Factsheet #10

Mapping vegetation with remote sensing

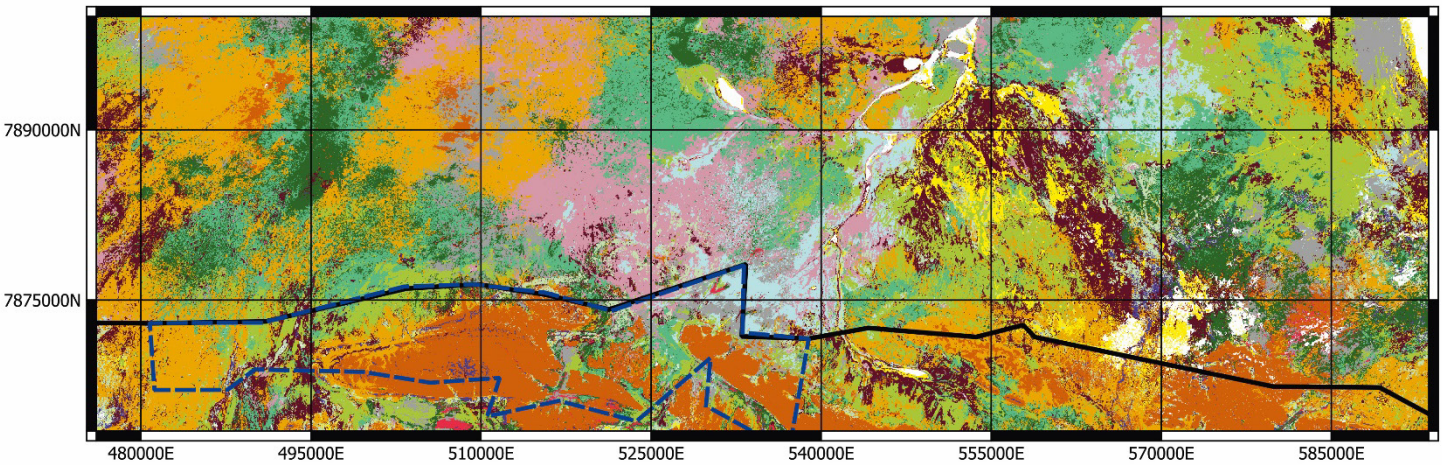
Mapping vegetation types

Mapping vegetation from the air or from space is possible using a growing number of tools. These cover a wide range of spatial and temporal scales, from one-time airplane campaigns to continuous satellite measurements over the past 40 years.

One key requirerment to classifying satellite or other remote sensing data is **field verification campaigns**. To properly translate what you can see from afar, you need to have detailed information from the ground.

During the course of the ORYCS project, such field verification data was collected, resulting in a high-resolution map of major vegetation types in a test area in Northern Namibia.

Collecting detailed verification data is essential. Data on plant type, density, height, and health can be used to interpret remotely-sensed data over a larger spatial area. This makes it possible to go from sparse data to a continuous map covering a larger region.



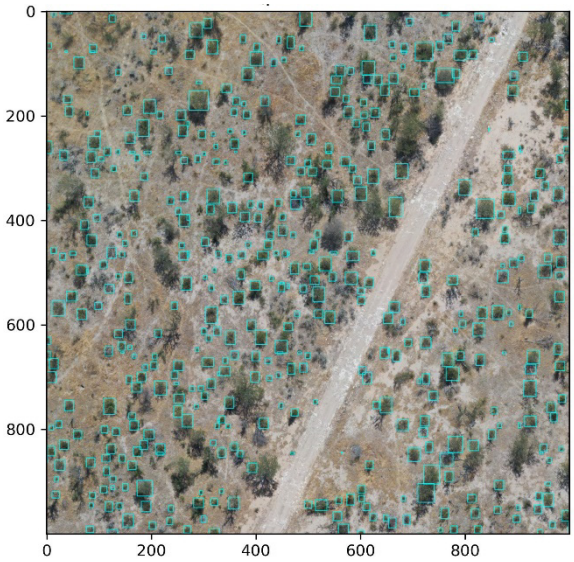
Provisional map of major vegetation types southwest of the Etosha Pan, based on Sentinel-2 data and ~100 field verification points. Coordinates in UTM 33S. Etosha Heights and Etosha National Park boundaries shown for reference.

- Etosha Heights Reserve
- Etosha National Park
- Senegalie (Acacia) mellifera
- Vachellia (Acacia) newbrownii
- Vachellia (Acacia) reficiens
- Catophractes alexandri
- Mopane medium/large
- Mopane open savanna
- Mopane riparian
- Mopane small
- Open grassland
- Small open areas with calc. Rocks
- Mixed stands on plain outcrops
- Mixed stands on mountains
- Bare soil

Cover photo: Taylor Smith; other photo: Robert Hering

Mapping individual trees

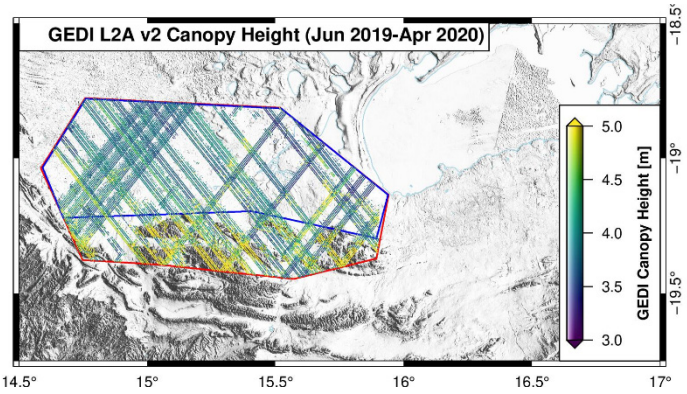
Improvements in **image resolution,** for example from air photos, also allow for new techniques to be applied. When high-resolution data is available, it can be used to map vegetation at an unprecedented scale.



The above aerial image illustrates how **machine learning** methods can be used to map individual tree locations over a large area. These cannot only be used to improve species maps, but also biomass estimations. The extent of this figure is 100 × 100 m with a spatial resolution of 10 × 10 cm. Not all trees are perfectly mapped – ongoing adjustments to the training data and mapping algorithm will improve this process with the goal of providing a complete tree accounting alongside precise tree type classifications.

Vegetation heights and biomass

There is an increasing amount of **Lidar** data (light detection and ranging), collected from the air and from space. These data measure precise **heights** using a laser, and can also be used to infer the **density** of plants.



These measurements were collected from space via laser measurements, and show the precise height of vegetation above the ground. Observations are collected along a profile, hence they are not spatially continuous (as is usual for optical data). Such data can be used to map **biomass** across large areas. This figure shows only vegetation heights above 3 m to highlight tree occurrence. Combined with other spaceborne data, these can be used to monitor **annual cycles in vegetation growth** – even for shorter vegetation such as grass and shrubs.

High-resolution photos can also be used to create high accuracy **3D models,** which complement space-based approaches. Combining these vegetation-density estimates with tree-counting or vegetation species maps will allow new and high-resolution studies on large-scale ecology in savannah ecosystems.

References

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The ORYCS Project

The German-Namibian research project "ORYCS – Options for sustainable land use adaptations in savanna systems" aims to assess the suitability of wildlife management strategies in Namibia as options for adapting land use to climate change in savanna ecosystems.

www.orycs.org

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