GEORG-AUGUST-UNIVERSITÄT
GÖTTINGEN

SALLnet Newsletter, November 2021

Dear SALLnet members,

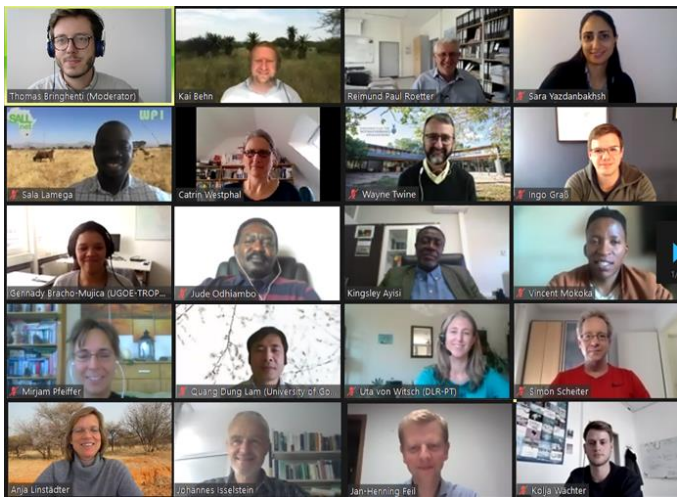
In this last issue for year 2021 of the SALLnet Newsletter, we collected materials and impressions from our 3rd Annual Meeting which took place in September. It was great to see all of you at the meeting and we are very glad to have had the opportunity to interact with so many key stakeholders and to have many fruitful discussions with you: Thank you very much for your active participation and engagement!

To facilitate further exchange, we utilize this issue of our newsletter in first place to document the findings of our meeting. Apart from that we have also included a selection of upcoming events that might be of interest for you.

The current issue contains information on:

SALLnet's 3rd Annual Meeting
Upcoming Events

SALLnet's 3rd Annual Meeting



SALLnet's 3rd Annual Meeting was held online on the 22-23 September 2021.

In our interdisciplinary research project, we ask **how the resilience of the multi-functional landscapes in southern Africa can be enhanced under the conditions of climate change**.
Focusing on the Limpopo region because of its diverse land-use, biodiversity and high spatiotemporal climatic variability, 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. Among our main objectives, there is to provide integrative tools and modelling platforms to develop land-use scenarios and management options to enhance the ecosystems' resilience.

To reach SALLnet's objectives, the **3rd SALLnet Annual Meeting** served:

- to assess and monitor the scientific progress made in SALLnet,
- to plan and strengthen further collaboration,
- to exchange with each other and with stakeholders on important research topics and their societal relevance, and
- to discuss general project issues, scientific challenges and future research needs.

After a brief welcome from the German and South African project coordinators (Reimund Rötter, Stefan Foord and Kingsley Ayisi) and in presence of a representative of the project management agency PT-DLR (Uta von Witsch), we started with a reporting session followed by several discussions on collaborative activities and other expected project outputs.

3rd Annual Meeting: Progress reports and joint activities, 22-23 September 2021

Progress Reports WPs 1–7

As a basis for the identification and discussion of collaborative activities and project issues the work packages of SALLnet were asked to report on the tasks carried out within the last year since the 2nd SALLnet Annual Meeting in September 2020. For reporting, work packages were asked to present:

- Objectives and important achievements
- Research highlights (findings + key publications)
- Planned activities until the end of the project

The slides and a recorded version of the reports' presentations can be accessed from our Google drive.

Joint activities: REFA, policy briefs and integration of results

A report on the latest joint **REFA** (Rapid Ecosystem Function Assessment) activities was also given. After a successful field campaign in April 2021, whereby soil, vegetation and insect samples were collected and analyzed, the next steps for the involved researchers and students will be completing the data analysis and integrating the results.

Other joint project activities and potential joint publications were discussed in a next step, such as:

- Joint capacity building activities (planning of the interdisciplinary course "Socio-ecological modelling for multi-functional landscapes" taking place in December 2021),
- Joint publications around the topic of sustainable macadamia production, and
- Writing policy briefs.

This last point was also in the center of the final plenary discussion. In fact, it was a largely shared opinion that a lot of materials that have been and still are produced by SALLnet researchers need to be transformed into a form that is more digestible for the stakeholders. This requires an extra effort on the scientists' part, but is considered very important by us for reaching the relevant stakeholders (especially policy makers) with our results. In this respect, producing **policy briefs** was widely considered an important and desirable objective of the project, especially in view of the (likely physical) final SALLnet meeting in South Africa (earmarked is mid-June 2022). Such plan was also encouraged by the project management agency (PT-DLR). Some concrete suggestions came up already from the discussion with the stakeholders (e.g. extending the duration of subsidies for the recovery period of drought-affected rangelands, increasing the availability of drought-tolerant maize varieties etc.) – see the following paragraph for more details.

The next steps to concretize such ideas and to produce relevant policy briefs is to identify responsible people for the various suggested topics and to agree on deadlines. This will be done latest at the forthcoming SALLnet online meeting on 11 November 2021, when Wayne Twine from WITS University will give a short seminar on how to write policy briefs in the framework of SALLnet. Guidelines and templates for writing policy briefs are already available on the SALLnet Google drive and should be read carefully before starting with the process.

Another key objective of SALLnet is the **integration of results** (WP7) and the publication of synthesis papers. This is however not a simple task to accomplish with the available very heterogenous datasets, often having different temporal and spatial resolutions. It was suggested to dedicate considerable attention to this objective and to the progress of synthesis papers in general during the next online meetings and latest with a dedicated session at the Final project meeting (possibly inviting an outside expert to facilitate in the process). In view of integrating datasets for interdisciplinary paper, the status of the commercial (macadamia and avocado) farmers survey was discussed. After a poor response to the first version of the questionnaire (mainly due to its excessive length), a new shorter version of it is planned now. This should not require more than 30 minutes for the interviewed farmer to compile. Jan-Henning Feil aims at having some preliminary results in 6 months from now. The importance of involving members of WP3 (Catrin Westphal, Mina Anders and others) and WP5 (Reimund Rötter and Thomas Bringhenti) in the process of selecting relevant questions for joint analyses (e.g. cost-benefit analysis of sustainable management practices in macadamia orchards) was stressed once again.

3rd Annual Meeting: Stakeholder day, 23 September 2021

Among SALLnet's main objectives, there is to provide integrative tools and modelling platforms to develop land-use scenarios (with a special focus on arable crops, rangelands and tree orchards) and management options to enhance the ecosystems' resilience. The key to developing feasible and acceptable land-use scenarios and sustainable management options is that stakeholders are involved in the research process. In particular, the tools and findings so far developed in this project need to be evaluated by potential users if we are to provide meaningful information to formulate sustainable land management strategies and support policy design.

Therefore, as part of our 3rd Annual Meeting on 23 September 2021, we organized a Stakeholder Day to present our work to the relevant stakeholders, engage with them and ask for their feedback. This was done in a "hybrid" format: most of the participants joined online on ZOOM but a number of them physically gathered in two locations (Maruleng and Levubu) in Limpopo. This allowed the participation of a very heterogenous group of stakeholders, ranging from the political sphere to academics and researchers, members of national and international organizations, extension officers and farmers (Figure 1).

Following some short presentations by SALLnet researchers (which you can access here), a plenary discussion with the possibility for all stakeholders of asking questions and giving feedback to the project results was held. On the basis of this discussion, parallel breakout group sessions were organized, where project members and stakeholders could meet in smaller formations for more in-depth discussions on specific topics related to the previous presentations. Finally, everybody gathered again for a synthesis and conclusion of the event.

Figure *1:* *SALLnet project members and stakeholders jointly discussing on ZOOM*

Below we provide an overview on the discussion topics of the Stakeholder Day, which were:

1. Sustainable intensification of maize farming systems (moderated by Jan-Henning Feil and Reimund Rötter)
2. Livestock feed gaps (Jude Odhiambo and Sala Lamega)
3. Rangelands and drought (Kai Behn and Vincent Mokoka)
4. Macadamia pollinators (Mina Anders and Elsje Joubert)
5. Linking groundwater and crop modelling (Kingsley Ayisi, Quang Dung Lam and Gennady Bracho-Mujica)

The session on the **sustainable intensification of maize farming systems** was the most attended by stakeholders. Starting from the results from a multi-method analysis conducted in selected villages of Limpopo and combining data from extensive smallholder surveys, on-farm agronomic samples, crop model simulations and their economic assessments, the main challenges and some promising strategies for small-scale farmers to implement sustainable intensification (SI) of maize production systems were discussed. According to such simulations, a proper combination of different management interventions, like irrigation, fertilizer application and weeding, could lead to considerable yield increases compared to the status quo in all investigated villages (Figure 2). This would also be economically beneficial already on the short-term.

From the discussion with the stakeholders it emerged that the availability of drought tolerant maize varieties represents a major obstacle to implementing SI in maize farming in general. The implications of this for both farmers and politicians going forward were also addressed. In this respect, it would help if extension officers were to provide a better support to farmers in selecting and accessing the most suitable varieties. Furthermore, farmers themselves sometimes lack the preparedness to change their farming systems, e.g. by introducing inter-cropping, mulching or livestock-keeping, to become more resilient against multiple risks like droughts and pests. The underlying reasons for this are, amongst others, time and capital constraints (one participant stated: "It sometimes gets overwhelming."). As one promising solution (already successfully implemented in some areas) to ease off farmers time and capital constraints and hence to enable them to implement strategies towards SI, co-operations between different farmers of a village/region were intensively discussed. These could be used to share capital intensive machinery like tractors and irrigation equipment (e.g. mutually used boreholes, pumps and main pipes), but also to ongoingly share knowledge and experience (e.g. regarding different maize varieties or management of inter-cropping) and to support each other physically and mentally. This would, of course, require a certain degree of openness of the farmers, but could well pay-off at farm-level in the mid- and long-term. Another topic discussed was a necessary improvement of the extension officers' training, especially in crucial topics like drought resistant maize varieties and the management of irrigation practices (e.g. water access, specific machinery choice and access). Here, politicians should soon work out and implement a plan of a respective improvement program.

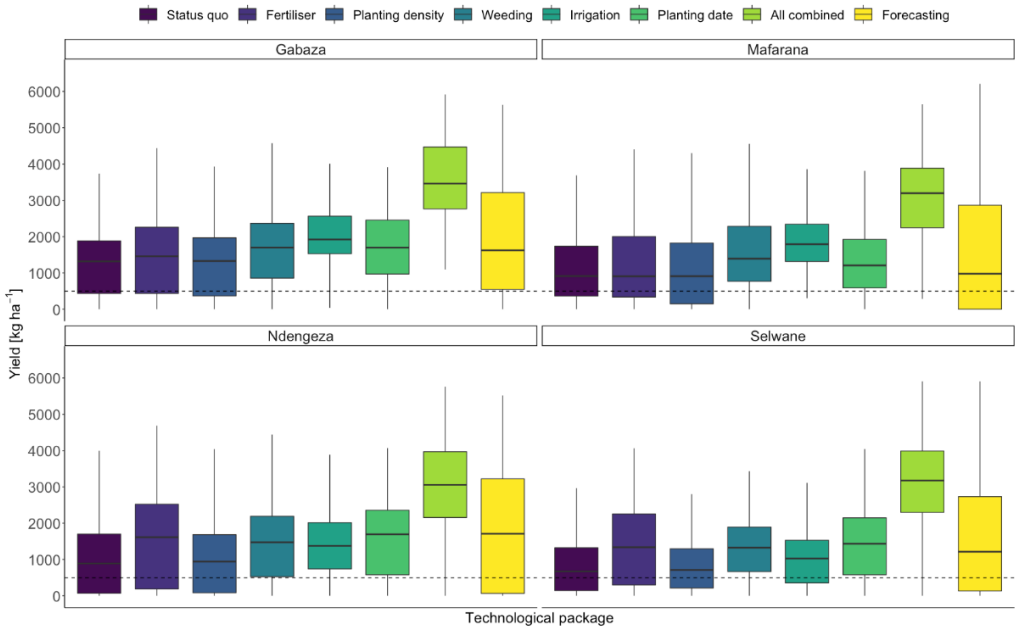


Figure 2: *Example of the effect on maize yield of different management interventions in selected villages of Limpopo as simulated with the Agricultural Production Systems Simulator (APSIM) model. Source: Nelson et al. 2021*[1]

The topic of the second discussion group was the seasonal, climate-induced shortages in the supply of quality forage in semi-arid areas such as Limpopo. **Feed gaps** in Limpopo is a serious problem (starting in June) for livestock production – especially for those small farmers that rely on communal rangelands. Farmers do receive support in feed aids, but such a support usually comes late in the year after the drought period. Moreover, the feed aid is insufficient for livestock stock and will not meet livestock demand. Results from SALLnet researchers indicate that winter forage such as rye, rapeseed, clover and vetch (particularly when planted early and irrigated) look like a promising strategy to respond to such livestock feed gaps (Figure 3). Nevertheless, limited land and water availability are often major constraints to forage production. Other possible solutions mentioned during the discussion included (i) the provision of improved storage techniques for feed/forage, (ii) improved pasture management (e.g. rotations, selection of drought tolerant grass species) and (iii) facilitating education and training between extension services and farmers on this topic. Finally, linking scientific results with on-ground reality was deemed as essential to deliver adequate recommendations against the frequent occurrence of feed gaps.

[1] Nelson, W., Hoffmann, M.P., May, C., Mashao, F., Ayisi, K.K., Rötter, R.P. Constraints and options to sustainably intensify smallholder maize farming systems in southern Africa. Submitted to: *Environmental research letters*.

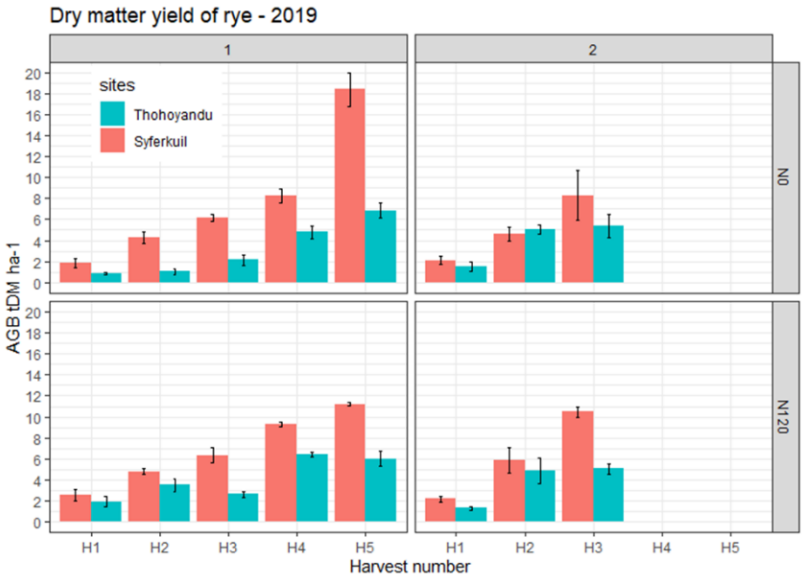


Figure 3: *Dry matter of rye (ton/ha) measured at different sampling times (H1-5) as affected by sowing dates (1 = early, 2 = late) and N levels (0, 120) at two different experimental sites (Syferkuil and Thohoyandou). Source: Lamega et al. 2021*[2]

In the third discussion group, results from a long-term experiment (DroughtAct) on the **combined effects of droughts and grazing on savanna ecosystems** were presented (Figure 4). These show that the impact of drought becomes particularly severe after three or more consecutive years, with valuable perennial forage grasses permanently disappearing. Grazing, although initially beneficial, amplifies the impact of prolonged drought.

The implications of these results were also discussed, especially in terms of grazing management, which has to be adapted to the intensity and duration of drought. During drought, rangeland´s productivity and hence the forage provision, is reduced, leading to first feed deficiency for cattle and second to a higher, and often too high grazing pressure. A reduction of herd sizes in times of drought does often not take place due to farmer´s unwillingness to destock. Reasons for that also include the lack of potential buyers and very low prices during drought. To ease the situation of the farmers, the South African government provides drought help in form of hay to the affected farmers. According to farmers, the extent of the feed supply is generally not sufficient. Additionally, this strategy has negative side effects. In fact, the lacking predictability of the course of the drought and of possible future feed supply, induces farmers to keep the feed supply for emergency and maintain the grazing pressure. Furthermore, the feed supply may reduce the initiative to destock during the drought.

After the drought the herd sizes and hence the grazing pressure remains the same. The post-drought carrying capacity of the rangeland is however lower. Depending on drought duration and intensity, rangeland needs time to regenerate.

To counteract these problems, to improve the rangeland integrity and the situation of the farmers, we would suggest the following:

- A rain / drought insurance to offer farmers financial compensation in times of resource scarcity;

- Improving rangeland management with a participatory collaboration with farmers, traditional authorities and extension services setting up and implementing common rules for all cattle farmers, as well as monitoring the rangeland health;

- Farmers need support (feed supply) also beyond actual drought time as the carrying capacity of the rangelands is lower in the initial recovery stage;

- Feed supply for farmers needs to be combined with regulations – certain parts of the rangelands need to be excluded from grazing for the first half of the growing season, but not for the full season;

- To avoid depletion of the seedbank that reduces regeneration capacity after drought, small patches where grazing is excluded (either through fences or cut branches of spiny shrubs and trees) are important. They allow (perennial) grasses to develop seeds and shall be regularly distributed throughout the rangeland.

[2] Lamega, S.A., Komainda, M., Hoffmann, M.P., Odhiambo, J.J., Ayisi, K.K., Isselstein, J. 2021. Closing Feed Gaps by Winter Forage Production in Limpopo: What Is the Potential? XXIV International Grassland Congress Proceedings

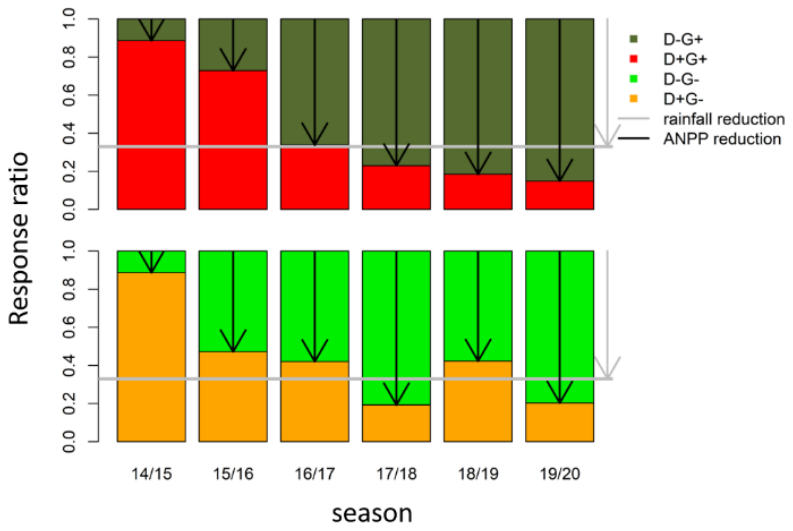


Figure 4: *Response ratio of drought (D+) compared to ambient rainfall (D-) under grazed (above) and rested (below) conditions. The black arrow indicates the relative reduction of aboveground net primary production (ANPP), while the grey line indicates the relative rainfall in the D+ plots.*

Moving from rangelands to tree orchards, another group discussed the importance of **insect pollination for macadamia production** and the role of semi-natural habitats for hosting pollinators. SALLnet researchers illustrated the results of pollination experiments conducted in macadamia orchards located along a landscape heterogeneity gradient in Limpopo. They observed a decrease of 75% in the initial nut set (3 to 5 weeks after flowering) and 90% in the final nut set (15 to 25 weeks after flowering) of trees where insect pollination was excluded (Figure 5a). The observed pollinators were mainly honeybees (95%) but also small wild bees and possibly other insects like hoverflies or butterflies. The honeybees comprise managed but also wild honeybees, that form colonies in natural and semi-natural habitats adjacent to the macadamia orchards. The flower visitation rates of honeybees and other pollinators increased with the cover of semi-natural habitat in the surrounding landscape, i.e. the proportional area of semi-natural habitats in a 1km radius around the observed macadamia trees (Figure 5c). The initial nut set increased with a higher number of different varieties (or cultivars) of macadamia planted in the same block in the orchard, i.e. one, two or three to five varieties. This effect became indistinct for the final nut set, which still strongly depends on the initial nut set (Figure 5b). A higher number of different varieties promotes inter-varietal cross pollination, which was shown to be beneficial for the fertilization of the macadamia flowers.

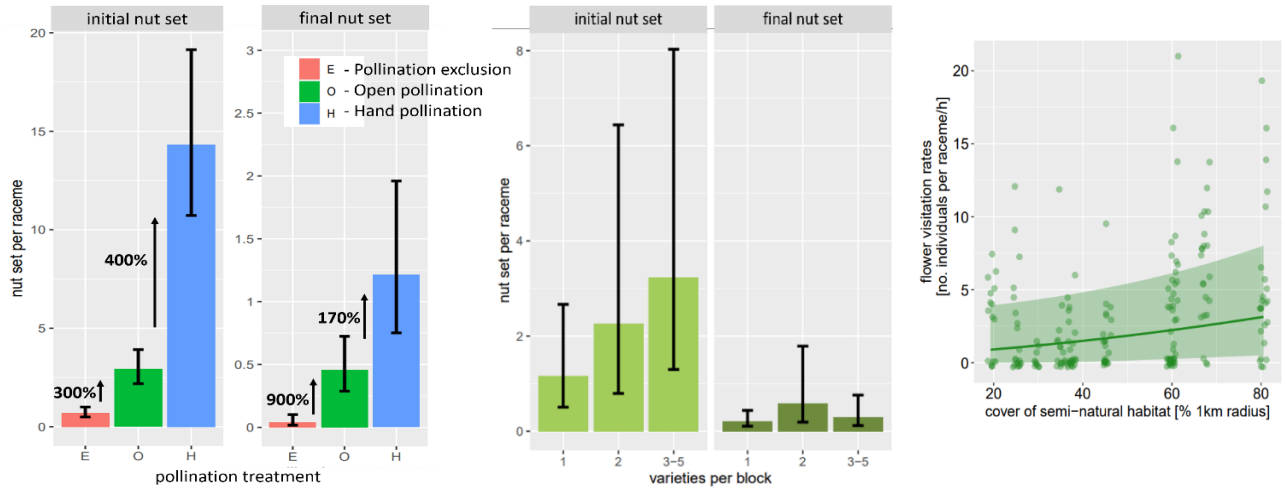


Figure 5: *Initial and final macadamia nut set depend on different pollination types (a), as well as on the number of planted varieties per block (b). Flower visitation rates by pollinators increase with higher cover of semi-natural habitats in the surrounding landscape (c). Source: Anders et al. 2021*[3]

[3] Anders, M., Grass, I., Whyte, V.M.G., Taylor, P.T., Westphal, C. Biological pest control and pollination in macadamia orchards - Effects of landscape composition and altitudinal gradients. 23rd International Congress of Zoology Nov 2021, Cape Town (abstract accepted)

One question that emerged from the discussion, was which pollen donors should be selected for different pollen recipients (macadamia varieties), in order to benefit from the increased nut set and nut quality deriving from cross-pollination. In order to answer this, systematic studies on macadamia production with different donors and recipients that are most commonly used in Limpopo are needed.

The role of semi-natural habitat for pollinators was also in the center of the discussion. Such habitats generally consist of e.g. indigenous forest, secondary forest, thicket/dense bush or woodland/open bush. They function as food resource during the seasons, when macadamia is not flowering. As the pollinators are heavily affected by pesticides that are applied in the macadamia orchards, semi-natural habitats serve as important refuge in this period. Moreover, they harbor wild bees that can be very effective pollinators, too, complementing the pollination service of honeybees. At the same time, semi-natural habitats are not likely to distract the honeybees from macadamia orchards (delusion effect), because in the flowering period of macadamia the food supply in the orchards exceeds by far the food supply by individual flowers in the semi-natural habitats. Furthermore, the number of pollinating insects in the orchards increased with the cover of semi-natural habitat in the landscape, which speaks against a potential delusion effect. As the honeybees in the macadamia orchards can have different origins (managed bee hive or semi-natural habitat), the number of hives per hectare is not a good indication of the number of honeybees on the macadamia flower. The number of worker bees in and out of the bee hive or some quantitative measure should be presented to guide farmers.

Besides being important for pollinating insects, natural and semi-natural habitats also host other species, thus contrasting the global loss of biodiversity. Furthermore, their carbon sequestration capacity could be of special interest also for macadamia farmers in South Africa, as they will be responsible to compensate the carbon footprint of the macadamia production. Carbon taxation might soon be a reality to farmers. By conserving natural vegetation on the farm, the carbon tax is reduced. Some incentives could also include planting flower hedges, and these could prevent insecticide spray drift. Therefore, it is key for macadamia growers to maintain a high biodiversity in their orchards, including the preservation of functional vegetation and weeds in and in close proximity to them.

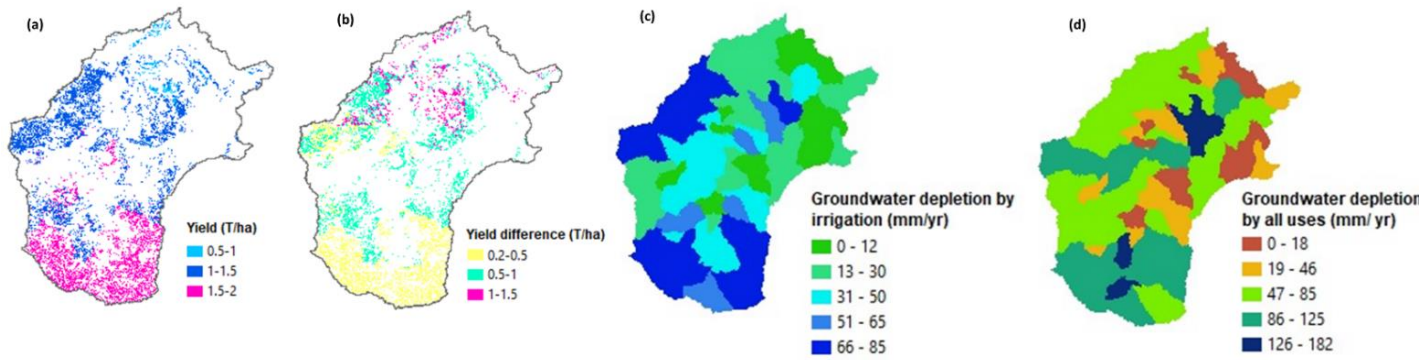


Figure 6: *Simulated average annual maize yields distribution for (a) rainfed cultivation and (b) yield difference between rainfed and deficit irrigation; simulated yearly groundwater depletion due to (c) irrigation and (d) all uses combined. Source: Lam et al. 2021*[4]

Finally, a last group focused on suitable options to **link crop simulation modelling with agro-hydrological models**. Results from the long-term spatial simulation (using the agro-hydrological SWAT model) of rainfed and irrigated maize yields in the semi-arid Olifant River Basin and their effect on groundwater depletion at catchment scale were presented (Figure 6). These showed that yields from rainfed maize cultivation (0.5-2.0 t ha^{-1}) could be increased by 0.2 to 1.5 t ha^{-1} through the application of deficit irrigation. However, annual groundwater depletion due to irrigation ranged from 0-85 mm per year. Combining this with the extraction of groundwater by all other sectors shows a depletion of the groundwater table by up to 182 mm per year.

[4] Lam, Q.D. et al. Modelling maize yield impacts of improved water and fertilizer management in southern Africa using DSSAT coupled to SWAT at field and catchment scale. Submitted to: *Agronomy and Crop Science*.

These findings were used as a basis for discussing the long-term sustainability of groundwater use for irrigation in Limpopo. In particular, crop water requirements in the region are expected to increase in the near future as a consequence of climate change, thus making supplementary irrigation an option to be considered. Groundwater is for local smallholder farmers mostly available from boreholes but currently there is not enough information on the water table recharge to support decisions leading to a sustainable irrigation water usage. Finally, modelling studies at regional and catchment level were judged as important and informative, but to address specific hydrological issues, a greater focus on local situations and more comprehensive analyses are needed to get a clear picture.

Final remarks after the conclusion of the SALLnet 3rd Annual Meeting

Feedback from stakeholders

Interacting with and receiving feedback from stakeholders is a very important component of the research process in SALLnet and is highly appreciated by its scientists. During the parallel discussions at the annual meeting it was possible to go in depth into the various topics of SALLnet research, with some concrete suggestions given by the stakeholders to increase the relevance and applicability of the project's results.

The virtual meeting format is far from optimal for interacting with stakeholders, since some of them are not comfortable with such technologies and were a bit reluctant at intervening and contributing during the plenary discussion. The format of the parallel breakout groups made the interaction a bit easier but still not comparable to a physical meeting, which should be the preferred form of interaction for future interactions with stakeholders. Nevertheless, there was a unanimous consensus that it is better to have a virtual meeting than not at all.

The presentations by SALLnet researchers, although very interesting, were still judged a bit too complex and long – at least for part of the audience. It was suggested to adopt the same format as for the WP reports in the future, with a maximum of 5 slides showing the most important results in a clear and simple way and more time left for the discussion. Interdisciplinary topics (including ecological, economic and social aspects - e.g. sustainable intensification of smallholder maize systems) seem to be most interesting for the stakeholders, therefore such interdisciplinary topics should be encouraged for future presentations on Stakeholder Days.

The participating stakeholders were very heterogenous, including, among others, politicians, members of international organizations (FAO, UN Women), academics, extension officers and farmers. Out of the 70 invited stakeholders, at least 35 participated at some point during the meeting. However, only a smaller number of them participated actively in the parallel breakout room sessions and unfortunately nobody decided to join the discussion group on "rangelands and droughts" (partially because all stakeholders with a background in livestock keeping were joining the meeting from a single computer and couldn't split between the two breakout rooms dealing with the same topic – another disadvantage of virtual meetings) - thus indicating the need of better linking the selected discussion topics and the area of competence/ discipline of the invited stakeholders in the future.

For increased participation of stakeholders in future, organization of "hybrid" meetings was suggested, with part of the stakeholder physically gathered and part of them joining virtually. Yet, from experience of lecturing in hybrid, this has its own downsides.

Other expected outputs of SALLnet

An important output of SALLnet is publishing scientific papers and technical reports, so that people know how we collected and analyzed our data (e.g. LUIS - landuse information system). Very important is also transferring data and information originating from SALLnet to the SASSCAL database to make them accessible. A list of key publications from SALLnet (including interdisciplinary and some very high impact journal papers) has been drafted and discussed during the Steering Committee Meeting.

SALLnet participates with a number of different oral presentations at several international and national conferences – basically involving all disciplines. All WP PIs were kindly reminded to provide the SALLnet coordination (Thomas Bringhenti) with information on upcoming conferences that are relevant for SALLnet researchers.

Further Materials of the 3rd Annual Meeting

The following documents can be accessed here:

SALLnet Meeting, 22-23 September 2021

- Meeting program
- Participants list
- Progress reports: presentations of all WPs

Stakeholder day, 23 September 2021

- Stakeholder day: program
- Participants list
- Stakeholder day: presentations by SALLnet researchers

Upcoming Events

EGU General Assembly 2022, Vienna (Austria)

3-8 April 2022
Deadline for submission of abstracts: **12 January 2022**

Further information please find here.

European Society for Agronomy XVII. Congress 2022, Potsdam (Germany)

29 August – 2 September 2022
Deadline for submission of abstracts: **28 February 2022**

Further information please find here.

4th Agriculture and Climate Change Conference, Dresden (Germany)

7-9 May 2023
Deadline for submission of abstracts: **11 November 2022**

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 to the Google Drive 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.
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 platform).

SALLnet – South African Limpopo Landscapes Network

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