# Pachyderm

July–December 2010 Number 48

ISSN 1026 2881

SPECIES
SURVIVAL
COMMISSION



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# Pachyderm

**Journal of the African Elephant, African Rhino and Asian Rhino Specialist Groups**

**July–December 2010** **No. 48**



Cover: A greater one-horned rhino (*Rhinoceros unicornis*) in Chitwan National Park, Nepal, photographed from elephant back. Photo: Esmond Martin

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## Acknowledgements

The production of this issue of *Pachyderm* was only possible through contributions from a number of organizations and individuals. In particular, we would like to thank the following:

# CHAIR REPORTS
# RAPPORTS DES PRESIDENTS

## African Elephant Specialist Group Report
## Rapport du Groupe Spécialiste des Eléphants d'Afrique

*Holly T. Dublin, Chair/Président*

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This has been a busy six months in the elephant world, and there continues to be a great deal of fascinating research undertaken. New research into the genetics of the African elephant has made headlines, following the publication of an article in PLoS Biology by Rohland et al., entitled 'Genomic DNA Sequences from Mastodon and Woolly Mammoth Reveal Deep Speciation of Forest and Savannah Elephants.' As regular readers of *Pachyderm* will know, the AfESG has long recommended that further research be undertaken to overcome data gaps and to answer remaining questions on the potential division of the African elephant into two species. Such a division would have consequences for the treatment of data and for the status of the species in a number of different regulatory and monitoring regimes. However, it would not materially impact the management challenges and necessary actions, which we have long known to be very different for the two subspecies (*Loxodonta africana cyclotis* and *Loxodonta africana africana*) in forest and savannah habitats. The new publication will be circulated to the AfESG membership for their input, and we will then undertake a process to determine whether the AfESG would recognize the division, which would have implications for future IUCN Red List processes. I look forward to keeping you posted on the discussions surrounding this ongoing and important issue.

Cela fait six mois que le monde de l'éléphant est occupé, et on continue à voir beaucoup de recherches fascinantes entreprises. La nouvelle recherche sur la génétique de l'éléphant d'Afrique faisait la une des journaux, après la publication d'un article dans Biologie de la Bibliothèque Publique Scientifique par Rohland et al, intitulé ' Les Séquences d'ADN Génomique du Mastodonte et du Mammouth Laineux indiquent une Spéciation profonde des éléphants de forêt et de savane '. Comme les lecteurs réguliers du *Pachyderme* le savent, le GSEAf a longtemps recommandé que des recherches supplémentaires soient entreprises pour combler les lacunes de données et répondre aux questions sur la répartition potentielle de l'éléphant d'Afrique en deux espèces. Une telle répartition aurait des conséquences sur le traitement des données et le statut de l'espèce dans un nombre de différents régimes de réglementation et de surveillance. Cependant, elle n'affecterait pas matériellement les défis de gestion et les actions nécessaires, lesquels nous savons depuis longtemps être très différents pour les deux sous-espèces (*Loxodonta africana cyclotis* et *Loxodonta africana africana*) dans les habitats de forêt et de savane. La nouvelle publication sera distribuée aux membres du GSEAf pour leur contribution, et nous entreprendrons alors un processus pour déterminer si le GSEAf reconnaîtrait la répartition, qui aurait des implications sur les futurs processus de la Liste Rouge de l'UICN. Je vous tiendrai au courant des discussions concernant cette question importante et son évolution.

## *Pachyderm*

The new structure within *Pachyderm*'s editorial board, which has now been in place for two issues, seems to be working very well. Both Debbie Gibson and Kees Rookmaaker have worked not only to shepherd manuscripts through review, but also to work with authors to improve the quality of the articles under submission. It has always been a goal of *Pachyderm* to build capacity for scientific publication amongst range State contributors, and we will continue to work on ways to improve our support for this goal.

This is the 48th issue of *Pachyderm*, and you will find that the Editor has outlined a number of changes to the journal's editorial policies that the Editorial Board decided on during their last meeting in October.

As always, securing funding for *Pachyderm* remains challenging. We have just received word from the International Elephant Foundation that we will receive partial funding for the next issue of *Pachyderm*, which is a great help, and we hope to be able to count on their and others' support in the years to come.

## The African and Asian Elephant Database

The African and Asian Elephant Database (AAED) is up and running and now in the testing phase. It can be found at http://elephantdatabase.org, and we welcome your input on this promising new tool. We developed the new AAED as an open source project and we hope that refinements and new developments will continue to be made. Over the next year, we will focus on adding data which we have been collecting since the publication of our last Status Report in 2007. We have over 50 new survey reports for the African elephant range ready to be entered, and many more for which we are awaiting reports. This represents a great deal of new knowledge on the African elephant, and it is now imperative to get these data digitized and into the database. While we do not intend to produce a new Status Report right away, the database will allow us to produce updated numbers and maps at the country, subregional and national level, which we intend to do more frequently.

## *Le Pachyderme*

La nouvelle structure du comité de rédaction du *Pachyderme*, qui est en place depuis deux publications, semble marcher très bien. Debbie Gibson et Kees Rookmaaker travaillent non seulement pour guider les manuscrits à travers la révision, mais aussi avec les auteurs pour améliorer la qualité des articles soumis. Cela a toujours été un objectif du *Pachyderme* de renforcer la capacité pour la publication scientifique parmi les auteurs des états de l'aire de distribution, et nous continuerons à chercher des moyens d'améliorer notre soutien à cet objectif.

Voici le 48ème numéro du *Pachyderme*, et vous constaterez que le rédacteur a décrit un nombre de changements aux politiques éditoriales de la revue décidés par le bureau de rédaction lors de sa dernière réunion en octobre.

Comme toujours, trouver un financement pour le *Pachyderme* reste un défi. Nous venons de recevoir un mot de la Fondation Internationale pour l'Eléphant promettant un financement partiel pour le prochain numéro du *Pachyderme*, ce qui serait d'un grand secours, et nous espérons pouvoir compter sur leur soutien et sur celui des autres dans les années à venir.

## LaBase des Données de l'Eléphant d'Afrique et d'Asie

La Base des Données de l'Eléphant d'Afrique et d'Asie (BDEAA) est en service dans la phase expérimentale. On peut la trouver sur http://elephantdatabase.org, et nous accueillons votre contribution sur ce nouvel outil prometteur. Nous avons développé la nouvelle BDEAA comme un projet de source ouverte et nous espérons continuer à faire des améliorations et de nouveaux développements. Au cours de l'année prochaine, nous ajouterons les données que nous avons rassemblées depuis la publication de notre dernier rapport de situation en 2007. Nous avons plus de 50 nouveaux rapports d'étude pour l'aire de distribution de l'éléphant d'Afrique prêts à être saisis, et nous attendons beaucoup d'autres rapports. Cela représente beaucoup de nouvelles connaissances sur l'éléphant d'Afrique, et c'est maintenant impératif d'avoir ces données digitalisées et saisies dans la base de données. Alors que nous n'avons pas l'intention de produire un nouveau rapport de situation tout de suite, la base de données nous permettra de produire des chiffres et des cartes mis à jour au niveau du pays, aux niveaux sous-régional et national, ce que nous avons l'intention de faire plus fréquemment.

I would like to encourage you to contact us if you have any survey information to share. We do our best to keep track of the surveys being undertaken, but quite often activities are going on beyond of our radar, and we rely on our members and the readers of *Pachyderm* to let us know if there is any new information we need to follow up on.

## Human-elephant conflict

Despite there being little activity in the human-elephant conflict (HEC) working group this year, we are seeing a rewarding amount of uptake of the vertical integration model. A recent meeting in Kenya brought together cross-sectoral stakeholders to discuss the HEC challenge in the Transmara region. The meeting also had representation from various national government departments and NGOs, and was the first very important step towards a longer-term solution for HEC in that region. The AfESG was invited to share the details of its vertical integration model, and we were pleased to see the progress already made towards implementing a longer-term structure for HEC mitigation in the context of greater land-use and landscape planning.

Leo Niskanen, who many of you will remember as the former Senior Programme Officer of the AfESG for many years, has joined the IUCN Eastern and Southern Africa Regional Office as the Technical Co-ordinator for Conservation Areas and Species Diversity. Not only are we thrilled to have Leo back in the IUCN family, but I think it provides very real opportunities for the AfESG and IUCN to collaborate on a number of fronts in Eastern and Southern Africa, with HEC being an obvious starting point.

## Illegal killing and ivory trade

### *Update on the CITES-MIKE and ETIS programmes*

The third African Elephant Range States meeting was held from 1–3 November in Nairobi, under the auspices of the CITES–MIKE programme. The meeting brought together representatives from 35 of the 37 range States. As we have done for the first two such meetings, the AfESG provided support to this meeting, both with developing the technical

Je voudrais vous encourager à nous contacter si vous avez des informations à partager. Nous faisons de notre mieux pour suivre l'évolution des études entreprises, mais très souvent nous ne sommes par au courant des activités et nous comptons sur nos membres et les lecteurs du *Pachyderme* pour nous faire savoir s'il y a des informations nouvelles pour lesquelles nous devons faire un suivi.

## Conflit homme-éléphant

En dépit du fait qu'il y a peu d'activité dans le groupe de travail sur le conflit homme-éléphant (CHE) cette année, nous voyons une utilisation encourageante du modèle d'intégration verticale. Une réunion récente au Kenya a réuni les intervenants intersectoriels pour discuter le défi du CHE dans la région de Transmara. La réunion avait également une représentation des différents départements des gouvernements nationaux et des ONG et c'était la première étape très importante vers une solution à long terme du CHE dans cette région. Le GSEAf était invité à partager les détails de son modèle d'intégration verticale, et nous étions heureux de voir le progrès déjà accompli vers la mise en œuvre d'une structure à long terme pour l'atténuation du CHE dans un contexte d'une meilleure planification de l'usage foncier et du paysage.

Beaucoup de membres se souviendront de Leo Niskanen, le Chargé de programme du GSEAf pendant plusieurs années, qui a rejoint le Bureau régional de l'Afrique orientale et australe de l'UICN en tant que Coordinateur technique pour les Aires de Conservation et la Diversité des espèces. Nous sommes ravis d'avoir Leo de retour dans la famille de l'UICN, et en plus je pense que cela offre de vraies possibilités de collaboration entre le GSEAf et l'UICN sur un nombre de fronts en Afrique orientale et australe, le CHE étant un point de départ évident.

## Abattage illégal et trafic d'ivoire

### *Mise à jour sur les programmes de la CITES-MIKE et d'ETIS*

La troisième réunion des Etats de l'aire de distribution de l'éléphant d'Afrique s'est tenue du 1 au 3 novembre à Nairobi, sous les auspices du programme de CITES-MIKE. Ont assisté à la réunion les représentants provenant de 35 des 37 états de l'aire de distribution. Comme nous l'avons fait pour les deux premières réunions, le GSEAf a fourni un appui à cette

agenda, and with facilitation of the meeting itself. In addition, at this meeting I served as co-chair with Ibrahim Thiaw from UNEP. Ibrahim was only able to attend the first half of the meeting, so I finished up the remainder of the three-day meeting, helping to move participants towards a number of important conclusions and agreed next steps on issues under debate, in particular the structure and responsibilities of the steering committee for the African Elephant Fund, which will guide the implementation of the African Elephant Action Plan. Prior to the meeting, we prepared an update on the conservation challenges facing elephants in different range States, using information from the survey reports we have received in the past three years. Following on from issues raised at the AfESG members' meeting in 2009, we also prepared a discussion paper on how to incorporate 'non-official' sources of information on illegal killing, as well as the need to have an 'early warning' system in place to deal with new and emerging challenges to elephant security. All the documents from the meeting are available on http://cites.org/eng/prog/MIKE/index.shtml.

At the meeting, we facilitated an extensive session on the possible revision of the CITES resolution governing MIKE, ETIS and the ivory trade (Resolution Conf 10.10 Rev CoP15). Participants provided feedback on the operational and analytical structure of both MIKE and ETIS, offering a wide range of very useful input to this process. While citing their desire to see some changes, in particular more attention to site and national level management needs, participants also expressed a clear desire for the continuation of both MIKE and ETIS. This was the first time in my long history with these programmes (now going on for 13 years) that I have heard such unequivocal support for the two programmes. Importantly, they emphasized their support for the AfESG's technical role in MIKE and other actions mandated under Res Conf 10.10 (Rev CoP15) and requested that IUCN be made an implementing partner of the programme by enshrining it formally in any revision of the resolution. As the CITES Secretariat is now sourcing funding for the continuation of MIKE post-2011, IUCN is working to ensure that the partnership going forward is not only cost-effective, but also mutually beneficial, both programmatically and financially.

rencontre, en élaborant l'ordre du jour technique, et en facilitant la réunion elle-même. En outre, lors de cette réunion j'ai servi de co-président avec Ibrahim Thiaw du PNUE. Ibrahim ne pouvait participer qu'à la première moitié de la réunion, j'ai donc présidé le reste de la réunion, en aidant les participants à arriver à un certain nombre de conclusions importantes sur les questions en discussion, surtout la structure et les responsabilités du comité de direction du Fonds pour l'Eléphant d'Afrique, qui guidera la mise en œuvre du Plan d'action de l'éléphant d'Afrique. Avant la réunion, nous avons préparé une mise à jour sur les défis de conservation auxquels les éléphants sont confrontés dans différents états de l'aire de distribution, en utilisant les rapports d'études que nous avons reçus au cours des trois dernières années. A la suite des questions posées lors de la réunion des membres du GSEAf en 2009, nous avons également préparé un document de discussion sur la façon d'incorporer des sources d'informations non-officielles sur l'abattage illégal, ainsi que la nécessité d'avoir un système ' d'alerte précoce ' en place pour affronter les nouveaux défis émergents à la sécurité de l'éléphant. Tous les documents de la réunion sont disponibles sur http://cites.org/eng/prog/MIKE/index.shtml.

Lors de la réunion, nous avons facilité une grande session sur la révision possible de la résolution de la CITES régissant MIKE, ETIS et le trafic d'ivoire (Résolution Conf 10.10 Rev CdP15). Les participants ont fourni un feedback sur la structure opérationnelle et analytique de MIKE et d'ETIS, exprimant de nombreuses idées très utiles sur ce processus. Tout en citant leur désir de voir des changements, surtout plus d'attention aux besoins de gestion au niveau du site et au niveau national, les participants ont également exprimé un désir clair de voir le travail de MIKE et d'ETIS se poursuivre.

C'était la première fois de ma longue histoire avec ces programmes (maintenant 13 ans) que j'ai entendu un tel soutien sans équivoque pour les deux programmes. Surtout, ils ont souligné leur soutien au rôle technique du GSEAf dans MIKE et d'autres actions autorisées en vertu de la Rés. Conf. 10.10 (Rev. CdP15) et ils ont demandé que l'UICN soit un partenaire dans la mise en œuvre du programme en l'inscrivant officiellement dans toute révision de la résolution. Comme le Secrétariat de la CITES cherche maintenant des financements pour la poursuite de MIKE après 2011, l'UICN travaille afin d'assurer que le partenariat pour l'avenir soit non seulement rentable, mais aussi mutuellement bénéfique, à la fois par programme et financièrement.

Along with other members of the AfESG serving on the Technical Advisory Groups (TAG) for MIKE and ETIS, I attended the 9th MIKE TAG and the 4th ETIS TAG here in Nairobi in December. These meetings always pose challenges and present new ideas for the continued development and improvement of both monitoring systems. We undertook an important exercise to begin modelling drivers of illegal killing and the illegal trade in ivory, trying to understand the factors at play at all points along the supply chain. This model will help to underpin the joint MIKE and ETIS analytical framework.

Finally, we are close to completing the first in what we hope many continue to be a series of MIKE-funded studies into the elephant meat trade in Central Africa. Dr Daniel Stiles has undertaken this consultancy on our behalf, and has now completed four case studies in Cameroon, Central African Republic, Democratic Republic of Congo and the Republic of Congo. Each case study follows the trail of elephant meat from the hunter, through middlemen and vendors, to consumers. The case studies are currently under review and will be published this year.

### *Ivory flows meeting in China*

In response to worrying losses in key elephant populations and potentially growing demand for ivory from consumer nations, we have undertaken an exciting new initiative this year. At the CITES CoP15 in Doha in March, we were approached by a number of Parties to help design innovative interventions that are expected to contribute to the reduction of the illegal trade in ivory. With the help of the CITES Management Authorities of China, Thailand and the United States of America, we developed a proposal for a process to bring together countries along the current ivory supply chain to discuss new approaches for outreach and education to help reduce the illegal flow of ivory from Africa.

The first step in this process was a technical exchange meeting, and we secured financial support from the United States Fish and Wildlife Service and a generous offer from China to host the meeting. In November, representatives from the DRC, Tanzania, Thailand, Vietnam, China and the United States met in Hangzhou, China, along with representatives from TRAFFIC and the CITES–MIKE programme. It is

Avec d'autres membres du GSEAf siégeant dans les Groupes Consultatifs Techniques (GCT) pour MIKE et ETIS, j'ai participé à la 9ème réunion du GCT de MIKE et à la 4ème réunion du GCT d'ETIS, ici à Nairobi en décembre. Ces réunions posent toujours des problèmes et présentent de nouvelles idées pour le développement et l'amélioration continus des systèmes de surveillance. Nous avons entrepris un exercice important de modélisation des moteurs de l'abattage illicite et du trafic de l'ivoire, en essayant de comprendre les facteurs en jeu à tous les niveaux le long de la chaîne d'approvisionnement. Ce modèle contribuera à soutenir le cadre analytique conjoint de MIKE et d'ETIS.

Enfin, nous sommes en passe d'achever une première étude dans ce que nous espérons va être une série d'études financées par MIKE sur le commerce de la viande d'éléphant en Afrique centrale. Le Dr Daniel Stiles a entrepris cette consultation pour nous, et a maintenant terminé quatre études de cas au Cameroun, en République centrafricaine, en République Démocratique du Congo et en République du Congo. Chaque étude de cas suit les traces de la viande d'éléphant du chasseur, en passant par les intermédiaires et les vendeurs, jusqu'aux consommateurs. Ces études de cas sont actuellement à l'étude et seront publiées cette année.

### *Réunion sur le flux d'ivoire en Chine*

En réponse à des pertes inquiétantes chez les populations clés d'éléphants et la demande croissante pour l'ivoire provenant des pays consommateurs, nous avons entrepris une nouvelle initiative passionnante cette année. A la CdP15 à Doha au mois de mars, nous avons été contactés par plusieurs Parties pour qu'on les aide à concevoir des interventions innovatrices qui devraient contribuer à la réduction du trafic illicite de l'ivoire. Avec l'aide des autorités de gestion de la CITES de la Chine, de la Thaïlande et des États-Unis d'Amérique, nous avons élaboré une proposition pour un processus visant à rassembler les pays provenant de la chaîne actuelle d'approvisionnement d'ivoire pour discuter de nouvelles approches de sensibilisation et d'éducation pour aider à réduire les flux illégaux d'ivoire en provenance d'Afrique.

La première étape de ce processus a été une réunion d'échanges techniques, et nous avons obtenu un soutien financier du Service de la Pêche et de la Faune des Etats-Unis et une offre généreuse de la Chine d'accueillir la réunion. En novembre, les représentants de la RDC, de Tanzanie, de Thaïlande, du Vietnam, de Chine et des Etats-Unis se sont réunis à Hangzhou, en Chine, avec des

the first time that countries involved from each step of the supply chain—from producer, through transit and to consumer—have been brought together to share experiences on the challenges each faces.

While law enforcement was not the focus of the meeting, challenges in this area remain significant and were discussed. Relevant issues have been forwarded to the CITES Secretariat for their follow-up. The focus of the meeting was, rather, how to reach out to consumer country nationals travelling to or residing in Africa to educate them on the laws governing ivory and the dire consequences for elephants of the continuing illegal trade. We came up with a number of activities that those present will undertake. In addition, we will be preparing a report for the 61st meeting of the Standing Committee to CITES in August 2011 about this gathering, its recommendations and the activities undertaken to date. This is a challenging, but very important new effort, and the synergies with a number of ongoing initiatives will likely grow.

## Updates on conservation and management strategies and action plans

The 2010–2020 Conservation and Management Strategy for the Elephant in Kenya has been completed and awaits ministerial approval. This strategy has taken many years to develop, but will provide an important framework for the Kenya Wildlife Service, as well as the many other stakeholders working on elephant conservation in the country, to undertake co-ordinated efforts to overcome the many challenges facing the species in Kenya. Mozambique's national strategy is now completed and also awaits ministerial approval. Tanzania's strategy is still under development, and we look forward to assisting with the next stage of this process. AfESG members have been closely involved in driving and advising all three of these processes, and I am grateful to them for taking on this important work.

In West Africa, Niger has completed its national strategy and this can be found on our web site. Diane Skinner will be travelling to West Africa in January to discuss ongoing activities and to ensure that momentum for the West African Elephant Conservation Strategy continues.

représentants de TRAFFIC et le programme de MIKE-CITES. C'est la première fois que les pays impliqués dans chaque étape de la chaîne d'approvisionnement du producteur, par le biais du transit jusqu'au consommateur se sont rassemblés pour partager leurs expériences sur les défis auxquels chacun est confronté.

Bien que l'application des lois ne fût pas l'objet de la réunion, les défis dans ce domaine demeurent importants et ont été discutés. Des questions pertinentes ont été transmises au Secrétariat de la CITES pour le suivi. L'objectif de la réunion était plutôt de savoir comment atteindre les ressortissants des pays consommateurs voyageant ou résidant en Afrique afin de les sensibiliser sur les lois régissant l'ivoire et les conséquences désastreuses de la poursuite du trafic illicite pour les éléphants. Nous avons suggéré un nombre d'activités que les personnes présentes allaient entreprendre. En outre, nous allons préparer un rapport pour la 61ème réunion du Comité Permanent de la CITES en août 2011 sur cette rencontre, ses recommandations et les activités entreprises jusqu'à ce jour. C'est un nouvel effort difficile, mais très important, et les synergies avec un nombre d'initiatives en cours vont probablement augmenter.

## Mises à jour sur les stratégies de conservation et de gestion et les plans d'action

La Stratégie de conservation et de Gestion de 2010-2020 pour les éléphants au Kenya a été terminée et attend l'approbation du ministre. Il a fallu de nombreuses années pour élaborer cette stratégie qui fournira un cadre important pour le Service de la Faune du Kenya et les nombreux autres intervenants travaillant sur la conservation des éléphants dans le pays, pour entreprendre des efforts coordonnés afin de surmonter les nombreux défis auxquels l'espèce est confrontée au Kenya. La stratégie nationale du Mozambique est maintenant terminée et attend également l'approbation ministérielle. La stratégie de la Tanzanie est encore en cours d'élaboration, et nous attendons la prochaine étape de ce processus. Les membres du GSEAf ont été étroitement associés à faire avancer et à donner des conseils sur tous les trois processus, et je leur en suis reconnaissante d'avoir accepté ce travail important.

En Afrique de l'Ouest, le Niger a fini sa stratégie nationale et on peut la trouver sur notre site Internet. Diane Skinner se rendra en Afrique de l'Ouest en janvier pour discuter les activités en cours et faire en sorte que la dynamique de la Stratégie de Conservation de l'Eléphant d'Afrique de l'Ouest continue.

## Looking to 2011

By the time you read this we will be well into 2011, and Diane Skinner and Cecily Nyaga share my good wishes to you for the year to come. We hope to devote time in 2011 to facilitate membership engagement with us but also, and perhaps more importantly, with each other. We also hope to revamp our web site and the African Elephant Library. A small grant from the SWAN Foundation should set us well on our way for the Library and you will be hearing from us on this and other new and ongoing initiatives over the coming months.

## En se tournant vers 2011

Au moment où vous lirez ces lignes, nous serons déjà en 2011, et Diane Skinner et Cecily Nyaga se joignent à moi pour vous exprimer nos meilleurs vœux pour l'année à venir. Nous espérons consacrer du temps en 2011 à promouvoir la participation des membres avec nous, mais aussi, et peut-être plus important encore, les uns avec les autres. Nous espérons également réorganiser notre site Internet et la Bibliothèque sur l'Eléphant d'Afrique. Une petite subvention de la Fondation SWAN devrait nous mettre sur la bonne voie pour la bibliothèque et vous entendrez parler de nous à ce sujet et d'autres nouvelles initiatives entreprises au cours des prochains mois

# African Rhino Specialist Group report
# Rapport du Groupe Spécialiste des Rhinos d'Afrique

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## Escalating rhino poaching in South Africa

Rhino poaching has continued to escalate dramatically in South Africa (SA). Not only has the number of rhinos poached in SA increased every year since 2007, but the rate of poaching has also continued to increase. In the first four months of 2010 (January–April) 70 rhinos were poached. A further 115 were poached over the next four months (May-August) and another 148 from September to December, making a total of 333 rhinos poached in 2010 (an average of 0.9 rhino/day for the year and 1.2 rhinos/day for the last four months of this year). During this period there have been 159 arrests, one of which included a vet involved with the private wildlife and game capture industry. These losses should, however, be seen in the context that SA now has in excess of 21,000 rhinos and numbers are still increasing.

With the increased poaching, a number of rhino owners are starting to consider rhino ownership as a liability. This can be expected to result in reduced demand for live rhinos and a corresponding drop in prices; and there are some signs that this is starting to happen. None of the black or white rhinos up for auction at the August 2010 Vleisscentraal Game Auction at Alldays were sold, yet other game species sold. Shamwari was also unable to sell two black rhinos in May 2010 despite offering them at half-price. Another auction also did not sell any white rhinos. The average price obtained for white rhinos on the EKZNW's (2008–2010) and SANParks' (2008–2009) game auctions had dropped by South African Rand (ZAR) 75,000. With over 20,000 white rhinos currently in SA, this decline extrapolates to an asset value drop of ZAR 1.5 billion. Thus the poaching has had serious economic consequences. Each white

## Intensification du braconnage des Rhinocéros en Afrique du Sud

Le braconnage des rhinocéros a continué à s'intensifier en Afrique du Sud de façon dramatique. Non seulement le nombre de rhinocéros braconnés en Afrique du Sud s'est accru chaque année depuis 2007, mais le taux de braconnage a également continué à augmenter. Dans les quatre premiers mois de 2010 (janvier - avril) 70 rhinocéros ont été braconnés. Encore 115 ont été braconnés pendant les quatre mois suivants (mai - août) et 148 autres de septembre à décembre, faisant un total de 333 rhinocéros braconnés en 2010 (une moyenne de 0.9 rhinocéros/jour pendant l'année et de 1.2 rhinocéros/jour pour les quatre derniers mois de cette année). Au cours de cette période il y a eu 159 arrestations, dont l'une d'un vétérinaire travaillant dans l'industrie privée de capture de la faune et du gibier. On devrait, cependant, voir ces pertes dans le contexte actuel où l'Afrique du Sud a un excédent de 21.000 rhinocéros et les chiffres continuent à augmenter.

Avec ce braconnage accru, un certain nombre de propriétaires de rhinocéros commencent à considérer la possession d'un rhinocéros comme un risque. On peut s'attendre que cela puisse avoir comme conséquence une demande réduite des rhinocéros vivants et une baisse correspondante des prix; et il y a des signes que cela commence à se produire. Aucun des rhinocéros noirs ou blancs mis aux enchères au mois d'août 2010 aux Enchères du Gibier de Vleisscentraal à Alldays n'a été vendu, pourtant d'autres espèces de gibier ont été vendues. Shamwari n'a pu non plus vendre deux rhinocéros noirs en mai 2010 en dépit de les offrir à moitié prix. Une autre enchère n'a non plus vendu aucun rhinocéros blanc. Le prix moyen obtenu pour le rhinocéros blanc sur les enchères de gibier d'EKZNW (2008-2010) et de SA NPARK (2008-2009) avait baissé de 75.000 ZAR. Avec plus de 20.000 rhinocéros blancs actuellement en Afrique du Sud, on peut extrapoler ce déclin à une baisse de valeur des actifs de 1.5 milliards ZAR. Ainsi le braconnage a eu des conséquences

rhino poached represents a loss of more than ZAR 300,000. Should the trend of reduced demand and falling rhino prices continue, this will have significant negative consequences for conservation agencies, the private sector and communities that have been raising revenues from rhino sales. It may also reduce the demand for stocking new areas of private and community land.

The massive public response to the escalation of rhino poaching in SA has resulted in a number of legislative changes and initiatives. Lead SA has launched an initiative headed up by SANParks' Sam Ferreira to help combat rhino poaching. Also WWF has inaugurated an African Rhino Campaign with a seminar and press briefing in Pretoria, and followed this up with a national 'blow rhino poaching away' day where everyone in the country was encouraged to blow their Vuvuzelas. At the Pretoria campaign launch, AfRSG Scientific Officer Richard Emslie drew attention to the rapidly increasing poaching rate, warning that while current levels of poaching are sustainable, the rate at which rhino poaching is increasing in SA is not. He showed that if the rate of increase in poaching continued, then rhino numbers could start to decline nationally in just two to three years. This highlighted the need for a major collaborative effort to bring it under control. TRAFFIC's Tom Milliken also briefed those attending on recent trends in rhino horn trade and horn use in Vietnam. The head of SANParks reported on their increased efforts to curb the escalating poaching.

The previous South African Minister for Water and Environmental Affairs also convened a two-day Minister's Rhino Summit in Pretoria in October 2010. A number of presentations were given by the South African Police Service, National Prosecuting Authority, AfRSG and the South African Development Community's (SADC) Rhino Management Group and others. Future strategies and options for dealing with the upsurge in poaching were discussed and the country's National Strategy for the Safety and Security of Rhinoceros Populations was also officially released at the Minister's Summit. The formation of a new National Wildlife Crime Reaction Initiative/Unit by the Minister, with a major focus on rhino crimes, is an

économiques graves. Chaque rhinocéros blanc braconné représente une perte de plus de 300.000ZAR. Si la tendance d'une demande réduite et la baisse des prix de rhinocéros continue, cela aura des conséquences négatives importantes pour les agences de conservation, le secteur privé et les communautés qui engrangent des bénéfices des ventes de rhinocéros. Elle peut également réduire la demande de repeuplement de nouveaux domaines de terre privée et communautaire.

La réponse publique massive à l'intensification du braconnage des rhinocéros en Afrique du Sud a eu comme conséquence un certain nombre de changements et d'initiatives législatifs. Lead SA a lancé une initiative dirigée par Sam Ferreira des Parcs Nationaux sud-africains (SANParks) pour combattre le braconnage du rhinocéros. Le WWF a également inauguré une campagne africaine sur le rhinocéros avec un séminaire et une conférence de presse à Pretoria suivis d'une journée nationale lors de laquelle on a encouragé chacun au pays à souffler son vuvuzela pour ' se débarrasser du braconnage de rhinocéros '. Lors du lancement de la campagne à Pretoria, le Chargé scientifique du GSRAf, Richard Emslie, a attiré l'attention du public sur le taux rapidement croissant du braconnage. Il a averti qu'alors que les niveaux actuels du braconnage étaient viables, le taux auquel le braconnage de rhinocéros augmentait en Afrique du Sud ne l'était pas. Il a montré que si le taux d'accroissement du braconnage continuait, le nombre de rhinocéros pourrait diminuer au niveau national endéans juste deux à trois ans. Cela a mis en exergue la nécessité d'un effort important de collaboration pour le maîtriser. Tom Milliken de TRAFFIC a également informé ceux qui étaient présents des tendances récentes dans le trafic de cornes de rhinocéros et leur utilisation au Vietnam. Le directeur de SANParks a fait un rapport sur les efforts accrus pour limiter l'intensification du braconnage.

Le précédent Ministre sud-africain de l'Eau et des Affaires environnementales a également organisé un sommet de deux jours à Pretoria en octobre 2010 pour les Ministres en charge du rhinocéros. Des exposés ont été présentés par la police sud-africaine, le Ministère Public, le GSRAf et le Groupe de Gestion du Rhinocéros de la SADC. De futures stratégies et options pour faire face à la recrudescence du braconnage ont été discutées et la Stratégie Nationale du pays pour la protection et la sécurité des populations des rhinocéros a été officiellement publiée au sommet des Ministres. La formation d'une nouvelle initiative/unité nationale de réaction au crime de la faune par le Ministre, qui mettra l'accent sur les crimes

important development. Top provincial wildlife investigators and environmental management inspectors are being seconded to this Unit, joining colleagues from SANParks, the South African Police Service's Organised Crime and Hawks Priority Crime Units, the National Prosecution Service, the Asset Forfeiture Unit, the South African Defence Force and the South African Revenue Service. This Unit has been designed to tackle the problem nationally in a collaborative multi-disciplinary way. Specialist and experienced prosecutors have also been designated to deal with rhino cases within each province by the National Prosecution Service. During discussions, the need to fast track the establishment of special wildlife courts to expedite cases and hopefully improve prosecution rates was mentioned, similar to the need to speed up firearms licensing for those in the private sector. The listing of rhino crimes as 'priority crimes' now allows helicopters, vehicles and game farms used in rhino crimes to be confiscated by the State.

Hopefully we will soon see the impact of all these South African initiatives translate into reduced poaching levels despite the fact that organized criminal syndicates are behind most of the rhino poaching.

## Poaching in other major rhino range States

While poaching continues in Zimbabwe, some recent reports from the Lowveld region (where most of the country's rhino are situated) indicate that poaching levels are somewhat down and rhino numbers are increasing again.

While Namibia appears to have escaped the levels of poaching experienced elsewhere, the country is not being complacent. In the last edition of *Pachyderm* I reported on a workshop in April 2010 that started the process of developing a national security plan for elephants and rhinos in the country. During the reporting period work has continued on this initiative.

Unfortunately, Kenya has recently experienced increased poaching levels.

relatifs aux rhinocéros, est un développement important. Des détectives de la faune provinciaux et des inspecteurs de la gestion environnementale sont détachés à cette unité, joignant les collègues de SANParks, les unités de la Police Sud-africaine sur le crime organisé et les unités ' ' éperviers ' des crimes prioritaires, le Ministère Public, l'Unité de confiscation de capitaux, la Force de défense sud-africaine et le Service sud-africain des impôts. Cette unité a été conçue pour s'attaquer au problème au niveau national de manière multidisciplinaire et collaborative. Des procureurs spécialistes et expérimentés ont été également désignés pour s'occuper des procès sur les rhinocéros dans chaque province par le Ministère Public. Pendant les discussions, on a parlé de la nécessité d'accélérer la création des cours spéciales de la faune pour expédier les procès et si tout va bien, améliorer les taux de condamnation. On a également parlé de la nécessité d'accélérer l'autorisation des armes à feu pour le secteur privé. L'inscription des crimes de rhinocéros en tant que crimes prioritaires permet maintenant la confiscation par l'état des hélicoptères, des véhicules et des fermes de gibier utilisés dans les crimes de rhinocéros.

Si tout va bien, nous verrons bientôt l'impact de toutes ces initiatives sud-africaines se traduire par des niveaux réduits de braconnage malgré le fait que les syndicats criminels organisés sont derrière la quasi-totalité de braconnage des rhinocéros.

## Braconnage dans d'autres états importants de l'aire de distribution du rhinocéros

Même si le braconnage continue au Zimbabwe, des rapports récents provenant de la région de Lowveld (là où la plupart des rhinocéros du pays se trouvent) indiquent que les niveaux de braconnage sont légèrement en baisse et que le nombre de rhinocéros augmente de nouveau

Alors que la Namibie semble avoir échappé aux niveaux de braconnage rencontrés ailleurs, le pays ne perd pas sa vigilance. Dans la dernière publication de *Pachyderme* j'ai fait un rapport sur un atelier en avril 2010 qui avait commencé le processus de formulation d'un plan de sécurité nationale pour les éléphants et les rhinocéros du pays. Au cours de la période couverte par ce rapport, le travail a continué sur cette initiative.

Malheureusement, le Kenya a récemment subi des niveaux accrus de braconnage.

## Regional and international co-ordination

The SADC Rhino Management Group held its 18th meeting in October 2010, which was productive and well attended with representatives from all member countries.

The tenth meeting of the African Rhino Specialist Group will take place at Mokala National Park, SA, in March 2011. This meeting will, inter alia, reassess national and continental rhino numbers and trends. I will report on key aspects of the meeting in the next edition of *Pachyderm*.

## Revisions of national rhino conservation plans and strategies

*South Africa*—The black rhino plan has been revised and is currently being reviewed at national level as part of the formal ratification process. The National Strategy for the Safety and Security of Rhinoceros Populations is incorporated into this plan as an Annexure.

*Tanzania*—Tanzania's rhino plan has been revised at a multi-stakeholder workshop held in Arusha in which many AfRSG members participated.

*Botswana*—In early November a multi-stakeholder workshop was held in Gaborone to review and update the country's national rhino plan. Several AfRSG members took part in this workshop. A draft plan is being produced that will be circulated for comment prior to its completion.

*Zimbabwe*—Plans are afoot to implement a strategic planning process for rhino conservation. The National Rhino Conservation Strategy will be reviewed with the involvement of relevant stakeholders and external expertise with the aim of producing an updated policy framework. As part of this process it is proposed that two one-day review workshops be held (one on security and one on biological management). Specific AfRSG members have been requested by Zimbabwe to assist with these reviews.

*Uganda*—Due to personnel changes at the top of the Uganda Wildlife Authority, the proposed workshop to develop a national rhino policy and conservation plan has been postponed until 2011. The AfRSG's Secretariat has been invited to participate.

## Coordination régionale et internationale

EnOctobre 2010 le Groupe de gestion de rhinocéros de la SADC a tenu sa 18ème réunion, qui était fructueuse et à laquelle les représentants de tous les pays membres ont participé.

La dixième réunion du Groupe de Spécialistes du Rhinocéros d'Afrique aura lieu au Parc National de Mokala en Afrique du Sud en mars 2011. Cette réunion réexaminera, entre autres, les nombres nationaux et continentaux des rhinocéros et les tendances. Je ferai un rapport sur les aspects clés de la réunion dans le prochain numéro du *Pachyderme*.

## Révisions des plans et des stratégies nationaux pour la conservation du rhinocéros

*Afrique du Sud* - Le plan du rhinocéros noir a été révisé et on l'examine actuellement au niveau national en tant que partie du processus officiel de ratification. La Stratégie Nationale pour la Protection et la Sécurité des populations de rhinocéros est incorporée à ce plan comme une annexe.

*Tanzanie* - Le plan du rhinocéros de la Tanzanie a été révisé dans un atelier pour les intervenants tenu à Arusha auquel beaucoup de membres du GSRAf ont participé.

*Botswana* - Début novembre un atelier auquel ont assisté plusieurs intervenants s'est tenu à Gaborone pour examiner le plan national de rhinocéros du pays et le mettre à jour. Plusieurs membres du GSRAf ont participé à cet atelier. On est en train de préparer une version provisoire qui sera distribuée pour commentaires avant d'être finalisée.

*Zimbabwe* - Les plans sont en cours de réalisation pour mettre en œuvre un processus de planification stratégique pour la conservation du rhinocéros. La Stratégie Nationale de Conservation du rhinocéros sera examinée avec la participation des intervenants et les experts externes dans le but de produire un cadre de politique mis à jour. En tant que partie de ce processus, on propose d'avoir deux ateliers de revue d'une journée chacun (l'un sur la sécurité et l'autre sur la gestion biologique). Le Zimbabwe a demandé à des membres spécifiques du GSRAf de participer à ces revues.

*Ouganda* - A cause du changement de personnel à la tête de l'Autorité de la Faune d'Ouganda, l'atelier proposé pour développer une politique nationale du rhinocéros et le plan de conservation a été ajourné jusqu'en 2011. Le Secrétariat du GSRAf a été invité à y participer.

## Rhino horn DNA

A white rhino DNA index system database has been successfully developed as a result of co-operative work between Cindy Harper (Onderstepoort's Veterinary Genetics Laboratory, University Pretoria, SA), and Ross McEwing and Rob Ogden (TRACE in the UK). Over the last three years they have developed markers suitable for identifying individual white rhinos, and a technique to undertake nuclear DNA analysis has been developed which works on horns of varying age. The rhino database that has been developed is called RhoDIS and is modelled on the human Combined DNA Index System (CODIS) database system. The former has already been successfully used in both SA and the UK. In SA, recovered horn was matched back to a poached rhino; and in the UK it was used to help convict a horn smuggler that had stolen the horns of the dead zoo rhino destined for destruction.The method uses standards, which will allow results from different labs to be compatible (like human DNA work).

The technique provides a valuable new tool in the fight against rhino crime. However, as with the collection of all evidence that might eventually be used in court, maintaining the chain of evidence for the horn, blood and other samples is essential. With the assistance of the South African Police Service's Forensics Lab, data collection forms and tamperproof evidence bags have been developed for collecting rhino samples. Apart from its obvious use in criminal investigations and studying the rhino horn trade, the technique could be used to enhance biological management of small populations by providing information on levels of inbreeding and the domination of breeding by specific bulls. Such information could be used to inform translocation decision-making. The current cost is about ZAR 300 per sample.

## Update on the northern white rhino at Ol Pejeta, Kenya

The final decision on what to do with the four northern white rhinos (NWR) involved rests with the Dvůr Králové Zoo and its Board. Partners assisting Dvůr Králové to implement this project include Fauna and Flora International, Back to Africa, Ol Pejeta Conservancy, Lewa Wildlife

## L'ADN de cornes de rhinocéros

Une base de données des indices ADN du rhinocéros blanc a été développée avec succès en raison du travail coopératif entre Cindy Harper (Laboratoire de Génétique Vétérinaire d'Onderstepoort de l'Université de Pretoria en Afrique du Sud), et Ross McEwing et Rob Ogden (TRACE au Royaume Uni). Au cours des trois dernières années ils ont développé des marqueurs appropriés pour identifier des rhinocéros blancs particuliers et aussi une technique pour entreprendre une analyse nucléaire d'ADN qui marche sur les cornes d'âge variable. La base de données de rhinocéros s'appelle RhoDIS et elle est modélisée sur le système de la base de données du Système Humain Combiné d'Indices ADN (CODIS). Ce premier a déjà été utilisé avec succès à la fois en Afrique du Sud et au Royaume Uni. En Afrique du Sud, une corne récupérée a été identifiée à un rhinocéros braconné; et au Royaume Uni la technique a été utilisée pour aider à faire condamner un contrebandier qui avait volé les cornes d'un rhinocéros mort d'un zoo qui devaient être détruites. La méthode utilize des normes, qui permettront aux résultats de différents laboratoires d'être compatibles (comme l'ADN humain fonctionne).

La technique fournit un nouvel outil précieux dans la lutte contre le crime de rhinocéros. Cependant, comme avec la collecte de toutes les preuves qu'on pourrait par la suite utilizer devant un tribunal, le maintien de la chaîne de preuves pour la corne, le sang et d'autres échantillons est essentiel. Avec l'aide du laboratoire de médecine légale de la police sud-africaine, des formulaires de collecte de données et des sacs inaltérables de preuves ont été développés pour rassembler des échantillons de rhinocéros. A part son utilisation évidente dans des enquêtes criminelles et dans l'étude du trafic de cornes de rhinocéros, on pourrait utilizer la technique pour améliorer la gestion biologique de petites populations en fournissant des informations sur les niveaux de l'endogamie et la domination reproductive des mâles spécifiques. On pourrait utilizer de telles informations pour informer la prise de décision sur la translocation. Le coût actuel est d'environ 300 ZAR par échantillon.

## Mise à jour sur le rhinocéros blanc du nord à Ol Pejeta au Kenya

La décision finale sur ce qu'on doit faire des quatre rhinocéros blancs du nord dépend du Zoo de Dvůr Králové et de son Conseil d'Administration. Les partenaires qui aident Dvůr Králové à mettre en œuvre ce projet incluent Fauna et Flora International, Back to Africa, la Conservation d'Ol Pejeta, la Conservation de

Conservancy and the Kenya Wildlife Service. A committee assesses and reviews their performance and management.

According to Ol Pejeta's staff and project management, the rhinos have settled down well. The oldest of the NWR bulls and older NWR female have been introduced into a large area with five other wild southern white rhino females. The second NWR bull and the younger NWR female are currently in an adjacent fenced-off area. Since adapting to life back in Africa, there have been significant positive changes in the rhinos' behaviour. They are now grazing fully on natural vegetation and wallowing in mud, and the males have been observed scraping their feet and spray urinating to mark their territory, which are all encouraging natural wild behaviours. The animals have also put on significant muscle bulk as a result of their more active lifestyle.

Regular hormonal analyses of dung have confirmed that the younger of the two ex-Dvůr Králové females has been cycling. She has also been observed mating with the one Dvůr Králové bull in her area (selected to minimize inbreeding at F=0.125). As yet it is not known if she has become pregnant. Given the urgent need to get this young NWR female pregnant to secure her reproductive future (as advised by the Berlin IZW reproductive experts Thomas Hildebrandt and Robert Hermes) it might be advisable to try to mate her with a proven southern white rhino breeding bull in an attempt to get her pregnant should she not become pregnant in the next few months.

Unfortunately the second older female does not appear to be cycling and this is currently under investigation. Initial reports indicated the old NWR bull in the area with her was avoiding the wild southern white rhino cows.

## Northern white rhino subspecies status

In April 2010, Colin Groves and co-workers published a paper in which they argued (based on morphological and genetic differences and estimated time since divergence from a common ancestor and using a phylogenetic species concept), that the northern white rhino should now be considered as a separate species.

la Faune de Lewa et le Service de la Faune du Kenya. Un comité évalue et examine leur performance et leur gestion.

Selon le personnel d'Ol Pejeta et la gestion des projets, les rhinocéros se sont bien établis. Le plus vieux des mâles des rhinocéros blancs du nord et l'une des vieilles femelles ont été introduits dans une large zone ayant cinq autres femelles rhinocéros sauvages blanches du sud. Le deuxième rhinocéros mâle et la jeune femelle blancs du nord sont actuellement dans une aire clôturée adjacente. Depuis leur adaptation à la vie en Afrique, il y a eu des changements positifs cruciaux du comportement chez les rhinocéros. Maintenant ils paissent entièrement sur la végétation naturelle et se vautrent dans la boue, et on a vu les mâles racler leurs pattes et répandre leur urine pour marquer leur territoire, tous des comportements normaux sauvages encourageants. Les animaux ont également développé une masse importante de muscle en raison de leur style de vie plus actif.

Les analyses hormonales régulières des crottes ont confirmé que la plus jeune des deux femelles venues de Dvůr Králové avait fait un cycle. On l'a également vue s'accoupler avec le mâle de Dvůr Králové dans son secteur (choisi pour minimiser l'endogamie à F=0.125). Jusqu'à maintenant on ne sait pas si elle est pleine. Etant donné le besoin urgent que cette jeune rhinocéros soit gestante pour assurer son avenir reproductif (comme conseillé par les experts en matière de reproduction Thomas Hildebrandt et Robert Hermes de l'IZW de Berlin), il serait conseillé d'essayer de l'accoupler avec un mâle blanc du sud de reproduction connu pour qu'elle soit gestante si elle ne l'est pas déjà dans les quelques mois à venir.

Malheureusement la deuxième femelle plus âgée ne semble pas faire de cycle et cela est actuellement à l'étude. Les rapports initiaux ont indiqué que le vieux rhinocéros mâle blanc du nord dans ce secteur évitait les femelles sauvages blanches du sud.

## Situation de la sous-espèce du rhinocéros blanc du nord.

En avril 2010, Collins Groves et ses collègues ont publié un document dans lequel ils argumentaient, (en se basant sur les différences morphologiques et génétiques et le temps calculé depuis la divergence d'un ancêtre commun et en utilisant un concept phylogénétique d'espèces), qu'on devrait maintenant considérer le rhinocéros blanc du nord comme une espèce à part.

This conclusion is being contested by, amongst others, African rhino genetics expert Colleen O'Ryan who has informed the AfRSG that she and her colleagues are working on a detailed rebuttal of Groves et al.'s paper based on findings derived from larger sample sizes, and using what she feels are more appropriate genes. The resultant rebuttal paper is expected to be submitted to a refereed journal.

At this point in time, the AfRSG's Secretariat does not accept the split into two species.

Defining a species will always be problematic as there are a number of different species concepts. Depending on which species concept one uses, one can end up defining separate species or lumping organisms together as a single species. For example, if by nature you are a taxonomic 'splitter' and favour the phylogenetic species concept (used by Groves et al. 2010), one is more likely to routinely classify populations inhabiting different areas that have some morphological and genetic differences as distinct species. The problem with this approach is that one runs the risk of species-level status being accorded to a large number of subspecies.

By way of contrast, many field conservationists favour a combination of the biological species and mate recognition concepts. Using this approach, if animals that are put together from different populations recognize each other as the same species mate successfully and can produce viable and fertile offspring (irrespective of whether or not there are some morphological differences or limited fixed genetic differences between separated populations), they would not be regarded as separate species.

It could well be argued that given that the ultimate conservation objective of the move of NWR to the wild, the issue of whether or not northern white rhinos should be treated as a species or subspecies is somewhat academic. This is on the basis of 1) the current low number (four) and high degree of relatedness of the remaining northern white rhinos at Ol Pejeta (calculated Founder Genome Equivalent of only 1.71, meaning that the genetic composition of the remaining animals is equivalent to what would have been represented in fewer than a single pair of animals in the former wild population); 2) the fact that any pure-bred offspring from remaining animals would be inbred

Cette conclusion est contestée, notamment, par Colleen O'Ryan, expert de la génétique du rhinocéros d'Afrique, qui a informé le GSRAf qu'elle et ses collègues travaillaient sur une réfutation détaillée du document de Groves et al. basée sur les résultats dérivés d'une plus grande taille d'échantillons, et utilisant ce qu'elle pense être des gènes plus appropriés. On s'attend à ce que le document résultant de la réfutation soit soumis à un journal ayant un comité de lecture.

Actuellement, le Secrétariat du GSRAf n'accepte pas la séparation en deux espèces.

La définition d'une espèce sera toujours problématique car il y a plusieurs concepts de ce que c'est qu'une espèce. Selon le concept d'espèce qu'on utilize, on finit par définir des espèces séparées ou regrouper des organismes en une seule espèce. Par exemple, si par nature on est un ' diviseur ' taxonomique et on favorise le concept phylogénétique d'espèce (utilisé par Groves et al. 2010), on va normalement classifier des populations habitant des zones différentes ayant quelques différences morphologiques et génétiques comme des espèces distinctes. Le problème avec cette approche est qu'on court le risque d'accorder le statut d'espèce à un grand nombre de sous-espèces.

En revanche, beaucoup de défenseurs de la nature sur terrain favorisent maintenant une combinaison de l'espèce biologique et des concepts d'identification du conjoint sexuel. Selon cette approche, si des animaux mis ensemble provenant de différentes populations se reconnaissent comme étant de la même espèce, s'accouplent avec succès et produisent une progéniture viable et fertile (indépendamment du fait qu'il y a des différences morphologiques ou des différences génétiques limitées entre ces populations séparées), on ne les considèrera pas comme des espèces séparées.

On pourrait argumenter que, étant donné l'objectif de conservation du transfert du rhinocéros blanc du nord dans la nature, la question de savoir s'il devrait être traité comme une espèce ou une sous-espèce est quelque peu académique. C'est sur la base:1) du nombre actuel peu élevé (quatre) de rhinocéros blancs du nord restants à Ol Pejeta et du niveau important de parenté (un Equivalent Calculé de génome de fondateur de seulement 1,71, ce qui veut dire que la composition génétique des animaux restants équivaut à celle représentée dans moins d'un couple d'animaux dans l'ancienne population sauvage); 2) du fait que toute progéniture pure des animaux restants serait consanguine aux degrés différents; 3) de la nécessité de maximizer le rendement reproductif de tous

to differing degrees; and 3) the need to maximize reproductive output from all these NWR (both males are old and may not live much longer and only one of the two females is young) to maximize the retention of adaptive NWR genes. Mating the males with as many SWR females as possible would also help achieve this.

IUCN SSC Conservation Breeding Specialist Group's Bob Lacy and Kathy Traylor-Holzer have advised that, given the above situation and overall conservation objective, we have reached a stage where there is little chance of achieving medium- to long-term goals without the successful intercrossing of NWR with SWR. This would at least conserve some NWR genes within breeding populations that could later resume evolutionary adaptation to wild habitats. They have advised that, in the total absence of human-caused losses (e.g. poaching), genetic and demographic modelling of such a small population of inter-related animals shows that the remaining four NWR are very unlikely to form a viable population in the longer term. This is because of the negative effects of severe inbreeding and the high probability of chance demographic events significantly reducing or eliminating the remnant population at some time in the future. Thus attempts at breeding only pure NWR under these circumstances are likely to fail in the medium- to long-term. Of course inter-crossing may end up not being successful either.

ces rhinocéros blancs du nord (les deux mâles sont vieux et pourraient ne pas vivre longtemps et une seule femelle est jeune) dans une tentative de retenir de façon maximale les gènes adaptatifs du Rhinocéros blancs du nord. Faire accoupler les mâles avec autant de femelles blanches du sud que possible aiderait aussi à réaliser ce but.

Bob Lacy et Kathy Traylor-Holzer du Groupe de Spécialistes de la Reproduction pour la Conservation du CSE de l'UICN ont conseillé qu'étant donné la situation ci-dessus et l'objectif de conservation, nous avons atteint une étape où les défenseurs de la nature ont peu de chance d'atteindre des objectifs de conservation du moyen à long terme sans l'inter-croisement du rhinocéros blanc du nord avec celui du sud. Cela conserverait au moins des gènes du rhinocéros blanc du nord chez les populations de reproduction qui pourraient plus tard reprendre l'adaptation évolutionnaire aux habitats sauvages. Ils ont conseillé que, en l'absence de pertes causées par l'homme (par exemple le braconnage), la modélisation génétique et démographique d'une si petite population d'animaux consanguins montre qu'il est peu probable que les quatre rhinocéros blancs du nord qui restent puissent former une population viable à long terme. Ceci est en raison des effets négatifs de l'endogamie et la probabilité que des événements démographiques réduisent ou éliminent la population restante à l'avenir. Ainsi les tentatives de produire des rhinocéros blancs du nord purs dans ces circonstances risquent d'échouer dans le moyen à long terme. Naturellement, l'inter-croisement peut finir par ne pas réussir non plus.

# Asian Rhino Specialist Group Report
# Rapport du Groupe Spécialiste des Rhinos d'Asie

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## Update on current state of Asian rhinos

### *Greater one-horned rhino*

India and Nepal have been working to ensure the long-term conservation of the greater one-horned rhino in its natural habitat. Nepal lost at least 13 rhinos to the illegal rhino horn trade in 2010. In the same year, eight rhino calves were born in Chitwan NP (National Park) while two were born in Bardia NP, Nepal. In India, two rhinos were killed by poachers in Rajiv Gandhi Orang NP in Assam during 2010 while in Kaziranga NP about five rhinos were poached. There is also a single record of rhino poaching from Jaldapara Wildlife Sanctuary (WLS) of West Bengal during 2010. Pabitora WLS in Assam recorded no rhino poaching along with Gorumara NP in West Bengal and Dudhwa NP of Uttar Pradesh.

Currently the there are about 2800-2850 greater one-horned rhinos in the wilderness of India and Nepal.

In Assam under Indian Rhino Vision 2020, two female rhinos were captured in the Pabitora WLS on 28 December and translocated into Manas NP of Assam where the two female rhinos were released on the morning of 29 December. Sixteen more rhinos are to be captured in Pabitora WLS and Kaziranga NP in 2011 that are scheduled to be released in Manas NP to build a breeding population to give further boost to the rhino conservation in Assam, India. The Indian Rhino Vision 2020 is a joint initiative of the Assam Forest Department, International Rhino Foundation, WWF and U.S. Fish and Wildlife Service, which was initiated in 2005.

## Mise à jour sur l'état actuel du rhinocéros d'Asie

### *Grand rhinocéros unicorne*

L'Inde et le Népal travaillent pour assurer la conservation à long terme du grand rhinocéros unicorne dans son habitat naturel. Le Népal a perdu au moins 13 rhinocéros au trafic illicite de corne de rhinocéros en 2010. Dans la même année, huit veaux de rhinocéros sont nés au Parc National de Chitwan et deux sont nés au Parc National de Bardia, au Népal. En Inde, deux rhinocéros ont été tués par des braconniers au Parc National Rajiv Gandhi Orang dans l'Assam en 2010 alors qu'au Parc National de Kaziranga, environ cinq rhinocéros ont été braconnés. Il y a eu aussi un seul enregistrement de braconnage de rhinocéros du Sanctuaire de la Faune de Jaldapara du Bengale Occidental en 2010. Le Sanctuaire de la Faune de Pabitora dans l'Assam n'a enregistré aucun braconnage de rhinocéros ainsi que le Parc National de Gorumara au Bengale occidental et le Parc National de Dudhwa de l'Uttar Pradesh.

Actuellement, il y a entre 2800 et 2850 grands rhinocéros unicornes dans la jungle de l'Inde et du Népal.

Dans l'Assam, sous la Vision 2020 du Rhinocéros d'Inde, deux rhinocéros femelles ont été capturées dans le Sanctuaire de la Faune de Pabitora le 28 Décembre et transportées au Parc National de Manas de l'Assam, où elles ont été libérées dans la matinée du 29 décembre. Seize rhinocéros sont encore à capturer dans le Sanctuaire de la Faune de Pabitora et au Parc National de Kaziranga en 2011 et on prévoit de les libérer au Parc National de Manas afin de créer une population reproductrice et de donner un élan à la conservation des rhinocéros dans l'Assam, en Inde. La Vision 2020 du Rhinocéros d'Inde est une initiative conjointe du Département des forêts de l'Assam, la Fondation Internationale pour le Rhinocéros, le WWF et le Service de la Pêche et de la Faune des Etats-Unis, lancée en 2005.

## Javan rhino

The critically endangered Javan rhino conservation in Ujung Kulon NP, Indonesia seems to be the only hope for the species to survive as the conservation of the few remaining (three to five) Javan rhino in Cat-tien National Park in Vietnam received a blow when one rhino was found dead, suspected to be poached. The Ujung Kulon population in Indonesia reported ranges from 35–45. Meanwhile work has started in Gunung Honje forests adjacent to Ujung Kulon NP of Indonesia for the Javan rhino Study and Conservation Area to intensely monitor the few Javan rhinos to unearth more information about the species to further assist in better management of Javan Rhinos. This initiative is being supported by the International Rhino Foundation, Ministry of Forests, Indonesia and WWF; it is being implemented by Yayasan Badak Indonesia (YABI) and the Ujung Kulon NP authorities with technical inputs from the Rhino Task Force of Indonesia

## Sumatran rhino

The conservation of critically endangered Sumatran rhinos remains challenging, particularly due to lack of proper estimation tools that could give us the current population status. However, whatever information could be gathered by different conservation organizations, the trend surely shows a declining state. Sabah in Malaysia and Sumatra in Indonesia hold the last hope for the species. What is needed is to assess the population trend every three to four years to take appropriate conservation initiatives.

## Rhinocéros de Java

La conservation du rhinocéros de Java, gravement menacé de disparition, au Parc National d'Ujung Kulon en Indonésie semble être le seul espoir pour que l'espèce survive car la conservation de quelques (trois à cinq) rhinocéros de Java restants au Parc National Cat Tien au Vietnam a reçu un coup terrible quand on a retrouvé un rhinocéros mort, soupçonné d'être braconné. La population d'Ujung Kulon rapportée en Indonésie varie de 35 à 45. Dans l'entre-temps les travaux ont commencé dans les forêts Gunung Honje adjacentes au Parc National d'Ujung Kulon d'Indonésie au cours desquels l'Aire de conservation et d'étude du Rhinocéros de Java va surveiller de près les quelques rhinocéros de Java afin de trouver plus d'informations sur l'espèce et mieux gérer ces rhinocéros. Cette initiative est soutenue par la Fondation Internationale pour le Rhinocéros, le Ministère des Forêts d'Indonésie et le WWF; elle est mise en œuvre par Yayasan Badak Indonésie (YABI) et les autorités du Parc National d'Ujung Kulon avec des apports techniques du Groupe de travail sur le rhinocéros d'Indonésie.

## Rhino de Sumatra

La conservation du rhinocéros de Sumatra, gravement menacé de disparition, reste difficile, notamment en raison du manque d'outils d'évaluation appropriés capables de nous renseigner sur la situation actuelle de la population. Cependant, quelques soient les informations que différentes organisations de conservation ont pu recueillir, la tendance montre sûrement un déclin. La Malaisie Sabah et Sumatra en Indonésie offrent le dernier espoir pour l'espèce. Il faudrait évaluer la tendance de la population tous les trois à quatre ans afin de prendre des initiatives de conservation appropriées.

# RESEARCH

## Determining the suitability of using eye wrinkle patterns for the accurate identification of individual black rhinos

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### Abstract

Photograhic identification is used to identify individual black rhinos (*Diceros bicornis*) with the distinguishing features of sex, the size and shape of the anterior and posterior horns, peculiarities of the ears, the pattern of wrinkle contours on the snout, prominent scars and sores on the body, the state of the tail, body size including the size of a calf in relation to the mother and skin folds. Eye wrinkle patterns have received little attention but were found to be useful when separating a large number of photographs of 19 captive rhinos particularly for distinguishing individual sub-adults where other features such as horn length and shape were very similar. Each rhino was found to have unique eye wrinkle patterns which remained consistent when the eyes were open or closed. By developing and applying a series of tests, judgement errors that occur when reviewing eye wrinkle photographs were determined and are reported. Results show that individual black rhinos can be accurately identified from suitable photographs but, even for the best of the judges, using eye wrinkles alone to identify individual rhinos was not completely reliable.

**Key words:** photo-identification, photographs, black rhinos

### Résumé

L'identification photographique est utilisée à identifier différents rhinocéros noirs (*Diceros bicornis*) ayant des traits distinctifs de sexe, de taille et de la forme des cornes antérieure et postérieure, les particularités des oreilles, la configuration des contours des rides sur le museau, les cicatrices et les blessures sur le corps, l'état de la queue, la taille du corps - y compris celui d'un veau par rapport à sa mère - et les plis de la peau. Les configurations des rides oculaires ont suscité peu d'attention mais se sont avérés utiles quand on a organisé un grand nombre de photographies de dix-neuf rhinocéros captifs, surtout pour distinguer les différents sous-adultes alors que d'autres traits, comme la longueur et la forme de la corne, étaient semblables. Chaque rhinocéros s'est avéré avoir des configurations de rides oculaires qui restaient conformes que les yeux soient ouverts ou fermés. En développant et en appliquant une série de tests, les erreurs d'appréciation qui se produisent lorsqu'on examine les photographies des configurations des rides oculaires ont été déterminées et rapportées. Les résultats montrent qu'on peut correctement identifier les différents rhinocéros noirs à partir des photographies appropriées mais, même pour le meilleur des juges, les rides oculaires seules n'étaient pas complètement fiables pour identifier les individus.

## Introduction

The natural features used for the identification of individual black rhinos are sex, the size and shape of the anterior and posterior horns, peculiarities of the ears, the pattern of wrinkle contours on the snout, prominent scars and sores on the body, the state of the tail, body size including the size of a calf in relation to the mother, and skin folds (Klingel and Klingel 1966; Goddard 1966, 1967; Hamilton and King 1969; Hitchins 1969; Schenkel and Schenkel-Hulliger 1969; Hitchins and Keep 1970). Polet et al. (1999) used eye wrinkle patterns to distinguish photographs of individual Javan rhinos (*Rhinoceros sondaicus*). This technique has not so far been used for black

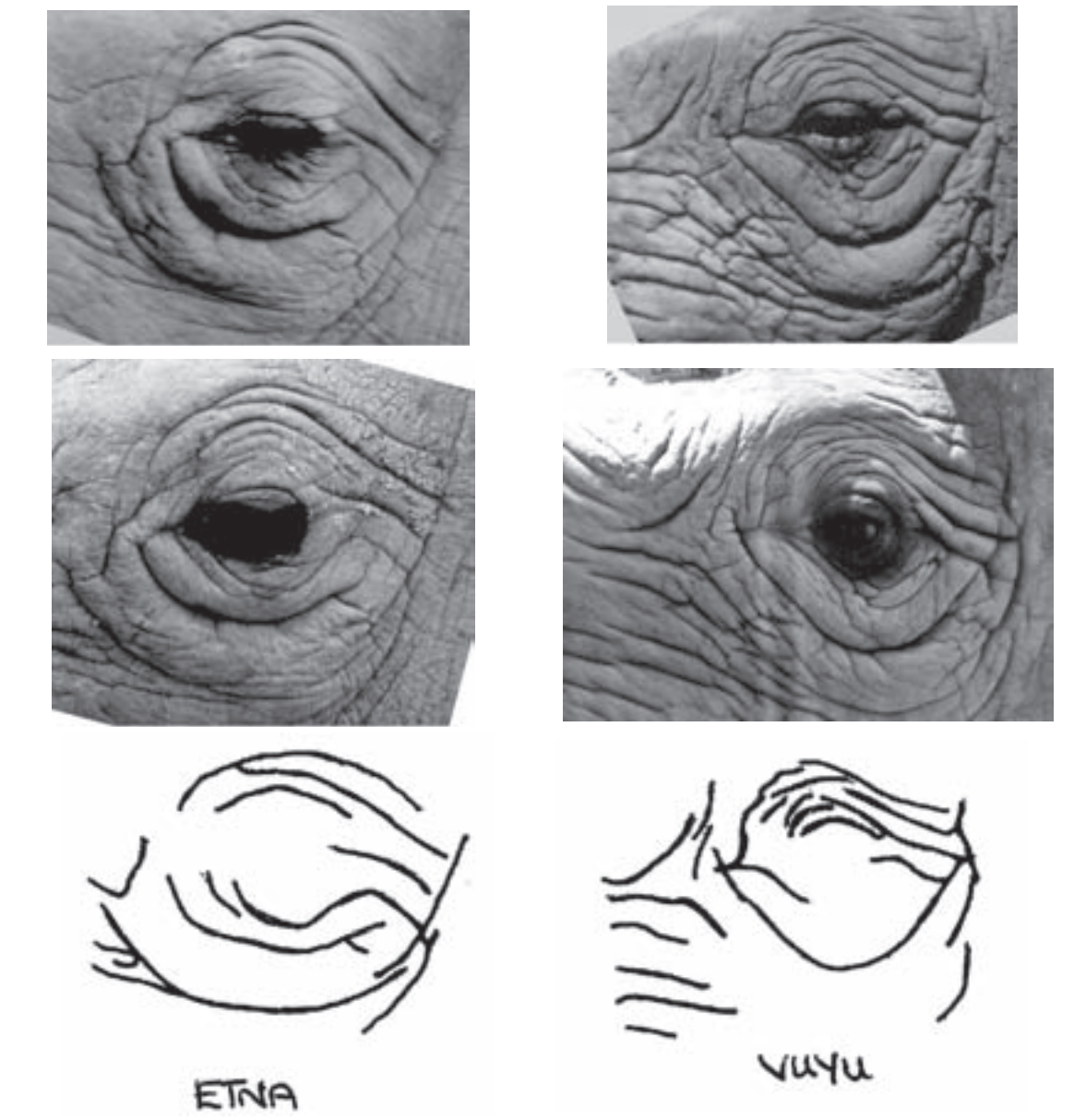


Figure 1. Examples of left eye wrinkle patterns for two black rhinos from Port Lympne Wild Animal Park, UK. Top photographs show the eyes nearly closed, middle photographs show the eyes open, bottom drawings are of the key wrinkles.

rhinos (*Diceros bicornis*)—nose wrinkle patterns have but our observation was that these proved to be inconsistent as a result of differing facial expression. Therefore, in this study we test the use of eye wrinkles for the individual identification of black rhinos from photographs and assess the consistency of the feature in comparison to other key features used similarly. Examples of left eye wrinkle patterns for two black rhinos are shown in Figure 1.

## Methods and materials

Port Lympne Wild Animal Park is situated in the county of Kent in the south of England. In August 2001 at the start of the study, the Park held 19 black rhinos. The rhinos were originally obtained from zoos in the United Kingdom, Italy, Ireland and the Czech Republic and from wild populations in Kenya and South Africa. During the study period there were several births and three introductions.

Rhino matings are managed to maximize genetic diversity. For example, the four calves of the female Rukwa were all sired by different males. With a widely sourced founder group and managed matings, despite the relatively small population of 19, it was expected that there would be a wide range of variability within identification features such as the eye wrinkle patterns.

### *Photography*

Photographs appropriate for individual identification were considered to be those akin to the outline drawings used to identify individual rhinos in the Kenya Wildlife Service 'Black Rhino Sighting Form Booklet'. These drawings are of the left and right body profile, the left and right head profile, a front view of the head, the left and right ear, nose wrinkles and rear view but also including, where possible, left and right eye wrinkles. Therefore, 11 photographs of each individual were required for a full 'set' to show all the features used for identification as mentioned previously. Photography was carried out in August 2001, August 2003 and August 2005 in order to identify the changes in these features over time. Photographs were taken from the roadways and holding areas enabling clear sighting of the rhinos which were often within 10 m of the camera.

### *Equipment and processing*

In August 2001, photographs were taken with an SLR camera with a 400 mm lens using ASA 400 colour film. In August 2003 and August 2005, the fixed 400mm lens was replaced with a more versatile Tokina 80-400 mm zoom lens with film and processing as in 2001. In August 2005, photographs were taken using a Minolta Dimage 7D digital camera.

### *Image enhancement*

Individual rhino features were initially obtained by scanning prints. In 2005, digital images were downloaded directly from the digital camera. The scans and images were saved using JASC Paint Shop Pro 7 software as 'JPG' files in greyscale as this gave the most observable contrast.

### *Test of consistency of eye wrinkle patterns*

Identification photographs taken over the study period were compared to determine whether eye wrinkle patterns had changed, if they had changed whether these could lead to mis-identification and whether eye wrinkle pattern photographs were more or less robust for identification than other feature photographs.

Face, right and left profiles and right and left eye wrinkle pattern photographs taken in mid-2001 were compared to those taken in mid-2005 for the 11 rhinos present in both years by three judges (two rhino researchers and a senior zookeeper unfamiliar with the Port Lympne rhinos) who independently provided a rating of 1 to 3: 1 = where the photographs could be mistaken for different rhinos; 2 = where they were seen to be of a similar rhino but could be of a different one; 3 = where the photographs were clearly of the same rhino.

Identification feature scores were tested using the Kruskal-Wallis non parametric statistical test with further analysis of the effect of age using the Mann-Whitney test (Corder and Foreman 2009).

### *Test of reliability of eye wrinkle patterns*

'Couples' and 'twinning' tests were devised in order to test specifically whether eye wrinkles were a robust identification feature to distinguish individual rhinos from photographs. Ten judges were selected, five postgraduate degree students who had little or no knowledge of rhinos and five rhino keepers from Chester Zoo, UK.

For the couples test, 18 pairs of good quality pho-

Table 1. Summary of average judges scores

| Rhino | Sex | Age '01 | Age '05 | Face | Rt profile | Lft profile | Rt eye | Lft eye | Mean |
|---|---|---|---|---|---|---|---|---|---|
| Rukwa | f | 31 | 35 | n/a | 3.0 | 3.0 | 3.0 | 3.0 | 3.00 |
| Addo | m | 26 | 30 | 3.0 | 2.0 | 2.3 | 3.0 | 3.0 | 2.70 |
| Kingo | m | 18 | 22 | n/a | 2.0 | 2.0 | 3.0 | 3.0 | 2.50 |
| Nakuru | f | 12 | 16 | n/a | n/a | 2.7 | 2.0 | 3.0 | 2.60 |
| Vuyu | f | 10 | 14 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.00 |
| Jaga | f | 9 | 13 | n/a | 2.7 | 2.7 | 3.0 | 3.0 | 2.85 |
| Etna | f | 8 | 12 | 2.3 | 2.7 | 2.3 | 3.0 | 2.3 | 2.52 |
| Baringo | m | 9 | 13 | 3.0 | 2.3 | 2.3 | 3.0 | 3.0 | 2.72 |
| Ruaha | f | 5 | 9 | 2.7 | 2.3 | n/a | 2.3 | 2.7 | 2.50 |
| Magadi | m | 2 | 6 | 1.7 | 1.3 | 1.7 | 2.7 | 3.0 | 2.08 |
| Rufiji | f | 2 | 6 | 2.0 | 2.3 | 2.0 | 3.0 | 2.3 | 2.32 |
| Mean | | | | 2.53 | 2.36 | 2.40 | 2.82 | 2.84 | |

Rating 1 = looks like a different rhino  Rating 2 = looks like the same rhino but could be different

Rating 3 = looks like the same rhino

tographs from the Port Lympne photo-identification database were prepared with one of the pair being of a profile of a rhino where the eye wrinkle pattern was discernible and the other photograph being a close up view of an eye wrinkle pattern. Ten of the pairs were matches of the same individual and eight were incorrectly matched. The pairs of photographs were given separately to the 10 judges who were asked to record if they thought the photographs were of the same individual or if they thought they were different individuals.

For the twinning test, using the set of 10 photographs where the pairs matched, the profile photographs were laid on a table in front of each of 10 judges who were handed separately one of the eye wrinkle photographs and asked to select which one of the 10 photographs was of the same individual. The judges were informed that there was definitely one that corresponded to the one in hand and were allowed to move the 10 photographs in any way they liked.

## Results

Table 1 summarizes the results of the ratings for changes in certain rhino identification features, including eye wrinkles, between 2001 and 2005. Of the individual features analysed, eye wrinkles showed least change (most consistency) and in only 4 out of 22 cases was it deemed likely that a misidentification could take place while the figures were 11 out of 20 for profiles.

Table 2 shows that there is a significant difference

Table 2. Test between identification feature scores shown in Table 1, using the Kruskal-Wallis test

| Feature | Number | Median | Av. rank | z |
|---|---|---|---|---|
| face | 7 | 2.7 | 22.9 | -0.41 |
| profile | 20 | 2.3 | 18.0 | -2.84 |
| eyes | 22 | 3.0 | 32.0 | 3.10 |
| overall | 49 | | 25.0 | |

H = 11.54  DF = 2  P = 0.003  adj for ties

Table 3. Comparisons of identification feature scores between adult and sub-adult black rhinos, using a Mann-Whitney U test

| Profiles | Adults | Sub-adults |
|---|---|---|
| | n. 15 | 5 |
| | W = 183.5 | |
| | P = 0.023 (adj for ties) | |
| Eye wrinkles | | |
| | n. 19 | 6 |
| | W = 276.0 | |
| | P = 0.015 (adj for ties) | |

Table 4. Analysis of errors made in the twinning test

| | ALL | Inexperienced | Experienced |
|---|---|---|---|
| No. Judges | 10 | 5 | 5 |
| Matches | 100 | 50 | 50 |
| Matching errors | 12 | 4 | 8 |

Table 5. Analysis of errors made in couples test

| Error | Total | % | Actual | Inexperienced | | Experienced | |
|---|---|---|---|---|---|---|---|
| Maximum possible | 180 | 24 | 13.3 | 12 | 50% | 12 | 50% |
| Error: false negative | 100 | 10 | 10.0 | 7 | 70% | 3 | 30% |
| Error: false positive | 80 | 14 | 17.5 | 5 | 36% | 9 | 64% |

between the median values with 'eyes' having the highest average rank and 'profile' the lowest. Eye wrinkles are therefore shown to be a more reliable feature for identification over time.

Table 3 shows a further analysis of the results in Table 1 by considering the effect of age with adults obtaining significantly better profile, (left and right profile scores combined), and eye wrinkles scores than those for sub-adults. Face data were limited, there being several missing scores.

### *Twinning and couples test results*

The 10 judges considered that all photographs used for the eye wrinkle test were of good quality and no wrinkle pattern was considered more or less distinct than another and all patterns were unique.

Table 4 shows that the overall error made in the twinning test was 12% with the inexperienced judges making half the number of errors (8%) compared to those with experience (16%) although a test of two proportions showed that the difference was not significant ($Z = 1.24$; $P = 0.215$).

Table 5 shows that overall a similar level of error (13.3% compared to 12%) was made in the couples test as in the twinning test and that inexperienced judges performed similarly to experienced judges. There were less false negative errors (pairs described as different when they were the same), than false positive (pairs described as the same when they were different)- (10/14) - although a test of two proportions showed that the difference was not significant ($P = 0.149$). While inexperienced judges made the same number of errors as experienced judges (12/12), the inexperienced judges made more false negative errors (7/10) and the experienced more false positive (9/14).

Table 6 shows the effect of presenting the results not by experienced/inexperienced judges but by the best five judges compared to worst five judges. The results show that the worst five judges made five times more errors (30 verses 6) than the best five judges in using eye wrinkles for rhino identification so selection of judges is important.

It can be concluded that eye wrinkles are a robust feature to discern individuals from photographs with the best five judges achieving an overall accuracy of 95%+ (6 errors in 280) when comparing a single eye wrinkle picture against a limited database of 10 potentials.

Table 6. Analysis of errors made in both eye wrinkle tests by best and worst judges

| Error | Total | Actual | % | Best 5 Judges | | Worst 5 Judges | |
|---|---|---|---|---|---|---|---|
| Maximum possible | 280 | 36 | 12.9 | 6 | 17% | 30 | 83% |
| Error: couples test | 180 | 24 | 13.3 | 5 | 21% | 19 | 79% |
| Error: twinning test | 100 | 12 | 12.0 | 1 | 8% | 11 | 92% |

## Discussion

Eye wrinkle patterns, fully established by 9 to 12 months of age, were found to be unique between the rhinos and consistent when photographed with the eyes open or closed unlike nose wrinkles which change in appearance depending on the position of the proboscis. The feature was found to be very useful in identifying individuals when sorting through a large number of photographs particularly separating the sub-adults where other features such as horn length and shape are very similar.

The tests showed that judges differed in their ability to identify correctly individuals from eye wrinkle photographs and that ability was not

dependent on the experience of the judge. This suggests that the aptitiude to judge eye wrinkles from photographs is more important than experience with rhinos as was found to be the case when testing the general use of photographs in identifying individual black rhinos (Patton and Jones 2008).

An attempt was made to draw the key lines of the eye wrinkles from one photograph of the rhinos and use the data set to identify an individual from another picture. This was found to be very difficult but when comparing photographs with photographs (not the drawings) it was straightforward. However, in bush conditions, it may not be possible to get so close to the rhinos to get such clear eye wrinkle pattern photographs as was the case at Port Lympne.

One suggestion for the use of eye wrinkle patterns for individual rhino identification would be when a rhino has been killed by poachers, the horns have been taken away and hyena or other carnivores have eaten the ears. The skull is often the last part to be destroyed and eye wrinkle patterns may be discernible. A good time to capture the patterns on photographs would be when a rhino has been anaesthetized for translocation, notching or treatment.

It may be possible to obtain the eye wrinkle patterns of individual rhinos photographed in close up using camera traps. These may be used to assist in determining the structure of a rhino population in dense habitat where visual observation of individuals is difficult or impossible (Polet et al. 1999).

Although the data set was limited to 19 rhinos considered to be widely genetically diverse, eye wrinkle patterns appear to offer a robust feature for identifying individual rhinos from photographs. Should this be an inherited feature, for which there was no evidence from the photographs, it may be a less robust identification feature in enclosed, reserve populations where genetic diversity is more restricted.

## Acknowledgements

The basic research was carried out as part of a more comprehensive investigation into black rhino identification features with the support of the management and staff of Port Lympne Wild Animal Park, Kent, UK.

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# Effective law enforcement in Ghana reduces elephant poaching and illegal ivory trade

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## Abstract

Ghanaians have a long history in ivory, both for export and for carving. From the 1970s to the early 1990s, however, most of Ghana's elephant were killed either by local farmers in retribution for human-elephant conflict or by poachers for the ivory trade. Ghanaian ivory craftsmen used the tusks primarily to make jewellery and figurines over this time. These curios were mostly sold in Accra, the capital, but due to lack of market surveys, very little data are available.

In July 2010 I surveyed the retail outlets selling ivory in Accra and counted only 10 items on display in an art gallery and 85 items brought to me in five of 186 souvenir shops and stalls I visited. The reason there were so few items was that the Ghana Police Service and Wildlife Division of the Forestry Commission had carried out a raid in November 2008 in the main curio market confiscating several hundred kilos of ivory items, fining and imprisoning the dealers. Since then the vendors in Accra have feared to sell ivory.

Elephant poaching declined at the start of the 21st century thanks to improved law enforcement. In 2004 a new system was introduced that involves performance and adaptive management through the monitoring of patrol effort and observations by the field-staff in the Wildlife Division. The combined effect of performance and adaptive management was that the number of effective days spent in the field by an average Wildlife Guard doubled, which dramatically lowered the number of elephants killed illegally. In addition, governance improved, Ghanaians developed greater respect for the law and there was less corruption, which reduced elephant poaching and the sale of ivory objects.

This paper concludes that Ghanaian examples of greater patrol staff performance through improved monitoring—and of successfully raiding outlets selling illegal ivory—are a sound approach to reducing elephant poaching. While improving anti-poaching exercises is more difficult in some African range States, the Ghanaian example of shop raids is easier to implement and has also worked in countries such as Cameroon and Ethiopia. Other countries in Africa, especially Cote d'Ivoire, Democratic Republic of Congo, Nigeria and Senegal, need to follow the example of Ghana in carrying out official raids on ivory in retail outlets.

**Key words:** Ghana, ivory trade, elephants, poaching, law enforcement

## Résumé

Les Ghanéens avaient une longue histoire avec l'ivoire; ils l'exportaient et ils le sculptaient. Entre les années 70 et le début des années 90, cependant, la plupart des éléphants du Ghana ont été tués par les fermiers locaux en rétribution au conflit homme-éléphant ou par des braconniers pour le commerce d'ivoire. Les artisans d'ivoire ghanéens ont principalement utilisé les défenses pour faire des bijoux et des figurines pendant cette période. Ces objets d'art étaient vendus surtout à Accra, la capitale, mais en raison du manque d'études du marché, peu de données sont disponibles.

En juillet 2010 j'ai étudié les débouchés vendant l'ivoire au détail à Accra et j'ai compté seulement 10 articles en vente dans une galerie d'art et 85 articles qui m'ont été apportés dans cinq des 186 magasins et boutiques de souvenirs que j'ai visités. La raison pour laquelle il y avait très peu d'articles était que la police du Ghana et la Division de la Faune de la Commission des Forêts avaient effectué une rafle au mois de novembre 2008 sur le marché principal des objets d'art et avaient confisqué plusieurs centaines de kilos d'articles en ivoire, en faisant payer des amendes

aux revendeurs et en les emprisonnant. Depuis lors les vendeurs à Accra ont peur de vendre l'ivoire.

Le braconnage d'éléphant a diminué au début du 21ème siècle grâce à une amélioration de l'application de la loi. En 2004 on a introduit un nouveau système qui comprend la performance et la gestion adaptative par le suivi des efforts de patrouille et des observations par le personnel de terrain dans la Division de la Faune. L'effet combiné de la performance et de la gestion adaptative a été que le nombre de jours effectifs passés sur terrain par un écogarde moyen a doublé, ce qui a nettement réduit le nombre d'éléphants tués illégalement. En outre, la gouvernance s'est améliorée, les Ghanéens ont développé plus de respect pour la loi et il y a eu moins de corruption, ce qui a réduit le braconnage d'éléphants et la vente des objets en ivoire.

Ce document conclut que les exemples ghanéens d'une meilleure performance du personnel de patrouille grâce à une surveillance améliorée et des rafles réussies contre les détaillants qui vendent l'ivoire illégal sont une approche solide pour réduire le braconnage d'éléphants. Alors qu'il est plus difficile d'améliorer les exercices anti-braconnage dans certains états de l'aire de répartition, l'exemple ghanéen de rafles de police sur les magasins est facile à mettre en œuvre et cette approche a également marché dans les pays tels que le Cameroun et l'Ethiopie. D'autres pays en Afrique, surtout la Côte d'Ivoire, la République Démocratique du Congo, le Nigeria et le Sénégal, doivent suivre l'exemple du Ghana et faire des rafles de police sur les débouchés vendant l'ivoire au détail.

## History of Ghana's ivory trade

Ghanaians, especially the Akan-speaking peoples, have used ivory for over 500 years. The best-known objects made were side-blown horn instruments that were used as part of the regalia of the kings of the Asante. Many of these ivory horns were individually named and had specific roles. Some were adorned with human jaw-bones from enemies of the State (Ross 1992). Today ivory horns are still part of the regalia of the Asantehene's Royal Court and of the lesser courts throughout the south-west part of the country.

From the 1650s onwards, when Europeans introduced firearms to the coastal people, Ghanaians used them to hunt elephants in the forest. In the

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Figure 1. These thin 2.5-cm bone carvings were selling for USD 10 for the pair in a smart Accra beach hotel.

northern savannahs, beyond the influence of European-made goods, hunters used traditional bows and arrows to kill elephants until the 19th century (Kwarteng 2008). The historian K.Y. Daaku believes that few tusks were exported from 1600 to 1720 (Ross 1992).

By the 19th century ivory exports had increased considerably due to European demand and modernized firearms. From 1879 to 1886, 30,720 kg of tusks (a yearly average of 4389 kg) were exported, 87% to UK, 11% to Germany and 2% elsewhere. Between 1920 and 1932, exports halved to an average of 2218 kg per year, probably because the elephant habitat was being destroyed for export crops and because former hunters were becoming farmers (Kwarteng 2008).

According to Kwarteng (2008), legal exports of tusks from Ghana ended in the mid-1930s. CITES figures, however, show there were some legal exports of ivory from 1979 to 1987, but only 75 kg plus 128 tusks (Parker 1989). During this period there also would have been some illegal trade from poached elephants, but this cannot be quantified.

Before 1979 there were no reliable data on the number of elephants in the country, so information on ivory trade cannot be extrapolated from elephant numbers. Most researchers believe there was a significant decline in the elephant population from the 1950s to the 1990s due to human population increase, which led to growing human-elephant conflict and elephant deaths. There was also serious commercial elephant poaching for the tusks and meat (Government of Ghana 1991; Barnes et al. 1995; Okoumassou et al. 1998; Sam et al. 1998; Barnes et al. 1999; Boafo et al. 2004; Bouche 2007; Jachmann 2008a; Kwarteng 2008).

## Methodology

I carried out fieldwork in and around Accra from 11 to 17 July 2010. I visited the main markets, hotels, shopping malls, art galleries and souvenir shops in order to find out whether ivory was available for retail sale. I interviewed shopkeepers, especially in the largest craft market in Accra called the Arts Centre, and I talked to the Chairman of the Greater Art and Craft Dealers Association of the Arts Centre. I spoke to members of the Wildlife Division, Ghana Wildlife Society, the Ghana Police Service—including Interpol—and the Customs Excise and Preventive Service. I visited the Forestry Commission library to research unpublished reports and learn about Ghana's ivory legislation. I went to the National Museum to see old ivory items carved in Ghana, and visited several biologists studying Ghana's elephants and wildlife conservationists.

## Legislation

Ghana's legislation regarding elephants and the trade in their products dates back to 1901 when a minimum weight per tusk for domestic sale and export was introduced. The 1923 the Wild Animals Preservation Ordinance increased the weight to a minimum of 25 pounds (11 kg) per tusk in order to reduce the killing of immature cows and calves. The 1961 Wild Animals Preservation Act prohibited the killing of young elephants and all females with young; this Act also permitted the government to confiscate all elephant tusks weighing less than 25 pounds. By 1971, under the Wildlife Conservation Regulations, all hunting, capturing and destroying of elephants was prohibited and a 'game trophy export permit' was required to export tusks. In 1983 the Wildlife Conservation (Amendment) Regulations made it an offence to acquire or be in possession of any ivory unless authorized in writing by the Chief Game and Wildlife Officer. In 1988 under the Wildlife Conservation (Amendment) Regulations, persons owning ivory would have to pay a fee of Ghanaian cedis (GHS)100 for jewellery, GHS 400 for worked ivory and GHS 400 for each piece of raw ivory. An export fee of 59% of the value of the ivory was also introduced that year (Republic of Ghana 2002; Kwarteng 2008).

The first tusk registered under the 1983 regulations was on 14 February 1984 when an architect registered two polished tusks weighing a total of 19.4 kg (Cletus Nateg, Operations Manager, Protected Areas, Forestry Commission—Wildlife Division pers. comm.). According to the hand-written records in the 'Registration of Ivory (Elephant Tusks)' book, which is kept in the Wildlife Division, from 1984 to 1987, 1580 kg of ivory were registered plus some items that did not have weights; these exclude government stocks. In 1997 the Wildlife Division registered another 8.45 kg of ivory followed by 36.2 kg in 2000, mostly ivory from chiefs' regalia. Thus from February 1984 to June 2010 officials had registered at least 1625 kg of ivory belonging to 110 individuals. No doubt there is more ivory owned in Ghana that has not been registered.

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Figure 2. Crude cow bone animal figurines were for sale in several souvenir shops and stalls in Accra. They were newly carved in Ghana.

No licences for the sale of ivory items have been given for many years; officials will not give them out. Thus all ivory, including antiques, for sale in Ghana is illegal (Nana Kofi Adu-Nsiah, Executive Director, Forestry Commission—Wildlife Division, pers. comm.). Ghana joined CITES in 1976, which since 1990 has prohibited Ghana (as for most member states) from importing and exporting commercial ivory, except antiques and hunting trophies, although there has not been elephant sport hunting in Ghana for decades.

All undated interviews referred to in this manuscript were carried out during fieldwork in July 2010.

## Results

### *The killing of elephants since the late 20th century*

According to IUCN there were 789 'definite' elephants in Ghana in 2006 with perhaps another

387 classified as 'probables'. The largest number was in Mole (401) and Digya (357) National Parks (Blanc et al. 2007). Previous estimates by Douglas-Hamilton of 3500 elephants in 1979 and by Burrill and Douglas-Hamilton of 2964 elephants in 1987 (Cobb 1989) indicate that there were many more elephants in the country in the 1970s and 1980s than in 2006. Others studying elephants in Ghana agree that their numbers declined steeply in the late 20th century (Jachmann 2008a; Kwarteng 2008). The Environmental Investigation Agency (1994) stated that the country's elephant population declined by some two-thirds in the 1980s because of a flourishing commerce in ivory with traders from Cote d'Ivoire providing arms and ammunition to the poachers in Ghana.

The decline in elephant numbers over the past forty years was due mostly to farmers and government control officers killing crop-raiding elephants and also to commercial poaching for the ivory and meat carried out by Ghanaians and occasionally by poachers from neighbouring countries. With the rapid expansion of cocoa plantations, forests were cut down and the elephant range in the forests was further reduced. Human population growth spread into elephant areas and human-elephant conflict increased; farmers retaliated against crop raiding by killing elephants. Government game scouts sometimes went further and followed elephants deep into the forests to kill them. Some of the ivory entered the illegal trade. Human-elephant conflict increased in the 1980s and early 1990s in the forest belt because game scouts often did not respond quickly enough to the farmers' requests for assistance and thus the farmers took increasing action themselves by killing elephants on their land and in the adjacent forest (Kwarteng 2008).

Commercial poaching for tusks from the 1970s to the early 1990s was particularly serious, especially for export. Cote d'Ivoire was a major market for ivory trade in West Africa (Dublin et al. 1995) and some of Ghana's tusks reached Abidjan, either for carving or for re-export. In northern Ghana, ivory smugglers could easily walk across the border into Cote d'Ivoire, and those poachers who were provided with guns from traders in Cote d'Ivoire often would have sent their tusks across the border back to these traders. There was also demand for ivory from local craftsmen to make jewellery and animal figurines to sell mainly to Europeans and Americans in Ghana. In the early 1980s there were around eight ivory craftsmen in the Accra Arts Centre, where most carvers were based, mostly Ghanaians (Abu Adamu, Chairman of the Greater Art and Craft Dealers Association, Arts Centre, pers. comm.).

During this period the Department of Game and Wildlife (as it was then named) had an acute shortage of trained field personnel, vehicles and other equipment to fight illegal hunters. For example, in 1991, of the 127 approved and established senior posts in the Department only 40 were filled and these posts commanded a salary of only USD 600-1000 per year. In 1988 the Department possessed only two working pick-up trucks, two tractors, and 27 vehicles in disrepair that had been allocated for the 1,200,000 hectares of protected area under the Department's control. In 1989 the recurrent budget of the Department was USD 615,000 for the 650 staff (including casuals), 92% of which was used to pay salaries and other benefits to the staff (Government of Ghana 1991). Therefore there was extremely little funding for anti-poaching work and poaching consequently flourished.

By the early years of the 21st century elephant poaching in the main areas of their range (Mole, Kakum, Digya and Bia National Parks) appeared to have declined in Ghana. For example, in Mole National Park in the north-west, which has the largest elephant population in the country, poachers worked at night using torch lights or during the day when the Wildlife Division staff were not present. They used mostly single-barrel shotguns because ammunition for these was easy to obtain, but they occasionally had rifles as well. Most elephant and other wild animal

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Figure 3. These ivory male lions were probably carved in Cote d'Ivoire and were brought to the Arts Centre to sell clandestinely.

poachers were, and still are, Ghanaian farmers from surrounding villages who consider wildlife a free public resource from which they can make quick money (Government of Ghana 2005). The Mole elephants are most in danger when they leave the Park during the wet season and move south-west into poorly guarded forest reserves. Poachers inform one another by mobile phones when they see elephants in these areas. Some experts believe that more elephants are being killed outside than inside the Park (Hugo Jachmann, biologist, pers. comm.). Officials from the Wildlife Division believe, however, that only four elephants were poached in the entire country in 2009, mostly in Mole and Kakum National Parks (Adu-Nsiah pers. comm.).

One known incident in Kakum National Park occurred when officials interrupted three poachers in 2003 after they had shot two elephants with a .458 rifle. The poachers had to flee before they could remove the tusks. One was arrested on the road looking for transport. In his bag he carried the rifle and some elephant meat. He was taken to court and found guilty of four charges. He never went to prison but received a small fine and his rifle was confiscated (Nateg pers. comm.).

The poaching of large mammals declined in 2004 with the introduction of a system that checked the Wildlife Division's patrolling effort and their monitoring work. The system keeps a record of the number of staff on patrol, the exact duration of each patrol, the area travelled, the types, qualities and locations of illegal activity and the number of large mammals encountered by species and location. Halfway through 2009, all 13 terrestrial protected areas (not including coastal wetlands) under the control of the Wildlife Division had this improved system operating (Jachmann 2010). This project was supported by the SNV-Netherlands Development Organization and supervised by Hugo Jachmann, who has had many years of wildlife experience in Africa. The results in staff performance have been impressive. From 2005 to the end of 2007 patrolling performance in those areas with the new system increased from about eight effective days per staff member per month to 16 days. In Digya National Park staff patrol time was consistently high at 13 to18 days each in the month; however, in Mole National Park, where guards were few and funding was the lowest per km$^2$ of the areas with the new system, patrol days increased from six to eight per month for each guard. By the end of 2009, however, Mole staff numbers not only increased significantly, but effective patrol time was the highest for the country at 20 days per staff member per month on average (Jachmann pers. comm. October 2010). Overall, the new system has resulted in the decline in poaching of large mammals, including elephants. For instance, for all of the protected savannah areas, for the first five years of this programme, poaching incidents decreased an average of 22% a year. For the three protected forest areas, the decline was slightly less, 20% on average per year, because of poor visibility in forests compared with savannahs. This dramatic decrease in poaching was due to the improvement in the management of the Wildlife Guards' activities, which reduced commercial poaching for elephants considerably (Jachmann 2008a; 2008b; 2010).

## *Retail outlets selling ivory in Accra*

In July 2010 I visited 186 curio shops and stalls distributed all over Accra, which sell mostly locally crafted wooden items, stone jewellery and clothing. The only retail outlet that displayed ivory for sale—only 10 items—was one of two art galleries. This shop sold mainly Ghanaian paintings, pottery, wooden and stone sculptures, as well as traditional second-hand clothing. Inside a glass case on the ground floor were nine rather old plain bangles that were 1.5 cm wide selling for GHS 30 (USD 21) each. A Ghanaian from the northern part of the country collected these bangles to sell in the art gallery. There was one other ivory item for sale, a plain, traditional 35-cm side-blown horn hanging on the wall for GHS 600 (USD 429) which, according to the salesperson, was made in northern Ghana several decades ago. Also for sale in the art gallery were two old skirts with leopard skin pieces attached to them made in northern Ghana for GHS 1200 (USD 857) each. There were also six Ghanaian recently painted ostrich eggs, probably from ranched ostriches for GHS 200 (USD 143) each.

Although I saw no ivory displayed for sale anywhere else, vendors in five other outlets in the curio market within the Arts Centre, brought to me 85 ivory items when I asked for them. This huge market is composed of 175 shops and stalls selling handicrafts, mainly souvenirs to tourists, along with 303 clothing and fabric shops and a section with

workshops making furniture, drums, masks and other items mostly from wood. The Arts Centre has been in its present location near the sea in central Accra since 1982, at which time there were only 33 shops (Adamu pers.comm.).

Almost immediately after I enquired about ivory at the Arts Centre, the shopkeepers, within three to twenty minutes, brought ivory curios to show me. Some were hidden within the market while others came from nearby residents. Most were wrapped in brown paper to hide them. All the ivory items I was shown in the Arts Centre were recently carved. Nobody claimed they were antique. The vendor at the first shop showed me four ivory animal figurines, but he was reluctant to give prices. He said they were carved in northern Ghana. The second vendor offered three animal figurines: a 13-cm leopard from Cote d'Ivoire for GHS 1200 (USD 857), a 13-cm elephant for GHS 1500 (USD 1072) and a 6-cm hippo for GHS 400 (USD 286). The third shopkeeper brought five arm bangles for GHS 120–180 (USD 86–129) each, two beaded necklaces for GHS 800 (USD 571) and a 9-cm elephant for GHS 1500 (USD 1071). The vendor claimed they were from neighbouring countries. At the fourth outlet the vendor brought for me 51 pendants including 2.5-cm miniature tusks, hearts and elephants priced at GHS 30 (USD 21) each. He also showed me two beaded necklaces for GHS 150 (USD 107) each and one 9-cm hippo for GHS 1000 (USD 714). The fifth and final vendor offered me four animal figurines from 13–17 cm for GHS 1200 (USD 857) each, supposedly from Cote d'Ivoire. With bargaining it is possible to get reductions, such as at the last stall where the vendor offered me a 9% discount.

Prices for these animal carvings are very high compared with similar objects found in other countries in West and Central Africa. One possible reason is that the shopkeepers in the Arts Centre may not have owned the items themselves and were adding on a commission. Furthermore, the vendors are not familiar with prices elsewhere and due to their uncommonness the prices are higher than in other markets.

There were hundreds of ivory items available for sale in Accra before 2008, almost all on display in the Arts Centre, according to the Wildlife Division and to conservationists. The main explanation for why so few ivory objects were seen on display in Accra in 2010 (10 items) and from hidden sources (85 items) was that the vendors fear they may be arrested and their items confiscated. Before 2008 there had been no raids

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Figure 4 & 5. Central Accra is a main shopping area for Ghanaians and is lively and colourful; there were no shops with ivory in this part of the city.

or seizures of ivory items in the shops. In late 2008 officials collected information on where the largest numbers of ivory items were for sale; they correctly singled out the Arts Centre. On 15 November 2008 at about 0630 h as the shops were opening, members of the Ghana Police and Wildlife Division surrounded the Arts Centre. They then raided 11 shops, 10 of which had ivory. They confiscated several hundred kilos of ivory curios and seized crocodile skin bags. The shop owners and their assistants were arrested immediately for dealing in endangered wildlife products without a licence, and put into prison for one night until bail money was paid (Asare 2008). Most of the arrested shopkeepers were from northern Ghana and the items seized were mainly ivory animal figurines and jewellery that had been crafted in Cote d'Ivoire, Ghana, Nigeria

and Gabon (Adamu 2009). This case was still pending in the courts in July 2010.

Every vendor I spoke to in the Arts Centre knew that it was illegal to sell ivory without a licence and that they would have no chance getting a licence as officials do not want an ivory trade. When the vendors returned to their shops with items to sell to me, they hid them in bags and showed them clandestinely at the back of their shops away from the tourists. Most became suspicious of me, especially when I asked questions and did not buy anything, and a few started to think I was a spy from an international conservation organization coming to help the authorities to get them arrested.

Despite their reluctance to talk, the dealers in the Arts Centre admitted that the main buyers of ivory items were Chinese, Americans (who especially like necklaces) and Europeans, in that order. The dealers also said that there were no ivory craftsmen still active in the country. Some of the vendors still deal illegally in a few crocodile skin handbags and drums with antelope skins. Business for curios in general does not appear to be thriving because there are nowadays too many retail outlets relative to the number of tourists, and aggressive touts harass the tourists, putting them off from buying items (Adamu pers. comm.).

## *New government efforts to close down Ghana's ivory trade*

Since the raid of November 2008 the Wildlife Division and the Police have not considered it necessary to carry out another raid in the Arts Centre nor elsewhere in Accra for illegal ivory because there has not been enough evidence of ivory sales, nor sales of other wildlife products. The Police, including Interpol, are active in Ghana and concentrate on higher priorities that include drugs trade, human trafficking, fraud and fugitives. The Police believe, however, that to improve wildlife product law enforcement, a workshop should be organized with officers from the Wildlife Division, Police, Immigration, Customs and Forest Department to learn from experts about endangered wildlife products (DSP Peter Abillah, CID Headquarters in Accra, pers. comm.).

The Ghana Customs and Preventive Service says that in the past larger quantities of ivory curios were illegally imported into Ghana from Cote d'Ivoire to sell to tourists, but this trade has now declined. Customs is not aware of ivory, either raw or worked, being smuggled in or out of Ghana's airports. There

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Figure 6. Such ivory musical instruments on display in the National Museum are called side-blown horns. Similar ones are still played during traditional ceremonies in Ghana.

are four sniffer dogs at the airports, but these are only used to find drugs, not ivory as in Kenya. Customs officials are aware, however, of bush meat, perhaps some from elephants, which is illegally exported in dried form to Europe.

All the government officials and other conservationists in Ghana I spoke to brought up the growing threat of the Chinese trading in ivory, both raw and worked. For example, several years ago, the Chinese obtained contracts to construct several sports stadiums in Ghana. While one was being built at Tamale, a town approximately 100 km east of Mole National Park, a Ghanaian middleman was arrested with tusks; he apparently planned to sell them to the construction company (Nateg, pers. comm.). It is believed that the Chinese from this construction site sent word that they would buy elephant and warthog tusks (Jacob Awere, Executive Director, Ghana Wildlife Society, pers. comm. and Jachmann pers. comm.); they apparently also requested hippo tusks (John Mason, wildlife expert in Ghana, pers. comm. October 2010).

## *Substitutes for elephant ivory*

The main substitute for elephant ivory carvings in Ghana is cow bone and very occasionally camel bone. Most of the cow bone curios are small, newly carved pairs of animals, such as giraffes or elephants, and sometimes humans. In mid-2010 they were on display for sale in the Arts Centre, one hotel curio shop, an art gallery, and a souvenir shop. All were crudely carved and inexpensive compared with ivory. For instance, a pair of human figurines, 10-cm tall, was offered for sale for only GHS 15 (USD 11), a necklace for GHS 20 (USD 14) and pair of 10-cm giraffes for GHS 21 (UDS 15). The main buyers of ivory substitutes, as is the case in many countries, are European and American tourists.

Vendors named the substitute materials correctly, except on two occasions. In the hotel curio shop an inexperienced vendor said, probably through ignorance, that her bone necklaces were made of ivory although the prices were very low; and one vendor in the Arts Centre claimed his crude bone carvings, stuck on pieces of wood, were ivory and was trying to charge ivory prices!

## Discussion and conclusion

Compared with other West African countries, especially Cote d'Ivoire, Nigeria and Senegal, the trade in ivory in Ghana is small (Courouble et al. 2003). Probably no ivory craftsmen are practising the profession in Ghana nowadays, and few ivory items from neighbouring countries are smuggled into the country for sale as demand is low. The export trade of raw and worked ivory is also insignificant due to improved law enforcement in Ghana, and elephant poaching in the country has also been reduced.

The main reason for the scarcity of ivory objects seen in Accra's retail outlets is that the raid on the shops in the Arts Centre in November 2008, the first and only recent such action taken in Ghana, acted as a major deterrent for this illegal activity. Since the mid-1990s, with the successful implementation of multi-party elections, a freer press and less corruption, governance in Ghana has greatly improved (Briggs 2009). Thus the vendors of ivory objects fear the authorities and consequently do not want to sell ivory items. Those vendors who tried to sell me a few ivory items in mid-2010 knew ivory sales were illegal and were nervous, saying they did not want to be arrested and put in prison, as had happened in 2008.

In 1999 shopkeepers in Douala and Yaounde in Cameroon were offering on display for sale 6015 ivory items (Martin and Stiles 2000). Several crack-downs by the government, with the help of the Last Great Ape Organization, have resulted in no ivory items seen openly for sale in the former ivory outlets (such as the Central Arts Market and in the luxury hotels) in mid-2010 (Dan Stiles, ivory trade consultant, pers. comm. August 2010). Similarly, two shop raids by government staff occurred in Ethiopia in 2005 and in 2009, following under-cover work by TRAFFIC. From 3557 ivory items on display in the souvenir shops in Addis Ababa in 2004, numbers fell to 78 after the first raid, but crept up again to 1340 by July 2009, which urged the government to carry out the second raid (Milledge and Abdi 2005, Martin and Vigne 2010). Officials in Ghana also need to ensure that the ivory items do not return to the shelves and if so, action would be needed again. At the moment no such raid is needed in Ghana due to the scarcity of ivory objects.

Shop raids in Africa by government authorities for ivory are one-off activities and much easier to manage, as well as being a fraction of the cost, compared with running anti-poaching units to protect elephants. They are highly effective in reducing demand for ivory in the shops, which helps to reduce elephant poaching. Raids are relatively simple to implement as ivory items are displayed openly for sale and are concentrated in the souvenir shops that officials can easily locate and visit. Such a law enforcement exercise is urgently needed for many countries in West and Central Africa.

Ghana has also successfully reduced elephant poaching because of improved governance in the country and a new anti-poaching system that was introduced in 2004. The new system, a combination of performance and adaptive management, which among other activities monitors the patrolling effort of the Wildlife Guards in protected areas, has doubled patrolling time; this has certainly helped elephants and other large animals. The system is operational in all Ghana's protected areas (under the Wildlife Division), while numbers of guards have doubled in Mole National Park (Jachmann pers. comm. October 2010). More patrol work would also help to stop elephants from wandering out of the Park into regions where they are more threatened. Ghana's new system of patrol monitoring would be wise to implement in other countries in West and Central Africa that have reasonable governance in order to reduce the poaching of elephants and other large mammals.

Overall, Ghana has demonstrated that with improved strategies for law enforcement, including shop raids on ivory (which has almost eliminated ivory items on display in retail outlets) and monitoring the work of patrol staff in protected areas (which has increased their productivity), elephant populations can be better secured. These initiatives need to be emulated in other elephant range States, where there is appropriate governance, to improve the security of elephants.

## Acknowledgements

I am grateful to the various people I interviewed during my visit to Ghana. Special thanks goes to Hugo Jachmann, John Mason and Lucy Vigne for their work and constructive comments on the manuscript.

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# The seasonal distribution of savannah elephants (*Loxodonta africana africana*) in Nazinga Game Ranch, southern Burkina Faso

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## Abstract

Elephant wet and dry season distributions were compared at Nazinga Game Ranch in southern Burkina Faso. Dropping counts along line transects provided an index of occupancy at the end of each season: wet 2006, dry 2007 and dry 2008. We expected that the distribution of elephants would differ between the dry and the wet seasons, with elephants concentrating around water sources in the dry season and spreading out across the landscape during the wet season. Elephants were found to be clumped in both wet and dry seasons, although the degree of aggregation was much greater in the dry seasons, especially in the drier year of 2008. Human populations have increased dramatically around Nazinga in the last 15 years, and we speculate that the increasing abundance of crops outside in the wet season may influence the distribution of elephants inside the ranch area.

**Key words:** Nazinga, Burkina Faso, elephants, distribution, wet season, dry season

## Résumé

Les distributions d'éléphants des saisons pluvieuse et sèche, ont été comparées au Ranch de Gibier de Nazinga. L'indice d'occupation des éléphants dans le ranch à été estimé au moyen des mesures de déjections le long des transects, en fin de saison pluvieuse 2006 et en fin de saisons sèches 2007 et 2008. Les attentes étaient que la distribution des éléphants en saison sèche soit différente de celle de la saison pluvieuse; avec un regroupement des éléphants autour des points d'eau en saison sèche, puis leur dispersion dans les paysages de toute l'aire du ranch pendant la saison pluvieuse. Il a été observé que les éléphants étaient regroupés aussi bien en saison sèche qu'en saison pluvieuse; même si le degré d'agrégation était plus important en saison sèche particulièrement en 2008 qui était l'année la plus sèche. La densité des populations humaines a augmentée considérablement autour de Nazinga, pendant les 15 dernières années; nous soupçonnons que la disponibilité des cultures hors du ranch pendant la saison pluvieuse, pourrait influencer la distribution des éléphants à l'intérieur du ranch.

## Introduction

The African elephant (*Loxodonta africana*) is a water dependent species. In arid habitats the elephants tend to aggregate near permanent water holes during the dry season when water is scarce; while during the wet season, they disperse (Jachmann 1988; 1992; Barnes et al. 2006; Kioko et al. 2006; Canney et al. 2007; Leggett 2009). Therefore, we expected that elephant distributions at Nazinga would differ between seasons, with a clumped distribution in the dry season and a random (Poisson) distribution in the wet season. The objective of this paper is to describe and compare the elephants' seasonal use of the landscape in the Nazinga Game Ranch during the wet and dry seasons.

## Study area

The Nazinga Game Ranch lies in southern Burkina Faso between 11°1' and 11°18' N and between 1°18'and 1°43' W. It covers an area of about 98,100 ha. A portion of its southern boundary runs along the international border between Burkina Faso and Ghana (Fig. 1). The area is relatively flat with a mean altitude of 300 m (Spinage 1984), and is traversed by the valley of the Sissili River and two of its tributaries, the Dawevélé and the Nazinga Rivers, which flow seasonally. Soils in the ranch are primarily lithosols on ironstone pavements and reworked tropical ferruginous soil above sandy clay material at depth (Brown 1987).

Nazinga lies in the soudanian zone (Founier 1991), and in the East Black Volta phytogeographic district of the southern soudanian sector (Guinko 1984) where climate is characterized by a dry season running from October to May and a rainy season from June to September. The mean annual rainfall is about 900 mm. Figure 2 shows the total wet season rainfall (June to September) for each year. The vegetation consists of tall grass tree/shrub savannah, showing mainly riverine forest, savannah woodlands and shrub savannah (Guinko 1985).

The Nazinga Game Ranch is a protected area and harbours one of the most important savannah elephant populations in West Africa (Blanc et al. 2007). The most recent estimate of the elephant population by means of direct foot count along line transects was 2173 (95% confidence interval: 882, 5355) (Hema et al. 2009). The main management activities in the ranch include game hunting inside the ranch, game viewing, education and community-based activities, law enforcement, habitat management and research. There are 10 villages in the immediate limits of the ranch. With fewer than 10 inhabitants per km$^2$ the Nazinga Ranch and its surrounding areas have one of the lowest human densities of the country. However, since the Sahelian drought in the 1970s, the area has been subject to increased immigration from northern populations, representing 76% of the national total internal migration (Ouedraogo 1997; Kessler and Geerling 1994). The 2006 census data, which is available at the local level (prefecture of Bieha and Sia health centre), estimated the human population of the 10 villages at 8148 inhabitants. The main activity of the communities is agriculture with the most important food crops being maize, sorghum, millet, yams, groundnuts, cotton and beans.

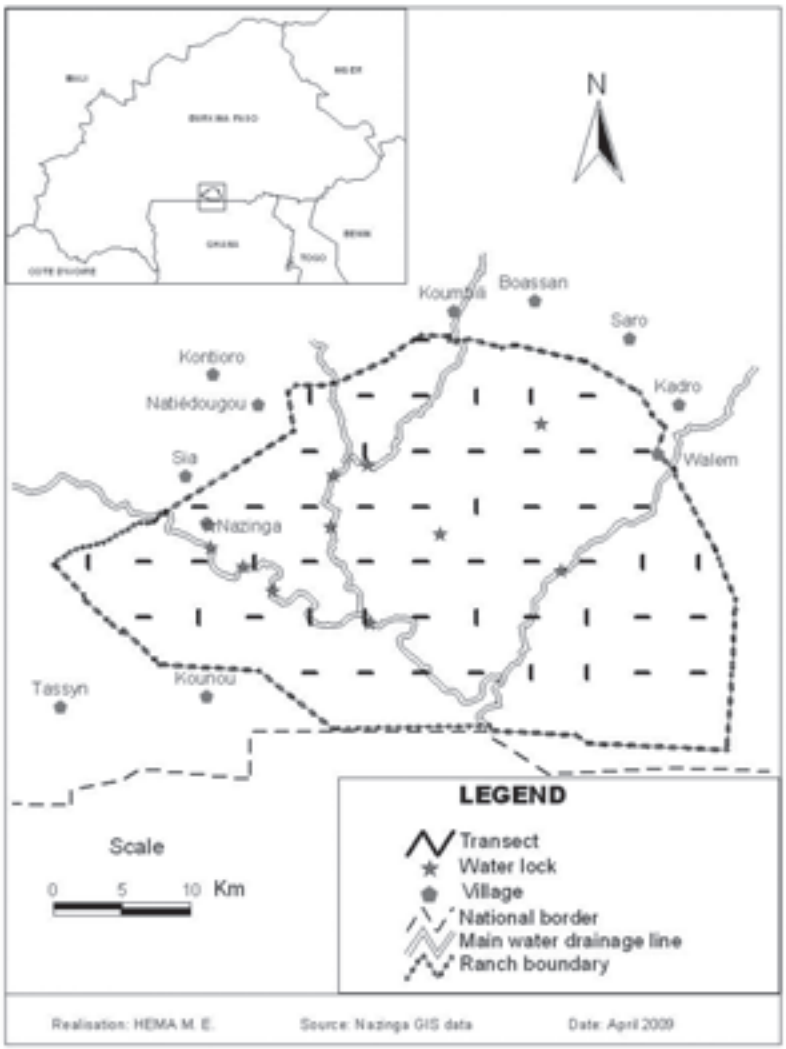


Figure 1. Location of Nazinga Game Ranch in Burkina Faso (inset) and map of the ranch showing the distribution of transects.

## Methods

### Map and Field

We used a Geographic Information System (ArcView 3.2) to prepare all maps. Rainfall data were collected at the meteorological station of Pô, about 15 km from the ranch. Human population data for 2006 were collected at the prefecture of Bieha for the villages of Boala, Tassyan and Kounou, and at the Sia health centre for the others. All the population data prior to 2006 were collected at the Institut National de la Statistique et de la Démographie library in Ouagadougou.

### Mammal droppings survey

A survey of mammal droppings and woody vegetation was conducted at the ranch between 2006 and 2008. We used a systematic transect design with a random start (Buckland et al. 2001). A grid with sides measuring 2 km was placed over the study area; then from a random start, 54 transects were laid at 4–km intervals; such that they ran through the centre of each selected cell (i.e. every other cell). Each transect was 1 km long and oriented north-south or east-west in order to cut across the drainage lines (Fig. 1).

On each transect three mammal dropping counts were conducted. The first was carried out between 1 November and 12 December 2006, corresponding to the start of the dry season. The distribution of dung-piles was therefore a measure of elephants' use of space during the last few weeks of the wet season. The second was executed between 1 April and 6 May 2007, corresponding to the end of dry season. The third was conducted between 5 April and 3 May 2008, also at the end of the dry season.

The line transect survey method (Buckland et al. 1993; 2001) was used to estimate dungpile abundance (Barnes 1993; Barnes and Jensen 1987; Buckland et al. 1993). The survey team consisted of three members: the compass reader, a scribe and a research assistant. All team members searched for dung, but the scribe and the research assistant were the principal observers. The survey team walked in a straight line on a pre-determined compass bearing. The observers walked slowly, scanning the ground on either side. Each time a pile of droppings was observed, the following parameters were noted: distance along the transect, stage of decomposition and perpendicular distance from the transect centre-line.

### Analysis

The mean density of elephant dung for a transect ($E_j$) was estimated from the equation (Burnham et al. 1980):

$$E_j = \frac{n_j.f(0)}{2.L_j}$$

where $n_j$ was the number of dung-piles recorded on the jth transect, $L_j$ was the length of that transect; and f(0) was the reciprocal of half the effective strip width for survey, calculated using DISTANCE 4.1.2 (Thomas et al. 2003). The hazard-rate key adjusted cosine fitted best the data for 2006, and the half-normal key adjusted cosine fitted best the data for 2007 and 2008.

We estimated the mean elephant dung density for each transect and used ArcView 3.2 to map the elephant distribution for each season. An elephant concentration area was defined as a place where the elephant dung density was greater than the mean density for the ranch.

Within each season we assumed visibility and therefore the effective strip-width was constant across the study area. Therefore we assumed the number of droppings seen in each transect is a measure of elephant occupancy. The frequency distributions of dung-piles between seasons were

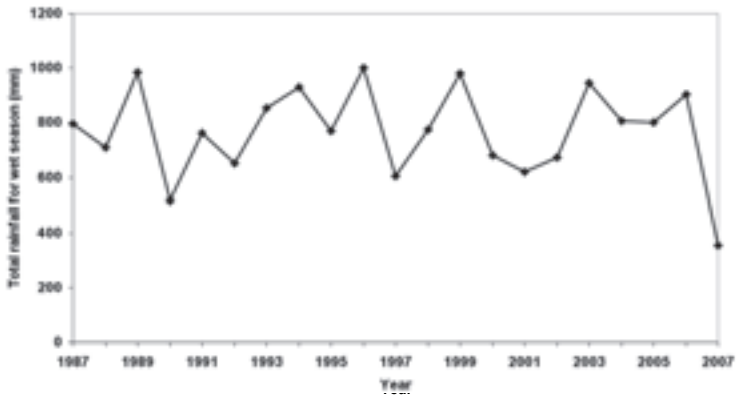


Figure 2. Total wet season rainfall (June to September) for each year since 1987. The low rainfall of the 2007 wet season preceded the 2008 dry season.

Table 1: Measures of dispersion of elephant dung-piles during the three seasons.

| Year | 2006 | 2007 | 2008 |
|---|---|---|---|
| Month | Nov–Dec | April- May | April- May |
| Season | Wet | Dry | Dry |
| Rainfall in preceding 3 months (mm) | 568.5 | 0 | 5.4 |
| Median number of dung-piles on transect | 5 | 31.5 | 52 |
| Variance:mean ratio | 12.33 | 49.66 | 131.40 |
| Standardized Morisita's index, $I_p$ | 0.512 | 0.509 | 0.517 |
| Number of transects | 54 | 54 | 54 |

compared by the Kolmogorov-Smirnov two-sample test (Sokal and Rohlf 1981).

The standardized Morisita's index of dispersion ($I_p$) was used as a measure of the spatial pattern. $I_p$ ranges from -1.0 to +1.0. Random patterns (Poisson distribution) give an $I_p$ of zero; while uniform patterns have $I_p$ below zero and clumped patterns an $I_p$ above zero. Values of $I_p$ below -0.5 or above +0.5 are significantly different from a random pattern (Krebs 1989)

## Results

At the end of wet season 2006 elephants concentrated towards the west, the south-west, and the east (Fig. 3a). At the end of dry season 2007 they aggregated mostly in the west with one isolated concentration area in east-central (Fig. 3b). At the end of dry season 2008 they were most evenly aggregated along a line from west to north-east (Fig. 3c).

The standardized Morisita's index of dispersion was greater than 0.5 in all three surveys (Table 1), showing that elephants were clumped significantly in both wet and dry seasons. However, the frequency histograms show large differences between seasons in the way elephants were distributed (Fig. 4). For example, the variance:mean ratios show that the dry season distributions were more clumped than the wet season (Table 1). The distribution of dung-piles in the wet season differed from that in the 2007 dry season (Kolmogorov-Smirnov two-sample test: $D = 0.59, n_1 = 454, n_2 = 2583, P<0.001$) and from that in the 2008 dry season ($D_{max} = 0.65, n_1 = 454, n_2 = 3819, P<0.001$).

There was no difference in dung-pile distribution between the two dry seasons ($D_{max} = 0.02,\ n_1 = 2579, n_2 = 3819$, NS).

For those villages with data for both 1975 and 2006, the human population increased from 940 to 4,665 (Table 2). This is a mean rate of 5.3% per annum.

## Discussion

The wet and dry season dung samples are not strictly comparable. The wet season samples represent the distribution of elephants during the preceding three or four weeks, depending upon the intensity of rainfall, while the dry season samples represent the accumulated occupancy for the preceding months when decay was negligible. The distribution of dung-piles between transects within each season concerns us here.

A random or Poisson distribution would give a variance:mean ratio of unity, and an $I_p$ value of zero. Both measures indicated that elephants were aggregated or clumped in all seasons. The variance:mean ratio, as well as the median numbers of dung-piles, showed that the dry season 2008 sample was more clumped than the dry season 2007 sample which was in turn more clumped than the wet season sample. However, $I_p$ did not show this ordering: it indicated that the degree of clumping of the wet season sample was between the two dry seasons. Different indices vary in the way they measure clumping (Krebs 1989). Another measure is the negative binomial, but we could not use it here because it works best when the populations of dung-piles are of similar size (Krebs 1989).

We expected elephants to be clumped during the dry seasons because they congregate near permanent water. This expectation was confirmed. However, dung-piles appeared to be more clumped in 2008 than in 2007, although the difference was not significant. For example, a very large concentration of dung-piles in one transect was recorded only in 2008 (Fig. 4c).

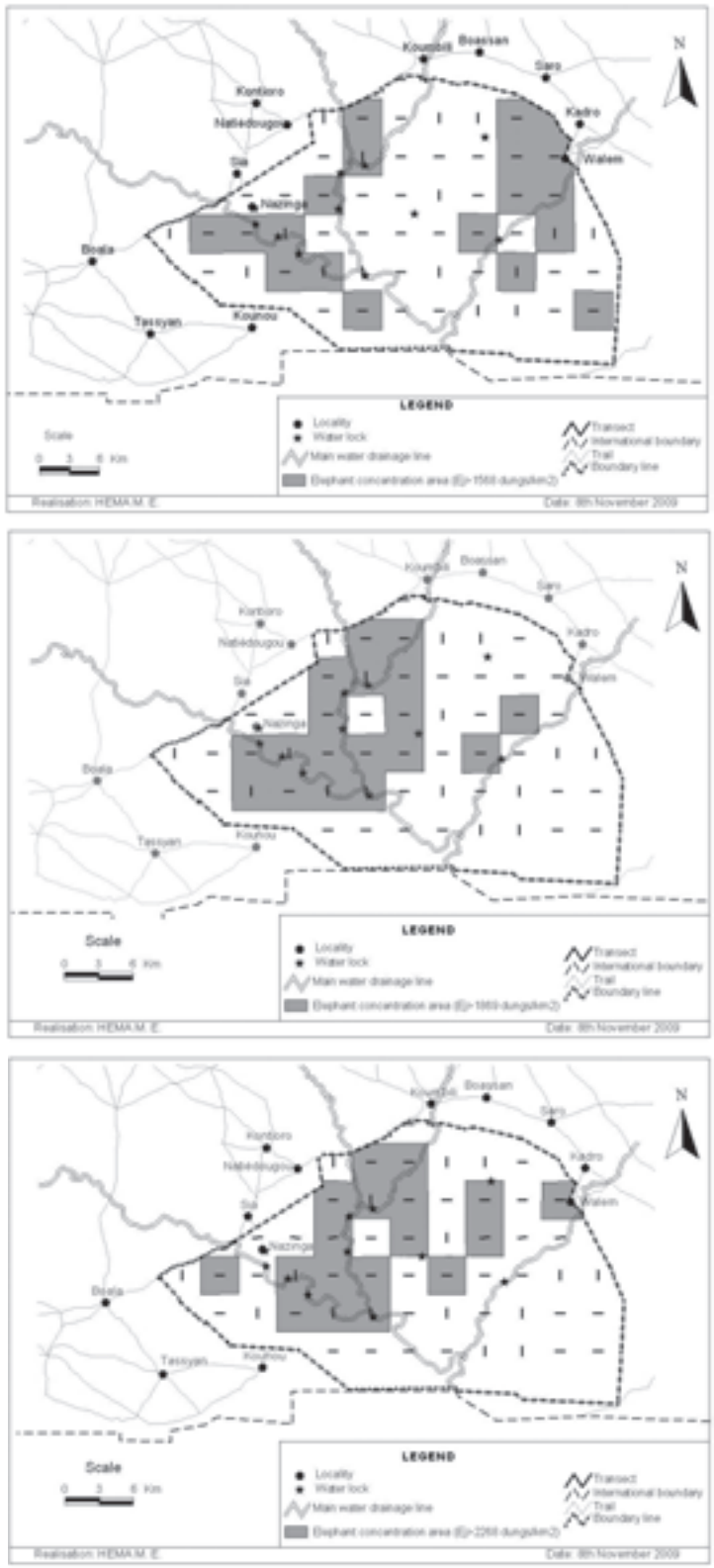


Figure 3. Maps of elephants' concentration areas at Nazinga; (a) Wet season 2006; (b) Dry season 2007; (c) Dry season 2008.

Table 2: Populations of the villages around Nazinga from 1975 to 2006

| Village | 1975 | 1985 | 1996 | 2006 |
|---|---|---|---|---|
| Boala | 233 | 331 | 691 | 738 |
| Boassan | 43 | - | - | 746 |
| Kounou | 87 | - | - | 236 |
| Kountioro | 106 | 190 | - | 577 |
| Koumbili | - | 210 | 265 | 3,483 |
| Natiedougou | 61 | - | 911 | 495 |
| Saro | 93 | 112 | 195 | 666 |
| Sia | 16 | 217 | - | 284 |
| Tassyan | 239 | - | - | 620 |
| Walem | 62 | - | 153 | 303 |
| Total for villageswith data for both 1975 and 2006 | 940 | - | - | 4,665 |

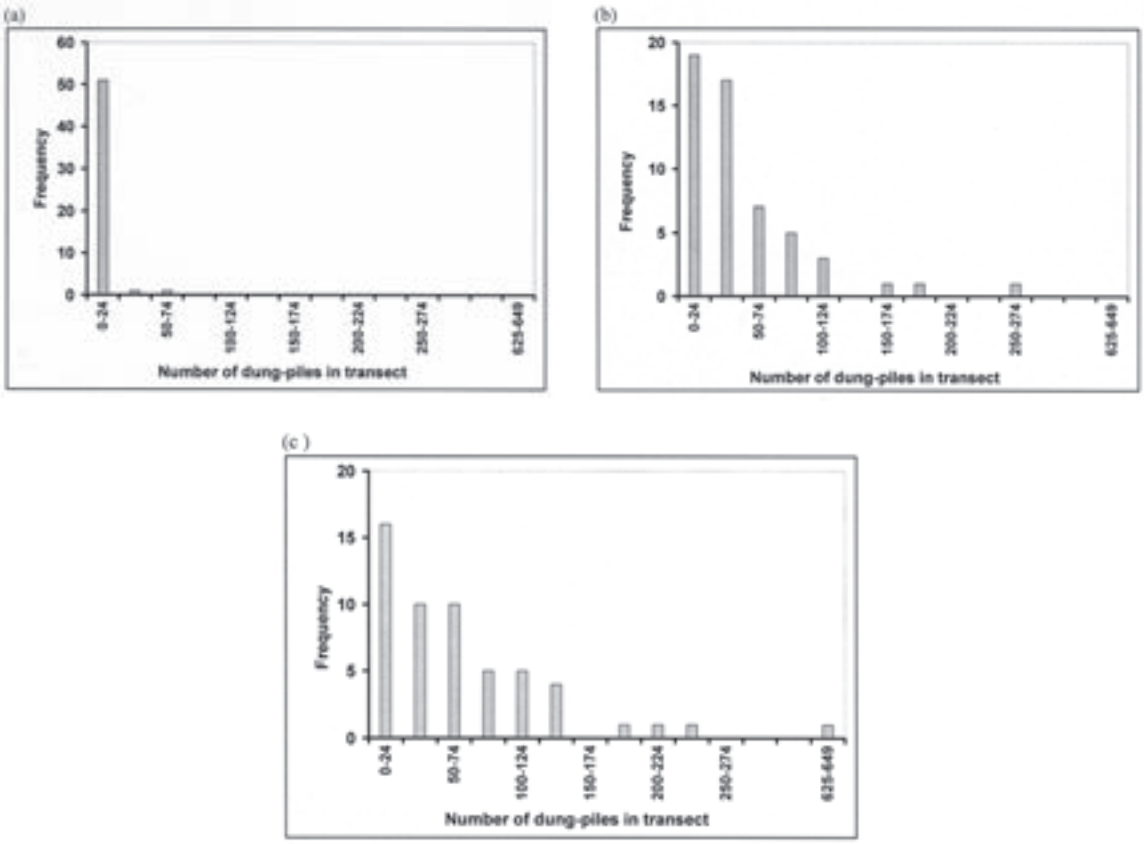


Figure 4. Frequency distributions of dung-piles during each season; (a) Wet season 2006; (b) Dry season 2007; (c) Dry season 2008.

This can be explained by the unusually low rainfall in the preceding wet season of 2007 (Fig. 2). Consequently, the vegetation was much drier in 2008 and there was less surface water available.

Jachmann (1988, 1992) reported that elephants at Nazinga dispersed throughout most of the ranch during the mid- and late-wet season when water was abundant and widespread.Therefore we expected elephants to be randomly distributed across the study area in the wet season. However, we found them to be clumped, albeit less concentrated than in the dry seasons. This suggests that they might have been attracted to certain features of the habitat.

The increasing human populations around the periphery of the ranch over the last two decades (Kessler and Geerling 1994; Ouedrago 1997) may explain the observed clumped distribution in the wet months. For example, Vermeulin (2001) noted that in the village of Sia the migrant population doubled between 1989 and 1990, and then doubled every five years between 1990 and 2000. The average rate of growth of 5% per annum recorded for most of the nearby villages (Table 2) indicates that the human population is doubling every 14 years.

These dramatic increases in human density immediately outside the ranch have brought about changes in the surrounding landscape as fields have been cleared for agriculture. In the wet season the expanses of maize, millet and sorghum are very attractive to elephants. Therefore one might predict elephants to be more common just inside the ranch's periphery. On the other hand, there will be more activity and human disturbance around the villages. In addition, farmers may actively repel elephants from their farms. So another possibility is that in the wet season elephants will be less common towards the edges of the ranch. For example, Chase and Griffin (2009) found that human settlements caused elephants to aggregate in the centre of Sioma Ngwezi Park in Zambia during the wet season. We suggest that the changing patterns of human settlement and land use outside the ranch influence elephant behaviour and seasonal distribution within the ranch. A subsequent paper will examine these hypotheses.

## Acknowledgements

Fieldwork was financed by the Nazinga Game Ranch as part of its Ecological Monitoring Program; we benefited from additional supports from the consortium of WILD Foundation in USA, Save the Elephants in Kenya and the Environment and Development Group in UK.

The late M. Adama Ouédraogo, Director of Nazinga Game Ranch during the period of the study, gave us permission to work at Nazinga. We are grateful to the Directeur de la Faune et des Chasses, M. Urbain Belemsobgo who made the study possible. We thank all field assistants especially M. Banzourou Niagabaré, M. Néti Naman, M. Tinsgnimi Dialla, M. Ousmane Badini, M. Boukaré Ouédraogo, M. Dominique Zida, M. Boureima Kaboré and M. Misson Zida, for their support.

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# Assemblages of avian communities in forest elephant (*Loxodonta cyclotis*) range in Ghana

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## Abstract

The bird assemblages occurring in the habitats altered by the forest elephant (*Loxodonta cyclotis*) in Kakum Conservation Area, Ghana were examined. The conservation area was divided into five blocks and then four circular plots of 30-m-radius were established in each of three identified habitat types: close forest, open forest and swamp forest. Thus each habitat type was represented by 20 plots of 0.30 ha each, and altogether, 60 plots covering 18 ha of the study area were sampled. The degree of elephant use in each plot was recorded, and, all the birds were identified and counted. The elephants were found to alter all the three habitats with the highest intensity recorded in the swamp forest, followed by open forest and close forest with 49, 59 and 57 species of birds respectively. The species similarity found among bird assemblages range between 55 and 59%. The mean abundance of birds per ha in close forest was 30.2 ± 1.9 significantly lower than in open forest with 42.8 ± 3.9 and swamp forest with 39.3 ± 2.5. Diversity indices (Shannon) ranging between 3.63 and 3.86 indicated high diversity of bird assemblages in the three habitat types. The relationships between the intensity of elephant habitat alteration and both abundance and bird species were weak and not significant. Though the forest elephant's habitat alteration may have some influence on bird assemblages, other factors may act in concert to affect the avian communities.

**Key words:** avian communities, forest elephant (*Loxodonta cyclotis*), habitat types

## Résumé

On a examiné les rassemblements d'oiseaux qui se produisent dans les habitats modifiés par les éléphants de forêt (Loxodonta cyclotis) dans l'Aire de Conservation de Kakum au Ghana. L'Aire de Conservation a été divisée en cinq blocs, puis quatre lopins de terre circulaires de 30 m de rayon ont été créés dans chacun des trois types d'habitats identifiés: la forêt fermée, la forêt claire et la forêt marécageuse. Ainsi, chaque type d'habitat était représenté par 20 lopins de terre de 0,30 ha chacun, et au total, 60 lopins de terre couvrant 18 ha de la zone d'étude ont été échantillonnés. On a enregistré le degré d'utilisation des éléphants dans chaque parcelle, et tous les oiseaux ont été identifiés et comptés. On a trouvé que les éléphants modifiaient tous les trois habitats avec l'intensité la plus élevée enregistrée dans la forêt marécageuse, suivie par la forêt claire et la forêt fermée, habitats occupés par 49, 59 et 57 espèces d'oiseaux respectivement. La similitude entre les espèces qui se trouvent dans les rassemblements d'oiseaux varie entre 55 et 59%. L'abondance moyenne des oiseaux par hectare dans la forêt fermée était de 30,2 ± 1,9 significativement moins que dans la forêt claire avec 42,8 ± 3,9 et la forêt marécageuse avec 39,3 ± 2,5. Les indices de diversité (Shannon) compris entre 3,63 et 3,86 ont révélé une grande diversité de rassemblements d'oiseaux dans les trois types d'habitats. Les rapports entre l'intensité d'altération des habitats par les éléphants et l'abondance et les espèces d'oiseaux étaient faibles et non significatifs. Bien que l'altération des habitats par l'éléphant de forêt puisse avoir une certaine influence sur les rassemblements d'oiseaux, d'autres facteurs peuvent agir de concert pour affecter les communautés aviaires.

## Introduction

The forest elephant (*Loxodonta cyclotis*) is the largest rainforest mammal remaining on earth and remains an important component of the forest ecosystem. They once roamed throughout the moist forests of Ghana, however, hunting and deforestation have drastically reduced the number to a mere handful and their occurrence has been limited to a few protected areas (Pareen and De Graff 1995). The ecological importance of this species cannot be overemphasized. Forest elephants play a major role in maintaining the linkages in the rainforest food web. They have a dominant position within ecosystems due to their enormous size, large food requirements, effects on plant species composition, dispersal of seeds and fruits and their role in nutrient recycling, which makes nutrients found in woody plants available to other species (Kortland 1984). They also have enormous influence on forest structure. For instance, in certain parts of Krahn-Bassa National Forest, Liberia, between 10 and 60% of the area was altered by elephant activity and in Grebo National Forest, Liberia, at least two-thirds of the close forest was found to have a structure clearly altered by forest elephants (Sachter and Hamer 1967). Campbell (1991) also concluded that forest elephants maintain and modify the forest canopy by trampling and debarking. The feeding and other habitat interactions create clearings, which serve as niches for certain specialized species. The IUCN/AESG (1999) have expressed concern that the extermination of the species would cause dramatic changes or extinctions in ecosystems.

Birds, in the same vein, are the best known group of vertebrates. They play an important role in the rainforest as pollinators and dispersers of seeds. Many eat large numbers of insects, other arthropods and


Figure1. Map of Kakum Conservation Area showing the division into blocks.

small mammals. African crown eagles (*Stephanoaetus coronatus*), for example, are top predators in some forests, and may even prey upon mammals as large as a colobus monkey (*Colobus polykomos*) (Bennun and Howell 2002) and may in turn, be preyed upon by reptiles, mammals and other birds. Birds are often considered as a useful indicator group, either for monitoring environmental change (Furness and Greenwood 1993) or for assessing biodiversity importance (Stattersfield et al. 1998). Many forest birds form 'guilds', that is, birds not necessarily taxonomically related feed or behave in a similar way. Bennun and Fanshawe (1998) showed that classification according to guilds could be useful for understanding the effects of forest management, since various guilds respond differently to particular structural changes. Knowledge about the effects of forest elephants' activities on other taxa is scant compared to that of the savannah counterpart (Hawthorne and Parren 2000). The hypothesis is that forest elephants' activities have influenced their environments, which in turn influence the bird communities. For example, the forest elephant browses on many tree species that numerous birds depend on for habitation and feeding sources (Sachter and Hamer 1967). The main goal of the study therefore, is to determine bird communities that occur within the different stages of habitat use by elephants and to evaluate the species interaction network in the tropical forest ecosystem

## The study area

Kakum Conservation Area is made up of Kakum National Park and Assin Attandansu Resource Reserve, located in the Twifu Hemang Lower Denkyira and Assin Districts of the Central Region of Ghana (Fig. 1). This conservation area forms about 360 km² of contiguous forest. The area lies between longitudes 1°51' W and 1°30" W and latitude 5°40' N and 5°20" N. It has been identified that 105 species of vascular plants and about 266 bird species occur in the Reserve (Wildlife Department 1996).

## Materials and methods

The study relied on a field study of sampled plots that were representative of three habitat types—namely close forest, open forest and swampy forest—according to the canopy coverage.

To equalize sampling effort, the study area was outlined into five blocks of approximately 72 km² each. The blocks were labeled 1, 2, 3, 4 and 5 (Fig. 1). In each block, four circular plots of a 30-m-radius each were established in each habitat type, thus 12 plots covering 6 ha per block, and in all 60 plots summing up to18 ha were covered by this study. Even though the plots did not necessarily follow a straight line, the interval between two plots was not less than 200 m as per Herreman (1995).

The fieldwork was conducted in April/May 2007 between 0530 h and 1100 h when the temperature ranged from 35° to 40° C. Winds were low and there was no precipitation. Four experts participated in the survey: one person identified and counted birds, another recorded the vocalized species. The third person collected data on elephant habitat use while the fourth was armed to provide protection against wild animals.

### *Habitat classification*

For the purpose of this study the habitat type in each plot was classified according to light penetration and swamp forest was classified based on edaphic forest formations (Table 1).

### *Measurement of habitat use by elephants*

The degree of habitat use by elephants was measured by signs of elephant's presence or absence. The observer conducted a search through the plot and looked for signs left behind as a result of habitat utilization by the elephants. The degree of use was coded: 0 for no sign of elephant presence; 1 for signs of elephant presence (trail, footprints, dung piles), but no identified utilization; 2 for signs of elephant presence and ≤ 50% browsing; and 3 for signs of elephant presence (debarking, bulldozing, wallowing, trampling) and > 50% browsing of the area. The codes scored in each plot in the respective habitat types were ranked according to the magnitude (1st for habitat that had high average recorded code, 2nd for the next and 3rd for habitat that recorded the least number).

### *Bird census*

In the bird census the observer stood at the centre of a plot and after a 10–minute settling-in period, the next 10 minutes were spent recording all birds detected in all directions by visual observation, song or call note. Ten minute increments were enough to record all the birds in a plot and brief enough to avoid or reduce

Table 1. Habitat classification according to canopy coverage for open forest (<75%) and close forests (>75%) and edaphic factors for swamp forest

| Forest type | Characteristics |
|---|---|
| Close forest | light penetration to forest floor <25% (>75% canopy coverage) |
| Open forest | light penetration to forest floor > 25% (<75% canopy coverage) |
| Swamp forest | edaphic forest formations on poorly drained soil (with characteristic vegetation e.g. dominated by Raphia spp.) |

double counting. Sounds of all vocalized birds in all directions were recorded using a Marantz digital recorder, for confirmation of species identification and documenting purposes. Additional notes were taken on different species observed to have been feeding together and classified them as guilds. Over-flying species were excluded from the recordings because their particular location would be difficult to determine. Only species encountered during the survey period were considered.

## *Calculation of community parameters*

Diversity (Hs) of the study area was calculated for each of the three habitat types using various diversity indices after Magurran (1988). Thus, Shannon index (Hs) was calculated using the following formula:

$$Hs = -\sum_{I=1}^{S} Pi \ln Pi$$

Pi =n*i*/N, where P*i* is proportion of individuals found in the *i*th species, n*i* is the number of individual of species and N is the total number of individuals.

Evenness (E), the ratio of the observed to maximum diversity was calculated as:

E = Hs/lnS. S is the number of species in each community

Dominance (d): expresses the proportional importance of the most abundant species and was calculated as d= n*i*/N*100

Söerenson index (Cs) was also calculated as:

Cs =2S1.2/(S1+S2)

Where S1 or S2 is the number of species in each community and S1.2 the number of species shared between them. Cs is constrained between 0(no species in common) and 1.0 (all species in common).

Frequency of occurrence (%) was determined from the raw data by dividing the number of plots where a particular species was present by the total number of plots and multiplying by 100. For the purpose of this study the relative status of each species based on the frequency of occurrence was defined as follows:

- Super-common: species occurring within more than 50% of the census plots
- Common: species found in between 20–49% of the census plots
- Uncommon: species occurring within between 11–19% of the census plots
- Rare: species found in between 1–10% of the census plots.

All the computations and statistical analyses were done using JMP5.0 (2002) statistical software.

# Results

## *Distribution of birds in different habitat types*

In the close forest, the mean number of individual birds (abundance) was 30.2 ± 1.9, N=20 per ha; the open forest recorded 42.8 ± 3.9, N=20 whilst the swamp forest recorded 39.3 ± 2.5, N=20.

Analyses of variance (ANOVA) indicated a significant difference of bird numbers between the three habitat types (p=0.00038). The student t-test indicated no significant difference between open and swamp forest (p>0.05), but the differences in bird numbers between close and open forest (p=0.00033) and close and swamp forest (p=0.00023) were significant. Also 59, 49 and 57 different species were recorded in the close, open and swamp forests respectively.

## *Species diversity, evenness and dominance*

The Shannon diversity index of bird species surveyed in close forest was 3.86 (3.57, 3.79 at 95% confidence limit (C.L.)); open forest was 3.63 (3.43, 3.61 at 95% C.L); and swamp forest was 3.77 (3.54, 3.74 at 95%C.L.). The diversity t-test indicated a significant difference between diversity of birds in close and open

Table 2. Frequency of occurrence of bird species in the study area

| Habitat type | Status of occurrence (%) | | | |
|---|---|---|---|---|
| | Super-common | Common | Uncommon | Rare |
| Close forest | 2 | 25 | 10 | 63 |
| Open forest | 0 | 30 | 13 | 57 |
| Swamp forest | 4 | 16 | 23 | 57 |

forest ($p<0.05$) but the differences between close and swamp forest, and open and swamp forests were not significant ($p>0.05$).

The Söerenson index of species similarity indicated that 59% of bird species were found between close and open forest, 57% were found in both open and swamp forests and 55% found between close and swamp forests.

Different species dominated at different habitat types. The community in the close forest was dominated by green hylia (*Hylia prasina*) and tambourine dove (*Turtur tympanistria*); the open forest was dominated by velvet-mantled drongo (*Dicrurus modestus*), naked-faced barbet (*Gymnobucco calvus*), western black-headed oriole (*Oriolus brachyrhynchus*) and blue-headed wood dove (Turtur brehmeri); and, the swamp forest was dominated by black-cap illadopsis (*Illadopsis cleaveri*), swamp-palm bulbul (*Thescelocichia leucopleura*) and white-spotted flufftail (*Sarothrura pulchra*).

Most of the bird species (57-63%) were classified as rare in the study area, few as uncommon (10-23%) and common (16-30%), and very few (0-4%) as super common (Table 2). No bird species was found to be super-common in the open forest (Table 2).

Three species of special conservation concern were encountered: the near threatened yellow-casqued hornbill (*Ceratogymna elata*) occurred in the swamp forest, and crested guinea-fowl (*Guttera pucherani*) and Sharpe's apalis (*Apalis sharpii*), a restricted-range species, occurred in the close forest.

### *Levels of elephant habitat use and relationship between bird assemblages*

The elephant habitat encounter was the highest in the swampy area (53.0), followed by the open forest (45.0) and close forest (23.0). The differences among these levels of habitat use were found to be significant ($p<0.05$) (ANOVA). In the close and open forests the correlation between the bird assemblages and elephant habitat use were negative; that is, the more elephants use the habitat the fewer birds were found, but the coefficients of determinations were very weak ($r=-0.3555$ and $r=-0.2270$ respectively for close and open forests). The model explained only 22% and 12% ($p>0.05$) of the relationship respectively. However, in the swamp forest, there was positive correlation ($r=0.3482$), that is the more the elephants use the habitat types the more the birds assembled, and the model explained only 12% of the relationship ($p>0.05$) thus the relationships were not significant enough to any conclusions.

## Discussion and conclusion

### *Distribution and abundance of bird species in the different habitat types*

Though the study was not extensive enough, lacking seasonal satisfaction and without replication due to logistic concerns, the nature of the animals studied and the moderately effective law enforcement in the Park suggest a stable situation that makes year effects of recorded data minimum in addition to the intensive nature of the study that gave respectable results over the brief period. The number of species recorded, however, lies well below expectation for such an area, which is the only intact forest considered as refuge for species from the surrounding degraded forest. But this could be better explained by under recording and exclusion of overflying, hypothetical and nocturnal species than environmental effects. Though the under recording appeared reasonable at first sight, vocalizations played major role in detection, therefore detection could not be considered a major bias. However, the behaviour of the close forest species might contribute to this low density. Close forest species tend to be habitat specialists and are normally confined to a specific area. This is supported by Bennun and Howell (2002) who stated that forest-specialist birds tend to have a smaller distribution range than that of other categories of birds. Newmark (1991) also noted that close forest species spend their whole lives within a small area of forest and may be reluctant to cross even small gaps between forest patches. Diet may be a major determinant factor of the relatively high density in the open and swamp forest habitats. In

these habitat types the vegetation pattern is not static, but rather in the process of development. Therefore they offer the best opportunities for numerous categories of feeders—both specialized and non-specialized feeders. Similarly, Waltert (2000) found more opportunistic behaviour in species at the heavily logged areas (equal to open canopy forest) in the Bossematie Forest in Cote d'Ivoire.

### *Avifaunal composition in communities*

The abundance structure among bird communities in the close, open and swamp forests habitat types in the Kakum Conservation Area indicates some similarities and differences in species composition. The evenness in distribution did not differ strongly among all the habitat types, which might suggest that various levels of elephants' habitat interactions are not considered as disturbances to the birds' communities, sufficient to have much influence on their assemblages. This is opposite to other anthropogenic-based disturbances like logging, which tends to influence bird communities in forests (Waltert 2000; Fanshawe 1995). The differences among the avifauna of the three habitat types might be due to other factors such as the specific relationship of particular birds to certain conditions that are specific to a particular habitat type. This phenomenon, where a higher number (i.e. greater abundance) of birds in the open and swamp forests where more elephants activities were recorded than the close forest with low recorded number of birds, conforms to Herremans (1995), who recorded higher number of birds in heavily impacted vegetation than the more intact woodland in northern Botswana. However, some birds occur only in one habitat type, which suggests that such species only exist where their ecological requirements are met. For example, white-spotted flufftail and African jacana (*Actophilornis africanus*) occur only in swamp forests because of their water requirements.

As far as global preservation of genetic diversity is concerned, the heterogeneous pattern of the forest appears to favor the existence of certain endemic bird species. For example shape's apalis occurred in both close and swamp forest whilst yellow–casqued hornbill and crested guineafowl, both near-threatened species were recorded in the open and close forest respectively. This suggests that the various levels of elephant's impacts have no detrimental effects on the general avian community. With the inter-specific relationships that occur in the rainforest ecosystem, a careful conclusion could be that, with only some exceptions, almost all the forest birds could be recorded in all the three habitat types considered with variation in abundance.

Elephant habitat interaction and bird assemblages Although there is much speculation about the influence of elephants' habitat use on other taxa (Cumming et al. 1997; Kortland 1984) bird community assemblages and elephants' habitat use have been found to be poorly correlated in different habitat types in the same conservation area. This could imply that different species that have lived together in the same place for a long period have evolved mechanisms to coexist harmoniously. This may appear to be contradictory at first sight to Cumming et al. (1997), who stated that large generalist herbivores can have a devastating effect on biodiversity, but indeed their study was about savannah ecosystems in South Africa, which is different from a rainforest ecosystem of West Africa. The results imply that elephant activities have no effect on bird population, and vice-versa, in this Park; further, it suggest that any special conservation measures for birds or for elephants to promote population growth should be encouraged without fear of impacting negatively on the other.

## Acknowledgement

We are grateful to the Management and staff of Kakum Conservation Area for giving us permission to undertake this study in the Reserve.

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# MANAGEMENT

## Enhanced community support reduces rhino poaching in Nepal

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### Abstract

Rhino poaching in Nepal declined in 2008 and 2009 in contrast to the previous seven years. Among the primary reasons for this decrease were the improved law and order throughout the country and better anti-poaching efforts. NGOs allocated more resources to local communities living around Bardia and Chitwan National Parks, and an increase in tourism meant that the Parks' Buffer Zone Management Committees received more money and assistance from the Department of National Parks and Wildlife Conservation (DNPWC). Lower caste people who understand the needs of the poorest were elected to senior positions on the Management Committees and User Groups in the Buffer Zones. In turn, these developments encouraged the mostly poor people of the local communities to support more fully rhino protection. Improved co-operation amongst the NGOs, DNPWC, the Army and local communities helped reduce rhino poaching in 2008 and 2009.

**Key words:** buffer zone, rhinos, Nepal, Chitwan, Bardia, rhino poaching, community development

### Résumé

Le braconnage de rhinocéros au Népal a diminué en 2008 et en 2009 contrairement aux sept années précédentes. Parmi les raisons principales de cette diminution figuraient une situation sécuritaire améliorée dans tout le pays et de meilleurs efforts anti-braconnage. Les ONG ont alloué plus de ressources aux communautés locales vivant à proximité des parcs nationaux de Bardia et de Chitwan, et une augmentation du tourisme voulait dire que les comités de gestion des zones tampon des parcs ont reçu plus d'argent et d'aide du Département des Parcs Nationaux et de la Conservation de la Faune (DNPWC). Des représentants des castes plus basses qui comprennent les besoins des pauvres ont été élus aux positions de responsabilité dans les Comités de Gestion et dans les Groupes des usagers des zones tampon. Par conséquent, ces développements ont encouragé les membres des communautés locales, qui sont pour la plupart pauvres, à mieux appuyer la protection des rhinocéros. Une meilleure coopération entre les ONG, le DNPWC, l'armée et les communautés locales a facilité la réduction du braconnage de rhinocéros en 2008 et en 2009.

## Introduction

The Buffer Zone concept was promulgated in Nepal in 1993 for certain protected areas in order to encourage the local communities to be more reliant on economic activities within such a zone rather than illegally exploiting the resources inside the parks. The second purpose was to make the communities more aware of wildlife conservation since it is in their best economic interests to reduce poaching of rhinos and tigers, large animals that make tourism profitable. The Buffer Zones were to be funded from 30–50% of the revenue raised in the protected areas, later confirmed at 50%. This new, exciting concept was set up in Chitwan National Park (NP) in 1996 (DNPWC and WWF Nepal 1996), but did not really get going until around 1999. For Bardia National Park (NP) the concept was also set up in 1996 (DNPWC 1996).

In the initial years after the implementation of the Buffer Zone concept, it was not effective in protecting the rhino as the poorest people received too few benefits (Adhikari 2005). From 2001 to 2006 at least 120 rhinos were poached in and around Chitwan NP, and in Bardia NP's Babai Valley the entire rhino population was eliminated by poachers with Bardia's total rhino number declining from 67 to 30 during this time (Martin et al. 2009). There were other reasons for the serious rhino poaching, including a breakdown in law and order throughout Nepal, but the local communities were not particularly helpful in preventing poachers and traders from moving in and out of the Buffer Zone areas contiguous to the two Parks. Several researchers who studied the situation, including Mark Murphy, Krishna Oli and Steve Gorzula (2005) concurred with our belief (Martin et al. 2009) that the Buffer Zone concept had not at the time changed the behaviour of the local communities towards enhancing conservation of wildlife. Even officials, such as the Chairman of the Buffer Zone Management Committee at Chitwan NP admitted in 2008 that the local communities had not received the conservation messages, and the marginalized and vulnerable groups within the Buffer Zone generally had been excluded from decision-making on conservation issues (Bhurtel 2008).

Fortunately, the Buffer Zone concept relevant to wildlife conservation was implemented more successfully in 2008 and 2009, the period covered in this paper. This improved community concern for protecting rhinos has greatly helped to reduce poaching.

Esmond Martin

Figure 1. The greater one-horned rhino carries a horn worth thousands of dollars on the black market in East Asia.

## Methodology

We carried out fieldwork in Nepal from 2 to 23 January 2010. We concentrated on interviewing people directly involved with the local communities around Chitwan and Bardia NPs, especially as the senior officers of the Buffer Zone Management Committees and officials of the Buffer Zone User Committees share their views on wildlife conservation. We did not visit Suklaphanta Wildlife Reserve because there are so few rhinos left, probably only six. We talked with the Chief Wardens of Chitwan and Bardia NPs, who are directly involved with the projects that are carried out in the Buffer Zones. We had meetings with the National Trust for Nature Conservation (NTNC), the Zoological Society of London (ZSL) and WWF Nepal—NGOs that have expanded their activities with the communities around the two Parks. Other people who were contacted included the officers in charge of the Nepal Army inside the Parks, assistant wardens of DNPWC, Forest Department staff, individuals in the tourist industry, and researchers.

All undated interviews referred to in this manuscript were carried out during fieldwork in January 2010.

## Results

### *Rhino poaching in Nepal in 2008 and 2009*

#### Chitwan National Park

In 2008 there were about 400 rhinos in and around Chitwan NP of which 7 rhinos were shot. All except

one were killed inside the Park. The authorities retrieved only one horn. In 2009 10 rhinos were poached, 7 inside the Park and 3 in the Buffer Zone; officials retrieved three horns. Poachers wounded two rhinos in July/August 2009, around the tourist area of Sauraha, but due to the quick response from the Park staff, the poachers did not have time to remove the horns from the injured animals. Later these injured rhinos died from their bullet wounds (Narenda Pradhan, Chief Park Warden, and Madhav Khadka, ranger, Chitwan NP, pers. comm.). Official figures of 17 rhinos poached in 2008 and 2009 are considerably lower than those from the previous seven years when the official average number killed per year was just over 17 (Martin et al. 2009.

Poachers and middlemen who had been arrested in 2008 and 2009 gave information on prices. There was one exceptionally high price, when in the latter part of 2009 a gang of about seven poachers killed a rhino with a .303 rifle. The gang removed the 1-kg horn and sold it to a trader in Kathmandu supposedly for 1,400,000 Nepalese rupees (USD 19,178). A possible explanation for the high price is that the trader based in Kathmandu reportedly desperately needed rhino horns immediately and put out the word that he would offer a very high price; this was probably a one-off transaction that was negotiated directly with the poachers and not through a middleman (Diwaka Chapagain, Manager of the Wildlife Trade Program for WWF Nepal, pers. comm., and Ram Prit Yadav, Terai Arc Landscape Program, WWF Nepal, pers. comm.). This horn may have gone to the town of Darchula in north-west Nepal on the Nepal-India-Tibet border where two seizures of horns were made earlier in 2009. Those horns were to be sent to China (Chapagain, Pradhan and Khadka, pers. comm.).

### Bardia National Park

There were only two rhinos known to have been poached in Bardia NP in 2008 and none in 2009, mainly because some Army and ex-Army people who had been directly involved in the poaching and selling of horn were arrested in 2008 (Kock et al. 2009). In early 2008 the two rhinos were shot dead. One was inside the Park and the other was in the Buffer Zone. The one inside was shot by a gang of Soncha tribal people, who are traditional fishermen and gold panners; they rarely own land and are very poor. A Kathmandu trader, originally from the mountains, but not a Tibetan, came to a village called Manu west of the Karnali River. He approached a Tharu tribal leader who organized a gang of four Sonchas to kill the rhino. A businessman from Kathmandu paid NPR 200,000 (USD 3091) to the poachers for the horn. This payment was split evenly amongst the four gang members. The Park authorities arrested two members of the gang and the trader, and they were put into jail (Ramesh Thapa, assistant warden, Bardia NP, pers. comm.). The rhino killed in the Buffer Zone was shot by a gang of six people. A woman of Tibetan origin, resident in the town of Nepalgunj, purchased the horn for NPR 900,000 (USD 12,329) on behalf of a trader who may have been an ethnic Lama. She took the horn to him in Kathmandu but received only NPR 10,000 (USD 155) as commission. She was later arrested, as were some of the poachers, but the trader was not caught (Ramesh Thapa, pers. comm.). At the end of 2009 only 22 rhinos were counted in the Park, all inhabiting the Karnali River floodplain in the west (Ramesh Thapa, pers. comm.).

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Figure 2. Rhinos in Nepal prefer the grassy swamp areas and are less frequently seen feeding in the forests.

## *Increased security in Nepal*

The signing of the Peace Accord in 2006 ended a 10-year civil war. Subsequently, fighting in the countryside decreased and security greatly improved in Nepal. Consequently, the Nepalese Army resident in Chitwan NP was able to re-occupy more former Army posts. In 2001 the Army had manned 32 posts, but by 2006 only 7 were garrisoned. By mid-2007 the Army had moved back into a total of 22 (Martin et al. 2009), and by the end of 2009 32 were once again fully functional. In

addition, in mid-2008 a company of troops was added to the battalion in the Park, which improved the frequency and effectiveness of anti-poaching activities.

In Bardia NP the Nepal Army occupied only seven posts in 2004, but by December 2007 six more were re-established (Martin and Martin 2006, Martin et al. 2009). By the end of 2009, Nepal Army personnel occupied 19 posts. During the insurgency the Army could not move around the Babai Valley as it was diverted to counter insurgency operations. By 2008 Army personnel spent most of their time carrying out anti-poaching activities once more.

## *The buffer zone communities*

In late 2005 we studied the conservation efforts carried out by communities living in the Buffer Zones of Chitwan and Bardia NPs and concluded that they were not particularly effective. This was due to a decline in the money paid into the Buffer Zones as a result in the drop in tourist numbers, and the fact that the Buffer Zone Management Committees received this money automatically whether they adequately protected rhinos or not. Also the communities within the Buffer Zones had not been well informed on how to deal with conservation issues nor motivated to implement a successful anti-poaching strategy. These problems continued in 2006 and 2007. One reason was that the Buffer Zone Management Committees and the many User Groups were dominated by the relatively well-educated Hindu elite who took advantage of the vast majority of the poor, landless people. The Madheshis, who are of Terai origin and live around Chitwan and Bardia NPs, are extremely poor and have little formal education. In 1999 the average Madheshi had completed only 1.7 years of schooling compared with 4.6 for the elite Brahmins. Although the Madheshis made up 28% of Nepal's population, they held only 3% of the positions in the judiciary and 7% in the education sector, contrasting to 81% and 77% of the higher caste Hindu Bahuns/Chhetris (Pradhan and Shrestha 2005).

### Chitwan National Park

For the 750km$^2$ Buffer Zone around Chitwan NP, home to approximately 300,000 people, there is one Buffer Zone Management Committee, 21 User Committees and 1,700 User Groups that are involved in deciding how the money earned by the Park will be allocated and spent by the local communities in the Buffer Zone. In a 2009 election, a Dalit (a person of the lowest Hindu caste) became the Chairman of the Buffer Zone Management Committee, the first time a Dalit had become a Chairman. More democratization occurred with a greater variety of members in the User Committees. For example, in 2009, of the 13 members of the Mrigakunja User Committee (9 elected and 4 appointed) 4 were women, which was rare in the past. There were six Brahmins, six Tharus and one Dalit. These people gave greater attention to the needs of the poor (Buddhiman Bishow Karma, secretary and Basudev Chapagain, Chairman, Mrigakunja User Committee, pers. comm.).

The Buffer Zone Management Committee for Chitwan allocates 30% for conservation projects to protect wildlife, 30% for building schools and roads, 20% for income-generating projects such as poultry and pig farming, handicrafts, and tailoring enterprises, 10% for administration and 10% for education. The conservation and education expenditures are particularly relevant to rhinos.

Along with a fair distribution of Park funds to the communities, which gave local people greater incentives for wildlife conservation, there was more money from the Park for the local people in the Buffer Zone due to an increase in tourism. Park revenue rose from NPR 30,831,199 (USD 398,885) in the financial year 2002/3 to NPR 58,793,101 (USD 871,655) in 2007/8 (DNPWC 2004, DNPWC 2008) with tourist numbers rising from 57,033 in 2005 to 113,486 in 2008 (DNPWC 2006, DNPWC 2009). Half of this Park revenue was allocated to the Buffer Zone.

The money allocated for education is often spent on projects to instruct the communities about the

Chryssee Martin

Figure 3. Esmond Martin meets some members of the Mrigakunja User Committee at their office near Chitwan National Park.

importance of protecting wildlife, especially rhinos. One strong argument is that if rhinos and other endangered animals are poached, then fewer tourists will visit the Park, reducing Park revenue for the Buffer Zone. Community instructors visit schools to teach the youth the importance of conservation and also to recruit youth into anti-poaching units for patrolling the Buffer Zone. Eco-clubs are also encouraged in the schools.

The Buffer Zone User Committees and User Groups spend more money on conservation projects compared to educational ones, although the latter are probably equally important for rhino conservation. In 2008 and 2009, the major conservation projects included erecting fences to protect crops from wild animals that stray out of Chitwan NP and improving the management of grasslands for rhinos. Other projects support the youths who voluntarily patrol in the Buffer Zone to arrest poachers and to report illegal weapons.

In 2008 and 2009 with security in the country improved (although there were still occasional outbreaks of violence and strikes in the Terai), with more democratically-managed Buffer Zone committees and with more funds productively spent by these committees, the NGOs increased their assistance for the Buffer Zone. The NGOs decided that with these improved conditions their financial and technical input would be more effective and in some of their projects went into partnership with the Buffer Zone committees.

One of the largest Nepalese NGOs, NTNC, increased its support in the Buffer Zone by improving the people's livelihoods, safeguarding people and crops from wild animals, and by helping to protect rhinos that wander into the Buffer Zone. NTNC plays an important role in funding informants in the Buffer Zone to help catch rhino poachers and traders. This has become more effective since the decline in violence, as it is now easier for informers to move around. NTNC set up a fund in 2005 and 2006 of NPR 5,000,000 (then worth USD 69,444), the interest on which is used to pay informers, to patrol outside the Park boundary and to help maintain anti-poaching vehicles. NTNC has also put considerable effort into educating the community on the importance of wildlife to their future well-being. Members of NTNC have encouraged those people living close to the Park boundary to plant crops unpalatable to rhinos and other wildlife—such as mint, citronella and camomile—as a deterrent to the farmers' fields

Esmond Martin

Figure 4. Some of the less poor families around Chitwan National Park live in houses such as this, growing crops and raising livestock.

(Ganga Jang Thapa, executive director, and Naresh Subedi, research officer, NTNC, pers. comm.).

NTNC, along with assistance from the Darwin Initiative (British government aid), ZSL and the Parks' staff have erected fences to deter wild animals from going into farmers' fields. For example, a solar-powered electric fence was built on the eastern side of the Park in 2008 to reduce human-wildlife conflict. NTNC has also been encouraging local communities not to over-exploit the natural resources of the forest by encouraging other forms of economic activity and paying the start-up costs. These include supporting alternative energy sources such as biogas plants and supplying tree seedlings.

NTNC, with assistance from the Darwin Initiative, ZSL and the Park, has recently set up a monitoring system for the rhinos. The plan is to photograph every rhino in the Park, and give each a name or a number, similar to the scheme set up by Richard Kock and Raj Amin of ZSL in Kenya. By the end of December 2009, more than 100 rhinos had been photographed, starting with the low rhino density areas in Chitwan. Ten NTNC staff have been employed to do this work, while also protecting the rhinos, finding rhino carcasses, tracking and apprehending poachers. NTNC staff have GPS devices, binoculars and cameras which, along with training, have improved staff morale (Subedi, pers. comm. and Anon. 2008 and 2010). More rhinos need to be individually recognized and monitored in order to reduce poaching significantly. Military presence alone will not eliminate poaching.

Another major NGO, WWF Nepal, has also

expanded its activities in the Buffer Zone. In 2009 WWF Nepal donated NPR 4-5 million (USD 52,300–65,400) to the communities as part of the large WWF programme called the Terai Arc Landscape (TAL) which in Nepal covers 49,500 km$^2$ (Ajaya Kumar Jha, finance and administrative officer, TAL, WWF Nepal, pers. comm.). WWF Nepal works with the communities in the Buffer Zone to reduce human-wildlife conflict and aids income-generating projects such as goat keeping, pig farming and biogas plants. They also support eco clubs at schools and carry out awareness programmes on the importance of conservation to protect the rhino. WWF Nepal spent NPR 800,000 (USD 12,365) in 2009 for informers and for intelligence gathering on potential poachers and wildlife traders (Jha pers. comm.).

WWF Nepal under the TAL programme supports a rhino conservation co-ordinator based in the town of Sauraha, just to the north of the Park, Ram Prit Yadav, who was formerly Chief Warden of Chitwan NP. He spends a lot of time with the local communities imploring them to protect rhinos, explaining that rhinos can help local people earn a lot of money. He reminds them that if any of them are caught poaching rhinos the penalty is up to 15 years imprisonment and/or a fine of NPR 100, 000 (USD 1,370). In addition, he coaches the 150 guards recruited from the Buffer Zone, who patrol on a daily basis the community forests and who collect information on poachers. These laymen are paid a small amount (NPR 700–2000 or USD 10–27 a month) by the community, but they are very effective (Yadav pers. comm.). In 2008 WWF Nepal helped to set up 12 tiger/rhino conservation committees that co-ordinate these guards' activities (Jha pers. comm.).

The Park staff members also have improved relations with the communities in the Buffer Zone. An assistant warden based at Chitwan NP headquarters at Kasara oversees the management and co-ordination of the Buffer Zone activities for DNPWC. The Park helps support the management of the Buffer Zone User Groups by employing staff, including a sub-engineer to estimate the cost of development works. Another assistant warden based at Sauraha, who organizes patrolling inside the Park, also works closely with the communities in conservation awareness and community development projects.

One problem that still needs to be resolved is that of hand-outs. There has been a tendency amongst

Esmond Martin

Figure 5. NGOs have helped to finance water projects around Chitwan National Park, amongst other community development projects, while also encouraging local support for wildlife conservation.

Park and NGO staff to give the communities hand-outs without enough accountability for conservation action. Some are now realizing that a more organized approach to conservation and development as opposed to revenue hand-outs would improve co-operation and success further (Richard Kock, pers. comm. August 2010).

### Bardia National Park

Although Bardia NP is slightly larger at 968 km$^2$ than Chitwan NP, the Buffer Zone is much smaller: 328km$^2$ with 120,000 inhabitants. There is one Buffer Zone Management Committee, but 15 User Committees and at least 226 User Groups that are involved in deciding how the money is allocated. Tourism declined sharply during the Maoist insurgency, reaching a low of 1173 visitors in the 2004/5 financial year, resulting in the Buffer Zone receiving very little money from the Park's income. In the 2007/8 financial year, the number of tourists increased to 4476, and the Park's income rose to NPR 4,012,763 (USD 59, 492) with half of that amount earmarked for the communities living in the Buffer Zone (DNPWC 2008). The amount of money paid by the Park to the Buffer Zone around Bardia NP was less than 1/14 of the amount received by the Buffer Zone around Chitwan NP. Thus the contributions made by the NGOs to Bardia's Buffer Zone User Groups were especially important for rhino conservation.

NTNC has recently given greater assistance to Buffer Zone communities in order to ensure

that the rhinos remain safe and thus continue to attract tourists to the Park. A rhino identification system was started in June 2008, with financial support from the Darwin Initiative and technical assistance from ZSL, to monitor the rhinos and curtail poaching attempts. By late December 2009, 19 of the 22 rhinos were individually photographed and recorded, and 17 of them were regularly seen on elephant-back patrols. From May 2008 to at least early 2010 no rhino poaching took place. The scientists working for the Darwin Initiative in Nepal credit this decline in poaching, 'largely through engagement of the communities surrounding the Park and by their active role in anti-poaching' (Kock et al. 2010). The Darwin Initiative has helped fund NTNC to put a lot of effort into community education: 45 to 50 schools were regularly visited, emphasizing to the students the importance of wildlife conservation. Eco clubs were also supported. The Trust employed 17 people in 2009 (up from 15 in 2008) in the Bardia area to implement projects in the Buffer Zones in the fields of natural resources conservation, human-wildlife mitigation, health services, forest development and capacity building. (Rabin Kadaya, conservation education officer, Manish Raj Pandey, officer in charge, Bardia Conservation Programme, NTNC, pers. comm.). There is also a positive response from the mentha processing plants put in place by the Darwin Initiative (Kock pers. comm. August 2010).

WWF Nepal is increasing its help to the User Committees in the Buffer Zone. Support is given to 104 youth volunteers who have been assembled by the User Group Committees since 2008 to gather information and patrol the outskirts of the Park, especially in the Karnali River area. According to the Chairman of the Buffer Zone Management Committee, the biggest problem facing the poor communities living close to the Park is human–wildlife conflict (Davi Prasad Devkota, chairman, Bardia Buffer Zone Management Committee, pers. comm.). In response, WWF Nepal has contributed to the construction of 34 km of electric fencing on the western bank of the Karnali River to prevent large mammals from leaving the Park. Consequently, since 2007, human–wildlife conflict has been reduced (Devkota, R. Thapa, pers. comm.). In addition, WWF Nepal provides relief money for people injured by wild animals. The Fund also helps to motivate the local community by implementing rhino conservation education projects and by supporting new forms of income, such as furniture-making and the extraction of oils from plants to sell commercially.

All this assistance from NGOs to the User Committees in 2008 and 2009 has improved the communities' attitude towards wildlife. The Bardia Buffer Zone User Committees have become more democratic. For example, in 2009, after a recent election, women made up 42% of the Executive Committee members of the User Committees. The Brahmins and Chhetris and other high caste Hindus comprised 48% of the total Executive Committee members whilst the local tribal peoples (especially the Tharu) made up 42% and the Dalits 11% of the membership, which signals a major change from earlier years. This democratization of decision-making has ensured that more of the contributions made by NGOs and the Park have gone to the poor, marginalized peoples in the local communities (Shyam Thapa, Community Improvement Officer, Western Terai Landscape Complex Project, WWF pers. comm.). Democratization has also increased transparency and the ability of the poor people to voice their opinions on projects undertaken by the Buffer Zone User Groups.

## Discussion

The official decrease in the number of rhinos poached in Nepal in 2008 and 2009 compared to the number killed between 2000 and 2007 can be attributed to five main factors: improved security in the country, a system set up by the Darwin Initiative to monitor rhinos, more efficient use of informers, increased support for projects in Chitwan and Bardia NPs' Buffer Zones by the NGOs and DNPWC, and greater commitment by local communities to protecting rhinos. These factors are interlinked. For instance, the decline in violence associated with the Maoists has allowed the Army stationed inside the Parks to spend more time protecting rhinos rather than dealing with the Maoist insurgency. Greater security has resulted in more tourists visiting the Parks, which brings in more money for the communities. This in turn has encouraged local people to put a higher priority on wildlife conservation. Leadership is equally important. The Buffer Zone User Groups' decision-making process about how to use their revenue has become more democratic and the relationships between the Parks' senior staff and the Buffer Zone Management Committees have become stronger. Furthermore,

improved law and order in the Terai region has allowed the Buffer Zone volunteer anti-poaching units to become more effective. It has also encouraged the NGOs to put more resources into the Buffer Zones as there are now greater chances of success. Most notable has been the Darwin Initiative (with GBP 300,000 invested from 2007 to 2010, including ZSL support) for scientific patrol-based monitoring, transparent monthly reporting and annual status reporting of rhinos; community education; problem animal work including fencing; strategically planting non-palatable crops and starting mentha processing; and initiating new APU systems involving over 100 community-based anti-poaching volunteers. These activities have brought with them pride and motivation amongst the people. All the factors responsible for improving rhino protection are directly related to general improved communication and co-operation among the work of the NGOs, Army, Parks Department, tour operators and the Buffer Zone User Groups. In order for the communities living around the two Parks to improve their motivation and effectiveness, conservation endeavours such co-operation and transparency, along with funding, must continue.

At present, tourist revenue earned from Chitwan NP is a major source of external funding for its Buffer Zone. The Park possesses many attributes for successful international tourism. There is an airport nearby or it takes five hours to get there by car from Kathmandu. There are a variety of places for tourists to stay, ranging in price from USD 10 to several hundred a night per person, and many activities for the visitors. On the other hand, there is far less tourist revenue for Bardia NP because fewer tourists choose to travel that far west, which requires about 12 hours to drive from Kathmandu or 15 hours by bus, or an expensive round trip air ticket of USD 290 for foreigners, plus a 2-3 hour drive from the airport in Nepalgunj to the Park. In December 2009, the Bardia area had only 15 functioning small lodges and tented camps (with just 318 beds in total) compared to more than 60 in the Chitwan area; most of the accommodation around Bardia NP is very basic with prices as low as USD 3 a night per person without food. Bardia NP suffers from poor tourist promotion, unannounced strikes in the region rendering transport unreliable, continued worry that the area is still unsafe, and a shortage of electricity that is also often erratic. The local tourist association, called the Eco-tourism Development Forum, attempts to improve the situation, but the Forum has very little financial resources and its lack of technical knowledge renders it largely ineffective.

## Conclusion

Prospects for rhinos in Nepal are dependent firstly upon security in the country. Daily vigilance of rhinos with transparent reporting is essential so that everyone knows the status of the remaining population and any losses are rapidly reported. This ensures pride, hope and commitment amongst the people and deters senior staff from hiding the truth. Zero poaching in Bardia must be congratulated and such an aim for Chitwan could be achieved using similar monitoring techniques and co-operation amongst all the stakeholders. Close, effective co-operation and transparency amongst the DNPWC, NGOs, Army and the Buffer Zone Management Committees are essential. It is imperative that the communities living around Chitwan and Bardia NPs continue to receive significant benefits, for which they are accountable from the DNPWC and NGOs to sustain their motivation and efforts towards protecting rhinos. In 2008 and 2009 the Buffer Zone Management Committees and the poor people they represented received more benefits to put greater efforts into wildlife conservation than in earlier years, especially around Bardia NP, resulting in a significant decline in the number of rhinos illegally killed in Nepal. However, if close co-operation and transparency amongst the stakeholders does not continue and the competency of the anti-poaching activities in and around the two Parks falters, then rhino poaching will increase due to the high value of the horns in the East Asian markets.

## Acknowledgements

Thanks are due to the Columbus Zoo and Aquarium Conservation Fund for funding this fieldwork in Nepal. Thanks are also due to numerous officers in the Department of National Parks and Wildlife Conservation, the Forest Department, NGOs and community groups for all their time and assistance, many of whom are referred to in the text. Richard Kock was most helpful in checking the manuscript and providing important information. Thanks especially go to Lucy Vigne for making valuable contributions to this paper.

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# Elephant use and conflict leads to Tanzania's first wildlife conservation corridor

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## Abstract

Corridors linking protected areas are recommended for reducing the effects of human settlements that fragment African elephant (*Loxodonta africana*) home ranges and dispersal areas, and increase human-elephant conflicts. Community interviews and hilltop surveys were used in two Maasai villages in northern Tanzania in 2000 and 2001 to determine the extent of wildlife conflict, community attitudes towards elephants, and if elephants were using a vegetation corridor between the two villages to move between Tanzania and southern Kenya. Elephants were the most problematic species in the two villages adjacent to the corridor due to crop-raiding of primarily maize (*Zea mays*) and beans (*Phaseolus vulgaris*). Although villagers considered elephants a nuisance, they believed they attracted tourists, and generally did not believe elephant numbers should be reduced. Elephants used the corridor primarily in the wet and early dry seasons, and breeding herds were more numerous than bull herds. Based upon elephant conflict and use, and the communities' need to maintain areas for cattle grazing and medicinal plant collection, the two Maasai communities established the first wildlife conservation corridor in Tanzania working in co-operation with government authorities and other stakeholders.

**Key words:** Amboseli, community interviews, crop-raiding, hilltop surveys, human-elephant conflict, Kilimanjaro, transboundary movements

## Résumé

Les corridors reliant les aires protégées sont recommandés pour réduire les effets des peuplements humains qui fragmentent le domaine vital et les zones de dispersion de l'éléphant d'Afrique (*Loxodonta africana*), et augmentent les conflits hommes-éléphants. On a utilisé des interviews dans les communautés et des études à partir des collines chez les Maasai habitant deux villages au nord de la Tanzanie en 2000 et 2001 pour déterminer l'étendue des conflits avec la faune sauvage, les attitudes des communautés envers les éléphants, et si les éléphants utilisaient un corridor de végétation entre les deux villages pour se déplacer entre la Tanzanie et le sud du Kenya. Les éléphants étaient l'espèce la plus problématique dans les deux villages adjacents au corridor à cause de la maraude des cultures, surtout de maïs (*Zea mays*) et de haricots (*Phaseolus vulgaris*). Bien que les villageois considèrent les éléphants comme une nuisance, ils croient qu'ils attirent les touristes, et en général ils ne croient pas que le nombre d'éléphants devrait être réduit. Les éléphants utilisaient le corridor principalement pendant la saison des pluies et au début de la saison sèche, et les troupeaux familiaux étaient plus nombreux que ceux des mâles. En se basant sur les conflits avec les éléphants et la nécessité des communautés

de conserver les zones de pâturage et de collecte de plantes médicinales, les deux communautés Maasai ont créé le premier corridor pour la conservation de la faune en Tanzanie en collaboration avec les autorités gouvernementales et d'autres intervenants.

## Introduction

With nearly 70% of the African elephant range outside of protected areas (Blanc et al. 2007) and increasing human settlements in many of these unprotected areas (Newmark 2008), elephant home ranges and dispersal areas are increasingly fragmented and human-elephant conflicts increasing (Barnes et al. 1997; Dublin et al. 1997; Hoare and du Toit 1999; Sitati et al. 2003; Lee and Graham 2006; Cushman et al. 2010). Movement corridors were recommended for linking protected areas and reducing human-elephant conflicts in Zimbabwe (Osborn and Parker 2003), Kenya (Douglas-Hamilton et al. 2005) and Tanzania (Mwalyosi 1991; Hofer et al. 2004), and as an option for reducing elephant densities in over-abundant elephant populations (Balfour et al. 2007; van Aarde and Jackson 2007). Further, human settlements and farms around many protected areas in Tanzania increase their isolation and pose barriers to traditional wildlife migration routes (Borner 1985; Mwalyosi 1991; Newmark 1993, 1996, 2008; Kamenya 2000; Hofer et al. 2004; Caro et al. 2009). Although some efforts are underway to establish conservation corridors in Tanzania, such as the Selous-Niassa (Hofer et al. 2004), Kwakuchinja (Gamassa 1987) and Derema (Ministry of Natural Resources and Tourism 2006; Newmark 2008) corridors and review by Caro et al. (2009), no conservation corridors were permanently protected by the Tanzanian national government until the current project.

Afolayan (1975) and later Grimshaw and Foley (1990) and Newmark (1993) suggested that elephants may be using a vegetation corridor (Kitendeni) to move between Mt Kilimanjaro and the Amboseli Plains in southern Kenya; however, the occurrence of this corridor was based upon aerial photos of elephant trails, ground observations of elephant sign (tracks and droppings) or discussions with local Maasai. Thus, the objectives of this study were to determine if this elephant movement corridor existed, the extent of its use by elephants and to assess the extent of wildlife conflicts and human attitudes towards elephants in two nearby Maasai communities. Lastly, we describe the process of working with the communities, government authorities and other stakeholders for establishing the first wildlife conservation corridor in Tanzania. We hope that this manuscript provides tools for establishing additional wildlife conservation corridors in Tanzania, as urged by Caro et al. (2009), and other African elephant range States.

### *Study area*

The study area is in the West Kilimanjaro (West Kili) region of northern Tanzania, which is a complex mosaic of diverse natural communities, extensive grazing lands, large agricultural fields at lower elevations on Mt. Kilimanjaro, and diverse human populations, including agro-pastoral Maasai communities. The unprotected lands in West Kili may support as many as 600 elephants in the dry season (KERP 2003). The study area (3059 ha) for the hilltop surveys was a 6-km-wide corridor of vegetation off the northwest corner of Kilimanjaro National Park (NP) (formerly Forest Reserve) (Fig. 1). The corridor extends from the forest border of Kilimanjaro NP north to the Tanzania-Kenya border (6.6 km along the midline). Amboseli National Park is 15.5 km to the north of the international border.

The corridor was located within two Maasai villages, Kitendeni (2° 50' 53.50" S, 37° 14' 38.43" E) to the west and Irkaswa (2° 51' 52.65" S, 37° 19' 26.75" E) to the east. A ridge along the midline of the corridor delineates the boundary of the two villages. Two intermittent streams occur in the corridor; Olkeju-Loorgum stream defines the eastern edge of the corridor and the somewhat larger Kitendeni stream runs along the western edge of the corridor. During the study, numerous bomas (n≈20) were immediately adjacent to the corridor along about half the length of the eastern border in Irkaswa Village. On the Kitendeni side, there were five bomas and a school within the corridor and another 12 bomas outside the corridor (<1 km). One artificial water point stands within the corridor on the Kitendeni side. Two hills are adjacent to the corridor; these hills were used as observation points for our hilltop surveys. Kitashu Hill (1754 m) was about 800 m west of the western corridor boundary, and Kilima Nyuki (1750 m) was about 750 m from the eastern border of the corridor

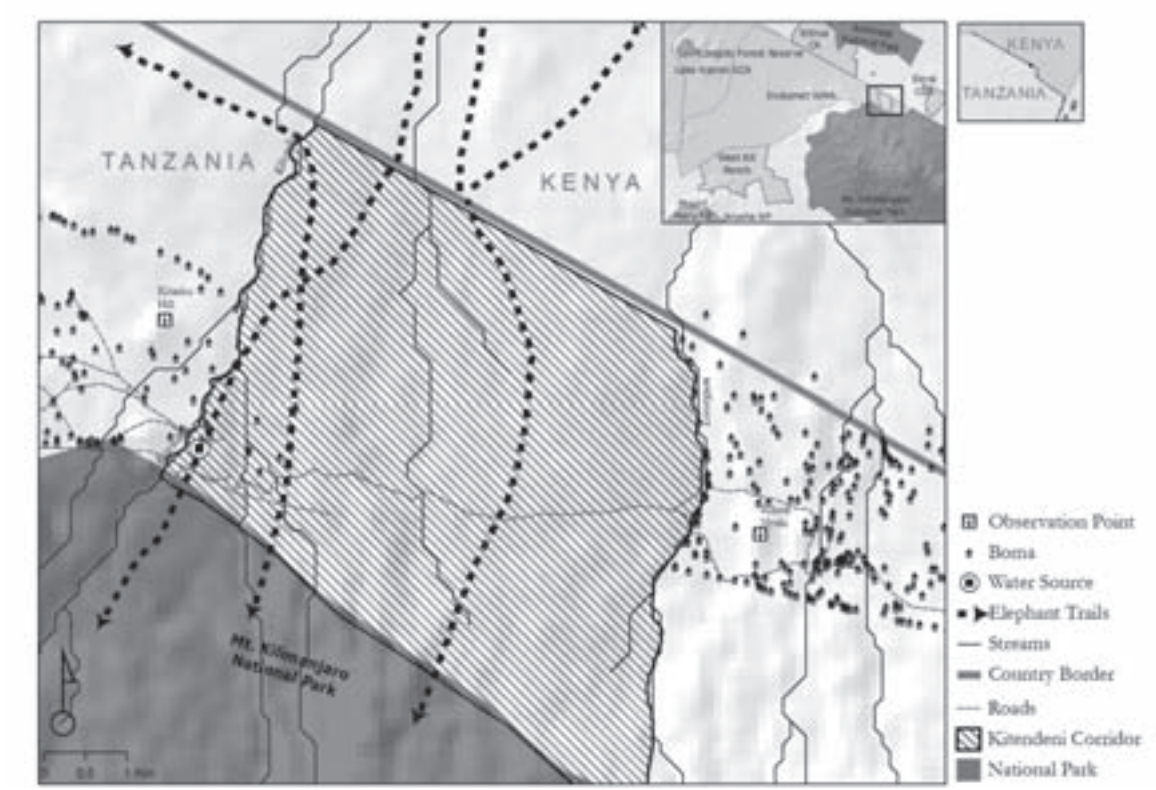


Figure 1. Kitendeni Corridor study area showing observation hills, physical and cultural features, and designated corridor boundaries (courtesy of African Wildlife Foundation, Nairobi, Kenya).

on the Irkaswa side.

The corridor extended from about 1600 to 1750 m elevation with a savannah climate with 220 cm annual rainfall (Rohr and Killingtveit 2003). Vegetation varies according to elevation with *Acacia seyal*, *A. nilotica*, *A. drepanolobium* and *Balanite aegyptiaca* dominate the woodlands at the upper portion of the corridor. *A. nubica* and *Commiphora africana* dominate the shrub communities in the lower portion of the corridor. Several large pockets of grassland (dominated by *Themeda triandra*, *Cynodon plectostachyus, C. dactylon* and *Pennisetum stramineum* also occurred on the eastern side of the upper portion and throughout the lower portion of the corridor. *Lantana* spp. shrubs occurred throughout the corridor in open areas.

Both Kitendeni and Irkaswa are agro-pastoral communities that graze cattle and other livestock and raise subsistence crops, primarily maize, beans, wheat (*Triticum aestivum*) and potatoes (*Solanum tuberosum*). Kitendeni was a small (78 households) traditional Maasai village, whereas Irkaswa was a larger village (501 households) (Monduli District Council, unpubl.) consisting mostly of Maasai (n≈70%) and other tribes (Waarusha and Chaga) and served as a market centre for three surrounding villages. Each village had a village council consisting of an elected village chairman, a village executive officer appointed by the Monduli District Council, and 25 community members elected to the council.

## Methods

### *Community interviews*

Interviews were conducted in October and November 2000 in the two villages adjacent to the corridor, Kitendeni and Irkaswa. In Kitendeni, three distinct groups were interviewed, the village chairman and executive officer, and a village women's group and a village men's group not on the council. In Irkaswa, two groups were interviewed, the village chairman and executive officer, and a combined group of village men and women who were not on the council.

After explaining the purpose of the interview to various groups, each group member was individually interviewed. Following Maasai custom, a woman interviewed the women in Kitendeni, whereas a man conducted the individual interviews for all other group members. Each interviewee was asked a series of questions about their background, wildlife conflicts in their village and attitudes towards elephants (Table 1). All interview questions were asked in Kiswahili, translated into Maasai, and responses again translated back into Kiswahili for recording. Individual interviews lasted 20–60 minutes. Responses to the background questions (Table 1, section A) were not used in the analyses because of small sample sizes.

### *Hilltop surveys*

From December 2000 to May 2001, systematic observations were made simultaneously from the Kitashu and Kilima Nyuki hilltops by six observers who recorded numbers of elephants within the corridor during a 7-hour period (0730 to 1230 hrs and 1500 to 1700 hrs) for 3–5 continuous days per month. Observations stopped during observation periods when moderate to heavy rain and fog limited visibility. Using 12 x 50 mm binoculars, the hilltop vantage points provided observers complete views of the corridor from the forest border at Kilimanjaro NP north to the international border, and extending across the corridor to the ridgeline. We reduced the potential for multiple counts of the same herd during a day's observation period by having simultaneous observations from each hilltop, and subsequently comparing times of herd observations, herd size and unique ear and tusk characteristics of individuals within each herd. Further, the ridge running along the midline of the corridor also prevented observers from seeing across the entire width of the corridor, thereby reducing the potential for duplicate herd counts. Vegetation within the corridor limited our ability to determine herd structure consistently, especially the young elephants. Further, we could not always distinguish between individual herds during the monthly 3–5 day observation periods. Thus, we used the maximum count of elephants recorded during a single observation day for each month.

Table 1. Questions for respondent background, wildlife conflict, and attitudes about elephants used in interviews in Kitendeni and Irkaswa villages in northern Tanzania, October/November 2000

A. Background of respondent
   1. How many people in your household
   2. Age of respondent
   3. Sex of respondent
   4. Education? Primary/secondary/college
   5. Occupation?
   6. How long have you lived in this village?

B. Wildlife conflicts
   1. What are the problem wildlife species in your village?
   2. What problems do they cause?
   3. What crops do elephants raid?
   4. Why are the elephants here?
   5. Where do the elephant's come from?

C. Attitudes about elephants
   1. To what degree do you agree or disagree with the following statements:
      (strongly agree, agree, no opinion, disagree, strongly disagree)
      a. Elephants are a nuisance and should be kept away
      b. Elephants are a nuisance but they attract tourists
      c. Elephants should be left to roam free
      d. There are two many elephants
      e. Elephants should be killed to reduce the numbers

## Results

### *Community interviews*

We interviewed 15 people in Kitendeni (11 men, 4 women) and 20 in Irkaswa (15 men, 5 women). Although six species were identified as problem wildlife in the two villages—bush pig (*Potamochoerus larvatus*) (n=2 respondents), bushbuck (*Tragelaphus scriptus*) (n=1), southern eland (*Tragelaphus oryx*) (n=1), African buffalo (*Syncerus caffer*) (n=1), elephant (n=25), spotted hyena (*Crocuta crocuta*) (n=1)—respondents considered elephants the major problem wildlife species. Crop-raiding was the most frequent conflict caused by wildlife cited by respondents (n=29), while one respondent cited goat predation. Maize was the most frequently raided crop by elephants (n=21) with beans

(n=8), wheat (n=1) and potatoes (n=1) raided less frequently. Seventeen of the respondents in the two villages indicated that elephants primarily occurred near their villages from November–July. Respondents indicated that elephants used the area as a corridor (n=12), feeding area (n=11), because food (n=6) and water (n=2) were available, or to escape ants and tsetse flies (n=4). All respondents believed that elephants in their villages were coming from Amboseli NP (n=19) or Kilimanjaro NP (n=15), except one respondent who didn't know.

All respondents from Kitendeni (15/15) and 19 of 20 from Irkaswa disagreed with the statement that 'elephants are a nuisance and should be kept away'. For Kitendeni, 14 of the 15 respondents agreed/strongly agreed with the statement that 'elephants are a nuisance but attract tourists', and one respondent strongly disagreed with this statement. Similarly, 16 of the 20 respondents in Irkaswa strongly agreed/agreed with this statement, while four disagreed/strongly disagreed. All but one respondent from the two villages disagreed/strongly disagreed with the statement that 'elephants should be left to roam free'. Most of the respondents in both villages disagreed/strongly disagreed with the statement that 'there are two many elephants', and three agreed with that statement in Irkaswa and two stated 'they don't know'. All of the respondents in both villages disagreed/strongly disagreed with the statement that 'elephants should be killed to reduce the numbers'.

### *Hilltop surveys*

Thirty-nine elephant herd observations (n=29 breeding, n=10 bull) occurred within the corridor during 24 observation days for the 6-month observation period, but there was much variation in numbers of elephants observed on a single day, ranging from 3 to 55. Both breeding and bull herds occurred in the corridor from December to May, but bull herds predominated in mid May at the beginning of dry season. Maximum daily number of elephants (n=55) occurred in March, and the lowest in December (n=20) and May (n=23) (Table 2). Based upon maximum daily number observed per month, typically more elephants were observed from Kitashu (=21.5, SD=3.4, n=6) than the Kilima Nyuki ( =12.5, SD=10.9, n=6) hilltop for the 6-month observation period, but this difference was not significant (t=1.93, df=6, P=0.102).

Table 2. Maximum daily number of elephants observed per month from two hilltops within the Kitendeni Corridor in northern Tanzania from December 2000 - May 2001

| Month (n=obs. days) | Kitashu | Kilima Nyuki |
|---|---|---|
| December (5) | 18 | 2 |
| January (4) | 26 | 4 |
| February (4) | 22 | 19 |
| March (3) | 25 | 30 |
| April (3) | 20 | 15 |
| May (5) | 18 | 5 |

## Discussion

Crop-raiding by elephants was the most serious wildlife problem for the two villages—most likely because of the close proximity of the corridor to the villages and its high use by elephants as reported during interviews. Maize was the crop most frequently raided by elephants because it is the most extensively grown crop in the two villages, similar to other human-elephant conflict studies in southern Kenya (Sitati et al. 2003) and southern Tanzania (Malima et al. 2005).

Despite the extensive problems that elephants had caused in villages, respondents did not believe that elephants should be kept away; however, they did not want elephants to roam freely in their villages. This positive attitude towards elephants may be related to the perception of respondents that elephants bring tourists to their villages. Although there is no evidence to indicate that these two villages directly benefited from tourism, community conservation programmes sponsored by Tanzania National Parks in both communities may have influenced their attitudes linking elephants and tourism. Further, we believe that reports of monetary benefits of wildlife and tourism in another nearby Maasai community (Sinya Mine) may have influenced this attitude. In contrast to the problems that elephants caused in both communities, most of the respondents did not believe that there were too many elephants, and none of the respondents wanted elephants killed to reduce their numbers.

Our hilltop surveys and interviews confirmed that elephants extensively utilized the corridor between the two villages, especially during the wet season, and respondents believed that the elephants in the corridor came from Amboseli or Kilimanjaro NPs. Although our hilltop surveys were conducted primarily in the wet season, respondents in the interview confirmed that elephants occur within the corridor during the wet season and part of the dry season. We believe that clay soil conditions in the lowlands of southern Kenya may discourage elephants from using these lowland areas during the wet season. Thus, elephants move up into the corridor where soils are better drained, and there is extensive scrub and woodland vegetation, providing abundant forage and cover from human disturbance. Further, human disturbance within the corridor is reduced during the wet season when the Maasai move their herds further west out of the corridor into open woodlands where grass is more abundant. Typically, Maasai herds return to the corridor during the dry season when grass diminishes in lowland plains and woodlands. Although vegetation is still available for elephants to browse during the dry season, water in the two streams is typically limited to small pools by mid-May; thus elephants begin moving out of the corridor. They move into the lowland plains and woodlands to the west where there are seasonal pans with water and north into Amboseli NP where there are permanent swamps with water. Elephants may use the corridor beyond July, but may be less noticed because of their lower numbers and absence of crop-raiding; all crops are harvested by this time.

The occurrence of more herds on the Kitendeni side of the corridor was likely due to several factors. First, the only permanent water available within the corridor was the artificial water point on the western side of the corridor (Fig. 1). This water point provided a reliable water source for elephants, especially during the dry season when there was no water in the two intermittent streams in the corridor. Further, the larger Kitendeni stream forms the western border of the corridor and water persisted longer into the dry season than for the smaller Olkeju-Loorgum stream along the eastern border of the corridor. The occurrence of two traditional elephant trails, one from Sinya Mine and the other from southern Kenya, converged on the west side of the corridor about 1.5 km south of the Kenya-Tanzania border (Fig. 1). This trail continues up the western side of the corridor to the artificial water point, extending to the forests of Kilimanjaro NP. Levels of human disturbance were probably higher on the eastern side of the corridor. Numerous bomas (n≈20) were immediately adjacent to the eastern corridor boundary in Irkaswa Village. In contrast, only five scattered bomas and a school occurred within the western side of the corridor in Kitendeni Village. Additionally, the corridor was primarily the only place where the Maasai from Irkaswa had access to graze their cattle. However, in addition to the corridor, the Kitendeni Maasai had access to the open woodlands and grasslands to the west of their village away from the corridor to graze their cattle. Thus, their use of the corridor for grazing was reduced, thereby decreasing the potential for disturbance of elephants within the western portion of the corridor. A subsequent satellite telemetry study (Kikoti 2009) of an adult female elephant collared in the Kitendeni Corridor supports the elephant movement observations of our hilltop surveys (Fig. 2).

## Threats to the corridor

In 1989, the vegetation corridor extended for about 10 km west of Irkaswa Village when Grimshaw and Foley (1990) first visited the area. By the beginning of our study in 2000, the corridor was only 6 km wide. In this intervening decade, Irkaswa Village had expanded westward and numerous bomas and agricultural fields occurred within the eastern 4-km portion of the original 10 km-wide corridor. On the western Kitendeni side, a school and five bomas were established within the corridor. Further, in early 2001 after our hilltop surveys began, many people from Irkaswa Village (possibly as many as 200) began to mark trees, claiming plots of land within the corridor for future agricultural fields. These expanding human settlements into the corridor threatened the integrity of the remaining 6-km-wide vegetation corridor for cattle grazing and wildlife, and would result in increased human-wildlife conflicts and disturbance of wildlife. These increasing threats to the corridor were the impetus for us to initiate protective measures for the corridor.

## Establishing the Kitendeni Corridor

Establishing the Kitendeni Corridor was a multi-step process over a 1.5-year period involving local communities, government authorities and other stakeholders. Our first step was to meet with the Enduimet Division Officer to discuss the threats facing the corridor and to obtain his support and assistance in working with the two villages that owned the corridor. He arranged meetings with the chairman and

executive officers of each village.

At each meeting typically only a few (often the most influential) of the participants would arrive at that time, and participants would continue to arrive over a three-hour period, and general conversations occurred before the formal meeting began. These informal conversations with participants were critically important because 1) they helped us to identify the most influential participants and many of the key issues that would arise later in the formal meeting; 2) 'got to know' people so that they were more likely to express their views in front of a 'stranger' during the formal meeting later; and 3) reduced misconceptions and reassure participants' concerns that their 'land would not be taken away' or 'the government would limit the use of their land'.

During the first meeting in each community, village leaders were asked about the importance of the corridor to the community and threats to the area. There were upwards of 400 people at one of the early meetings. Having food available at the end of every meeting encouraged people to attend and stay at meetings until the end. Another important meeting strategy was to have separate question and answer segments so that committee members could be better assisted in responding to concerns posed during the question segment. This process was critically important to avoid the perception that this was a meeting controlled by an 'outsider' not the village authorities.

The village leadership in each of the communities recognized that expansion of bomas and agricultural fields, as well as burning and tree-cutting, were threats to their cattle-grazing activities and to wildlife use of the area. With these threats acknowledge by the village leadership, additional village meetings were called to discuss the issue. At the village meetings, the people of Kitendeni recognized the importance of the corridor for cattle-grazing, wildlife and medicinal plants and the threats of human settlement; they wanted to find permanent solutions to these threats. Similarly, most of the community members in Irkaswa recognized the importance of the area and the threats to it, but several community members (n≈15 people) argued that the village had no room to expand and

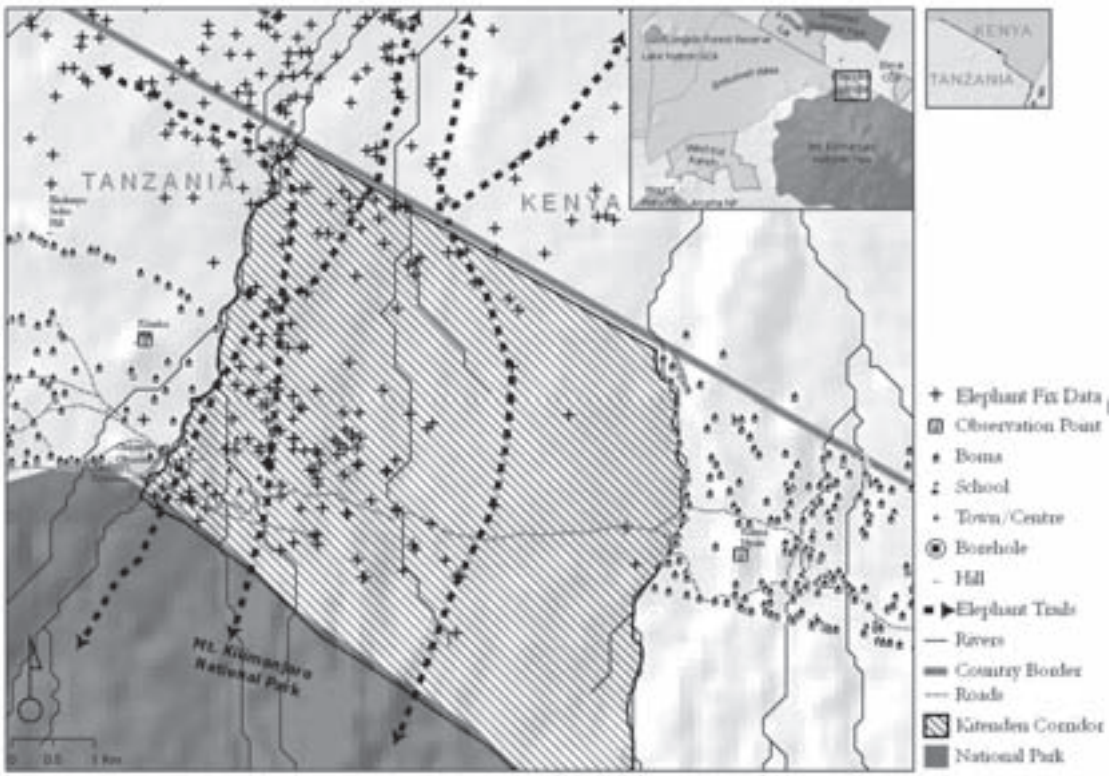


Figure 2. Locations of a satellite-collared adult female elephant in Kitendeni Corridor and southern Kenya from 6 November 2006 to 1 July 2008 (Kikoti 2009).

this area was needed for settlement and agriculture.

To build stronger consensus in the Irkaswa community for protecting the corridor, the Kitendeni Village leadership agreed to attend a village meeting in Irkaswa to discuss why they believed it was important to protect the area. This meeting served to reduce the number of people who opposed protecting the area, and in the end about five people out of the community of over 500 households still opposed protective measures. However, the Irkaswa community decided to continue with efforts to protect the area despite this small opposition.

Another critical element that played a pivotal role in building community support for the corridor began when we first initiated the research project, almost a year and a half before the first village meetings on the corridor. Without a strong, trusting relationship with the village elders developed over these early years, it would have been impossible to obtain the support and approval of the local communities to protect the corridor.

Once both communities agreed with the need to protect the corridor, a task force committee was formed, consisting of five representatives from each village, the division officer, the district game officer and the field researcher (A. Kikoti). This task force created a report that documented the threats to the corridor and recommended designation of a 5 km-wide corridor (2881 ha) and what activities should be permitted within it—including livestock grazing, medicinal plant collection and firewood collection of dead wood only. Villagers collecting honey would be required to obtain a permit, which was done in an effort to reduce the incidence of wildfires that can result from untended fires used during honey collection. No settlement would be allowed, including temporary bomas. The task force also recommended that five bomas in the corridor and the Kitendeni School be relocated. Although the school was not within the proposed 5 km-wide corridor, it was located 600 m west of the proposed corridor border and 70 m south of the artificial water point. This proximity to the corridor and the water point that is used extensively by elephants posed a great risk to the students and staff.

The draft corridor management plan was presented as a workshop, one in each community. Following minor revisions, the plan was submitted to the Ward Development Committee. Although several members of the task force also served on the Ward Development Committee, many other stakeholders were on the committee, including village and natural resource authorities, the head teacher from the Kitendeni School, private landowners, representatives from tour operators and non-governmental organizations. After minor revisions, the committee approved the plan and forwarded the plan to the Monduli District Council.

The district council sent their technical staff into the field to confirm the details of the report; for example, they verified that there was support for the plan in the two villages. They also requested assistance from the villages to survey and demarcate the corridor. The boundaries of the corridor were surveyed and a map prepared for district council review. Upon approval by the district council, the mapped boundaries were confirmed again at village meetings, after which the district council installed survey beacons along the boundaries of the corridor. A final district council report was developed justifying the establishment of the corridor and documenting the survey points, and sent to the National Land Commission for final approval.

The commission then sent a technical team to verify the report received from the district council to confirm the boundaries and reconfirm that villagers were aware of the corridor designation. Although the proposal had been submitted to the land commission as the Kitendeni Wildlife Corridor, there was no provision under the Wildlife Act of Tanzania of 1974 to establish a 'wildlife corridor'. Thus, in October 2002, the corridor was registered by the land commission as a 'farm' where the only allowable activities were defined by the corridor management plan developed by the task force and accepted by the communities.

Following designation by the land commission, people living in the five bomas within the corridor were given land elsewhere within the village and time to establish their new bomas. The Tanzania National Parks, Monduli District Council and other stakeholders provided funds to build and furnish a new school away from the corridor. After these relocations, the corridor was expanded by an additional 178 ha to include the area around the artificial water point and former school. Since its designation in 2002, local game scouts from the villages regularly patrol the corridor for unauthorized activities. This monitoring and strong resolve of both communities to enforce the provisions of their corridor management plan are critical for protecting the integrity of Tanzania's first wildlife conservation corridor.

## Acknowledgments

We gratefully acknowledge the support of the U.S. Fish and Wildlife Service African Elephant Conservation Fund, African Wildlife Foundation (AWF), Tanzania National Parks, Tanzania Wildlife Research Institute, Tanzania Wildlife Department and Tanzania Land Commission. Kilimanjaro NP's Mr Mafulu, Chief Park Warden, and Mr Ole Meikasi, Community Conservation Warden, contributed much logistical support. The eventual designation of the corridor would not have been possible without the support of many staff from the Monduli District Council, especially Mr Kihato, former District Commissioner; Mr Mawanja, District Game Officer; Mr Lwambano, surveyor; and Mr. Kombo, Land Use Officer. AWF staff provided critical assistance, especially J. Kahurananga, AWF's former country representative for Tanzania, and Mr Katabaro, former Senior Finance and Administration Officer. Foremost, thanks go to Mr Kitashu, Chairman of Kitendeni Village; O. Saitabau, former Chairman of Irkaswa Village; N. Bendera, former Irkaswa Village Executive Officer; Kitendeni game scouts (S. Ole Nasalei, Kidemi Ketikai and Saitoti Lembalai); and the village councils in both communities. Finally, we wish to thank the village elders. Without their wisdom, commitment to and love for their communities, designation of Tanzania's first wildlife conservation corridor would not have been possible.

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# RHINO NOTES

## Camera trapping as a method for monitoring rhino populations within the Waterberg Plateau Park, Namibia

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### Abstract

For species with unique markings, camera trapping has been used as a non-invasive method for generating population estimates and monitoring the fate of particular individuals. Rhinos—both black (*Diceros bicornis*) and white (*Ceratotherium simum*)—have unique horn sizes, shapes and scarring, making camera trapping a monitoring technique that could be useful. Over a 7-week period during 2006 in the Waterberg Plateau Park (WPP) in Namibia, we obtained 125 photos of rhinos from 11 camera stations during 545 camera nights, about half of which were useful in identifying 18 individual black rhinos and 13 white rhinos. Additional coverage of the Park could lead to more complete counts that would complement ongoing monitoring efforts.

**Key words:** camera trapping, monitoring, black rhino, white rhino, Namibia

### Résumé

Pour des espèces ayant des marques uniques, le piégeage photographique a été utilisé comme une méthode non envahissante pour produire des évaluations des populations et surveiller la situation des individus particuliers. Les rhinocéros noirs (*Diceros bicornis*) et blancs (*Ceratotherium simum*) ont la taille des cornes, des formes et des marques uniques, rendant le piégeage photographique une technique de surveillance qui pourrait être utile. En 2006, sur une période de sept semaines nous avons obtenu 125 photos de rhinocéros de 11 stations photographiques pendant 545 nuits de photographie au Parc du plateau de Waterberg en Namibie, dont environ la moitié servait à identifier 18 différents rhinocéros noirs et 13 rhinocéros blancs. Une couverture supplémentaire du parc pourrait mener à des comptages plus complets qui compléteraient les efforts de surveillance en cours.

## Introduction

Developing cost-effective techniques for conducting surveys of endangered species is a conservation priority. Several techniques have been developed for non-invasively monitoring populations of uniquely identified individuals through camera trapping and genetics (Woods et al. 1999, Karanth and Nichols 2002, Trolle et al. 2008). Since both black (*Diceros bicornis*) and white rhinos (*Ceratotherium simum*) are species of concern (Linklater 2003)—and can be identified individually through horn size, shape and scarring (Berger and Cunningham 1998)—camera trapping surveys may be useful for monitoring individuals over time and assessing the effectiveness of ongoing anti-poaching activities (Jackson et al. 2006).

In this analysis, we focus on the rhino populations within the Waterberg Plateau Park (WPP) in north-central Namibia. These populations have been monitored since their release through anti-poaching patrols and annual 48-hour waterhole counts. As part of this monitoring effort, rhinos have been ear notched, but this practice was terminated in recent years as the result of a lack of funds. Since the WPP is a closed population where long-term monitoring efforts are ongoing, it is a logical location in which to assess camera trapping as a technique for rhino monitoring. Although we discuss the utility of this method for estimating populations, we do not report estimates here due to the sensitive nature of rhino conservation in the region.

### *Study area*

The WPP, located in north-central Namibia (S20.46133, E17.20812), is a 470 km$^2$ area that was established in the 1970s for the protection of large herbivore species, including black and white rhinos (Schneider 1998). The plateau is characterized by 200–m high sandstone cliffs with deep sands on top. Average annual rainfall is between 400 and 500 mm (Mendelsohn et al. 2002), with most ground water seeping into underground springs that feed groundwater wells on the farms along the base of the escarpment. To the north-east, the plateau levels off with surrounding farmland. There are four different vegetation zones within the WPP: fountain plant communities, rocky outcrop communities, bush savannah and mixed tree and shrub woodland (Jankowitz 1983, Schneider 1998).


Figure 1. The camera trap station locations within the Waterberg Plateau Park.

## Methods

The study area was divided into two parts—the southwestern and northeastern portions of the WPP. Eleven stations were constructed for two 7–week (52–day) study sessions during June–July and September–October 2006 (Fig. 1). The initial objective of this study was to estimate leopard abundance and therefore, camera trap stations were set to photograph them (Karanth and Nichols 2002). Each camera trap consisted of two Deercam™ film cameras (Nontypical Inc. Park Falls, WI) that took photographs when passive beam motion and heat sensors were triggered. Cameras were set, facing the trail and offset by 1 m, on opposite sides of commonly used game trails or roads. Cameras were either set level at 0.7 m or, in cases where moving vegetation could cause false trips, 1.7 m and angled down onto the path where the area was cleared of grass and branches. A scent lure was placed between the two camera traps to attract animals to the site. It is unclear whether these lures deterred rhinos though rhinos were photographed smelling the lure.

The stations were visited every two to three days to record the number of photos taken, to determine the presence of tracks, to collect hair samples and to change film and batteries when necessary. For all camera traps, hair snare stations were set within 30 m of each other, but for six others the distance between them was set to 30–60 m. Photos of rhinos were

Figure 2. Photographs of white rhinos taken within the Waterberg Plateau Park using motion-sensor camera traps between June and October of 2006. Note the marked difference in horn size and shape between individuals.

examined and separated based on horn size, shape and unique scratches and markings. When released in the WPP, individual rhinos were ear notched and these were used when possible. The analysis was conducted by one individual unless there was confusion about particular individuals when colleagues were asked to independently review the photos for consensus.

## Results

A total of 72 black rhinos and 53 white rhinos were photographed. There were 18 individual black rhinos identified including 4 recaptured individuals and 13 individual white rhinos with 4 recaptured. For black and white rhinos, only 51% and 50% of the total photographs, respectively, were used for identification. Photographs were omitted from the analysis if they had been taken within five minutes of clearer pictures or if the camera angle prohibited an adequate visual of the horn.

## Discussion

Both black and white rhinos, being protected species, require active management, which includes intensive population monitoring. Techniques such as 48-hour waterhole counts and tracking give managers of the WPP select information that has guided management practices in the past. Our current study suggests that camera trapping could be another useful, non-invasive tool for monitoring the survivorship and health of particular individuals over time. When monitoring populations of heavily persecuted species, data on the survivorship of particular individuals could provide valuable information (Jackson et al. 2006). Camera trapping is relatively easy to learn, and after the initial investment of the camera traps (USD 100–200 per trap), the costs are reduced to that of batteries, personnel for monitoring and transport expenses such as vehicles or horses. Further, camera trapping or footprints can be used to generate population estimates using a mark-recapture model and extrapolating the estimates using home range estimates, Mean Maximum Distance Moved and Bayesian techniques depending on a priori information (McCarthy et al. 2008; Royle et al. 2009).

Although this technique has potential for use in rhino monitoring programmes, there are several limitations that could impact the effectiveness of this technique. First, camera trapping could be useful in calculating rhino population estimates in habitats where commonly used rhino trails are known. The thick vegetation of the WPP causes rhinos and other species to use roads and game pathways that are conducive to camera trapping. In other regions of Namibia, such as the Kunene or Etosha National Park, vegetation is sparse and rhino movements are not as predictable, therefore this technique may not be applicable. Second, since our survey was designed to target leopards, the rhino estimates that we calculated were below the expected numbers based on previous surveys. In future, surveys would be more effective targeting particular pathways that rhinos frequent.

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# Eighteen-month update on the movements and social organization of a population of black rhinos introduced to a new area by 'same day' free release translocation in Kenya

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## Introduction

Details of the free-release translocation of 27 black rhinos into a new area of the Ol Pejeta Conservancy in the Laikipia area of central Kenya were presented in Patton et al. (2010). The results for the first six months after release suggested that all the rhinos bar one had settled in their new environment. Research, as described below, was continued for a further 12 months to determine how the population developed as the individuals became more used to their new environment.

## Results

At day 550, the end of the reporting period, blocks J+K+L+O+P+T (Fig. 1) were the most utilized (at 77%) by 22 of the 27 rhinos (82%). Blocks Q+R+S+M+U+V were rarely utilized (at 18%) and by only 4 of the 27 rhinos (15%).

In the 18-month period, the furthest recorded distance (GPS location) from the release site averaged 8.54 km (range 4.22-14.96kms; n=27). Of the 27 rhinos, 18 moved no further than their furthest distance recorded in the first six months, while the other 9 moved a further 2.56 km (range 0.96-8.02kms; n=9).

Between 6 and 12 months of release, three rhinos made what we considered to be an important change to their centre of activity—two females and one male. Between 12 and 18 months, six rhinos made what we considered to be an important change to their centre of activity—all males.

The time taken for the rhinos to settle is shown in Table 1 and varied between one and 510 days (mean 351 days, n=27) with one rhino


Figure 1. Ol Pejeta Conservancy sector map highlighting where inner fences were removed.

Table 1 Movement of rhinos into new areas prior to settling

| No. of changes | No. of rhinos | Time taken to settle (days) | Mean |
|---|---|---|---|
| 0 | 6 | 1, 1, 15, 32, 71, 351 | 78 |
| 1 | 6 | 122, 190, 243, 272, 400, 507 | 289 |
| 2 | 7 | 191, 214, 236, 359, 381, 438, 448 | 324 |
| 3 | 3 | 269, 475, 510 | 418 |
| 4 | 3 | 389, 450, 457 | 432 |
| 5 | 1 | 431 | 431 |
| 6 | 1 | 483 | 483 |

Table 2 Interactions recorded during the research period

| Interaction sexes | 0-18m | % | 0-6m | % | 7-12m | % | 13-18m | % |
|---|---|---|---|---|---|---|---|---|
| Male/male | 145 | 30 | 18 | 18 | 42 | 20 | 85 | 47 |
| Female/ female | 4 | 1 | 0 | 0 | 1 | 0 | 3 | 2 |
| Male/ female | 337 | 69 | 82 | 82 | 162 | 80 | 93 | 51 |
| TOTAL | 486 | | 100 | | 205 | | 181 | |

changing its area of activity six times before settling.

### *Interactions*

Table 2 shows the interactions, where two rhinos were sighted at the same location at the same time, recorded over the 18-month period of the research.

## Discussion

Most of the blocks favoured in the first 6 months of the research continued to be so for the next 12 months when blocks L and T, further to the west of the new area, were favoured over blocks M and N. The least utilized blocks were in the far west of the Conservancy, some distance from a release site. These blocks contained equally good habitat for the black rhinos as the favoured blocks. This suggests that the translocated rhinos neither had desire to travel away from an area they found suitable nor to explore the potential extent of their territory.

While initially block data analysis suggested that 26 of the 27 rhinos in the new area settled their ranges within 6 months of release, the longer-term data showed that 21 of the 26 rhinos changed their area of activity in later periods. The data illustrates the difficulty in definitively stating when an individual has finally settled after translocation.

Black rhinos are considered solitary animals (Patton and Jones 2008). Over the 18-month period, our results indicate a general preference for solitude with rhinos sighted alone on 77% of occasions (3352 out of 4328 times). Six individuals were alone at between 90% and 100% of their sightings, 11 at between 75% and 89% of their sightings, 7 at between 50% and 74% of their sightings with only 2 rhinos at less than 50% of their sightings. There was no observable effect of age or sex.

At the end of the 18-month research period, female rhinos were largely spread out throughout the new area. Five occupied exclusive areas with no other females present while the other four shared space in one cluster of two and one cluster of three. The picture was less clear for the males with only four showing exclusive or near exclusive spacing but the majority clustering in groups o f two, three and four. These results may simply be a reflection of the low density population—27 rhinos in 180 km$^2$ is only 0.15 per km$^2$ compared to around 0.3 per km$^2$ in the old area of the Conservancy, the former Sweetwaters Game Reserve, especially with the females.

Despite the close spacing and sharing of territories of the males, there were only three observed male fights. It is not possible at this early stage of the research to determine whether this arrangement demonstrates a system of territorial breeding males tolerating non-breeding males within their territory or whether all males were potential breeding males but were not territorial tolerating the presence of other breeding males within the same space but not often meeting as shown by the limited number of recorded interactions—145 male/male out of 2858 male sightings (5%).

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# Sighting of a rhinoceros in Upper Myanmar in 1996

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The northern part of Myanmar is within the known historical range of the Sumatran rhinoceros (*Dicerorhinus sumatrensis*). The animals were seen occasionally in these remote areas and some sightings were reported in the 1950s (Tun Yin, 1954, 1956). The rhinos in this mountainous habitat are notoriously elusive, often climbing a high mountain merely to go down the other side (Hubback 1939). Rabinowitz (2002) saw no trace of rhinos on his journey to the region of Mt. Hkakabo Razi in the far north of Myanmar bordered by India, Tibet and China. Some 350 km further south, in the Tamanthi Wildlife Sanctuary, Upper Chindwin District, rhino tracks were recorded in 1991 despite the fact that at least nine animals were poached here during the 1980s (Rabinowitz et al. 1995). It is still estimated that '6–7+' rhinos exist in Myanmar (Foose and van Strien 1997). For that reason, any recent sighting is worth recording, especially from the border areas, which are closed to researchers due to insurgent activity.

One day in 1996, Colonel Ian John Travis (born 1953 in New Zealand) visited a small village of the Kachin people in the north-central part of Myanmar. It was located between the Nmai-Hka and Mali-Hka Rivers, at about 27ºN 97ºE. The villagers were keeping a small rhinoceros in a makeshift enclosure. Travis was told that the rhino just showed up one night, was caught, and then kept for a period of two to three months. During this time the animal became quite tame, the villagers petting and feeding it, in general treating it like a pet cow. It grew somewhat during the time it was with the villagers, and eventually the rhino was released into the forest.

There is no doubt that the animal was a rhinoceros. Travis took at least one photograph that ELK has seen. When we recently tried to retrieve this rare piece of evidence, we learned that Travis was murdered near his home in Bangkok on 28 February 2002. His possessions were scattered and our efforts to trace the photograph have been unsuccesful. Still, the possibility of a small tame rhino in a remote Karen village, in a period when the rhinoceros in Myanmar is close to extinction, is worth placing on record.

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# A sketch of a white rhinoceros from John Campbell's expedition 1821

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In the November issue of the Calcutta Journal of Politics and General Literature, a correspondent who called himself EKALBB wrote a letter about Campbell's rhinoceros. In 1820, John Campbell (1766–1840) travelled from Cape Town to the small town of Mashow (north of the current Zeerust) as Director of the London Missionary Society. His hunters shot two rhinos six miles to the east of the town on 18 May 1820. When the head of one of these animals was brought to Campbell, he saw that it was different from other rhinos, having a straight horn projecting three feet from the forehead and a short horny substance of eight-inches representing the posterior horn. Campbell brought the skull with him to London, where it was widely acclaimed in both the scientific and the popular press as an African unicorn (Rookmaaker 2008). The skull was later transferred to the American Museum of Natural History in New York, where it may still be available (Heller 1913).

The pseudonymous correspondent 'Calcutta' passed the Cape of Good Hope in September 1821, just a few months after Campbell's return from the interior. Here he talked to the missionary John Philip (1775-1851), who showed him the head of a rhinoceros brought from the interior by Campbell's party. He was also shown a sketch of the animal, which he copied, and subsequently engraved for the Calcutta Journal. In the accompanying text, it is stated that the sketch was a 'faithful representation of the size and position of the horns as corresponding with the skull' seen in Cape Town. The dimensions of the body of the animal were said to be as follows:

> From the point of the larger horn to the root of the tail—12 feet
> Height to the withers—6 feet
> From the back to the lower part of the belly—4 feet 3 inches
> Circumference of the thickest part of the body—12 feet 9 inches.
> There are also some dimensions written on the plate, in feet and inches: length of anterior horn along the curve 2–3, anterior horn in straight line 1–9, length of posterior horn along curve 0–2.5, distance from tip of anterior to tip of posterior horn 1–5, distance from tip of anterior horn to shoulder 3–2, length of head 3–5.

It is worth reproducing the plate from the Calcutta Journal of 1822. The shape of the horns and the sizes provided on the plate differ from other representations of the head of Campbell's unicorn, so it is likely to be another animal drawn during the same expedition. The specimen clearly is a white rhinoceros (*Ceratotherium simum*) and hence is probably the first published plate of the species published since its description by William Burchell (1781–1863) in 1817.

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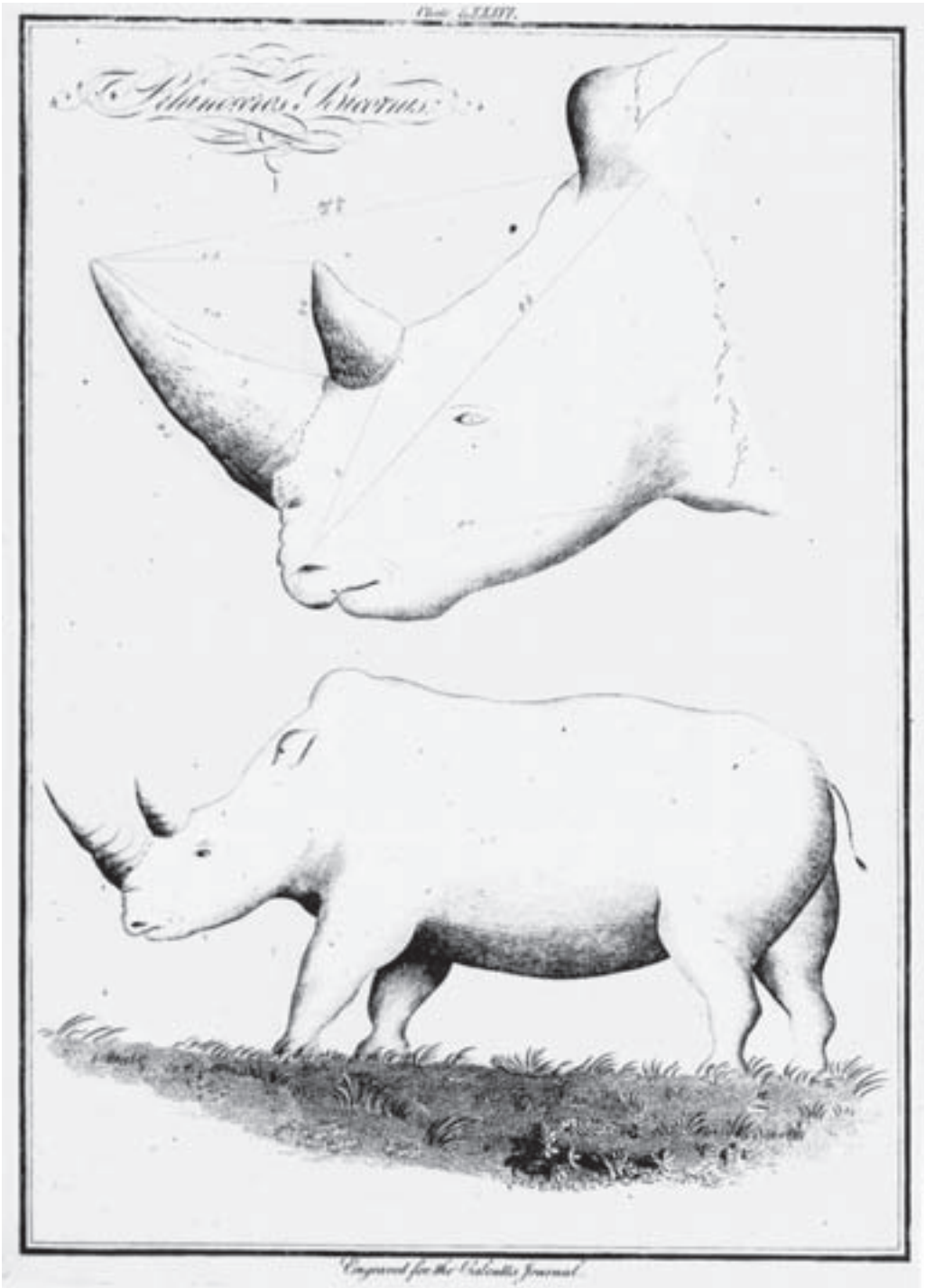

Figure 1. *Rhinoceros bicornis*, showing a rhinoceros shot in South Africa near Zeerust in 1822 by the party accompanying John Campbell. From the Calcutta Journal of Politics and General Literature of 4 November 1822.

# OPINION

## AfRSG northern white rhino strategy—an alternative view

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The reporting of the situation regarding the northern white rhino (NWR) in *Pachyderm* 45 and 46 leaves a lot to be desired as it seeks to justify the stance of the AfRSG and its selected experts. For the sake of balance, at least some of the data put forward by experts who disagree with the strategy should also be presented.

AfRSG seeks to justify intercrossing the NWR with Southern White Rhino (SWR) by maintaining that they are closely related subspecies. A recent, peer-reviewed paper published by Groves et al. (2010) re-assessed the taxonomy of the two species using new material and analytical techniques. They concluded that the two forms were morphologically and genetically distinct, warranting the recognition of the taxa formerly designated as subspecies as two distinct species. Given this, intercrossing would not be considered appropriate by many geneticists and inferred from Harley et al. in *Molecular Ecology* (2005).

Two of the recognised methods of describing whether two forms of a similar animal are a species or subspecies are based on whether they look different and whether they inhabit different, usually widely separated, areas (Groves pers. comm.). For those experienced in viewing both NWR and SWR, the differences, such as body shape and ear margins, are clear. Historically, populations of both NWR and SWR have inhabited geographically distinct and widely separated regions.

Moving the remaining four potential breeding animals from Dvůr Králové Zoo to the wild was justified by the AfRSG based on long-term data regarding the poor reproductive performance of NWRs in captivity. As in most areas of science, new knowledge can overcome problems and recent research has made marked improvements to captive rhinoceros breeding success. Long-term infertility has been found to be due to an asymmetric aging process, the onset of which can be prevented by early pregnancy (Hermes et al. 2006). If it is not possible to obtain pregnancy by natural sexual reproduction, artificial insemination can be used. Natural sexual reproduction among captive rhinos has been greatly improved by utilizing more open spaces and controlled introduction of males to females to avoid sibling type relations that occur when keeping males and females permanently together; i.e. the lack of brother–sister relationships can lead to males not breeding with females (Versteege pers. comm.).

In the *Pachyderm* 46 African Rhino Specialist Group Report, Brooks states that moving the four animals to, (hopefully reproduce in), the wild is 'probably the "last chance saloon" for northern white rhino genes'. This is not wholly the case as the use of assisted reproduction technologies (ARTs) offers an equal, if not greater, prospect of conserving NWR genes now and in the future when further advances in such technologies are likely. ARTs for rhinos such as AI (artificial insemination), in vitro fertilization and embryo transfer (ET) could include, in the future, the use of developing stem cell technology enabling even dead NWR animals to provide genetic resources. Together this could provide the genetic equivalent of what Brooks refers to as the 'four unrelated founders indicated by previous vortex modelling to be the minimum number with a reasonable chance of long-term genetic and demographic viability over a 50 year period'.

Probably the best chance of maintaining NWR genetics, developing pure NWR individuals and rapidly breeding up a new NWR population is from

ET and the use of SWR as surrogate mothers. The basic technology of ET is well understood and applied in practice in many species including humans, cattle and horses. Initial laboratory work has resulted in the successful production of in vitro white rhino embryos. With further attention to species-specific protocols, success rates could be improved. Specialists do not consider implantation of embryos a problem.

However, the application of ARTs requires sources of NWR sperm, eggs or embryos from as wide a number of sources as possible. Moving four out of the eight available NWR individuals to the wild and releasing them in large open areas has put them all but out of reach for this and of the expertise required to apply ARTs. For AI and ET, standing sedation as opposed to complete knockdown of ART recipient animals has been found to produce significant benefits over full anaesthesia but this is only practical in a captive environment. A more appropriate and far less costly and risky relocation of the four animals would have been to improve their existing facility or move them to a better captive facility in Europe, as was the recommendation at the time by the European Association of Zoos and Aquariums (EAZA 2009).

The four animals moved were acknowledged to be of the greatest conservation value, yet they were moved to the Laikipia area of Kenya where all rhino reserves were on high alert for poachers who had successfully increased their activity in many parts of Africa. The safest option may have been to have kept the rhinos in Europe where zoos have a better record of rhino security than African reserves, thus also making them readily available for ART development.

The reproductive status of the potential females for movement was only tested in 2006 by specialists using ultrasound technology uniquely developed for use in rhinos. The two that were eventually moved were found to be reproductively healthy although neither had an oestrus cycle at that time. Any time lag in obtaining a pregnancy, given the ages of the females, could be sufficient for the female to develop the reproductive problems that cause infertility. However, as could have been expected, it was not until late December 2009 that the relocation took place due to the time needed to procure the export/import permissions, obtain the high level of funding needed for the project and prepare the animals for shipment. Even then a further time lag could be expected in getting the animals to settle and then getting either of the males to breed with them. There was no updated test of reproductive performance prior to movement and it could now be several years before a pregnancy. All this time the risk of reproductive problems was and is increasing. Was this an acceptable risk with such valuable animals when a far safer alternative was available? The older male developed an intestinal tumour that would lead to a reduced lifespan. This made it essential to obtain as much of its sperm as possible before its death but moving it away from Europe made this expensive and technically more challenging.

The single donor who provided the funding for the translocation to Africa did so in order to save the NWR species. It could be considered that, for this end, the funding may have been better spent on an intra-European translocation and proposed developments in ARTs—with a potentially better chance of reaching the objective of the AfRSG members and their experts.

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# MIKE–ETIS UPDATES

## Update on the implementation of the MIKE programme in Africa

## Mise à jour sur la mise en œuvre du Programme de MIKE en Afrique

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As reported at the 15th meeting of the Conference of the Parties (CoP15, Doha, 2010), and after years of preparation, piloting and investment by donors and range States, MIKE is currently meeting its four objectives as reflected in Resolution Conf. 10.10 (Rev. CoP15) on Trade in elephant specimens (see documents CoP15 Doc. 44.2 (Rev. 1), CoP15 Inf. 40 (Rev. 1) and CoP15 Inf. 41). Firstly, the programme provided the CITES community at CoP15 with a scientifically robust, objective analysis on trends in the illegal killing of elephants in Africa and Asia from 2002 to 2009, and continues to collect relevant MIKE data. At CoP15, the Parties decided that MIKE should deliver annually updated analyses until the 16th meeting of the Conference of the Parties (CoP16), which will be held in Bangkok in 2013. The first of these updates will be presented to the CITES Standing Committee in August 2011. Secondly, the MIKE analysis elucidated that no evidence could be established for a relationship between CITES decisions and levels and trends in elephant poaching. Thirdly, MIKE maintains increasingly sophisticated databases and provides information on factors that are associated with elephant poaching to support management, protection and enforcement decision-making. In this regard, MIKE demonstrated that the Human Development Index and government effectiveness at the national level, and human population density and forest cover at the site level were the most important factors statistically associated with levels of illegal killing. And finally, MIKE undertakes comprehensive capacity building activities in African elephant range States, including helping countries to operate a new data

Comme on l'a rapporté lors de la 15ème réunion de la Conférence des Parties (CdP15, Doha, 2010), et après des années de préparation, de pilotage et d'investissement par des bailleurs et des états de l'aire de distribution, MIKE répond actuellement à ses quatre objectifs tels que reflétés dans la Résolution Conf. 10.10 (Rev. CdP15) sur le Trafic des spécimens d'éléphant (voir les documents CdP15 44.2 (Rev. 1), CdP15 Inf. 40 (Rev. 1) et CdP15 Inf. 41). Premièrement, à la CdP15, le programme a fourni à la communauté de la CITES une analyse qui était scientifiquement rigoureuse et objective sur les tendances de l'abattage illicite des éléphants en Afrique et en Asie de 2002 à 2009, et continue à rassembler des données MIKE pertinentes. A la CdP15, les Parties ont décidé que MIKE devrait fournir des analyses mises à jour annuellement jusqu'à la 16ème réunion de la Conférence des Parties (CdP16) qui se tiendra à Bangkok en 2013. La première mise à jour sera présentée au Comité Permanent de la CITES en août 2011. Deuxièmement, l'analyse de MIKE a expliqué qu'on ne pourrait établir aucune preuve pour un lien entre les décisions de la CITES et les niveaux et les tendances du braconnage d'éléphants. Troisièmement, MIKE maintient des bases de données de plus en plus sophistiquées et fournit des informations sur les facteurs qui sont associés au braconnage d'éléphants pour appuyer la prise de décisions sur la gestion, la protection et la mise en application de la loi. A cet égard, MIKE a démontré que l'Indice de Développement Humain et l'efficacité des gouvernements au niveau national, la densité de la population humaine et la couverture forestière au niveau du site étaient les facteurs les plus importants statistiquement liés aux niveaux de l'abattage illicite. Et enfin, MIKE entreprend des activités de renforcement de capacité dans des états de l'aire de distribution de l'éléphant d'Afrique, y compris l'aide aux pays pour gérer un nouvel outil de collecte et

collection and analysis tool (MIST).

In 2011, the MIKE Phase II project (2007-2011) will continue to be implemented in Africa with support from the European Commission. The following overview shows some facts and figures of the current MIKE programme in Africa, and indicates key activities that have been accomplished thus far in the course of Phase II.

On the technical front, the months following CoP15 were devoted to the development of new analytical methods to make the outcomes of MIKE analyses simpler and more reliable. Amongst them are the use of Protected Area Management Effectiveness (PAME) scores as indicators of governance at the local level; the use of a multinomial technique for the analysis of PIKE (Proportion of Illegally Killed Elephants) data, which will prevent PIKE analyses form being confounded by sudden increases in natural mortality (e.g. due to droughts). Weighting PIKE by the numbers of elephants at each site should improve PIKE as an indicator of the scale of poaching; and conducting an analysis of MIKE data for a subset of sites for which patrol-level effort data are available will test whether the PIKE indicator is biased by different levels of effort. The purpose is to allow a more refined analysis of MIKE data for presentation to the Standing Committee in August 2011. Work has also been devoted to simplifying the MIKE data requirements (both carcass and patrol data), and to a review on different options for conducting reliable and cost-effective population surveys in large forested sites.

These developments and other scientific aspects of the programme were presented to and discussed by the MIKE Technical Advisory Group at its 9th meeting held in Nairobi in December 2010 (summary minutes are available from the CITES website).

In order to provide continued supervision to the MIKE and ETIS programmes, the Standing Committee re-established its MIKE-ETIS Subgroup at its 60th meeting (SC60; Doha, 25 March 2010), composed of Botswana, the Democratic Republic of the Congo, Japan, Uganda, the United Kingdom and the United States of America. Although Mali is currently an alternate member of the Standing Committee, it was proposed by the DRC as a seventh member. In order to have better representation from Asian elephant range

d'analyse des données (MIST).

En 2011, on continuera à mettre en œuvre le projet de la phase II de MIKE (2007-2011) en Afrique avec l'appui de la Commission Européenne. La vue d'ensemble suivante donne quelques faits et chiffres sur le programme actuel de MIKE en Afrique, et indique certaines activités qui ont été accomplies au cours de la phase II :

Dans le domaine technique, les mois suivant la CdP15 ont été consacrés à l'élaboration de nouvelles méthodes analytiques pour rendre les résultats des analyses de MIKE plus simples et plus fiables. Parmi ces résultats il y a l'utilisation des points d'Efficacité de Gestion des Aires Protégées comme indicateurs de gouvernance au niveau local; l'utilisation d'une technique polynômiale pour l'analyse des données de PIKE (Proportion d'Eléphants Illégalement Tués), qui empêchera des analyses de PIKE d'être confuses par des augmentations soudaines de la mortalité normale (par exemple en raison des sécheresses); la pondération de PIKE par le nombre d'éléphants à chaque site, ce qui devrait améliorer PIKE comme un indicateur de l'échelle du braconnage; et la réalisation d'une analyse des données de MIKE pour un sous-ensemble de sites pour lesquels les données d'effort au niveau de la patrouille sont disponibles, pour tester si l'indicateur de PIKE est influencé par les différents niveaux d'efforts. Le but est de permettre une analyse plus raffinée des données de MIKE pour la présentation au Comité permanent en août 2011. On a également travaillé sur la simplification des conditions que les données MIKE doivent remplir (des données de carcasse et de patrouille), et examiné les différentes options pour mener des enquêtes de population fiables et rentables dans des sites couverts de grandes forêts.

Ces développements et d'autres aspects scientifiques du programme ont été présentés et discutés par le Groupe Consultatif Technique de MIKE lors de sa 9ème réunion tenue à Nairobi en décembre 2010 (le compte rendu sommaire est disponible au site Internet de la CITES).

Afin de fournir une supervision continue aux programmes de MIKE et d'ETIS, le Comité Permanent a rétabli son sous-groupe de MIKE-ETIS lors de sa 60 ème réunion (SC60; Doha, le 25 mars 2010), composé du Botswana, de la République Démocratique du Congo, du Japon, de l'Ouganda, du Royaume-Uni et des Etats-Unis d'Amérique. Bien qu'actuellement le Mali soit un membre remplaçant du Comité permanent, il a été proposé par la RDC en tant que septième membre. Afin d'avoir une meilleure représentation des états de l'aire de distribution des éléphants d'Asie, la Thaïlande a plus

States, Thailand later agreed to become the eighth member of the Subgroup. Uganda was nominated Chair of the MIKE-ETIS Subgroup and Botswana Vice-Chair. The work of the Subgroup has been moderated by the MIKE Central Co-ordination Unit since CoP15.

The CITES Secretariat convened the third African Elephant Range States meeting in Nairobi from 1 to 3 November 2010. The meeting was organized by the Secretariat's MIKE CCU and attended by representatives from 35 of the 37 African elephant range States. The meeting provided updates of the MIKE and ETIS programmes, informed the African elephant range States about the outcomes of CoP15 concerning elephants, reviewed the relevant CoP15 Decisions and discussed their implementation by range States and others, and highlighted a number of new and emerging elephant conservation issues such as the impacts of trade in elephant meat. During the meeting, much attention was paid to the establishment of an African Elephant Fund to support the implementation of the African Elephant action plan [Decision 14.79 (Rev. CoP15)] and the revision of Resolution Conf. 10.10 (Rev. CoP15) [Decision 15.74]. Summary minutes of the meeting are available from the CITES website.

The current phase of the MIKE programme in Africa comes to an end in December 2011. However, in order to fulfill the Parties' instructions agreed to at CoP15 and provide the information expected by the CITES community, the programme will need to continue at least until CoP16. This will also allow the MIKE programme to continue its current drive for technical innovation and simplification, outreach to stakeholders and increasingly successful capacity building activities.

Furthermore, for a long-term monitoring and capacity building programme such as MIKE, continued, uninterrupted support and strong commitments from countries to allocate the necessary financial and staff resources to implement the scheme are of the utmost importance. The unique objectives of MIKE, whereby over 80 sites in Africa and Asia are required to collect information on elephants in a similar manner so that trends can be analysed and management advice established, imply that all participating countries move forward in as synchronized a manner as possible. A number of sites and countries

tard accepté de devenir le huitième membre du sous-groupe. L'Ouganda a été nommé Président du sous-groupe de MIKE-ETIS et le Botswana Vice-président. Le travail du sous-groupe a été modéré par l'Unité Centrale de Coordination de MIKE depuis la CdP15.

Le Secrétariat de la CITES a organisé la troisième réunion sur les éléphants d'Afrique à Gigiri, au Kenya, du 1 au 3 novembre 2010. La réunion était organisée par le Secrétariat du l'UCC de MIKE et suivie par des représentants provenant de 35 des 37 états de l'aire de distribution de l'éléphant d'Afrique. La réunion a fourni des mises à jour des programmes de MIKE et d'ETIS, a communiqué aux états de l'aire de distribution de l'éléphant d'Afrique les résultats de la CdP15 relatifs aux éléphants, a discuté les décisions pertinentes de la CdP15 et leur mise en œuvre par les états de l'aire de distribution et les autres, et a mis en exergue un des questions émergentes sur la conservation de l'éléphant telles que les impacts du trafic de la viande d'éléphant. Lors de la réunion, on a beaucoup parlé de la création d'un Fonds pour l'Eléphant d'Afrique qui soutiendrait la mise en œuvre du Plan d'action pour l'éléphant d'Afrique [Décision 14.79 (Rev. CdP15)] et la révision de la Résolution Conf. 10.10 (Rev. CdP15) [Décision 15.74]. Le compte-rendu sommaire de la réunion est disponible au site Internet de la CITES.

La phase actuelle du programme de MIKE en Afrique se termine en décembre 2011. Cependant, afin d'accomplir les instructions convenues à la CdP15 et fournir des informations auxquelles la communauté de la CITES s'attend, le programme devra continuer au moins jusqu'à la CdP16. Cela permettra également au programme de MIKE de continuer ses efforts actuels en faveur de l'innovation et la simplification techniques, les contacts avec les intervenants et les activités de renforcement de capacité de plus en plus réussies.

En outre, pour un programme de surveillance et de renforcement de capacité à long terme tel que MIKE, un appui continu et ininterrompu et des engagements forts des pays pour allouer des ressources financières et en personnel nécessaires pour mettre en œuvre le plan sont primordiaux. Les objectifs uniques de MIKE, selon lesquels plus de 80 sites en Afrique et en Asie collectent des informations sur des éléphants de la même manière pour qu'on puisse analyser les tendances et établir des conseils de gestion veulent dire que tous les pays participants avancent de façon aussi synchronisée que possible. Un certain nombre de sites et de pays suivent comme il faut les pratiques de MIKE, mais une mise

are fully absorbing MIKE's practices, but consistent implementation of MIKE throughout Africa and Asia will remain dependent on targeted external funding over the next coming years, particularly in regions that experience high political instability and have major governance problems.

Therefore, much attention will be paid to ensuring that the programme can remain vibrant and productive until CoP16 or beyond. Importantly, the African elephant range States, at the Third African elephant meeting, expressed general support for the continuation of MIKE and ETIS, and called upon the European Commission to continue its support for MIKE beyond 2011.

en œuvre consistante de MIKE partout en Afrique et en Asie continuera à dépendre du financement externe ciblé au cours des prochaines années, surtout dans les régions qui éprouvent une instabilité politique élevée ou de graves problèmes de gouvernance.

Par conséquent, il faut veiller à ce que le programme reste vibrant et fructueux jusqu'à la CdP16 ou au-delà. Mais surtout, les états de l'aire de distribution de l'éléphant d'Afrique, ont exprimé leur soutien général pour la continuité de MIKE et d'ETIS, lors de la troisième réunion sur l'éléphant d'Afrique, et ont invité la Commission européenne à continuer son appui à MIKE au-delà de 2011.

| Indicator | Total |
|---|---|
| Number of African elephant range States implementing MIKE | 29 (+ Ethiopia since 2010) |
| Number of MIKE sites | 58 (+ Ethiopia since 2010) |
| Area of 58 MIKE sites | 519,900 km² |
| Number of elephants in 58 MIKE sites | 277,100 |
| Number of carcasses recorded (up to end of 2009) | 6264 |
| Number of illegally killed elephants recorded (up to end of 2009) | 2479 |
| Number of rangers involved in MIKE | 4513 |
| Number of rangers trained in MIKE methods | 742 |
| Number of population surveys conducted with assistance from MIKE | 9 |
| Area covered by MIKE population surveys | 106,110 km² |
| Number of training events held | 52 |
| Number of Subregional Steering Committee meetings held | 12 |
| Number of site visits by SSOs | 98 |
| Number of computers installed and GPS units deployed | 90 |
| Number of sites where MIST is being deployed (various stages of progress) | 50 |

# ETIS update number four: Progress in the implementation of the Elephant Trade Information System (ETIS)

# Mise à jour numéro quatre d'ETIS: Progrès dans la mise en œuvre du Système d'Information sur le Trafic d'Eléphants (ETIS)

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To augment the ETIS analytical report presented at the 15th meeting of the Conference of the Parties to CITES (CoP15, Doha, Qatar, March 2010), TRAFFIC produced individual ETIS Country Reports for 170 CITES Parties and their dependent territories, plus all non-CITES Parties represented in the database. This marks the seventh occasion whereby the ETIS data has been distributed to the Parties so that the authorities in each country have had the summary details of every single elephant product seizure case that relates to them. These reports were sent electronically to the CITES Secretariat on 4 August 2010, but TRAFFIC was informed that they were subsequently distributed to the Parties by the Secretariat in late October 2010.

The reports cover the time period from 1 January 1989 through 28 February 2010 and include a summary of all data received and entered into ETIS during this 21-year period. In addition, for the second time, ETIS prepared and distributed a two-page country-specific summary analysis of the ETIS data for all African and Asian elephant range States, as well as any other country that was identified in the cluster analysis of the ETIS data presented at CoP15 (see CoP15 Doc. 44.1 Annex, Monitoring of Illegal Trade in Ivory and other Elephant Products). CITES Parties are requested to vet the data and come back to TRAFFIC with any corrections or additions to the information captured for individual seizure cases. They are further encouraged to contact those countries that are identified as part of the trade chains of illicit ivory transactions to develop collaborative law enforcement strategies for future consideration. Although this periodic provision of the ETIS data

Pour améliorer le rapport analytique d'ETIS présenté lors de la 15ème réunion de la Conférence des Parties à la CITES (CdP15, Doha, Qatar, mars 2010), TRAFFIC a produit des rapports particuliers ETIS sur des pays pour 170 Parties à la CITES et leurs territoires dépendants, plus toutes les non-parties à la CITES représentées dans la base de données. Cela représente la septième occasion dans laquelle les données ETIS ont été distribuées aux Parties pour que les autorités dans chaque pays aient des détails récapitulatifs de chaque cas de saisie de produits issus des éléphants qui s'y rapporte. Ces rapports ont été envoyés électroniquement au Secrétariat de la CITES le 4 août 2010, mais TRAFFIC a été informé qu'ils avaient été distribués par la suite aux Parties par le Secrétariat fin octobre 2010.

Les rapports couvrent la période allant du 1er janvier 1989 jusqu'au 28 février 2010 et comprennent un résumé de toutes les données reçues et saisies dans ETIS au cours de cette période de 21 ans. En outre, pour la deuxième fois, ETIS a préparé et distribué une analyse sommaire spécifique de deux pages par pays, des données d'ETIS pour tous les états de l'aire de distribution des éléphants d'Afrique et d'Asie, ainsi que tout autre pays qui était identifié dans l'analyse de groupement des données d'ETIS présentées à la CdP15 (voir Annexe du docu 44.1 de la CdP15, Contrôle du trafic illégal d'ivoire et d'autres produits issus d'éléphant). On demande aux Parties à la CITES de vérifier les données et renvoyer à TRAFFIC toutes les corrections ou additions aux informations saisies pour les différents cas de saisie. On les encourage en outre à entrer en contact avec ces pays identifiés en tant qu'éléments des chaînes des transactions illicites d'ivoire afin de développer des stratégies de collaboration pour l'application de la loi pour un examen futur. Bien que cette provision périodique des

to the Parties is not a requirement of Resolution Conf. 10.10, in the interest of transparency and accountability, TRAFFIC regards this feedback as a vitally important component of ETIS' operation.

In terms of data collection, the fifth annual data exchange of elephant product seizures between the World Customs Organization (WCO) and TRAFFIC took place in August 2010. This annual event takes place under the auspices of the Memorandum of Understanding between the WCO and the CITES Secretariat that came into force in October 2006. In this regard, elephant product related seizure data held in the Customs Enforcement Network are provided to ETIS, whilst seizure records that come directly to ETIS that are made by customs authorities are given to the WCO for inclusion in their tracking system. In the recent round of exchanges, TRAFFIC submitted 1198 cases from 20 countries to the WCO, and received 103 cases from 16 countries in return (of which 28 were duplicates of ETIS records).

Data entry functions to ETIS, which had been suspended for the production of the ETIS Country Reports, were resumed in August 2010. A total of 461 new seizure cases from 26 countries were subsequently added to ETIS, which now comprises 15,873 ivory and non-ivory seizure records. During this time, four seizure records were deleted as duplicates and 327 cases are pending verification prior to data entry.

The Darwin Initiative Grant to support ETIS — which is funded by United Kingdom's Department of Environment, Food and Rural Affairs (Defra) and ably led by Dr Fiona Mary Underwood of the University of Reading and supported by Robert W. Burn, who both developed the existing ETIS software and conducted the analyses undertaken to date—continues to mark progress. One of the objectives of this grant is to develop new ETIS software to address a range of needs and requirements that have emerged from 13 years of experience with the existing system. Following a comprehensive assessment of database functions and operational procedures, a number of decisions have been made to address redundant features and establish a range of alternative capabilities for a 'new and improved' ETIS. The plan is to allow greater access to the database by a wider

données ETIS aux Parties ne soit pas une condition de la Résolution de la Conf. 10.10, dans l'intérêt de la transparence et de la responsabilité, TRAFFIC considère ce feedback comme une composante extrêmement importante de l'opération d'ETIS.

En termes de collecte de données, le cinquième échange annuel de données de saisies des produits issus d'éléphant entre l'Organisation Mondiale des Douanes (OMD) et TRAFFIC a eu lieu en août 2010. Cet événement annuel a lieu sous les auspices du Protocole d'Accord entre l'OMD et le Secrétariat de la CITES qui est entré en vigueur en octobre 2006. À cet égard, des données de saisie relatives aux produits issus d'éléphant contenues dans le Réseau Douanier de Lutte Contre la Fraude sont fournies à ETIS, tandis que les données de saisie qui viennent directement à ETIS en provenance des autorités douanières sont données à l'OMD pour inclusion dans leur système d'observation. Au cours des échanges récents, TRAFFIC a soumis 1198 cas provenant de 20 pays à l'OMD, et a reçu en échange 103 cas de 16 pays (dont 28 étaient des copies des données ETIS).

Des fonctions de saisie de données à ETIS, qui avaient été suspendues en raison de la production des rapports ETIS sur les pays, ont été reprises en août 2010. Un total de 461 nouveaux cas de saisie provenant de 26 pays a été donc ajouté à ETIS, qui comprend maintenant 15.873 données de saisie d'ivoire et non-ivoire. Au cours de cette période, quatre enregistrements de saisie ont été effacés car c'étaient des copies et 327 cas attendent la vérification avant la saisie de données.

La subvention de l'Initiative Darwin pour soutenir ETIS financée par le Département de l'Environnement, de l'Alimentation et des Affaires Rurales du Royaume-Uni (Defra) et habilement dirigé par le Dr. Fiona Mary Underwood de l'Université de Reading appuyé par Robert W. Burn, qui a développé le logiciel existant d'ETIS et qui a réalisé des analyses entreprises jusqu'aujourd'hui, continue à faire des progrès. L'un des objectifs de cette subvention est de développer un nouveau logiciel d'ETIS qui prend en compte les exigences et conditions qui ont émergé des 13 ans d'expérience avec le système actuel. Après une évaluation complète des fonctions de la base de données et des procédures opérationnelles, un certain nombre de décisions ont été prises pour s'occuper des faits superflus et établir une gamme d'autres possibilités pour un nouveau ETIS amélioré. Le plan est de permettre un plus grand accès à la base de données par un groupe plus large d'utilisateurs et d'intervenants, surtout les fournisseurs de données, automatiser les sorties de

group of users and stakeholders, especially data providers, to automate a range of data outputs and simple analyses, and to expand certain fields to allow better tracking of trade routes in the future. TRAFFIC is keen to ensure that the software development platform is open-source and that future sustainability issues are fully addressed. Based on the outcomes of a detailed review, a functional specification for the new database was prepared and a tender process instigated in August 2010 by the University of Reading to identify an appropriate software developer. The winner of the tender was Solertium Corporation, a US-based company that has extensive experience with database projects in the biodiversity sector. For example, Solertium has previously developed a grant management system for Conservation International and helped manage the Species Information Service toolkit and Red List Web site for IUCN, as well as partnering with the IUCN/SSC AfESG and AsESG on the ElephantDatabase.org (AAED) Initiative.

A week-long meeting between Solertium, TRAFFIC and the University of Reading's 'ETIS team' took place in Harare, Zimbabwe from 13–17 December 2010 to kick-off the development of the phase two software. Obviously, safeguarding continuity with the existing ETIS system is a strong requirement whilst new, user-friendly features will upgrade and revitalize a range of considerations. Development of the statistical analysis framework is also proceeding concurrently and will necessarily contribute to a range of developments within the new system. The plan is to have an alpha-test version of the new database by early February 2011 and, following a period of review and testing, a beta-test version by June 2011. The team expects that the final version will be fully operational by October 2011.

Since CITES CoP15, TRAFFIC has participated in a number of elephant and ivory trade events and discussions which have highlighted aspects of the ETIS data. The Third African elephant meeting was convened in Nairobi, Kenya in November 2010 by the CITES Secretariat and was attended by 35 of the 37 African elephant range States. An update of the ETIS data from a sub-regional perspective was provided, drawing attention to ongoing concerns

données et les analyses simples, et augmenter certains champs pour mieux permettre le suivi des itinéraires du trafic à l'avenir. TRAFFIC tient à s'assurer que la plate-forme de développement du logiciel est une source ouverte et que les questions de viabilité future sont abordées de façon détaillée. En se basant sur les résultats d'un examen détaillé, une spécification fonctionnelle pour la nouvelle base de données a été préparée et un processus de soumission engagé en août 2010 par l'Université de Reading pour identifier un programmateur de logiciel compétent. Le gagnant de la soumission était Solertium Corporation, une société basée aux Etats-Unis qui a une vaste expérience en ce qui concerne des projets de base de données dans le secteur de la biodiversité. Par exemple, Solertium a développé auparavant un système de gestion de subventions pour la Conservation Internationale; il a aidé à gérer le Guide Pratique du Service d'Information sur les Espèces et le site web de la Liste Rouge de l'UICN et a travaillé en partenariat avec le GSEAf et le GSEAs de la CSE/UICN sur l'Initiative de la Base de Données sur l'Eléphant d'Afrique (ElephantDatabase.org).

Une réunion d'une semaine entre Solertium, TRAFFIC et l'équipe ETIS de l'Université de Reading a eu lieu à Harare au Zimbabwe du 13 au 17 décembre 2010 pour commencer le développement de la phase deux du logiciel. Évidemment, la sauvegarde de la continuité avec le système existant d'ETIS est une condition importante tandis que de nouvelles caractéristiques faciles à utilizer amélioreront et revitaliseront de nombreux aspects. Le développement du cadre d'analyse statistique se poursuit concurremment et contribuera nécessairement aux développements dans le nouveau système. Le plan est d'avoir une version du test alpha de la nouvelle base de données début février 2011 et, après une période d'examen et d'essai, une version du test bêta pour le mois de juin 2011. L'équipe s'attend à ce que la version définitive soit complètement opérationnelle au mois d'octobre 2011.

Depuis la CdP15 de la CITES, TRAFFIC a participé à un certain nombre d'évènements et de discussions sur le commerce de l'ivoire qui ont mis en exergue les aspects des données ETIS. La 3ème réunion africaine sur l'éléphant a été organisée à Nairobi au Kenya au mois de novembre 2010 par le Secrétariat de la CITES et 35 des 37 états de l'aire de distribution de l'éléphant d'Afrique y ont participé. On a donné une mise à jour des données ETIS sous une perspective sous régionale, en mettant en lumière des préoccupations continues relatives aux pays où les efforts d'application de la loi sont

with countries where law enforcement effort scores remained poor, especially in West and Central Africa. At the same time, each elephant range State received a copy of their ETIS Country Report (as noted above) for consideration. TRAFFIC also presented an analysis of 'Elephant and ivory trade questionnaires' that had been mandated pursuant to Decision 13.26 adopted at CITES CoP14. TRAFFIC had been subsequently contracted by the CITES Secretariat to analyse and compile the questionnaire responses. The presentation compared the responses of the 30 African elephant range States that had replied to the questionnaire with the ETIS data. Based on this analysis, TRAFFIC concluded that the situation in Côte d'Ivoire, the Democratic Republic of the Congo, Ethiopia, Mozambique, Nigeria, Senegal and the Sudan require further clarification. It was also noted that there were discrepancies in some countries between ivory stocks reported in the 2007 questionnaires and those previously reported in other CITES processes.

TRAFFIC also participated in the 'First Technical Exchange Meeting between producing, consuming, and transiting nations to reduce the illegal trade in African elephant ivory' held in Hangzhou, China in November 2010. This event, hosted by China, supported by the United States government and chaired by the IUCN/SSC AfESG, brought together representatives from the Democratic Republic of the Congo, Tanzania, Thailand and Vietnam to examine the factors driving illicit trade in ivory—at each stage of the trade—and to identify key awareness-raising activities that can be implemented along the supply chain. To put things in context, a presentation on the ETIS data highlighted trade routes, dynamics and problematic issues operating in the countries attending the meeting. Uncoupled from the CITES process, the Hangzhou event afforded key countries the opportunity to identify common goals and develop solutions to shared problems in a low-pressure, supportive atmosphere.

Finally, the fourth meeting of the ETIS Technical Advisory Group (TAG) was held in Nairobi, Kenya on 8 December 2010, following the ninth meeting of the Monitoring of Illegal Killing of Elephants (MIKE) TAG the previous

défaillants, surtout en Afrique centrale et occidentale. En même temps, chaque état de l'aire de distribution d'éléphant a reçu une copie du rapport ETIS sur le pays (comme mentionné ci-dessus) pour examen. TRAFFIC a également présenté une analyse des ' questionnaires sur le trafic de l'ivoire et des produits issus de l'éléphant ' qui avait été autorisée conformément à la Décision 13.26 adoptée à la CdP14 de la CITES. TRAFFIC avait été par la suite chargé par le Secrétariat de la CITES d'analyser et compiler les réponses aux questionnaires. La présentation a comparé les réponses des 30 états de l'aire de distribution de l'éléphant d'Afrique qui avaient répondu au questionnaire avec les données ETIS. D'après cette analyse, TRAFFIC a conclu que la situation en Côte d'Ivoire, en République Démocratique du Congo, en Ethiopie, au Mozambique, au Nigéria, au Sénégal et au Soudan exigeait plus de clarification. On a également noté qu'il y avait des anomalies dans quelques pays entre les stocks d'ivoire rapportés dans les questionnaires de 2007 et ceux rapportés auparavant dans d'autres processus de la CITES.

TRAFFIC a également participé à la Première réunion technique d'échange entre les nations productrices, consommatrices, et de transit pour réduire le trafic illégal d'ivoire de l'éléphant d'Afrique qui s'est tenue à Hangzhou en Chine en novembre 2010. Cet événement, organisé par la Chine, soutenu par le gouvernement des États-Unis et présidé par le GSEAf de la CSE/UICN, a réuni des représentants de la République Démocratique du Congo, de la Tanzanie, de la Thaïlande et du Vietnam pour examiner les facteurs régissant le trafic illicite de l'ivoire - à chaque étape du trafic - et identifier les activités principales de sensibilisation qu'on peut mettre en œuvre le long de la chaîne d'approvisionnement. Pour mettre les choses dans le contexte, une présentation sur les données ETIS a mis en exergue les itinéraires du trafic, la dynamique et les sujets problématiques dans les pays participant à la réunion. Détaché du processus de la CITES, l'événement de Hangzhou a donné aux pays clés l'occasion d'identifier des objectifs communs et de développer des solutions aux problèmes communs dans une atmosphère rassurante et sans pression.

Enfin, la quatrième réunion du Groupe Consultatif Technique (GCT) d'ETIS s'est tenue à Nairobi au Kenya le 8 décembre 2010, suite à la neuvième réunion du GCT de MIKE les deux jours précédents. Les GCT d'ETIS et de MIKE ont tous les deux participé à un atelier d'une journée pour évaluer les moteurs du massacre illégal des éléphants et le trafic illégal de l'ivoire comme des étapes envers le développement ultérieur des cadres

two days. Both the MIKE and ETIS TAGs participated in a facilitated, one-day workshop to assess drivers of illegal killing of elephants and illegal trade in ivory as steps towards the further development of analytical frameworks for the two CITES monitoring systems for elephants. In order to analyse the MIKE and ETIS data, it is important to model the drivers that govern the supply and demand factors along the ivory trade chain from source countries, through transit nations, to end-use markets in consumer countries. The objectives of this exercise were to determine the series of drivers that are causally linked to outcomes such as trends or changes in trends over time; to identify and assess existing or potential sources of data for these factors; and to understand and map causal and hierarchical relationships among the various drivers and between drivers and outcomes. Whilst the workshop marked progress in tackling these issues, further work remains to be done in developing a workable model.

analytiques pour les deux systèmes de contrôle de la CITES en faveur des éléphants. Afin d'analyser les données MIKE et ETIS, il est important de modéliser les moteurs qui régissent les facteurs de l'offre et de la demande le long de la chaîne du trafic de l'ivoire à partir des pays sources, en passant par les nations de transit, jusqu'aux marchés d'utilisation finale des pays consommateurs. Les objectifs de cet exercice étaient de déterminer la série de moteurs qui sont causalement liés aux résultats tels que les tendances ou les changements des tendances avec le temps; d'identifier et évaluer les sources de données existantes ou potentielles pour ces facteurs; et comprendre et retracer les rapports causaux et hiérarchiques parmi les divers moteurs et entre les moteurs et les résultats. Alors que l'atelier a fait des progrès en abordant ces questions, il reste beaucoup de travail à faire pour développer un modèle réalisable.

# GUIDELINES FOR CONTRIBUTORS

## Editor's note

During *Pachyderm*'s October 2010 Editorial Board Meeting, the Board made a number of changes to the 'Guidelines for contributors'. The 'Aim and scope' and 'Submission of manuscripts'—as outlined below—remain unchanged. However, the Editorial Board reviewed the editorial policies and standards for 'Preparation of manuscripts'. In particular, *Pachyderm*'s sections were refined and approved, as follows:

*Research and Management Papers*
This is the bulk of the material submitted to *Pachyderm* and should remain unchanged.

*Field Notes*
There was little change recommended to this section, except to specify the word limit (<2,500 words).

*Review Papers*
Review papers, which are unbiased reviews of all the existing knowledge on a specific topic, are welcomed. Length should be <6,000 words.

*Letters to the Chair*
This was considered to be a place in which opinions could be expressed in *Pachyderm*. They would be letters to the relevant Specialist Group Chair, and would be limited to 1,000 words. The relevant Chair would be responsible for deciding whether to accept a letter, whether to ask for any factual edits, and whether to solicit a contrasting opinion.

Changes to the 'Journal conventions' were also approved. The Board unanimously recommended that *Pachyderm* follow the *IUCN Style Manual* because the periodical is published under the auspices of IUCN. The guide is available online at http://cmsdata.iucn.org/downloads/iucn_style_manual1209.pdf. Authors should, in keeping with IUCN publication standards, use the Harvard system of referencing. Because this is the most common academic referencing system, it will facilitate authors who use digital bibliographic programmes as well maintain consistency with other IUCN publications. The *IUCN Style Manual* describes these guidelines in detail on pages 39–47.

These Guidelines for contributors, amended below, will take effect as of issue number 49. If you have any queries about these policies, please write to us at afesg@iucn.org.

## Aim and scope

*Pachyderm* publishes papers and notes concerning all aspects of the African elephant, the African rhino and the Asian rhino with a focus on the conservation and management of these species in the wild. At the same time, the journal is a platform for disseminating information concerning the activities of the African Elephant, the African Rhino, and the Asian Rhino Specialist Groups of the IUCN Species Survival Commission.

## Submission of manuscripts

All manuscripts should be submitted online at http://pachydermjournal.org.

If there are any questions or concerns regarding the submission process, please send an email to: afesg@iucn.org or otherwise contact by post/telephone:
The Editor, *Pachyderm*
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## Preparation of manuscripts

Manuscripts are accepted in both English and French languages. Where possible, the abstract should be provided in both languages.

### *Images, figures and maps*

Preferably provide figures and maps in their original form, for example, charts and data in Excel files, maps as EPS and images in the highest quality possible, such as TIF (600 dpi). Indicate clearly the author or source of figures, maps and photographs.

### *Title and authors*

The title should contain as many of the key words as possible but should not be more than 25 words long. Follow with the name(s) of the author(s) with institutional affiliation and full postal and email address of the corresponding author, to whom proofs and editorial comments will be sent.

### *Research and management papers*

These should be not more than 5,000 words and be structured as follows: 1) Title 2) Abstract of not more than 250 words (informative type, outlining information from the Introduction, Materials and methods, Results, Discussion, but not detailed results) 3) additional key words (if any), not appearing in the title 4) Introduction 5) Materials and methods 6) Results 7) Discussion 8) Conclusions, if appropriate 9) Acknowledgements (optional, brief) 10) References (no more than 25) 11) Tables 12) Figure and photo captions 13) Figures and photos.

Papers may be reports of original biology research or they may focus more on the socio-economic aspects of conservation, including market surveys.

### *Field notes*

The journal welcomes notes from the field. They may contain figures and tables but should <2,500 words.

### *Review papers*

Review papers, which are unbiased reviews of all the existing knowledge on a specific topic, are welcomed. Length should be <6,000 words.

### *Book reviews*

*Pachyderm* invites reviews of newly published books, which should be <1,500 words.

### *Letters to the Chair*

Letters should be addressed to the relevant Specialist Group Chair, and should be <1000 words. Letters are welcome that comment on articles published in *Pachyderm* or on any other issue relating to elephant and rhino conservation in the wild.

## Journal conventions

### Nomenclature

Use common names of animals and plants, giving scientific names in italics on first mention. Generally refer to animals in the plural form (i.e. rhinos, elephants).

### Spelling

Use British spelling, following the latest edition of the *Concise Oxford Dictionary* or the *Oxford English Dictionary*, using 'z' instead of 's' in words like 'recognize', 'organization', 'immobilized'; but 'analyse', 'paralyse'. The dictionary is available online at http://oed.com.

### Numbers

Use International System of Units for measurement (m, km, g, ha, h) with a space between the numeral and the unit of measurement. Give measurements in figures, for example 12 mm, 1 km, 3 ha, except at the beginning of a sentence.

Spell out numbers under 10 if not a unit of measurement unless the number is part of a series containing numbers 10 or over, for example: 14 adult males, 23 adult females and 3 juveniles.

In the text, write four-digit numbers without a comma; use a comma as the separator for figures four digits or more: 1,750 and 11,750. The separator will be a full stop in French papers.

### References

Use the Harvard method of citing and listing references.

In the text, cite two authors: '(X & Y, 1999)' or 'X and Y (1999)'; cite more than two authors '(X et al., 1996)' or 'X et al. (1996)'. Note that there is a comma between the author(s) and the year.

If multiple works are being cited, separate them by a semi-colon: (X, et al., 2002; Y, 2002; Z, 2002).

Please see the *IUCN Style Manual*, for a detailed description and examples of reference citation. The manual is available to download at http://cmsdata.iucn.org/downloads/iucn_style_manual1209.pdf.