

[NTNU_IBI] [Case number 2]

Institution: Norwegian University of Science and Technology (NTNU)
Administrative unit: Department of Biology (IBI)
Title of case study: AfricanBioServices and other research in the South
Period when the underpinning research was undertaken: 2011-2020
Period when staff involved in the underpinning research were employed by the submitting institution: 2011 – 2022
Period when the impact occurred: from 2011 until present

1. Summary of the impact (indicative maximum 100 words)

The Department of Biology has a long tradition for building research capacity in the South. From 2010- to 2013 the department was engaged in a project related to the construction of a new road in northern Serengeti. In this project we built up capacity of Tanzanian researchers and students to independently assess impacts of such a road in a vulnerable area surrounding a national park.

AfricanBioServices is another example of a research driven capacity building project. The project generated and collated, analysed, synthesized, and disseminated unprecedented amounts of data from the Greater Serengeti Mara Ecosystem.

2. Underpinning research (indicative maximum 500 words)

In AfricanBioServices we by use of satellite images produced a description of the ecosystem and land cover maps for the entire Serengeti-Mara region. This described fine-scale spatial land cover changes during the past 40 years. We developed future scenario models with inputs from stakeholders (local farmers and pastoralists, rangers and conservancy leaders, and policymakers). Unfortunately, the papers associated with the future scenario workshops are not yet published because the pandemic prevented us to go back in early 2020 for follow up meetings as planned. We furthermore made more traditionally ecological studies providing more knowledge about the system and training students and researchers. One example is the use of GPS collars showing movement of wild dogs. Wild dogs did not rely on the protected areas as much as expected but were having a much larger home range and may even be jeopardized by an increasing population of lions in the Serengeti National Park. We also studied behaviour, stress, and movement of impala and concluded that the environmental variation in the landscape were a stronger driver of stress hormone levels in the impala than fear created by human or other predator encounters. An ambitious masters project in collaboration with Tanzania National Parks and Michael Anderson from Wake Forest University, USA, described the preferred plant species of the reintroduced black rhino and how these preferred plant species respond to fire that is used as a management tool prescribed in most of Serengeti as a management tool. We could show how fire actually decreases the food source for the rhino and that rhinos avoid areas that has been burned for many years after. We also carried out biodiversity measurements with eDNA sampling from streams, and guided a study on the use of local land users' information on species occurrence and abundance. We repeated countings of animal density along transects from other earlier studies to be able to track increases or decreases in species densities over the past decade, and could show that most mammal herbivores were doing well in the Serengeti park. Another such repeated study was on carnivores where by use of call-in stations we could demonstrate that lion populations had increased in the Western Serengeti protected area while it completely collapsed just as the vulture populations dramatic decrease outside the park. The vegetation part described in detail the importance of rainfall and other regional variation and of grazing pressure by livestock outside the park versus by the wildlife inside the park to species composition, plant productivity and decomposition. Despite big differences in species composition and grazing pressure temporal patterns, the primary productivity and decomposition outside the park appeared still well functioning in the Serengeti region. A Bayesian Belief Network (BBN) for land cover changes and projection was developed based on consultation with stakeholders. Part of the data gathering

was done at the future scenario workshops where also playing a board game with stakeholders on different levels simulated development of local communities.

Fieldwork activities were intense, and many institutions contributed and generated much synergy in the work. Local community facilitators participated in workshops in Tanzania and Kenya and were instrumental to the fieldwork. During the fieldwork, close contact between researchers and locals helped a two-way transfer of knowledge on important ecological and anthropogenic processes. The land cover maps and the BBN were done to show the development in land use and potential future land development scenarios. Such maps and tools are important resources for informed policy decisions in land management strategies.

In the AfricanBioServices project we developed a database that is accessed by conservation managers in East Africa. The work involved moving data from a repository (in Groningen), and into the database. NTNU hosted the work and is still in control of the database until sufficient facilities and human capacity are in place in Tanzania and Kenya. The training of technicians at advanced stage has been continuing until we are sure of ensuring sustainability of the commenced important database on biodiversity and social economic datasets in Tanzania and Kenya. The database work was led by Dr. Peter Sjolte Ranke and Dr. Gine Roll Skjærvø from NTNU.

Other projects associated with AfricanBioServices or running before this project was carried out in East Africa and other parts of Africa. These has been mostly on animal behaviour and vegetation responses to various anthropogenic impacts.

During the period 2011-2020 the group produced 13 Tanzanian PhDs, and 14 Masters. In addition, the group produced 5 PhDs from other African and Asian countries as well as 15 Masters from other southern countries. Many of these students possess currently senior positions in the Conservation and Education sector. Three of the former students are having top positions (VC, principles) at three universities in Tanzania, while many have top positions in the conservation sector. One student is currently the national rhino conservation coordinator in Tanzania. Though the research group has avoided being involved in political decision-making processes in Africa and Asia, the impact has been indirect due to the capacity built during their studies at NTNU.

The NTNU researchers involved in this work were Prof Eivin Røskaft (coordinator of AfricanBioServices and researcher, who has been working in Africa for more than 30 years) and active in Africa from 2010-2021), prof Bente J Graae (WP2 leader in AfricanBioServices and researcher in vegetation, active in Africa from 2011-2021), The Kenyan guest researcher Dr. Mohammed Saïd (researcher in land use mapping, employed at NTNU three months during 2018), Dr. Stuart Smith (Post doc and researcher in vegetation, 2015-2019), Dr. Gine Roll Skjærvø (assistant coordinator and researcher in AfricanBioServices and active in Africa btw 2010-2020). In addition, Dr Bård Gunnar Stokke (Researcher 2015-2020), Dr. Frode Fossøy (Researcher 2015-2020) and Dr. Mimi Stith (Researcher 2018-2019) and the PhD students Louis Hunninck (working on impala), Emmanuel Masenga (wild dogs), Emmanuel Clamsen Mmasssy (kori bustard), Wilfred Marealle (Giraffes), Monica Shilereyo (small rodents), Richard Lyamuya, Moses Kyando, Flora Manyama and Franco Mbise (human-carnivore conflict). Several master students from Tanzania were also enrolled in the project, eg. Philbert Ngoti (2015-2017 on rhinos), Joana Awuha (2015-2017 on ecosystem carbon response to fire)

3. References to the research (indicative maximum of six references)

- Hunninck, L., May, R., Jackson, C., Palme, R., Røskaft, E., & Sheriff, M. (2020). Triiodothyronine (T3) levels fluctuate in response to ambient temperature rather than nutritional status in a wild tropical ungulate. *Conservation Physiology*, 8(1), coaa105.
- Jackson, C., Maddox, T., Mbise, F., Stokke, B., Belant, J., Bevanger, K., Durant, S., Fyumagwa, R., Ranke, P., Røskaft, E., May, R., & Fossøy, F. (2020). A dead giveaway: foraging vultures and other avian scavengers *Ecology and Evolution*, 219443182.
- May, R., Jackson, C., Bevanger, K., & Røskaft, E. (2019). Servicescape of the Greater Serengeti-Mara Ecosystem: visualizing the linkages between land use, biodiversity and the delivery of wildlife-related ecosystem services. *Ecosystem Services*, 40, 101025.

- Smith, S. W., Speed, J. D. M., Bukombe, J., Hassan, S. N., Lyamuya, R. D., Mtweve, P. J., Sundsdal, A., & Graae, B. J. (2019). Litter type and termites regulate root decomposition across contrasting savanna land-uses. *Oikos*, 128, 596–607.
- Kija, H. K., Ogutu, J. O., Mangewa, L. J., Bukombe, J., Verones, F., Graae, B. J., ... & Nzunda, E. F. (2020). Spatio-temporal changes in wildlife habitat quality in the greater Serengeti ecosystem. *Sustainability*, 12(6), 2440.
- Anderson, T., Ngoti, P., Nzunda, M., Griffith, D., Speed, J., Fossøy, F., . . . Graae, B.J. (2020). The burning question: Does fire affect habitat selection and forage preference of the black rhinoceros *Diceros bicornis* in East African savannahs? *Oryx*, 54(2), 234-243. doi:10.1017/S0030605318000388

4. Details of the impact (indicative maximum 750 words)

With our scientific studies we have been able to contribute in great details to the knowledge about the nature and its threats in Africa. Far most of our studies have been carried out in Tanzania with professor Eivin Røskaft as leader. Røskaft has built an extensive network with various Tanzanian universities and institutions which facilitates both the logistics and the quality of the studies. This approach has been challenging because collaboration with institutions in developing countries requires much aligning with our research tradition. Nevertheless, it also enrich the research in terms of realism and opportunities for including indigenous knowledge and it serves the important purpose of contributing to what we anticipate as sustainable development in the developing countries. With the high number of supervised students, Røskaft contributed significantly to developing the research in ecology and in human wildlife conflicts in Tanzania.

Overall, our many studies in the Tanzanian ecosystems have shown the drivers of change in biodiversity and ecosystem services. In AfricanBioServices we could demonstrate the impact of management, the intactness of the fauna and flora within the park and the drastic changes in land use and land cover, vegetation composition and animal density outside the park since 1975. By involving the locals in our studies, we were able to discuss the reasons for the ecological changes and the anthropogenic drivers, including climatic, cultural, economic and psychological drivers. These discussions both elevated our research credibility and acceptance and the knowledge of the driving forces and their sustainability for the locals and policymakers. Our results generated discussions among the researchers within the AfricanBioServices but also in some previous projects and political/ideological drivers often will have a great impact on how researchers may advise the stakeholders on nature management and sustainable development. In our group, we decided that our most important role is to provide the African researchers with up-to-date knowledge and tools for making informed decisions, and not for us to recommend how to manage their land that is a highly political issue. Therefore, it has been important for us to have local researchers and other stakeholders involved in our projects but avoid too many recommendations and what may be seen as political activism or even neocolonialism.

We are therefore proud to have contributed to the capacity building for both academics and local stakeholders. Many scientific papers resulted from AfricanBioServices and surrounding projects, but the societal impact is likely more gained through the capacity building and discussions we had with stakeholders at various levels. These are though hard to evaluate and document.

An indicator of contribution to the African academia and natural resource management and conservation sector can though be demonstrated by the success of our graduated students as mentioned above.

We disseminated our research on the **AfricanBioServices** blog, in scientific journals and at conferences. We also presented our results to local stakeholders in the 12 villages we worked with. Finally, we developed poster scenarios and the board game. The game has further been played at various universities and is now included in ecology curriculums at universities in Norway, Denmark, and Sweden. This is to further teach students in the Western world about human-wildlife conflicts and dilemmas in an innovative way and based on our experiences in Tanzania and Kenya. The game is also sitting at the embassies of Denmark and Norway in Tanzania (<https://maasaimarascience.org>) as well as in the 12 villages we visited and with regional policymakers in both countries.

5. Sources to corroborate the impact (indicative maximum of ten references)

<http://africanbioservices.eu/>

<http://www.savannalife.no>

<https://www.tandfonline.com/doi/abs/10.1080/14660466.2018.1491754?journalCode=uevp20>

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Røskaft, E. (2014b). Threats to Africa's biodiversity. *Pan European Networks: Science & Technology*, 12, 248-249.

Røskaft, E. (2019). Linking biodiversity, ecosystem functions and services in the Serengeti-Mara Region, East Africa: Drivers of change, causalities and sustainable management strategies. *The Project Repository Journal - PRJ*, 3, 42-45. <http://edition.pagesuite-professional.co.uk/html5/reader/production/default.aspx?pubname=&pubid=fdadc48b-a0c9-49a3-b12f-fadaebf0aa07>

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