[Supplementary material]

Climate change adaptation policy and planning for cultural heritage in low- and middle-income countries

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OSM1: case studies

Lagos region, Nigeria

Projected climate changes for Lagos state are a warmer climate (temperature rise between 1.4–2.3°C by 2065), longer and more intense periods of rainfall (annual increase approx. 150mm by 2065), extreme weather events (including more intense tropical storms) and sea level rise (SLR). The geography of Lagos, as a coastal region, influences the nature of the impacts on its cultural heritage, including landscapes and archaeological sites and monuments. Areas such as Badagry, Epe, Lagos Island, Mushin etc are all wetlands where hydrographic impacts of climate change are predominant.

The Lagos State Climate Change Adaptation Strategy (LAS-CCAS) was developed by Lagos state government and the NGO Nigerian Environmental Study/Action Team (NEST) (Building Nigeria's Response to Climate Change Project 2012). The consultations were largely expert- and organisation-based with limited/negligible involvement of community groups.

Figure S1. First storey constructed by Christian missionaries in 1845, Badagry, Nigeria (photograph by O. Adetunji).

The plan is cross-sectoral, heritage can be found under Coastal zones and Marine Ecosystems, Land use, Forestry and Biodiversity, and Human Settlements. The resources addressed include built-heritage (Figure S1) and historical landscapes, intangible heritage (e.g. local knowledge, agricultural practices), natural heritage (forests, historical trees, zoological gardens, natural parks) and coastal heritage (protected areas on Atlantic Ocean and the Lagos Lagoon).
LAS-CCAS can be regarded as the first stage in addressing climate change and its impacts in Lagos, revealing the initial scoping of impacts on all sectors, such as, for example, water, wetlands and freshwater ecosystems, human health and disaster risk management (Lagos State Government 2012). Although a vulnerability assessment was planned for each sector there is no evidence that these have been conducted. Actions to be implemented in each sector were however identified. In the Land Use, Forestry and Biodiversity sector, for instance, establishment of land-use zoning and control were identified to influence the impacts of flooding, SLR and temperature changes. The organisations to implement the actions were also identified including both government and non-government organisations.

Cartagena De Indias, Colombia

On the northern Caribbean coast of Colombia the city of Cartagena de Indias was one of the most important ports of the sixteenth to eighteenth centuries and today is one of the most complete examples of a historic fortified city in South America. Due to a combination of natural threats, lack of maintenance, and development pressures, Cartagena's World Heritage site is at risk. The historic centre was built on low lying ground less than 2km from the seafront and has always been at risk from coastal processes (Louis XIV is reputed to have said "in Cartagena the sea is an invincible Lord"). Over the centuries coastal engineering measures such as the La Marina underwater breakwater was installed to protect the city and its fortifications, but with rising sea levels these are now insufficient.

Figure S2. Fort San José de Bocachica (photographs by A. Consorcio and A. Bocachica)

Climate projections for 2100 suggest SLR of 80–100cm and a 30 per cent increase in rainfall intensity and the Ministry of Environment and Sustainable Development *et al.* (2014) proposes five strategies for adaptation. Strategy three is aimed at the protection of built heritage and monuments and plans for the creation of a reclaimed coastal strip of approximately 100m and improvements to the drainage infrastructure to prevent flooding. Other projects that have been undertaken to adapt the historic fabric to climate change impacts include:

- Damp proofing of walls and improvement to building drainage systems to prevent ingress of higher ground water (including seawater) and rainwater (Herrera Diaz 2009).

- Extensive analysis and restoration of the San Fernando and San José Forts in Bocachica (Herrera Díaz *et al*. 2014) and the design of solutions to reduce flooding due to SLR and increased storms and waves (Figure S2).

Plans for the management and protection of the fortifications of the bay are in the process of elaboration and a special plan for the management and protection of the historic city centre is also being developed. This latter plan is taking a cultural landscape-based approach and will include a risk management component. The success of this process relied on ensuring that all stakeholders shared a unified vision and a clear understanding of the impacts of climate change and of what was possible within limited budgets/timescales. Following implementation of adaptation measures a strict regime of monitoring needs to be undertaken to evaluate the effectiveness of specific interventions and guide future work.

OSM2: questionnaire

Methodology

In order to obtain an overview of the inclusion of cultural heritage within climate change policy we undertook a practitioner survey. According to Ford and Berrang-Ford (2016) this is a useful alternative to relying on publicly available information. We chose a sample group of 105 National Committees (NCs) (52 of which were LMICs) and 29 International Scientific Committees (ISCs) of the International Council on Monuments and Sites (ICOMOS). ICOMOS is a global non-governmental organisation of heritage professionals and is one of three advisory bodies to the World Heritage Convention (ICOMOS 2011). An online questionnaire was developed and administered using Qualtrics Survey Software (following a pilot test). The questionnaire was available in English, Spanish and French languages. The ICOMOS Secretariat forwarded the link together with three email reminders to all NCs and ISCs (n = 136) from mid-June to mid-August 2020. The total number includes responses from Cameroon and Algeria, which do not have ICOMOS NCs but returned the questionnaire through snowball sampling of ICOMOS members in Africa. The survey was designed in conjunction with the *Climate Heritage Network's HiCLIP* project, which is seeking to identify global exemplars of policies in this area (http://climateheritage.org/wg4/). It was administered in accordance with the ethical guidelines of the University of Lincoln, the data was controlled by the Delft University of Technology in

accordance with EU GDPR regulations and respondents had to provide informed consent. The questionnaire comprised of 22 questions, both open-ended and closed-ended, as well as multiple and single choice (English version available as OSM3, below). Some of the questions were aimed at finding examples of CCA plans at different governance levels that related to heritage. For the purposes of this article these responses were utilized to guide the selection of LMIC case studies (section 4). In addition, one question (multiple choice), on identifying barriers or obstacles experienced in policy development was chosen for analysis. Once the online questionnaires were completed, the responses in Spanish and French were translated into English. The response rate of LMIC NCs was 23 per cent (overall response rate was 18 per cent). In a follow-up with the entire ICOMOS sample-group we asked those who had not completed the survey to explain why.

The target group for the questionnaire was heritage experts involved and/or interested in the climate change topic. The ICOMOS NC climate change focal points were an ideal sample group as they are self-selected ICOMOS members who have been named as climate change contact points by their NCs and are part of an international professional organisation that conducts its business in English, French and Spanish. We provided the questionnaire in all three languages but acknowledge that for most respondents this would still pose a potential barrier to full participation and perpetuates legacies of European colonialism. Unfortunately, we did not have the capacity to translate the questionnaire into further languages although this would have been our preference. The climate change focal points were expected to be familiar with technical language such as that found in plans and policies and the formulation of the questionnaire reflected that. The reasons provided for non-completion suggest there remains a lack of capacity amongst heritage professionals from all countries, not just LMICs, regarding the topic of climate change. Thus, the use of climate change policy language in the questionnaire may have acted as an additional barrier.

OSM 3: questions

Country:

Organisation/Role:

Your name (optional):

International plans and policies for climate change ADAPTATION of cultural heritage

In this survey, **plans and policies** refer to national, regional and local/municipal plans, as well as Indigenous Peoples' plansand policies that address climate change. First and foremost, this means **climate action plans** (which typically focus on mitigating greenhouse gas emissions, GhGs) and **climate adaptation frameworks** (which typically focus on adaptation).
Further, **cultural heritage** is here broadly construed, including archaeology, built heritage, cultural landscapes, objects andcollections and intangible heritage, including traditional wisdom and indigenous knowledge and science.

Governments in your country with ADAPTATION PLANS/POLICIES that address CULTURAL HERITAGE

	Yes	No
National government	○	○

Governments in your country with ADAPTATION PLANS/POLICIES that address CULTURAL HERITAGE

	Yes	No
Regional government(s)	○	○

Please provide an estimate of how many such plans/policies address cultural heritage:

Governments in your country with ADAPTATION PLANS/POLICIES that address CULTURAL HERITAGE

	Yes	No
Local government (s)	○	○

Please provide an estimate of how many such plans/policies address cultural heritage:

Governments in your country with ADAPTATION PLANS/POLICIES that address CULTURAL HERITAGE

	Yes	No
Indigenous Peoplegovernment(s)	○	○

Please provide an estimate of how many such plans/policies address cultural heritage:

Do climate adaptation plans/policies at the level generally contain GOALS AND TARGETS for CULTURALHERITAGE?

National government

Yes	No
○	○

Do climate adaptation plans/policies at the level generally contain GOALS AND TARGETS for CULTURALHERITAGE?

government(s)

Regional

Yes

No

Please provide an estimate of how many such plans/policies address cultural heritage:

Do climate adaptation plans/policies at the level generally contain GOALS AND TARGETS for CULTURALHERITAGE?

	Yes	No
Local government (s)		

Please provide an estimate of how many such plans/policies address cultural heritage:

Do climate adaptation plans/policies at the level generally contain GOALS AND TARGETS for CULTURALHERITAGE?

	Indigenous People	government(s)

Please provide an estimate of how many such plans/policies address cultural heritage:

Block 1b

Climate ADAPTATION of cultural heritage

In your area, how many climate ADAPTATION plans or policies (at any level of government) specificallyconsider cultural heritage? *Please drag a bar to indicate a number of projects.*

Number of plans/policies

0 2 4 6 8 10 12 14 16 18 20

Please provide the title(s) of the cultural heritage climate change ADAPTATION plans/policies you are familiarwith or that you have been working on:

Plan/Policy 1

Plan/Policy 2

Plan/Policy 3

Plan/Policy 4

Plan/Policy 5

Plan/Policy 6

Plan/Policy 7

Plan/Policy 8

Plan/Policy 9

Plan/Policy 10+

From the above, please choose one plan/policy that you are most familiar with and answer the questionsbelow.

Please provide the title of the plan/policy that you are the most familiar with

Who is/has been the administrator or responsible agency for developing the plan/policy? *Select all that apply.*

☐ National government ☐ Regional government ☐ Local government
☐ Non-governmental organization (NGO) ☐ University
☐ Community Statutory body
☐ Other (please specify):

What type of cultural heritage is/are being addressed? *Select all that apply.*

☐ Archaeological site(s)
☐ Historic site(s) or building(s)
☐ Museum(s), archive(s) and/or library(s) ☐ Garden(s)
☐ Cultural landscape(s)
☐ Traditional and Indigenous practice(s), skills and way of knowing
☐ Other (please specify):

Which aspects of adaptation planning are/have been addressed in the plan/policy? *Select all that apply.*

☐ Scoping
☐ Vulnerability or risk assessment ☐ Action identification and appraisal ☐ A formal plan has been written ☐ Partial implementation of the plan ☐ Full implementation of the plan
☐ Plan review
☐ Other (please specify):

Which climate change-related impacts are/have been addressed by the plan/policy? *Select all that apply*

☐ Sea level rise (e.g., saline intrusion, flooding, coastal erosion)
☐ Increased precipitation (e.g., flooding, landslides, erosion)
☐ Decreased precipitation (e.g., wildfires, drought, desertification)

☐ Biodiversity changes (e.g., loss or gain of species, pests and diseases)

☐ Extreme weather (e.g. storm damage)

☐ Temperature increases (e.g. loss of permafrost, acidification of oceans, microbial degradation)

☐ Humidity cycle changes (e.g. salt damage, metal corrosion, mould)

☐ Adaptation actions/interventions adversely affecting diverse cultural heritage (e.g. building adaptations, flood defences)

☐ Other (please specify):

Has there been consultation in the development of the plan/policy? *Select all that apply.*

☐ With community

☐ With academics/researchers ☐ With heritage professionals

☐ Other (please specify):

☐ No consultation

Has consultation been undertaken in the following adaptation steps? *Select all that apply.*

☐ Scoping

☐ Vulnerability or risk assessment ☐ Action identification and appraisal

☐ Plan writing

☐ Implementation Review

☐ No, there hasn't been any consultation

Has the plan/policy been publicised? *Select all that apply.*

☐ Internet ☐ Video/film ☐ Media

☐ In print

☐ Other (please specify

What barriers or obstacles has the plan/policy experienced? *Select all that apply.*

☐ Lack or limited funding, subsidies, tax incentives for cultural heritage at risk from climate change

☐ Lack/inadequate technical skills or training related to climate change impacts, adaptation solutions

☐ Lack/inadequate information/knowledge on climate change risks/impacts on cultural

heritage

☐ Lack of professional methodologies (no standards of practice)

☐ Lack of understanding on how to engage and communicate with government agencies

☐ Lack of connectivity/alignment between government agencies (cross-purposes)

☐ Lack of support from elected officials about climate change adaptation and cultural heritage intersection

☐ Lack of coordination and recognition of the cultural heritage and climate change adaptation issues withinenvironmental programs

☐ Lack of political support for climate change adaptation and cultural heritage nexus ☐ Climate change skepticism/denial

☐ Community opposition to the proposed climate change adaptation plan/policy ☐ Other (please specify):

Have the efforts (e.g., awareness, information/knowledge, collaborations) changed over the time of theplan/policy?

Yes	No
○	○

How has it changed?

Have the cultural heritage-related provisions of this plan been effective

OSM4: Links to LMIC national adaptation plans

Country	Link
Albania	NAP Training (available via https://unfccc.int)
Brazil	https://www4.unfccc.int/sites/NAPC/Documents/Parties/Brazil NAP English.pdf
Cameroon	https://www4.unfccc.int/sites/NAPC/Documents/Parties/PNACC_Cameroun_VF_Valid%c3%a9e_24062015%20-%20FINAL.pdf
Cambodia	Cambodia Climate Change Strategic Plan (available via https://unfccc.int)
Colombia	Colombia NAP Spanish (available via https://unfccc.int)
Guatemala	https://www4.unfccc.int/sites/NAPC/Documents/Parties/Guatemala NAP small.pdf
Kiribati	http://napglobalnetwork.org/resource/joint-implementation-plan-for-climate-change-and-disaster-risk-management-kjip-2019-2028/
Kuwait	Kuwait National Adaptation Plan 2019–2030 (available via https://unfccc.int)
Nepal	NAP_v3.pdf (available via https://unfccc.int)
Palestine	https://www4.unfccc.int/sites/NAPC/Documents%20NAP/National%20Reports/State%20of%20Palestine%20NAP.pdf
Paraguay	https://www4.unfccc.int/sites/NAPC/Documents/Parties/Plan Nacional de Adaptación al Cambio Climático_Paraguay_final.pdf
Peru	Perú_NAP_Spanish.pdf.pdf (available via https://unfccc.int)
Saint Lucia	https://www4.unfccc.int/sites/NAPC/Documents/Parties/SLU-NAP-May-2018.pdf
South Sudan	South-Sudan-First-NAP .pdf (available via https://unfccc.int)
Sri Lanka	https://www4.unfccc.int/sites/NAPC/Documents%20NAP/National%20Reports/National%20Adaptation%20Plan%20of%20Sri%20Lanka.pdf
Suriname	https://www4.unfccc.int/sites/NAPC/Documents/Parties/Suriname%20Final%20NAP_apr%202020.pdf
Timor Leste	Timor Leste NAP.pdf (available via https://unfccc.int)

References

Building Nigeria's Response to Climate Change Project. 2012. Towards a Lagos state climate change adaptation strategy. Available at: http://csdevnet.org/wp-content/uploads/Towards-aLagos-Adaptation-Strategy.pdf (accessed 26 August 2019).

FORD J.D. & L. BERRANG-FORD. 2016. The 4Cs of adaptation tracking: consistency, comparability, comprehensiveness, coherency. *Mitigation and Adaptation Strategies for Global Change* 21: 839–59. https://doi.org/10.1007/s11027-014-9627-7

HERRERA DÍAZ, A. 2009. Estudios Técnicos y Proyecto de Restauración del Lienzo de Murallas entre el monumento de la India Catalina y el museo de La Marina en Cartagena de Indias. Unpublished report on behalf of the Ministerio de Cultura de Colombia, Bogotá.

HERRERA DÍAZ, A., A. CONSORCIO & A. BOCAHICA. 2014. Estudios Técnicos y Proyecto de Restauración Integral del Fuerte San Fernando y el Fuerte –Batería de San José de Bocachica. Unpublished report on behalf of the Ministerio de Cultura de Colombia, Bogotá.

ICOMOS. 2011. Introducing ICOMOS. Available at: https://www.icomos.org/en/about-icomos/mission-and-vision/mission-and-vision (accessed 18 June 2020).

Lagos State Government. 2012. Climate change policy 2012–2014. Lagos: Lagos State Government. Available at: https://silo.tips/download/lagos-state-climate-change-policy (accessed 26 August 2019).

Ministry of Environment and Sustainable Development *et al*. 2014. *Plan 4C: Cartagena de Indias Competitiva y Compatible con el Clima*. Medellín: Marquillas. Available at: https://plan4c.cartagena.gov.co/quienes-somos/ (accessed 26 August 2019).