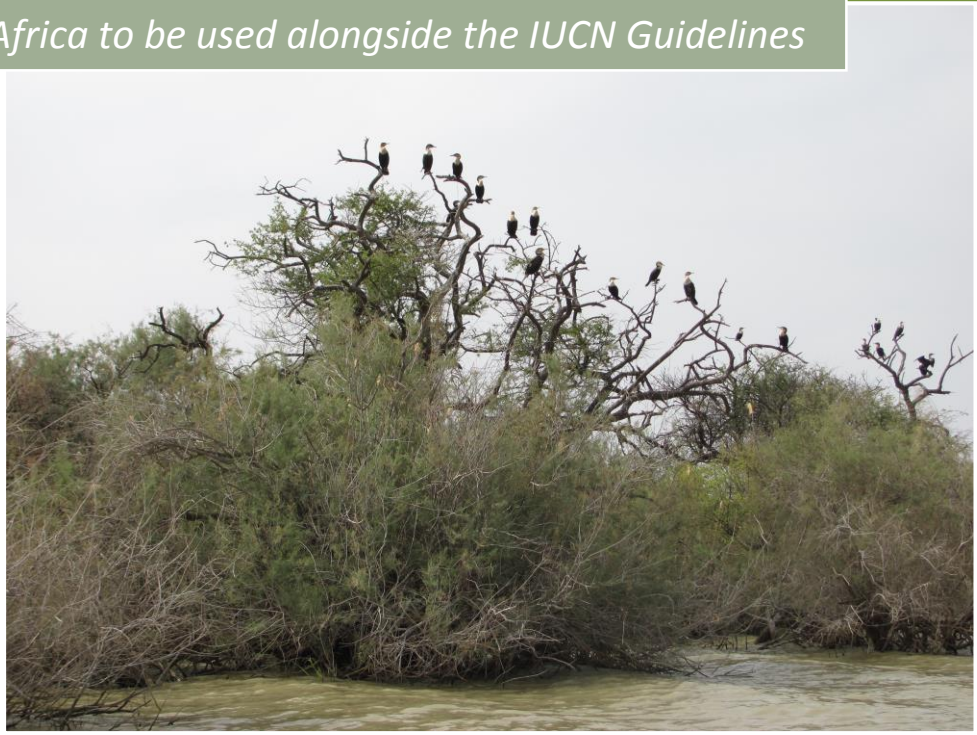
Protected Areas Resilient to Climate Change, PARCC West Africa

2016

# Guidelines for protected area managers in the face of climate change

*Insights from PARCC West Africa to be used alongside the IUCN Guidelines*



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## Acknowledgments

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## Executive Summary

This report highlights good practices and approaches to plan and manage protected areas (PAs) in the face of climate change, with a focus on West Africa. It is adapted from the IUCN's World Commission on Protected Areas guidelines (consultation draft) 'Responding to Climate Change: Guidance for Protected Area Managers and Planners'[1] and complemented with some of the findings of the 'Protected Areas Resilient to Climate Change (PARCC) West Africa' project, which produced a number of science-based tools and strategies to help PA managers strengthen the resilience of PA networks to climate change.

In the face of climate change, PA managers will increasingly have to integrate change into planning and management, rather than consider PAs as fixed entities. Adaptation strategies will also need to consider specific threats and needs and be capable of addressing the most relevant climate impacts and vulnerabilities. Key elements of management planning in the face of climate change are: i) assessing social and ecological vulnerabilities to climate change and using this information to identify and select adaptation actions; ii) building capacity for adaptation to climate change; iii) conducting planned adaptation actions, iv) monitoring the effectiveness of the adaptation actions and v) reviewing existing goals and objectives from a climate change perspective.

The results of the PARCC project have shown that the climate of West Africa has been changing in recent decades, with some of these changes clearly attributable to global climate change (Janes et al. 2015). In addition to existing anthropogenic threats, biodiversity and PAs in West Africa are being affected by these changes, and a number of PAs are expected to lose, or more rarely, gain species as their distribution is expected to shift under climate change (Baker and Willis 2015). A significant number of West African species have also been identified as being vulnerable to climate change based on their biological traits (Carr et al. 2014). Of these species, those that have been assessed as globally threatened should be considered priorities for conservation. It is expected that climate suitability will decrease in the current ranges of a large proportion of species by the end of the century, and a high species turnover is expected in most PAs of the region, especially in the Guinean Forest region (Baker and Willis 2015).

The PARCC project recommends improvements in effectiveness of PA management in order to enhance the resilience of PAs to climate change. It will also become important to adopt a more flexible approach to management that takes into account climate impacts. For instance, for species identified as vulnerable to climate change, specific management options could be to facilitate their dispersal and identify sites of suitable climate persisting within their current ranges. In addition, in order for all essential conservation features of the region to be protected, it is recommended that existing PA networks are extended and better connected through corridors.

[1] Gross, John, James Watson, Stephen Woodley, Leigh Welling and David Harmon. *In press*. Consultation draft. Responding to Climate Change: Guidance for Protected Area Managers and Planners. Best Practice Protected Area Guideline Series, Gland, Switzerland: IUCN.

# 1. Introduction

Protected areas (PAs) have long been used as a key mechanism for conserving the multi-faceted value of biodiversity. PAs in West Africa are, however, under heavy and increasing threats from anthropogenic pressures, including overexploitation of natural resources, poaching, and bush fires, which are expected to be exacerbated by climate change. Furthermore, existing capacity to manage resources within the region is often inadequate.

PARCC West Africa, officially known as 'Evolution of protected area systems with regard to climate change in the West Africa region' is a full-size GEF project focusing on the impacts of climate change on PAs, implemented from 2010 to 2015, with UNEP as the implementing agency and UNEP World Conservation Monitoring Centre (UNEP-WCMC) as the executing agency, working in collaboration with IUCN West and Central Africa Programme (IUCN PACO).

The main objective of the PARCC West Africa project was to develop strategies and tools to increase the resilience of PAs to climate change, and build capacity in the region to implement these new approaches. After developing new regional climate projections for West Africa, the vulnerability of species and PAs to climate change was assessed through two complementary methodologies which were subsequently integrated: Species Distribution Models (SDM) and Traits-based Vulnerability Assessments (TVA). An analysis of the connectivity of the West African PA network also highlighted the importance of specific PAs and links between PAs. Based on these findings, a gap analysis and spatial conservation prioritisation was carried out using the systematic conservation planning approach, both at the national and regional level, to help inform the design of new PAs. Based on the scientific outputs mentioned above, five transboundary pilot sites were selected for the implementation of practical activities aimed at enhancing the resilience of transboundary PAs. These activities included developing recommendations for species monitoring, designing or revising transboundary management plans that consider climate change (for The Gambia, Mali and Chad), as well as the development of a new Management Effectiveness Tracking Tool (METT) integrating climate change aspects. Finally, adaptation strategies and policy recommendations were developed for climate change adaptation and PA management at the national and regional level.

This report highlights good practices and approaches to plan and manage PAs in the face of climate change, with a focus on West Africa. It is based on the IUCN guidelines 'Responding to Climate Change: Guidance for Protected Area Managers and Planners'[1] (in the following referred to as 'IUCN guidelines') and has been given a specific focus on the West Africa region, notably through some of the results of the PARCC West Africa project. This document is primarily aimed at PA managers and planners, but also decision makers, and any other stakeholders in PA management. The report therefore follows the structure of the IUCN guidelines, with the addition of numerous references to the findings of the PARCC project.

# 2. Planning for change

## 2.1 Manage for change, not just persistence

PAs have been key to biodiversity conservation, however, their fixed boundaries make them particularly sensitive to climate change impacts. In the face of climate change, PA managers will thus increasingly have to 'manage for change rather than focus on maintaining the persistence of existing systems' (Gross et al., *in press*). Importantly, it will be necessary to plan for the future by developing conservation goals and objectives that are likely to remain meaningful under future climate and ecological conditions, rather than trying to maintain or restore reference conditions from the past. In order to do that, PAs will need to be considered as part of the larger landscape and seascape. PA management will have to become more adaptive, and will have to look into the future in order to tackle in a timely and appropriate manner the challenges posed by climate change. To this end, PA planning and management will need to make use of the best social and ecological knowledge in order to support decisions that take into account climate change impacts, as well as the uncertainties associated with future climate scenarios.

In West Africa, the PARCC project showed through regional climate projections that the climate is expected to significantly change in the region. Five high resolution regional climate models were used by the Met Office Hadley Centre (MOHC) to assess the potential changes in temperature and rainfall across West Africa (Janes et al. 2015). These models all suggested a general warming trend, in agreement with global climate models used to inform the Intergovernmental Panel on Climate Change Fifth Assessment Report (IPCC AR5). In conjunction with this warming, an increase in temperature variability is also apparent within the regional climate results, and could result in a greater frequency of unusually hot events. The high level of agreement across global and regional climate models suggests that there is a high level of confidence associated with this projected increase in temperatures. Projections for mean annual temperature change in West Africa range from 2.5 to 5.5°C by the end of the century (Hartley et al. 2015).

These expected changes could have large impacts on ecosystems and livelihoods across the West African region, and adaptation of these systems will be required in order to make them resilient in the face of any negative impacts. Climate variability and change is for example likely to lead to an increase in uncontrolled bushfires, especially in the Sahel; PAs will therefore have to be managed in order to reduce the risks of fires.

With regards to rainfall, projections with both regional and global climate modelling experiments are highly variable, with projections of precipitation changes ranging from –60% to +50% by the end of the century, with little to no consensus on either the direction or magnitude of potential changes. Thus, the best advice currently is to build robust resilience to current climate variability, as either the drier or wetter types of this variability could be experienced in the future.

Based on these climate projections, the PARCC project also showed that the expected species turnover is high within most PAs, with climate expected to become less suitable for a high number of species (see next section below). This information can be used to inform the choice of appropriate management strategies for the PA (see section 4 below).

## 2.2. Reconsider conservation goals, not just management strategies

Clearly articulated conservation goals and objectives are essential to identify appropriate management interventions and to monitor and evaluate the effectiveness of these interventions. A key aspect of climate adaptation for PA management will be to reconsider existing goals and objectives in the light of climate change and the associated uncertainties, and to 'adopt forward-looking, climate-informed goals'. It will also be important to adopt goals both at the PA level and at the level of the entire PA system, and assess whether the goals adopted are 'climate-smart'.

To set these goals, it is recommended that the 'SMART' framework is used, that is to say, that the goals should be Specific, Measurable, Achievable, Relevant and Time-bound. Within the framework of climate change, it is particularly important to define attainable goals, but these should not be restricted to the easiest ones to accomplish in the present conditions. Aspirational goals should be considered too, taking the likely future climate conditions into consideration (Gross et al., *in press*).

Conservation goals and targets tend to vary between PAs. Conservation targets may include species, habitats, unique biological attributes, or resources that provide essential services to communities inside and/or outside the PA. These conservation targets or criteria to justify the exceptional value of the PA are generally mentioned in the PA establishment documentation or management plan. Assessing the vulnerability of these conservation targets to climate change can help managers develop more climate resilient goals and measures.

In West Africa, climate change is expected to cause changes in species' distributions and abundance patterns and cause changes in ecosystems and the services they provide. It is therefore important to assess the likely suitability of the current PA network to protect species of conservation interest in the future, in order to set appropriate conservation goals. Within the framework of the PARCC project, Species Distribution Models (SDMs) have been used to model the likely future distribution of species under the effect of climate change.

The projections of future climatic conditions from the MOHC were used (see section above), as well as estimates of dispersal potential, to assess impacts of changing climatic conditions on the distribution of bird, mammal and amphibian species across the region's PA network (Baker and Willis 2015). SDMs do not take into account the ability of species to adapt to climate change or species interactions; these aspects have been considered by assessing species vulnerability to climate change based on their biological traits (see section 3 below). Results from SDMs have shown that climate change impacts on West African biodiversity across the region's PA network are projected to increase during the 21$^{st}$ century. For instance, a species turnover of 26% of amphibians, 14% of bird and 16% of mammal species is expected by the 2010-2039 time period, and by the 2070-2099 time period, 91% of amphibian, 40% of bird, and 50% of mammal species are projected as 'extremely likely' to have reduced climate suitability across the region's PA network. Individual PAs are likely to both lose and gain species as their distributions shift, resulting in significant changes to faunal communities in many PAs. The analysis has also shown that the PAs which are likely to be highly impacted by climate change for two or more taxa are located in the Guinean Forest region, with most of the PAs found in Ivory Coast.

All the project's SDM results can be found either by searching for a specific West African protected area on the Protected Planet website, the online interface of the World Database on

Protected Areas (WDPA), or by accessing the list all West African PAs at http://parcc.protectedplanet.net/sites.

## 2.3. Adopt forward looking, climate informed goals

Many existing conservation goals are focused on past reference conditions and use these to guide current management actions. With climate change, there is a need to adopt 'forward-looking and climate-informed goals'. It is recommended that the goals include the following components: the conservation target such as species or habitat types ('what'), the intended outcome ('why'), the geographic scope ('where') and the timeframe for the goals ('when').

It is important that the goals and objectives take into account possible future climate and ecological conditions rather than focus only on the past ones. Information about the past can help to understand how ecosystems and societies respond to changes. However, in a context of continuous change, maintaining past or current conditions will become increasingly difficult and in some cases problematic, and may result in interventions that undermine adaptation or that conflict with other PA values such as the maintenance of 'naturalness'. While respecting the past, it is therefore essential to also plan for the future. There is therefore a need to gain a better understanding of the effects climate change can have on biodiversity and protected areas, on the basis of regularly updated information and data. Both near-term and longer-term conservation challenges should be considered, as well as transition strategies, and the institutional landscape should be treated more broadly by engaging and collaborating with a wide variety of stakeholders.

A key recommendation for developing climate-informed goals is to broaden the planning horizon. This is done by considering PAs as part of the larger landscape and seascape, taking into account possible climate-induced shifts in the dispersal of species and threats both within and outside PA boundaries. For instance, the PARCC project contributed to assessing the likely future distribution of species under the effect of climate change (see section 2.2. above). Furthermore, the connectivity of the West Africa PA network was also assessed to identify which PAs or links between PAs are the most important to maintain or enhance connectivity (see section 4 below).

Finally, there are a number of uncertainties associated with climate projections, as well as with social and ecological responses to change. Regional climate projections carried out as part of the PARCC project (see section 1 above) have shown that an increase in temperatures is expected in the West Africa region, but there is little consensus regarding potential changes in precipitation, which is very important in determining future ecological conditions. When designing goals and objectives, PA management should therefore consider these types of uncertainty. Existing approaches for dealing with uncertainty in planning and decision making include scenario-based planning and structured decision-making (see Gross et al., *in press*, for more details).

## 2.4. Link adaptation actions to climate impacts

The IPCC's fifth assessment (IPCC 2014) defines adaptation as 'the process of adjustment to actual or expected climate and its effects'.

There is no one-size-fits-all adaptation strategy and many adaptation actions will draw on both new and existing practices and tools. What is important is that the proposed strategies and actions consider the combinations of threats and needs that are specific to a particular PA, that they address relevant climate change impacts and vulnerabilities, and that they contribute to the achievement of the forward-looking climate-informed goals adopted for the PA.

When planning for adaptation, it can help to use logic models to explain how particular actions lead to the desired outcomes, that is to say that the proposed actions should follow a clear logical argument. Given the uncertainties associated with climate change, there is not necessarily a right or wrong approach, but adaptation actions should be carried out in a purposeful manner and follow a clear rational, including assumptions about how the system is likely to respond. These types of logic models are in line with the Open Standards for the Practice of Conservation (CMP 2013) concept of 'Theory of Change', which describes how specific actions will lead to the chosen conservation outcome.

Adaptation is generally understood as a means of reducing vulnerability and risks while taking advantage of possible beneficial effects of climate change. Vulnerability assessments therefore constitute the basis to identifying adaptation strategies and linking actions to climate impacts.

The linkages between adaptation actions and climate impacts should be clearly articulated and documented, not only to gain support from others, including prospective funders, but also to allow for adaptive management and learning. In the face of an increasingly variable and uncertain climatic future, adaptation is an on-going process and adaptation actions can be seen as 'hypotheses to be monitored, evaluated, and refined as needed' (Gross et al., *in press*).

## 2.5. Integrate climate into existing planning

Limitations such as competing demands or limited resources may prevent the development and implementation of climate adaptation plans. Integrating climate considerations and adaptation into existing processes can help overcome these challenges and connect longer term-adaptation needs with short-term conservation challenges. However, in West Africa climate change is rarely taken into consideration in existing policies, and the understanding of the links between climate change, protected areas and communities should be improved (Masumbuko and Somda, 2014).

Uncertainty and the long time scale of many climate change impacts sometimes constitute obstacles to the implementation of adaptation actions. This can be addressed by focusing on short term strategies and actions that are compatible with adaptation needs in the long term. These approaches are known as 'no-regrets' or 'low-regrets' strategies.

Stand-alone adaptation plans are particularly useful when climate change is the primary focus of management. They can also be useful to demonstrate success on a pilot scale. However, as expertise increases, it is expected that climate considerations will become an integral component of all PA planning and management.

In the PARCC project, regional and national adaptation strategies and policy recommendations were developed on the best approach to managing PAs in the West Africa region (Mulongoy, 2016a) and at the national level for each of the five project countries (Mulongoy, 2016b). This included ways to integrate recommendations into i) National Biodiversity Strategies and Action Plans (NBSAPs) of the Convention on Biological Diversity (CBD), ii) National Adaptation Programmes of Action (NAPAs) and National Adaptation Plan (NAP) of the United Nations Framework Convention on Climate Change (UNFCCC) and iii) Sustainable Development Goals (SDGs).

The proposed elements of the adaptation strategies for each country include three strategic goals and eleven objectives, which have been developed taking into account existing adaptation activities. The three strategic goals have been defined as follows:

1. Strengthening ongoing conservation plans and programmes and their implementation so as to improve the performance of existing PAs and finalise the designation or regulation of areas identified as requiring protection;
2. Anticipate climate change impacts and adopt a proactive response to ongoing and future environmental changes; and
3. Create or strengthen the enabling environment for a successful implementation of national strategies, including through the integration of elements of these strategies into wider strategies, plans and programmes.

Guidance and tools that were developed under the NBSAPs 2.0 *Mainstreaming Biodiversity and Development* project executed by IIED and UNEP-WCMC, as well as the publications *Tips and tasks from African experience* (IIED and UNEP-WCMC 2015) and *Developing a business case for biodiversity* (IIED and UNEP-WCMC 2014) may also be useful in the context of mainstreaming climate change considerations and adaptation into various processes.

# 3. Assessing climate change vulnerability

Climate vulnerability assessments are key to define adaptation options as they bring together essential information on climate projections, important conservation features, and on the possible ecological and social consequences of climate change. To this end, it is essential that all the necessary information and data are up-to-date and easily accessible.

## 3.1. Design the vulnerability assessment to match the needs of the PA

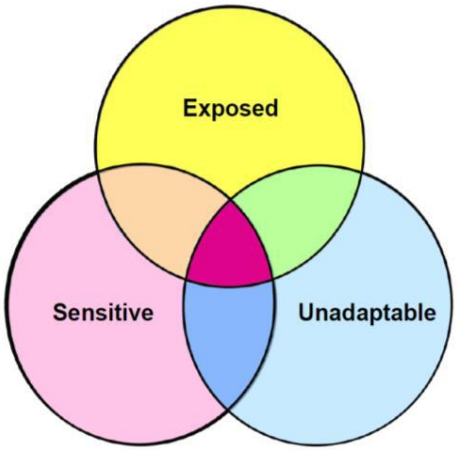
Climate vulnerability assessments are essential to inform management goals and adaptation strategies and should be conducted early in the adaptation planning process. They help to understand '*which* conservation targets are most vulnerable, *why* they are vulnerable and *where* they are vulnerable in a given protected area' (Gross et al., *in press*).

Conducting a vulnerability assessment involves selecting the geographic area, the time period, the number and types of conservation targets to be assessed, and the methods and data to be used. The area can be larger than the PA to include species or habitats susceptible to migrate into (or out of) the PA and take into account possible changes occurring in the wider landscape such as changes in land or water use. Vulnerability assessments that cover multiple time periods and incorporate scenarios are particularly useful as they can support a broad range of decisions addressing both near-term and longer-term challenges.

A number of approaches exist for assessing the vulnerability of species, habitats, ecosystems, biomes and human communities to the effects of climate change. Vulnerability assessments need to be designed to match the needs, resources and capacities of the PA. Approaches to assessing vulnerability include species-based approaches, many of which are described in the IUCN Best Practice guidelines on species vulnerability assessment (Foden et al. 2014), as well as ecological communities and landscape approaches, which enable users to assess vulnerability at multiple levels and identify changes at a broader scale. Vulnerability assessments can also focus on habitats, ecosystems, biomes or plant functional types, and more recently on ecosystem services. They can also focus on the well-being or economic activities of local communities (see below).

In the PARCC project, we used two complementary approaches to assess the vulnerability of species and PAs to climate change: Species Distribution Models (see section 2 above), which assessed the likely future distribution of species under the effect of climate change, and Traits-based Vulnerability Assessments (TVAs), which consider specific ecological and biological traits that can make species vulnerable to climate change. Through several workshops with national and international experts, biological and ecological trait data were collected for all West African amphibian, bird, freshwater fish, mammal and reptile species (Carr et al. 2014). This data was used to infer, for each individual species, their 'sensitivity' and 'adaptive capacity' to climate change. Species distribution polygons, collated through the process of assessing species for the IUCN Red List, were overlaid with future climate projections provided by the MOHC (see section 2 above) to determine the changes in the means and variability of temperature and precipitation that each species may be exposed to. Species that are both considered sensitive and poorly able to adapt to climate change,

and are among the most severely exposed to climatic changes are described as 'climate change vulnerable'.




***Climate change vulnerability (in dark pink) occurs where species face highest Exposure to climatic change (in yellow), and also possess biological traits that confer both Sensitivity (in pink) and a Low Adaptability to such change (in blue).***

The number of species qualifying under each component of the assessment framework was calculated, for all individual biological traits used and for each individual framework 'dimension' (i.e., sensitivity, low adaptability and exposure), as well as the total number of species considered climate change vulnerable. Based on these results, maps were created highlighting the broad geographical areas that contain high numbers and/or proportions of climate change vulnerable species within a given taxon. This information can help conservationists identify the most prevalent mechanisms through which climate change may impact upon each taxonomic group in the region, and can help to develop suitable adaptation actions. Furthermore, the identification of the geographic areas that contain high numbers and/or proportions of climate change vulnerable species within a given taxonomic group can be used to determine where conservation measures to reduce the impacts of climate change may be most urgently required. It is recommended that species that are both globally threatened and vulnerable to climate change should be seen as top priorities for conservation action. Similarly, species that are either threatened or climate change vulnerable should also receive attention, and species that are considered Data Deficient on the Red List and/or were unable to be assessed in terms of climate change vulnerability due to insufficient information should be considered as priorities for research.

All the project's TVA results can be found on the Protected Planet website by searching for a specific West African PA, or by accessing the list all West African PAs at http://parcc.protectedplanet.net/sites.

Finally, social and ecological vulnerabilities are often interlinked. Therefore, undertaking social vulnerability assessments and adaptation planning activities are also very important to integrate the vulnerability of communities living in and around PAs to the impacts of climate change. For example, the project 'Climate resilient communities and protected areas in coastal West Africa' used a participatory approach of resilience and adaptation planning (Wicander et al. 2016) which could be applied throughout the region and beyond. The 'Guidance on integrating ecosystem considerations into climate change vulnerability and impact assessment (VIA) to inform ecosystem-based

adaptation' (Munroe et al. 2015), which focusses on how to ensure that potential changes in ecosystem services are incorporated into social vulnerability assessments, also highlights a useful way to integrate the adaptation of ecological and social systems.

## 3.2. Use a structured process to conduct the assessment

Usually, PA managers contribute to the design of the assessment to ensure it can inform the management planning process, but the assessment itself is generally carried out by external experts. For more information on how to develop a management plan, the IUCN Guidelines for Management Planning of Protected Areas can be consulted (Thomas and Middleton 2003).

Key decisions to be made include selecting the area, time period, number and specific types of conservation targets to be assessed. A number of climate projections can be used that differ in geographical scale, climate variables considered, time resolution and methodology.

Vulnerability assessments are often made up of four stages (Gross et al., in press). The first one consists in defining the purpose, the audience and the decisions to inform, the second stage consists in gathering and evaluating information, the third stage in identifying patterns, implications and potential adaptation options, and the fourth stage in reporting and communicating the results.

## 3.3. Focus on key vulnerabilities

Results from vulnerability assessments can help determine priorities by selecting the vulnerabilities that can link conservation objectives with adaptation actions (Gross et al., *in press*). Criteria used to identify key vulnerabilities vary with the goals of the PA or planning process and may include: ecological significance of the conservation asset at risk, magnitude, likelihood, reversibility and/or timing of impacts, implications for other relevant societal values, and potential for successful adaptation.

# 4. Management strategies

As mentioned in section 2.4 on linking adaptation actions to climate impacts, there is no one-size-fits-all adaptation strategy and many adaptation actions will draw on both new and existing practices and tools. What is important is that the proposed strategies and actions address relevant climate change impacts and vulnerabilities, taking into account the uncertainties of projections, and that they contribute to the achievement of the forward-looking, climate-informed goals adopted for the PA (Gross et al., *in press*).

We suggest that these goals should consider specific species, where relevant, but should also include species-independent descriptions of the target state of the ecosystems. For example, they could describe the anthropogenic stressors that should be reduced (such as water pollution or overhunting), the natural processes that are to be maintained (such as bird migration), or whether the PA is expected to protect 'natural' ecosystems' or a cultural landscape. Such descriptions are thereby much more likely to remain relevant in the long term.

Identifying and selecting adaptation options can be done through a variety of techniques including brainstorming workshops and scenario planning. It usually involves experts, PA managers and decision-makers, and community members with local knowledge.

## 4.1. Implement 'no-regret' actions common to all PAs

'No-regret actions' are defined as 'actions that PA managers can undertake to be ready for climate change regardless of any chosen strategy and regardless of the amount of climate change the PA is going to experience' (Gross et al., *in press*). These include: ensuring that management capacity is in place for effective management in a changing climate, making sure that there is institutional support for adaptive management, increasing knowledge and information of impacts and responses to a changing climate, increasing awareness and motivating action by others through improved communication, and engaging participants and partners in common solutions. Providing capacity for monitoring to verify that the projections are correct is also important.

Finally, it should also be noted that there may also be 'no regret' actions specific to a PA, such as addressing a particular stressor.

## 4.2. Identify the full range of potential adaptation options

It is recommended to list the broadest possible range of options starting with general approaches to adaptation and best practices, and then expand the list by developing more specific options tailored to the local context. Possible adaptation actions can be identified through literature reviews, workshops and scenario planning.

In the PARCC project, a review of options for managing and financing PAs in the face of climate change identified a range of adaptation strategies and provided some guidelines on how to select and

implement them (Smith 2013). The review showed that these adaptation strategies use similar tools and approaches to business-as-usual PA management, but integrate information about likely climate change impacts and a much more dynamic understanding of biodiversity and climate. However, changing PA agencies to adopt a new more dynamic approach to PA management is a great challenge. It also highlighted that a broad range of financing mechanisms are available to support adaptation actions, some of them already in use in West Africa.

### *System level thinking in climate change adaptation*

Best practices for adaptation **at the system-level** include the following principles and actions:

- Expanding the PA network in order to enhance species and ecosystem adaptation to climate change;
- Having a variety of PA sizes in the system, but prioritising very large representative units;
- Planning PAs that have high physiographic diversity;
- Ensuring that legal and regulatory framework allows PA managers the flexibility to adapt to climate change;
- Ensuring landscape and seascape permeability by retaining and/or enhancing connectivity and prioritising the protection of large intact systems;
- Integrating PAs into the wider landscapes and seascapes; and
- Regularly reviewing PA boundaries, when necessary (given the cost associated with frequent changes).

For the West Africa region, the PARCC project contributed to a better understanding of how the PA network could be improved and better managed in the face of climate change, though a) an assessment of the connectivity of the PA network, and b) the identification of priority areas for conservation outside the existing PA network which would benefit from being protected.

**Assessing the connectivity of the PA network**

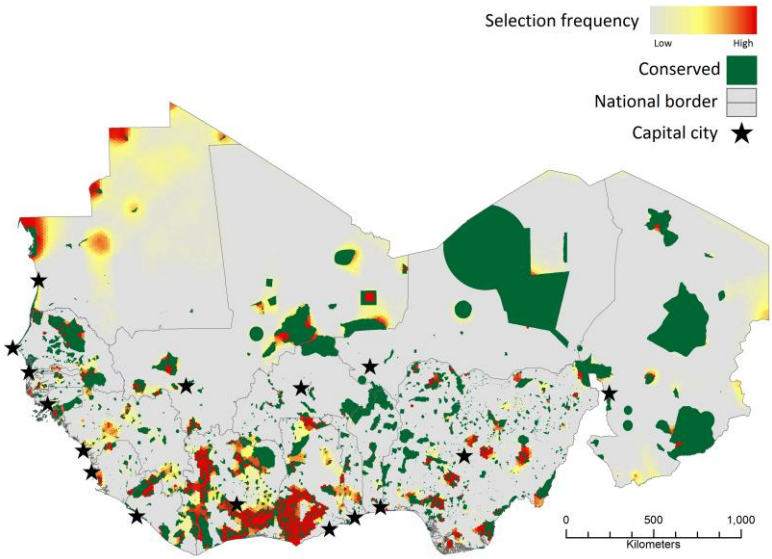
The connectivity of the West African PA network was assessed in order to better understand the importance of specific PAs and potential links between PAs, with a specific focus on transboundary sites (Arnell et al. 2014). This study used a set of generic focal species as surrogates to represent a combination of two variables: species habitat preferences (forest, grassland and generalist) and maximum dispersal distances (short, medium, and long). This approach modelled PAs containing habitat as patches and the distance between PAs as links. The value of a PA for connectivity was calculated from the overall change in connectivity of the PA network when the PA was removed, and the importance of potential links were calculated by measuring the connectivity change of the network. This study highlighted the importance of using a variety of approaches to improve connectivity for species with different dispersal distances. For short dispersal species, in most instances, habitat management and improvement should be preferentially implemented within PAs. Medium dispersal species, however, could be appropriate targets to improve links between PAs, especially for forest specialists. Finally, for long dispersal species, targeting the improvement of links between distant PAs may be less cost effective considering that a potentially high number of barriers may be present; therefore, better PA habitat management or PA expansion may be the best use of resources.

**Identifying priority areas for conservation through Systematic Conservation Planning**

Systematic conservation planning (SCP) is the most widely used approach for designing or improving PA networks. It involves producing a list of important species, habitats and ecological processes (collectively known as 'conservation features'), mapping their distributions and setting targets for how much of each conservation feature should be protected. These data are then used to carry out a gap analysis, which measures the extent to which the existing PA system meets these targets, and a spatial conservation prioritisation, by identifying priority areas for filling any target shortfalls. PA networks also need to be robust to the impacts of climate change, as the distributions of the conservation features are likely to shift in response to changes in temperature, rainfall and sea levels. SCP can be used to address this problem by identifying priority areas for conservation that protect current species distributions, as well as their predicted future distributions.

A gap analysis and spatial conservation prioritisation for the West African region was carried out thanks to a regional SCP system (Smith 2015). This system was used to help identify different ways in which PA networks could be improved to conserve biodiversity both now and in the future, taking into consideration climate projections. The SCP system for West Africa contained data on all natural land cover types, ecoregions, and amphibian, bird and mammal species found in the region. It also contained data on the predicted future distributions of amphibian, bird and mammals species that are listed as Threatened on the IUCN Red List and/or have been assessed as being vulnerable to the predicted impacts of climate change.

The West Africa region already has 12.6% of its territory comprised within PAs, while another 1.1% falls within unprotected Important Bird Areas (IBAs). The percentage of each country that falls within PAs or unprotected IBAs ranges from 1.1% for Mauritania to 34.8% for Guinea-Bissau. Only six West African countries would meet their Aichi target 11 if IBAs were also included in their PA network. The gap analysis showed that the West African network of PAs and IBAs meets targets for over half of the ecoregions, but fails to conserve any of some specific ecoregions. The PAs and IBAs network meets targets for the majority of conservation features, however, some features are completely missing from this network, such as threatened species, with a significant number being currently unprotected. The conservation planning software was then used to identify priority areas for meeting the conservation targets. The analysis was designed to avoid areas of high human population density, where possible, and to identify priority areas that extend existing PAs or are large enough to be ecologically viable. It was calculated that for meeting all the conservation targets that were set, 21.6% of the West Africa region would need to be protected.




***Priority conservation areas for West Africa: areas shown in red are the ones selected most frequently by the software as important for conservation***

The results from the gap analysis and the spatial conservation prioritisation can be used to inform conservation policy and practice in West Africa. However, caution is needed when using the results because most of the distribution data were based on range maps that include some unsuitable habitats. Thus, the first step in implementing these results is to carry out literature reviews and field surveys to confirm that each priority area identified is indeed important for the conservation features for which it was selected. Finally, it is important that researchers and conservation practitioners continue to improve the planning system by updating and adding new data.

### *PA level strategies and actions*

There are four main strategies to consider **at the PA level** to identify appropriate climate change adaptation actions according to Gross et al. (*in press*). These four strategies range from managing for existing conditions when ecosystems are unlikely to be much affected by climate change to adopting new ecological goals when new ecosystems are expected to form.

For West Africa, some of the outputs of the PARCC project can provide some useful information that can help selecting the most appropriate strategy to implement at individual PAs:

- SDMs (Baker and Willis 2015) provided, for each protected area in West Africa, a measure of the expected species turnover for mammal, bird and amphibian species, which gives an indication of the amount of change expected within the PA in terms of species composition. It also provides the list of species expected to significantly gain or to lose in climate suitability within the protected area. See section 2 above for more details.
- TVAs (Carr et al. 2014) were used to compile a list of species found within PAs which are considered vulnerable to climate change based on their biological traits. See section 3 above for more details.

All the project's SDM and TVA results can be found by searching for a specific PA on the Protected Planet website, or by accessing the list all West African PAs at http://parcc.protectedplanet.net/sites.

**1. 'Holding the line: Managing for existing conditions by ecological integrity and resilience'**

This strategy applies when the same ecosystem types are likely to remain practically unchanged, and it is therefore recommended to focus on improving management effectiveness to enhance the integrity of the PA. Existing conservation goals can be kept, and the following principles should be applied: i) PAs should aim to conserve all native species (possibly with a priority given to threatened and/or endemic species); ii) the viability of a few selected indicator species should be monitored; iii) ecosystem trophic levels should remain intact; iv) disturbance regimes should maintain existing biological communities; v) productivity and decomposition should be kept in balance within the ecosystem; vi) ecological connectivity should be ensured, and vii) known non climate related threats should be managed. This strategy should be considered where no expected species turnover is expected in the PA and almost no species considered climate change vulnerable, or when climate projections are too uncertain to make them the basis for adaptation action.

**2. 'Actively managing to maintain specific ecological values'**

This strategy applies when the PA's ecological integrity is affected but it retains its existing ecological functions. In this case, PA managers should focus their efforts on maintaining ecological values. They could for instance identify climate refugia where species could persist. Key principles for this strategy include: i) managing populations which have been identified as the goal of the PA and are likely to be lost if no action is taken; ii) maintaining genetic diversity of key populations; iii) actively identifying and managing climate refugia; iv) managing and restoring ecological processes; and v) considering how climate change is affecting important ecosystem services. This strategy should be considered where some species turnover is expected but is not very high, and a few species vulnerable to climate change have been identified.

**3. 'Managing for significant modifications to former ecological conditions'**

This strategy applies when conservation goals need to be reconsidered because it is expected that ecosystems will be disrupted and biodiversity will be lost even with an effective management. The following actions and principles should be applied: i) undertake vulnerability assessments; ii) forecast likely future changes for species and ecosystems; iii) work with all relevant stakeholders to develop new goals; iv) revise the monitoring plan; and v) assess which components of the new ecosystem might require active management in the future. This strategy should be considered where a high species turnover is expected, and a significant number of species, including charismatic ones, are expected to be affected by climate change.

**4. 'Moving to new ecological goals and managing a new ecosystem type'**

This strategy applies when new ecosystem types have been established or will be established in the near future, and the new conservation value of the PA will need to be defined. Key principles to apply this strategy include: i) using the best available information to forecast changes in species and ecosystems; ii) define the new value of the PA; iii) modify the PA's goals and write a new management plan (see Thomas and Middleton 2003, for general advice on management planning of PAs); and iv) decide if the transformation into a new ecosystem type requires immediate active management. This strategy should be considered where there is very high species turnover and a very high number of species considered vulnerable to climate change.

## 4.3. Build capacity

Another key element of management planning in the face of climate change is building capacity for adaptation to climate change. This can be done through 'equipping PA managers to respond to a changing climate' and by raising awareness of people on the effects of climate change.

Capacity building was a key element of the PARCC project and took place at multiple institutional levels through regional and national workshops in order to increase the understanding and knowledge of how climate change is likely to impact biodiversity and PAs in the West Africa region. All the training provided throughout the project can be found in the project training manual (UNEP-WCMC 2015). The manual is available in both English and French and divided into six modules: 1. Protected Areas and the World Database on Protected Areas (WDPA); 2. Climate data and scenarios; 3. The IUCN Red List of Threatened Species; 4. Species Vulnerability Traits; 5. Species Distribution Modelling; and 6. Conservation Planning.

### *Equipping PA managers to respond*

Equipping PA managers to respond can be done by: i) compiling a baseline of relevant information from a broad range of sources (i.e. local, national and international); ii) making sure that all stakeholders involved in PA management have a good understanding of climate change impacts; and iii) enabling the managers to plan for adaptive management, supported by all stakeholders, policies and financial resources. It is also essential that the different roles and responsibilities of the various stakeholders are well defined.

### *Passing the information on*

Informing relevant stakeholders can be done through the following activities: i) setting up an effective outreach programme targeting local communities and visitors; ii) focusing on messages that are solutions-oriented; iii) showing how climate change has already impacted the area; iv) developing new partnerships and programmes; v) using play, storytelling and role models; vi) involving the youth in communication design; vii) engaging young people through experiential learning; and viii) developing networks of educators.

# 5. Monitoring and Evaluation

Monitoring and evaluation (M&E) is extremely important in the context of climate change in order to manage PAs in the face of high future uncertainties. M&E is essential for the identification of successful adaptation processes. A monitoring and evaluation programme should be designed to show how management actions address climate vulnerabilities and contribute to adaptation, and assess whether the projected changes in climate and their impacts are actually occurring.

Goals and benefits of a monitoring and evaluation programme include identifying trends in key indicators of ecological conditions to inform decisions; assessing the results of management actions; improving management through learning; providing a baseline for comparison; promoting accountability and transparency; and involving the communities, building support, and promoting the values of PAs.

Best practice should consist of: i) using established principles and supporting adaptive management; ii) identifying how M&E will feed into and inform adaptive management; iii) anticipating and designing monitoring programmes that can measure and track change; and iv) including adaptation-specific indicators into existing monitoring practices.

## 5.1. Use established principles and support adaptive management

Key elements of successful monitoring programmes include 'early engagement of partners, good data management, clearly documented protocols, use of statistically credible designs, robust and documented methods for analysis of data, and regular reporting of results in formats appropriate to primary audiences' (Gross et al., *in press*).

A number of guideline documents have been developed for designing and implementing monitoring and evaluation programmes and can be adapted to PAs. These include the Biodiversity Indicators Partnership (2011)'s Guidance for National Biodiversity Indicator Development and Use, the IUCN Best Practice Guide for Evaluating Effectiveness (Hockings et al. 2006) and the Open Standards for the Practice of Conservation (CMP 2013). Bours et al. (2013) also provide a review of approaches.

Monitoring and evaluation is a key feature of adaptive management, especially under climate change. According to the IUCN framework for evaluating management effectiveness, adaptive management has six characteristics which Gross et al. (*in press*) summarise as:

- Regularly revisited management objectives
- An explicit and testable model of the system being managed
- Participants have described and evaluated a range of management choices
- Monitoring and evaluation of outcomes
- An explicit mechanism to incorporate learning into decisions
- A collaborative process for stakeholder participation and learning

A key aspect of PA management is monitoring its effectiveness. Within the framework of the PARCC project, the Management Effectiveness Tracking Tool (METT) has been revised to include climate change considerations (Belle et al. 2012). The two new questions added address the planning and management response to climate change at the PA scale: '1. Has the protected area been designed to take into account the likely effects of climate change?', and '2. Is the protected area being consciously managed to adapt to climate change?' These updates constitute significant changes to the METT, which is a widely used tool in West Africa and beyond, to monitor management issues related to climate change.

## 5.2. Identify how M&E will contribute to adaptation

Ensuring that adaptation actions clearly relate to conservation goals and impacts is key to effective climate adaptation. Monitoring is essential to assess progress towards both short and long term goals and objectives, and ensure the continued relevance of goals in the light of what is actually happening. Monitoring the following three key elements of adaptation can be done in order to track progress towards successful adaptation (Oliver et al. 2013):

- Building institutional adaptive capacity

This involves training staff about climate change, adaptive management, and new management techniques and actions. For issues that are particularly complex, it is important to have access to topical experts, appropriate tools for management and supportive institutions.

- Reducing identified risks and vulnerabilities

Information on threats can be obtained from a variety of sources including climate vulnerability assessments, site and resource-specific management plans, and other assessments, reviews and reports. Monitoring is particularly recommended for adaptation actions that address specific threats and elements of vulnerability of a conservation target.

- Successful management despite climate change

When planning for adaptation, actions need to be evaluated not only under the current climate, but the potential effects of these actions should also be considered in the light of possible future climates that may occur over the project's lifetime. Given the uncertainties associated with future climate projections, adaptation plans that take into account a range of possible futures are likely to be more successful. For instance, scenario planning can help identify possible management actions across a range of possible future climates.

## 5.3. Anticipate and design monitoring for change

When monitoring for climate adaptation it is recommended to focus on conservation targets that are highly vulnerable to change, as well as on the necessary changes to organisations and

management practices. This should involve monitoring ecological processes, communities, or services, in addition to particular species.

Regarding **species monitoring**, the PARCC project provided recommendations for monitoring strategies in the face of climate change for the five transboundary pilot sites (Carr 2015a-e). These recommendations were developed on the basis of consultations with national and international species experts. These recommendations provide some information on a) the methods used to identify the species most vulnerable to climate change at both the regional and site scales, b) the importance of monitoring species in the context of climate change, and c) specific recommendations for species monitoring at the five transboundary pilot sites. Under the effect of climate change, species may experience changes to their habitats or microhabitats, changes of environmental factors beyond tolerable thresholds, disruptions to important interspecific interactions, the emergence or increase of negative interspecific interactions, the disruption of important environmental cues or triggers, and increases in the frequency of local extinctions. Species that are sensitive and exposed to such change might be able to either disperse to areas where the environment is more suitable, or adapt to change *in situ*. Species that are unable to respond in such a way (e.g. due to low genetic variability, low reproductive output, the presence of barriers that prevent dispersal and/or a low intrinsic capacity for dispersal) are those species that are considered vulnerable to climate change.

Biodiversity monitoring is widely conducted as a means to detect changes in natural systems and to assess the requirements and effectiveness of management actions. There is now a pressing need to also monitor the impacts of climate change on species, so that managers may respond to this emerging threat in the most timely and effective manner (Carr 2015a-e). In many cases, the monitoring of climate change impacts on species can and should be built upon existing monitoring schemes, but certain additional considerations must be made when developing a monitoring strategy to specifically look at climate change impacts:

1. It is essential to monitor over a long time period;
2. In addition to monitoring biodiversity, it is also crucial to monitor the actual climate;
3. Any monitoring effort needs to set its objectives prior to developing the sampling protocol, as the former will greatly influence the latter;
4. When selecting the species (or species groups) for monitoring, the following questions should be asked: Is there already a monitoring scheme in place? Should I monitor one, several or many species? Are there any other factors at work that may disguise the impacts of climate change? Is my focal species sufficiently observable to detect a population trend?

## 5.4. Include adaptation-specific indicators into existing monitoring practices

Climate adaptation actions and monitoring should be incorporated into existing management processes and become part of existing monitoring practices.

Indicators will usually be needed to specifically evaluate adaptation activities and progress towards adaptation goals. As already mentioned above, indicators should be SMART (Specific, Measurable, Achievable, Relevant and Time-bound). Examples of indicators useful for measuring progress during design and implementation of climate adaptation can be found in Gross et al. (*in press*), Bours et al. (2014) and Ervin et al. (2010).

## 6. Conclusions

In this report, we summarised the key messages from the IUCN guidelines 'Responding to Climate Change: Guidance for Protected Area Managers and Planners' (Gross et al., *in press*) and complemented them with some key results from the PARCC project which can contribute to enhancing PA management in the West Africa region in the face of climate change.

It has been highlighted that under the impacts of climate change, PA managers will increasingly have to manage for change, rather than focus on maintaining existing systems. Management planning will have to include the following key activities: (i) reviewing existing goals and objectives from a climate change perspective in order to adopt forward-looking goals; (ii) assessing vulnerability to climate change to identify and select appropriate adaptation actions; and (iii) building capacity for adaptation to climate change and monitoring the effectiveness of these actions. Furthermore, there is an increased need for adaptive management and for managing under uncertainty.

The PARCC project provided new science-based methodologies to assess the vulnerability of species and PAs to climate change, and helped identify new areas which would benefit from being protected, taking into account a number of factors including expected climate change effects. It also encouraged countries to review their transboundary management plans to integrate climate change aspects. Furthermore, it contributed to building capacity at multiple institutional levels in the region. The project also recommended to enhance the management effectiveness of existing PAs in order to give PAs better chances to be resilient to climate change impacts, and to significantly expand the regional PA network in order to increase the representation of key conservation features and improve the connectivity of PAs to facilitate species dispersal. It is also worth noting that the tools and training provided by the PARCC project could now easily be applied to other West African countries and beyond.

Key recommendations for West African PA management in the face of climate change can be summarised as follows:

1. **Plan for change, not just persistence, adopt forward-looking goals and integrate climate change considerations into existing plans.** The climate has been shown to be changing in the West Africa region, and this will be affecting ecosystems. These findings should be taken into account when setting conservation goals and should be integrated into existing policy processes.
2. **Assess ecological and social climate change vulnerability using a structured methodology and process, focus on key vulnerabilities that can be addressed.** Species distribution models and traits-based vulnerability assessments can provide useful information on species expected to be vulnerable to climate change and West African PAs the most likely to be impacted.
3. **Implement no-regret management strategies, identify all potential adaptation actions at the system level and PA level, and build capacity.** Assessing the connectivity of the PA network, and using systematic conservation planning to identify priority areas for conservation which would benefit from being protected are particularly useful to inform actions to be undertaken at the PA network level.

4. **Monitor and evaluate the impacts of adaptation actions and integrate climate indicators into existing monitoring processes.** The revised Management Effectiveness Tracking Tool, which integrates questions on the PA planning and management under climate change, is a useful tool to track management effectiveness.

Through this report, by placing the IUCN recommendations for managing PAs in the face of climate change in the context of West Africa, with some specific examples of outputs from the PARCC project, PA managers and other relevant stakeholders should be better able to consider climate change in the management of PAs in the region.

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