



Sahel & Sahara Interest Group

2023 meeting proceedings



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Almeria, Spain

Abstracts

Recueil des résumés

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22nd MEETING OF THE SAHEL & SAHARA INTEREST GROUP

The Sahel & Sahara Interest Group was born in 1998 on the back of a meeting organized by the Convention on Migratory Species in Djerba, Tunisia, to adopt an action plan for endangered Sahelo-Saharan antelopes. Since then, the meeting has become an annual forum for all those working on environment, conservation and sustainable development in arid lands of North Africa and the Middle East

Facilitated by Sahara Conservation's team, the meeting is a unique opportunity to bring people together to share ideas and projects, and to continue a strong tradition of collaboration on behalf of Sahelo-Saharan wildlife and people.

For the first time since 2019, the meeting was held in person, hosted by the Estación Experimental de Zonas Áridas (Superior Council of Scientific Research) in Almería, Spain. The EEZA is a Spanish research center under the Spanish National Research Council, dedicated to the study of the landscape, ecosystem and biology of arid and semi-arid zones. It also stands out for its efforts in the recovery of North African species of ungulates close to extinction.

This year's session was organized around three themes:

- Protected area management models in the Sahara and Sahel region
- Insights on species biology and implications for *in situ* and *ex situ* conservation of populations
- Human-wildlife interactions: health concerns and community engagement in the Sahara and Sahel

64 participants coming from 15 different countries among 4 continents attended the 2-days event.

EEZA Director's, Francisco Domingo Poveda, opened the meeting on Thursday 4th May, followed by introducing remarks from Margarita Paneque Sosa, CSIC Institutional Delegate for Andalusia and Extremadura, and John Watkin, Sahara Conservation's CEO.

During the meeting, 23 speakers presented their field work, research and studies on subjects as varied as species reintroduction, genetic research, animal ecology and behavior, management of *ex situ* populations, or animal movement's monitoring.

This document contains the abstracts from the presentations given at the 2022 SSIG meeting.

This year's special feature – the Great Green Wall Initiative

For the first time this year, the Great Green Wall initiative was in the spotlight. Sakhoudia Thiam, Head of Research and Development Office for the Pan African Agency of the Great Green Wall, and Jaime Garcia Moreno, International Program Coordinator at Vogelbescherming Nederland, hosted a dedicated workshop on biodiversity monitoring along the Great Green Wall Corridor. Although the Great Green Wall (GGW) Initiative includes biodiversity aspirations in its original plans, these have received little attention thus far. The aim of the workshop was to provide an overview of the scope of work that the GGW Initiative is considering around biodiversity, elaborate a stakeholder map – at both regional and national scales – to identify actors with whom collaboration is necessary or desirable, and explore channels of information exchange with groups that are already working in the GGW.

22^{ème} REUNION DU GROUPE D'INTERET SAHEL & SAHARA

Depuis 2001, la réunion du Groupe d'intérêt du Sahel & Sahara est un forum annuel pour tous celles et ceux qui travaillent à la conservation de la faune sauvage dans les zones arides d'Afrique du Nord et du Moyen-Orient.

Animée par l'équipe de Sahara Conservation, la réunion est l'occasion de rassembler pour partager des idées et des projets, et de poursuivre une forte tradition de collaboration au nom de la faune et des populations du Sahel et du Sahara.

Pour la première fois depuis 2019, la réunion s'est tenue en personne, à l'Estación Experimental de Zonas Áridas (EEZA - Conseil supérieur de la recherche scientifique) à Almería, en Espagne.

L'EEZA est un centre de recherche espagnol relevant du Conseil national espagnol de la recherche, qui se consacre à l'étude du paysage, de l'écosystème et de la biologie des zones arides et semi-arides. Il se distingue également par ses efforts de renforcement et réintroduction d'ongulés d'Afrique du Nord en voie d'extinction.

La session de cette année était organisée autour de trois thèmes :

- Modèles de gestion des aires protégées dans la région du Sahara et du Sahel
- Perspectives sur la biologie des espèces et implications pour la conservation *in situ* et *ex situ* des populations
- Interactions homme-faune : préoccupations en matière de santé et engagement des communautés dans le Sahara et le Sahel

64 participants, originaires de 15 pays différents sur 4 continents ont assisté à l'événement de 2 jours.

Le Directeur de l'EEZA, Francisco Domingo Poveda, a ouvert la réunion le jeudi 4 mai, suivi d'une introduction de Margarita Paneque Sosa, Déléguée Institutionnelle du CSIC pour l'Andalousie et l'Estrémadure, et John Watkin, Directeur Général de Sahara Conservation.

Au cours de la réunion, 23 intervenants ont présenté leurs travaux de terrain, recherches et études sur des sujets aussi variés que la réintroduction d'espèces, la recherche génétique, l'écologie et le comportement animal, la gestion des populations *ex situ*, ou le suivi des mouvements d'animaux.

Ce document contient les résumés des présentations faites lors de la réunion 2022.

L'atelier dédié de cette année : l'initiative de la Grande Muraille verte

Pour la première fois cette année, l'initiative de la Grande Muraille verte a été mise à l'honneur. Sakhouidia Thiam, chef du bureau de recherche et de développement de l'Agence panafricaine de la Grande Muraille verte, et Jaime Garcia Moreno, coordinateur du programme international de Vogelbescherming Nederland, ont organisé un atelier consacré à la surveillance de la biodiversité le long du corridor de la Grande Muraille verte. Bien que l'initiative de la Grande Muraille Verte (GMV) comprenne des aspirations en matière de biodiversité dans ses plans initiaux, celles-ci n'ont reçu que peu d'attention jusqu'à présent. L'objectif de l'atelier était de fournir une vue d'ensemble de l'étendue des travaux envisagés par l'initiative de la GMV en matière de biodiversité, d'élaborer une carte des parties prenantes - à l'échelle régionale et nationale - afin d'identifier les acteurs avec lesquels une collaboration est nécessaire ou souhaitable, et d'explorer les canaux d'échange d'informations avec les groupes qui travaillent déjà dans le corridor de la GMV.

ABSTRACTS

LEAD SPEECHES: Introducing notes from range states representatives

Mise à jour sur la conservation au Niger

Yacouba SEYBOU, Directeur Général des Eaux et Forêts, ministère de l'Environnement et de la Lutte Contre la Désertification, Niger

Update on conservation in Chad

John WATKIN, Chief Executive Officer, Sahara Conservation, Chad

Retour d'expérience de la COP 15 : le nouveau Cadre Mondial sur la Diversité Biologique et son application au niveau national

Zouhair AMHAOUCH, Chef de la Division des Parcs et Réserves Naturelles, Direction de la Lutte Contre la Désertification et la Protection de la Nature, Département des Eaux et Forêts, Maroc

The Great Green Wall Initiative

Sakhoudia THIAM, Head of Research and Development Office, Pan African Agency of the Great Green Wall, Mauritania

The Great Green Wall Initiative (GGWI) is an African effort to restore and sustainably manage land in the Sahelo-Saharan region in order to combat land degradation and poverty. Originally proposed in 2005, the initiative aimed to create a 15 km wide and 8,000 km long barrier along the Sahel. However, the vision has since been transformed into an integrated ecosystem management approach, targeting sustainable management of drylands, regeneration of natural vegetation, and water conservation. The initiative, endorsed by the African Union, is coordinated by the Pan African Agency of the Great Green Wall, which integrates the 11 countries (Burkina Faso, Djibouti, Ethiopia, Eritrea, Mali, Mauritania, Niger, Nigeria, Senegal, Sudan, Chad) touched by an east-west corridor running from the Atlantic Ocean to the Red Sea in the area defined by an annual rainfall of between 100-400 mm.

The first decade of the GGWI highlighted some constraints and lessons learned, leading to the development of a Priorities Investments Plan for the second decade of implementation (2020-2030). However, the Sahel region still faces environmental, social, and developmental challenges, and technical assistance and financial support are necessary to scale up successful experiences and allow countries to continue their efforts. To achieve its goals of restoring the natural capital of this transect, the initiative has set ambitious goals for 2030: restoration of 100 million hectares of degraded land, capture of 250 million tons of Carbon, and the creation of 10 million productive green jobs.

Up to now, less attention has been paid to issues related to the preservation of biological diversity, conservation of ecosystems, and strengthening and enhancement of ecosystem services, which although considered by the GGWI, lack tangible goals similar to those stated ahead. In order to address this situation, the PAGGW and BirdLife International have established a collaboration at regional and national scales, with the immediate goals of strengthening the integration of biodiversity across the initiative, and helping the PAGGW measure the impact that the implementation of the GGWI has on nature.

The presentation aims to share information about the GGWI, its 2030 goals, and the current plans for integration and monitoring of biodiversity in GGW Initiative.

THEME 1: Protected area management models in the Sahara and Sahel region – Modèles de gestion des aires protégées dans la région du Sahara et du Sahel

Keynote speech: Mapping land cover and land use across the Reserve de Faune du Ouadi Rimé–Ouadi Achim

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Across north and central Africa, land cover and land use are highly seasonal, spatially heterogeneous, and temporally variable. For example, family plots are the primary mode of agricultural practice, with individual plots often smaller than 5 ha. In arid and semi-arid areas in particular, grasslands appear highly similar to agricultural crops in optical satellite imagery, and also have similar growing seasons. Thus, there is great disagreement among global land cover classifications about the types and spatial distributions of vegetation and land uses in these range states.

Using time series of Sentinel-2 satellite data, we developed two products that leveraged information on (1) seasonal grassland dynamics, and (2) local cropping and harvesting schedules, to increase classification accuracy.

We then developed a medium-resolution (20m) land cover classification for the Reserve de Faune du Ouadi Rimé–Ouadi Achim, a large protected area in central Chad where scimitar-horned oryx and addax have been reintroduced. We use this classification to highlight potential high-quality habitat for reintroduced antelope, and identify areas where reintroduced antelope and humans and domestic livestock are likely to co-occur.

Keywords: Tchad, RFOROA, land cover, land use, map

1. Réintroduction des espèces dans la Réserve de Biosphère de Gadabedji

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² Projet de gestion durable de la Biodiversité dans les Aires Protégées Direction de la Faune, Chasse des Parcs et Réserves, Niger

2. **The BIOREC Bouhedma Observatory Project: a strategic approach to the Conservation of Sahelo- Saharan Wildlife & its arid Savanna Habitat in Bouhedma Park, Tunisia**

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The Bouhedma National Park (BNP) in pre-Saharan Tunisia contains some of the last tracts of rare pristine acacia savanna biomes in the country. These habitats host scimitar-horned oryx (*Oryx dammah*), African golden wolves (*Canis lupaster*), North African ostriches (*Struthio camelus camelus*) and many other Sahelo-Saharan wildlife of global significance. For several years, the parks management lacks the continuous availability of data on current states and trends of wildlife populations and threats. This lack is felt by the site itself, by the local population and at all decision-making levels. It is of the utmost importance to have long-term monitoring programs that establish reference conditions, which over time help to define and plan restoration efforts. Based on the knowledge and experience that we have acquired on the study site since 2019 we have developed an approach that is meant to help closing this gap by a vast monitoring program and by the involvement of local communities and their local knowledge in the sustainable conservation of BNP: "BIOREC Bouhedma" is an initiative that aims to set up a participatory observatory that brings together several local, national and international biodiversity actors to organize a wildlife monitoring program in the field, to study the evolution of ecological dynamics, and to restore degraded habitats. Key tools in this research are camera traps, radio collars, thermal imagery and drones. From our preliminary results, we present information on the occurrence, distribution and status of wildlife in BNP and its surroundings that will help identify the need for corrective management actions.

Keywords: Wildlife monitoring, Observatory, anti-poaching program, scientific tourism, Tunisia

3. **Gestion de la Réserve Naturelle Nationale de Termit et Tin-Toumma, Niger**
(recorded)

Sébastien PINCHON¹, Martin Hochart¹, Torsten Bohm¹, Abdoulaye Harouna¹

¹ Noé, Niger

La RNNTT, l'un des derniers refuges pour la faune sahélienne-saharienne, est gérée par Noé depuis le 5 novembre 2018. Après une première phase de mise en œuvre, quels sont les résultats, les difficultés rencontrées et les perspectives pour la gestion de cette aire protégée et la conservation de sa biodiversité ?

Mots clés : Mégafaune sahélo-saharienne, braconnage, habitats, communautés

THEME 2: Insights on species biology and implications for *in situ* and *ex situ* conservation of populations – Perspectives sur la biologie des espèces et implications pour la conservation *in situ* et *ex situ* des populations

Keynote speech: Action plan for the conservation and restoration of sahelo-saharan megafauna

Marc ATTALAH¹

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Concerted Action 13.4 on Sahelo-Saharan Megafauna adopted by CMS COP13 in 2020 calls for the development of an updated Action Plan for the conservation and restoration of Sahelo-Saharan Megafauna among other activities.

The CMS Secretariat, with funding from the Government of Germany is implementing a four-year regional project, Addressing the illegal killing of Sahelo-Saharan Megafauna, to complete the activities of the Concerted Action to strengthen conservation efforts for the eight species of Sahelo-Saharan megafauna (Scimitar-Horned Oryx (*Oryx dammah*), Addax (*Addax nasomaculatus*), Dama Gazelle (*Nanger dama*), Slender-Horned Gazelle (*Gazella leptoceros*), Cuvier's Gazelle (*Gazella cuvieri*), Dorcas Gazelle (*Gazella dorcas*), Red-fronted Gazelle (*Eudorcas rufifrons*) and Barbary Sheep (*Ammotragus lervia*)). The project covers the species' 16 Range States (Algeria, Burkina Faso, Chad, Egypt, Eritrea, Ethiopia, Libya, Mali, Mauritania, Morocco, Niger, Nigeria, Senegal, South Sudan, Sudan and Tunisia).

The Third Regional Seminar on the Conservation and Restoration of Sahelo-Saharan Megafauna was held from 14 to 16 March 2023 in Agadir, Morocco. The Range State representatives discussed and agreed upon an Action Plan. Furthermore, Representatives provided recommendations on the extension of the Concerted Action to the habitat of the African Wild Ass, explored funding and partnership opportunities for the implementation of the Action Plan and made recommendations on the establishment of a CMS Sahelo-Saharan Megafauna Initiative.

At the SSIG meeting, the CMS Secretariat will present the main outcomes of the Regional Seminar, explore the potential role of the SSIG in the future of the SSMF Concerted Action, and engage partners and donors in the implementation of the newly agreed upon Action Plan.

Keywords: Regional cooperation, conservation policy

1. Genetic diversity in global populations of the critically endangered addax (*Addax nasomaculatus*) and its implications for conservation

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Addax, an iconic Saharan antelope, are in a perilous situation in the wild with fewer than 100 individuals remaining in a single population in Niger. *Ex situ* populations, totaling several thousand individuals, are therefore playing a crucial role in preventing the species' extinction and have provided founders for reintroduction efforts across its historic range. However, these *ex situ* populations are fragmented, have experienced differing intensities of management, and have incomplete knowledge of pedigrees and founder origins. We undertook a global assessment of genetic diversity across wild, *ex situ* and reintroduced populations in Tunisia to assist conservation planning for this critically endangered species.

We show that the remnant wild addax population retains more genetic diversity than the global *ex situ* population. However, genetic lineages captured within these *ex situ* populations differ from those detected in the wild. This highlights the need for careful management of both all addax populations to prevent any further loss of genetic diversity within this species. Additionally, we assessed the genetic relationships amongst *ex situ* populations and reveal that whilst population structure is minimal, each population carries unique diversity. Finally, we show that careful selection of founders and subsequent genetic management is vital to ensure genetic diversity is provided to, and minimize drift and inbreeding within, reintroductions. Our results highlight a vital need to conserve the last remaining wild addax population, and we provide a genetic foundation for determining integrated conservation strategies to prevent extinction and optimize future reintroductions.

Keywords: Addax, genetics, wild, *ex situ*, reintroductions

2. **Biologging heart rate in scimitar-horned oryx – opportunities for improving *in situ* conservation**

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Heart rate biologging has been successfully used to study wildlife responses to natural and human-caused stressors. Although rarely deployed to inform conservation, heart rate monitors may be particularly valuable for assessing success in wildlife reintroductions. We tested and validated the use of subcutaneous heart rate monitors in captive scimitar-horned oryx. We evaluated biologger safety and accuracy while collecting long-term baseline data and assessing factors explaining variation in heart rate. None of the biologgers were rejected after implantation and accuracy was high (83–99%). Average heart rate was 60.3 ± 12.7 bpm, and varied by about 12 bpm between individuals, with a minimum of 31 and a maximum of 188 bpm. Oryx displayed distinct circadian rhythms, with low heart rate and activity early in the morning and peaks near dusk. Circadian rhythm patterns were relatively unchanged across season, but hourly averages for heart rate and activity were higher in spring and summer, respectively. Variation in hourly heart rate averages was best explained by a combination of activity, hour, astronomical season, and ambient temperature. Biologgers are safe and accurate and can be deployed in free-ranging and reintroduced scimitar-horned oryx. The resulting biologging data could significantly aid in 1) evaluating care and management prior to release, 2) characterize animal personalities and how these might affect reintroduction outcomes, 3) identify stressors after release. Heart rate monitoring in released scimitar-horned oryx may also aid in advancing our knowledge about how desert ungulates adapt to extreme environmental variation in their habitats (e.g., heat, drought).

Keywords: biologging, physiologging, heart rate, conservation physiology, activity

3. **Optimiser la conservation de la gazelle dama avec une approche paysage dans la Réserve Nationale Naturelle de l’Aïr et du Ténéré**

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La Réserve Naturelle Nationale de l'Aïr et du Ténéré située au nord du Niger est l'un des quatre sites abritant l'une des dernières populations de gazelles dama (*Nanger dama*), dont le nombre global est estimé à moins de 200 individus à l'état sauvage. Les données collectées depuis des années lors de missions terrain et grâce aux pièges photographiques installées sur le massif de Takoulkozet ont permis de confirmer la présence de gazelles dama, ainsi que d'autres espèces fauniques, et de collecter des données inédites sur leur écologie et leur distribution. Cependant, diverses activités anthropiques sur le massif, telles que le braconnage et l'extraction d'or impactent la faune, et à ce jour, les ressources et capacités disponibles pour leur conservation restent limitées. Afin d'améliorer le statut de conservation de l'un des derniers refuges sauvages pour la faune saharienne, des actions simultanées ont été mises en place à différents niveaux, notamment un suivi régulier des espèces phares telles que la gazelle dama et le mouflon à manchette et de leur habitat, a été mis en place dans le but d'améliorer les connaissances disponibles et afin de développer des mesures de conservation adaptées. En parallèle la surveillance des zones clés a été intensifiée par un appui aux autorités compétentes. Enfin, l'implication des communautés environnantes dans la protection de leur environnement, combinée à une étude sur leur perception de la conservation de la faune, a permis de compléter l'approche multidimensionnelle, tout en développant des appuis adaptés aux zones d'intervention.

Mots clés : Gazelle dama, population locale, conservation

4. **Understanding the mhorr gazelle (*Nanger dama mhorr*) ecology and behavior for a better success on its reintroduction projects**

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It is quite common for Sahelo-Saharan antelope species reintroduction projects to go through a phase in which the species live in semi-wild conditions in fenced-protected areas, often sharing space with other species of similar ecological requirements; in these protected areas, there is a certain human intervention. The mhorr gazelle is one of them. Until now, the success of the mhorr gazelle reintroduction projects in their native areas has been uneven. Assessing the factors that may be limiting the success of the Mhorr gazelle in reintroduction projects is paramount to ensure the future of the species, and it reintroduction project in the MCissi reserve (Morocco) an opportunity to assess it. The MCissi reserve is a 4000-hectare fenced-protected area located in the southeast of Morocco; the prevailing ecological conditions there are typically Saharan. Food and water supply are regularly provided to the animals. The mhor gazelle was reintroduced in this reserve in 2008, and share the space with three other reintroduced species: the dorcas gazelle, the scimitar-horned oryx and the red-necked ostrich. Direct observations of the species in the reserve as well as 26 camera-traps located there reveals interspecific differences in terms of food selection, water requirement, rhythm of activity and human tolerance. Preliminary results show that those species more tolerant to the human

presence and its interventions (as are the scimitar-horned oryx and North african ostrich), benefit more than those showing a wilder behavior, as the mhorr gazelle. The main benefit of these tolerant species is an extra food supply, which presumably allows for a better body condition, greater reproductive success and survival. By the contrary, the mhorr gazelle in MCissi is almost acacia-dependent for their feeding. In consequence, their reproductive success and survival is linked both to the productivity of the acacia trees and the competition they face from the herbivores in the reserve.

Keywords: Mhorr gazelle, reintroduction, semi-captivity, Morocco

5. **The value of genetic management in the *ex situ* population of mhorr gazelle (*Nanger dama mhorr*) as source for reintroduction projects**

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Currently, the survival of many species depends on their breeding in captivity and a possible reintroduction into the wild. However, captive populations are often small and originate from low numbers of individuals, making them susceptible to negative genetic effects resulting from inbreeding. As consequence, the *ex situ* breeding programs should focus not only on increasing the population size, but also on retaining as much genetic variability as possible within the population. Therefore, determining the genetic variability and the structure of the *ex situ* population is essential before selecting individuals for reintroduction projects. The *ex situ* breeding program for the mhorr gazelle (*Nanger dama mhorr*) was created in 1971 at the Estación Experimental de Zonas Áridas of Almeria (Spain), when a noticeable decline in the wild population was observed. Later, the captive population of Almeria expands through different institutions in Europe, North America, Africa and the Arabian Peninsula. Pedigree information recorded in the mhorr gazelle studbook was analyzed to assess the evolution of genetic variability and the genetic management carried out during 50 years of its *ex situ* breeding program. Due to the low number of founders (1 male and 3 females), the mean inbreeding coefficient of the *ex situ* population is 25.21%. However, the mating strategy used, based on minimizing coancestry between mating individuals, has allowed both, to reduce the losses of genetic variability and to balance the genetic contributions of the founders within the population, in addition to avoiding the appearance of new bottlenecks. Although it is necessary to study in depth how this level of inbreeding affects reproductive and survival traits, the potential of the *ex situ* population of mhorr gazelle should be considered for reintroductions and reinforcements, making an appropriate selection of individuals.

Keywords: breeding program, *ex situ* population, genetic variability, mating strategy, mhorr gazelle

6. **Assessments from Texas ranches, USA, important for captive situations**
Elizabeth Cary MUNGALL¹

¹ Second Ark Foundation, United States

Numerous observations from exotic dama gazelles (addra, *Nanger dama ruficollis*) on Texas ranches, USA, have particular importance for husbandry of dama gazelles anywhere that herds are captive – including Chad to bolster wild population. Because adult males become territorial and “fight for damage,” space use investigations have been a priority. On 8,996 hectares of semi-arid rangeland, collared adult males averaged overlapping home ranges of 1,800 hectares and non-overlapping core areas of 440 hectares. No deaths were reported. In a more mesic 202-hectare pasture, two males split the space between them, and a third male turned up dead.

Essentially, these dama gazelles showed flexibility as to the amount of space for a functional territory, but they retained the impulse to fight if crowded. Multiple males in a pasture increases reproduction. Separating breeding groups within sight but across fencing with a lane in between can avoid fighting. Among all types of mortality, most serious is predation, especially from bobcats (*Lynx rufus*) and coyotes (*Canis latrans*). These take mainly immatures. For more on this species, see the book, “The Dama Gazelles: Last Members of a Critically Endangered Species,” available from Eurospan or direct from Texas A&M University Press. The 16 authors present work in Africa, Europe, the United States, and Arabia. As well as interchange at SSIG meetings, a third international dama gazelle conservation workshop is planned for Kerrville, Texas, in 2024. Discussion is expected to include how the more than 1,500 dama gazelles in Texas can improve survivorship of the species.

Keywords: Addra, dama gazelle, space use, captive, fighting

7. **Assessment of population structure and genetic diversity of wild and captive populations of *Ammotragus lervia* provide insights for conservation management** (recorded)

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The aoudad (*Ammotragus lervia*) is a Vulnerable bovid endemic of North Africa. Although legally protected almost every country of its native distribution, the aoudad continues to be hunted for meat and trophy both North Africa and in the countries where it has been

introduced. No management or conservation units have never been designed for this species, which was subject to past translocations planned irrespectively of the genetic diversity and local adaptations of source and receiving populations. We aim to provide here important insights on the taxonomy of the aoudad subspecies and the genetic diversity of most of its wild and captive populations. Our results support the presence of four genetically different wild populations, corresponding to three distinct mitochondrial lineages plus a fourth group restricted to Egypt identified by the nuclear markers. We also provide genetic evidence on the affiliation of some introduced European populations with respect to the native ones. The genetic variation within all wild populations was low, potentially as a consequence of small effective population size related to hunting, the decline in habitat availability and quality (i.e. overgrazing, and frequent drought), and high inbreeding degree. Our results have important implications for the conservation intervention in this species, including reintroductions and reinforcement actions of wild populations and the exchange of individuals among captive stocks.

Keywords: Conservation genetics, molecular systematic, phylogeography, Sahara ungulates, aoudad, desert

8. **Les vautours en Afrique de l'Ouest et Centrale : acquis et perspectives pour améliorer leur conservation**

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¹Sahara Conservation, France

²Sahara Conservation, Niger

En Afrique, les vautours ont connu un déclin considérable au cours des dernières décennies, avec les taux de déclin les plus élevés en Afrique de l'Ouest. L'un des facteurs reconnus est la chasse illégale à des fins traditionnelles. Le Niger et le bassin du Tchad ont été identifiés parmi les plus grands regroupements d'habitats de vautours en Afrique de l'Ouest. Cependant, le manque de données et de ressources est un obstacle à leur protection.

En réponse à ces constats, Sahara Conservation a initié un programme dédié, basé sur une approche multidimensionnelle.

Un suivi des nids des différentes espèces de vautours a permis la collecte d'informations sur leur nidification et leurs principales zones de distribution au Niger et au Tchad. Parallèlement, des études sur les menaces ont permis la collecte de preuves directes et indirectes du trafic de vautours et de leurs utilisations. Afin de rompre la chaîne d'approvisionnement, un travail a été fait avec les chasseurs et les autorités compétentes, dans le but d'accroître la surveillance. En parallèle, les communautés locales et les guérisseurs traditionnels ont été impliqués afin de réduire la demande pour ces produits.

Des résultats positifs ont été obtenus avec la réduction du nombre de parties de vautours à la vente dans des régions ciblées du Niger. Cependant, afin d'optimiser les actions et d'avoir un impact durable, il est indispensable d'aborder une approche régionale.

L'amélioration des connaissances est également une priorité. Entre autres, l'utilisation d'émetteurs permettrait de générer des données inestimables sur ces populations de vautours.

Mots-clés : vautours, Niger, Tchad

9. **Monitoring of tagged Rüppell's Vultures (*Gyps rueppelli*) along Europe, North Africa and Sahel**

Rachid El Khamlichi¹, **Jose Rafael Garrido**², Zouhair Amhaouch³, Karim Rousselon⁴, Justo Martín⁵, Juan Jose Iglesias-Lebrija⁶, Ernesto Álvarez⁶, Virginia Moraleda⁶, Miguel Ferrer⁷, Carlos Florencio⁷, Vincent Lieron⁸, Iñigo Fajardo⁹, Jose Ramón Benitez⁹, Jesús Bautista¹⁰, Helena Clavero¹¹ and Catherine Numa¹¹

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The Rüppell's Vulture (*Gyps rueppelli*) is listed as 'Critically Endangered' at the global level in the IUCN Red List of Threatened Species and the Red Lists of breeding raptors of North Africa and Mediterranean region. Over the last 4 years, 27 individuals have been marked with GPS transmitters in northern Morocco during their movements from their areas of origin in the Sahel to Europe and vice versa following the Griffon Vulture (*Gyps fulvus*) migration. The analysis of the movements of these vultures confirms previous results that most of the Ruppel's vultures that arrive in northern Morocco in spring do not manage to cross the Strait of Gibraltar to Spain due to morphological limitations, and those that do return to Africa in very low numbers, remaining mainly in Spain, but also reaching Portugal and France. The study also showed that the return journey to the Sahel for vultures that do not cross the Strait of Gibraltar has little chance of survival, so that 37 % of the tagged individuals have returned to the Sahel. There are currently several specimens tagged with GPS transmitters in Senegal that are providing valuable information on the use of the territory in their original breeding grounds, providing information for their conservation.

Keywords: Rüppell's Vulture Monitoring Conservation

10. **Migrating eagles stopping in the Sahara desert: aberrant behavior or foraging strategy?**

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The Sahara desert is one of the major ecological barriers of the Palearctic–Africa bird migration system. Billions of individuals of migrating species breeding in Eurasia spend here a short but important part of their life cycle. Foraging opportunities are very rare, and usually raptors try to cross the desert as quick as possible, compatibly with the availability of favorable weather conditions. We analyzed the behavior of GPS-tagged booted eagles (*Aquila pennata*) breeding in Spain and wintering in Sahel, focusing on the Sahara crossing. We found that non-directional and/or slow movements occur in the 35% of the migratory journeys and last up to 31 days. The analyses show that this behavior is not triggered by adverse weather conditions, and is shown especially by females during spring. These wandering movements occur in hyper-arid areas without vegetation cover. A similar behavior has not been previously recorded in any other trans-Saharan raptor, and is probably related to the ability of booted eagles to take advantage of food resources unexploited by other predators, such as migratory songbirds stopping in the desert during the day, and migratory locusts. Our findings show a new way of combining foraging and migration, without a well-defined directed trajectory, nor stopping in a restricted spot, but instead wandering over wide areas. This research provides a new picture of the Sahara desert for migrating birds, suggesting that foraging opportunities may be available even in this ecosystem, which once again demonstrates to be richer and more complex than previously supposed.

Keywords: raptors, stop-over, booted eagle, foraging, satellite tracking

11. **Retour d'expérience sur la conservation de l'autruche d'Afrique du Nord**
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¹Sahara Conservation, Niger

Démarré en 2007, le programme de conservation de l'Autruche d'Afrique du Nord a été l'une des premières initiatives d'envergure de Sahara Conservation au Niger. Depuis, cet engagement a évolué vers un modèle innovant de gestion d'un site d'élevage en captivité de cet oiseau impliquant la Direction de la Faune, de la Chasse, des Parcs et des Réserves, l'association locale CERNK et Sahara Conservation. En effet, de 5 individus en 2013 sur le site de Kellé, 2 individus en 2017 au niveau du site de Mainé-Soroa, jusqu'à 45 individus ont été obtenus sur les deux sites sous gestion en 2019 par couvaison naturelle des parents.

Pour renforcer ces effectifs, le site de Kellé a été modernisé, rendu autonome en eau et électricité, et les infrastructures ont été améliorées. De plus, la population locale a bénéficié de créations d'emplois.

Ce fut alors au tour de l'incubation artificielle d'être mise en place, permettant ainsi de commencer le processus de la réintroduction dans la Réserve de biosphère de Gadabeji avec deux transferts d'autruchons en 2021 (neuf individus) et 2022 (deux individus).

La présentation abordera ainsi les résultats de ce programme au fil des années, en termes de succès de la reproduction, d'éducation et de sensibilisation.

Mots-clés : Autruche, conservation, Niger

12. **The North-African ostrich, an EAZA *ex situ* program (EEP)** **Maren FRERKING¹**

¹Zoo Hannover, Germany

In 2011, ostrich eggs from Souss Massa National Park in Morocco were transferred to Hannover Zoo and artificially incubated there. The hatched chicks are the basis for the EEP, which was subsequently established by EAZA. Reproduction started in 2014. Now the EEP population comprises 37 birds in 15 European zoos. Challenges in keeping arise, for example, due to the birds' aggressiveness or the start of the laying period in the middle of the European winter. The interest in the species, however, remains very high, and so the program has good chances to grow.

Keywords: North African ostrich, EAZA *ex situ* Program

13. **Northern bald ibis reintroduction program in southern Spain as a model for reintroduction projects in sahelo-saharan areas** **Miguel QUEVEDO¹**

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The northern bald ibis (*Geronticus eremita*) is one of the rarest birds. Although recently recategorized on the IUCN's Red List from Critically Endangered to Endangered, it has a small wild population limited to Morocco. The northern bald ibis was probably once widespread across the Middle East, northern Africa and southern and central Europe. Habitat destruction, persecution and the impacts of agricultural pesticides led to its disappearance from most of its former range. It was extirpated from central Europe 400 years ago. In Algeria, the last confirmed breeding was in 1984. Maintaining current efforts in Morocco remains a high conservation priority.

Restoration programs have been initiated independently in several locations using captive zoo populations within the European Endangered Species Program (EEP *ex situ* programs). Ongoing reintroduction projects in Europe are Waldrappteam and Proyecto Eremita. Waldrappteam operating in Austria, Germany, Switzerland and Italy, resulted in a

migratory population in Central Europe. Proyecto Eremita in southern Spain resulted in a sedentary population. Release techniques in Spain has combined hand-reared and soft release. Annual releases of 30–40 birds have demonstrated the ability of captive bred northern bald ibises to survive after release and to establish a wild colony in the region. There is a need to evaluate the suitability of potential and former breeding sites and associated feeding areas for both the western (Morocco, Algeria) and eastern (Syria, Turkey, Yemen, Iraq) populations. Captive zoo populations within the EEP *ex situ* programs and release techniques are available for potential reintroduction programs in Sahelo-Saharan areas.

Keywords: Northern Bald Ibis, release technique, reintroduction

14. **Husbandry guidelines and hand rearing of Barred Buttonquail (*Turnix suscitator*) at ZooBotánico Jerez: basic know-how to apply at Common Buttonquail (*Turnix sylvaticus*), a critically endangered species in North Africa**
Mariano CUADRADO¹

¹Zoobotánico Jerez, Spain

Turnix suscitator has been extensively reproduced at ZooBotánico de Jerez to get experience (know-how) on the reproduction and the hand-raising of the species in captivity. In this communication, we provide basic information on the maintenance of the species in captivity and hand rearing of offspring from artificially incubated eggs. A total of 6 birds from Praha zoo were used as founders in 2008. From this population, we obtained a total of 66 birds between 2008 and 2013. Breeding facilities included an outdoor aviary for reproductive pairs and common breeding facilities found at our nursery. Hand rearing of chicks was necessary during the first days after hatching. Our goal was to apply this knowledge to the Critically endangered *Turnix sylvaticus*, a close relative species now extinct at the Iberian Peninsula and critically endangered in North Africa.

Keywords: Common Buttonquail, *Turnix sylvaticus*, husbandry guidelines, critically endangered, North Africa

15. **Genetic structure of wild boar population in Tunisia**
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In Tunisia, the wild boar is very common, widespread and the most important large game species. Populations are increasing and distribution ranges are expanding throughout the country. In the northern part of Tunisia, the current total population of wild boar is estimated to be in the range of approximately 100,000 individuals, and it is still increasing and expanding. The present study aims at elucidating the genetic patterns of wild boar in Tunisia and relating them to results recently published for European wild boar.

Keywords: genetic diversity, microsatellites, mtDNA, *Sus scrofa*, Tunisia

16. **Factors affecting the diel activity of a diverse Saharan carnivore community**

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In hyper-arid regions, the climate usually forces nocturnal activity, therefore limiting the foraging time while increasing the intra-guild competition and the predation risk. Despite being a stressful environment, the Atlantic Sahara is home for twelve carnivore mammals. So, which are the coping strategies of this diverse guild? Through camera trapping surveys carried out between 2017 and 2020, we have tried to find some answers on this topic. A total of 3139 independent captures of 9 carnivore species were obtained, which allowed for building the diel activity patterns using Kernel density estimates. We found a complex interaction net that was ruled by abiotic factors (rains), human presence (nomadic herders), prey abundance, and intra-guild relationships. The more diurnal taxa were the bigger species (African golden wolf, honey badger, red fox, and North African wildcat), while the smaller species were strictly nocturnal (Ruppell's fox, fenech fox, sand cat, common genet, and Saharan striped polecat), the last group overlapping their activity with prey (rodents). As we detected that body size determined a strong first order habitat segregation (the bigger species inhabiting the mountain areas or djebels and the smaller ones the flat areas or regs), no interactions were present between both size groups, except for Ruppell's foxes and wolves in the djebels. Within each habitat, intra-guild asynchronies were observed for most pairs of species, which suggested avoidance behaviors. Our results highlight one of the mechanisms that allows the co-existence of the diverse carnivore community of the Sahara desert, within a scenario of human uses.

Keywords: Carnivore mammals, deserts, human-wildlife interactions, resource partitioning, stressful environments

17. **Classification of three species of hares and a jackals from North Africa**

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² École Supérieure de Technologie Laâyoune, Université Ibn Zohr, Morocco

Two phylogenetic studies have been carried out. The first has been made to elucidate the species of hares found from the westernmost part of the Maghreb. The analysis groups the hares into three different lineages, which in turn correspond to their own morphological characteristics and with a geographic distribution that overlap in contact areas. *Lepus mediterraneus* Wagner, 1841 inhabits from the north of the westernmost part of the Maghreb. *Lepus schlumbergeri* Remy-St. Loup, 1894 inhabits from de center of the westernmost part of the Maghreb. To the Sahara desert inhabits the one that we give as a new species, *Lepus saharae* Urios, Soria-Boix, Rguibi & Donat-Torres, 2020. This species is a small-sized hare that extends at least through the southwest of the Sahara. Its underparts are pure white; its ears are longer than those of other conspecifics and have a typical white line along the edge.

The second study was made to clarify the phylogenetic position of the African golden jackal. Our genetic analysis showed that its lineage was separated from the rest of the canids, in particular from the Eurasian jackal *Canis aureus* Linnaeus and the wolf (*Canis lupus Linnaeus*). In 2015, we confirmed the different species that we initially named *Canis anthus* Cuvier, described by Cuvier in Geoffroy Saint-Hilaire & Cuvier, 1824. Other authors have confirmed this new species, although with other names.

In subsequent phylogenetic analyses, we confirmed the distribution of the species to all that previously assigned to *Canis aureus* in Africa.

Keywords: *Lepus saharae*, *Canis anthus*, phylogeny

18. **The essential contribution of ex situ**

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² Marwell Wildlife, United Kingdom

Healthy, well-managed *ex situ* populations are important for antelope conservation, particularly for those species that need conservation translocations. A good well-considered regional collection plan forms the foundation for good, well-managed *ex situ* populations. In August 2022 the European Association of Zoos and Aquaria (EAZA) Antelope & Giraffid Taxon Advisory Group (AGTAG) published the new Regional Collection Plan (RCP) for antelopes and giraffids, built around conservation. And with a major focus on species of the Sahara and Sahel region.

The EAZA AGTAG RCP integrates work of the SSC Specialist Groups and *in situ* species specialists following IUCN SSC Guidelines for the Use of *Ex Situ* Management for Species

Conservation. The plan contributes to the One Plan approach to create an integrated conservation plan for antelope and giraffids by developing species-specific recommendations useful to strategic planning by the field conservation community and progressive zoo associations, like EAZA.

The AGTAG represents some 300 EAZA members. We do not only aim to build genetic and demographic sustainable *ex situ* insurance populations in the EAZA-region for future conservation translocations. We also respond to requests for short- or long-term technical support for within-range *ex situ* breeding initiatives, providing typical *ex situ* management expertise, including husbandry, small population management tools, design, nutrition, etc. With the launch of the new RCP conservation is the main driver of our work. With that, we wish to increase our financial and in-kind support to our conservation partners.

Keywords: EAZA, RCP, conservation support

19. **Habitat use by sympatric Cuvier's, dama and dorcas gazelle in a Mediterranean forest**

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Effective management of populations is based on accurate understanding and assessment of habitat use, which is important as behavioral responses may often be the first measurable reactions that animals show in response to environmental changes. In ungulates, habitat use is mediated by habitat composition and habitat structure that change among seasons. Species are expected to narrow their home ranges when resources are not limited, promoting interspecific coexistence. Conversely, when resources are scarce, competition increase and species are expected to increase their home ranges to exploit also sub-optimal resources. By using Generalized Linear Mixed models, here we tested the hypothesis that the different use of the habitat in spring and summer, when there are differences in food resources availability, modulate interspecific relationships in three endangered gazelle species living in sympatry. Results showed Cuvier's gazelle foraged in woodland, dama gazelle in grassland and dorcas gazelle in scrubland in summer when comparing with spring. Given the seasonal differences observed in the use of the habitat by these three species, changes in climatic conditions -the predicted low rainfall in Mediterranean basin- would make the species even more vulnerable.

Keywords: habitat use, gazelles, seasonal changes

20. **Daily activity patterns of Cuvier's gazelle (*Gazella cuvieri*) in the desert: living side by side with African golden wolf (*Canis lupaster*), Barbary sheep (*Ammontragus lervia*) and nomadic herders**

F. Javier HERRERA-SANCHEZ¹, Jose María Gil-Sánchez^{1,2}, Javier Rodríguez-Siles¹, Juan Manuel Sáez¹, Ángel Arredondo¹, Inmaculada Cancio¹, Mariola Sánchez-Cerdá¹, Miguel Ángel Díaz-Portero¹, Begoña Álvarez¹, Jaime Martínez-Valderrama^{1,3}, Joaquín

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Under stressful environmental conditions, activity patterns can provide valuable information on species' adaptation to the habitat from an ecological point of view, but also on human-induced changes and community structure. We deployed a camera trap survey in a remote region of the Sahara desert to investigate the factors that determine the activity patterns of Cuvier's gazelle. Abiotic (seasons, moon phase and rainfall) and biotic factors (predatory activity of the Africa golden wolf, intra-guild competition with Barbary sheep, human herders and difference in sex) were tested. The influence of each factor was assessed using the activity overlap coefficient (Δ) and by the non-parametric circular Mardia-Watson-Wheeler test. The selection of a period in a daily cycle was analyzed using chi-square contingency tables and the "Wi" parameter of the resource selection coefficients. Cuvier's gazelle showed a crepuscular bimodal pattern (better delimited on females) with predominant activity at dusk and a peak in the morning. The most significant changes were induced by seasonal effects and the phase of the moon. In contrast, anthropogenic or intra-gremial factors did not produce significant differences suggesting no clear temporal niche differentiation for both species. Furthermore, there was a clear synchrony between the three species studied with a shared bimodal crepuscular pattern, although there was a significant discrepancy in the selection of periods for the African golden wolf, with a clear avoidance of daylight hours. Our results contribute to understanding the adaptations of this endangered gazelle to a hyper-arid environment and its relationships with keystone species and humans.

Keywords: Cuvier's gazelle, activity patterns, desert, camera trapping, temporal niche

THEME 3: Human-wildlife interactions: health concerns and community engagement in the Sahara and Sahel – Interactions homme-faune : préoccupations en matière de santé et engagement des communautés dans le Sahara et le Sahel

Keynote speech: L'engagement communautaire au Mali : gestion des aires protégées et médiation de la coexistence entre l'homme et l'éléphant Nomba GANAME¹

¹WILD Foundation Mali

Cette présentation vise à décrire de façon brève le travail du Projet des Éléphant du Mali. Elle aborde en particulier:

- le rôle de l'engagement communautaire dans la conception,
- la gestion et l'application de la nouvelle réserve de biosphère du Gourma de 42 000 km².
- la manière dont la démarche du projet est utilisée pour faciliter les relations entre les hommes et les éléphants dans la région du Gourma, au Mali.

Mots clés : Aires protégées, communautés, coexistence éléphants – humains

1. Supporting nature's recovery: a conservation health approach in Tunisia

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This is an important time for our planet. The linked crises of climate change, ecosystem degradation and biodiversity loss, are rooted in the disconnect between people and nature. Unchecked, they have the potential to permanently alter our global environment, severely impacting the wellbeing of billions of people.

Conservation Health is a unifying approach that recognizes the interdependency between the health of people, animals, and ecosystems and applies conservation action to assist nature's recovery. We will illustrate the application of conservation health in conservation projects from Tunisia emphasizing the value of partnerships and collaboration around the themes of health, connection, and knowledge exchange and innovation.

We will give examples including work with slender-horned gazelles focused on population health and welfare; challenges and opportunities for connecting ungulate wildlife populations across fragmented arid land landscapes; and how advances in knowledge and technology-based approaches could change how conservation action can be

delivered. These projects have the conservation of arid land wildlife and their habitats at their heart but have the potential to yield wider benefits for both people and nature.

Keywords: conservation health, nature recovery, biodiversity, Tunisia

2. La vision du PPI-OSCAN pour les OSC émergentes et ses mécanismes de renforcement de capacité pour la société civile en Afrique du Nord **Houda EL ALAOUI¹**

¹ IUCN Centre for Mediterranean Cooperation, Spain

Le programme PPI-OSCAN 3 a pour objectif global le renforcement des capacités techniques, administratives et financières des OSC émergentes, afin de contribuer à la mise en œuvre des stratégies nationale de conservation en matière de biodiversité et de lutte contre les changements climatiques en Libye, Maroc et Tunisie.

Il poursuit quatre objectifs :

- Mise en œuvre et gestion effectives et efficaces de projets de conservation par les organisations de la société civile en Libye, Maroc et Tunisie ;
- Amélioration de l'efficacité et de la pérennité technique, organisationnelle et institutionnelle des OSC dans leur capacité à mener des projets de terrain ;
- Favoriser les échanges et la mise en réseau des OSC, et poursuivre le dialogue et la coordination avec les gouvernements ;
- La reconnaissance des résultats générés.

Mots clés : PPI-OSCAN, OSC, conservation, changement climatique

3. Systematic Conservation Planning approach to KSRNR Zoning Plan **Hossameldin ELALKAMY¹**

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Multi-objective management is a tool applied by biodiversity managers to effectively manage large areas of land designated for conservation. Especially when Protected Areas are large or pursue multiple objectives, there are many conflicting land uses and associated stakeholders that need to be considered. Zoning Protected Areas into sectors managed for different conservation priorities and different intensities of resource use is proven the best approach. Land managers seek different ways to accomplish the proper zoning and proper land management. However, zoning processes are data-intensive tasks and require big amounts of input on different features to guide zoning decisions. When real-time observational data is scarce, modeling is the direct alternative in the context of biodiversity conservation. The objective here is to come up with a zoning plan for the King Salman bin Abdulaziz Royal Reserve over an area of 130,000 km². The area is home to a considerable amount of faunal and flora diversity ranging from large desert Ungulates to flagship eagles to diverse flora of about 230 desert plant species. On the other hand, there

are about 350,000 inhabitants scattered around the area with various anthropogenic impacts ranging from grazing, mining, quarrying, and others.

A systematic spatial conservation planning approach using Marxan with Zones was adopted in an approach trying to optimize the tradeoff between prioritization for conservation and incurring the least cost to conservation. To prepare the input information for Marxan with Zones, extensive species distribution modeling was done using ensemble models of MAXENT and Random Forest Models to map the possible distribution ranges of the target species. In addition, some floral data was incorporated into the planning process from current floral baseline survey in the area. Thus SDM provided an alternative to scarce field data in a process that yielded a higher product in the mission of conserving the site.

Keywords: spatial conservation planning, MARXAN with zones, multiple objective management

WORKSHOP: biodiversity monitoring along the Great Green Wall corridor – Suivi de la biodiversité le long du corridor de la Grande Muraille Verte

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Although the Great Green Wall Initiative includes biodiversity aspirations in its original plans, these have received little attention thus far. In an effort to amend this situation, the Pan African Agency of the Great Green Wall (PAGGW) and BirdLife international established an official collaboration through which biodiversity will be mainstreamed and measured.

With support from BirdLife, the National Agencies of the Great Green Wall will be establishing Biodiversity Working Groups at each of the eleven countries along the GGW corridor. Through these working groups it will be possible to coordinate biodiversity monitoring and reporting for the Great Green Wall Initiative, both nationally and regionally. The biodiversity status and trends will support decision-making and management in the corridor.

In this workshop we aim to:

- Provide an overview of the scope of work that the Great Green Wall Initiative is considering around biodiversity (e.g., nature conservation through strengthening of PA and designation of new PAs, habitat restoration with native species, sustainable management and protection of wetlands, monitoring of landscapes and key species...).
- Elaborate a stakeholder map – at both regional and national scales – to identify actors with whom collaboration is necessary or desirable.
- Explore channels of information exchange with those groups that are already working in the GGW.