Stakeholder-driven research: Studying the ecology of leopards *(Panthera pardus)* on farmland in Namibia.

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Leopards are the most adaptable of the big cats as they are opportunistic hunters with a vast prey range and can adjust to various habitats.

The leopard *(Panthera pardus)* is the smallest of all big cats but also has the largest geographic extent, covering a variety of different habitats ranging from desert to rainforest. It is widely distributed in sub-Saharan Africa with the exception of sheep-farming areas in central South Africa; density is related to habitat, prey availability and intensity of persecution, from below one individual to over 30 per 100 km², with the highest densities recorded in protected eastern and southern African environments. It is classified as 'near threatened' under the IUCN and CITES Appendix I.

Leopards are solitary, nocturnal carnivores with spacious home ranges and are known to defend their territories against adult conspecifics of the same sex. They are opportunistic hunters and have a vast range of prey, varying from species as small as the dung beetle up to large mammals such as the eland antelope. In Namibia, 80% of the wildlife occurs on farmland, including carnivores; therefore stakeholder involvement is essential for research in those regions.

Most of the farmers are engaged in cattle breeding, but also utilise the locally abundant game either for their own use, for selling the meat locally or for trophy hunting with guests from mainly overseas. Predation on livestock and/or valuable game species by leopards can cause severe losses which increases the economic stress for the farmers. With the aim of ensuring the long-term coexistence of farmers and leopards, sound knowledge is needed to develop guidelines for a sustainable management.

Stakeholders as driving factor

Involving stakeholders in research projects has become increasingly fashionable within the scientific community. Accordingly, more and more researchers add a "stakeholder involvement" component to their projects. However, in order to reach maximum benefits for both sides, a long-term, trusted relationship, in which the needs and concerns of all parties are considered, is essential. This requires a lot of commitment and resources of the scientists. Therefor the involvement of stakeholders in the research is often reduced to a minimum and seldom reaches a level on which the involvement is satisfactory for the non-scientific participants as well as effective for the research. Preferably, stakeholder involvement should take place already in the planning phase of a project and communication between parties has to be maintained throughout the whole research process, thereby increasing the success of a project as we are very happy to observe within the Auas Oanob Leopard Research Project.

This project of the Leibniz Institute for Zoo and Wildlife Research (IZW) and the Auas Oanob Conservancy is a joint venture of farmers and scientists. In 2011, the steering committee of the conservancy approached the resident researchers from the IZW with an idea to expand the IZW's research activities on predators also into their area. In the following months, farmers and scientists developed research questions together, a study design was put together by the research team and each party tried to raise funds.

The successful application of the Auas Oanob Conservancy to the Nedbank Namibia Go Green Fund got the Leopard Research Project eventually of the ground in 2012. Yet, as every field researcher knows, the devil is in the details and capturing leopards turned out to be anything but easy. Here again, the cooperation of the two parties proofed to be fruitful. With the experience of the farmers (many of them being hunters) and the knowledge of the researchers, 10 leopards were captured, 7 out of which could be fitted a GPS collar. Checking traps and providing meat for baiting is part of the farmers' responsibility while immobilisation, collaring and data analyses are done by the research crew. Findings are shared and discussed in quarterly meetings of the conservancy.

In a nutshell, the interaction between the researchers and the farmers in the Leopard Research Project is taking place on four different levels:

- Developing research questions
- Fund raising
- Operational running of the project
- Interpreting the scientific results

Consequently, as the initial start-up and running of this project are based on the long-term, trusting and fruitful cooperation between the farmers and the IZW research team, the Leopard Research Project serves as an example for stakeholder-driven research.

In addition to the core area of the study within the conservancy, opportunistic captured leopards are

also collared throughout the whole study area of the IZW in Namibia and the collected data are combined with the information gathered in the Auas Oanob region (current total sample size: 17 leopards).

Objectives of the study

- ✓ Estimate the home range size and habitat use of leopards on farmland
- ✓ Investigate prey preferences and potential specialisation of individuals on livestock and/or certain game species
- ✓ Give feedback to stakeholders to improve farm management and mitigate local human-wildlife conflict

How to obtain data from leopards

Leopards are captured with the help of box traps, immobilised and then fitted with GPS-collars. The collars take GPS-positions every 15 minutes which are then downloaded via aerial telemetry, thereby allowing a detailed picture of the animal's movements.

Example set up of a box trap.

Investigating collected data

Data are analysed using Geographical Information Systems (GIS) to calculate and display home range sizes and habitat use of collared leopards as well as to investigate their prey preferences.

Leopards use a killed prey item repeatedly until fully consumed, thus returning to the hiding place of their prey over a period of up to four days. This causes a clustered pattern of consecutive GPS-positions in the same location. Detected clusters are then visited on the ground and searched for prey remains such as bones, trophies and hair to identify the utilised prey species.

Female leopard fitted with GPS-collar.

Home range size

Obtained data showed clearly a difference of the home range size between the sexes; male leopards tend to have home ranges up to three times larger than females in the same area as shown in the example in Figure 1. Furthermore, only little overlap seems to occur between the home ranges of leopards of the same sex (Figure 2).

Collared animals are tracked and data are downloaded via aerial telemetry.

Prey preferences

Regarding collected data on feeding habits, this study so far revealed a wide range of prey species confirming the opportunistic hunting strategy of leopards. However, data further showed that oryx (*Oryx gazella*), greater kudu (*Tragelaphus strepsiceros*) as well as warthog (*Phacochoerus africanus*) seem to be the main prey choice of the spotted cats which is most likely due to the high abundance of these species throughout the study area.

Outlook

Although the preliminary data already provides an interesting insight into the spatial ecology and the prey preferences of leopards, additional data will be collected throughout the upcoming years in order to get an even better understanding of leopard ecology on Namibian farmland.

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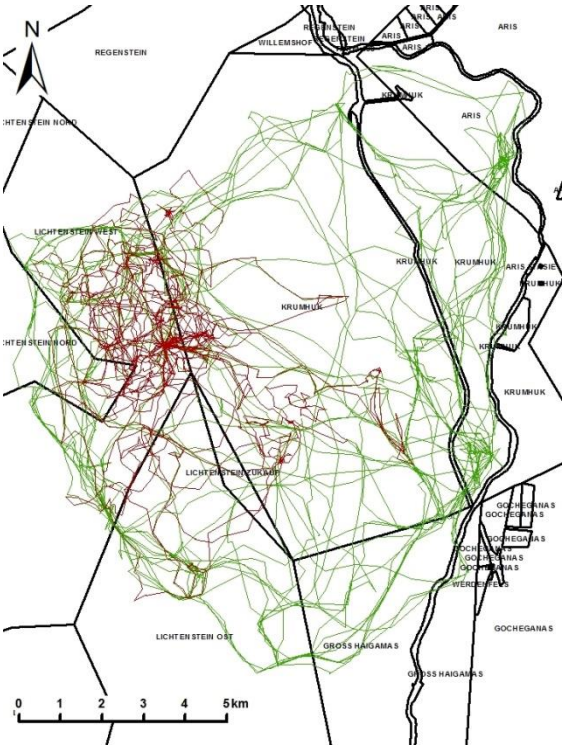

Fig.1: Home range of a female (red) within the home range of a male leopard (green).

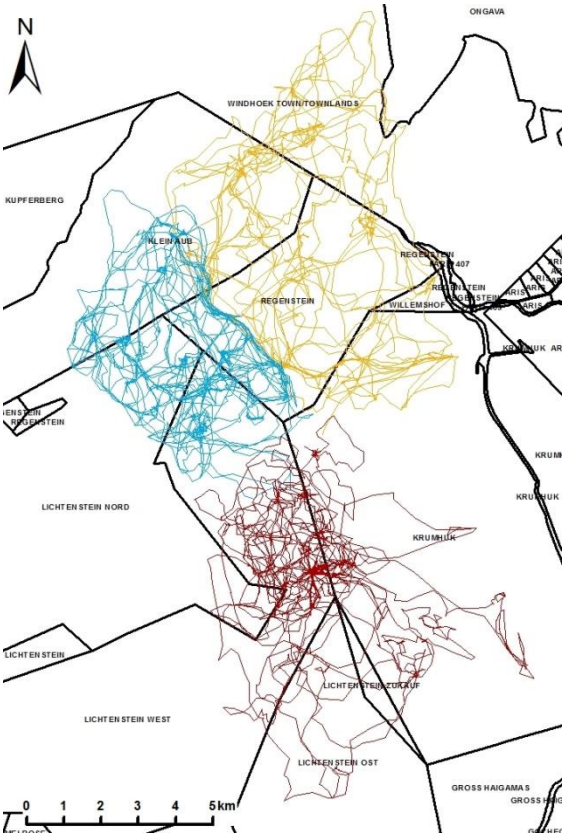

Fig.2: Home ranges of three neighbouring female leopards (red, blue and orange).