GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN

SALLnet Newsletter, March 2021

Dear SALLnet members,

the current issue of our newsletter is focusing on field and research activities conducted recently to provide you with some insight on what is going on in SALLnet while COVID-19 is still affecting our work quite a lot. Especially, we would like to draw your attention to the next SALLnet Seminar on 15 April 2021, when **Mirjam Pfeiffer** (WP 6) will present on the **impact of climate change on vegetation in Africa**.
These efforts are much appreciated and our thanks go to everyone who has been and is contributing to this!

The current issue contains information on SALLnet related:

Field Work

SALLnet focuses on how the resilience of the multi-functional landscapes in southern Africa can be enhanced. To do so, we are developing and testing new approaches and methods for more sustainable land-use, with a focus on the interactions between the connected land-use types: **arable lands, rangelands and tree orchards**.

Arable experimental trials to overcome climate variability, and Covid-19 disruptions: WP 5

Arable experiments are key for several SALLnet activities. However, in WP 5 ("Effect of climate change and management interventions on ecosystem services of arable land and macadamia plantations in Limpopo region") in which researchers from the Universities of Göttingen, Venda and Limpopo collaborate, they are carried out by South African early career scientists, who run and analyse the trials. These activities do not only train young South African scientists, but the data generated from them feeds crop simulation models (CSM) for calibration and validation purposes. The use of CSM enables us to upscale field-based investigations, which assess the effect of management interventions on arable cropping systems, as well as ecosystem services. Once CSMs are validated by experimental data, they are used to generate input for several SALLnet work packages. The studies conducted by four South Africa students, as described below, are the foundation of a substantial amount of SALLnet's output.

Students based at the Universities of Venda and Limpopo assess several climate smart agricultural approaches, including:

- **Cowpea variety trials** and rotational impacts on maize production
  Musumuvhi Thabelo, PhD student, University of Venda
- **Maize-lablab intercropping**, using several lablab cultivars
  Sophy Thaba, MSc student, University of Venda
- **Groundnut variety trials**
  Mulaudzi Ntakadzeni Rose, MSc student, University of Venda
- **Sorghum-cowpea intercropping** under different tillage methods
  Mogale Tlou Elisabeth, PhD student, University of Limpopo

All students were awarded grants in 2020 to visit TROPAGS, University of Göttingen to advance their experience with the CSM APSIM. Restrictions meant they could not travel to Göttingen, but were instead given the opportunity to take part in an online workshop in August, called: APSIM Advanced and Dynamic Vegetation Modelling.

These experiments assess yield production as well as soil water, nitrogen, and carbon dynamics at a field scale and were set up in multiple locations and over several years, starting with the Nov-2018 to April-2019 season.
While in the first season all samples could be gathered, the following one (2019-2020) was dramatically disrupted by Covid-19 travel restrictions and lockdowns. Around the 2020 harvest period, students were not granted access to experimental stations to harvest crops and sample at key stages. The 2019-2020 experiments largely failed due to this but were been reinitiated in autumn 2020 to produce this much needed data. Soil analysis, key for CSM setups, was also delayed as the necessary equipment could not be delivered. A joint effort of TROPAGS, University of Göttingen and the University of Venda secured the funding, purchase and safe delivery of vital soil lab equipment, which is now in South Africa and due to be installed over the coming months and used to analyse the backlog of soil samples.
The delay of experimental trial data collection has knock on effects for several work packages. With plans in place to ensure the collection of field trial data for the 2021 harvest, WP 5 looks forward to the insights due to be gained from two full years of experimental data.

Left: Groundnut trials (four cultivars) and soil sampling, University of Venda, 2019-20. Photos: Mulaudzi Ntakadzeni Rose

Right: Maize-lablab intercropping trial (left), lablab pods and seeds (right), University of Venda, 2019-20. Photos: Sophy Thaba

Grasses, Forbs or Shrubs: What do cattle eat in a dry savanna? WP 2

SALLnet's WP 2 ("Rangelands and agroforestry") focuses on the delivery of multiple ecosystem services (ESs) of Limpopo's rangelands and agroforestry systems, and evaluates ecosystem stability in the face of climate change.

To better understand seasonal differences in cattle diet in a South African savanna, an international team investigates forage provision and consumption. For that purpose, plant samples and cattle dung were collected in different seasons. The field work was done on the research farm of the University of Limpopo, South Africa, in April 2019 (rainy season), October 2019 (dry season) and concluded in December 2020 (early rainy season). Analyses are currently done via DNA-Metabarcoding and stable isotope analysis. One main question is if cattle resort to forbs and shrubs during times when grasses are scarce e.g. in early rainy season. The results will eventually contribute to improved concepts for grazing management and for compensation of seasonal nutritional deficits. The research is led by the SALLnet WP 2 in close collaboration with WP 1 ("Arable lands"). It includes researchers from the Universities of Potsdam, Göttingen and Bonn in Germany and the University of Limpopo and the North-West University in South Africa.

Left: Collection of cattle dung in April 2019, Middle and right: Vegetation assessment and biomass collection in December 2020. Photos: Vincent Mokoka (left), Charity Selaphelo (middle), João Silva (right)

SALLnet – Pollinator and Predator Trials in Macadamia Orchards: WP 3

SALLnet's WP 3 ("Orchards") examines the effects of landscape composition and altitudinal gradients: Considering current land use and climate change we are investigating two ecosystem services (ESs) and their potential trade-offs (pollination and biocontrol) in macadamia systems, which are located along an elevation gradient. Our project is led by researchers at the University of Göttingen and carried out in close collaboration with our colleagues from the Universities of Venda and of the Free State. In our project the provisioning of biological control by bats and birds as well as pollination services by insects are manipulated experimentally during flowering and fruit ripening to assess their relative importance and potential interactions for yield quantity and nut quality.

Left: Macadamia orchard

Right: bird and bat exclusion cage around two macadamia trees.

Photos: Mina Anders

Dr. Valerie Linden and Prof. Peter Taylor (University of the Free State) are recording bat and bird activity using passive acoustic monitoring. 40 AudioMoth recorders are being deployed in the orchards every six weeks for two days and nights, autonomously recording either sound or ultrasound. Additionally, Samson Mulaudzi, a local bird guide, has been employed to do visual bird counts (local ornithologist www.birdingsoutpansberg-venda.co.za). Moreover, nut set and final yields and kernel quality is monitored throughout the upcoming growing season. Since the field trip of Mina Anders (PhD student, University of Göttingen) had to be cancelled, due to the Corona pandemic, two students from the University of Venda, Vusani Mphethe (PhD student) and Lorraine Ramotjiki (MSc and new field assistant), took over the fieldwork until January. They conducted pollinator observations and pollinator exclusion experiment in the macadamia orchards, as well as the nut set monitoring. The macadamia nuts are developing and will be mature soon, so that we can start harvesting and subsequently perform the quality analysis of the nuts. From February onwards, a group led by Dr. Lourens Swanepoel (www.aice.org.za) takes over the maintenance of the experimental setup and the data collection on site.

Left: Pollination exclusion by a mesh bag around a macadamia inflorescence

Middle: A honeybee pollinating a macadamia flower

Right: A raceme with immature macadamia nuts.

Photos: Mina Anders

The rain has been generous in our study area this winter and temperatures have been favorable during flowering. Unfortunately, the rain has become excessive in the last weeks causing flooding in some parts of the area and hampering the fieldwork. Still, the climatic comparisons between the two field seasons will be interesting, with the first one having been very dry and hot, causing an overall low yield for all of South Africa.

First results indicate that feral and managed honeybees, which are evenly distributed along the elevation gradient, dominate pollinator communities in macadamia orchards. However, remnants of natural bush have a positive effect on bat activity and biological control resulting in enhanced yields and nut quality.

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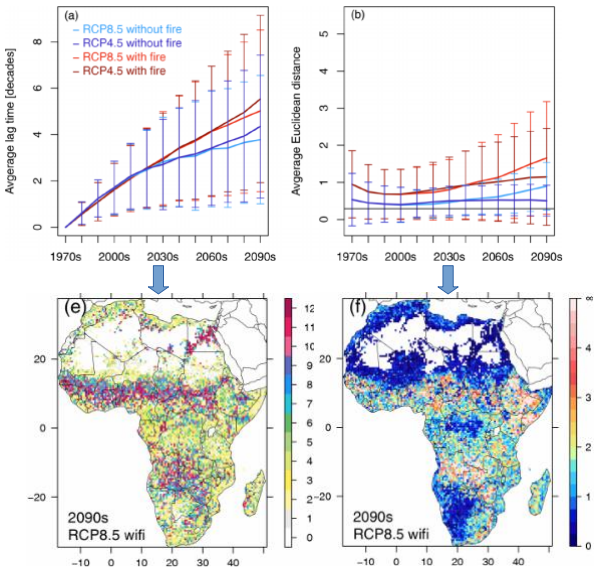
Research

2nd SALLnet Seminar

Mirjam Pfeiffer (WP 6): Climate change will cause non-analog vegetation states in Africa and commit vegetation to long-term change



Lags caused by delayed vegetation response to changing environmental conditions can lead to disequilibrium vegetation states. Awareness of this issue is relevant for ecosystem conservation. We used the aDGVM vegetation model to quantify the difference between transient and equilibrium vegetation states in Africa during the 21st century for two potential climate trajectories. Lag times increased over time. In addition, vegetation was non-analog to any equilibrium state due to multi-lag composite states. Therefore, conservation efforts need to consider that observed vegetation must be expected to continue changing substantially even after stabilization of external environmental drivers.

Thursday, 15 April 2021, 12:00 CET/SAST Online

SALLnet DroughtAct experiment: After six extreme drought years, the focus is now on recovery processes: WP 2

After six years of experimental drought in the **DroughtAct experiment** situated in a dry savanna in South Africa's Limpopo province, plots under drought treatment turned to bare ground (Figure 1). Before the growing season 2020/2021 an important treatment change was initiated: The six-year drought was ended and now the post-drought recovery processes in vegetation and soil will be investigated in the coming years.

Figure 1: Core treatments of DroughtAct in the sixth observation year (2020). Photos: Vincent Mokoka

Results from the past years show a collapse of annual net primary production (ANPP) in the drought plots, both under grazing and resting conditions (Figure 2). Relative reduction of ANPP in drought plots increased with the length drought (Figure 3), indicating of decreasing rain use efficiency and therefore a degradation of vegetation. While we found the vegetation to be relatively resistant and resilient to a 2-years drought, we expect a lengthy recovery process after a 6-years drought.

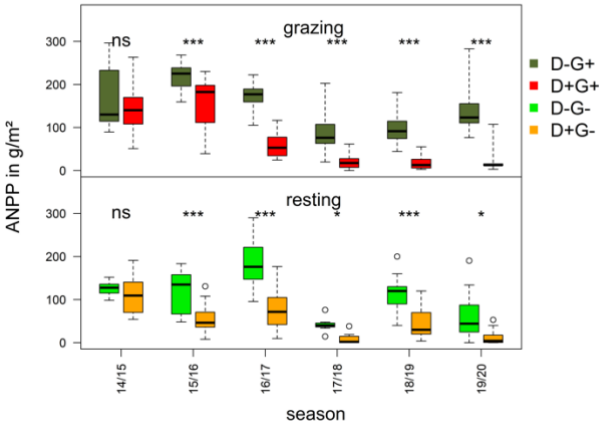


Figure 2: Comparison of ANPP (in g/m²) between drought (D+) and ambient rainfall conditions (D-) both under grazing (G+) and resting (G-) conditions. Asterisks indicate a significant difference between D+ and D- at p<0.05.

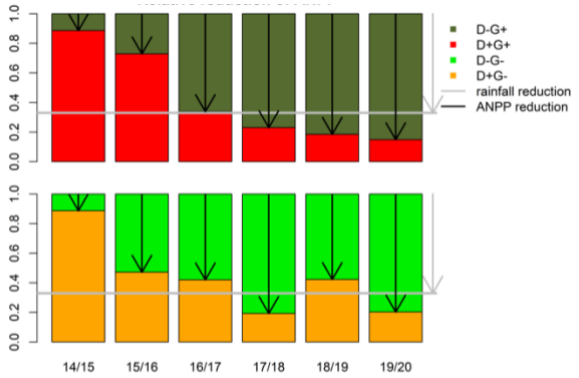


Figure 3: Response ratio of Drought (D+) compared to ambient rainfall conditions (D-). The black arrow indicates the relative reduction of ANPP in the D+ plots compared to D- plots, while the grey line indicates the relative rainfall in the D+ plots (33% of the ambient rainfall).

The DroughtAct experiment was established in 2014 following a pre-treatment year in the context of the Spaces: Limpopo Living Landscapes (LLL) project. The main aim of the experiment was to understand the combined effects of a centennial-scale drought and grazing on a dry savanna ecosystem, using a full-factorial design. With continuous data collection until today, DroughtAct has become a long-term experiment and an integral part of the WP 2 ("Rangelands and Agroforestry") led by Prof. Dr. Anja Linstädter. With the end of the SALLnet project, DroughtAct will be handed over to the working group of Prof. Dr. Kingsley Ayisi at the University of Limpopo for further investigations of ecosystem recovery.

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Documents

SALLnet Policy briefs

As decided at **SALLnet's 2nd Annual Meeting**, the Policy brief group has developed

- guidelines and
- a template

for **SALLnet policy briefs**. Thank you very much for this effort to everyone who has been involved!

If you plan to write a policy brief, please consult these documents, which are to be found on our Google drive.

As you will see, we as well gather further information related to this topic. Of particular importance are **Policy information from others** as well stored on our Google drive. If you plan to write a policy brief, please consult these papers.

We are about to complete our collection of these already existing policy information, please help us to further develop this and provide SALLnet's coordination with further information whenever you across!

Data Gaps

Another important discussion at **SALLnet's 2nd Annual Meeting** has focused on the question, how to deal with **data gaps**. This discussion and its results is documented in a report now available on our Google drive.
Thank you very much to the data gaps group!

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Members

As at 1 January **Prof. Peter Taylor** (WP 3) has left the University of Venda (now University of the Free State). While for that reason he has to leave his formal SALLnet positions as co-lead/South African scientific coordinator and PI of WP 3, he will continue contributing scientifically in many ways. Thank you very much, Peter, for your great and continuous support in the leadership team of SALLnet!

Prof. Stefan Foord will substitute Peter Taylor as SARChI Chair at the University of Venda will act as PI of WP 3 and Speaker of the South African research partners in SALLnet, jointly with Kingsley Ayisi from University of Limpopo.
Thus, a warm welcome to Stefan, who is very familiar with SALLnet, since he has already supported our consortium since the early days of the precursor project Limpopo Living Landscapes (LLL) under SPACES in its first funding period.

Dr. Valerie Linden (WP 3, University of Venda) has left SALLnet, what we very much regret! Thank you, Valerie for your continued support of the Limpopo Living Landscapes (LLL) and the SALLnet project!

Dr. Ewald Weber (WP 2, University of Potsdam) has joint SALLnet already in October last year. He has taken over from Kai Behn (WP 2, University of Bonn) regarding the coordination of the Rapid Ecosystem Function Assessment (REFA) campaign. We warmly welcome you, Ewald!

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Media Contributions

Farmer's weekly: Valerie Linden (WP 3) on bats in Macadamia orchards

Valerie Linden has been interviewed by the journal "farmer's weekly". In this article she presents important insights into her research on bats and their pest control abilities for macadamia. Even though increased pest control application and insect pest damage to South Africa's macadamia industry relates to a declining number of bats, these mammals have a great potential of effective natural pest control, why Linden aims to create awareness on how management practices affect natural predators and gives advices how to increase the presence of bats.

Read more.

The Macadamia Magazine: Valerie Linden, Sina Weier, and Peter Taylor (WP 3) on bat houses

Valerie Linden, Sina Weier, and Peter Taylor have presented their findings on how to support the survival of bats in macadamia orchards, which plays an integral role in a natural and more balanced approach to pest control.

Read more.

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Upcoming Events

EGU General Assembly 2021, online

19–30 April 2021
The **EGU General Assembly 2021** will bring together geoscientists from all over the world to one meeting covering all disciplines of the Earth, planetary, and space sciences.

Further information please find here.

22nd Congress of the Entomological Society of Southern Africa

28 June–1 July 2021, Tshipise, Forever Resort
The theme for the **22nd Congress of the Entomological Society of Southern Africa** is: "Insects in the Anthropocene".

Further information please find here.

Grassland Society of Southern Africa: 56th Congress

26–30 July 2021
GSSA 56th Congress
Surval Boutique Olive Estate, Oudtshoorn

Further information please find here.

Landscape 2021: Diversity for Sustainable and Resilient Agriculture, online

20–22 September 2021
Landscape 2021 will bring together scientists from across disciplines with key actors to explore whether and how diversity and diversification can contribute to a more sustainable and resilient agriculture.

Further information please find here.

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Information on SALLnet are as well to be found on our Website and on our Google Drive. Access will be granted to everyone using the links implemented into this document. The Google Drive can as well be accessed via the link Project Documentation on our website for those of you who are registered. To register please send your google address to SALLnet's coordinator.

To keep these formats updated and useful for you, please provide us with further project information (at any time) and insert changes regarding your projected field stays into our Calendar – thank you very much!

We also recommend to visit the SPACES II website, where all capacity building courses of SALLnet and the entire SPACES II programme are announced (with access to the application tool).

SALLnet – South African Limpopo Landscapes Network

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