Protected Areas Resilient to Climate Change, PARCC West Africa

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Rapid Screening of Vulnerability Assessment Tools and Framework Proposal

Executive Summary

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Background

This report summarizes the findings of a larger report reviewing available vulnerability assessment approaches and methodologies, which was conducted within the frame of the 'Protected Areas Resilient to Climate Change', PARCC West Africa project.

The term vulnerability is used by most disciplines involved in global change, environmental change, natural disasters, hazards or change research. It has also been recently applied to climate change studies, development and poverty alleviation. Just as the concept of vulnerability has been defined in several ways and has been variously applied to locations, towns, people and the physical environment, techniques to measure it have also varied according to the discipline assessing the vulnerability and "what" is "vulnerable to what".

1. Vulnerability Framework

The objective of the planned project assessment is the network of protected areas in the West African region; this implies the legislative figure or administrative authority in charge of protected areas, species and ecosystems within protected areas and their connectivity, ecosystem services provided by the protected areas, and the communities living within protected areas boundaries or whose livelihoods depend on them.

In this respect, vulnerability considers both the nature of the disturbances/impacts, their plausible consequences and the capacity of the systems (human or ecological) to respond to changes or alteration of the environmental conditions. However, when assessing vulnerability other important aspects need to be carefully considered, including the spatial and temporal scales, the uncertainty related to the information used for the assessment and also related to the outputs, the natural changing conditions of the environment and the level of subjectivity within each assessment.

Considering that the concept of vulnerability used in this project includes a measure of impact and response and considering the concept of protected areas (areas with limited human use), but also being aware of the region's reality (human communities living within and around protected areas), five factors have been considered: i) changes on the natural environment resulting from climate change, that push species thresholds, and hence alter capacity of species to respond to those environmental changes; ii) alteration of the ecosystem services provided by ecosystems within protected area, closely related to the previous; iii) the geomorphology, climate and location, and geographical settings; iv) the countries or region's capacity to maintain PA as they exist, and their reason to be; and v) the presence of the human element.

The framework presented here aims to integrate the different components that a vulnerability assessment should consider, in order to produce results that are useful for decision makers. The framework also aims to identify the strengths and weaknesses of the protected area system and where more attention is required in order to diminish its vulnerability to climate change.

Climate change vulnerability assessments need to reflect both coping capacity and adaptive capacity. The former refers to the capacity of organisms to respond to an immediate threat, the

later to practices and responses to the consequences of climate change. Not all systems face the same environmental risks, are subject to the same social norms, political processes and resource endowments, technologies and structural inequalities. In particular, climate change will affect different individuals, groups, households, communities and countries in diverse ways, with some able to better manage climate risk while others suffer disproportionately from the impacts.

2. Approaches to assess vulnerability

Methods and tools to assess vulnerability are as diverse as the definitions and frameworks of vulnerability, the main differences are related to the discipline which is aiming to assess that vulnerability. Vulnerability is not easy to quantify or reduce to a single metric and is often relative to the component of vulnerability being assessed or the perspective of assessment. Methods to assess vulnerability include: descriptive approaches, storylines, qualitative assessments, syndrome analysis, spatial assessments, quantitative assessments, indicator based assessments, computational indexes, models based on simulations, models based on scenarios, models based on storylines, multidisciplinary approaches and sectorial approaches, deductive or inductive approaches, start point or end point assessments, participatory and non-participatory approaches.

The chosen methodology should identify the drivers of vulnerability, independent of climate change. It should also include a measurement of capacity to cope. A focus limited to perturbation and stressors does not really portray the potential responses a system could have. Interconnections between those drivers and responses is also important, bearing in mind that the system will not respond the same to a one off event (fire, drought, landslide) as to a continuous event (increase in temperature), therefore the assessment should include some measuring for both type of disturbances. Furthermore, a methodology focusing on the causes and drivers of vulnerability should be beneficial for this particular type of assessment.

Considering the many approaches to assess vulnerability, and that each particular assessment should be developed according to the aims of the project but also to reflect the real vulnerability of the object of assessment, it is thought that a combination of visualizing tools, process and analytical tools, and storylines would be the best set of tools for the assessment of protected areas network vulnerability to climate change in West Africa. It should also include participatory stages with stakeholders, and make use of expert knowledge both at the regional and global level. Bearing in mind that the overall objective of this project is to improve our knowledge of the links between climate change and protected areas, and build in-country capacity for protected areas' management, indicators chosen should be formulated in such a way that allow the periodical efficient assessment of protected areas management.

This report presents a series of methods and approaches to assess vulnerability which have been selected according to their potential applicability to the project aims, their close relation to the project objectives and their usefulness to provide guidelines to the project. Overall, indicators could be an appropriate approach, however, a more in depth analysis would need to be also undertaken, ideally with regional experts of each component (social, cultural, economic, physical, political and institutional and ecological), and in a situation where assumptions and limitations could be discussed.

3. Suggested methodological approach

A starting point type of assessment is suggested, in order to identify the sources of vulnerability and address them during the project; it should be quantitative, to allow comparison in time and space, and to be replicable and potentially applicable at the local and regional level. The assessment should contain a graphic or visual representation and a qualitative interpretation or storyline. A combination of process and analytical tools, visualizing and mapping tools, and a storyline interpretation of the results might be the best approach to assess the vulnerability to climate change of the protected areas network in West Africa. This should include participatory stages with stakeholders and expert knowledge (regional and global) at several stages of the assessment.

All different components of vulnerability (social, economical, political and ecological) can be approached using different methods; however, they need to be integrated into one unit that allows comparison and replication, independent of the surveying methods (whether ecological or social) and discipline. An indicator based approach could be used to integrate information from different disciplines and methods of collection. What is key in this process is to recognize, at each step during the integration of information, the assumptions made when collecting information and during its usage and interpretation, as well as the limitations within each method. This will provide managers and decision makers with a better tool for planning and decision making.

Mapping information spatially is one of the best ways to communicate information and to determine geographical settings, areas at risk, land use conflicts, population settling patterns, natural resources location and use, and changes on the landscape through time, among many other characteristics, all of which are crucial to determine vulnerability to climate change.

A descriptive interpretation of the results allows the reader to understand vulnerability and its drivers and to transform a score or value resulting from the aggregation of numerical data into a meaningful product that reflects the conditions of each area that increase or decrease its vulnerability to climate change.

Indicators based approach

Data requirements and methods for a vulnerability indicator based approach will vary depending on the indicator chosen. The choice of indicator will also be determined by the complexity of the information needed, data availability and quality. Although several indicators are listed in the report, the identification of measurable indicators for this project's vulnerability assessment and their integration into one assessment could be accomplished in workshops, where each component of vulnerability (physical, ecological, social and institutional) is considered to contribute to the overall assessment.

The key stages to assess vulnerability to climate change based on indicators are as follows:

1. Conceptual framework definition (including concepts, conditions that are likely to change and expected impacts)
2. Stakeholders identification (exposed units, groups of interest)

3. Geographical settings
4. Identification of information available and needed
5. Selection of indicators
6. Transform data into indicators
7. Vulnerability profiles visualization
8. Aggregation/integration of indicators
9. Measurement of robustness for adaptation
10. Interpretation of results

At all levels, information management, gathering and integration, are crucial, as well as a the spatial and temporal scale of the information. Vulnerability assessments are most useful at the sub-national and local level. A regional vulnerability assessment based on regional information will most probably identify patterns instead of vulnerability drivers, which in turn could lead to more detailed assessments and to the production of more accurate information. Regarding time, and particularly in respect to climate change, the use of future or past scenarios is important to understand how vulnerability drivers change through time and/or how the change in one driver can alter or not the overall vulnerability.

Information gathering and integration

Information required to achieve the above comes from different disciplines, sources and scales; hence it is crucial to consider the following: sources, quality, scale, uncertainties related to information collection and interpretation, methods used, dates of collection and interpretation.

All secondary information needs to be handled with care, and when metadata, images and GIS data are being used, it is crucial to understand the assumptions, uncertainties and errors related with that information to avoid error multiplication and misinformation.

There are several sources of information at the regional and global level that can be used including Esri, the World Database on protected Areas (WDPA), the International Union for Conservation of Nature (IUCN), the International Disaster database (EM-DAT), the Center for International Earth Science Information Network (CIESIN), the Center for Hazards and Risk Research (CHRR), the World Bank, the African Development bank, the UN Millennium development goals, the CIA Fact book, and the National Oceanic and Atmospheric Administration (NOAA); from these sources, important information can be gathered on human footprint and human influence indexes, protected areas, species distribution, Important Bird Areas (IBAs), and threatened species.

Other information can be found at the national level with the country partners and governments; these include for instance information related to land planning, development, protected areas, natural disasters risk management and environmental policies and legislation.

Information on infrastructure, population distribution, communications, accessibility to fresh water, dependence on the natural resources, income per capita, main productive activities and health and education access can all be found at the national level. However, it is crucial to understand that an assessment based on socio-economic indicators aggregated at the national level will not represent the real vulnerability of protected areas to climate change and could underestimate or overestimate the situation and drivers in the different countries within the region.

Being a multidisciplinary approach, it is impossible to design one single method of data collection, hence proper metadata management is crucial and every piece of information used should be quality tested.

Indicators selection

Considering the lack of ground information, the identification of information (needed and available) and of measurable indicators and their integration can be accomplished in workshops, where each component is considered as well as its contribution to the overall assessment.

It is crucial that the indicators selected reflect the impact, exposure, sensitivity and capacity to cope to the consequences of climate change and are based on the region's reality. An option is to identify them and discuss them with regional experts from each component of vulnerability (social, economic, political, ecological, and physical) in a scenario where the applicability of each indicator and assumptions, limitations and methods of collecting and producing information are discussed.

Credible indicators can be achieved by a process based approach, instead of a diagnosis of population characteristics and require clear stated objectives and scales, the inclusion of statistic assessments, acknowledgement of the connectivity between stressors and the coupling of the different components.

It is important that the chosen indicators provide information on exposure and capacity to cope, as opposed to impacts caused by change on environmental conditions, or purely ecological information.

Policy and institutions assessment are important, and the indicators selected should measure the institutions' capacity to increase adaptation and allow an open numerical answer.

A common alternative to transform information into indicators is establishing ranks, and these can be numerical or non-numerical. Non numerical ranks are often based on expert knowledge but also on thresholds assessment.

Integration of information

The aggregation of indicators of each component of vulnerability is often represented as a straight aggregation of values; however, it can also be done assigning ranked values to information.

Issues of assigning weights to indicators and the aggregation itself need to be carefully thought in order to diminish subjectivity. If weights are assigned to indicators, there needs to be a clear discussion about how it should be done and the reasoning/justification behind each weight.

Setting the indicators and aggregating information can be achieved with expert knowledge through workshops and/or interviews. Both require time and effort in organizing and should have specific and clear objectives; considering the constraints related to information and lack of temporal series of data, it is a good alternative. Methods to integrate information range simple sums of components to decision trees, neural networks, and matrices, all of which require the standardization of ranking of indicators.

At this stage, scale is also crucial; while aggregating information at regional level, pockets of vulnerability - a similar concept to biodiversity "hotspots" - could be lost, and those communities with greater vulnerability could lose significance.

In order to include the local scale and to ensure the inclusion of those "vulnerability hotspot" areas, considering that it would be impossible to assess all protected areas within the region, a solution could be to select a few areas that are representative of the region's geographical settings and ecosystems and downscale the assessment to those selected areas. The aggregation or categorization of similar protected areas and important conservation sites, and the application of a more detailed assessment to resulting categories would be another alternative to involve all three scales in the assessment.

Visualising information and mapping

The location of information in maps alone can provide an idea of vulnerability profiles and of the context within the region, as well as the identification of vulnerability hotspot areas.

Maps and visual figures can be used to obtain a rapid screen or an idea of the situation around protected areas, including conflicts with other land use activities, geographical settings and potential natural and artificial barriers for species and ecosystem adaptation and/or dispersion.

Depending on the quality of information available and its scale, several layers of information can be combined and thus a more complete diagnosis of the geographical context can be obtained. Crucial issues that need to be considered are related to the metadata (dates of information collected, processed and analyzed, methods, assumptions and sources).

Interpretation of vulnerability values

Results should be interpreted according to each area's reality, hence understanding the drivers of vulnerability and knowing how to interpret the final score is crucial. Transforming that score or value into a storyline based on the understanding of the processes that are modeling vulnerability is also vital. Hence, for each vulnerability assessment, be it numerical or visual, the use of a storyline is recommended to interpret the results and explain the drivers, location, conditions and characteristics considered behind that resulting number or map. By doing this, some of the simplifications involved with numerical and spatial approaches can be explained and the reader can understand better and use the results within context.

Similarly, when the results are used for comparison purposes, it is important to understand what is behind the resulting figure, map or table, as the drivers define the vulnerability and not the resulting value. The comparison will only be useful if those drivers and the context of the assessment are understood.

Other General considerations

Participatory approaches with experts in the region, experts about each component of vulnerability and the national authorities are very helpful in multidisciplinary approaches and to

understand the processes behind vulnerability. Such approaches can include workshops, interviews, questionnaires, meetings, discussion groups, and seminars.

The inclusion of case study areas in which the selected method is applied at a finer detail will allow the calibration of the method, the identification of shortcomings related with the aggregation or with the indicators identified and the detection of limitations and constraints. These case study areas do not need to be a protected area itself, if could be a group of them selected according their locations, geographical settings, ecosystems, pressures, and other factors.

4. Main Assumptions and limitations of the vulnerability assessment

Assumptions involved with the project proposal regarding the vulnerability assessment and the information available are included in one or more of the following topics: continuity and variability of climatic variables and their relation to the different species selected; the role of current protected area if ecosystems and species disappear or disperse to other areas; habitat quality; species patterns of migration and dispersion; the role of natural and artificial barriers and; and ecosystem services provided by protected area in the region.

Important drawbacks at the moment seem to relate to: the absence of information at the socio-environmental level; the exclusion of plants in the assessment and lack of information on how ecosystems are being pressured by other stressors different to climate change.

Other potential limitations include: relevant information from different spatial and temporal scales, species and taxa selected for the assessment, identification of units of exposure, the exclusion of sea level rise, other drivers related to vulnerability to climate change, and the scale of the assessment to achieve some of the project's objectives.

Limitations related to the use of indicators and composite indices include: subjectivity related to the selection of indicators and methods of aggregation, lack/paucity of data, accumulation of uncertainties, and oversimplification of a complex situation.

5. Recommendations

The following list summarizes key aspects that need to be considered to assess the vulnerability of the protected areas' network to climate change in West Africa:

- Considering the available information and scale of work, the main objective of building capacity among protected areas' authorities in West Africa should be refined, and/or a greater weight to policy and socio-economic factors should be given (to equal the ecological one).
- It is important to clarify if the vulnerability assessment aim is to identify the drivers of vulnerability in order to build capacity within the region or to identify how current protected ecosystems and species are likely to respond to climate change.
- It is necessary to gather more information even at the regional level. There are other sources of information that could be used. Additionally, for data that is not widely

available, another option would be to include other partners (national, regional and global) in the project, through workshops, information sharing and other participatory approaches.

- It is important to identify how social and ecological systems are responding to climate related stressors at present time and the units of exposure, as well as adaptation.
- With respect to the scale of assessment, the main problem with aggregating information at the national and regional level is that information is homogenized and does not necessarily reflect the real vulnerability, and pockets or "hot spots" of vulnerability can be lost. Hence, it is crucial, regardless of the level of assessment, to identify critical areas where local vulnerability is greater in comparison with other areas
- Although several variables, parameters and indicators have been outlined in this report, all of which have been used in vulnerability assessments, it is important to understand that those variables might not be the most accurate for this vulnerability assessment. The selection of indicators should be as objective as possible and aimed at assessing protected areas network vulnerability to climate change, hence they might vary from traditional national indicators available. The selection of variables to assess vulnerability should be a participatory approach with regional experts from social, ecological, political and economic disciplines.
- Variables chosen and indicators selected should also be formulated to allow periodical vulnerability assessments.

To ensure a holistic analysis of vulnerability to climate change, it is vital to first assess how social and natural systems currently respond to climate-related stressors with a view to determining how social and natural systems will be affected by future changes in climate. Based on a sophisticated understanding of vulnerability today and the factors that will shape it in the future, the design of robust adaptation policies and practices, which promote both biodiversity conservation and social and economic sustainability, will be enhanced.