Introduction to ETH-Soil

DBFZ

ETH-SOIL

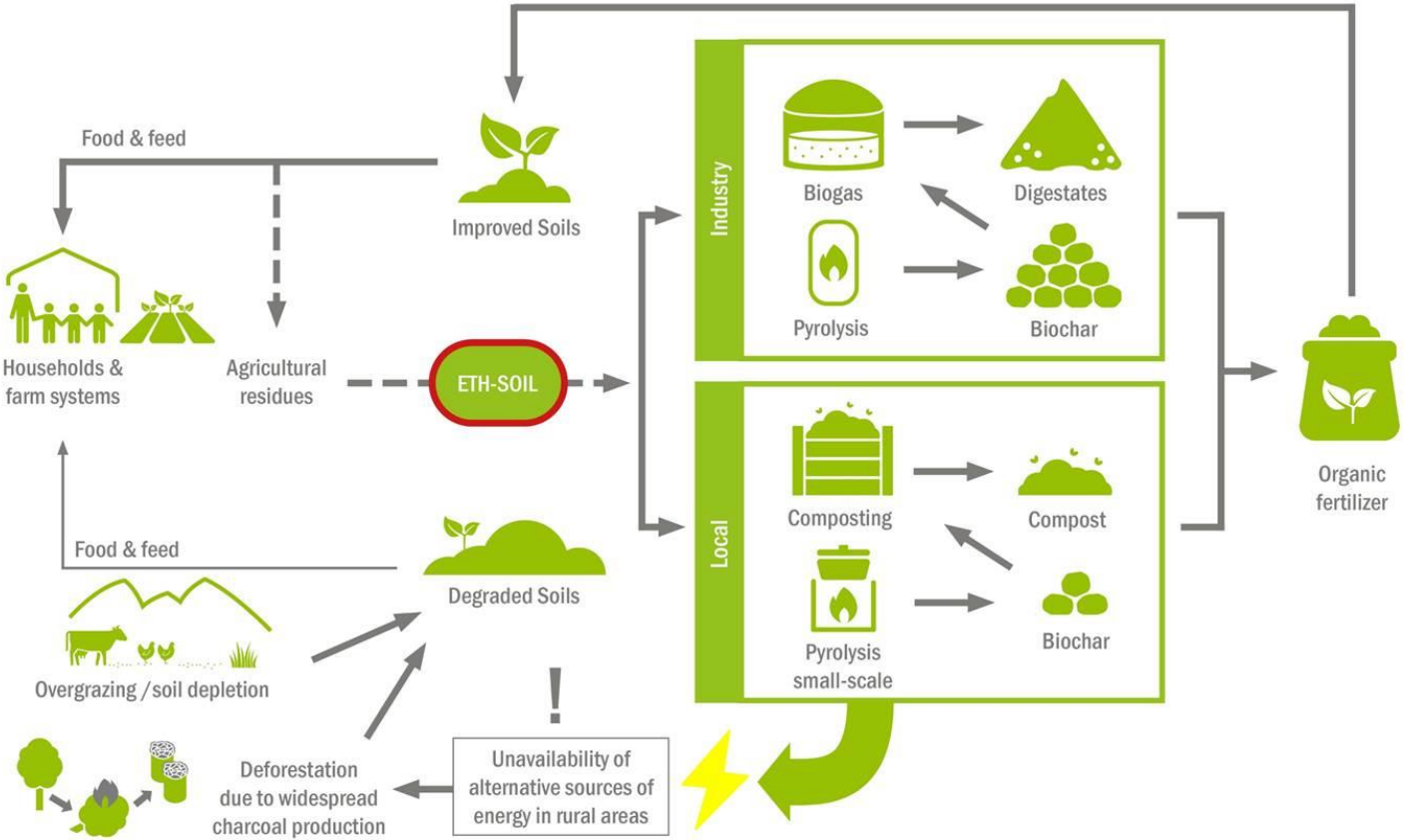
27-05-2024

german cooperation
DEUTSCHE ZUSAMMENARBEIT

Key facts

- **Overall objective:** With the slogan „Bio-Power for Healthy Soils“, the ETH Soil project aims to increase the resilience of smallholder farming and agricultural productivity, and facilitate more local value generation by an energetic or material use of agricultural residues.
- **Funding:** German Federal Ministry for Economic Cooperation and Development, Special Initiative: “Transformation of Agricultural and Food Systems”
  => developing and piloting innovative approaches
- Implementation period: 2021- 2026
- Main implementation partners:

ETH-Soil – Visual Overview



ETH-SOIL

2 ZERO HUNGER

15 LIFE ON LAND

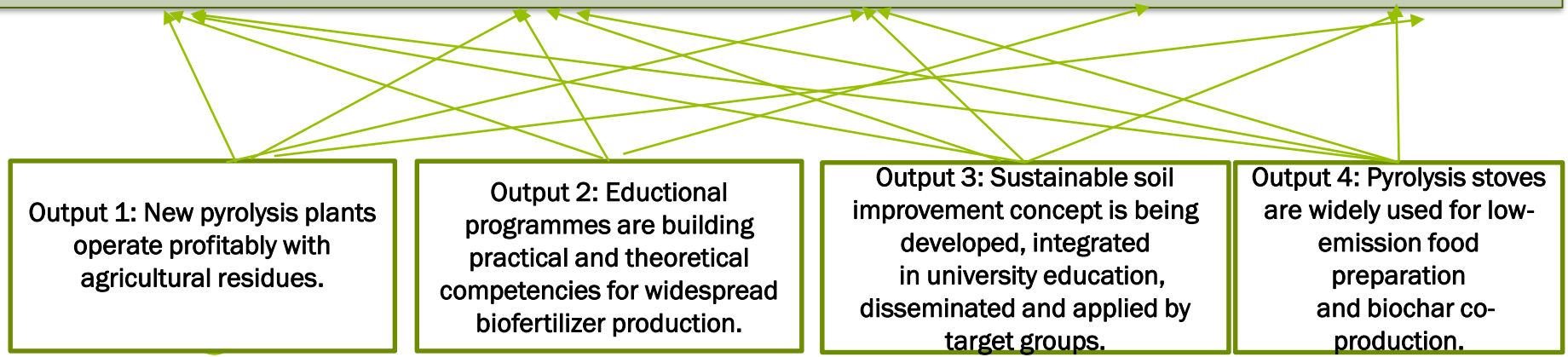
4 QUALITY EDUCATION

3 GOOD HEALTH AND WELL-BEING

7 AFFORDABLE AND CLEAN ENERGY

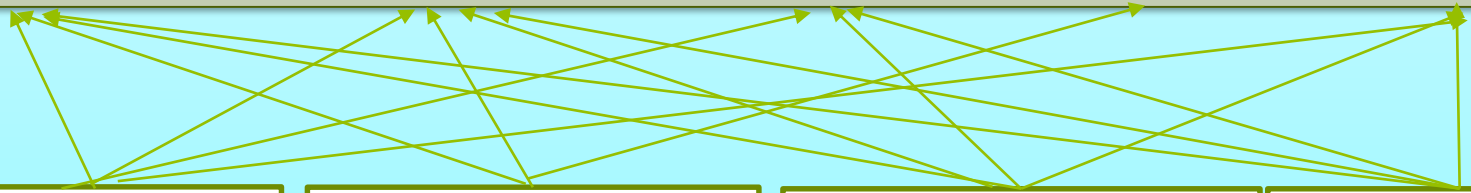
Outcome

Degraded soils are rehabilitated through the employment of un- or underused agricultural residues for the production of combined biofertilizer (produced through mixing of biochar with digestates or compost). Thereby, food-insecure smallholders with low income levels in rural communities gain new perspectives for increased agricultural productivity and higher incomes.



Outcome: Degraded soils are rehabilitated through the employment of un- or underused agricultural residues for the production of combined biofertilizer (produced through mixing of biochar with digestates or compost). Thereby, food-insecure smallholders with low income levels in rural communities gain new perspectives for increased agricultural productivity and higher incomes.

Indicator 1	Indicator 2	Indicator 3	Indicator 4	Indikator 5
In the pilot- and demonstration phase 50 ha of degraded farm plots in the pilot regions will be treated & improved via the application of 1000 t of combined biochar-based fertilizer	During the project implementation period 450 smallholder farmes with an average household size of 5 persons will record productivity increases of at least 15% on plots treated with a combination of digestates or compost with biochar	The pH-value of degraded soils will improve through the application of biochar-based fertilizer (digestates / compost)	Biogas plants for the production of digestates to be used in biocahr-based fertilizer are established and operate sustainably	Pyrolysis devices for low emission heat generation with simultaneous biochar production are established and operate in a sustainable manner



Output 1:	Output 2:	Output 3:	Output 4:
New pyrolysis plants operate profitably with agricultural residues.	Eductional programmes are building practical and theoretical competencies for widespread biofertilizer production.	Sustainable soil improvement concept is being developed, integrated in university education, disseminated and applied by target groups.	Pyrolysis stoves are widely used for low-emission food preparation and biochar co-production.

Main Outputs

Output 1: New pyrolysis plants operate profitably with agricultural residues

Output 2: Eductional programmes are building practical and theoretical competencies for widespread biofertilizer production

Output 3: Sustainable soil improvement concept is being developed, integrated in university education, disseminated and applied by target groups

Output 4: Pyrolysis stoves are widely used for low-emission food preparation and biochar co-production

Output 5: Soil transformation concept and related scientific evidence is ready for dissemination, replication & scale-up

Output 1: New pyrolysis plants operate profitably with agricultural residues.

- Production of biochar from agricultural residues without competing uses
- Optimisation of pyrolysis plants for heat production with simultaneous high-quality biochar production
- Confirmation that biochars are free from hazardous substances
- Capacity building for the production of pyrolysis devices in Ethiopia
- Development of business models for sustainable operation of pyrolysis devices

Output 2: Eductional programmes are building practical and theoretical competencies for widespread biofertilizer production.

- Establishment of demonstration and learning/training facilities for biogas with digestated being used for fertilizer production
- Capacity building for biogas plant operation and maintenance
- Integration of learning modules into university curricula
- Identification of further locations with the potential of sustainable business concepts

Output 3: Sustainable soil improvement concept is being developed, integrated in university education, disseminated and applied by target groups.

- Testing of fertilizer receipts
- Organisation of the availability of biochar and biochar-based fertilizers
- Training of multiplicators for smallholders (male & female) to gain the competence to apply and produce biochar on their own
- Registration of use pattern and productivity gains
- Soil monitoring for the development of sound evidence on soil improvement

Output 4: Pyrolysis stoves are widely used for low-emission food preparation and biochar co-production.

- Data collection on current pattern of fuel collection / procurement and use as well as of cooking preferences of smallholders
- Development, testing, and optimisation of a pyrolysis cookstove
- Capacity building for stove production in Ethiopia

Indicators of goal achievement

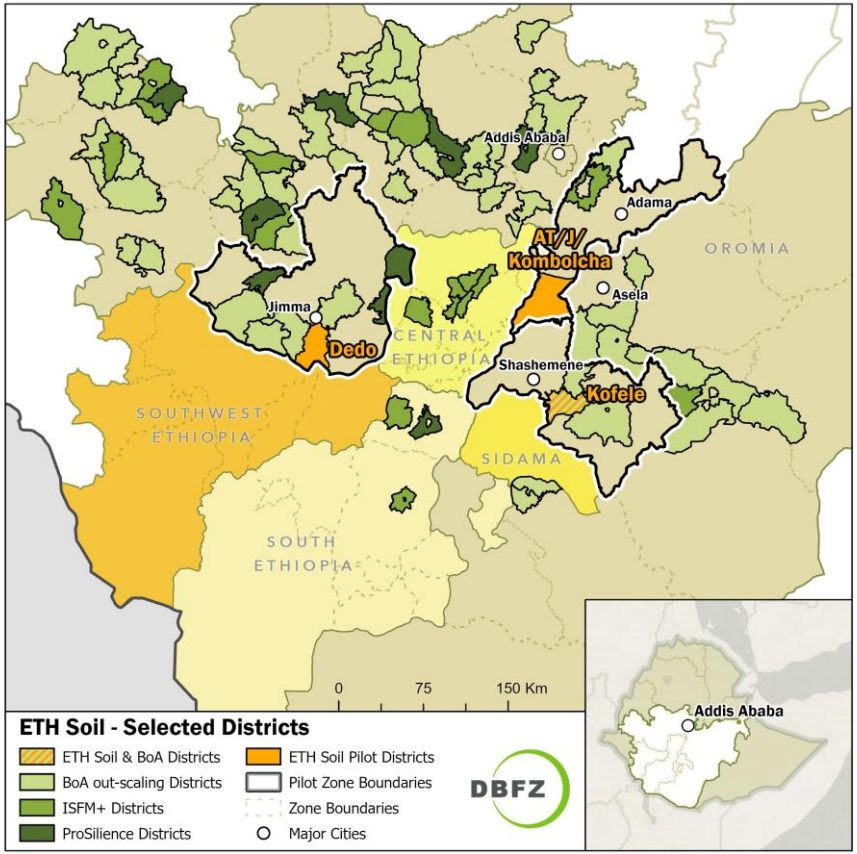
ETH-SOIL

- At least 3 stationary and 5 mobile pyrolysis units are being used for food processing and biochar production
- A modern biogas digester and biogas laboratory are established for the education of management staff and operational personnel
- A mixing, composting and biofertilizer production unit serves demonstration purposes
- At least 12 persons are qualified to independently plan or manage modern bioenergy units;
- At least 30 persons are qualified to independently operate and maintain modern bioenergy units
- At least 12 multiplicators are qualified to disseminate knowledge on the production and application of biochar-based biofertilizer in the context of climate-smart agricultural practices
- At least 1000 t of high-quality biochar-based biofertilizer (compost, digestates, and biochar) are applied on smallholder farms
- At least 450 smallholder households are engaged in the application of biochar-based biofertilizer and record at least 15% productivity gains on the average
- At least 50 ha of degraded soils are treated with biochar-based biofertilizer and record positive effects (increased pH-value, water retention, soil organic carbon, etc.)
- At least 450 pyrolysis cookers are being used by the target group for cooking and biochar co-production

Transformation Approach

Strengthening of the core actors of the regional & agricultural innovation system in Oromia (research, agricultural extension, farmers and handycraft firms) and knowledge exchange amoung them combined with the interactive, joint development of new knowledge for the production and application of biochar-based fertilizers.

Exploration of synergie potentials - coordination with other development interventions and donors.

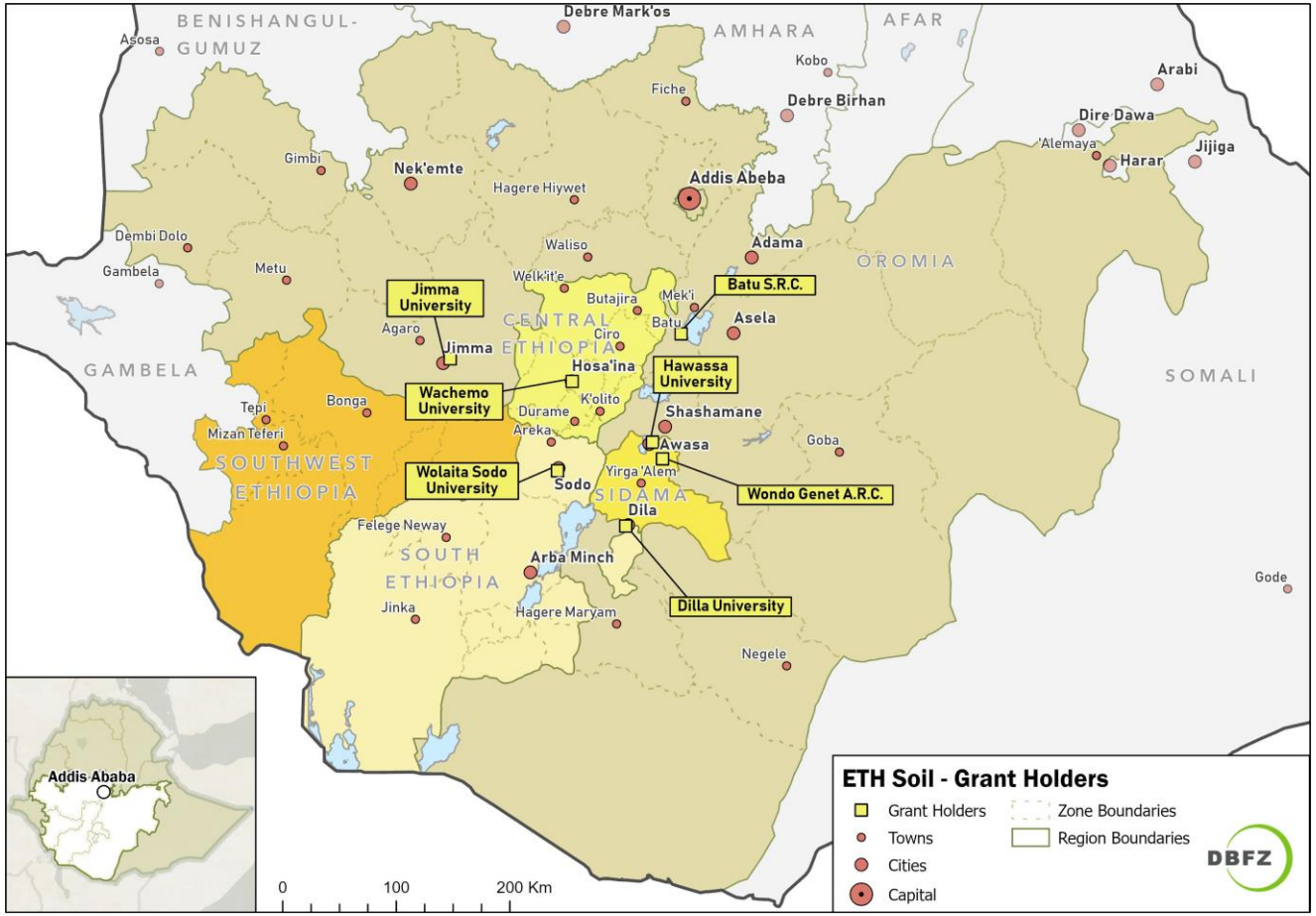


Research partners

for the testing of biochar-based fertilizer (BBF) formulations

=> on acidic or otherwise degraded soils

=> for the five main types of grain grown in Ethiopia



Main results so far

- Identification of 19 suitable types of agricultural residues in three pilot regions; systematic stock-taking on hot spots of biomass availability.
- Research partners in Oromia and in the south-east increasingly manage to produce high-quality biochar (low PAH content).
- A study tour on composting techniques and biochar production in Germany and Austria broadened the knowledge and contact networks of partners.
- Investments in infrastructural facilities and equipment at IQQO and JU prepared them for the production of up to 100 t of biochar in 2024.
- Testing of different BBD-formulations was effected with pot and field experiments for teff, sorghum, barley and maize, synthesized and prepared for further testing (including wheat).
- 1,7 t biochar-based feertilizer was applied on degraded plots of 36 smallholders facilitating new insights for 200 other smallholder farmers in three villages who inspected and discussed results.
  => Productivity increases of 60% to 78% (as compared to mineral fertilizer) were achieved.

Main results so far

- Capacity building implemented with partners on the calibration and use of lab equipment and experience exchange / cosulting on soil monitoring and use of Kon-Tikis for high-quality biochar production.
- Procurement of formal documents (incl. Preliminary EIA), establishment of the load bearing capacity at the biogas construction site, design and costing of an access road at the JIT, Jimma University and international tender of the plant and biogas lab construction.
- Agreement on the number and content of Modules that will allow students in the MSc. on Renewable Energy at Jimma University to specialise in biogas from September 2024 onwards.
- Implementation of a study tour on Biogas & the structure and content of comparable study programmes in Germany for JIT faculy.
- Implementation of two Soil Symposia (in 2023 and 2024) for knowledge sharing on biochar-based fertilizers.
- Use pattern of cooking fuels and cooking habits were studied in the pilot Woredas while DBFZ engineers were optimizing prototypes and asssed pyrolysis stove production capacities in the pilot zones.

Thank you for your cooperation and attention !

Kontakt:
Kerstin Wilde
kerstin.wilde@dbfz.de

DBFZ German Biomass Research Institute

Torgauer Str. 116
D-04347 Leipzig
Phone: +49 341 2434-112
E-Mail: info@dbfz.de
www.dbfz.de/en