GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN

SALLnet Newsletter, July 2020

Dear SALLnet members,

Covid-19 is heavily affecting SALLnet's research. Most of the planned field trips, capacity building courses and meetings had to be postponed. Hence, we are glad to see, that some trials could continue supported by our South African partners and some of the planned events will be held online. We will keep you informed about the further development. The current newsletter mainly presents first results of our research and information on upcoming events.

Information on SALLnet are as well to be found on our Website and on our Google Drive (link: Project Documentation on our website). If you have no access to the Google Drive yet, please send your google address to SALLnet's coordinator, so that our data can be shared with you.
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).

Take care and stay well!

The current issue contains:

Project Progress

WP 1

The increase of extreme weather events (e.g. prolonged droughts) is expected to negatively impact the mixed farming systems across resource constrained local farmers (smallholders, emerging) in the Limpopo region. At this local level, farmers have individually developed a way to deal with the climate induced impact on the farming system components (e.g. developing measures to reduce or to cope with feed gaps). Hence, SALLnet's work package 1 firstly attempts to examine and to understand the local mixed crop-livestock systems, and to identify risk management measures associated with the production of the livestock component on the basis of individual interviews. Secondly, we assess the potential/vulnerability of the local farming systems by analyzing the fertility of the arable, range lands, the quality of feed. Furthermore, work package 1 uses stable isotopic signature techniques (13C & 15N) on cattle hair, cattle dung, soil and forage to provide insight into the site conditions (for

instance, the capacity of the grazing pastures and feed) during the winter season. We started our investigation in 2018 with a preliminary survey across 30 farms in Limpopo. A follow up survey was carried out in the 2019 season with additional 90 farms. Thirdly, we established the first season (April – September 2019) of selected cool-season forage crops trials at two distinct sites (University of Limpopo – Syferkuil and University of Venda). The idea behind the third objective is to assess the biomass performances of these crops and their potential use to mitigate feed gaps in the winter period. The initial results from objectives 1 and 3 are accepted for presentation (poster and oral respectively at the joint International Grassland and International Rangeland Congress, Kenya Oct 2020 – now postponed). Finally, data collected (related to production systems, management options, rangeland biomass, feed quality, soil, field trials etc.) will be integrated in simulation models linking climate, crop, livestock and sites to facilitate decision making towards climate-smart agriculture.

1) Leonhard Klinck (University of Goettingen) successfully completed his MSc Thesis which explores the feed base systems and dry season rangeland forage quality across selected cattle farms in Limpopo.
2) Sala Lamega (PhD student – University of Goettingen) has carried out field trials and a survey in 90 households, analyzed field and survey data (laboratory work in progress) and is currently working on a manuscript. The planned second season of field trials is on standby due to covid-19.

WP 6

Work on aDGVM2 towards integration of a nitrogen scheme has focused on implementation of soil-related aspects of the nitrogen cycle. To that end, a new routine to dynamically calculate daily soil temperature as a function of air temperature (top boundary layer condition), annual mean air temperature (bottom boundary layer condition), soil depth, soil texture and soil water content has been implemented. Based on these variables, the new soil thermal scheme derives daily soil temperature as a function of soil heat capacity and soil heat conductivity between soil layers. For consistency reasons with the aimed-for implementation of the ORCHIDEE-CN soil nitrogen scheme, which includes calculations that estimate climatically relevant N-trace gas fluxes from nitrification and denitrification, the current YASSO SOM-scheme is being replaced with the CENTURY-based litter and SOM scheme used in O-CN. The litter scheme has been largely implemented by now, work on the SOM scheme has been started and is ongoing. It will be followed by a testing of the new routines.

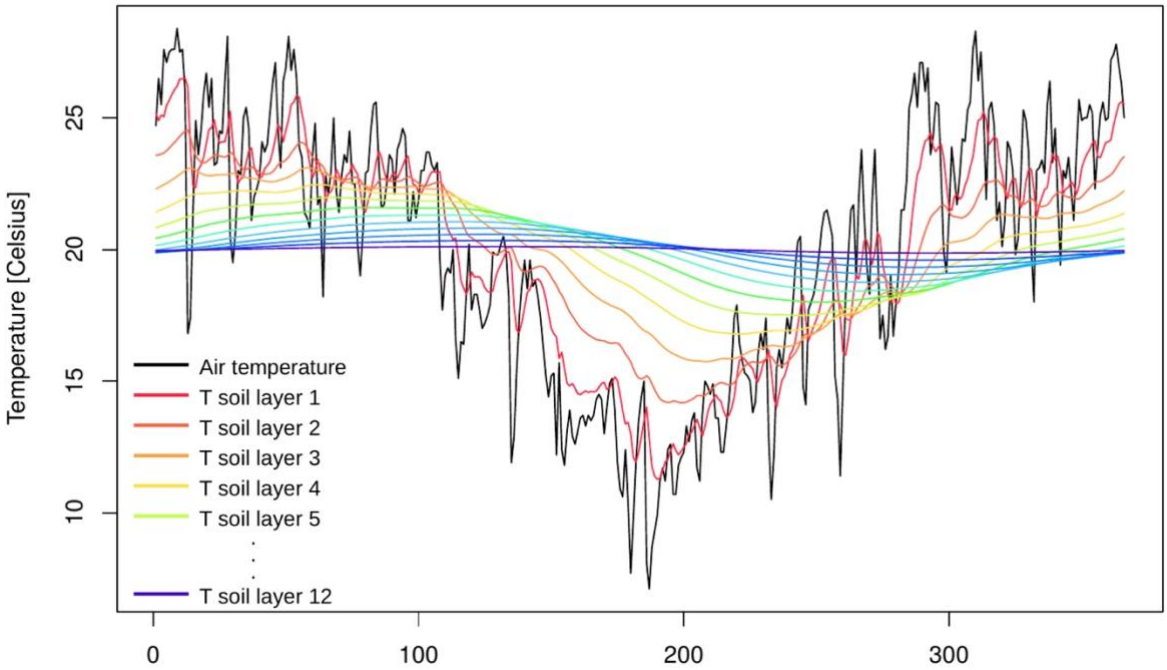


Fig.: Example for soil temperature in different soil layers as simulated by aDGVM2.

For more information about other work packages please visit our website!

Follow-up on recent events

EGU General Assembly 2020, Vienna

Modelling impacts of climate change and alternative management interventions on the multi-functionality of agricultural landscapes in southern Africa
Rötter, R.P., Nelson, W.C.D., Isselstein, J., Scheiter, S., Pfeiffer, M., Hoffmann, M.P., Ayisi, K., Lindstädter, A., Behn, K., Westphal, C., Grass, I., Feil, J.H., Odhiambo, J., Taylor, P., Twine, W., Merante, P., Bracho Mujica, G., Bringhenti, T., Lamega, S., Yazdan Bakhsh, S., Krieger, W., Linden, V., Weier, S., and Erasmus, B.
European Geosciences Union, 4–8 May 2020

The European Geosciences Union (EGU) General Assembly took place online between the 4th and 8th of May. The SALLnet group was represented by Prof. Reimund Roetter and Dr. William Nelson (TROPAGS, University of Goettingen), who showcased the entire SALLnet project, as well as a case study defined for the Limpopo Province, South Africa. The case study investigated the effects of current management practices and an intensification scenario over a longer period of years on soil organic carbon change under rangeland and arable land, potential erosion, productive water use, biomass production, monthly feed gaps, and rangeland habitat quality. The study looked at coupling the output of vegetation (aDGVM) and crop models (APSIM) regionally calibrated with sound ground/ experimental data. This appears promising to provide meaningful insights into the highly complex interconnections of different ecosystem services at a landscape level. Tentative results showed that sustainable intensification closed the livestock feed gap, but further reduced soil organic carbon (Fig.).

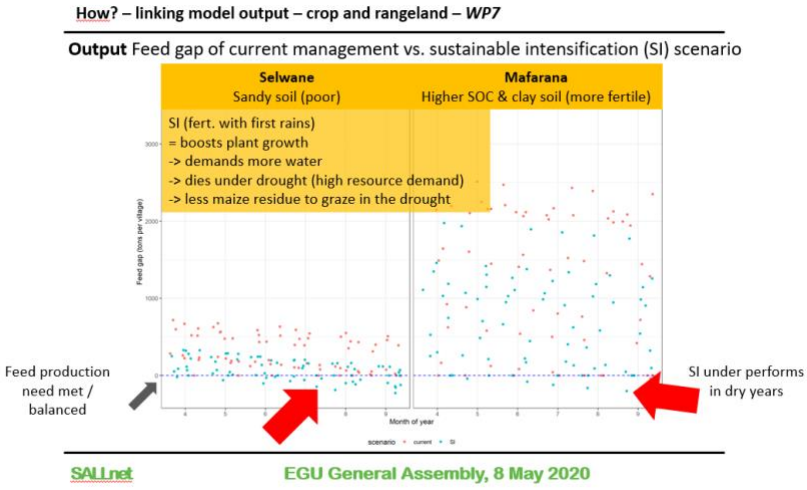


Fig. EGU 2020 SALLnet contribution highlights of model coupling study.

Further information (interactive PDF version of the presentation) are to be found here.

Publications of SALLnet members

Published Paper: Simulating medium-term effects of cropping system diversification on soil fertility and crop productivity in southern Africa

M.P. Hoffmann, C.M. Swanepoel, W.C.D. Nelson, D.J. Beukes, M. van der Laan, J.N.G. Hargreaves, R.P. Rötter European Journal of Agronomy, April 2020

Crop diversification is perceived as a strategy to achieve high productivity and maintain environmental sustainability. Utilizing the capability of agro-ecosystem models to quantify the interactions of crop productivity with management and environmental variables, the APSIM model was evaluated against six and an eight-year field trial datasets comprised of different crop rotations and fertiliser rates under two contrasting agro-ecological conditions in South Africa.
After evaluation, the model was applied over a ten-year simulation period with rotation treatments, fertiliser levels, and residue management for the two sites. Maize monoculture treatments with residues removed reduced yields strongly (>1000kgha−1). On commercial, fertilised cropping systems, allocating land to cultivate crops other than maize reduced the simulated total yield performance. This diversification disadvantage has to be considered against the benefits of increased SOC and yields in the medium-term. For the commercial systems, maize intercropped with delayed sown oats or cowpea appeared promising.
This study provided the first-ever evaluation of continuously simulated output from a crop model against medium-term field trial data in southern Africa. The simulation experiment suggests intercropping is a promising option for cropping system diversification. Simultaneously, it underlines the critical role of fertiliser and residue management when farmers

diversify in maintaining soil fertility (indicated by SOC and Nmin levels), stabilising yields in the medium-term. Overall, the usefulness of model applications for the design of suitable cropping systems in southern Africa, addressing various dimensions of sustainability is illustrated. (231 words)

Image left. Intercropped maize and cowpea field of a smallholder farmer in the study region.

Image right. Maize monoculture of a smallholder farmer in the study region.

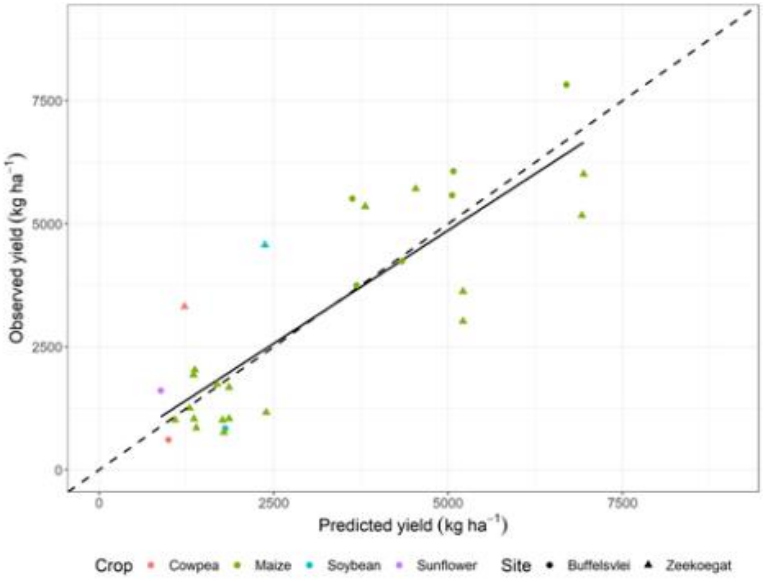


Fig. 1. Observed versus predicted yield across each year, site and treatment for the calibration exercise. Marker colour indicates crop types and marker shape indicates site, the dashed line is the 1:1 line, and the straight line is the regression line across all data points (n=29).

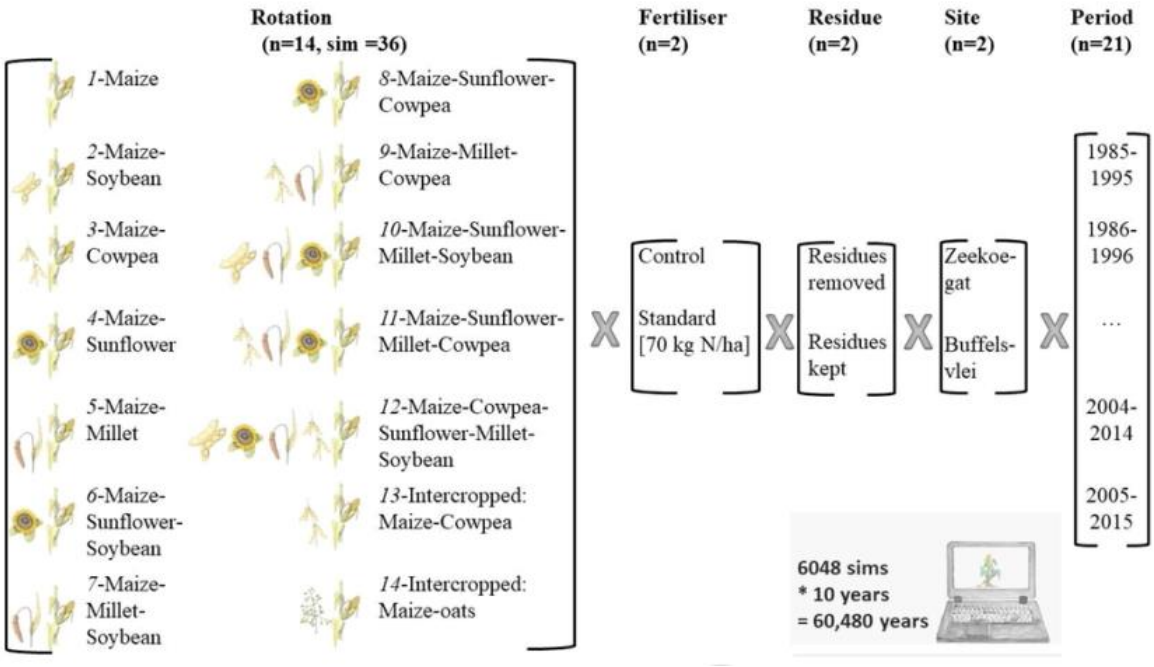


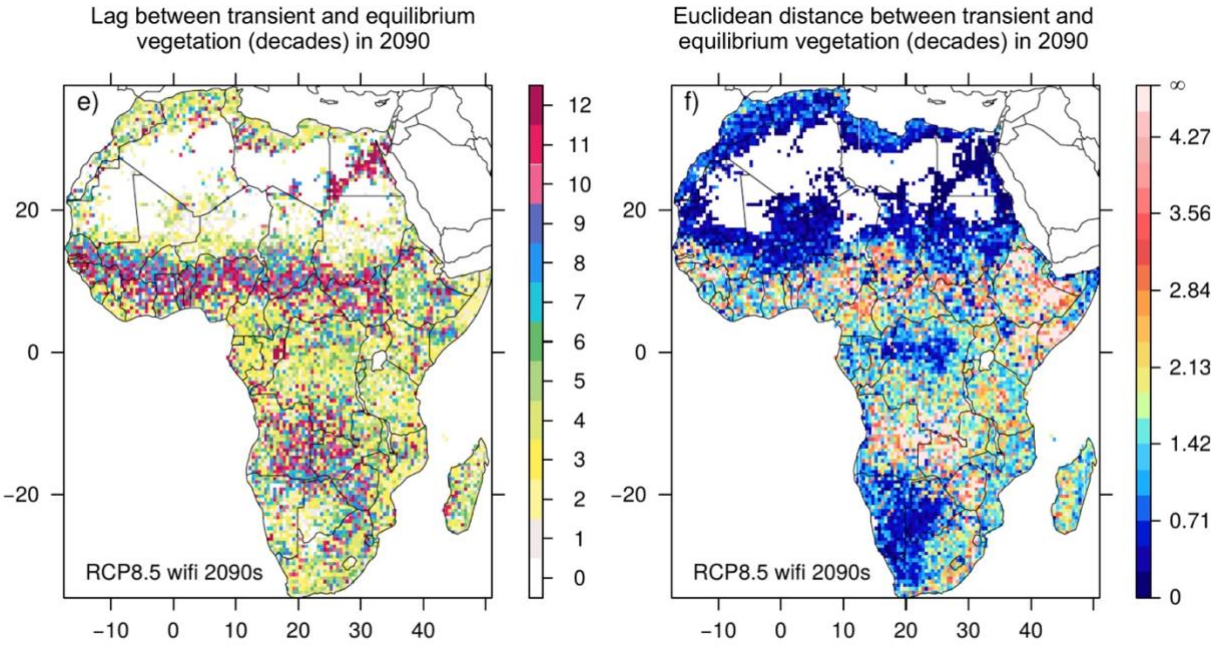
Fig. 2. Overview of the different factors taken into account for the simulation experiment. This constitutes the overall cropping system; rotation, fertiliser, residue management, plus the environment characterised by site and simulation period; in brackets, the number of levels. For rotations with a temporal sequence of crops, simulations were conducted with each crop as the starting crop; resulting in, for instance a rotation including five crops, five different independent simulations.

Pre-print under review: Climate change will cause non-analogue vegetation states in Africa and commit vegetation to long-term change

Mirjam Pfeiffer[1], Dushyant Kumar[1], Carola Martens[2], and Simon Scheiter[1]

[1]Senckenberg Biodiversity and Climate Research Centre (BiK-F), Frankfurt am Main, Germany
[2]Insitute of Physical Geography, Goethe University Frankfurt am Main, Germany

Abstract. Vegetation responses to changes in environmental drivers can be subject to temporal lags. This implies that vegetation is committed to future changes once environmental drivers stabilize. Understanding the trajectories of such committed changes is important as they affect future carbon storage, vegetation structure and community composition and therefore need consideration in conservation management. In this study, we investigate whether transient vegetation states can be represented by a time-shifted trajectory of equilibrium vegetation states, or if they are vegetation states without analogue in conceivable equilibrium states. We use a dynamic vegetation model, the aDGVM, to assess deviations between simulated transient and equilibrium vegetation states in Africa between 1970 and 2099 for the RCP4.5 and 8.5 scenarios. Euclidean distance between simulated transient and equilibrium vegetation states based on selected state variables was used to determine lag times and similarity of vegetation states. We found that transient vegetation states over time increasingly deviated from equilibrium states in both RCP scenarios, but that deviation was more pronounced in RCP8.5 during the second half of the 21st century. Trajectories of transient vegetation change did not follow a "virtual trajectory" of equilibrium states, but represented non-analogue composite states resulting from multiple lags with respect to vegetation processes and composition. Lag times between transient and most similar equilibrium vegetation states increased over time and were most pronounced in savanna and woodland areas, where disequilibrium in savanna tree cover frequently acted as main driver for dissimilarities. Fire additionally enhanced lag times and Euclidean distance between transient and equilibrium vegetation states due to its restraining effect on vegetation succession. Long lag times can be indicative of high rates of change in environmental drivers, of meta-stability and non-analogue vegetation states, and of augmented risk for future tipping points. For long-term planning, conservation managers should therefore strongly focus on areas where such long lag times and high residual Euclidean distance between most similar transient and equilibrium vegetation states have been simulated.



Reference

Pfeiffer M, Kumar D, Martens C, Scheiter S (2020) Climate change will cause non-analogue vegetation states in Africa and commit vegetation to long-term change. Biogeosciences Discussions, https://www.biogeosciences-discuss.net/bg-2020-179/, under review.

Upcoming SALLnet and SPACES II Events

SALLnet Online Training Workshop APSIM and aDGVM

24-28 August 2020
This course teaches advanced modelling of agroecosystems services for sustainable rural development under global change. Participants will learn the principles of process-based crop simulation-models (CSMs) and dynamic vegetation models (DVMs), with practical case studies and applications.
The course will be held online.

Further information please find here.

SALLnet 2nd Annual Meeting

14-15 September 2020
SALLnet's 2nd Annual Meeting will be dedicated to the exchange within the project, to enhance further collaboration and to get engaged with our stakeholders.
The meeting will be held online.

Please find the program of the 2nd Annual Meeting on our Google drive.

Please RSVP now, if you haven't already done so.

SPACES II Midterm Meeting

SPACES II
Science Partnerships for the Adaptation to Complex Earth System Processes in Southern Africa

Fall 2020
The SPACE II midterm meeting originally including Early career researcher workshops had to be postponed due to Covid-19. It will be held online. Early career researcher workshops have to be cancelled for this meeting, but will be implemented into the SPACES II Final meeting (see below).

SPACES II Final Meeting, Future Africa Campus, Pretoria

17–21 May 2021
17-18 May 2021: Early Career Researchers Workshops
19-21 May 2021: SPACES II Final Meeting

SALLnet related information

SALLnet Guidelines for fieldwork

SALLnet Guidelines for fieldwork

To carry out research within SALLnet our South African partners kindly provide our project with support without which neither SALLnet could be accomplished nor any future project in this context could be developed. This support is no matter of course. It is therefore necessary that all researchers and students using the services provided by our partners do so with respect and regard.

To make sure, that your field work can be supported by our partners at the best and that costs related to field work within SALLnet can be planned and balanced accordingly, SALLnet researchers and students are obliged to follow the rules developed within SALLnet Guidelines for fieldwork.

Get access here.

Webinar

Building networks and skills for climate change preparedness with small-scale farmers in the Olifants River Catchment

'Small-scale farming', 'backyard gardening', 'village food production'… call it what you will, this kind of agriculture has received inadequate attention – and is even scorned – as a means of building regional food security. Despite some lip service, the lack of meaningful engagement is evidenced in the lack of support by government departments, financial institutions, markets and even consumers. However, with global climate change and pressures such as COVID-19, commercial production and food distribution networks are failing. Local food production, short supply chains and agro-ecological practices are emerging as an important contributor to food security, and at times even as an alternative to large-scale food producing monopolies. In this webinar we introduce the Agriculture Support Initiative under USAID:RESILIM Olifants and its efforts to support scale-scale farmer networks and agro-ecological skill development in order to build a more resilient and climate-smart means of food production throughout the Olifants Basin.

Very interesting webinar presented by the **Association for Water and Rural Development**.

Get access here.

Further Upcoming Events

Ecological Society of America (ESA) Virtual meeting: Harnessing the Ecological Data Revolution

3.-6. August 2020
The Ecological Society of America (ESA) will be holding a virtual Annual Meeting this year from August 3–6 in response to the pandemic. The meeting focus on the chances and challenges of big and diverse data.
The 105th annual meeting encourages contributions that address these issues or that employ novel and integrative approaches to harnessing the data revolution to address pressing issues in ecology.
Deadline for registrations is **23 July**.

Further information please find here.

Calls

AGU Fall Meeting, San Francisco: Shaping the Future of Science

AGU FALL MEETING
San Francisco, CA | 7–11 December 2020

7–11 December 2020
AGU Fall Meeting will be mostly virtual and remain the global convening meeting for the Earth and space sciences community.
Fall Meeting sessions will include:

- COVID-19, from lessons learned in Earth and space sciences to ideas for what to do to advance research when one can't be in the field or in the lab.
- actions the Earth and space sciences should take to remove discrimination and eliminate racism to improve diversity and inclusion.
- how to better communicate your science to policymakers, reporters, voters and other key audiences.

Deadline for abstract submissions: **29 July**.

Further information please find here.

SALLnet – South African Limpopo Landscapes Network

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