

1 Project outline: Step one, short proposal

Project title Development of water conservation and nutrient recycling strategies for efficient and environmentally sound regenerative, permacultural agro-forestry on small farms in Sierra Leone
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Acronym: <i>GreenPERMALinks</i>
Topic – keywords: agro-ecology, water conservation, nutrient recycling, permacultural farm design, agro-forestry, rotation, demonstration farm, technology transfer, hydrogeophysics, water redistribution
Country focus: Sierra Leone
Duration of the project: 3 years plus initiation phase (best start between December and April)
Total costs: 1.100.100 € plus Initiation phase 40.000 €

2 Objective

A) Reference to Call

The proposal is oriented to the “Directive on the funding of international research cooperation for global food security”. The proposal references to the objectives of the call Announcement No. 04/22/33 (German Federal Ministry of Food and Agriculture), "Innovative Sustainable Production Systems", Funding instrument: “International research cooperation for global food security”.

- (1) The project will make a contribution to improve food security in the target country Sierra Leone as well as in the region,
- (2) The project meets the objectives and priorities of this call for proposals by developing an innovative sustainable production system: fundamental questions of water management and distribution are assessed by newest scientific methods and lead to a permacultural agro-forestry farm design, which can be easily adapted by farmers. Furthermore, the outcome will be a demonstration farm empowered to transfer the technology delivered by the project to other farmers even after the project has been completed.
- (3) The research is participatory by working in research tandems of German and Sierra Leonean scientists, extension services and farmers. The project is of practical relevance for the target region due to the development of a production system with a presumably high relevance for the local farmers. The project is highly user- and outcome-oriented and is adapted to the needs of the farmers and the region by offering a multi-level approach from subsistence agriculture to market-oriented production and outcomes can be directly transferred into practice already during the project.
- (4) The project makes a contribution to achieving 13 of 17 UN Sustainable Development Goals (SDGs, Annex 1).

B) Topic and relevance for sustainable and innovative production systems in the selected target region

A unique aspect of this project is the localization on a recently founded demonstration farm (Moringa Innovation and Start-up Centre Sierra Leone, MOST, Annex 2) run by the non-profit organizations Löwe für Löwe e.V. (Germany, DE) and Lowe für Lowe r. S. (Sierra Leone, SL) in the region of Waterloo, Sierra Leone. This will allow that all experiences and results can be transferred to practice immediately and sustainably supported by the research institutions and extension services even after the project terminated.

(1) Main goals

- Development of water conservation and nutrient recycling strategies for efficient and environmentally sound regenerative, permacultural agro-forestry on small farms in Sierra Leone
- Sustainable reinforcement of the Moringa Innovation and Start-up Centre Sierra Leone (MOST) as nucleus for continuing development of permacultural agro-forestry in Sierra Leone
- Establishment of an international GreenPermaLinks – network of scientific societies, scientists, citizen scientists, extension services, farmers, interested individuals and non-profit organizations related to the MOST actions

(2) Working hypotheses

- Permaculture as practical agricultural approach can be simplified for use by poorly trained people through agro-ecological indicator systems related to plant selection, water management and nutrient recycling.

- an appropriate combination of compost preparation and ridge system (hugelculture) together with a swale system is the key for water storage options, will prevent erosion and restore soil fertility.
- soil fertility can be enhanced by recycling of bio-waste as raw material for compost production classified by nutrient content.
- mixed cropping and appropriate rotation of deep and shallow rooting useful plants will utilize water redistribution processes and reduce water demand of the innovative plant production system.
- appropriate mixed cropping of annual, biannual and perennial cultivated plants (including bushes and trees) will result in biological control mechanisms with the option to reach compliance with organic agricultural standards.
- the innovative production system will result in a spectrum and quantity of useful plants, which allows subsistence and gradual up-scale of production for local, regional and international markets.
- Strengthening and empowerment of public-welfare oriented small agricultural NGOs can stabilize multi-level-stakeholder networks for sustainable local, regional and international exchange of knowledge and products.
- The MOST is able to form an international GreenPermaLinks – network of scientific societies, scientists, citizen scientists, extension services, farmers, interested individuals and non-profit organizations, which will be further developed after the project has been completed.

(3) Brief description of the project

An existing demonstration farm (Moringa Innovation and Start-up Centre, MOST) jointly run by two non-profit organizations in Sierra Leone and in Germany will be transformed into a permacultural agro-forestry system based on the hugelculture/swale method. Because soil degradation and limited water supply in the dry season becomes a widespread problem in Sierra Leone, new methods will be developed and tested to explore new innovative on-farm options for water storage and redistribution to save and store water for the dry season and avoid erosion. The nutrient cycle on farm will be monitored and described including the export of nutrients via products. The return of exported nutrients like nitrogen, phosphate or potassium, and micronutrients is planned to be conducted by using bio-wastes from nearby villages and cities like Robekhe Village, Joe-Town and Waterloo to produce compost of estimable nutrient content. This approach will substitute the use of mineral fertilizer and will regenerate the soil by improving soil life and structure as well as water-storage capacity. Plant selection will focus on plant mixtures and plant rotation systems, which take specific water and nutrient demands into account. Plant mixtures will be used to control the outbreak of plant diseases and pests by the agro-ecological promotion of beneficial organisms like predatory wasps or mycorrhizal fungi; self-made botanical pesticides like Neem-extracts will be used instead of chemical-synthetic pesticides. Doing so, the innovative holistic production system will be compliant with international production standards for organic farming.

The MOST will form the nucleus for the GreenPermaLinks - network inviting the scientific community and other stakeholders to work on the farm even after the project has been finished.

(4) Relevance for sustainable and innovative production systems in the selected target region

The project develops a sustainable, holistic production on basis of the permaculture principles. The basic features of a permacultural project are that it

a) Integrates design principles reflecting whole system thinking, b) Combines cultivated plants of all growth form types, c) Produces as diverse products as possible (ranging from timber, oil and fibers to vegetables, fruits, starch crops and medicinal plants), d) Is purely organic avoiding agro-chemicals, e) Extracts as much as is revolved, f) Recirculates nutrients, g) Produces no waste, h) Includes water harvesting methods i) Catches and stores energy, j) Aims at regenerative, diverse and self-maintained habitats, k) Observes and interacts, l) Applies self-regulation and accepts feedback, m) Is designed from pattern to details, n) Integrates rather than segregates, o) Uses small and slow solutions, p) Develops use and value diversity, q) Uses side-effects observed and values the marginal, r) Creatively uses and responds to change.

Such complex, holistic approaches usually need farmers with a broad knowledge and experience to apply them successfully. The project intends to simplify key elements in a reproducible way, specifically the water and nutrient management. Furthermore, the plant selection and the planting and rotation system under Sierra Leonean conditions will be worked out in a participatory way, i.e. respecting the farmers' customs, needs and wishes in order to create acceptance for necessary changes in traditional production systems. Concurrent training will enhance the acceptance and knowledge of permaculture principles. It is expected that respecting the above principles will result in an economically, ecologically and socially stable and sustainable production system. This production system to be developed will be a self-optimizing innovative sustainable production system:

- Economically, it guarantees subsistence of the farmers and opens opportunities to access local, regional and finally, international markets by producing fresh products with short and long shelf-life, and processed goods at the same time. An exotic multipurpose tree (*Moringa oleifera*) underutilized in Sierra Leone so far will be put into the nexus of food – health – production quality locally and will increase income of producers because of high prices on the world market for leaves and seeds. The basis will be laid for compliance with international trade standards like IFOAM organic agriculture.

- Ecologically, a science-based landscape planning will result in a water harvest and conservation design on farm. Simple methods will be provided for farmers to practice this under diverse circumstances. Recycling of bio-waste will guarantee sustainable production. The nutrient-flow assessment will result in a nutrient based classification system of compost, and application strategies for compost in relation to crop demand of the different crops.

- Socially, it overcomes malnutrition of children and foster women by their involvement in agricultural production and the transfer of methodology and knowledge to them. Formation of women's cooperatives will be recommended as future oriented tool for international export of products. The whole production system will include traditional elements, will respect preferences of farmers and will increase education by applying a holistic way of thinking and management. This will create expertise of the farmers involved.

C) Presentation of possible synergies or distinction from existing projects

- The project will be located mainly in the Moringa Innovation and Start-up Centre (MOST) and on reference areas. The MOST belongs to the non-profit organization Lowe für Lowe Sierra Leone r. S., which is supported by the independent non-profit organization Löwe für Löwe e. V. Braunschweig, Germany, since more than twenty years. In the MOST, agriculture is planned as citizen science approach, i.e. farmers learn by doing, monitor, document and teach their community. The project started with the construction of facilities in

2018. The MOST will directly interact with all other projects of LfL including health station, school, and radio station.

- The proposal fits into this developing center's concept, uses the infrastructure and implements the agricultural part as demonstration farm. JKI is working with LfL-SL/LfL-DE and Njala University since 2018 on a consultancy basis fixed in a Memorandum of Understanding between the partners.
- A solar power system has been installed and provides sufficient energy for a laboratory, a factory and a school building. These facilities will be shared with the universities involved in the project. Own or shared equipment for diagnosis and analyses should complement the center and allow education of farmers and students on-farm organized by the academic partners. Furthermore, the offer of a start-up consultancy service as the basis for small-scale entrepreneurial actions is intended.
- Groundwater wells for water production from a 20 m deep aquifer are available, a nursery for propagation of plant material and a network for the acquisition of staff working on the farm is already established. This allows a rapid start of the project proposed.
- The farm area has already been planted with Moringa trees in the last years. The Moringa tree is a multipurpose tree, which was recently grown for the fight against anemia of children in the hospital of the non-profit organization LfL using dried or fresh leaves as food supplement.
- The German consortium partners start a project in Germany in September 2022, which aims at the development of vitality indices for urban trees influenced by climatic factors like drought using the same new scientific methods for the exploration of the local subsurface water saturation and the monitoring of the actual water use and redistribution by plants. This will provide synergistic effects to the studies under the tropical conditions of Sierra Leone.
- In the Njala University, a project started to redesign the vegetable production of women cooperatives to organic agriculture standards coordinated by M.S. Makalay Sonda. This will provide the chance to crosslink the project in the third year with synergistic effects, which has been confirmed by her already.

D) Interfaces to innovation processes, ongoing or preceding research projects, existing initiatives and networks

Three interfaces to other actions will be connected:

- Locally, the existing network of field workers already temporarily working on the demonstration farm and living in Robekhe Village and Joe-Town will ensure the contact to nearby farms and villages.
- Regionally, the network of bio-waste collection points to be established will spread the information of the demonstration farm up to the town Waterloo.
- Nationally, the permanent exchange of students with the universities in Freetown guarantees the discussion of the approach in comparison to other production systems existing in other parts of the country. For instance, the cited vegetable women project is carried out in Koinadugu and will connect to very distant parts of Sierra Leone. Furthermore, concurrent meetings and scientific symposia will be used as interface for scientific discussions.
- Internationally, the most important European congress on tropical agriculture "Tropentag" carried out each year in September will be an interface to the international community. Here, specific workshops on the GreenPermaLinks - project will be carried out and results presented in order to enhance the

GreenPermaLinks - network. Additionally, results of the project will be published in international peer reviewed journals.

- The project will be linked to the Senior Expert Service of the German Ministry for International Cooperation by inviting Short Term Experts to clarify specific practically occurring questions.
- The project will be integrated in the German ATSAF network (Council for Tropical and Subtropical Research), and the working group “Plant Protection in the Tropics and Subtropics” of the German Society for Plant Protection and Plant Health (DPG e.V.). Within Sierra Leone, LfL will connect the project through products and information with their health station and school. NU and MMTU will distribute their information not only to their students but also to the Sierra Leonean Agricultural Research Institute (SLARI).

3 Work plan

(1) Work packages and responsibilities (overview in Annex 3)

WP1 Permaculture design – Responsible for reporting: JKI-G together with MMTU, Interactions with all other WPs:

Subproject 1: Planning of the zonal permaculture design including a hugelculture/swale system for regulating water movement; Partners: Scientist (Sc) 1 JKI-G with all other WPs;

Subproject 2: Planning of plant selection, planting of cropping and rotation systems; Partners: Sc 1 JKI-G with Sc 2 MMTU Botany.

Subproject 3: Concurrent biodiversity management including moderate weed management, plant protection, occurrence of beneficial organisms; Partners: Sc 3 MMTU Plant Protection with Sc 1 JKI-G.

WP 2 Water Conservation – Responsible for reporting: TUBS together with NU-AE; Interaction with WP 1:

Subproject 4: throughout the project, agro-meteorological microclimate observations will be carried out and the data provided to all other partners. Partners: Sc 4 TU-IGÖ with Sc 5 NU-AE.

Subproject 5: Water redistribution and water uptake of deep and shallow rooting plants will be studied in hugelculture constructions and agro-forestry guilds. Partners: Sc 4 TU-IGÖ, Sc 5 NU-AE.

Subproject 6: Research on water movement on the surface and saturation below ground. Exploration of water storage options below ground or recommendation of on ground storage options. Partners: Sc 6 TU-IGEP with Sc 7 NU-AE.

Subproject 7: Water induced reaction of indicator plants. Here, early drought induced plant stress will be studied and relevance for photosynthesis efficacy evaluated. Partners: Sc 6 TU-IGEP with Sc 7 NU-AE. Sc 6 IGEP is at the same time coordinator of the project.

WP3 Plant nutrient recycling – Responsible for reporting: Njala University SS with JKI-PB .

Subproject 8: Analytical devices will be established, calibrated and tested. Nutrient status of farm soil; macro-and micronutrients of different soil depths all over the farm will be measured before and after the installation of the plantation. Concurrent analytics will observe changes of the soil nutrient status during the experiments. Nutrient status of bio-waste, compost and harvested crops with potential market value will be analyzed for their nutrient content to estimate the potential nutrient export from the farm as well as the

nutrient demand of the crop rotation system to adapt the compost amount for the different crops to optimize plant nutrition. Partners: Sc 8 NU-SS, Sc 9 JKI-PB.

Subproject 9: Bio-waste acquisition and classification; a local network of nearby villages for bio-waste collection has to be build up and materials collected. On-farm and incoming bio-waste has to be classified with regard to origin and qualitative characteristics. Available and potential quantities of bio-waste will be estimated. Compost production from bio-waste and on-farm production; a procedure of local compost production and a classification system of compost related to nutrient content will be worked out. Partners: Sc 10 NU-SS, Sc 9 JKI-PB

WP4 Plantation management - Responsible for reporting LfL-SL with LfL-DE supported by JKI-G

Subproject 10: Local organization and logistics: The work package is the “service” package of the project. It guarantees the operation of the experimental farm. A manager (Mn 1) is acting as local coordinator and works tightly together with the German coordinator (Sc 6 IGEP). The partner LfL-DE is the counterpart of LfL-SL with the farm manager (Mn 2) and helps in the administration of the project throughout the project duration, guarantees shipping of goods to Sierra Leone, supports the German co-ordinator with respect to shipping of equipment and connects the developing GreenPermaLinks - network by their own network contacts. Partners: Mn 1 LfL-SL with Mn 2 LfL-DE supported by Sc 1 JKI-G.

Subproject 11: Implementation and maintenance of the experimental demonstration farm. Plant propagation, planting, and yield evaluation, cost-benefit analysis, post-harvest processing of crops and compliance criteria. Post-harvest processing will focus on the multipurpose Moringa tree as a model for different processing approaches (washing and transportation of fresh products, drying of leaves, storage of seeds, oil extraction from seeds). A cross link is planned to a running project of NU related to gender aspects and compliance criteria for organic farming. In urgent cases, WP 4 should have the possibility to ask consultants for their support (e.g. extension or plant protection services). Partners: Mn 1 LfL-SL with Mn 2 LfL-DE supported by Sc 1 JKI-G.

WP5 Knowledge transfer – Responsible for reporting: MMTU with LfL-DE.

Subproject 12: the organization of workshops for students or farmers is the central task of this work package and requires a specific manager (M3); in the school building of the MOST workshops for local farmers and interested people should be carried out twice per year to inform them about the project and its main topics. Additionally, workshops for students of the universities involved should be carried out once per year to inform them about the project. The main topics are supported by SES short-term experts. Partners: Mn 3 MMTU with Mn 1 LfL-SL and Mn 2 LfL-DE.

Subproject 13: Scientific conferences and networking (Partners: MMTU with LfL-DE supported by JKI-G); each year a conference of consortium partners and further partners involved is planned to discuss the results jointly. LfL-DE will organize a workshop at Tropentag each year carried out in Europe. Mn 3 MMTU will support to clarify the visa regulations for the participants. JKI-G will support to promote the event in the scientific community of Tropentag.

Subproject 14: Networking in Sierra Leone (Partners MMTU with NU and LfL-SL/LfL-DE); a joint meeting of all partners of the developing GreenPermaLinks network will be carried out at the end of the project in Freetown and the farm. Partners: Mn 3 MMTU with Mn 1 LfL-SL and MN 2 LfL-DE).

(2) Methods used and results expected

WP1 and WP4 Permaculture design and practical realization: planning of the farms transformation is following an Agile Project Management Process. This is an iterative approach to delivering a project throughout its life cycle. One of the aims of an agile or iterative approach is to release benefits throughout the process rather than only at the end. At the core, agile projects should exhibit central values and behaviours of trust, flexibility, empowerment and collaboration - the way of permacultural thinking.

Applying this to the farm we will reach a permacultural agro-forestry system including annual and perennial crops (vegetables, staple crops, fruit and multipurpose trees) stabilized by widely closed water and nutrient cycles. Concurrently, digital permaculture planning tools for smart phones are evaluated for their usefulness in later technology transfer.

Practically, contour ridges, tied ridges, and small pits will be supplemented by swales and hugelculture constructions (a combination of compost production and ridges). WP1 plans to work with a mini-excavator during the installation of the permaculture landscape to save time. Plant selection and cropping systems will be developed after workshops with stakeholders and literature research. They will be modified after each season due to experiences made. The productivity of crops and their water use efficiency will be studied under various water conservation technologies.

Permacultural production design requires intensive studies of biodiversity interactions, mainly cultivated plant interactions in mixed cropping and rotation systems, crop - weed, weed - beneficials, beneficials - crop and crop - symbiont interactions. We assume that an increase of biodiversity results in less management and better biological control of pests. This might result in a higher crop yield if the weed management is appropriate. Furthermore, bio-stimulating organisms and bio-fertilizers like rhizobia will be favoured by the biodiversity management and will increase soil fertility. We expect that mycorrhizal fungi will built up naturally and will be mutual while the soil is regenerating. A balance has to be found between all factors. The relative success of the innovative production system will be estimated by comparison with conventional systems.

WP 2 Water conservation: Water movement and water harvest on the 2-ha farm is studied and monitored by direct (monitoring wells, soil moisture sensors) and indirect (geoelectrical and ground-penetrating radar) methods. The fate of water in the soil-plant nexus will be studied by combining hydrogeophysical and ecohydrological monitoring. Using water stable-isotope methods, in addition, will contribute in determining water uptake depths of the agro-forestry system, the identification of water flow paths and the quantification of groundwater recharge rates of the system. Furthermore, the combined methodological framework will allow quantifying the benefits a combination of deep- and shallow-rooting trees/crops provides.

Early recognition of drought stress followed by appropriate reactions can avoid yield loss. UAV-derived vegetation indices will be used for regular monitoring of the system, be accompanied by, stomatal conductance measurements, and sap flow sensors in order to track an important part of the water balance - transpiration.

We expect that water run-off during and after precipitation, events will be slowed down by hugelculture constructions, which also promote substantial infiltration and storage of water. This hypothesis is tested by the integrated eco-hydrological and hydro-geophysical monitoring network installed in this WP2.

Groundwater recharge will be further promoted by planting trees surrounding and perennial plant associations (plant guilds) distributed over the farmland.

Deep rooting crops seem to cooperate with shallow rooting crops directly or via a mycorrhizal network related to water and nutrient supply. We assume that we can utilize this interrelationship by selecting appropriate plant mixtures and rotation systems.

WP 3 Plant nutrient recycling: Nutrient determination of all products will be conducted, samples will be taken and analyzed for nutrient export. We will use Inductively Coupled Plasma Optical Emission spectroscopy (ICP-OES) and Inductively Coupled Plasma Mass Spectrometry (ICP-MS) to determine total nutrient and pollutant levels in soils, plants and composts, microwaves for the digestion of soil, compost and plant samples, C/N analyzer, Photometer, ion chromatography, and Near Infrared Spectroscopy (NIRS) for the analysis of total and available plant nutrients.

As a result, nutrient budgets can be calculated for each crop and the demand for compost can be calculated.

The data will help to define crop rotations, which are best adapted to the demanding growth conditions in Sierra Leone and benefit most from the application of compost products. Together with economic data on the value added chain this will enable the development of site-specific crop rotations in connection with compost application which will deliver an optimized added value for local farmers.

Nutrients leaving the farm in form of the products has to be substituted by nutrient input from outside the farm what is supposed to be done by the collection of nutrient-rich biowastes for compost production.

Because this material is very heterogeneous, it is necessary to develop a classification and mixing scheme based on chemical characterization of the input materials and soil and plant analyses. We assume that a flexible and simple mixing procedure can be outlined for farmers to facilitate adoption.

WP 5 Knowledge transfer: We selected frequent events such as workshops and concurrent publications for knowledge transfer to different stakeholders as appropriate methods for knowledge transfer. This will result in a transfer of the project's idea and practical and scientific discussions with a large number of diverse, interested groups. Great emphasis is placed on the inclusion of women into the new approaches. Together with the principle of agile project management, this results in a self-optimizing input from outside and a participatory thinking in the GreenPermaLinks - network. A website will be launched already before the project's start during the initiation phase.

All results will be freely available for everyone by publishing them under the FAIR-principles. A research data management plan guarantees the process quality (Annex 4).

4 Capacity development and/or promotion of young researchers

The direct involvement of African researchers is 14, including 8 young researchers. On the German side 9 scientists including 4 young scientists are involved. The number of persons getting to know the project on local, national and international events is estimated to be more than 500 (impact of publications not estimated). The project leads to capacity building of scientific actors and non-scientific actors:

Number of scientific staff involved (African):

3 Chairs (WP 3, 4 and 5), 2 Co-chairs (WP1 and 2), 6 Master or PhD students (Sc 2 and 3 in WP1, Sc 5 and 7 in WP 2 and Sc 8 and 9 in WP 3), 2 managers Mn 1 in WP 4 and Mn 3 in WP 5).

Number of scientific staff involved (German)

2 Chairs (WP 1, 2), 3 Co-chairs (WP 3, 4, and 5), 2 scientist (Sc 1 WP 1 and Sc 9 in WP 3), 2 PhD students (WP2).

Number of non-scientific actors involved

10 field workers permanently working on farm for three years in Sierra Leone
1 manager in WP 4

Capacity Development (scientific actors)

Capacity building for scientists will take place at the individual level by work package chairs, co-chairs and coordinators as well as by WP 5 actions. Training: One-on-one or group training, whether face-to-face or online to increase personal knowledge and skills surrounding the work package issue. Methods used are workshop training, on-the-job learning, mentoring, staff meetings and cross visits and study tours. Accredited programmes of study leading to recognized certificates for young graduates, who could also be encouraged to stay and work on the farms as part of their training will be included.

Short term- training of young scientists in geophysics and soil/plant analytics in Germany.

Capacity Development (for farmers and non-scientific actors)

Capacity building for farmers and non-scientific actors will take place at the group level by WP 5 actions: workshop training, on-the-job learning, mentoring, staff meetings and cross visits and study tours

Knowledge & information management, Open data concept, data distribution

FAIR-Principles guaranteed, spread of data by international publications, local, regional and national workshops in Sierra Leone and in international workshops (Tropentag) in Europe

5 Presentation of the project partners in Germany and in the target region (more details see Annex 5)

Technische Universität Braunschweig (TUBS)

TU-IGEP: Expert for subsurface water monitoring (hydrogeophysical research using geoelectrical methods).

Development and application of indirect and non-invasive geophysical exploration methods for the characterization and monitoring of groundwater resources and groundwater-surface water interactions.

TU-IGÖ: Expertise in using water stable isotopes and drones together with ecohydrological approaches to investigate soil-vegetation-atmosphere interaction.

Federal Research Institute for Cultivated Plants, Julius Kuehn-Institute (JKI)

JKI-G: Expert for agro-ecology of mixed cropping systems and biodiversity management including plant protection; current urban permaculture projects.

JKI-PB: High competence in plant nutritional aspects and in evaluation of agronomic efficiency of fertilizers including composts.

Njala University (NU)

NU-AE: High competence on extending cropping into the dry season using a micro-dam rainwater harvesting system.

NU-SS: Special expertise on Climate Smart Agricultural systems for sustainable production of crops on marginal gravelly soils on rolling terrains.

Milton Margai Technical University (MMTU)

MMTU-A: Special expertise in education, training, and transfer of agricultural research.

Löwe für Löwe e.V./Lowe fur Lowe r.S. (LfL)

LfL-DE: independent non-profit organisation with highest competence for developmental projects (Health station, school, others) including fundraising and planning

LfL-SL: non-profit independent partner of LfL DE since 20 years. Special competence in project implementation, networking, and transfer.

6 Time schedule including milestones (details see Annex 6 and 7)

Three years of duration are planned for the project. The start should be in the dry season of Sierra Leone (between December and April). The time schedule with the milestones can be found in Annex 6. All WPs can start immediately in parallel. Shipping of equipment may result in the necessity to adapt the work plan slightly. Before the project starts an initiation phase is proposed to clarify specific questions (Annex 7).

7 Budget (details see Annex 8)

Total budget: 1.100.100 €

The financial requirements of the project are outlined in Annex 8 in detail. It is recognized and highly appreciated that the farm for the core experiments is provided by LfL-SL without costs. They expect an innovative outcome, which could fit in their intention to promote sustainable agriculture for small farms in Sierra Leone. The same is true for reference farms, which will not directly be paid for the possibility to install experiments there. It is planned to take over the installation costs there and to pay consumables for plant material and small tools (through WP1).

Generally, all activities are planned and carried out together. Therefore, for instance, equipment is listed only on the German side because it will be bought there and shipped to Sierra Leone. All equipment should remain in Sierra Leone after the project.

Personnel costs should be paid to the research units where the students or scientists are employed. For NGOs, the call provides not to apply for more than 50.000 € support per NGO directly (here: 50.000 € for each, LfL-SL and LfL-DE). Following our experiences, a local organizer is essential. He/she should be employed by LfL-De. Nevertheless, he/she will permanently work in Sierra Leone. LfL-SL will employ a farm manager and the field workers/technicians/drivers. By this construction, the practical side of the project fully lies in the hand of LfL and guarantees an agile management of farm development. This model works since 20 years without any problem and will allow carrying the farm with the new design in the future after the project ended.

Equipment is needed for the innovative research aspects and for repair of available devices. To be able to build up a bio-waste collecting system a (used) car with trailer is needed. For the installation of the swale system a mini-excavator is needed used afterwards for compost production. An appropriate chopper for compost raw material preparation is needed on top of that.

Consumables include chemicals for analytics but also plant material and small tools and construction material for nurseries (e.g. shadow nets).

Business journeys are transport of advisers (especially WP chairs) from Freetown to the farm or to meetings, of workers from the farm to other reference farms, collections of bio-waste and so on. Furthermore, all involved scientists and managers should meet one time per year in Europe at occasion of the international Tropentag. There a specific Workshop will be carried out to demonstrate results, discuss problems and invite colleagues from all over the world to participate in the GreenPermaLinks - network.

The coordinator of the project (Sc 6 of IGEP) should visit the farm minimally three times per year.

Additionally, costs for short term trainings of Sierra Leonean researchers in Germany and up to two visits of German WP chairs and co-workers in Sierra Leone are included here.

All partners agree that the practical realization of the project carried out on the farm of LfL SL might require consumables, which have to be paid by their own WPs. That means that consumables to run the farm as required by the research aspects have partially be paid by the other WPs and not by WP 4 alone. WP 4 does not receive sufficient consumables for the maintenance of the farm due to the restrictions with regard to NGO support. Therefore, this need will be met by mutual acceptance of responsibility.

Annex 1: Contribution to Sustainable Development Goals

The project makes a contribution to achieving 13 of 17 UN Sustainable Development Goals (SDGs):

SDG 1: fights against poverty by establishing an economically viable production system basing on subsistence agriculture with the possibility to reach international markets through the innovative production system introduced.

SDG 2: fights hunger via the production of manifold staple crops, vegetables, legumes, fruits and medicinal plants in an agro-forestry approach through combining subsistence agriculture with market-oriented production.

SDG 3: works for good health by reducing malnutrition (anemia) of children in a health station belonging to one of the applicants receiving processed Moringa-products directly from the farm.

SDG 4: provides quality education by transferring the project ideas and results concurrently to different stakeholders reaching from scientists to farmers, including illiterate people through teaching in a school belonging to the demonstration farm.

SDG 5: supports the transformation of the society with respect to gender equality by demonstrating role models for different actions and procedures on farm supported by a concurrent cross-linked gender project of the Njala University.

SDG 6: the provision of clean water is included in the project by developing botanical disinfection methods basing on Moringa-seeds tested and demonstrated in the projects processing section.

SDG 8: promotes sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all employees involved in the project throughout the project time.

SDG 10: reduces inequality among countries by applying international production quality standards to the production system to be developed.

SDG 11: includes sustainable cities' strategies by involving them into the bio-waste recycling circle (bio-waste for compost production is collected and processed on farm).

SDG 12: develops an innovative, ecologically sound permacultural production system as holistic approach for responsible production and consumption.

SDG 13: is involved in climate actions by its water management system and agro-forestry strategy.

SDG 15: protects, restores and promotes sustainable use of terrestrial agro-ecosystems, combats water deficiency, and halts and reverses land degradation and biodiversity loss by its complex permacultural system.

SDG 17: strengthens the means of implementation of the Global Partnership for Sustainable Development between all partners by installing a GreenPermaLinks - network.

Annex 2: Leaflet of the MOST



Löwe für Löwe e.V.

Löwe für Löwe e.V. was founded by German-Sierra Leonean friends in 1998. Since the rebel war in Sierra Leone, our association aims at initiating and promoting joined development projects with the Sierra Leonean non-profit organisation **Löwe für Löwe t. S.**

In the last twenty years, several projects have been realised: e.g.

- Health Centre construction
- Surgical Aid Missions
- Child and project sponsorships
- Primary School construction
- Children's home construction
- Container shipping
- Broadcast consultancy initiation

The Moringa project is an agricultural approach established in 2018.



Löwe für Löwe e.V.

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The Moringa Innovation and Start-up Centre Sierra Leone



The MOST: socially, ecologically and economically viable permaculture

Up to date, a huge amount of people in Sierra Leone is confronted with food insecurity or food unsafety. Agriculture is one of the most important key sources for subsistence and income. The intention of MOST is threefold:

- To establish an exemplary, innovative and socially accepted growing system independent on agro-chemicals
- To teach principals of holistic recycling approaches related to sustainable agriculture
- To outsource developed product ideas as opportunity for small scale business

All aims will be achieved by a permacultural agroforestry approach focused on the underutilized multi-purpose tree *Moringa oleifera*.



The current status of the project

Moringa oleifera is widespread in the tropics. All plant parts can be used for several purposes. In 2013, we recognized that Moringa could serve as a source for healthy food ingredients to fight anaemia of children in our Health Centre.

Because Moringa was still underutilized in Sierra Leone, the idea to establish a Moringa Centre began to be realized by building a farmhouse, a training centre, a factory, sanitary rooms and wells on a 2.5 ha farm in Robekoh Village near the larger city Waterloo. Very recently, we started to electrify the complex with solar energy substituting the generator running with fuel.

In 2019 the production of Moringa trees started in our own nursery. 1000 trees are already planted as the first part of an agro-forestry system to be installed on the farm. With the growing trees we will start to harvest leaves for food supplement production and biomass for the transformation of the agricultural farm to a permacultural agroforestry system.



Permacultural agro-forestry

On the basis of the traditional method of shifting cultivation we will introduce more and more permacultural practices characterized by nutrient recycling, water harvesting, seed production and intensive companion planting including development of plant guilds with indigenous fruits and vegetables.

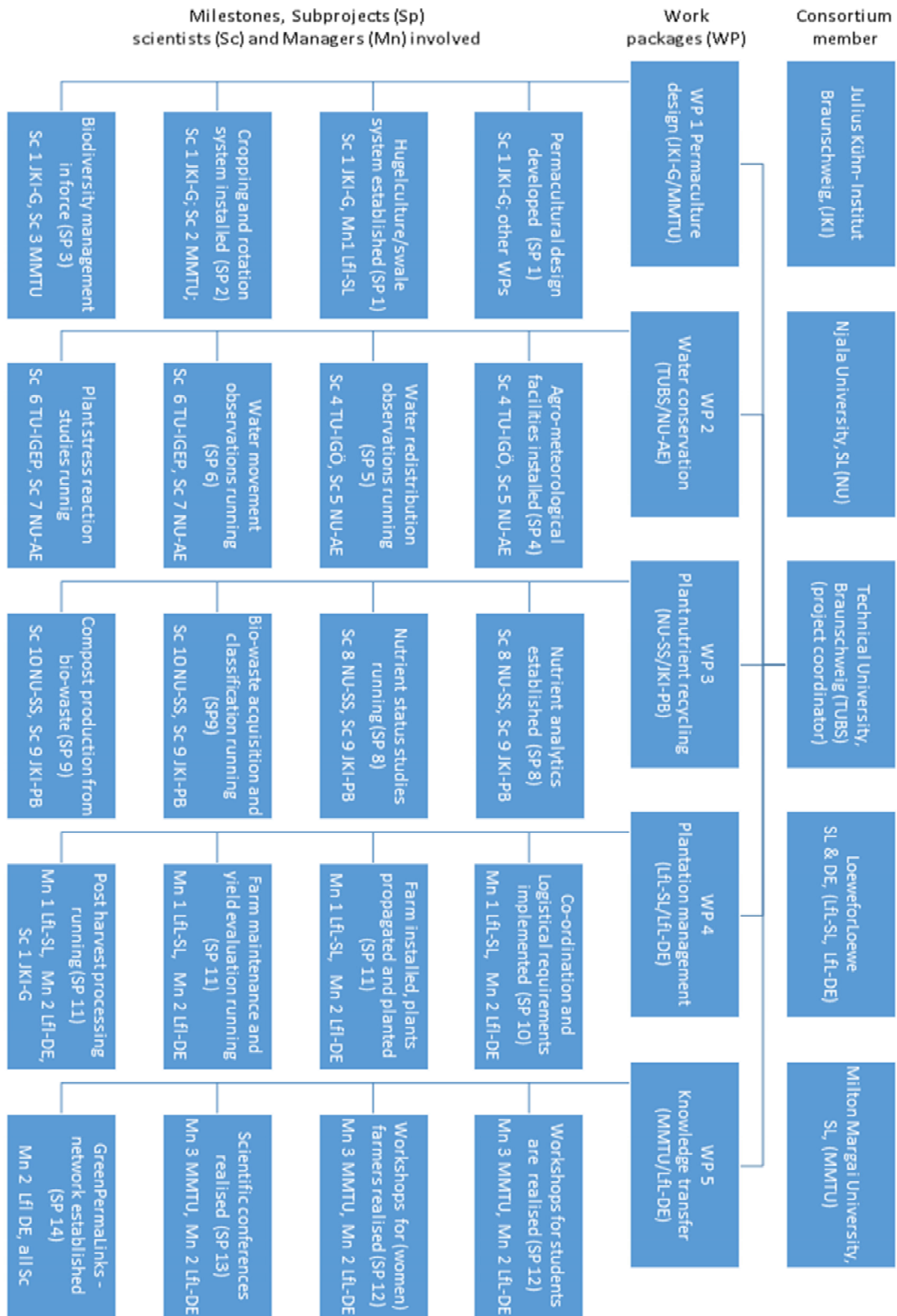
The generation and at the same time the dissemination of knowledge is planned in concurrent participation of farmers from the neighbourhood and intensive contacts with scientific institutions from Sierra Leone and abroad.

In order to get the skills for the project management on farm, we employed a young agricultural expert who is directing the ongoing project in tied connection with the management of the non-profit organizations.

Basing on our experiences we will write down a manual for the transformation of agricultural systems to be spread in Sierra Leone.

Be part of the project by sponsoring us!

Annex 3: Milestones, work packages (WP) with responsible institutions and subproject (SP) with responsible scientists (Sc) or managers (Mn)



Annex 4: Research Data Management Plan (RDMP) – 1. Phase

Description of data collection and processing

According to current research, no data regarding the topics of the project are publicly available. The project collects data on agro-meteorology, water movement and water availability, soil plant nutrients, nutrients in plant materials and composts, and plant genetic resources. The raw data is collected from field and laboratory tests and compiled in clearly structured tables (e.g. Excel spread-sheets). The data is stored with the associated metadata as an Excel file (reusable xlsx format). The data is analyzed using the respective software in the various formats and is exported to publicly used formats (xlsx or csv, txt) for general accessibility. For quality assurance, the data is collected over a period of two years at various locations and checked for representativeness and reliability using statistical methods using the open source statistical software. Access to the stored raw data is possible with standard MS Office programs. They are stored in the JKI cloud of the project. In addition, the meta-data and protocols of the studies are compiled in easily readable formats and files (e.g. csv and pdf files). The same applies to the statistical evaluation. Some of the statistical programs may be not open source, but these analyzes can be repeated after the project is completed.

The total volume of data collected in the project is estimated at 200 GB. The datasets may be relevant to other research institutions/researchers. The meta and data should therefore be made available for subsequent use via OpenAgrar (www.openagrar.de) as a subject-specific repository

Documentation of data

On the basis of "Good Laboratory Practice", the data collection is digitally documented in corresponding field and laboratory books and at the same time archived in the cloud of the Julius Kühn Institute by the project co-ordinator. At the same time, the raw data from field and laboratory tests are compiled in clearly structured tables (e.g. Excel spreadsheets). The standards for data storage, naming, versioning and metadata are defined before the start of the project by the network partners based on the OpenAgrar Repository (www.openagrar.de).

Data selection and data archiving

The raw data and metadata are stored in accordance with the guidelines for handling research data of the Julius Kühn Institute (https://www.julius-kuehn.de/media/IB/PDF/IB-JKI-Leitlinien_Forschungsdaten.pdf), and the FAIR principles (<https://www.go-fair.org/fair-principles/>) on a server at the JKI for archived and made available for a period of ten years or alternatively published via OpenAgrar Repository (www.openagrar.de), which is based on the Dublin Core metadata schema for data and provides DOIs to make the data findable, citable and available at the end of the project. In addition, the project name/number and link to corresponding article publications are provided. The archiving is carried out on behalf of the Julius Kühn Institute in order to support the guiding principle of research data management on the transparency and quality of the research results, their validation and the widest possible range of subsequent uses.

Availability of project data

The most important results, findings and conclusions are published at the end of the project with an identifier (DOI), preferably open source. The data and findings are analyzed and processed especially for scientists and farmers and are available to the various interested groups. Based on this, they are translated into the local language and thus made available for extension services. The datasets are shared within the consortium and can be used by other scientists and stakeholders (specific terms will be specified in the consortium agreement). In principle, the data generated in the project are interoperable, i. e. they enable data exchange

and reuse between researchers, institutions, organizations or countries. The formats used are open formats and widely used.

As no comparable data is available for secondary analysis to date, the research data will be made available to other researchers in the OpenAgrar Repository. The publications and research data resulting from the project receive a Creative Commons license CC-BY and a persistent identifier (DOI).

Annex 5: Presentation of the project partners in Germany and in the target region

JKI-G is the federal research institution for horticulture and urban green in Germany. The Institute for Plant Protection in Horticulture and Urban Green combines research, policy advice and statutory tasks in the context of authorising plant protection products. We are dealing with harmful organisms in a wide range of cultures: in horticulture, agro-forestry, urban green and home gardening. Our studies include the development of plant production systems considering the agro-ecology biology of pests and symbionts, the pathogenesis of plant diseases and vertebrate research in cropping systems to foster and develop targeted, integrated and sustainable plant protection approaches.

JKI-PB: The JKI-Institute of Crop and Soil Science carries out fundamental and applied research on agricultural production and the protection of natural resources. Main working fields are crop production, plant nutrition, fertilization and soil science. JKI-PB has a high competence in plant nutritional aspects and the evaluation of the agronomic efficiency of fertilizers. JKI-PB prepares annually the national nitrogen and phosphorus balances, and research is conducted amongst others on soil erosion, agroforest systems, climate change and plant stress metabolism in response to drought and biotic stress factors.

Dr. Elke Bloem is responsible for research on plant biochemistry, bioactive metabolites, plant stress metabolism and plant nutrition. The investigation of organic contaminants (antibiotics) in organic fertilizers, ecotoxicological experimentation and phosphorus availability of recycling fertilizers is in the focus of research. In relation to the proposal JKI-PB is currently running a project on the characterization of biobased fertilizers (EU project Lex4Bio: <https://www.lex4bio.eu/>) and their agronomic efficiency. Another related national project (BMBF <https://www.bmbf-rephor.de/verbundprojekte/p-net/>) analyze possibilities for regional phosphorus recycling from wastewater treatment plants. The institute possess all necessary equipment for elemental analysis of plants, soils and fertilizers and for the evaluation of the agronomic efficiency of fertilizer products.

TU-IGEP: is the Insitute for Geophysics and extraterrestrial Physics. It has a long track-record of hydrophysical research using geoelectrical methods. Since January 2022, Prof. Dr. Matthias Bückner holds a Junior Professorship in Urban Geophysics, which focuses on the development and application of indirect and non-invasice geophysical exploration methods for the chararcterization and monitoring of groundwater resources and groundwater-surface water interactions in urban and periurban areas. Currently, IGEP is involved in a project with JKI-G and IGÖ, where geophysical methods are applied for the characterization and monitoring of hydrological conditions of urban trees.

TU-IGÖ is the Institute for Geoecology of the Technical University Braunschweig. It has a long history and proven expertise in studies of the soil-vegetation-atmosphere interfaces. With its four sub-Institutes (Climatology & Environmental Meteorology; Landscape Ecology; Soil Sciences & Physics; Environmental Geochemistry), it covers the key fields addressed by the call. Dr. Matthias Beyer is leading an independent research group at the Institute for Environmental Geochemistry since 2018. In 2017, the Volkswagen

Foundation rewarded him with the renowned, Freigeist' Fellowship. From the University of Braunschweig, he received the Agnes-Pockels Award in 2018. His main project ,Isodrones' (www.isodrones.com) is using water stable isotopes and drones together with ecohydrological approaches to investigate soil-vegetation-atmosphere interaction. The research group has a focus on developing methods to study the water cycle using novel, innovative methods. He currently employs three PhD students, two scientific assistants, one visiting fellow and several Master students.

Recently, the group developed and tested a framework for a combined *in situ* measurement of soils and (Beyer et al., 2019; Kühnhammer et al., 2019, 2021). At the same time, novel drone-based methods (e.g. plant sampling using drones) are being developed by his PhD students. With those two combined and highly innovative approaches, the contribution of the working group to the overall project both for scientific quality but also by providing products that can be used by decision-makers is assured.

MMTU: The project will be anchored to the Department of Agriculture (10 Faculty members with qualifications in various fields in Agriculture). However, the project will be institutionalised and all lecturers with relevant knowledge will contribute towards the successful implementation of the project. The University has a laboratory equipped with modern equipment for various analysis including soils, water and plants. Dr Alhaji Ibrahim Sankoh (Project Lead at MMTU) – Director of Research, senior lecturer and project implementation coordinator --Environmental Scientist with special interest in soil science, analytical chemistry, pesticides, water, food and plant science. Our competences are a) Lead and coordinate the training of local farmers on proper use of both synthetic and organic pesticides in Kychom and Babarah Wallah Sierra Leone; b) Lead and coordinate the training of local vegetable producers along the sea-side communities along the Freetown peninsula on turning waste to harvest and using seaweed in to promote vegetable production; c) Mushroom spawn producer; d) Soil analyst for NETFLIX-SL, Leverage company limited etc; e) MMTU lead for the implementation of the AQHED-SL SPHEIR project in Sierra Leone; f) Project lead of the Skills Development Fund project in Sierra Leone; g) Member of the SUN coordinating team in Sierra Leone; h) Consultant for the development of a QA plan for the GHG and training of MDAs for QA/QC activities; i) Consultant for the Stockholm convention and focal point for Minamata convention.

NU-AE: Dr. Blango holds a PhD degree in Agricultural Engineering and has served as Head, Department of Agricultural Engineering, Njala University for over three (3) years. Since 2011, Dr. Blango has been working on extending cropping into the dry season using a micro-dam rainwater harvesting system. He is interested in improving water productivity in irrigated rice. As a staff in the Department of Agricultural Engineering, Dr. Blango continues to teach several courses that include Hydrology, Irrigation & Drainage, Water Harvesting for Agriculture and Land & Water Resources Management.

He has also served as consultant for several Projects supported by the International Fund for Agricultural Development (IFAD) and implemented by the Ministry of Agriculture and Forestry (MAFSL). Dr. Blango has published several articles in renowned journals, on themes that include rainwater harvesting, irrigation water management and use of biochar as soil amendment. He has also worked as Principal Investigator for an IAEA sponsored project investigating the effect of a microdam rainwater system on artificial recharge of

groundwater. In 2015, Dr. Blango was awarded a Borlaug LEAP grant, through which he was mentored at the International Rice Research Institute (IRRI) and the University of Illinois, USA.

NU-SS: The department of soil science has expertise in soil chemical analysis, fertilizer studies, recommendation, and plant sources for organic matter production (e.g. *Gliricidia sepium*). Experiences to use farm organic sources like rice straw and house hold refuse are available to get valuable organic bio degradable component for composting. The potential of mobilizing and analysing the value of organic sources of plant fertilizer is a huge opportunity waiting to be tapped in this project.

The Soil Science Department is about installing an AAS so that rapid soil analysis may be done including micro nutrients. However, we may explore more rapid means of doing so with options available for dry soil analysis.

Soil microbiology analysis is also critical in evaluating organic matter quality. The department has a soil microbiologist to look at this aspect.

We have designed and tested compost drums and been able to promote the rapid decomposition of plant materials while at the same time preventing leaching. We may share these experiences with you for possible inclusion in a more controlled research in this package. We have also designed and tested, to great effect, the use of small slashers and grinders to cut large twigs and leaves to smaller bits so that decomposition can be enhanced.

We have experience with ecological farming where we integrated rainwater harvesting methods for controlling loss of soil under a mixed farming cropping system. This has proved effective in stabilizing sloping soils on the side of valleys.

LfL-DE/SL: Since 1998, the German NGO Löwe für Löwe e.V. established a long-term/ strong relationship with a NGO Lowe fur Lowe in Sierra Leone. Löwe means Lion and is on the one hand the traditional symbol of the city of Braunschweig where the German NGO is located but on the other hand the symbol of Sierra Leone and even part of the countries name. The lion, therefore, is a symbol for the strong partnership between our organisations. Aim is to provide support for people in need, demonstrating how effective private engagement can be.

In the first years, the promotion of health and education as well as the poverty reduction were the focus of our work. In the following we would like to present you all projects in which we are currently engaged. All of them are implemented in Sierra Leone and are located around Freetown:

Health projects: a) Since 2007 cooperation with the Katelena-clinic in Freetown, Adra Hospital in Waterloo and Dr. David Koroma in Rokel (medical care, procurement of hospital furniture, medical devices, dressing materials, etc.); b) The Lion for Lion Health Center was launched in Brigitte Village in April 2010 and offers health care services for several thousand people in the region; c) In addition to primary health care and obstetric, health education and vaccination are conducted by the nurses, both in the health centre and the nearby villages; d) The Lion for Lion health centre is officially part of the programme “Under Five” to reduce child and maternal mortality alike; e) During the Ebola epidemic (2014 - 2016) the Lion for Lion Health Center was operating while many other hospitals and health posts were closed. In February 2015 it

was chosen to be the best health post among 144 in peripheral health units: The Ministry of Health and Sanitation and partners like UNICEF and Concern International awarded the “IPC Team Choice Award” to the Lion for Lion Health Center; f) Once a year there is a surgical relief mission for children in Sierra Leone implemented by surgeons from Germany; g) In 2015 Löwe für Löwe started the radio programme „Welbodi talk“ at Star Radion. Two nurses of the Lion for Lion Health Center and sometimes also guest speakers inform about different health topics every other Saturday.

Sponsorships: Since 2002 sponsoring is organised for the “Brigitte Village Community School”, the Moringa-project and the Lion for Lion Health Centre.

Container shipping: Since 2001 Löwe für Löwe has been shipping containers loaded with relief goods to Sierra Leone.

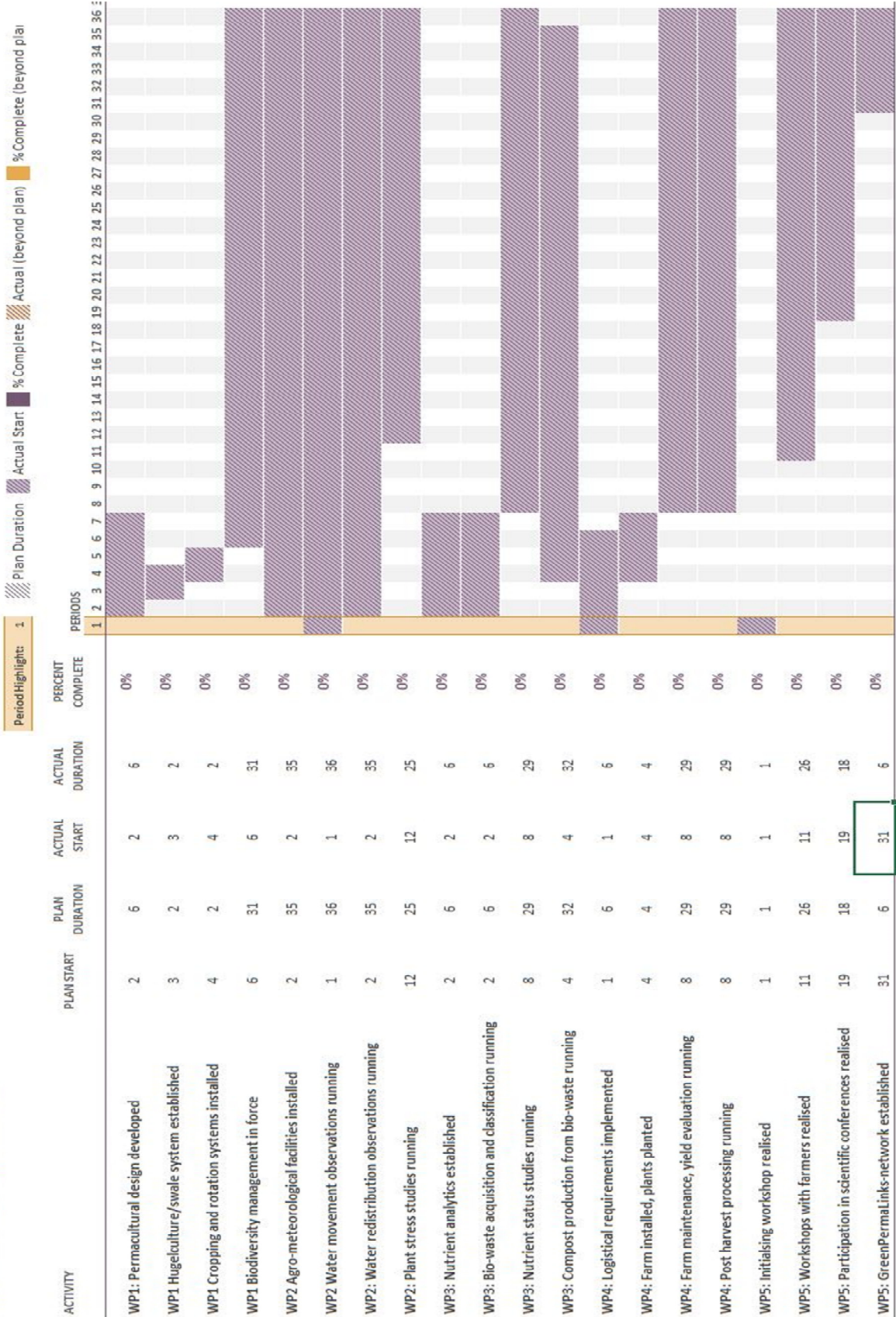
Children’s home: In 2001, Löwe für Löwe e.V. built a children's home according to local standard in Devil Hole, a suburb of Freetown.

Primary schools: In 2004 the first primary school was launched in Devil Hole nearby the children's home. Initially, the children had to bear a long walk to school in the next town every day. However, the school in Rokel was incredibly over-crowded; 80-100 children of three levels were taught in a single classroom. In 2013 we have handed over the school to the community that takes care of everything now, including salaries for the teachers. In 2015 we opened the second primary school in Brigitte Village at the Peninsular Freetown Highway the “Brigitte Village Community School”

The Moringa Innovation and Start-up Centre is the first agricultural approach of the well established bilateral interrelationship of the German non governmental and non profit organisation Löwe für Löwe e.V. and the partner NGO Lowe fur Lowe r. S. Sierra Leone.

Annex 6: Time schedule including milestones

Milestones and time schedule



Annex 7: Concept and estimated costs for the initiation phase of the GreenPermaLinks Project

Coordinating institution

Technische Universität Braunschweig (TUBS), Institut für Geophysik und Extraterrestrische Physik (TU-IGEP); Mendelssohnstraße 3, 38106 Braunschweig; Prof. Dr. Matthias Buecker; m.buecker@tu-braunschweig.de

Duration of the initiation phase: 4 months (minimally 2 months, if necessary)

Total costs: 40.000 €

The initiation phase will precede the implementation of the research project GreenPermaLinks. Funds of 40,000 euros for a period of four months are budgeted for this purpose here. The result of the initiation phase will be a full project proposal, closely coordinated with the partners, including a detailed budget for a three-year research project. Two visits of the consortium partners are conceptualized here, one in Sierra Leone, one in Germany.

1. Visit of partners in Sierra Leone

The visit of German partners in Sierra Leone will last for 14 days at the beginning of the initiation phase.

a) Identification and involvement of suitable partners, stakeholders and target groups.

Although the consortium partners are already well known by the partner LfL, the German partners from TUBS and JKI should meet them before the proposal is written in detail to discuss the scientific background. A scientific workshop related to the project topics should be launched (open and free access for all interested people). The partner of WP 5 (MMTU) should organize this workshop.

During the workshop, open questions and necessary changes should become clear. Furthermore, a clear division of labor within the project proposed should be the result.

b) Assessment of the research region for its suitability to carry out the subsequent research work.

Because of the well-settled NGO LfL, the research region and reference areas are already proposed.

However, it is necessary to assess them for suitability to answer the scientific questions. For instance, the geographical and physical details, e.g. the slope of the main experimental area and the reference areas, potential geology and hydrogeology have to be assessed to plan the concrete landscape design for the experiments. The superficial assessment of the landscape will be complemented by a geophysical assessment including a mapping of the shallow subsurface down to a few meters to know hydrogeological units (e.g. clay content, moisture, depth to bedrock, etc.).

All work package chairs will visit the MOST, the reference areas, and the laboratories of the universities. Furthermore, the mayors of the surrounding villages will be invited to inform them about the bio-waste collection planned. Stakeholders from other cross-linked projects take part in this journey.

c) Consortium meeting to discuss project details

In a follow-up closed meeting the consortium will discuss about specific scientific and administrative conditions and will agree on the distribution of the budget.

2. Meeting of work package chairs for final discussion of the project proposal (in Germany)

The German side will write the final project plan after the visit in Sierra Leone. This will take minimally six weeks. Afterwards, a consortium meeting should take place in Germany. This meeting is of special importance because of three reasons: a) The consortium members should take part in the finalization phase of the project development and b) should see the capacities of the German partners to get an impression which competence students should have being sent to Germany, and c) the visit should show the way to get visa for Sierra Leonean partners to travel to Germany (relevant for students coming later). In spite of having a German embassy in Freetown, Sierra Leone, applications for visa have to be submitted personally in Accra, Ghana, (<https://freetown.diplo.de/sl-en/-/2484138>). This costs expenses for flight and hotel for normally one week.

Budget plan for the initiation phase

Partner	Funded item	Amount [€]
TU-IGEP	Travel to SL including allowances	3.500
TU-IGÖ	Travel to SL including allowances	3.500
JKI-G	Travel to SL including allowances	3.500
	Organisation of meeting 2	1.500
JKI-PB	Travel to SL including allowances	3.500
NU-AE	Travel to DE including allowances	4.300
	Allowances for participation in meeting 1	200
NU-SS	Travel to DE including allowances	4.300
	Allowances for participation in meeting 1	200
MMTU	Travel to DE including allowances	4.000
	Allowances for participation in meeting 1	200
	Organisation of meeting 1	3.000
LfL-SL	Travel to DE including allowances	4.000
	Allowances for participation in meeting 1	200
LfL-DE	Travel to SL including allowances	3.500
Sum		40.000

The expenses for the travel of Sierra Leonean partners are calculated higher due to the visa costs including flight to Ghana and allowances for one week.

Annex 8: Estimated costs of the GreenPermaLinks Project (in Euro)

	Partner	Funded item	Year 1	Year 2	Year 3	Sum
WP 1	MMTU	Personnel costs	16.000	16.200	16.360	48.560
		Business journeys	7.500	7.500	7.500	22.500
	JKI-G	Personnel costs	19.000	19.950	20.950	59.900
		Equipment	8.000	5.000	5.000	18.000
		Consumables	17.000	7.500	5.500	30.000
		Business journeys	5.000	5.000	5.000	15.000
WP 2	NU-AE	Personnel costs	16.000	16.200	16.360	48.560
		Equipment	5.000	1.000	1.000	7.000
		Business journeys	7.500	7.500	7.500	22.500
	TU-IGEP	Personnel costs	54.220	56.030	56.550	166.800
		Equipment	40.000	3.000	3.000	46.000
		Consumables	20.000	5.000	5.000	30.000
		Business journeys	10.000	10.000	10.000	30.000
	TU-IGÖ	Personnel costs	29.160	30.660	32.200	92.020
		Equipment	28.000	3.000	3.000	34.000
		Consumables	4.000	4.000	4.000	12.000
		Business journeys	7.500	7.500	7.500	22.500
	WP 3	NU-SS	Personnel costs	16.000	16.200	16.360
Equipment			5.000	1.000	1.000	7.000
Consumables			5.000	5.000	5.000	15.000
Business journeys			7.500	7.500	7.500	22.500
JKI-PB		Personnel costs	19.000	19.950	20.950	59.900
		Equipment	40.000	0	0	40.000
		Consumables	5.000	5.000	5.000	15.000
		Business journeys	5.000	5.000	5.000	15.000
WP 4	LfL-SL	Personnel costs	9.300	9.700	11.000	30.000
		Equipment	2.000	0	0	0
		Consumables	2.000	2.000	1.000	5.000
		Business journeys	5.000	4.000	4.000	13.000
	LfL-DE	Personnel costs	16.000	16.500	17.500	50.000
	WP 5	MMTU	Personnel costs	8.000	8.400	8.900
Equipment			5.000			5.000
Consumables			5.000	7.500	7.500	20.000
Business journeys			1.500	7.500	7.500	16.500
Sum						1.100.100

Concept and estimated costs for the initiation phase of the GreenPermaLinks Project

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NU-AE	Travel to DE including allowances	4.300
	Allowances for participation in meeting 1	200
NU-SS	Travel to DE including allowances	4.300
	Allowances for participation in meeting 1	200
MMTU	Travel to DE including allowances	4.000
	Allowances for participation in meeting 1	200
	Organisation of meeting 1	3.000
LfL-SL	Travel to DE including allowances	4.000
	Allowances for participation in meeting 1	200
LfL-DE	Travel to SL including allowances	3.500
Sum		40.000

The expenses for the travel of Sierra Leonean partners are calculated higher due to the visa costs including flight to Ghana and allowances for one week.

Date and Location

Signature of coordinating institution

Consortium Agreement

A.1. TITLE AND DATES

Call title	Announcement No. 04/22/33: Innovative Sustainable Production Systems
Project title	Development of water conservation and nutrient recycling strategies for efficient and environmentally sound regenerative, permacultural agro-forestry on small farms in Sierra Leone
Acronym if applicable	greenPERMALinks

Consortium Partner Declaration

*Each coordinator and consortium partner should complete this declaration.
Please copy this page as many times as necessary.*

I declare that I have read the terms and conditions relating to applications for funding and that the information given in this application is complete and correct.

My institution will contribute to the activities of the project as stated in the project proposal.


The proposed partners of the research consortium have not committed any financial or other irregularity in the implementation of any previous EU or domestically funded programme.

I consent to the information recorded on this form being collected and stored electronically and used to process my application for a research contract with the funders. I consent to the information being sent to the funding programme manager BLE (Federal Office for Agriculture and Food) or to third parties for the purposes of assessing and reviewing the application. I acknowledge that:

1. Names, addresses and other details may be held on a database and used in order to communicate information
2. BLE will not permit unwarranted breach of confidentiality or act in contravention of applicable Data Protection laws.
3. The signing party confirms to inform the coordinator and the funding programme manager BLE immediately if any contribution to the project (as stated during the proposal phase, the contract negotiation phase or in the funding contract) is halted or the continuation / realisation of the submitted project is endangered in any other way.

Partner name and country

Löwe für Löwe e.V., Brigitte Amara-Dokubo, Germany

To be signed by	Signature	Date and Place
Name of Authorised Signatory: Brigitte Amara-Dokubo		Braunschweig, 07.08.2022

Stamp or seal of the organisation:

Löwe für Löwe e.V.
c/o B. Amara-Dokubo
Ottenroder Str. 12C
38106 Braunschweig



Consortium Agreement

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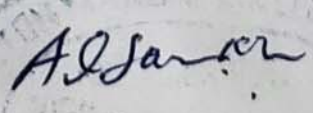
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Partner name and country		SIERRA LEONE
		MILTON MARCAI TECHNICAL UNIVERSITY
To be signed by	Signature	Date and Place
Name of Authorised Signatory: Dr. Alhaji Ibrahim Sankoh		11/08/2022 Freetown.

Stamp or seal of the organisation:

Consortium Agreement

A.1. TITLE AND DATES	
Call title	Announcement No. 04/22/33: Innovative Sustainable Production Systems
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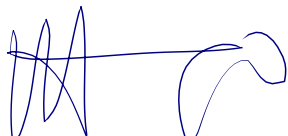
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<i>Partner name and country</i> DEPARTMENT OF AGRICULTURAL ENGINEERING, NJALA UNIVERSITY, SIERRA LEONE

To be signed by	Signature	Date and Place
Name of Authorised Signatory: DR. MOHAMED M BLANGO		11 th August 2022 NJALA, SIERRA LEONE.



Stamp or seal of the organisation:

Consortium Agreement

• A.1. TITLE AND DATES

Call title	Announcement No. 04/22/33: Innovative Sustainable Production Systems
Project title	Development of water conservation and nutrient recycling strategies for efficient and environmentally sound regenerative, permacultural agro-forestry on small farms in Sierra Leone
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Partner name and country

To be signed by	Signature	Date and Place
Name of Authorised Signatory:		
Sahid Bengura		8 th August 2022

Stamp or seal of the organisation: