Factsheet # 02

Rangeland Status from Above

Drone technology can support adaptive rangeland management

Challenge

- Rangelands, which are a cornerstone of our livelihoods, culture and economy suffer from land degradation.
- This is mainly due to climate change and unsustainable grazing practices that reduce forage resources and compromise livestock production.
- To better manage our rangelands, we need timely and accurate information on rangeland status and production, so that proactive grazing strategies can be implemented.
- The monitoring methods must be cost-effective, repeatable, and cover sufficient areas that are representative of these extensive landscapes.
- **One promising approach is drone technology: it offers an easy, fast, and accurate way of assessing rangelands.**

Fig. 1. Types of quadcopter drones & vegetation sensor that enable cost-effective and detailed mapping of rangeland health. Credit: Amputu et al. (2023).

Mapping rangelands using drones

Performance of drone technology was compared with common field methods in Namibia's semi-arid rangelands.

- The drone mapped key indicators of rangeland status accurately as follows:
  - herbaceous biomass (89%), bare ground cover (86%), herbaceous plant cover (96%), and woody plant cover (97%).
- It is based on a workflow that is robust and easy to reproduce (see Amputu et al. 2023).
- Therefore, we can use drones to see how much forage is available, to map the extent of bush encroachment, and to monitor restoration efforts like bush thinning in our rangelands.

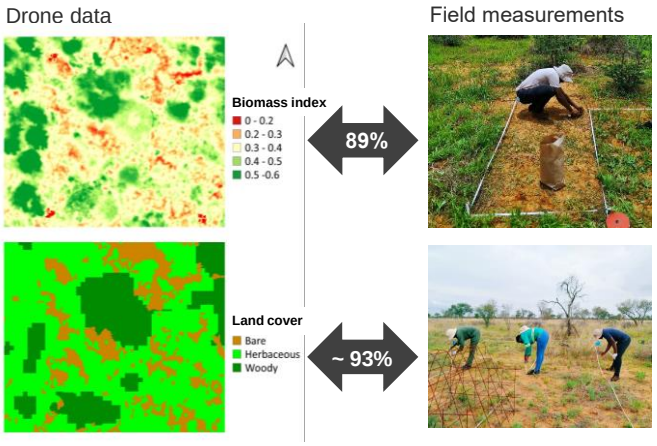

Fig. 2. Strong agreement (%) between drone and field estimated biomass and land cover. Credit: Amputu et al. (2023)

Credit cover photo: Vistorina Amputu

Accuracy of mapping land cover

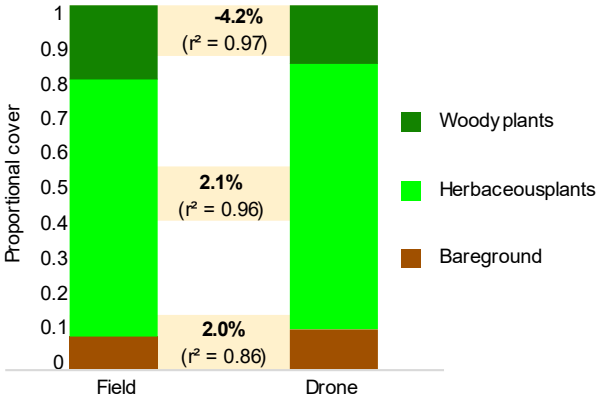

Fig. 3. Comparison of land cover estimated by the drone and in the field. The mean difference (%) and accuracy (r^2) are shown. Credit: Amputu et al. (2023)

Practical Implications

- **Inform Policy Development and Implementation:**
  - Detailed visual representations from drone mapping can support evidence-based policies and help policymakers assess the impact of management practices and identify areas for improvement.
  - Examples: (1) track the effectiveness of policies like the "National Rangeland Management Policy" (NRMP) and (2) monitor the implementation of legislation on debushing, charcoal burning, etc.
- **For Practitioners**
  - **Timely interventions:** farmers can use drone technology to assess forage availability and adjust animal numbers accordingly.
  - **Evaluate Restoration Measures:** e.g. bush control measures can be tracked using drone mapping and ensure that they adhere to the "National Strategy on the Sustainable Management of Bush Resources".
  - **Enhance Namibia Rangeland Monitoring System:** drone data can be used to calibrate & refine satellite outputs.

Key Findings

- Accurate estimates of key indicators of rangeland status using drone technology
- Drone mapping can be done at larger scales with much less effort in the field
- Overall, near-real time rangeland status that can guide proactive rangeland management

What is needed for mapping rangelands using drone technology:

- A quadcopter drone is practical for take-off and landing in savannah rangelands.
- Flight duration between 15 and 30 min, mapping up to 20 ha per flight.
- Flight planning can be easily done in free software like Pix4DCapture or DJI GS Pro.
- Standard (RGB) cameras or vegetation sensors can be mounted onto drone.
- QGIS (free) allows merging of raw drone images into maps (Fig.1.), calculating vegetation indices, and classifying land cover to assess rangeland status.
- Data storage: locally on external drives (cheaper) and/or cloud storage (may be costly).
- Keep up with NCAA regulations on operating drones here: https://www.ncaa.com.na/

References

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Authors

Vistorina Amputu, Plant Ecology Group, University of Tübingen. Contact: vamputu@gmail.com

Katja Tielbörger, Plant Ecology Group, University of Tübingen.

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The NamTip Project

The collaborative German-Namibian research project "NamTip – A Namibian Perspective on Desertification Tipping Points in the Face of Climate Change" aims to better understand the development of ecological tipping points in dryland rangelands by assessing desertification and woody plant encroachment processes. It also explores management options for preventing such tipping points and restoring degraded rangeland ecosystems.

www.uni-potsdam.de/en/namtip

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Project Lead

Prof. Dr. Anja Linstädter
E-Mail: anja.linstaedter@uni-potsdam.de

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