigators: Dr Will Megarry, Principal Investigator (Queen's University, Belfast); Professor Jane Downes, co-Investigator (University of the Highlands, Scotland); Dr Ewan Hyslop (Historic Environment, Scotland); and Dr Albino Jopela (Africa World Heritage Fund), is appreciated.

APPENDIX

Construction of graveyard wall through communal labour. February 2010.
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Appendix 1: Sukur Cultural Landscape Statement of Outstanding Universal Value

Brief synthesis[2]

Sukur is located in Madagali local government area of Adamawa state of Nigeria along Nigeria/ Cameroon border, some 290 km from Yola, the Adamawa state capital of northeastern Nigeria. It is a hilltop settlement which stood at an elevation of 1045 m. The total land area covered by the property is 1942.50 ha with core zone having 764.40 ha and the buffer zone 1178.10 ha respectively. Sukur is an ancient settlement with a recorded history of iron smelting technology, flourishing trade, and strong political institution dating back to the 16th century.

The landscape is characterized by agricultural terraces, dry stone structures and stone paved walkways. The terraced landscape at Sukur with its hierarchical structure and combination of intensive and extensive farming is remarkable. In addition, it has certain exceptional features that are not to be found elsewhere, notably the use of paved tracks and the spiritual content of the terraces, with their ritual features such as sacred trees.

The revered position of the Hidi as the political and spiritual head of the community is underscored by the magnificent dry stone architectural work of his palace, in and around which is a concentration of shrines, some ceramic. The villages situated on low lying ground below the Hidi Palace have their own characteristic indigenous architecture. Among its features are dry stone walls, used as social markers and defensive enclosures, sunken animal (principally bull) pens, granaries, and threshing floors. Groups of mud walled thatched roofed houses are integrated by low stone walls. Of considerable social and economic importance are the wells. These are below-ground structures surmounted by conical stone structures and surrounded by an enclosure wall. Within the compound are pens where domestic animals such as cattle and sheep are fattened, either for consumption by the family or for use as prestige and status symbols used in gift and marriage exchanges.

The remains of many disused iron-smelting furnaces can still be found. These shaft-type furnaces, blown with bellows, were usually sited close to the houses of their owners. Iron production involved complex socio-economic relationships and there was a considerable ritual associated with it.

Criterion (iii): Sukur is an exceptional landscape that graphically illustrates a form of land-use that marks a critical stage in human settlement and its relationship with its environment.

Criterion (v): The cultural landscape of Sukur has survived unchanged for many centuries, and continues to do so at a period when this form of traditional human settlement is under threat in many parts of the world.

Criterion (vi): The cultural landscape of Sukur is eloquent testimony to a strong and continuing spiritual and cultural tradition that has endured for many centuries.

[2] *The approved Statement of OUV is available at: http://whc.unesco.org/en/list/938*

Integrity

The boundary contains all the key elements of the cultural landscape. The traditional terraced system of agriculture and its associated ritual systems are still flourishing. However, the traditional buildings are vulnerable to changes in materials and techniques – particularly the thatched roofs that require frequent maintenance.

Authenticity

The key features of the cultural landscape have not been significantly modified since they were laid down. The way in which they have been maintained since that time has been in traditional form using traditional materials and techniques.
The cultural components are still actively present among the community since they are part of their living culture. The stone structures in form of houses, farm terraces and walkways still remain the most distinct feature of Sukur landscape. The regular observance of festivals and ceremonies are evidence of cultural continuity. These events have become more attractive due to the involvement of local and state governments.

Protection and management requirements

The Sukur Cultural Landscape is a National Monument as determined by the Joint Instrument of Federal Decree No. 77 of 1979 (now NCMM ACT, Cap 242 of 2000) and the subsequent legal authority of the Adamawa State Government as in Gazette No. 47 Vol. 7 of 20 November 1997, and the written consent of the Hidi-in-Council.

In 1998, the Madagali Local Government, the Sukur Development Association, the State Council for Arts and Culture, and Adamawa State Government have agreed to work with the National Commission for Museums and Monuments towards the development of a sustainable preservation and cultural education programme.

In February 2010, the Minister of Culture, Tourism and National Orientation inaugurated a Management Committee. Integrating customary law and Nigeria's decree No. 77 of 1979, the Site Management Plan for the period 2006-2011 is being used by the Committee as the guiding principle for site conservation, management and protection.

Since inscription in 1999, all physical remains have been properly conserved by the National Commission for Museums and Monuments in collaboration with Sukur community. Annual restoration work has been carried out using traditional construction materials. Along with shrines and other sacred places, the Hidi Palace Complex is properly maintained because they are currently in use.

Domestic farmlands are continually being expanded with the creation of stepped level benches adapted to hill farming. The age long tradition of communal labour is still used to maintain paved walkways, gates, graveyards, homesteads and house compounds.

Appendix 2: Key Values and Attributes Derived from the Statement of OUV for Sukur Cultural Landscape

Key values	Excerpts taken directly from the Statement of OUV	Attributes (at the level at which management is undertaken) for each key value
exceptional cultural landscape	hilltop settlement ... at an elevation of 1045 m characterized by terraces on the farmlands, dry stone structures and stone paved walkways terraced landscape at Sukur with its hierarchical structure and combination of intensive and extensive farming is remarkable graphically illustrates a form of land-use that marks a critical stage in human settlement and its relationship with its environment certain exceptional features that are not to be found elsewhere, notably the use of paved tracks villages situated on low lying ground below the Hidi Palace	**Tangible attributes** • dry stone structures • stone terraces • stone paved walkways **Intangible attributes** • cultural landscape
ancient settlement that still flourishes	ancient settlement with a recorded history ... flourishing trade, and strong political institution dating back to the 16th century The traditional terraced system of agriculture and its associated ritual systems are still flourishing Within the compound are pens where domestic animals such as cattle and sheep are fattened, either for consumption by the family or for use as prestige and status symbols used in gift and marriage exchanges cultural landscape of Sukur has survived unchanged for many centuries, and continues to do so at a period when this form of traditional human settlement is under threat in many parts of the world key features of the cultural landscape have not been significantly modified since they were laid down maintained since that time has been in traditional form using traditional materials and techniques	**Tangible attributes** • Intensive farming practices (e.g., animal pens) • Extensive farming practices (e.g., terraced **Intangible attributes** • Ritual systems • cultural landscape that has survived unchanged for centuries
Hidi spirituality	the spiritual content of the terraces, with their ritual features such as sacred trees. revered position of the Hidi as the political and spiritual head of the community is underscored by the magnificent dry stone architectural work of his palace, ... around which is a concentration of shrines, some ceramic eloquent testimony to a strong and continuing spiritual and cultural tradition that has endured for many centuries. Along with shrines and other sacred places, the Hidi Palace Complex is properly maintained because they are currently in use.	**Tangible attributes** • Hidi Palace complex • Sacred trees • shrines (some ceramic) **Intangible attributes** • Ritual systems • spiritual and cultural traditions
traditional indigenous architecture	notably the use of paved tracks characteristic indigenous architecture dry stone walls, used as social markers and defensive enclosures, sunken animal (principally bull) pens, granaries, and threshing floors mud walled thatched roofed houses are integrated by low stone walls Of considerable social and economic importance are the wells. .... below-ground structures surmounted by conical stone structures and surrounded by an enclosure wall	**Tangible attributes** • Paved tracks • Dry stone walls • Sunken animal pens • Thatched roofed houses • Below ground wells **Intangible attributes** • social and economic • importance of wells
cultural continuity/living culture	eloquent testimony to a strong and continuing spiritual and cultural tradition that has endured for many centuries The cultural components are still actively present among the community since they are part of their living culture The regular observance of festivals and ceremonies are evidence of cultural continuity. Annual restoration work has been carried out using traditional construction materials The age long tradition of communal labour is still used to maintain paved walkways, gates, graveyards, homesteads and house compounds.	**Tangible attributes** • Festivals • Ceremonies • Communal labour • Traditional construction materials (e.g., thatched roofs) **Intangible attributes** • Spiritual and cultural traditions • Cultural continuity
iron smelting technology	a recorded history of iron smelting technology remains of many disused iron-smelting furnaces shaft-type furnaces, blown with bellows, were usually sited close to the houses of their owners Iron production involved complex socio-economic relationships and there was a considerable ritual associated with it	**Tangible attributes** • Remains of iron-smelting structures **Intangible attributes** • Complex socio-economic relationships

Appendix 3: List of Significant Property Values that are Locally, Regionally or Nationally Significant for Sukur Cultural Landscape

Grouping of Values	Key Values	Description/Justification Locally, regional or national significance?
Cultural and Spiritual	Significant burial areas	Mabi Burial Area, local significance Burial area for individuals as designated by, the traditional council and also for persons who died from mysterious illness
		Second burial Festival Ground at Duba, local significance Sacred site for second burial festivals for elderly community members, signifying that the defunct community member has gone on to join the ancestors in peace. No other socio-economic activities can be carried out on this site
	Social	Dressing and accoutrements, local and regional significance Clothes and accessories worn by title holders, such as the priest Dalhatu, a key character in ritual rites in Sukur tradition, whose head dress consists of a lock of hair which lies just above his forehead. This lock of hair is cut off upon his death
	Rites of passage	Sacred initiation site Dtheng, local significance • Initiation to adulthood for male children when they reach 18 years. Priests - Mbusfui and Dalatu – lead these rites • Various iron objects used during the ceremony, often as as iron staffs (vidd ree, used by women) or rods (jeff kigir used by men)
Historic/Economic	Iron production	Various iron objects, local and regional significance • Sukur was famous in the region for iron production which served as currency and commodity. For example, the Sukur currency – the debbel – is an iron bar, three of which were considered the equivalent of a bull while thirty of them would be part of a young woman's dowry
Landscape features with Intangible value	Ritual site	Futu Sacred site, local significance Such as, where cleansing rites and rituals are carried out by the priests or designated title holders
	Memory	Farr Battle ground, local significance Memorial of past wars fought by the Sukur people.
Continuing landscape	Sacred	Midden Site near Hidi's Palace, local significance sacred place where the spirits of the late chiefs and title holders dwell; place of sacrifices made by Hidi and title holders. Critical path for Hidi when going out of his palace to attend important events.
	Religious	Various ritual places, local, regional and national significance Sites located long the paved paths leading to important festival grounds such as the Yawal festival
	Education and research	Landscape and archaeological features, local, national and regional significance • threshing floors, • conical wells, • sacred trees believed to link the dead and the living, the past and the present

Appendix 4: List of Workshop Participants

(Sukur Steering Committee members indicated by **)

Participant	Designation	Institution	Location
National CVI workshop participants			
Mr Olakunle Fatai	Site Manager, Osun-Osogbo Sacred Grove World Heritage Site	National Commission for Museums and Monuments, Nigeria	Osogbo, Nigeria
Mr Oise Ayeni	Assistant Chief Heritage Officer	National Commission for Museums and Monuments, Nigeria	Abuja, Nigeria
Mr Najega Rufia Bala	Senior Scientific Officer.	Department of Climate Change, Federal Ministry of Environment	Abuja, Nigeria
Dr Oluwatoyin Sogbesan	Lecturer	Architecture Department, Ajayi Crowther University	Abuja, Nigeria
Mr Friday Awonusi**	Secretary CVI Breakout Group Leader	ICOMOS Nigeria;	Abuja, Nigeria
Mr Daniel Mwada	CVI-trainee Note taker	National Commission for Museums and Monuments, Nigeria	Maiduguri, Nigeria
Mr Luka Gizik	Chief of Sukur (Hidi Sukur)	Sukur Cultural Landscape World Heritage Site	Sukur, Nigeria
Mr Simon Waida	Site Guide Sukur Community Member	National Commission for Museums and Monuments, Nigeria	Sukur, Nigeria
Mr Aliyu Lass Abdu**	President Former site manager of Sukur	ICOMOS Nigeria	Gombe, Nigeria
Mr Sunday Makandau	Archaeology Student Sukur Community Member	Ahmadu Bello University	Zaria, Nigeria
Ms Lucy Moses	Sukur Community Member	Sukur	Sukur, Nigeria
Dr Audu Haruna Omar	Lecturer	Department of Geography, Federal University Kashere	Kashere, Nigeria
Dr Abraham Zira	Lecturer Sukur Community Member	Federal College of Education, Potiskum	Potiskum, Nigeria
Mr Joseph Lawu	Museum Officer Sukur Community Member	National Commission for Museums and Monuments, Nigeria	Yola, Nigeria
Mr Francis Etuk	Heritage Consultant	African International Documentary Festival Foundation	Yola, Nigeria
Mr Anthony Sham**	Site Manager, Sukur Cultural Landscape	National Commission for Museums and Monuments, Nigeria	Yola, Nigeria
Mr Markus Makarma	Cultural Officer *CVI Breakout Group Leader Sukur Community Member	Adamawa State Agency for Museums and Monuments	Yola, Nigeria

Appendix 4: List of Workshop Participants

Participant	Designation	Institution	Location
Mr Yusuf Ibrahim**	Desk Officer	Adamawa State Ministry of Environment	Yola,Nigeria
Prof Abdulmumin Sa'ad**	Professor of Sociology and Criminology CVI Breakout Group Leader	American University of Nigeria	Yola, Nigeria
Dr Jamiu Olumoh**	Assistant Professor of Mathematics and Statistics	American University of Nigeria	Yola, Nigeria
Note takers			
Mustapha Muhammad Ahmad	Student, Note taker 1	American University of Nigeria	Yola, Nigeria
Yusufa Adamu	Student, Note taker 1	American University of Nigeria	Yola, Nigeria
Sharifa Aliyu Dahiru	Student, Note taker 1	American University of Nigeria	Yola, Nigeria
Project and Workshop Coordination (Remote)			
Dr Ishanlosen Odiaua**	Vice-President	ICOMOS Nigeria	Laval, Canada
Dr Eugene Itua	Chief Executive Officer	Natural Eco Capital	Lagos, Nigeria
Dr Scott Heron**	CVI co-developer	James Cook University	Queensland, Australia
D Jon Day**	CVI co-developer	James Cook University	Queensland, Australia
Riccardo Losciale	CVI Technical Support	James Cook University	Queensland, Australia
Taruna Venkatachalam	CVI Technical Support	James Cook University	Queensland, Australia
Prof Jane Downes**	Professor of Archaeology and Heritage, CVI-Africa project Co-Investigator	University of the Highlands & Islands	Orkney, Scotland
Ms Khansa Bouaziz	CVI-trainee, Note taker		Tunisia
Mr Jaylson Monteiro	CVI-trainee, Note taker		Cabo Verde
Ms Nengai Nairouwa	CVI-trainee, Note taker		Tanzania
Mr Simon Musasizi	CVI-trainee, Note taker		Uganda
Ms Fatma Twahir	CVI-trainee, Note taker		Kenya

Appendix 5: CVI Workshop Schedule, 19-24 September 2021

Sunday, 19 September 2021	**AM**	**Guided tour to facilities of the host institution, American University of Nigeria (AUN)**
	PM (Plenary: videos)	• Screening of the '13 Months of Sukur' Video (1.5 hours) • Video 1: Welcome message from Jon and Scott (J&S) • Video 2: Overview of CVI (S) • Video 3: Workshop overview (J&S) • Video 4: Sukur OUV & key values (J) • Video 5: Significant Property Values (Anthony Sham & Daniel Ishaya) **Welcome dinner AUN**
Monday, 20 September 2021	AM (Plenary and Group discussions with S&J)	• Participant introductions 30 minutes • Q&A on videos from previous day 30 minutes • Current Condition & Recent Trend (interactive) • SPVs intro task • Orientation
	PM (Plenary: videos and group discussions with JDo)	**Official opening** • Video 6: Climate data summary (Dr Itua) • Q&A: Climate data (Dr Itua) • Video 7: Climate stressors • Video 8: Timescale and scenarios
Tuesday, 21 September 2021	AM (Plenary and Group discussions with S&J)	• Q&A Day1-PM videos 30 minutes • Review climate stressors 30 minutes • Breakouts: Identify top 3 climate stressors in Sukur, 45 minutes • Plenary: Synthesise breakout results
	PM (Plenary: videos and discussions with JDo)	Viewing and discussions of the topics covered in the following videos: • Video 9: OUV Vulnerability - Exposure • Video 10: OUV Vulnerability - Sensitivity • Video 11: OUV Vulnerability - Adaptive Capacity
Wednesday 22 September 2021	AM (Plenary and Group discussions with S&J)	• Breakouts: Assessment of identified levels of exposure at Sukur (30 mins) • Plenary: Facilitated discussion on breakout result on climate stressors • Breakouts: Community Vulnerability – social and economic
	AM (Plenary and Group discussions with S&J)	• Q&A Day1-PM videos 30 minutes • Review climate stressors 30 minutes • Breakouts: Identify top 3 climate stressors in Sukur, 45 minutes • Plenary: Synthesise breakout results
Thursday, 23 September 2021	AM (Plenary and Group discussions with S&J)	• Breakouts: OUV Sensitivity & Adaptive Capacity • Q&A and review Economic, clearly state task for Breakout, 1 hour • Breakouts: Community Vulnerability, Economic: 1 hour • Plenary: Community Vulnerability, Economic: 1 hour
	PM (Plenary: videos with J Do)	• Video 14: Community Vulnerability - Social • Video 15: Community Vulnerability - Cultural
Friday, 24 September 2021	AM (Plenary and Group discussions with S&J)	• Q&A and review Community Vulnerability - Social and cultural - 45 minutes • Plenary: Results, Community Vulnerability - Social and cultural - 30 minutes • Q&A and review Cultural - 30 minutes
	PM	• Official Closing, including Video 16: Pre-recorded message by S&J

Appendix 6: Glossary

Adaptive capacity	The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.
Anthropogenic Climate	Resulting from or produced by human activities. The composite or generally prevailing weather conditions of a region, as temperature, air pressure, humidity, precipitation, sunshine, cloudiness, and winds, throughout the year, averaged over a series of years.
Climate change	A change in the pattern of weather, and related changes in oceans and land surfaces, occurring over time scales of decades or longer.
Climate projection	A projection of the response of the climate system to emission or concentration scenarios of greenhouse gases and aerosols, or radiative forcing scenarios, often based upon simulations by climate models. Projections from the Coupled Model Intercomparison Project Phase 6 (CMIP6) are referred to in this report.
Exposure	A measure of the contact between a system (whether physical or social) and a stressor.
Sensitivity	The degree to which a system is affected, either adversely or beneficially, by climate variability or change.
Extreme weather event	A weather event that is rare at a particular place and time of year. Definitions of 'rare' vary, but an extreme weather event would normally be as rare as or rarer than the 10th or 90th percentile of the observed probability.
IPCC (Intergovernmental Panel on Climate Change)	The United Nations body, established in 1988, for assessing the science related to climate change; it was created to provide policymakers with regular scientific assessments on climate change, its implications, and potential future risks, as well as to put forward adaptation and mitigation options. The IPCC is the most authoritative international body on climate science and is an essential component of the world's response to climate change.
Mitigation (of climate change)	A human intervention to reduce emissions or enhance the sinks of greenhouse gases (GHGs). Mitigation measures in climate policy are technologies, processes or practices that contribute to mitigation, for example renewable energy technologies, waste minimisation processes, public transport commuting practices, etc.
Restoration (in an environmental context)	Involves human interventions to assist the recovery of an ecosystem that has been previously degraded, damaged, or destroyed.
Weather	The state of the atmosphere – its temperature, humidity, wind, rainfall and so on – over hours to weeks.

Construction of sunken animal pen, 2010.
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