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Sandscript

An eye on the conservation of the wildlife of the Sahara and the Sahel

Photo credit: Jaime Dias/Wings for Conservation

The biannual publication of SaharaConservation,
only organization dedicated uniquely to the biodiversity
of the Sahara and Sahel

SAHARA CONSERVATION

Editorial

Species and habitat conservation requires a multidisciplinary approach involving different categories of experts. This includes the invaluable efforts of veterinarians to build healthy and sustainable populations in breeding centers or in the wild. This new issue of Sandscript features the work of our veterinarian colleagues associated with SaharaConservation projects in Chad. Each article provides a brief overview of different activities that are critical for the conservation of rare and endangered animal species in their natural habitats.

You will appreciate the broad veterinary expertise that spans from tele-anesthesia (darting animals for sedation), safe translocation and transport of antelopes and gazelles, preventative measures before reintroduction (including disease screening and vaccinations), to the study of emerging infectious diseases within a One Health framework. As highlighted by François Lamarque in his article, veterinarians bring a complementary expertise to other specialists in conservation. Using a clinical approach, they can also contribute to the preservation of functional ecosystems and provide new prospects.

In veterinary schools, students mainly learn about fundamentals of physiology and pathology in different animal species (focusing on companion and livestock species). This training is unique because animal and organismal science always encourage to have a broader view about medical conditions or sanitary crisis. Students also learn that animal health and welfare is as important at the population as it is at the individual level.

I started my career in the mid-1990s as a veterinarian epidemiologist based at the Laboratoire de Farcha in N'djamena, Chad. While working in the Sahel and Sahara, I quickly realized the potential impact of my profession and the different roles that could be played beyond the routine care of livestock species. This included the study and understanding of interactions between wildlife, humans, and domestic species. Like the colleagues featured in this issue of Sandscript, I decided to orient my career towards the study of many more animal species and the development of new approaches to preserve biodiversity.

Another key role that veterinarians play is on the training of students and professionals that are joining them in their conservation efforts. Inspiring future generations and building capacity of 'veterinarian-at-large' ensure that our profession is seen as a strong entity within the conservation community.

In sum, veterinarians from zoos, private practices, laboratories, academia, conservation institutions, or in the field have the possibility to change the conservation paradigm and make a difference.

I hope you enjoy reading those fascinating stories.

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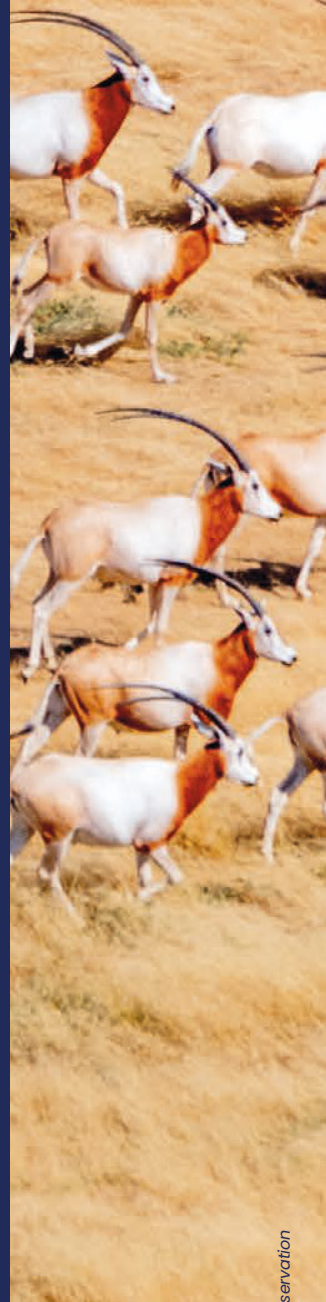

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SAHARA CONSERVATION

Photo credit: Stephanie Brien

From injection to management: the veterinarian's pathway in wildlife conservation

Avian influenza with a highly pathogenic H1N1 virus, SARS, Ebola, Covid-19, Monkeypox, etc.: the early 21st century has confirmed time and again that the boundaries between wild and domestic health categories were far from being impervious.

It has also demonstrated that the transmission of these diseases (previously confined to wildlife) to Humans was exacerbated – if not caused – by increasingly close and frequent cohabitation following the destruction of natural habitats in order to expand human activities.

These observations led veterinarians, concerned about the propagation of these "new" zoonoses[1] and keen to detect their emergence before the appearance of possible pandemics[2], to put forward the "One Health" approach at the turn of this century, which highlights the interdependence between the health of the environment, the health of Humans and their pets, livestock and the health of wildlife.

This concept, which is presented in one of the articles in this issue of Sandscript, along with various interventions by veterinarians to capture oryx, addax and dama gazelles by teleanaesthesia, monitor their

translocation and vaccinate these species, reveals the importance of this profession for the health of wild species in general, and Sahelo-Saharan fauna in particular.

However, veterinarians' contribution is not limited to acting in a strictly medical capacity. Through their extensive training, over and above their knowledge of biology, veterinarians have acquired many other skills in fields as diverse as administration, public health and health crisis monitoring and management. These skills prove extremely useful in the protection of living things, which nowadays requires a holistic and multidisciplinary approach.

Moreover, carrying out the profession of veterinarian not only requires great pragmatism but also constant humility and continual adaptability when faced with ailments affecting a patient incapable of providing any information. The approach adopted to overcome this impossible communication is based on several successive steps: aetiology (analysis of the possible causes of the disease), diagnosis (identification of the pathology thanks to this analysis and observation of the symptoms), treatment (prescription of curative measures), prognosis (evaluation of the course of the disease) and prophylaxis (preventive measures).

Aetiology
analysis of the possible causes of the disease

Diagnosis
identification of the pathology thanks to this analysis and observationof the symptoms

Treatment
prescription of curative measures

Prognosis
evaluation of the course of the disease

Prophylaxis
preventive measures

This approach perfectly applies to conserving natural resources and particularly wildlife. Faced with the decline or extinction of a species, the first reaction must be to understand how this situation has come about (aetiology), then to assess the current status of the species (diagnosis) before putting in place suitable restorative actions (treatment), evaluate their chance of success (prognosis) and put forward measures so that the species' conservation status does not deteriorate in the future (prophylaxis).

Veterinarians therefore have the qualities and aptitudes giving them every legitimacy to play a role in safeguarding wildlife. However, they had to bring about a real cultural revolution as, unlike traditional veterinary practice focused on caring for the individual, in terms of conservation, the health of the population comes first, with the loss of a few individuals being inconsequential except for critically endangered species.

Previously merely doctors occasionally performing technical interventions during episodes of disease affecting wild species, they are now actively involved at every stage of conservation.

Veterinarians are therefore found in research institutes, national administrations, international organisations and NGOs, where they are involved, on the ground or behind a desk, in designing, implementing and monitoring numerous programmes that help preserve wildlife.

Previously merely doctors occasionally performing technical interventions during episodes of disease affecting wild species, they are now actively involved at every stage of conservation.

François Lamarque
Membre du conseil d'administration
SAHARACONSERVATION

[1]Disease transmissible from animals to humans and vice versa
[2]Epidemic that develops over a wide area, beyond borders

A long-running story: the enduring search for health security common to humans, livestock and wildlife

1967. North-East Chad, somewhere towards Abéché in a region that is now gazetted as the Ouadi Rimé - Ouadi Achim Faunal Reserve (OROAFR). Farcha Veterinary Research Laboratory (now IRED, Livestock Development Research Institute) is on a field mission to study the epidemiology of Rift Valley fever (RVF) (Maurice & Baille, 1967), a zoonotic arbovirus infection (a viral disease transmitted by arthropod vectors) that affects both humans and domestic and wild ruminants.

The mission entails taking blood samples from livestock and wildlife to look for antibodies against RVF, indicating past infection with the virus. For the wildlife, the mission has to kill (it was the only method known at the time) 24 individuals in good health belonging to five different antelope species: 12 dorcas gazelles, 6 dama gazelles, 2 red-fronted gazelles, 3 scimitar-horned oryx and even a tiang as this antelope was in the habit of migrating that far north during the rainy season. Back in N'Djamena, the laboratory carries out serological analyses for RVF and discovers that, in addition to 20% of all the sheep sampled being seropositive, 46% of the antelopes sampled in the Abéché region (11 including 2 of the 3 oryx) were seropositive (Maurice & Baille, 1967). RVF will then be confirmed on several occasions in Chad, both in humans, including some casualties (e.g., Durand et al., 2003), and domestic ruminants (e.g., Ringot et al., 2003; Fayiz Abakar et al., 2014).

This mission was altogether banal, almost routine. However, it proves a valuable learning experience for us today.

We thus observe that in 1967 the Farcha laboratory had already adopted an integrated approach to research by exploring the role of both wild animals and domestic animals in the epidemiology of diseases. This was 37 years before the Wildlife Conservation Society's founding symposium in New York in 2004, which launched the "One World One Health" approach in spectacular fashion, that is nowadays on the tip of everyone's tongue. Moreover, in 1998, six years before the famous symposium, the Farcha laboratory – along with its partners – undertook a long interdisciplinary research series on the health of nomadic pastoralists and their livestock in the Sahel, bringing together a number of eminent specialists in human and animal health (Montavon et al., 2013).

In reality, the story of "One World One Health" in the Farcha laboratory had begun several decades before "One Health's" baptism in New York. Our predecessors were already exploring pathologies shared between humans and animals and influenced by the environment. Often more generalist than we are today, many of them were much more than health specialists; they were "naturalist-scientists" in the true sense of the term, with broad skills in many sciences such as zoology, botany, climatology and agrostology (the scientific study of grasses and pastoral rangeland). They quite naturally incorporated these different sciences into their work. Now quite obsolete, the term "naturalist-scientist" has largely disappeared. With progress in science, scientists have become ultra-specialised, slightly losing sight of the cross-functional nature of disciplines, which have become more in-depth, verticalised as it were. This is probably why health specialists felt the need to turn to a more horizontal approach such as "One Health" to recover the multidisciplinary method of our naturalist-scientist elders. Incidentally, certain sciences have perhaps even disappeared at the same time, such as agrostology, the science of grassland, which used to be a major discipline in the Sahel as demonstrated by the many publications from the last century.

To return to our 1967 mission, some twenty years later in the early nineties, not a single scimitar-horned oryx was to be seen in the region or anywhere in Africa for that matter. The species was declared extinct in the wild in 2000 (IUCN SSC Antelope Specialist Group, 2016). It took a further twenty or so years before a scimitar-horned oryx reintroduction programme began in Chad in 2016 under the aegis of the Chadian Ministry of Environment, Fisheries and Sustainable Development, Sahara Conservation Fund (now SaharaConservation) and the Environment Agency – Abu Dhabi, United Arab Emirates (UAE).

Between March 2016 and January 2017, the programme reintroduced three batches of 25 oryx each i.e., 75 oryx, from the UAE into OROAFR. On 11 February 2018, a fourth batch of 75 oryx was reintroduced and placed in quarantine enclosures to acclimatise before they were released into the reserve on 6 August of the same year i.e., almost six months after their arrival. Eighteen days after their release, two of these oryx wearing GPS collars died on the same day at a distance of 98 km from each other, beginning an episode of mass mortality as

Photo credit: Jaime Dias - Wings for Conservation

40 oryx from the fourth batch (53%) died in the space of 40 days. Only four oryx from the first three batches were affected. These batches had not been subjected to the constraints of the fourth batch: (i) on the one hand, containment in quarantine under heavy rainfall with forced exposure to an arthropods outbreak, (ii) on the other hand, the abrupt transition from their diet, which was extremely rich during quarantine, to natural Sahelian grassland, which was exceptionally abundant during this intense rainy season, but consequently was all the poorer in terms of nutrition. It is also possible that the oryx in the previous batches had been moderately exposed to the RVF virus during prior normal rainy seasons, thus allowing them to develop the immunity of a "natural vaccination".

Finally, the very last mortality in the oryx precisely coincided with the final rain of the 2018 wet season. It is important to note that in 2018 there had been twice as much rain as normal, triggering a cascade of phenomena, beginning with a population boom in arthropods: acarids on one side, particularly *Hyalomma* sp. ticks that passed on babesiosis to the oryx, and insects on the other, with a massive infestation of *Haematobia* sp. biting flies that exhausted the oryx with their incessant harassment, blood predation and the propagation of cutaneous streptothricosis. Autopsies also revealed several cases of haemorrhagic septicaemia.

A female oryx in particular intrigued us with its sudden death just after having aborted, despite being in very good general health. The clinical suspicion of RVF was reinforced by post-mortem. Samples were taken following the precautions required for this zoonosis. Laboratory examinations at CIRAD in Montpellier, WOAH's (World Organisation for Animal Health) international reference laboratory for RVF, made it possible not only to isolate but also to sequence the RVF virus. In addition, the blood samples from five of the nine oryx analysed for RVF (55%) tested positive by ELISA and/or PCR tests.

We know that the environment plays a major role in RVF's epidemiology. Climate-related events such as very heavy rainfall (El Niño phenomenon) can lead to

an outbreak of mosquitoes that are vectors for the virus. During inter-epizootic so-called 'silences' (between mortality episodes), the virus is thought to insidiously circulate in domestic animals, particularly small ruminants, even in the absence of wild animals (Lefèvre, 1997). The virus also subsists by vertical transmission (from the mother to her eggs) in mosquitoes of the *Aedes* genus, which preferentially feed on domestic animals. Moreover, during the same period and in the same region, the outbreak of insects caused by the exceptional rains not only triggered the RVF episode in the oryx but also a serious epizootic of another arbovirus disease, African horse sickness (transmitted by a biting midge of the *Culicoides* genus), which led to the mass mortality of donkeys and horses around Abéché. And later on, still in the same region, yet another arbovirus infection occurred, this time a Chikungunya epidemic affecting humans, the virus responsible also being transmitted by mosquitoes of the *Aedes* genus.

In the course of this story, we could not fail to notice that the oryx that were seropositive for RVF in 1967 did not present any signs of disease and were therefore probably healthy carriers, as were the seropositive sheep sampled at the time. Thus, the oryx might have co-evolved with the virus, selecting, if not natural resistance to the disease, at least reduced sensitivity, which incidentally disappeared with the extinction of the species in the wild.

While the oryx involved in the mass mortality in Chad in 2018 belong to the same species as the now extinct population studied in 1967, the individuals concerned have a completely different history and nature. These animals are from several generations of stock born and raised in captivity in the UAE in an environment free from RVF and under strict sanitary controls. These oryx seem to behave differently to their ancestors in Chad, demonstrating "naive" status with regard to RVF, as is said of living beings faced with unprecedented situations.

Therefore, naive oryx from the UAE were infected by the RVF virus in OROAFR, where we know that the virus has been circulating for over fifty years. The oryx could not have arrived in Chad carrying the virus as RVF's incubation period only lasts from 12 hours to 6 days (WOAH, 2022), whereas they were hit by the disease almost six months after their arrival in Chad.

This mortality episode in oryx is an exceptional case. It is rare to detect both: (i) the RVF virus in wild animals and (ii) a strong clinical expression in these same wild animals. It is also rare to observe so clearly the concurrent triggering by a climate-related event of: (i) a coinfestation by external and internal parasites and (ii) a coinfection by bacterial and viral pathogens.

Today, the long-running story of "One Health" in Chad continues to be written on many topics, including the question of biodiversity conservation in the Sahel.

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Vaccinating antelopes before their reintroduction: a necessity?

Since 2016, the Government of Chad and the Environment Agency - Abu Dhabi (EAD), with the participation of SaharaConservation, have been translocating scimitar-horned oryx (*Oryx dammah*), addax (*Addax nasomaculatus*), and dama gazelles (*Nanger Dama*) from the United Arab Emirates to Chad, into the Ouadi Rimé-Ouadi Achim Game Reserve. For this project to be a success, preventive medical protocols and treatments had to be set up and applied to the three ungulate species.

During the development of this ground-breaking project some important ethical questions were raised. Including issues such as, *should reintroduced animals receive preventive medical procedures? If so, which procedures are appropriate?* We also questioned ourselves *if we should protect these animals from all possible diseases or if we should allow natural selection to filter out the weaker, less resistant animals.*

Considering the significant cost of reintroduction projects, and the high value of each individual animal pushed us to protect all our animals as best we could. Even if we can only protect the first generation of released animals, we can aid the first reintroduced generation to survive the stressful experience with medical aid.

There are many diseases which could compromise the health of our animals, but which ones are the most important?

Wild ungulates are susceptible to many infectious diseases that also affect domestic ungulates and there is very limited data and literature about the role wild ungulates as reservoirs or targets of disease. Our protocols and vaccine selection were based on these publications and institutional experiences.

Since there are not many similar projects of this scale to take inspiration from, we used the experience from the Arabian Oryx (*Oryx leucoryx*) reintroduction in Saudi Arabia in the 1990s to help set some of our protocols.

The project follows two basic principles:

1. Do not harm the existing population of wild and domestic ungulates in Chad by introducing non native diseases. For this we did much intensive pre-translocation screening.

2. Protect the first generation of scimitar-horned oryx and addax with vaccines to help them face the harsh adaptation phase when stress is very high, and their immune system is weaker. The surviving animals will be able to produce stronger and more well adapted offspring.

Screening: To ensure the fulfilment of the first principle we needed to produce a healthy herd of candidates for the project. All candidate herds received an annual or biannual general health, Tuberculosis, Brucellosis and Contagious Caprine pleuropneumonia screening. Only animals coming from confirmed negative groups (2 rounds of testing) are eligible for reintroduction.

> **Should reintroduced animals receive preventive medical procedures? If so, which procedures are appropriate?**

Vaccination: Vaccination protocols for wild animals should be determined depending on factors specific to species such as susceptibility to a disease or likelihood of encountering different diseases. Other factors to consider are the risks of delivering a vaccine, the distribution/prevalence of a disease in an area, the ability to obtain the vaccine and the percentage success of each vaccine. Additionally, the zoonotic potential of diseases in wild ungulates and the risk of transmission to or from domestic ungulates must be considered.

In the early stages of this project, we met with Chadian veterinary institutions to evaluate which diseases were already present in the area and to verify how prevalent they were.

In our protocol we included core vaccines designed to protect against life threatening, widely spread diseases like the Peste des Petits Ruminants (PPR) and sheep & goat pox, *Pasteurella/ Mannheimia/ Clostridium* complex. Other vaccines we included were for diseases that are not a severe threat to our animals but that could potentially be transmitted to the local population of farm animals, resulting in enormous economic damages to local farmers. These diseases include Contagious Caprine Pleuropneumonia (CCPP) and Foot and Mouth Disease (FMD).

The initial protocol created was then reviewed and reinforced in 2019, after a Rift Valley fever (RVF) outbreak that killed several scimitar-horned oryx, demonstrating how sensitive these animals were to this virus. We thus introduced a vaccine for RVF in our protocol, together with CCPP vaccine.
The current vaccination protocol applied between 2 and 6 months before shipment of animals includes: Multi-strains *Pasteurella m./ Mannheimia h./ Clostridium* spp., CCPP, FMD, RVF, PPR, Sheep and Goat Pox.

We use vaccines developed for domestic ungulate species, so we don't know the true effectiveness of these vaccines on our wild animals, but up to now we didn't record severe side effects and, based on our experience in UAE, they seem capable of protecting all the three ungulate species from all those diseases. In conclusion, setting a preventive medicine protocol requires the consideration of several factors. It is not a static protocol, but it must be adapted accordingly with the results and experiences we gather day by day.

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Photo credit: John Newby

Translocation in conservation: to crate or not to crate?

Humans have been moving animals around for thousands of years. Initially for food and fiber, more recently for conservation. Sometimes, this can be as simple as encouraging a herd to walk in the direction you need or putting a lead rope or leash on an animal and leading it where you need it to go. Sometimes, particularly with wild hoofstock, it can be a lot more complicated than that!

For several years now, SaharaConservation has participated in the translocation of three endangered hoofstock species, namely: scimitar-horned oryx, addax, and dama gazelles. The longest trips have been to bring animals into Chad from the herds that are held at the Environment Agency - Abu Dhabi (EAD) Deleika Conservation and Breeding Center facilities. This requires a lot of coordination and planning.

First, the animals selected for travel and eventual release need to be separated out from their herd at the EAD Deleika Conservation and Breeding Center. There, they undergo a physical exam by veterinary staff to ensure that they are healthy and safe to travel. Once cleared, these animals are ready for the trip to Chad via cargo plane.

In order to accomplish this, we can take advantage of one of the best characteristics of Saharian hoofstock. When placed in a small, dark space, most hoofstock will lie down and calmly wait for their next opportunity to move. Hoofstock crates, by design, are only large enough for the animal to stand and lie down, but not turn around. When bedded with hay, these narrow crates encourage the animal to lie down calmly within the darkened crate. Once the animals are secured in their crates, the crates can be loaded onto a truck and driven to the airport where they are loaded into the large cargo plane for the five-hour flight to Chad. Interestingly, since hoofstock tend to travel so well in darkened crates, sedation for flying is rarely needed when the animals can be moved by crate.

Sometimes, however, a crate is not feasible. This is a problem that has occurred while moving dama gazelles around within Chad. Dama gazelles may be a more fragile species than scimitar-horned oryx or addax, and therefore could be more prone to injury and stress related diseases. Because of this, it is sometimes necessary to move them via plane in country rather than truck to decrease the transport time over rough roads. However, due to the remote nature of the areas where dama gazelles are typically located, airstrips are often not able to tolerate planes that are large enough to hold full sized hoofstock crates. In these situations, veterinary help becomes critical.

In 2020 and again in 2022, several dama gazelles had

Photo credit: Julie Swenson

to be flown from one location within Chad to another without the benefit of being confined in a crate. In order to do this safely, each animal had to be heavily sedated so that they would remain calm throughout the flight. For the drug protocol, this is a two-step process. First, the animals have to be removed from the crates they traveled the original portion of the trip in and anesthetized. Once the animals are asleep, they are hobbled into a recumbent position so that they will not be able to run if they are startled in the airplane. Blindfolds and earplugs are also applied to help with this. An intravenous catheter is placed in the jugular vein so that additional sedative drugs can be administered easily during the flight if needed. At this point, the animals are moved to the transport plane. Since prolonged anesthesia has some risks associated with it, the initial anesthesia drugs are reversed so that the animal is no longer fully asleep, and the sedation drugs are given in their place.

When placed in a small, dark space, most hoofstock will lie down and calmly wait for their next opportunity to move.”

These sedation drugs will allow the animal to remain calm, but still awake, during the transport. While in flight, the veterinary team monitors the animal's level of sedation carefully. If it appears that the animal is getting agitated, additional sedative drugs can be given to keep the animal calm throughout the flight. Once the animal arrives at the other end of the transport, these sedation drugs can be left in the animal's system if needed, to help them adjust more smoothly to their new surroundings.

This may seem like a lot of work to move a few animals around, but the conservation impact of being able to do this can be huge! In the year 2000, the scimitar-horned oryx was declared Extinct in the Wild by the International Union for Conservation of Nature Red List. However, through the translocation of captive bred animals from all over the world, this species has now been reintroduced in the Ouadi Rimé-Ouadi Achim Game Reserve, Chad. These translocated animals have thrived and are now again reproducing on their own in the wild.

Similarly, the dama gazelle is one of the most Critically Endangered species on the planet with estimates of less than 200 individuals remaining in the wild. A very small remnant population of very high genetic diversity lives in the Manga region of Western Chad. However, because of the risks they are facing in the area and the small population size, these animals are unlikely to continue to propagate in the wild. By capturing and safely translocating several of the animals to a new breeding population, we can preserve the unique genetic makeup of the Manga damas and reintroduce that genetic variability back into the larger population for future generations.

Translocation really does have an important role to play in conservation today!

Photo credit: Adam Eyres

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Photo credit: Jon Lloret Mínguez

Antelope darting protocols in Chad

The tele-anesthesia and chemical immobilization of wild antelopes that the Government of Chad, the Environment Agency – Abu Dhabi (EAD) and SaharaConservation strive to conserve falls under the responsibility of EAD veterinarians. The ultimate goal is to safely anesthetize individual animals from a distance to allow veterinarians and researchers to undertake the required procedures.

There are a few ways of delivering anesthetics drugs to wild animals. In the Ouadi Rimé-Ouadi Achim Game Reserve, we use a modified .22 caliber bolt action rifle powered by blank rounds. The gas of those cartridges propels a 50-caliber ballistic dart, loaded with a combination of anesthetics to the animal. The darts have a small charge of compressed air that, upon impact, propels the plunger to inject the drugs intramuscularly.

Shooting from a modified rifle is more complicated than shooting from a regular rifle. To deliver the anesthetic effectively the dart has to penetrate those areas of the animals with large muscles. The dart should also penetrate the animal as close to perpendicular as possible. A dart landing diagonally can cause the dart to be deflected. The dart also needs to be fired using the appropriate force based on the distance. To achieve this, different gas cartridges and different power settings are available to produce the right impact force. Wind direction and speed must be considered too, as the darts are not travelling as fast as bullets and are much heavier.

This process requires of a well-organized and coordinated team. The darting is undertaken from all terrain vehicles. The driver must be able to locate the vehicle in the appropriate direction, taking into consideration distance, angle, wind, sun direction and risk of having other animals passing by at the moment of shooting. Constant communication between the veterinarian and the driver is essential. Missing a shot could spook the animals or hit an unintended target.

To anesthetize wild antelopes in Chad, we use a combination of drugs. This is called balanced anesthesia and allows us to use less dosage of each substance, reducing the undesirable side effects of each drug and being able to modulate the effects easier. The darts are loaded with a dosage according to the species, weight and mood of the animals (a stressed animal will require a higher dose than a calm animal, for example).

Another advantage of using a combination of drugs is that they can be reversed once the procedure is finished. The reversal drugs are injected and the effects of the anesthetics disappear very quickly. The animal regains consciousness and is able to return with the herd almost immediately. This is very important, especially with wild animals. After a quick *in situ* evaluation of the recovery of the animal, the monitoring team will check on the animal to ensure that there is no renarcotization or any undesirable side effect in the following hours/days.

The usage of some substances poses a significant risk for humans, as they are extremely toxic. Just a tiny drop on the skin can have fatal consequences (cardiorespiratory arrest). Given that the darting is done in a remote area, hours away from the closest medical facility, it is very important for the veterinarian to protect himself while manipulating those substances. The preparation of the darts is always done using personal protective equipment's (PPE), separated from the rest of the team, with the wind blowing away and under supervision of a trained person who has the antidote loaded and ready to be injected.

Once the animal has been darted, the process of induction should not take more than 5 minutes. During this time, the animal is followed from a safe distance. When the drugs act and the animal falls asleep, the team will proceed to put a blindfold and horn guards and ensure an appropriate position to avoid aspiration pneumonia and to facilitate the procedures to be done.
While the animal is under anesthesia, a health check will be performed together with any other required procedure (collaring, sampling, biometrics, etc.). The veterinarian monitors the animal to ensure that there are no issues. Reflexes, temperature, heart and breathing rate are some of the parameters usually observed to evaluate that the anesthesia is safe and done to the required depth.

The procedures carried out in the field are usually within the duration of the anesthesia given, but if required, a top up of drugs can be given to modulate the length or depth of the anesthesia.

Once the procedure is finished, all the non-essential personnel and material are cleared from the area and the animal is reversed. The handling team will ensure that the animal maintains a proper posture until it regains full consciousness. Just before being released, the horn guards and blindfold will be removed.
All the data collected (drugs, dosages, gun settings, weather conditions, timings, effects....) is recorded in anesthesia sheets.

Since 2020, 27 wild scimitar-horned oryx and addax have been anesthetized in the field by the Veterinary team. All the procedures were carried with no side effects or fatalities and the animals recovered without any problem, proving that the protocol, dosage and drugs selected are appropriate.

Constant communication between the veterinarian andthe driver is essential. Missing a shot could spook the animals or hit an unintended target.

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Photo credit: Stephanie Brien

One Health Approaches in antelope reintroduction programs

The Ouadi Rimé-Ouadi Achim Game Reserve in Chad is the only place in the world where three species of highly endangered antelope – dama gazelle, scimitar-horned oryx, and addax – can all be found together. When the seasonal rains fall – about July to September of each year – pastoralist families and their livestock also enter the reserve. For six months or more, each year, hundreds of thousands of goats, sheep, cows, and camels, three endangered antelope (and other reserve wildlife), and human families must all share space and resources.

Traveling around the reserve during the rainy season is very difficult. Vehicles get bogged down in mud and sand, and the usual tracks are often flooded, sometimes dramatically. However, if you do manage to navigate the reserve, you'll often find groups of wildlife and livestock grazing near each other, or taking turns in the same shady spot. These scenes are a picturesque reminder that wild and domestic animals have long shared the Sahelian grasslands. But such co-occurrence can enable the transmission of dangerous diseases. If you venture under one of these trees, you'll soon find yourself covered in ticks in search of a blood meal.

By feasting on different creatures seeking a bit of shade, these ticks (along with insects) can spread diseases between species.
Because populations of dama, oryx and addax are so small, disease outbreaks could have catastrophic consequences. Pastoralists live extremely closely with their livestock, which creates opportunities

for diseases to pass between animals and people. Pastoralists also depend on their animals for food and income. Thus, diseases in livestock also impact human health and livelihoods.

We are using a One Health approach to investigate infectious diseases in both the antelope and livestock in the reserve. The One Health concept recognizes the interdependence of wildlife, livestock, humans, and the wider ecosystem in shared landscapes. One Health studies seek to identify how the different components are interconnected, in order to better understand and manage risks to health, and develop sustainable ecosystems that balance the needs of humans, domestic animals and wildlife.

The need for One Health approaches was highlighted by a mass mortality of scimitar-horned oryx released into the reserve in 2018. Veterinary examinations and laboratory analyses showed that oryx that died had multiple diseases, including the deadly Rift Valley fever virus, which can also cause illness and death in livestock and humans. Since this event, we have been conducting health surveillance in free-roaming scimitar-horned oryx.

The One Health concept recognizes the interdependence of wildlife, livestock, humans, and the wider ecosystem in shared landscapes.

The veterinary team at the Environment Agency – Abu Dhabi are providing samples and test results from before animals were transported to Chad, to enable comparison of infection status before and after reintroduction. Later this year we will sample livestock grazing in the reserve during the wet season, when land-sharing between domestic animals and wildlife is greatest, and the ticks and insects that act as disease vectors are most abundant. We will compare the samples collected from antelope and livestock to improve our understanding of the infection risks between species and identify the best targets for disease control.

This study is being implemented as a One Health collaboration between partners including SaharaConservation, the Smithsonian's National Zoo and Conservation Biology Institute, the University of Edinburgh, the Institut de Recherche en Élevage pour le Développement of Chad, the Centre de coopération Internationale en Recherche Agronomique pour le Développement and the IUCN Antelope Specialist Group. Each partner institution contributes their unique background – about human communities, animal diseases, zoonotic diseases, and wildlife movement and behavior – to learn how diseases spread among people, livestock, and wildlife in an integrated way.

We hope that bringing together knowledge across multiple disciplines will provide a powerful tool to improve health outcomes for people and animals in the shared environment of the reserve. Moreover, increasing our understanding of infection risks with livestock will benefit future antelope translocations and reintroductions in Chad and beyond.

Photo credit: Stephanie Brien

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Photo credit: Jaime Dias/Wings for Conservation

SAHARA CONSERVATION

Since its inception, Sandscript articles have been written by our teams, our partners, and all those who, through their fieldwork, make the conservation of biodiversity a reality.
Its primary purpose is to inform the public of our conservation activities in the Sahara and Sahel, and to share all related news, but also to make the readers aware of the beauty and richness of this region of the world. Over the years, Sandscript has gone beyond a simple informative role to provide original perspectives on zones of Africa that are relatively unknown, poorly documented, and home to a biodiversity that is unfortunately very poorly protected.

We are grateful to all those who contribute to make Sandscript one of the first and finest sources of information on the species of the Sahel and Sahara, unique in the world, and yet neglected.

How can you help?

The Sahara and Sahel are home to a biodiversity that is undergoing a "silent" extinction. Until very recently, this decline has been ignored, its study and measures to combat it have been underfunded by the international conservation community and development agencies around the world.

In 2004, a small group of committed individuals and institutions created the Sahara Conservation Fund (now SaharaConservation) issuing an urgent call to action, with this question in mind: "If not us, then who will speak for Saharan wildlife?"
SaharaConservation is now leading a rapidly growing movement for the conservation of Sahel and Sahara wildlife, aiming to protect and restore a unique and extraordinary array of key species, such as the addax, the scimitar-horned oryx, vultures and bustards, the North African ostrich or the Dama gazelles.
As a registered NGO in the United States and France, SaharaConservation relies on donations, grants and other funding from individuals, corporations and organizations to help drive its mission and give a voice to the Sahara, helping to preserve its incredible natural and cultural wealth.

We invite you to give voice with us, to restore the wildlife of the Sahel and the Sahara, by supporting SaharaConservation.

To make a donation: www.saharaconservation.org/donate

Photo credit: Jaime Dias/Wings for Conservation

SaharaConservation's missions is to conserve the wildlife, habitats, and other natural resources of the Sahara and its bordering Sahelian grasslands to the benefit of all people and wildlife. To implement our mission, we forge collaborations between communities, governments, zoos and scientific experts, international conventions, non-governmental organizations and funders. A powerful network with a common goal: the conservation of deserts and their unique natural and cultural heritage.

www.saharaconservation.org