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ETH-SOIL

1st Soil Symposium

Conference reader

1st Soil Symposium
28 February 2023 in Addis Abeba, Ethiopia

Implemented by:
DBFZ

Soil Symposium 2023

Date and Time

28th February 2023, 1:00 – 6:00 p.m. (GMT+3)

Place

Inter Luxury Hotel, Addis Ababa, Ethiopia

Agenda

Time	Agenda	Speaker
1:00 p.m. – 1:10 p.m.	Greeting and Priorities in Oromia	Mr. Elias Kadir, Oromia Bureau of Agriculture
1:10 p.m. – 1:30 p.m.	Promotion of Soil Health Improvements – Some Experiences	Dr. Steffen Schulz, GIZ
1:30 p.m. – 2:00 p.m.	Overview on the GIZ green sector development	Andrea Wilhelmi-Somé, GIZ
2:00 p.m. – 3:00 p.m.	Insights from the recent Meta-Analysis on the use of biochar for soil rehabilitation	Prof. Dr. Bruno Glaser, Martin-Luther University Halle-Wittenberg
3:00 p.m. – 3:30 p.m.	Break	
3:30 p.m. – 4:00 p.m.	EBC-aligned biochar quality	Dr. Annett Pollex, DBFZ
4:00 p.m. – 4:30 p.m.	Revenues from carbon sequestration with biochar (EBC Artisan process)	Mr. Meyer zu Drewer & colleague, ITHAKA
4:30 p.m. – 5:00 p.m.	Biogas Federal Strategy focus/status and bioslurry mainstreaming under NBPE+ implementation	Carlos Bueso Varela, SNV
5:00 p.m. – 5:30 p.m.	Assessing and monitoring GHG emissions from manure, agricultural residues and soil health inputs	Stefan Majer, DBFZ
5:30 p.m. – 6.00 p.m.	Outlook on the ETH Soil project activities	Dr. Volker Lenz, DBFZ Kerstin Wilde, DBFZ
From 6:00 p.m.	Joint Dinner	

Integrated Soil Fertility Management (ISFM+): Overview & Lessons learned

Addis Ababa | 28th February 2023

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MINISTRY OF AGRICULTURE

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The Problem

- Nutrient mining
- Lack of biomass
- No crop rotation

The Downward Spiral

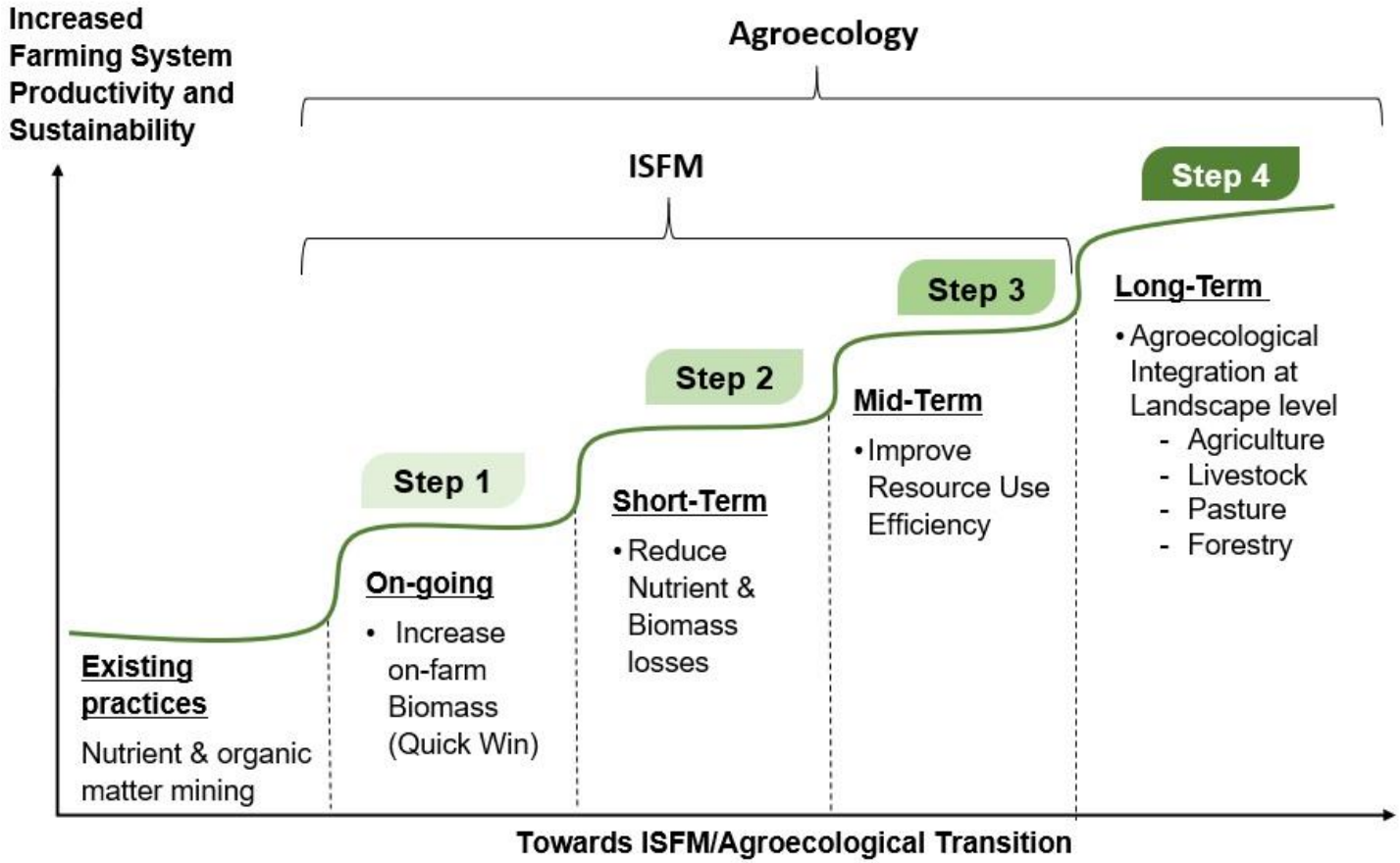
- Poor Soil Fertility causes low crop yields and, ultimately, abandonment of farms

ISFM: Overview

- **Duration: 01/2015 - 06/2025**
- **Oromia, Amhara, SNNP, Sidama and Tigray**
- **Financed by BMZ**
- **Expected Outcomes:**

1. **ISFM practices are applied on 200,000 ha**
2. **Teff, wheat and maize yields increased by 65%**
3. **ISFM input supply ensured through private sector**
4. **ISFM concept incorporated into extension and ATVET systems**

Step-wise approach



Partners

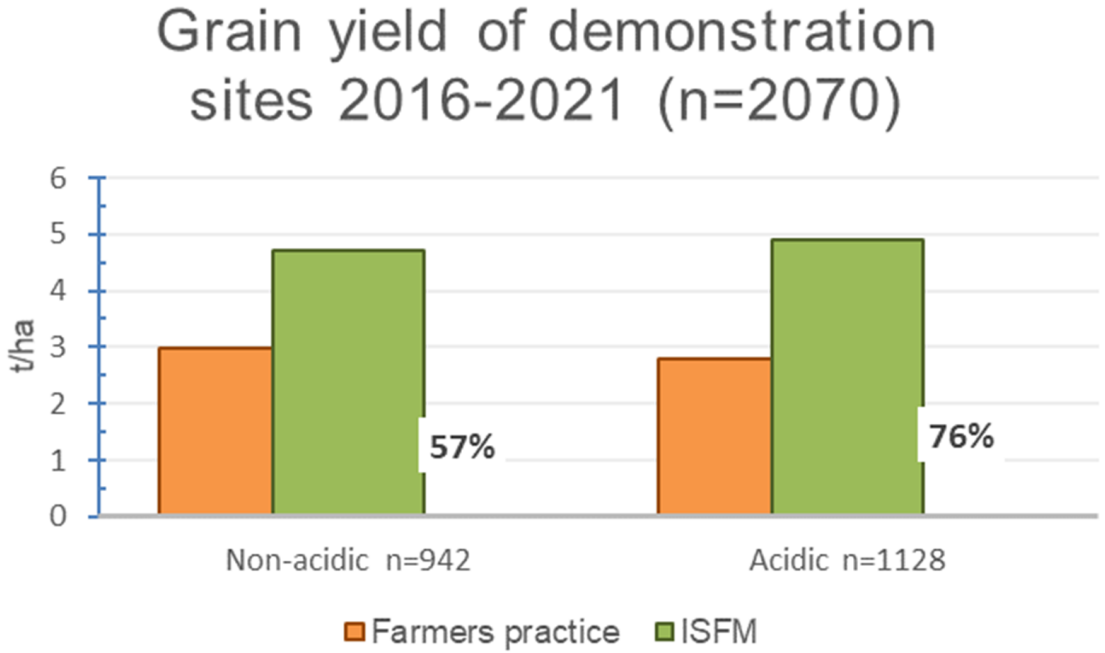
All project activities are implemented by partners, primarily the BoA and Woreda Offices of Agriculture

- **Extension:** MoA, RBoA, ZBoA and WoA
- **Research:** RARIs, EIAR, CIMMYT, CIAT, ICRISAT, IFPRI, Wageningen University, Haramaya University, TEAGASC
- **Other partners:** SNV, CFGB, National Biogas Programm and other GIZ projects

Quick-wins

- Visible impact within 6 months
- Woreda-level activities implemented by Farmer Groups (facilitation & technical backstopping by Woreda Agric. Staff)
- Field Demonstrations, Field Days and Farmer Field Schools

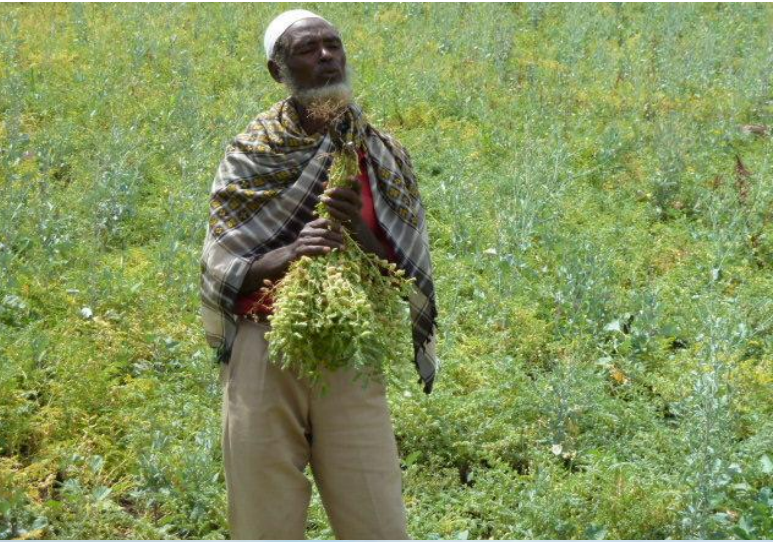
Yields with ISFM




ISFM
Farmer practice

Highlights

- ISFM incorporated into the national extension system (151 BoA out-scaling woredas)
- ISFM included in ATVETs and Haremaya university
- Mechanization service providers linked to micro-finance institutions (leasing scheme)
    - 1.5 Million ETB → 85 Million ETB in 2 years



Key Learnings

1. **Introduction of Technologies** is the easy part; **Institutionalization & Ownership** are the challenges

2. **Not only ‘What’ and ‘How’ but also ‘WHY’:** Immediate productivity gains for farmers / Alignment with policy priorities for BoA / MoA

3. **Seeing is believing & Learning by doing**

Key Learnings

4. Partnership Approach: Co-development for Ownership

- **Ensure alignment** with national and regional development plans
- **Build trust** (support partner to achieve their targets / objectives)
- **Joint Planning and Learning** (positive & negative experiences)
- **Key decisions** are not taken in official meetings / workshops but over a **cup of coffee**

Key Learnings

5. **Input and service supply chains** critical for sustainability
6. **Private sector** involvement (Business Models, access to loans)
7. **Patience & flexibility**: highly complex change processes cannot be pressed into a logframes
8. Encourage and learn from **farmer innovation**


Thank you!

Presentation of the German Development Cooperation Portfolio in Ethiopia in the Fields of Agriculture & Rural Development / NRM

7th of March 2023

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Implemented by

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

KFW

Deutsches Biomasseforschungszentrum gemeinnützige GmbH DBFZ

PTB Physikalisch-Technische Bundesanstalt Braunschweig und Berlin Nationales Metrologieinstitut

With support from

Federal Ministry of Food and Agriculture

by decision of the German Bundestag

Outline

1. General Information
2. Overview of Current Portfolio on Agriculture and Rural Development of German Cooperation in Ethiopia
3. Project information – highlights of current working packages
4. Portfolio Review Process – Transformation of Agri-Food Systems

General Information about GIZ in Ethiopia

- GIZ is in Ethiopia on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ) since 1964
- 875 Employees, more than 50% in AG & RD

Germany's development cooperation with Ethiopia focuses currently on three priority areas:

- ➢ Economic development and vocational education and training;
- ➢ Conservation and sustainable use of natural resources (biodiversity)
- ➢ Agriculture and food and nutrition security;

Total Volume in Agriculture /Food Security/Rural Dev.: **650,4 Mio. €**

Overview of Current Priority Areas of German Cooperation in Ethiopia

Rural Development: commitment Technical Cooperation (TC): 170.2 Mio. €

Capacity Development for Strengthening Drought Resilience 05/2019 – 06/2025; 12 Mio. €	**Support to Responsible Agricultural Investments** 12/2016 - 05/2026; 11.5 Mio. €	**Forests for Future** 01/2020 – 06/2026; 6 Mio. €
Sustainable Use of Land for Economic Development 01/2018 – 12/2023; 21.4 Mio. €	**Participatory and Integrated Land Use Planning** 01/2022 - 12/2024; 8 Mio. € (MoPD)	**Biodiversity and Forestry Project** 08/2021 - 07/2024; 12 Mio. €
Climate- sensitive Innovations for Land Management 07/2021 – 06/2024; 18 Mio. €	**Land Governance** 01/2020 - 12/2025; 15 Mio. €	
	ETH-Soil (German Biomass Research Centre) 01/2022-12/2026 - 18.4 Mio. €	
	Integrated Soil Fertility Management Afar Soil Rehabilitation Project 02/2015 – 06/2025; 47,9 Mio. €	

Overview of Current Priority Areas of German Cooperation in Ethiopia

Rural Development: commitment Financial Cooperation (KFW): 287,5 Mio. €	
Sustainable Land Management (FC) 2015 – 2026; 77 Mio. €	**Strengthening the Resilience of Vulnerable Groups in the Context of the Desert Locust Invasion**: -2023 [WFP] -26.5 Mio. €
Conservation and Sustainable Use of Biodiversity (and Forests) (FC, 3 projects) 2018 - 11/2024; 53 Mio. €	**Rural Resilience Initiative in Ethiopia** (R4): – 12/2024 [WFP] -27 Mio. €
Strengthening Drought Resilience 2014 – 08/2028; 44 Mio. €	**Productive Safety Net Program** (PSNP) via WB MDTF, preparation ongoing - 30 Mio € another 30 Mio. € already committed
Climate-Proofing Food Security in Ethiopia's Drought-Prone Lowland Areas via WFP 12/2022 – 12/2026; 30 Mio. €	

Overview of Current Priority Areas of German Cooperation in Ethiopia

Agriculture: commitment Technical Cooperation (GIZ/PTB/BMEL): 132,7 Mio. €

Agricultural Mechanization for Smallholder Farmers 01/2022 – 06/2024; 14 Mio. €	**Supporting Sustainable Agricultural Productivity (BMEL)** 01/2012 – 12/2023; 12.3 Mio. €
Strengthening Rural Value Chains 02/2021 – 12/2024; 20 Mio. €; (extension planned)	**Development Partnership with Trading Organic, Avocado – Sesame** 06/2018 – 05/2023; 8 Mio. €; (extension planned)
Green Innovation Centres for the Agriculture and Food Sector 02/2015 – 03/2026; 46,5 Mio. €	**Sustainability + Value Added in Agricultural Supply Chains; Coffee Supply Chain** 08/2020 – 03/2025; 4.6 Mio. €
Strengthening Quality Infrastructure for the Agriculture and Food Sector (PTB) 02/2022 – 03/2024; 2 Mio. €	**Strengthening Farmers' Organizations for Sustainable Agricultural Development** 01/2021 – 08/2026; 5.6 Mio. €
Nutrition Sensitive Agriculture 03/2015 - 05/2023; 19.7 Mio. €	

Overview of Current Priority Areas of German Cooperation in Ethiopia

<u>Agriculture</u>: commitment Financial Cooperation (KFW): 60 Mio. €
Increasing Agriculture Productivity through Innovation (incl. Mechanization) - Leasing: 02/2021 – 03/2024; 15 Mio. €
Strengthening Rural Value Chains: (in preparation) planned start 2023 - 10/2029; 25 Mio. €
Support to FSRP (Food Systems Resilience Programme, Worldbank Multi-Donor-Trust-Fund), starting 2023; 20 Mio. €

Project information
Enablers: VC supporting programs

Seed (BMEL):

- Modernizing breeding programs (variety development) and enhancing EGS production
- Advising MoA through facilitation of National Seed Advisory Group

Mechanization:

- Support the development of national mechanization strategy and agricultural mechanization forum
- Improved access to quality mechanization services for smallholders (private and cooperative service providers)

Application of quality agricultural inputs:

- Lime for integrated soil fertility management
- Access to agricultural inputs and services

Revision of Agricultural Extension System:

- Pluralistic Extension and
- Digitalization Roadmap

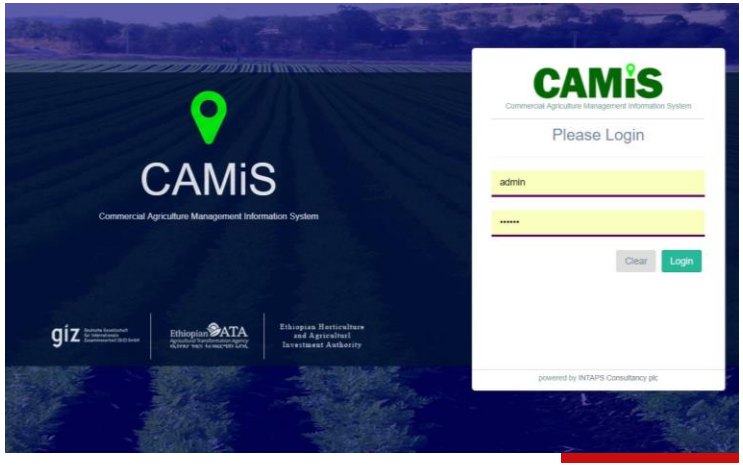
Agricultural Value Chains:

Value Chains: Wheat, Legumes, Coffee, Avocado, Soyabean, Horticulture & Apiculture

- Improve inputs and services → increase productivity and quality
- Support farmer clustering process and connect them to agro-industrial parks and companies
- (Eco)-GAP and Capacity Development for smallholder farmers and producer organisations
- Support Quality control and standards; quality infrastructure, digitalized traceability systems
- Support processing and strengthen supply chains → increase production and value addition
- Cooperation with private sector (i.e. Sanvado, WBM, Alatyon, Alema) on contract farming
- Improve market access (local & international) → increase income and export revenues → create jobs

Land Governance:

- Ensuring land tenure security through supporting the **Second Level Land Certification** in five regions
- **Digital Tools** for monitoring large-scale agricultural investments, registering land parcels as well as for training purposes
- Piloting **Integrated Land Use Planning** in five woredas including the development of legal frameworks and technical guidelines
- Development of the Social and Environmental Code of Practice and the national guideline for **Responsible Agricultural Investments**
- Piloting formal **Land Consolidation** in six kebeles including the development of legal frameworks and technical guidelines



Rehabilitation and Sustainable Management of Land and Ecosystems:

- Capacity development of state and community actors in Sustainable drought resilience and dry valley rehabilitation
- Support to country programming on Drought Emergencies in the Horn of Africa (CPP 2012)
- Support to SLMP design and implementation from 2010; innovation, knowledge mgmt, capacity development;
- Support to policy development in SLM: study on sustainable livestock mgmt / zero grazing; think tanks / networks in three Regions
- Methods:
  - Building Water Spreading Weirs and participatory social organization of user groups in pastoralist and agropastoralist areas
  - Supporting bottom-up, **community-owned land management** (21 Community field facilitators, 60 districts)
  - Support to SLMP to **save Lake Chamo** from collapse; piloting 'landscape' approach to ecosystem rehabilitation.

Background - BMZ 2030 Reform Strategy Launched in 2020

6 Core Strategies					
Peaceful and Inclusive Societies	**Transformation of Agri-Food Systems**	Sustainable Economic Development, Training and Jobs	Climate, Energy, Just Transition	Protection of our Natural Livelihoods	Health, Social Security and Population Policy

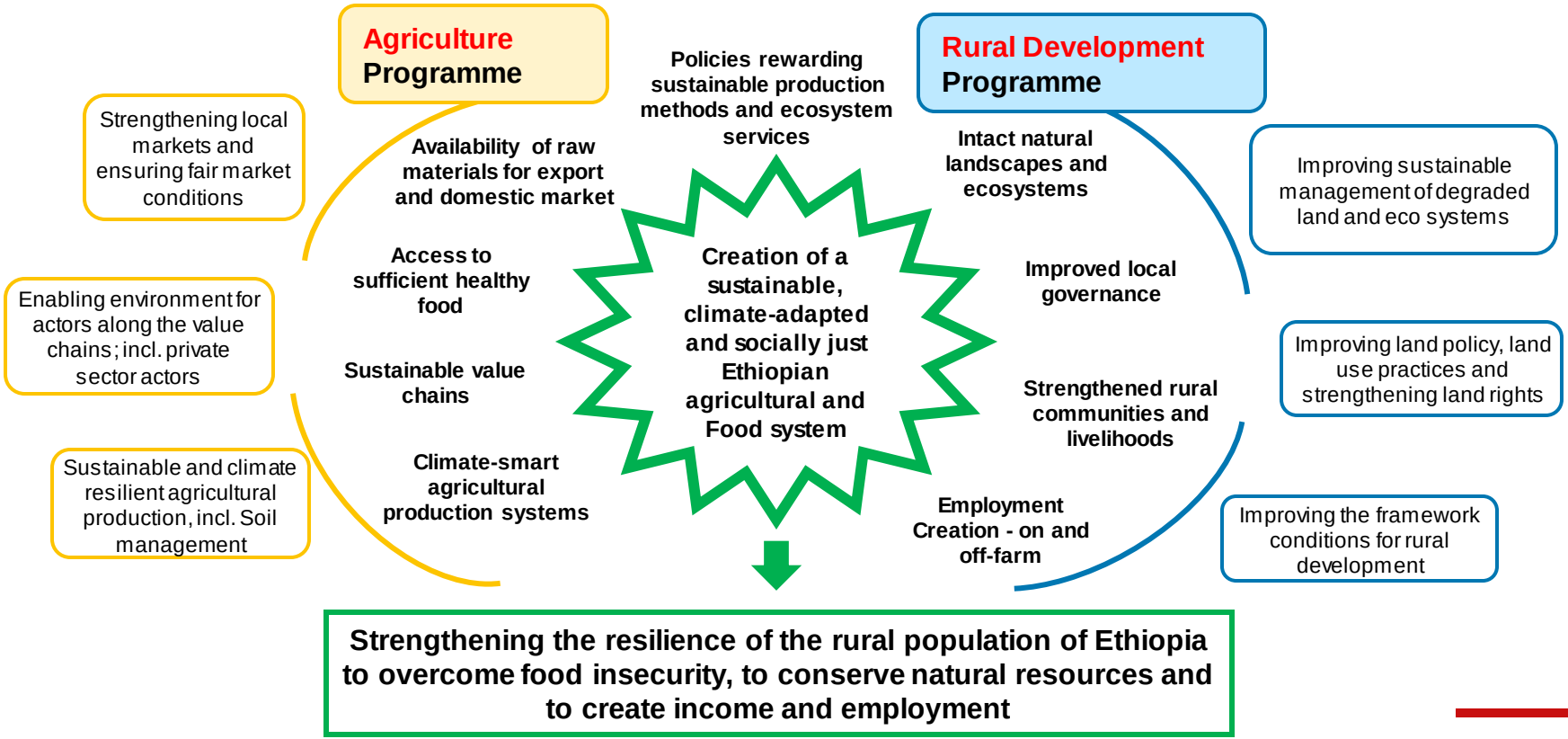
3 intervention areas		
Food and Nutrition Security	**Rural Development**	**Agriculture**

- Strategy guides programmatic development in 12 countries in Africa
- 2 development cooperation programmes foreseen for Ethiopia in the intervention areas of **“Agriculture”** and **“Rural Development”**

Transformation of Agri-Food Systems – Key Messages

- Nutrition as a human right - requires a sustainable increase in agricultural production and functioning markets, especially through innovations
- Food systems must become more shock-resilient, sustainable, effective and efficient
- Agriculture and rural areas play a central role in climate mitigation and adaptation as well as in biodiversity conservation
- Multisectoral approach and multi stakeholder platforms with governments, private sector, civil society, farmers organizations, professional associations and development partners are key for transformation of agriculture and food systems
- Faire conditions in producing countries and responsible consumption in Europe are interrelated
- Cross cutting topics/principles: gender focus; do no harm; human rights
- Innovation and Digitalization as a driver to adapt to or mitigate climate change

Proposed Strategic Objective: “Transformation of Agri-Food Systems in Ethiopia”



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Thank you for your attention !

Biochar Research & Technology – Facts & Myths

Bruno Glaser

Content:

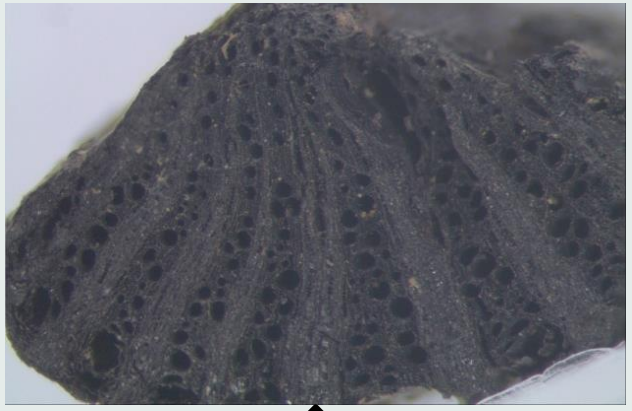
- Definition
- Properties
- Ecological effects (based on scientific data)
- C sequestration potential
- Best practice examples
- Take home

https://www.youtube.com/watch?v=ex2sFye9t_0&t=248s (deutsch)
https://www.youtube.com/watch?v=zf5rbSJ3lHo&t=12s (englisch)

Charcoal ≠ Biochar ≠ Black carbon ≠ Pyrogenic carbon

Charcoal

⇒ Energy production

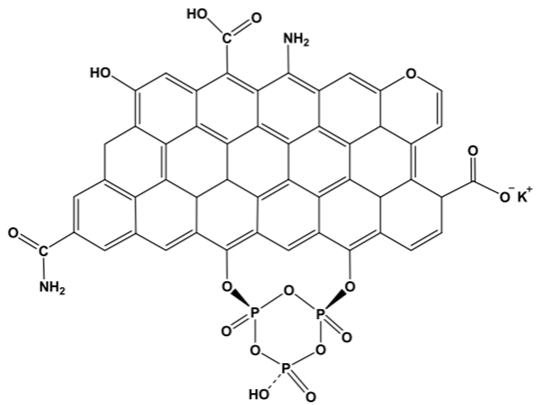


Biochar

⇒ Intentional production for soil improvement

Black carbon

⇒ Polycondensed aromatic carbon



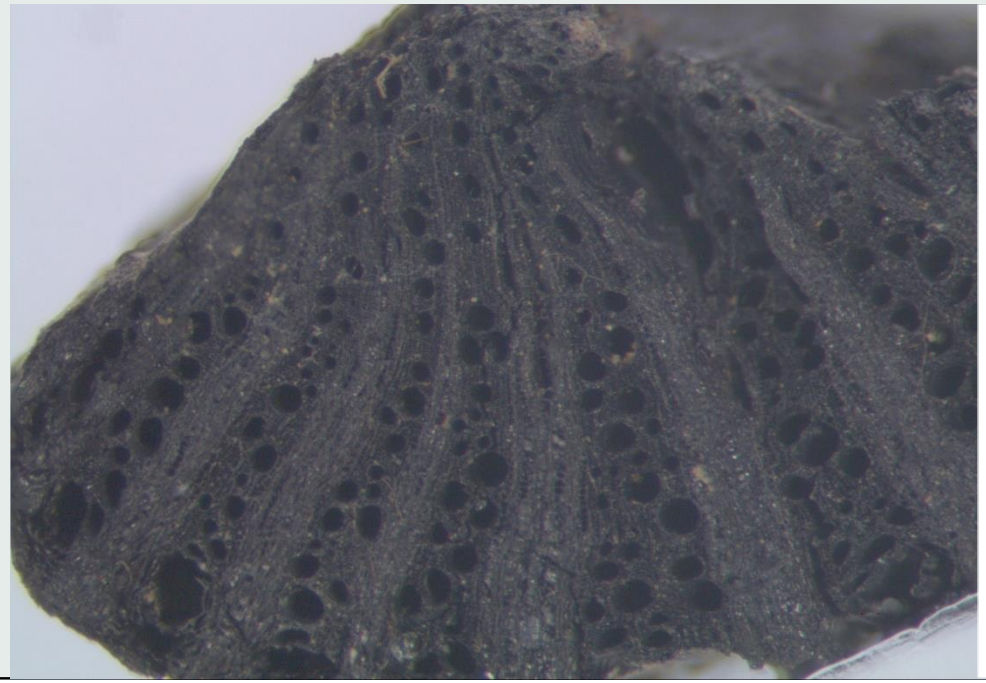
Pyrogenic carbon

⇒ Fire-derived carbon

Biochar properties

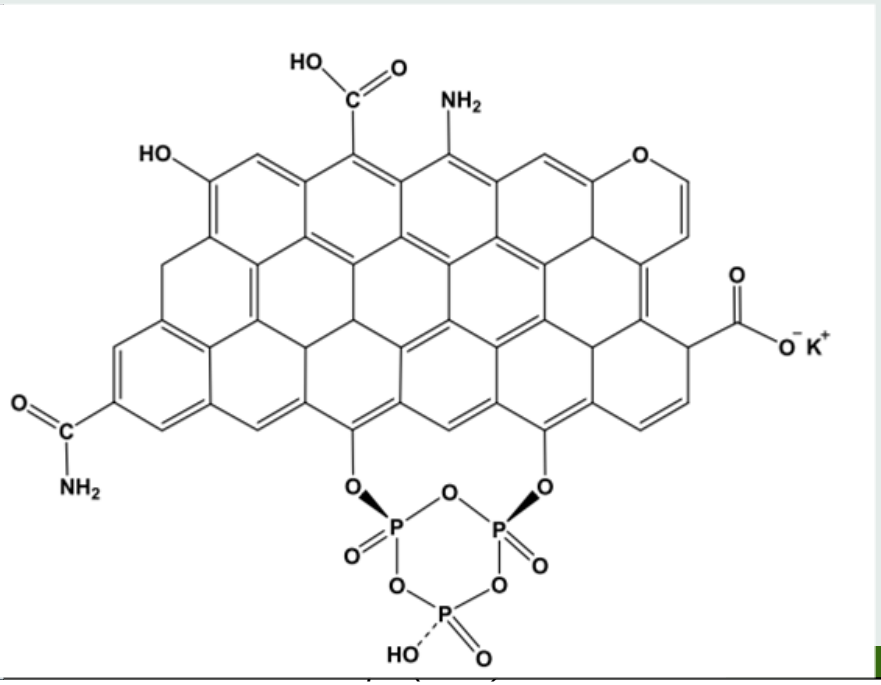
Structure

Porosity
Condensed aromatics
Functional groups
Labile organic carbon
Ash



Ecosystem function

⇒ Water storage
⇒ C storage
⇒ Nutrient storage
⇒ Food for microbes
⇒ Immediate fertilizer

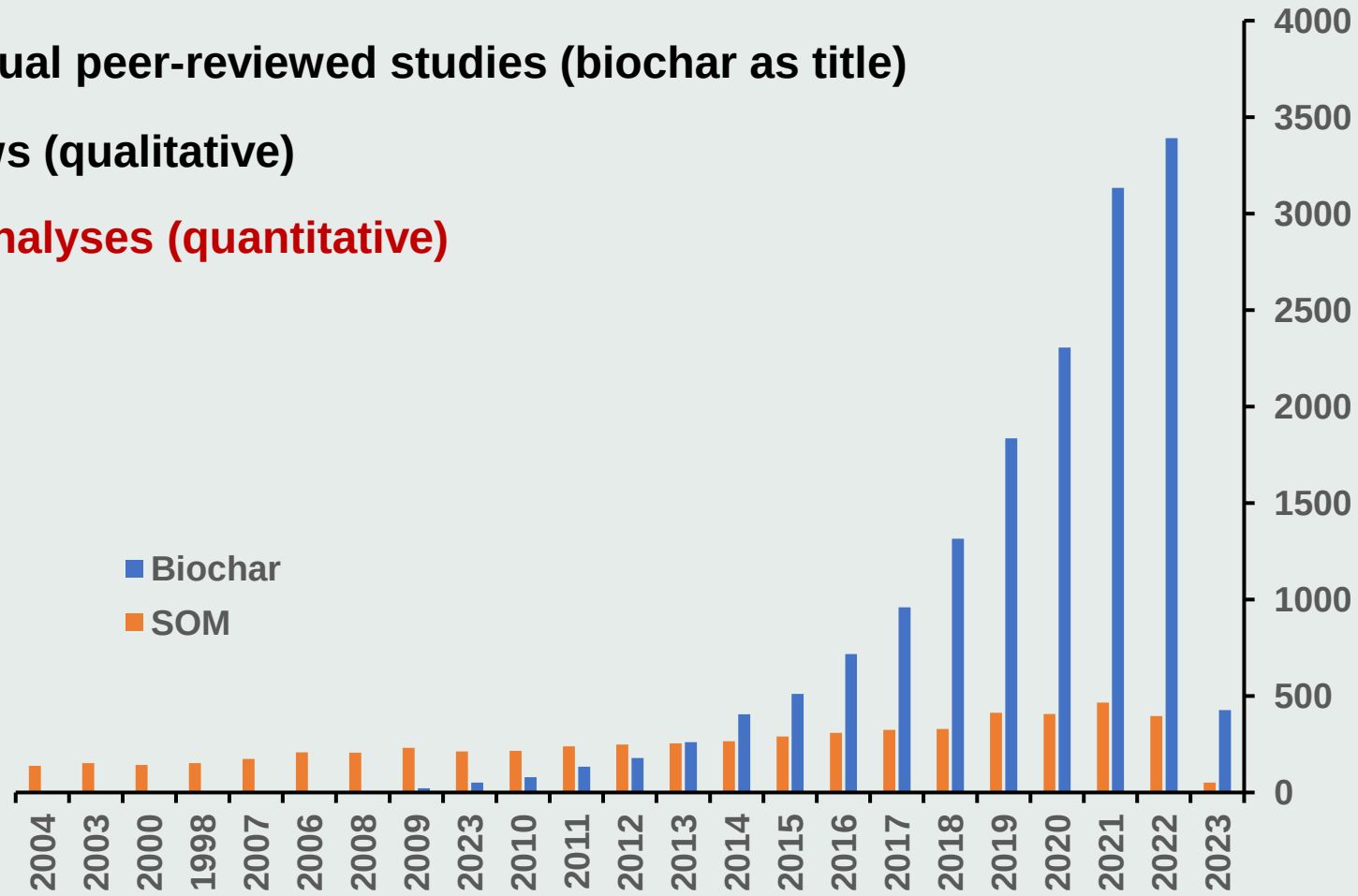


Biochar scientific literature (ISI Web of Science Core database)

15,659 Individual peer-reviewed studies (biochar as title)

807 Reviews (qualitative)

91 Meta-analyses (quantitative)



ISI Web of Science 26.02.2023

Meta-analysis

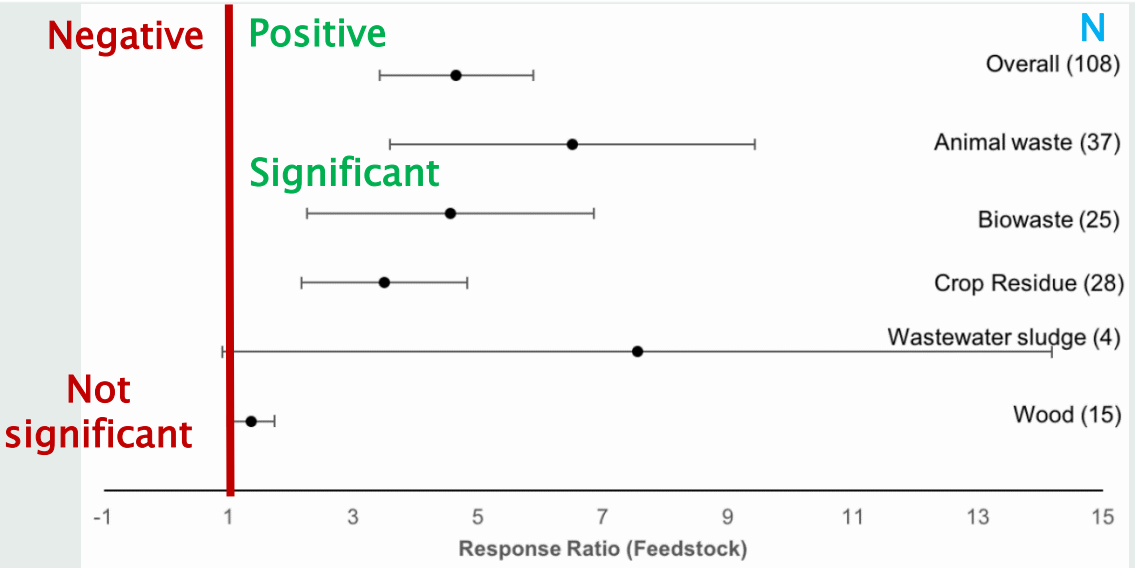
Quantitative approach for systematically combining results of previous research to arrive at conclusions about the body of research

Quantitative : Numbers
Systematic : Approved methods
Combining: Putting together
Previous research: What's already done
Conclusions: New knowledge

Meta-analysis: Methodological approach

$$RR = \frac{with\ BC}{without\ BC}$$

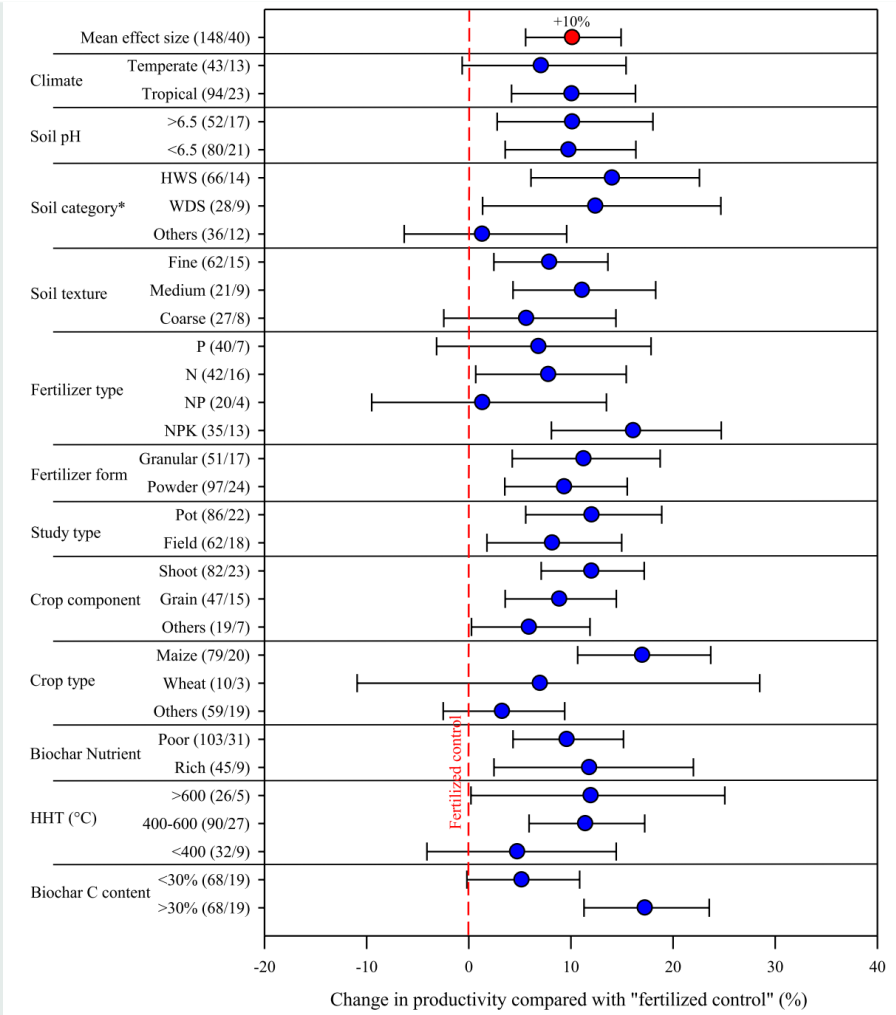
$$CI = RR \pm 1.96 \frac{\sigma}{\sqrt{N}}$$



- Response ratio (RR): Overall effect across all studies
- Differences among studies / treatments
- No weighting
  => field data more important than lab studies

Glaser and Lehr (2019) Scientific Reports 9: 9338

Agronomic performance of biochar–fertilizers compared to pure fertilizers

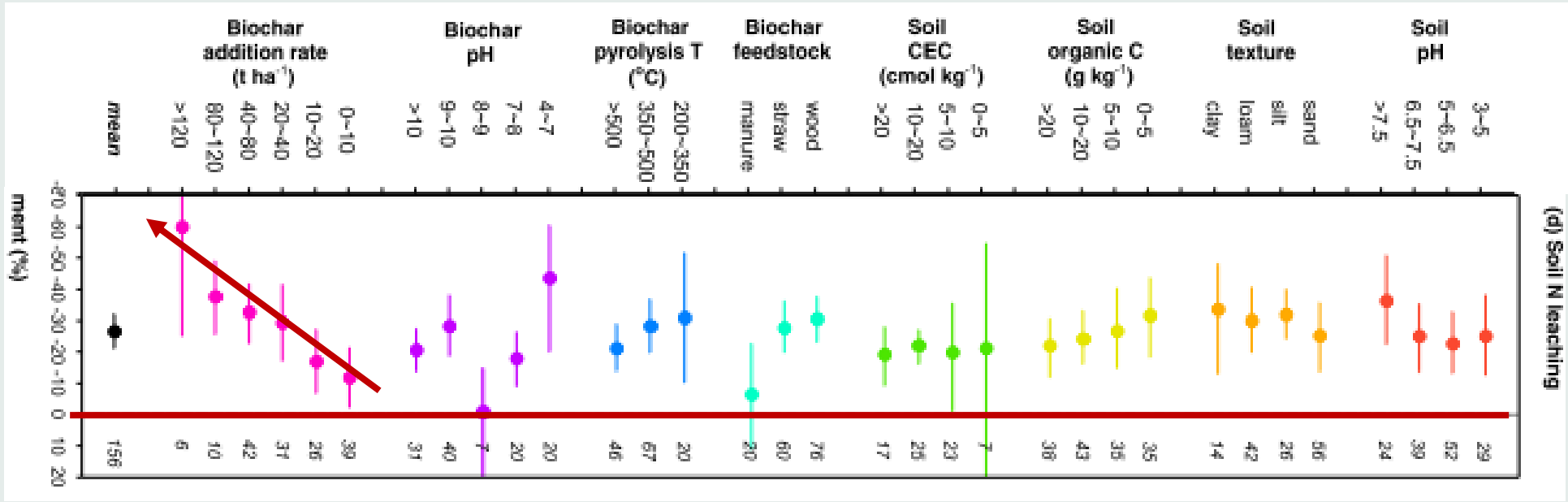


⇒ *Synergistic biochar effect, independent on biochar and site conditions*

⇒ *Overall + 10% plant growth*

Carrijo et al. (2022) Plant Soil (2022) 472:45–58

Nitrate leaching

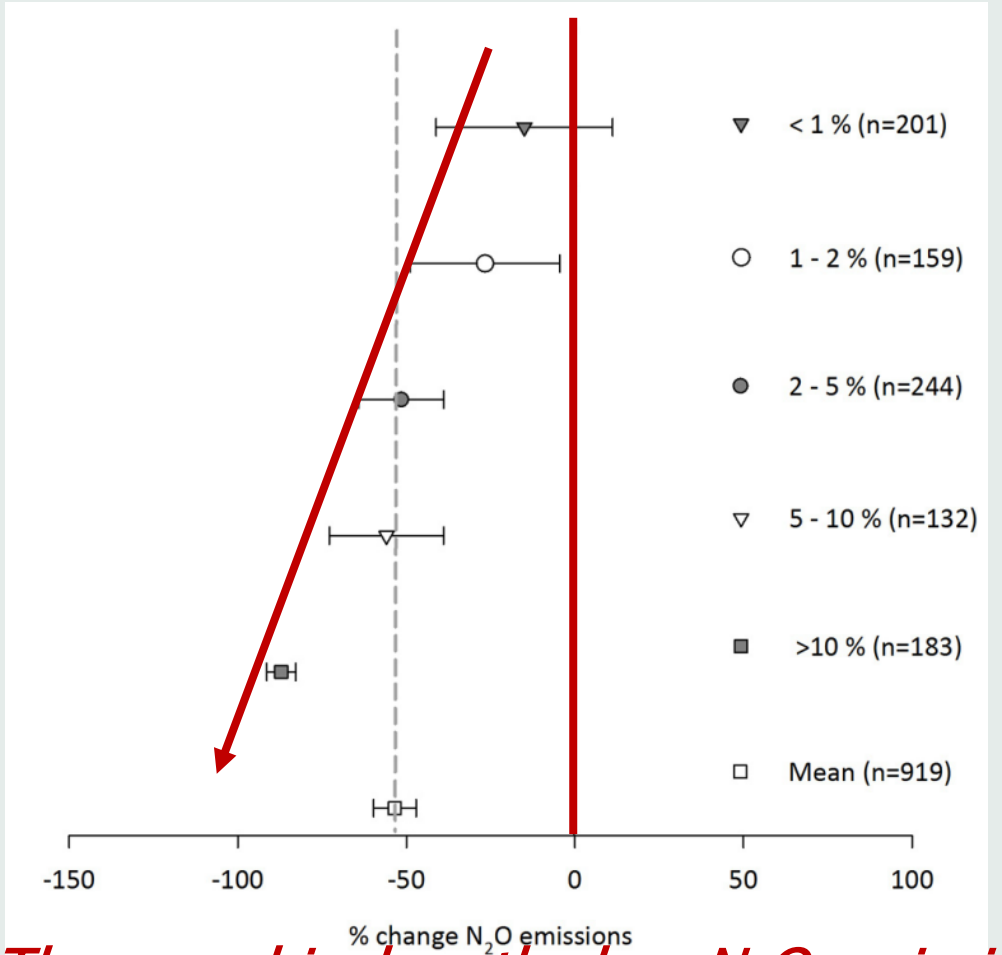


⇒ *The more biochar, the less nitrate leaching*

⇒ *Effect is independent of biochar or soil properties*

Liu (2018) Plant Soil 426: 211-225

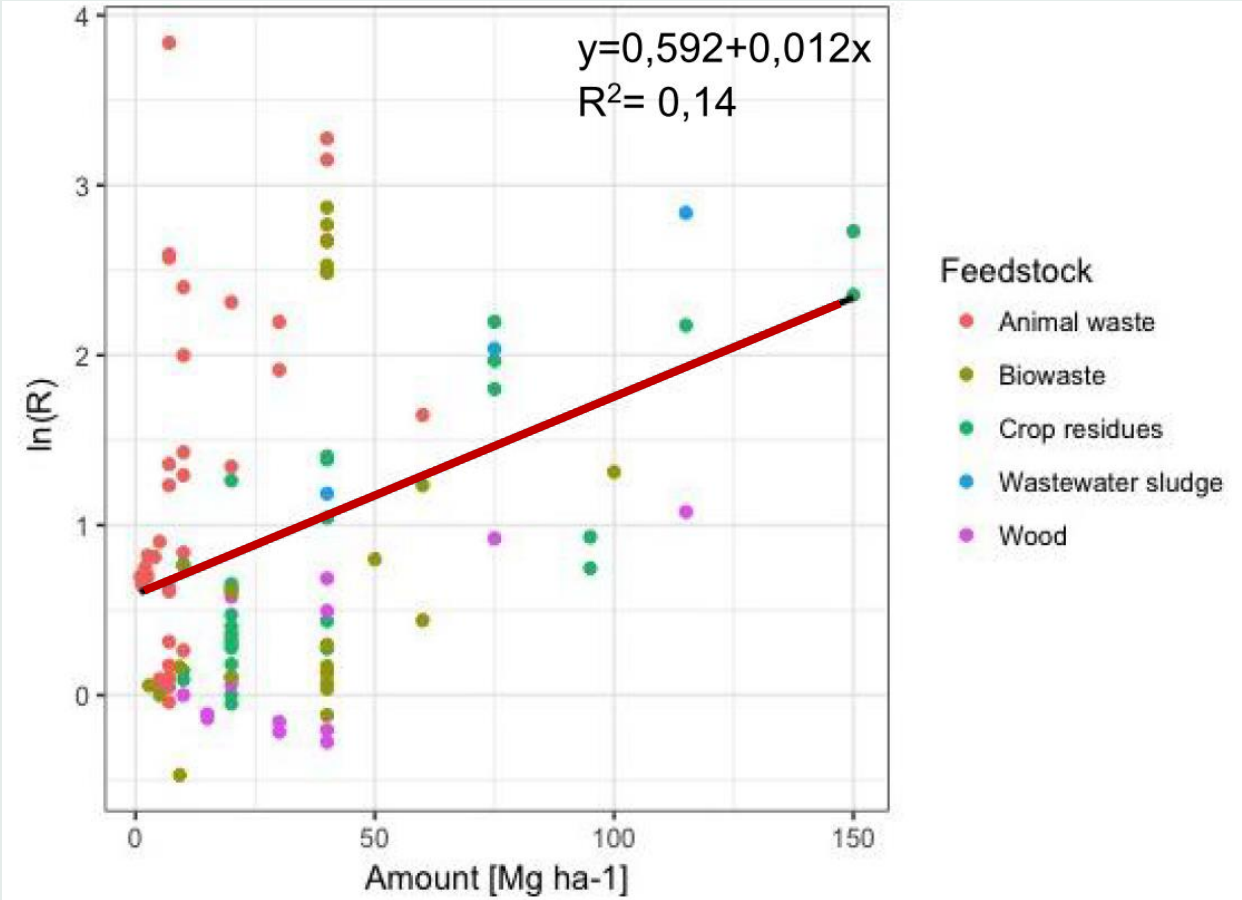
N_2O emission



⇒ *The more biochar, the less N_2O emission*

Cayuela (2014) Agriculture Ecosystems Environment 191: 5-16

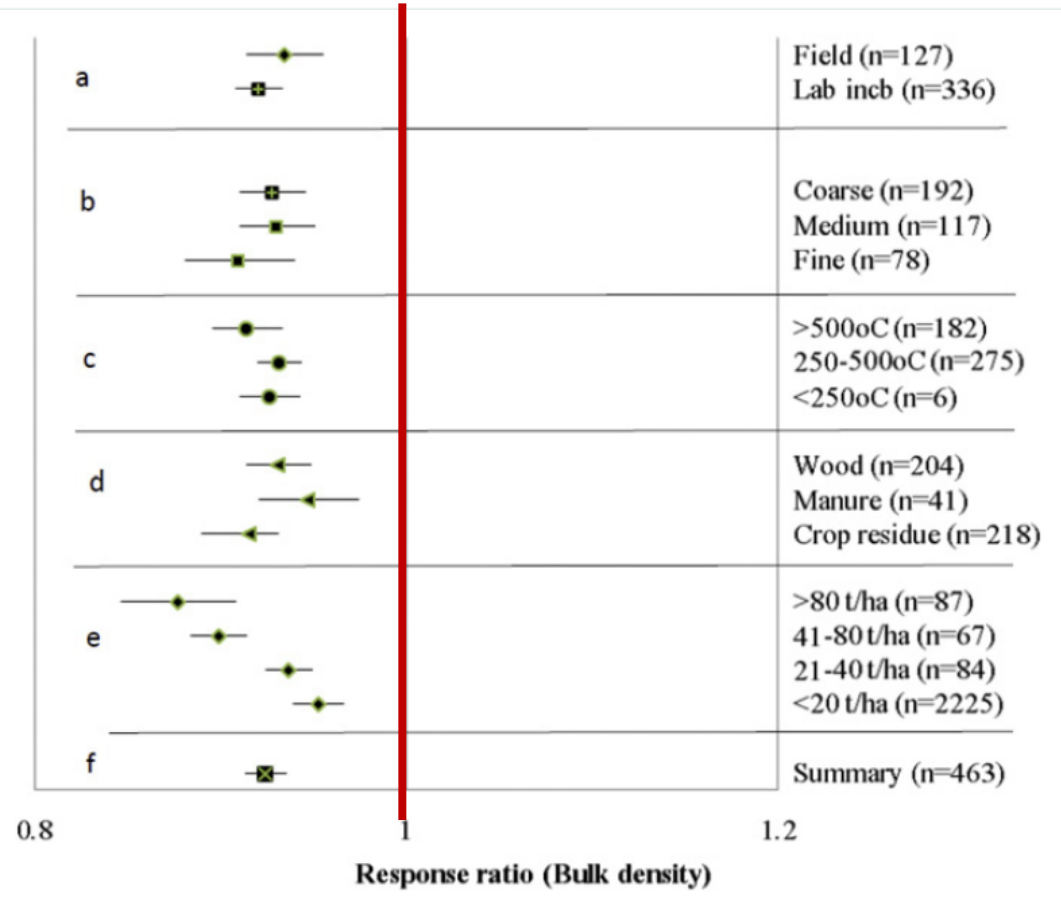
Plant P availability

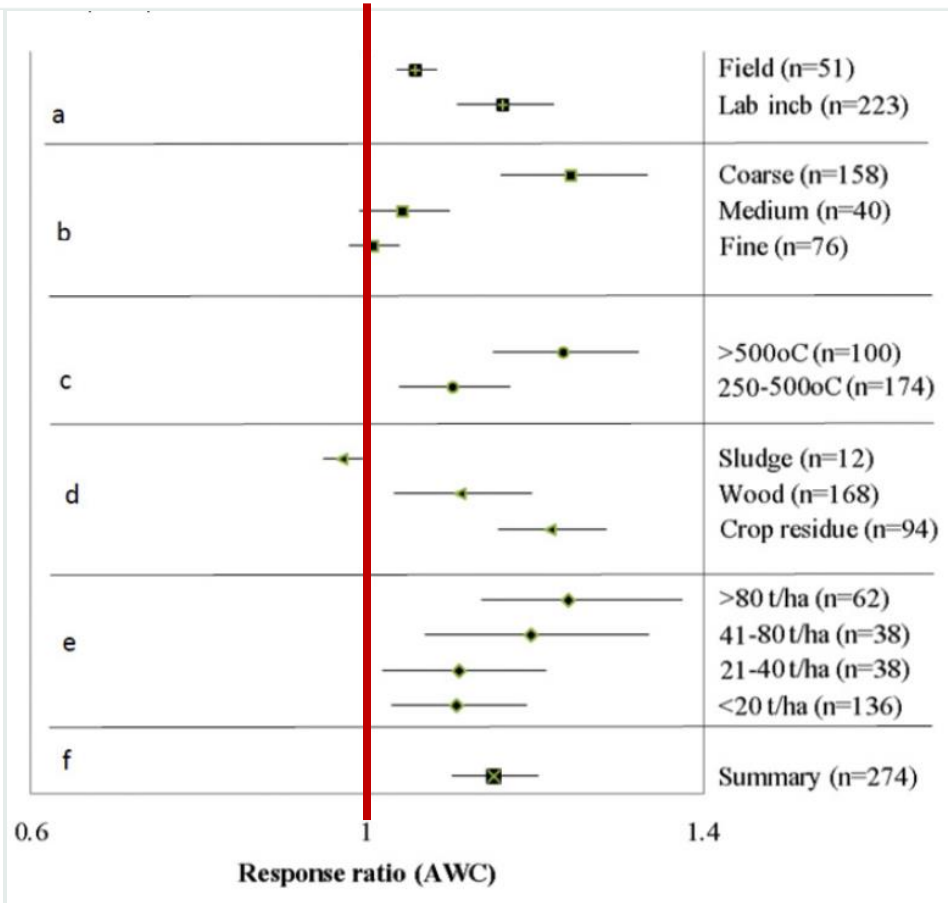


⇒ *The more biochar, the higher plant P availability (feedstock-independent)*

Glaser and Lehr (2019) Scientific Reports 9: 9338

Soil hydrological properties



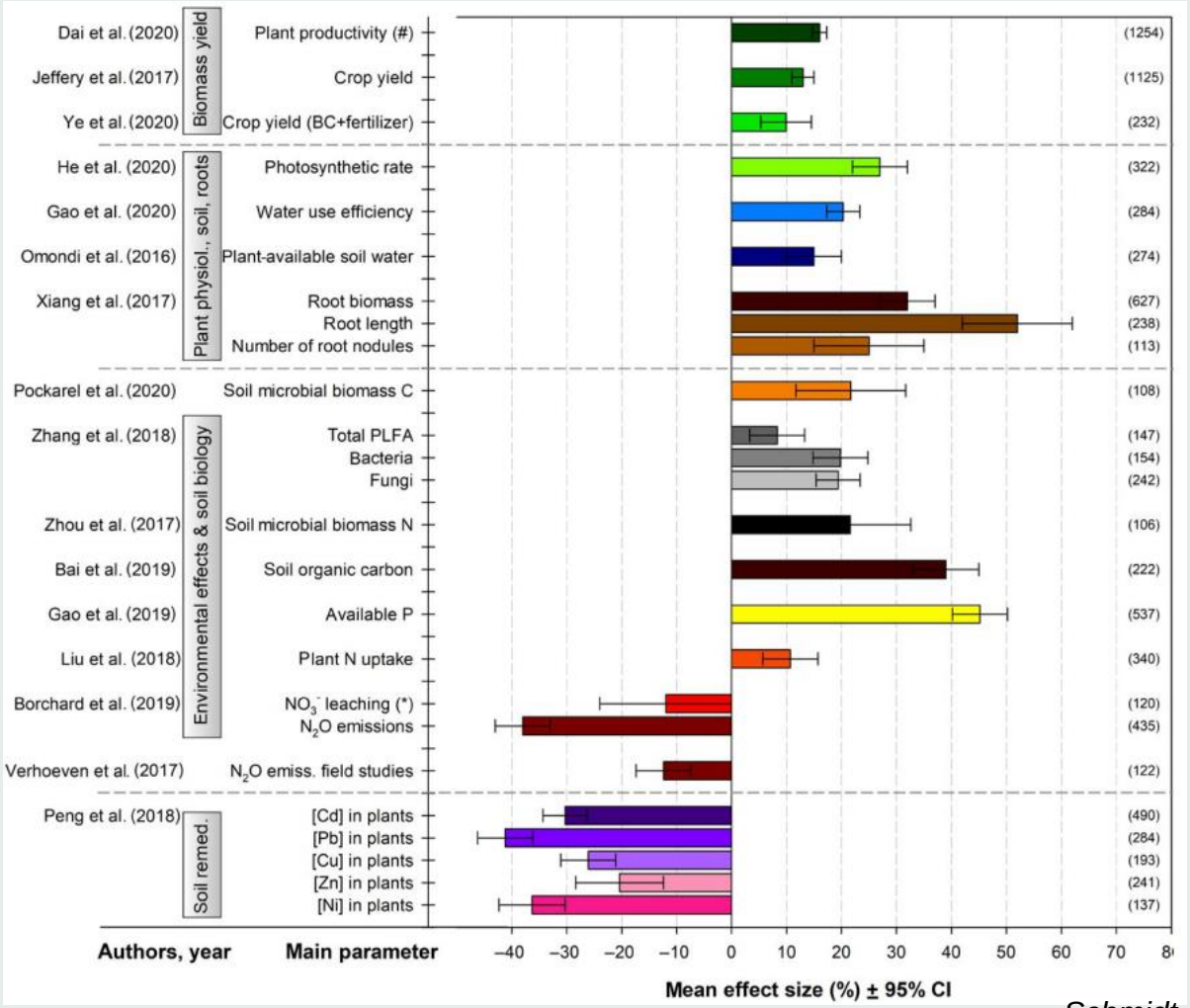


⇒ *Significantly decreased soil bulk density*

⇒ *Significantly increased soil water holding capacity*

Omondi (2016) Geoderma 274:28–34

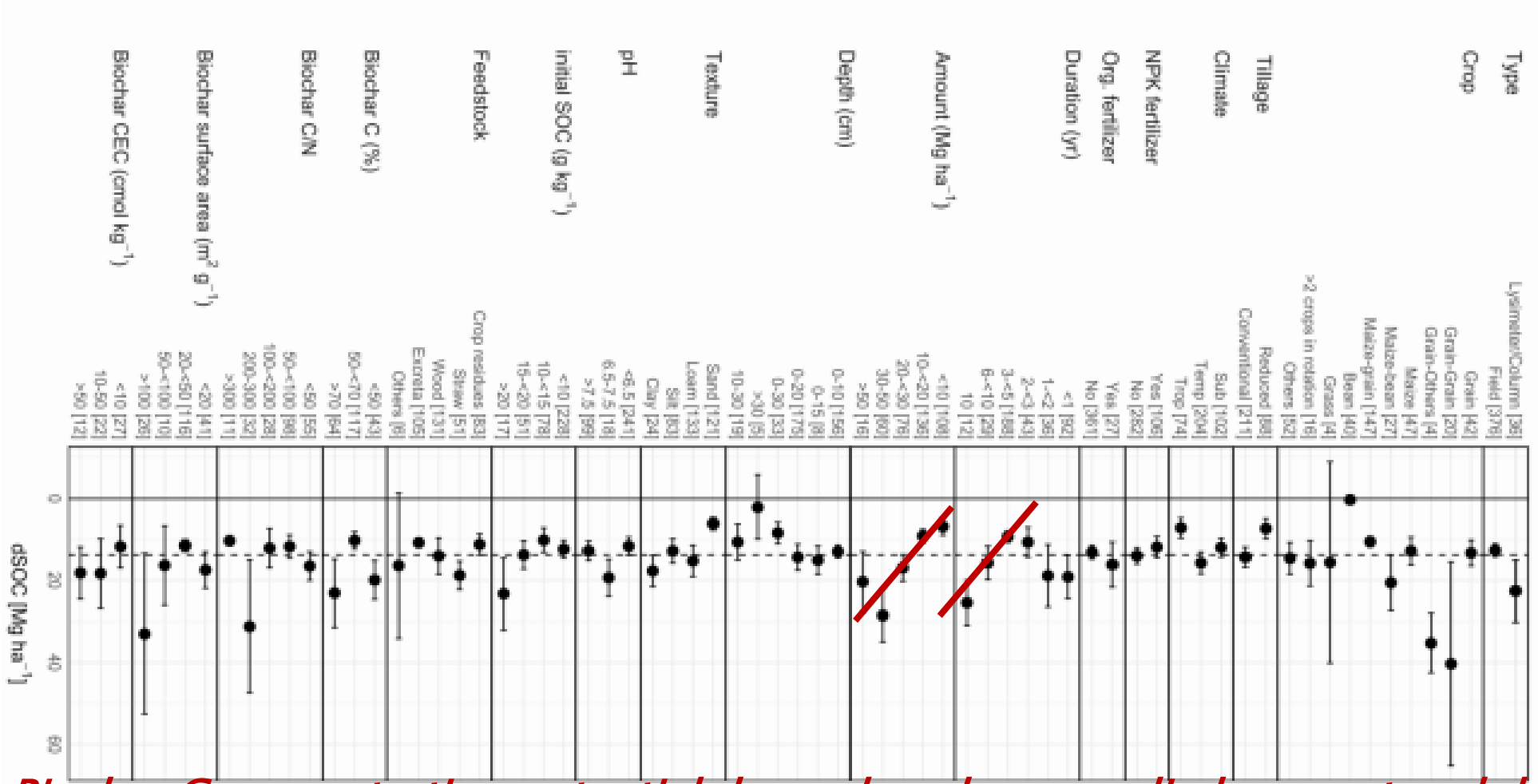
Meta-analysis of meta-analysis….



⇒ *Overall ecologically and statistically significant positive effects*

Schmidt et al. (2011) GCB Bioenergy 13: 1708-1730

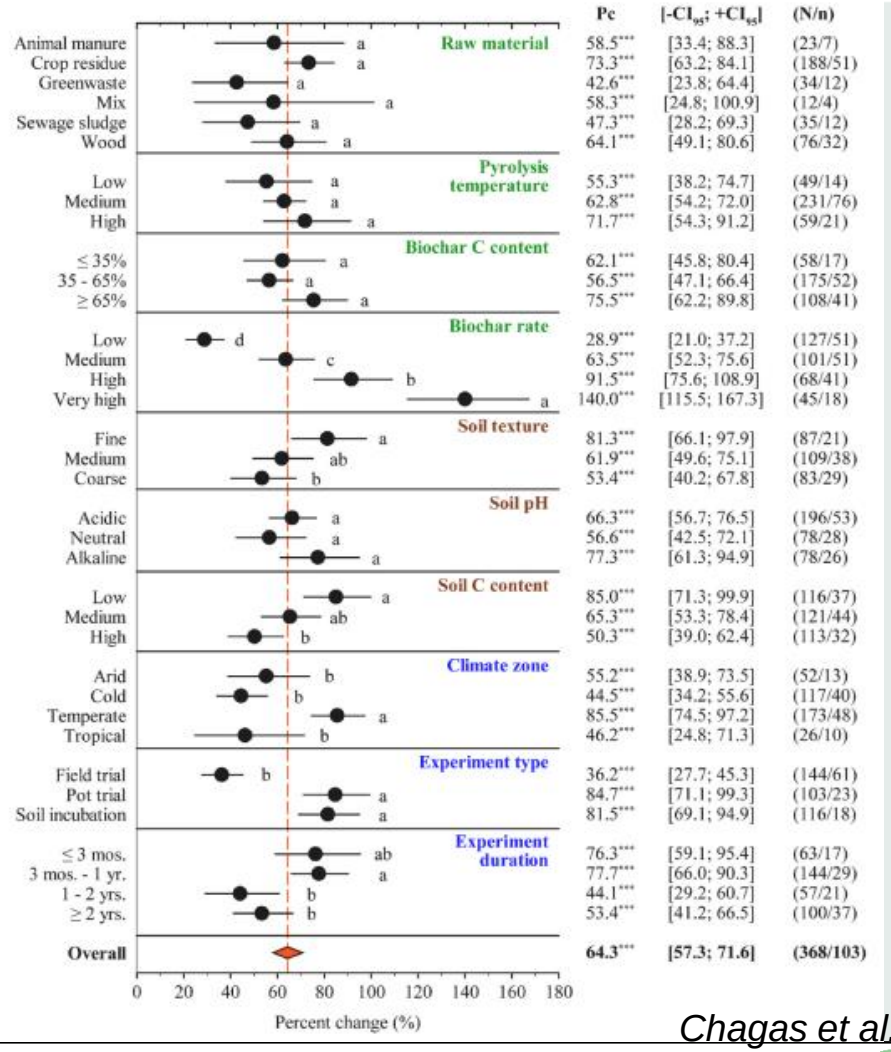
Potential of biochar for C sequestration



⇒ *Biochar C sequestration potential depends only on applied amount and duration*

Gross et al. (2021) Agronomy 11: 2474

Soil organic carbon stocks (C sequestration)



No influence of biochar feedstock

No influence of biochar C content

The more biochar the more C sequestration

More C sequestration in loam and clay

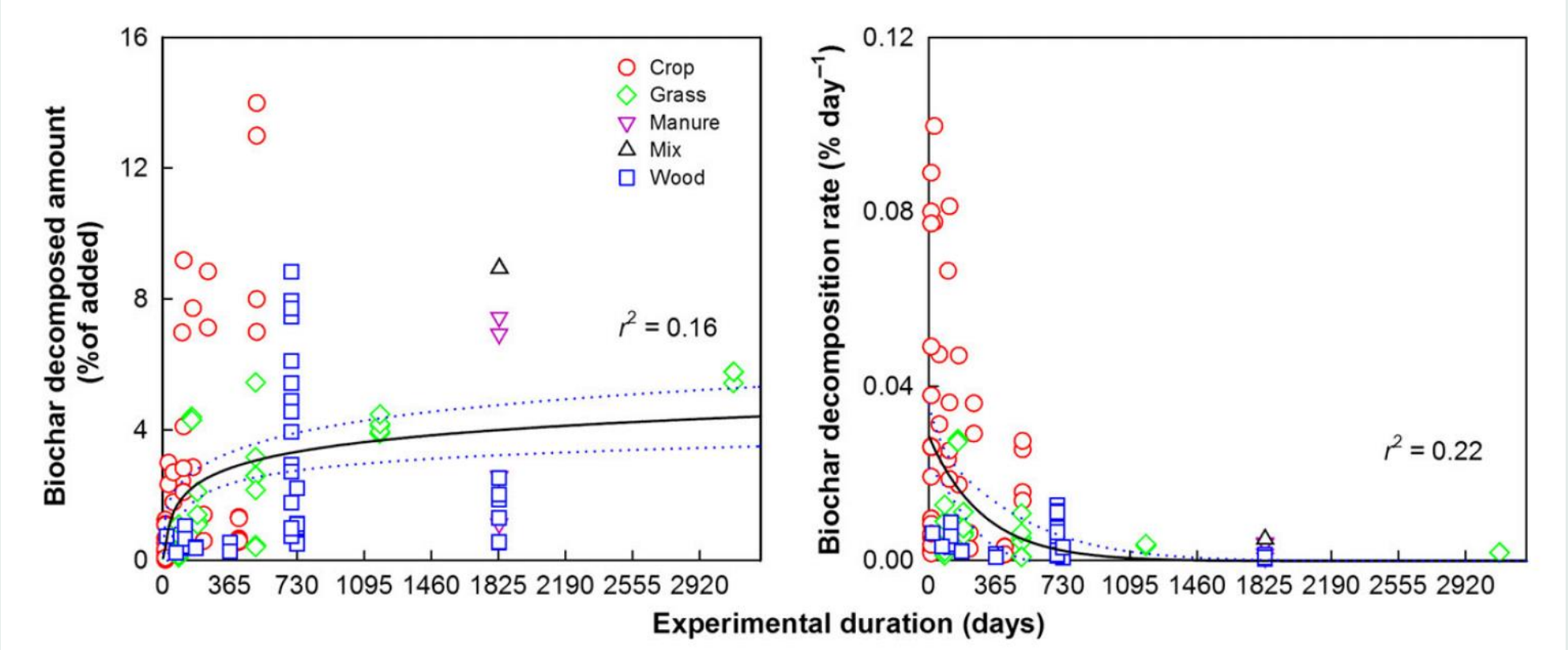
The more C sequestration the less is already there

Highest C sequestration potential in temperate climate

No relation to experimental duration (< 2 years)

Chagas et al. (2022) Journal of Environmental Management 305:114403

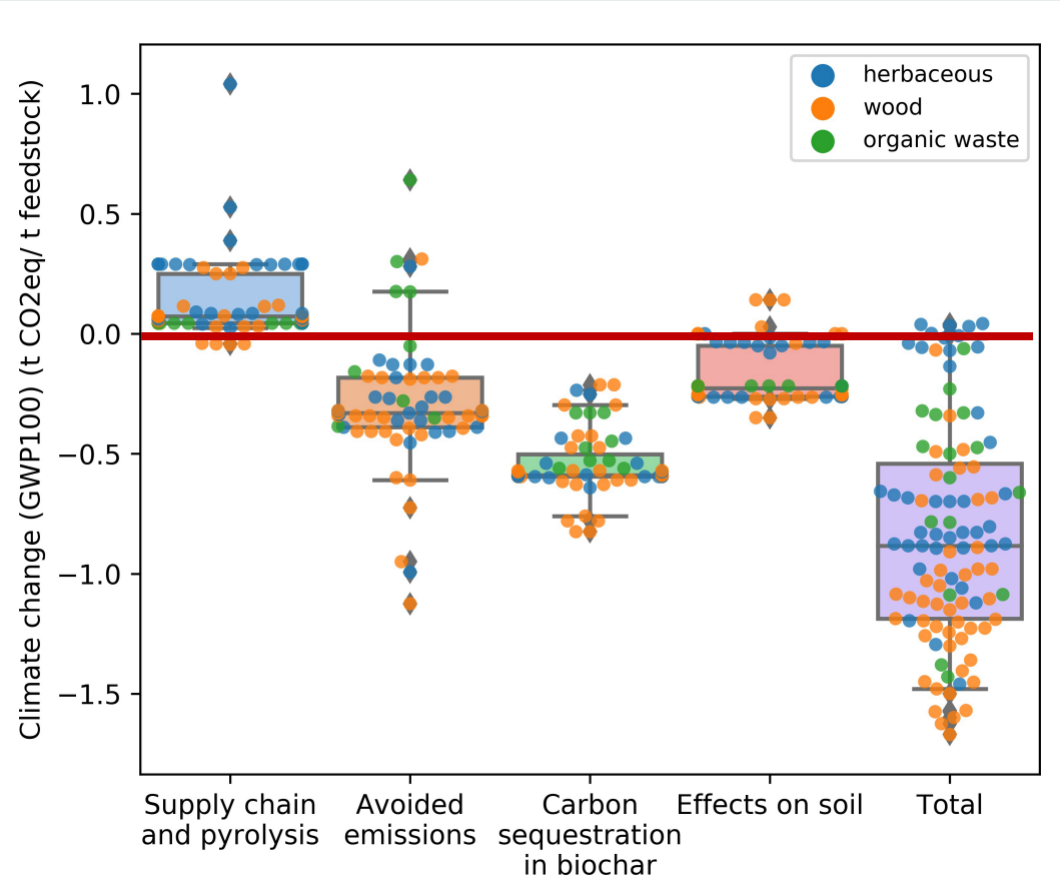
Biochar stability



Biochar decomposition decreases with increasing residence time

Wang (2016) GCB Bioenergy 8:512–523

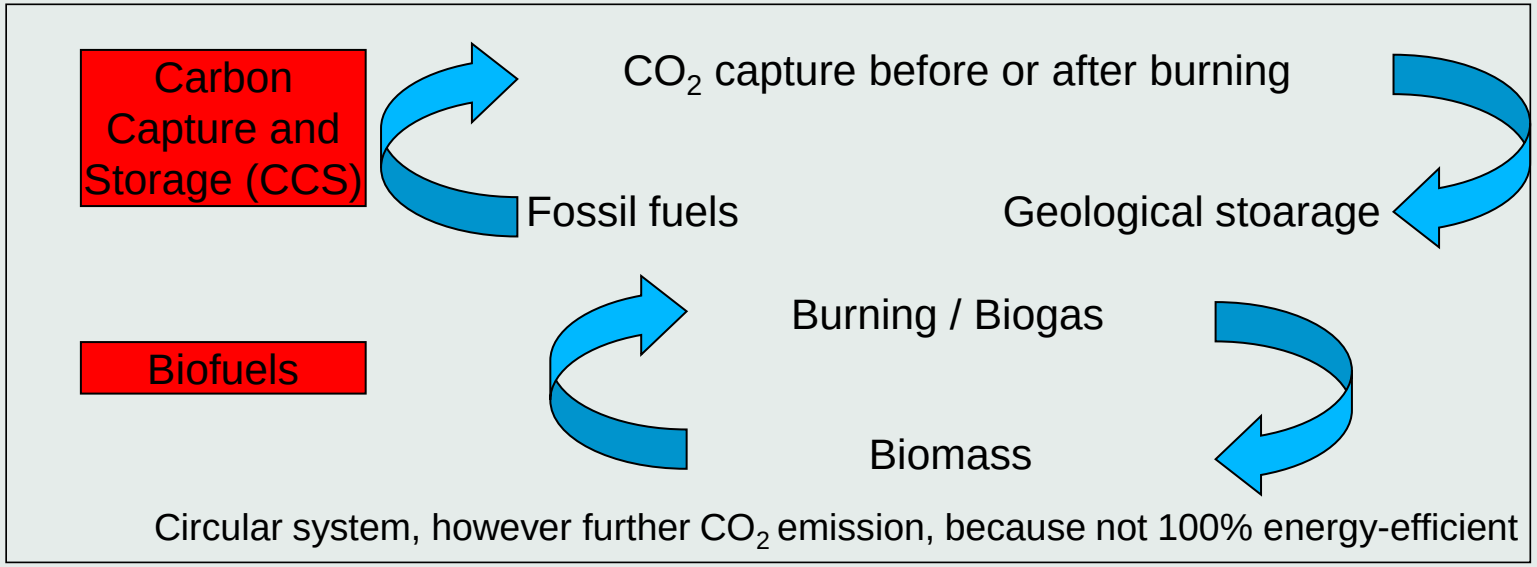
Potential of biochar for C sequestration



⇒ *Biochar is C-negative and ready to use…*

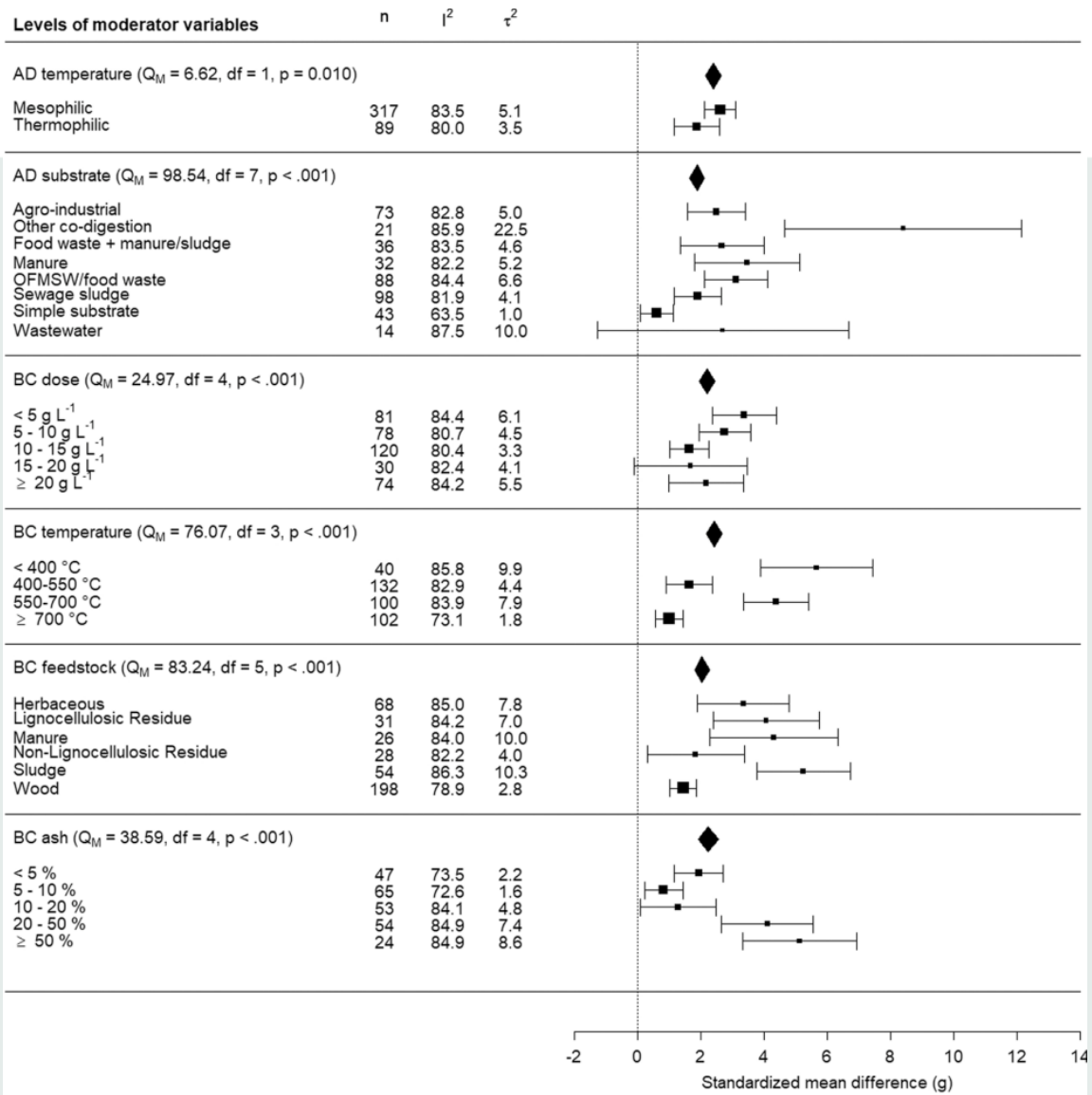
Tisserant et al. (2019) Land 8:179

Biochar as climate change mitigation option



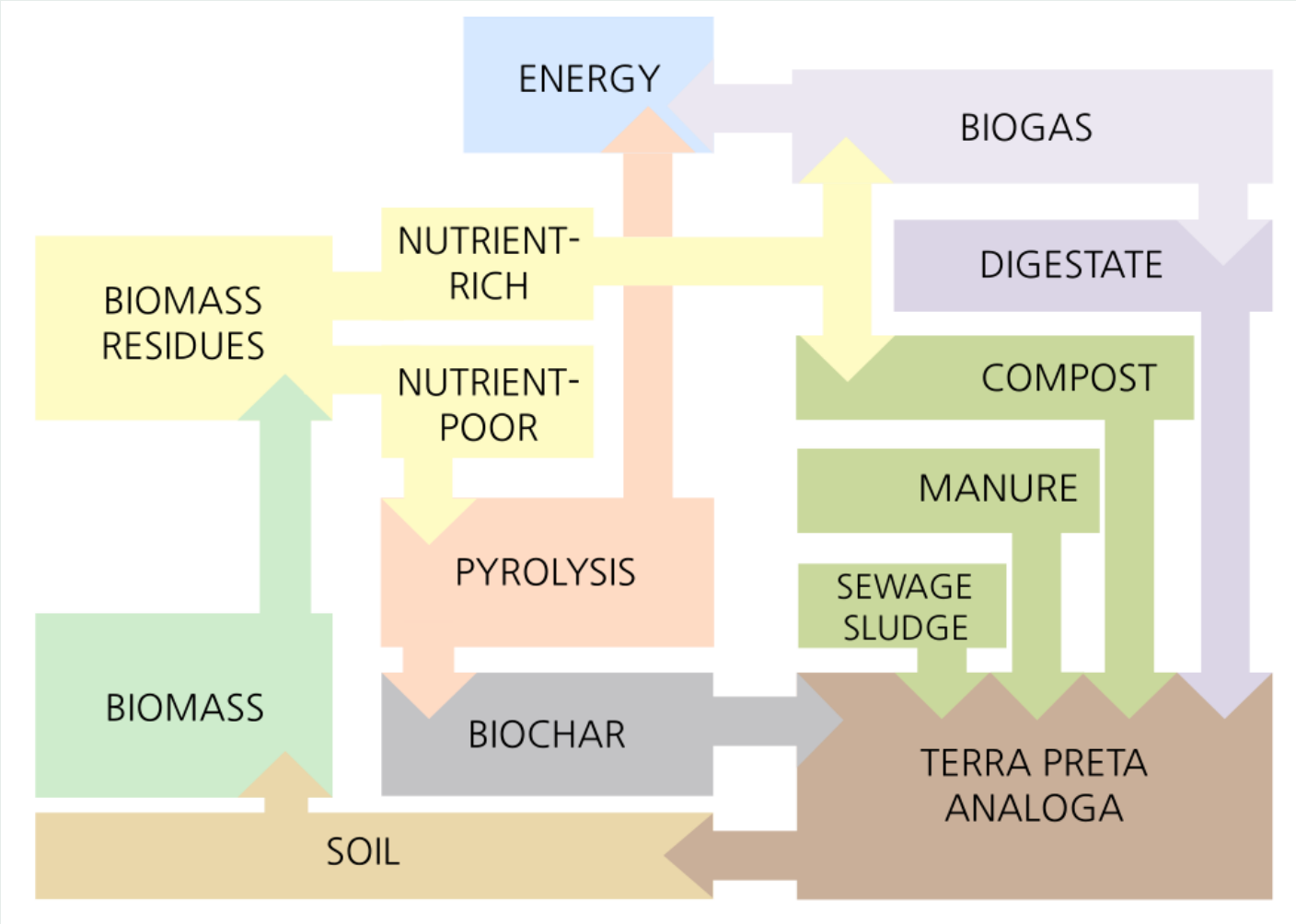
Glaser, B., Parr, M., Braun, C., and Kopolo, G. (2009). Biochar is carbon negative. Nature Geoscience 2, 2-2

Methane production

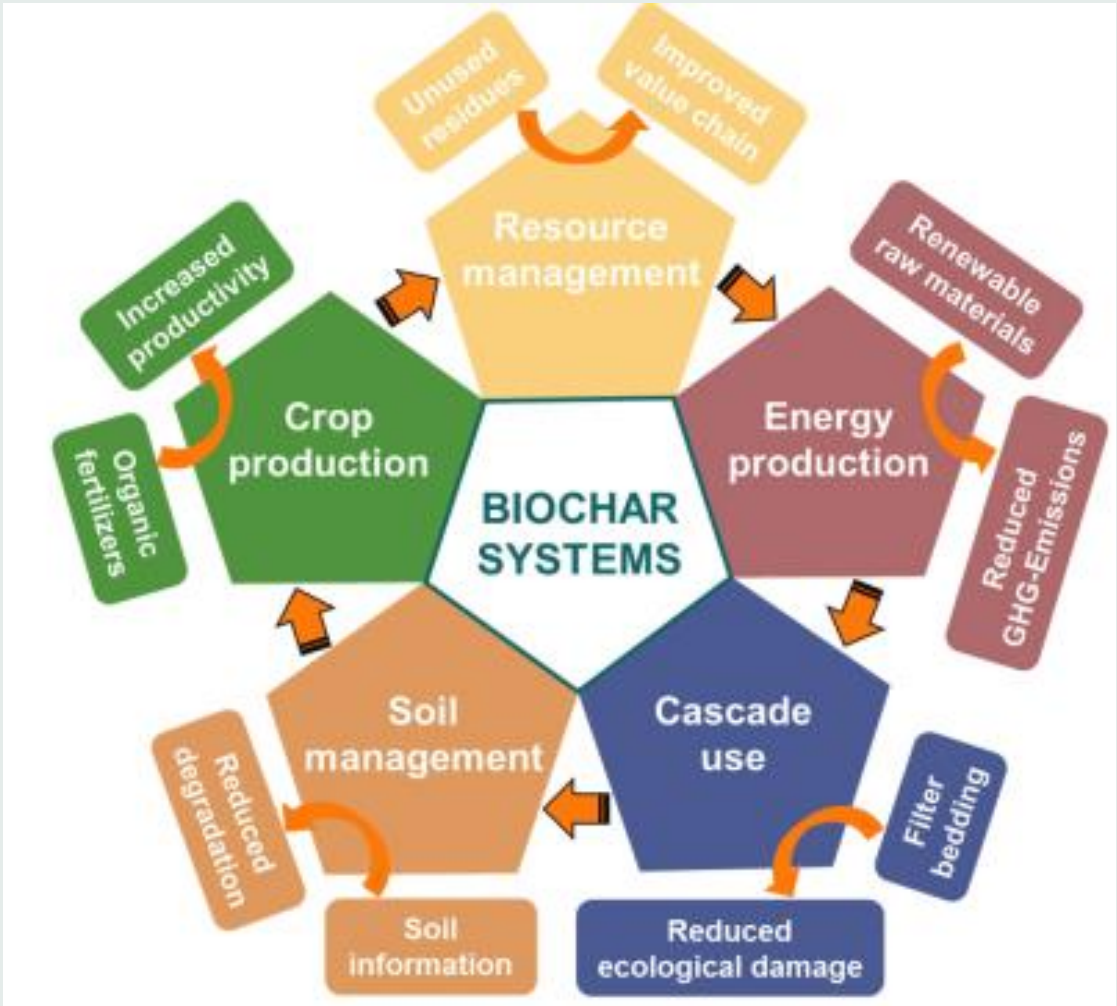


Chiappero et al. (2022) Journal of Environmental Chemical Engineering 10: 108870

Modern Terra Preta concept ⇒ *Biochar system*

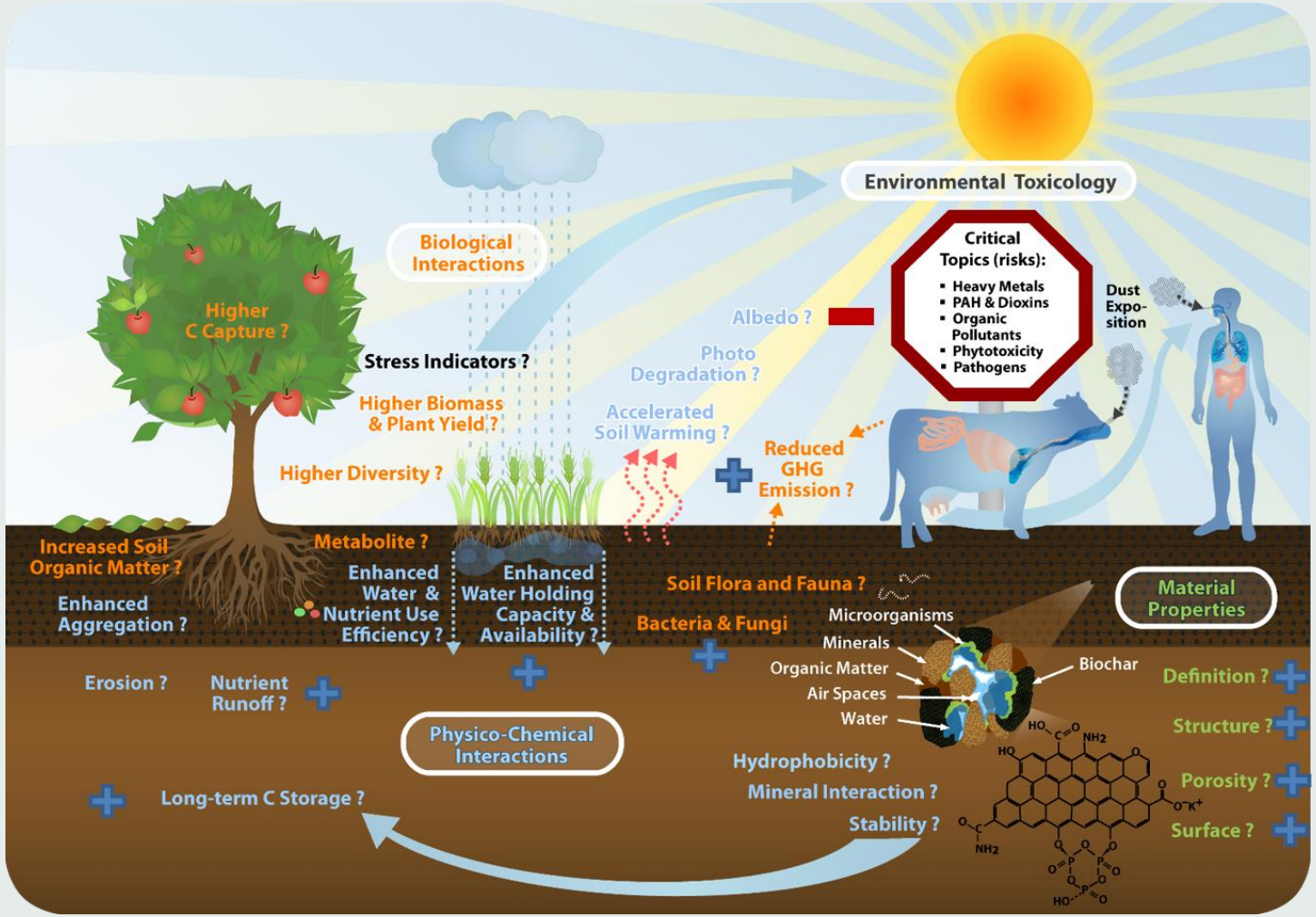


Cascade use of biochar



Seitz et al. (2017) Potential Analysis of Biochar Systems for Improved Soil and Nutrient Management in Ethiopia

Summary of biochar effects on ecosystem functions



Seitz et al. (2017) Potential Analysis of Biochar Systems for Improved Soil and Nutrient Management in Ethiopia

Most important biochar effects (summary of biochar meta-analysis)

- +10% Yield increase (biochar alone and as biochar-fertilizers)
- +40% Tree growth
- +60% C sequestration
- Up to -90% N_2O emission (amount-dependent)
- Up to -60% Nitrate leaching (amount-dependent)
- Up to +800% Plant P availability (amount-dependent)
- -30% Cd uptake into plants
- -10% Soil density
- +20% Soil water holding capacity

⇒ *Overall positive effects*

https://www.youtube.com/watch?v=zf5rbSJ3lHo&t=12s

EBC-aligned biochar quality

Soil Symposium 2023 | Annett Pollex | 28.02.2023

Definition of biochar

Biochar is a porous, carbonaceous material that is produced by pyrolysis of biomass and is applied in such a way that the contained carbon remains stored as a long-term C sink or replaces fossil carbon in industrial manufacturing. It is not made to be burnt for energy generation. (EBC, 2022)

EBC (2012-2022) 'European Biochar Certificate - Guidelines for a Sustainable Production of Biochar.' Carbon Standards International (CSI), Frick, Switzerland. (http://european-biochar.org). Version 10.2 from 8th Dec 2022

Biochar utilization options

Energy carrier for:

- Heat and electricity supply
- Cement production
- Privat use (barbeque coal)

Material use in various fields:

- Production of steel, silicium, basic chemicals
- Additive for polymers or building materials
- Adsorption agent

Feed and fodder:

- Soil amendment
- Fodder additive
- Medicinal coal

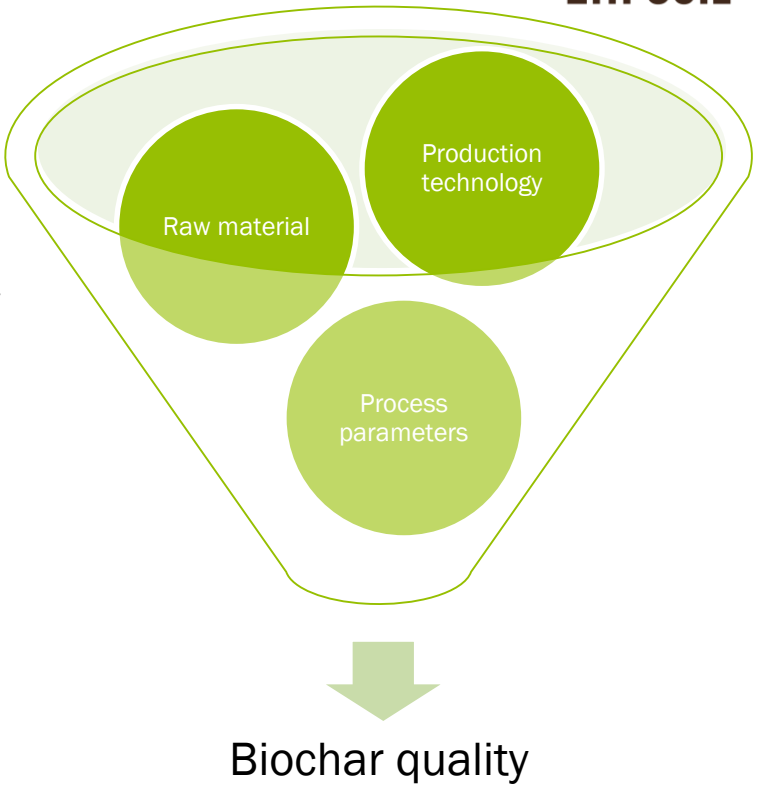
Biochar production

Pyrolysis

- Optimization of process parameters for high yield and required product quality
- Adaption of input material for optimized product quality
- Autothermal process control is possible

Gasification

Hydrothermal carbonization



Key aspects of the EBC certification

Pictures (from left to right): Jan Gutzeit (DBFZ), Andreas Morlok / pixelio.de, European Biochar Certificate, Eurofins

EBC certification (I) – Ensuring biochar quality

Product safety is assured by:

- Product certification based on control of the production process and the product quality
- Continues development and adaption of the certification system by the Ithaka Institute
- Management of the certification system by Carbon Standard International
- Control and certification by q.inspecta, among others after analysis of the material in an accredited analytical laboratory

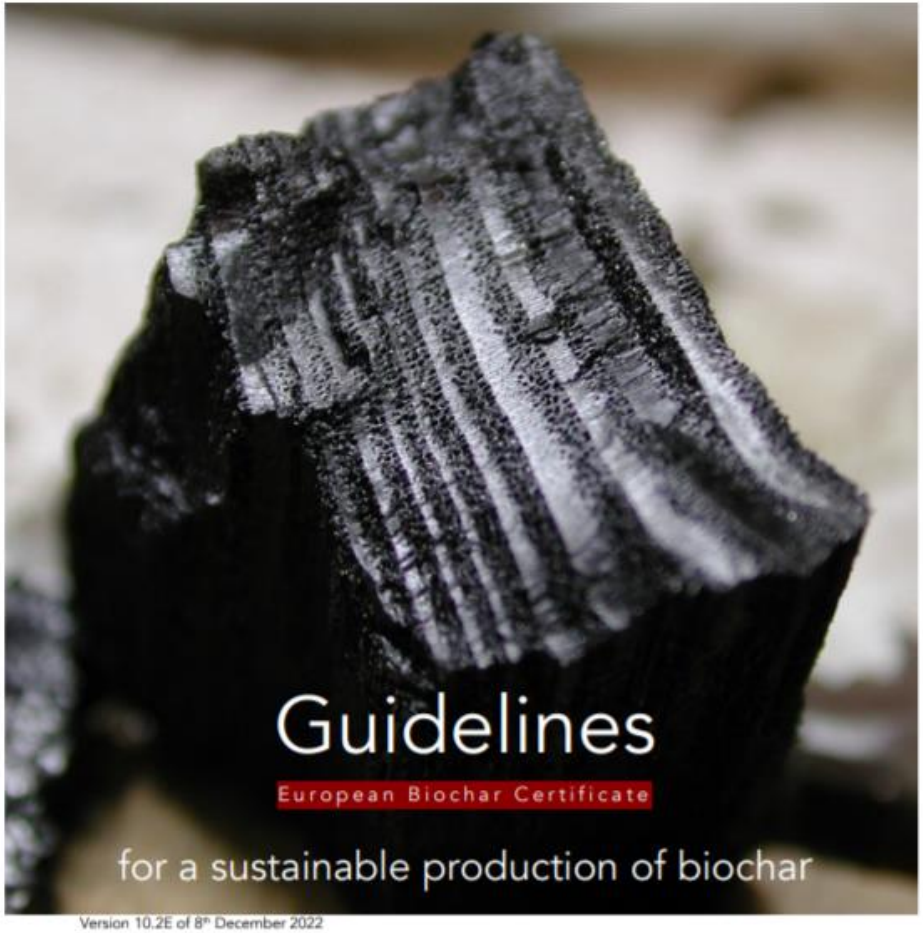
EBC certification (II) – Quality criteria

EBC -Certification Class		EBC-FeedPlus	EBC-Feed	EBC-AgroOrganic	EBC-Agro	EBC-Urban	EBC-ConsumerMaterials	EBC-BasicMaterials
Elemental analysis	Declaration of Ctot, Corg, H, N, O, S, ash							
	H / Corg	< 0.4		< 0.7				
Physical parameters	Water content, dry matter (as received and @ < 3mm particle size), bulk density (DM), WHC, pH, salt content, electrical conductivity of the solid biochar							
TGA	Needs to be presented for the first production batch of a pyroylsis unit							
Nutrients	Declaration of N, P, K, Mg, Ca, Fe							
Heavy metals	Pb	10 g t^{-1} (88%DM)	10 g t^{-1} (88%DM)	45 g t^{-1} DM	120 g t^{-1} DM	120 g t^{-1} DM	120 g t^{-1} DM	declaration, no limit values for certification
	Cd	0.8 g t^{-1} (88% DM)	0.8 g t^{-1} (88% DM)	0.7 g t^{-1} DM	1,5 g t^{-1} DM	1,5 g t^{-1} DM	1,5 g t^{-1} DM	
	Cu	70 g t^{-1}DM	70 g t^{-1}DM	70 g t^{-1}DM	100 g t^{-1} DM	100 g t^{-1} DM	100 g t^{-1} DM	
	Ni	25 g t^{-1} DM	25 g t^{-1} DM	25 g t^{-1} DM	50 g t^{-1} DM	50 g t^{-1} DM	50 g t^{-1} DM	
	Hg	0.1 g t^{-1} (88% DM)	0.1 g t^{-1} (88% DM)	0.4 g t^{-1} DM	1 g t^{-1} DM	1 g t^{-1} DM	1 g t^{-1} DM	
	Zn	200 g t^{-1} DM	200 g t^{-1} DM	200 g t^{-1} DM	400 g t^{-1} DM	400 g t^{-1} DM	400 g t^{-1} DM	
	Cr	70 g t^{-1} DM	70 g t^{-1} DM	70 g t^{-1} DM	90 g t^{-1} DM	90 g t^{-1} DM	90 g t^{-1} DM	
	As	2 g t^{-1} (88% DM)	2 g t^{-1} (88% DM)	13 g t^{-1} DM	13 g t^{-1} DM	13 g t^{-1} DM	13 g t^{-1} DM	
Organic contaminents	16 EPA PAH	6±2.4 g t^{-1} DM	CSI-declaration	6±2.4 g t^{-1} DM	6.0+2.4 g t^{-1} DM	CSI-declaration	CSI-declaration	CSI-declaration
	8 EFSA PAH	1.0 g t^{-1} DM						4 g t^{-1} DM
	benzo(e)pyrene benzo(j)fluoran-thene	< 1.0 g t^{-1} DM for each of both substances						
	PCB, PCDD/F	See chapter 10		Once per pyrolysis unit for the first production batch. For PCB: 0.2 mg kg^{-1} DM, for PCDD/F: 20 ng kg^{-1} (I-TEQ OMS), respectively				

* medical and health care products are not included

Quality classes:

- EBC FeedPlus
- EBC Feed
- EBC AgroOrganic
- EBC Agro
- EBC Urban
- EBC Consumer Materials
- EBC Basic Materials



EBC certification (III) - Perspectives

C-sink certification:

https://www.european-biochar.org/media/doc/2/c_en_sink-value_2-1.pdf

Artisan C-sink:

https://www.carbon-standards.com/docs/7c831c99c4c1f3639703621518a5cd87_artisan-c-sink-guidelines_v1_0.pdf

Contact

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CARBON STANDARDS international

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Global Artisan C-Sink

Methodology for the certification of biochar-based C-Sinks, where the biochar is produced with artisanal, non-industrial, methods of flame-cap (Kon-Tiki) pyrolysis.

The geographical scope of the Global Artisan C-Sink is limited to low-income, lower middle income and higher middle-income countries as defined by the World Bank classification of countries

Background

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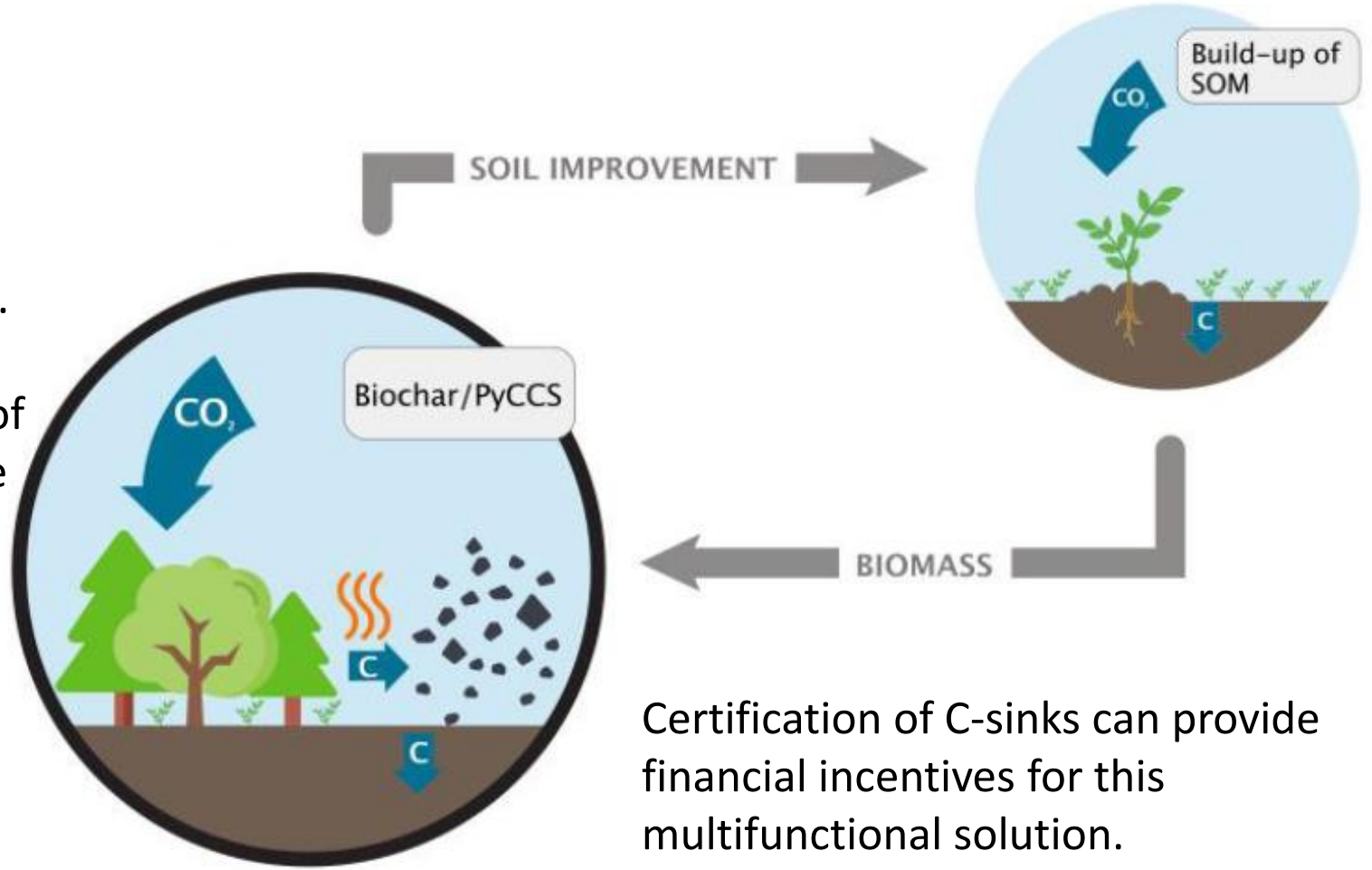
Why having a certification scheme for biochar-based C-sinks produced by smallholders?

- Readily available and scalable CDR relies on photosynthesis for CO_2 extraction. This process happens fasted in the tropics.
- Small holders are in stewardship of most of the agricultural land. Methods to promote and certify decentral biochar production are necessary - otherwise, we lose the largest share of the potential!



Certification of C-sinks can provide financial incentives for this multifunctional solution.

Figure: EBI, 2020

Concept and Structure

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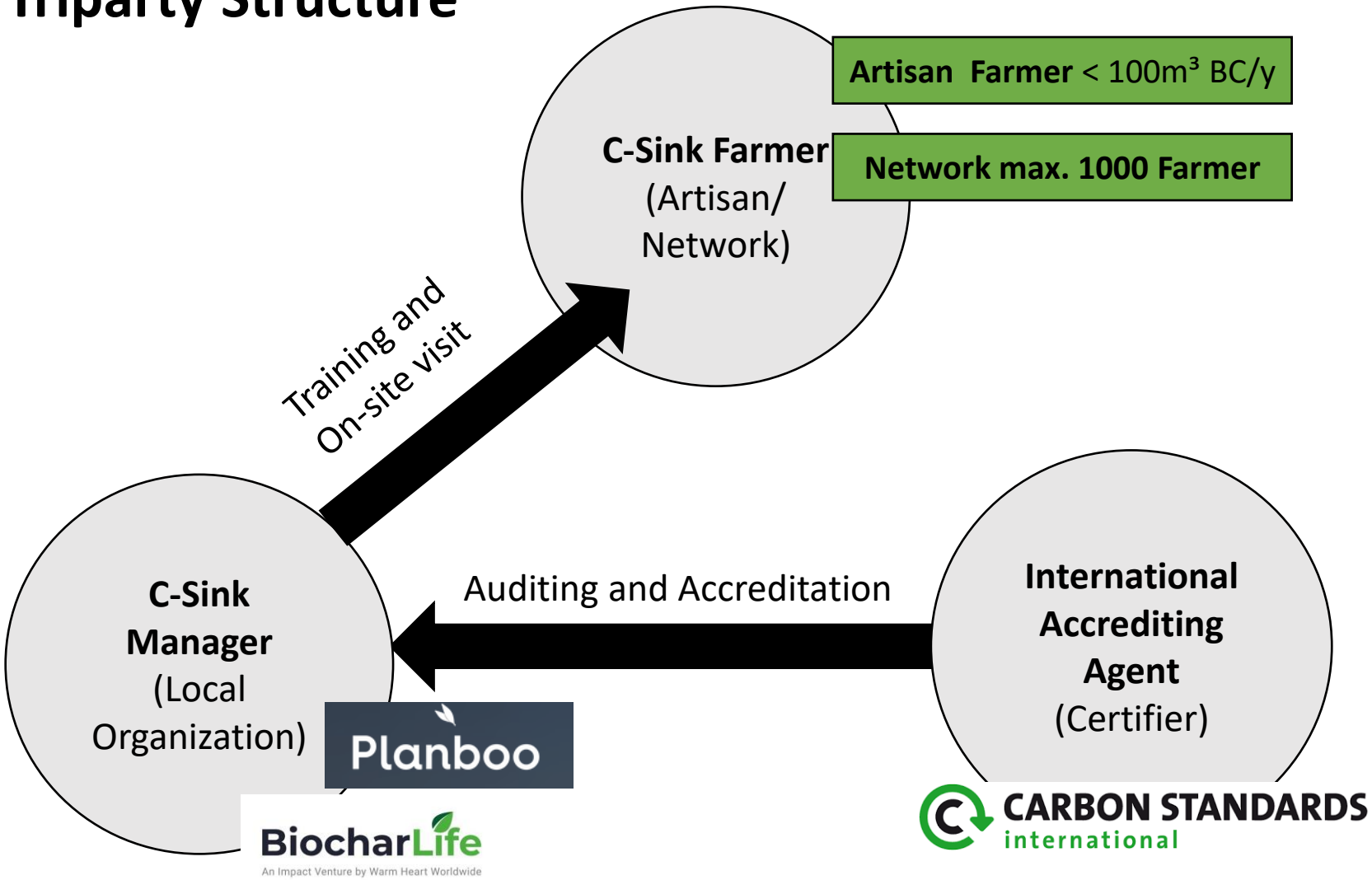
Triparty Structure

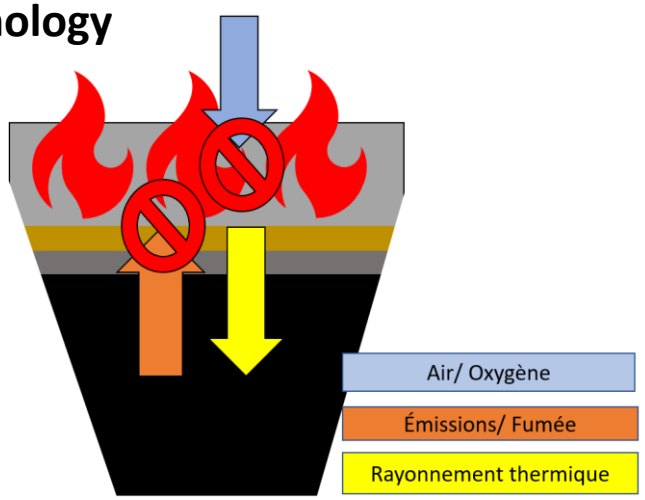


The Guidelines regulate:

- Eligible pyrolysis technology
- Sustainable biochar feedstock
- Training of the biochar artisan
- Smartphone based monitoring
- Methane compensation
- C-Sink calculation
- Transparency of benefit sharing
- Accreditation of monitoring apps and C-sink managers
- Additionality and Exclusivity

Pyrolysis Technology and Biochar Feedstock

- Low-technology solutions that combust the pyrolysis gases. **Kon-Tiki** flame curtain pyrolysis (most common) or TLUD.
- **Bridge-technology**



- **Feedstock: sustainably sourced farm residues** (straw, leaves, branches, kernels, pruning material). Food processing residues, fallow crops, dedicated biomass. **Excluded:** Forest biomass.

- Must be **stored dry** and aerated.
- Must be **dry at time of pyrolysis** (max 30% moisture)

Picture: J. MzD, Ithaka, Ghana

Training of the Artisan

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“It is not the Kon-Tiki technology as such that can be certified but only the combination of the technology and the executing artisan – the artisan biochar producer”

Training must cover:

- Principles of feedstock selection
- Biomass drying
- Kon-Tiki operation
- Volume measurements
- Post-pyrolytic treatment
- Agronomic use of biochar
- Use of the Artisan App (Participatory MRV)

Training must be completed by a successful examen.

Picture: M. Bier, Solidaridad, Tanzania

Monitoring: The Artisan App

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- **Data collected by the C-Sink manager → Certifier/ C-Sink Registry**
  - Create account for each C-sink farmer/Artisan
  - Upload training certificate
  - Register available biomass (GPS of farm + crop rotation)
  - Pyrolysis technology
  - Documentation of biochar production
    - **Feedstock** description
    - **Geo- and time referenced pictures** of process and product.
    - **Final volume produced**
  - Documentation of application/mixing of biochar (amount/date/location)
  - Sale

- **Biochar Samples:**
  - **Artisan:** No analytic- and retention samples required. Analysis only if unknown/novel feedstock.
  - Database on biochar characteristics from common feedstocks is available.

Picture: J. MzD, Ithaka, Ghana

Methane Compensation

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- Mean **0.03 t methane emissions per 1 ton biochar** produced via Kon-Tiki pyrolysis *(Cornelissen et al. 2016)*.

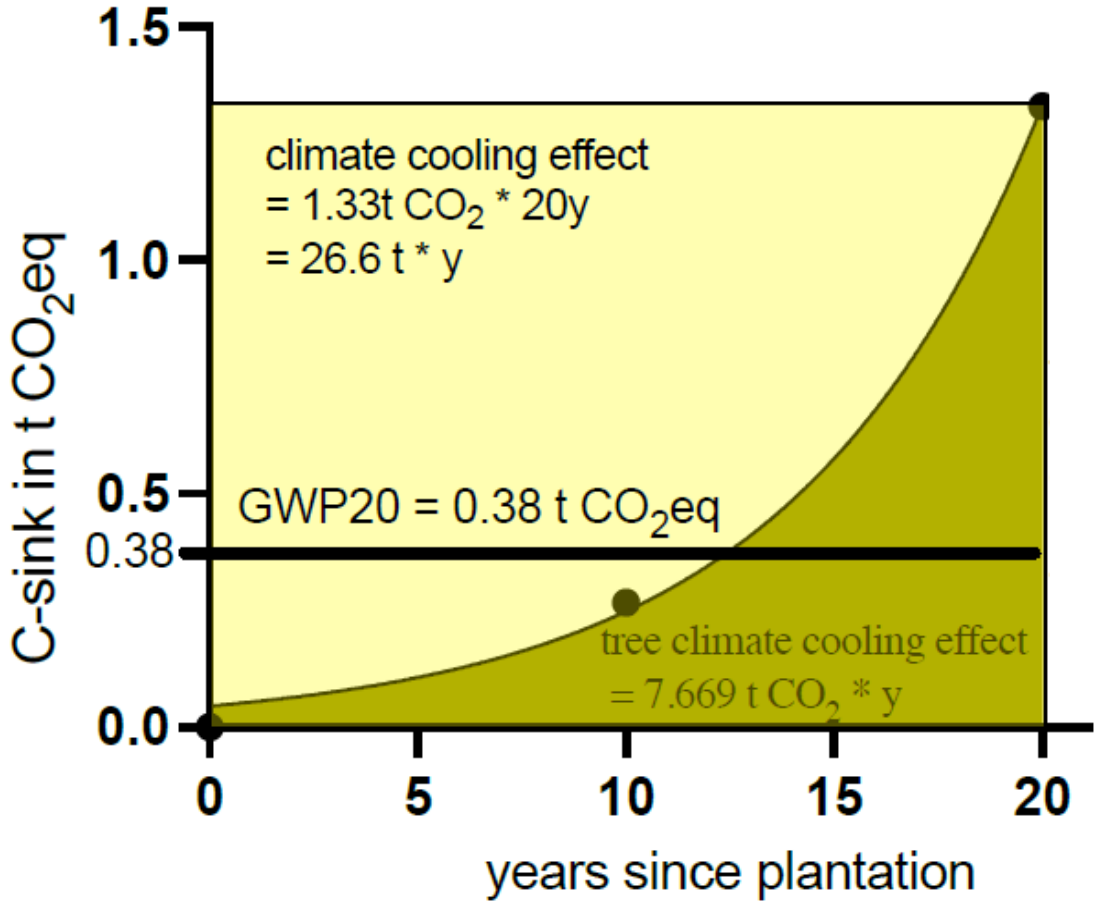
- Methane **GWP20 = 86 t CO_2 t^{-1}**
- Methane emissions **must be compensated**.

- **Avoidance of uncontrolled decomposition or uncontrolled burning** of biomass in the baseline scenario through controlled pyrolysis in project scenario.

- Compensation by avoidance **only approvable for 10 years** (transition period)
  → **new practice becomes common practice.**

- Active Methane **compensation**
  e.g., through tree planting.
  Trees must be registered by C-sink manager

Michelia Champaca



30kg CH4 *86 = 2.58 t CO_2
2.58 t CO_2 /0.38 t CO_2 = 7 *M. champaca* trees

Figures: Biochar Life, Global Artisan C-Sink Guidelines

C-Sink Calculation (Artisan)

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- C-Sink farmer (Artisan) document the feedstock type used, and the volume biochar produced and applied. Using biochar bulk densities (t/m³) and C-contents from the feedstock data base, the gross C-sink is calculated.

- **1000 l coconut-husk biochar * 0.19 t/m³ * 80% C-content * 44/12 = 0.56 t CO2 (gross)**

- From the gross C-sink **carbon expenditures** are deducted. If transport is <100 km all expenditures are covered by a **3% security margin**.

- To account for **potential decay** of the labile biochar fraction, once applied to soils, a **highly conservative fraction of 26% is deducted**.

- **0.56 tCO_2 * 0.97 *0.74 = 0.4 t CO_2 (net)**

- Price per tCO2 ~ 100-150€
- Direct money transfer to farmers (mobile money)
- Benefit sharing ratio must be transparent.

Picture: Planboo, Sri Lanka

Artisan Pro

- Annual production of 100-1500m³ biochar per year.
- Tighter MRV (Analytical sample and retention samples must be provided; annual on-site visits; check of feedstock supply chain)
- If >1500m³ a roadmap towards industrial solutions must be provided. → Kon-Tikis serve only at bridge technology!

Biochar Sale

- Sale/transport in a 100km range is possible.
- For longer distances a tracking system must be provided
- No sale to a different country (except cross border regions)

Additionality and Exclusivity

- Biochar application is no common practice.
- Occurs only at scale after active training and monetary incentive
- The creation of biochar-based C-sinks is thus clearly additional.
- No Artisan certification on areas included in certified SOC programs! This would cause a double-counting of C-sinks.

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Picture: Ithaka

Reference Project: Artisan Biochar Life (C-Sink Manager)

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- Impact venture of Warm Heart Foundation targeting biochar production at small-holder farm scale
- Improved **food security, farm income**, **better livelihood, climate change mitigation.**
- Operating in **Kenya, Malawi, Thailand, Tanzania and Indonesia**
- **Currently ~734 famer engaged and ~ 5000 t CO2 C-sink produced** *(1.900 t CO2 certified as of November 2022)*
- **80% C-revenue returned to farmer**
  (Total 2022: 100.000 USD or 140 USD/farmer)
- **Outlook:** Strong momentum in East Africa, **expansion to >100.000 t CO2 in 3 years.** Further projects is SE Asia, strategic partnerships with USAID, UN FAO, NORAD…

Picture: M. Bier, Solidaridad

Reference Project: Artisan Pro Planboo (C-Sink Manager)

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- Operating in **Sri Lanka** (Cinnamon plantation, rubber plantation), **Malawi** (Bamboo plantation) and **Namibia**.

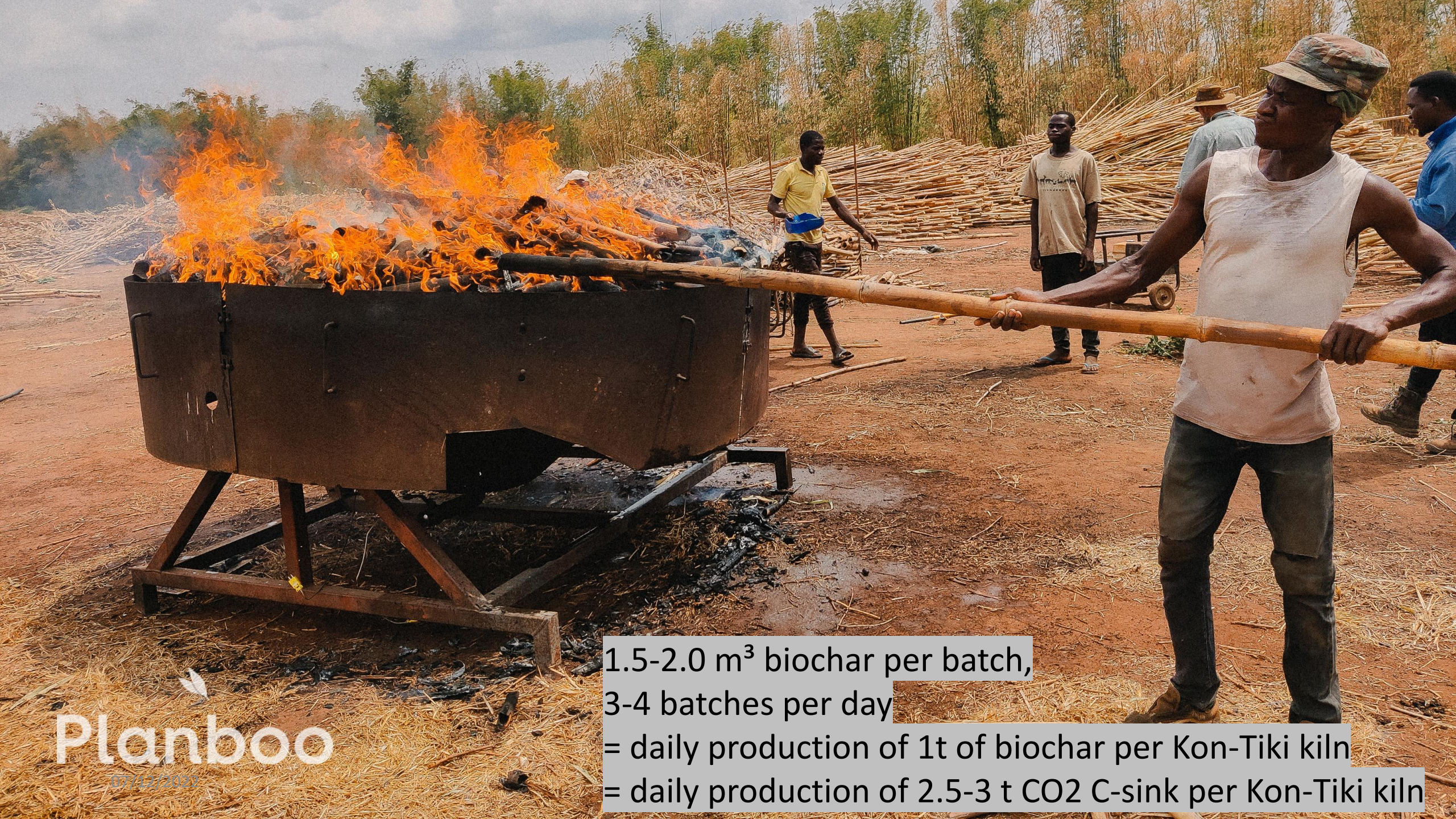
- Using **scaled Kon-Tiki technology** (round or square Kon-Tikis producing several m^3 biochar per batch)

- **Single operations with > 100 m^3 biochar / year** (some 100-1000 t biochar/ year)

- **Strong demand** for such C-sink solutions

- Proposals from **11 countries in the pipeline**.

Picture: Planboo



1.5-2.0 m³ biochar per batch,
3-4 batches per day
= daily production of 1t of biochar per Kon-Tiki kiln
= daily production of 2.5-3 t CO2 C-sink per Kon-Tiki kiln

Planboo
07/12/2022

Global Artisan C-Sink Guidelines are available here:

EBC C-Sink Guidelines & Documents

https://www.european-biochar.org/en/ct/139-C-sink-guidelines-documents

PDF

Contact
Carbon Standards International: info@carbon-standards.com
Ithaka Institute: mzd@ithaka-institut.org

For Industrial Biochar Production

The EBC C-Sink Guidelines are available here:

EBC C-Sink Guidelines & Documents

https://www.european-biochar.org/en/ct/139-C-sink-guidelines-documents

PDF

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Ithaka Institute: hagemann@ithaka-institut.org

Biogas Dissemination Scale-Up Programme (NBPE+)

Soil Symposium 2023

DBFZ

ETH-SOIL

SNV

28/02/2023

SNV

Content

1. SNV and NBPE+ background-introduction
2. Status Biodigester Sector Development strategy
3. Bioslurry mainstreaming under NBPE+implementation
4. Questions

SNV Netherlands Development Organisation

We were founded in

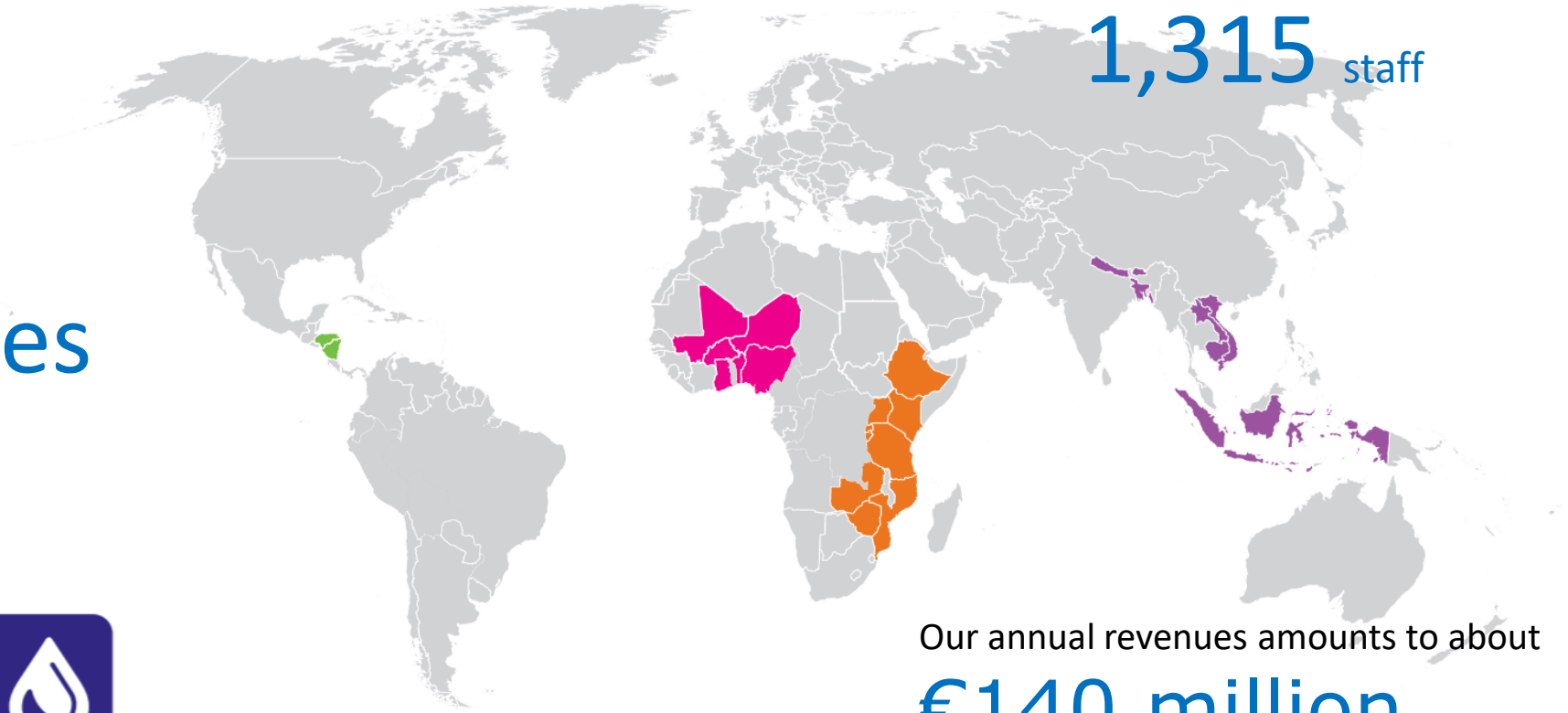
1965

We work in

24 countries

We focus on

Agriculture Energy WASH

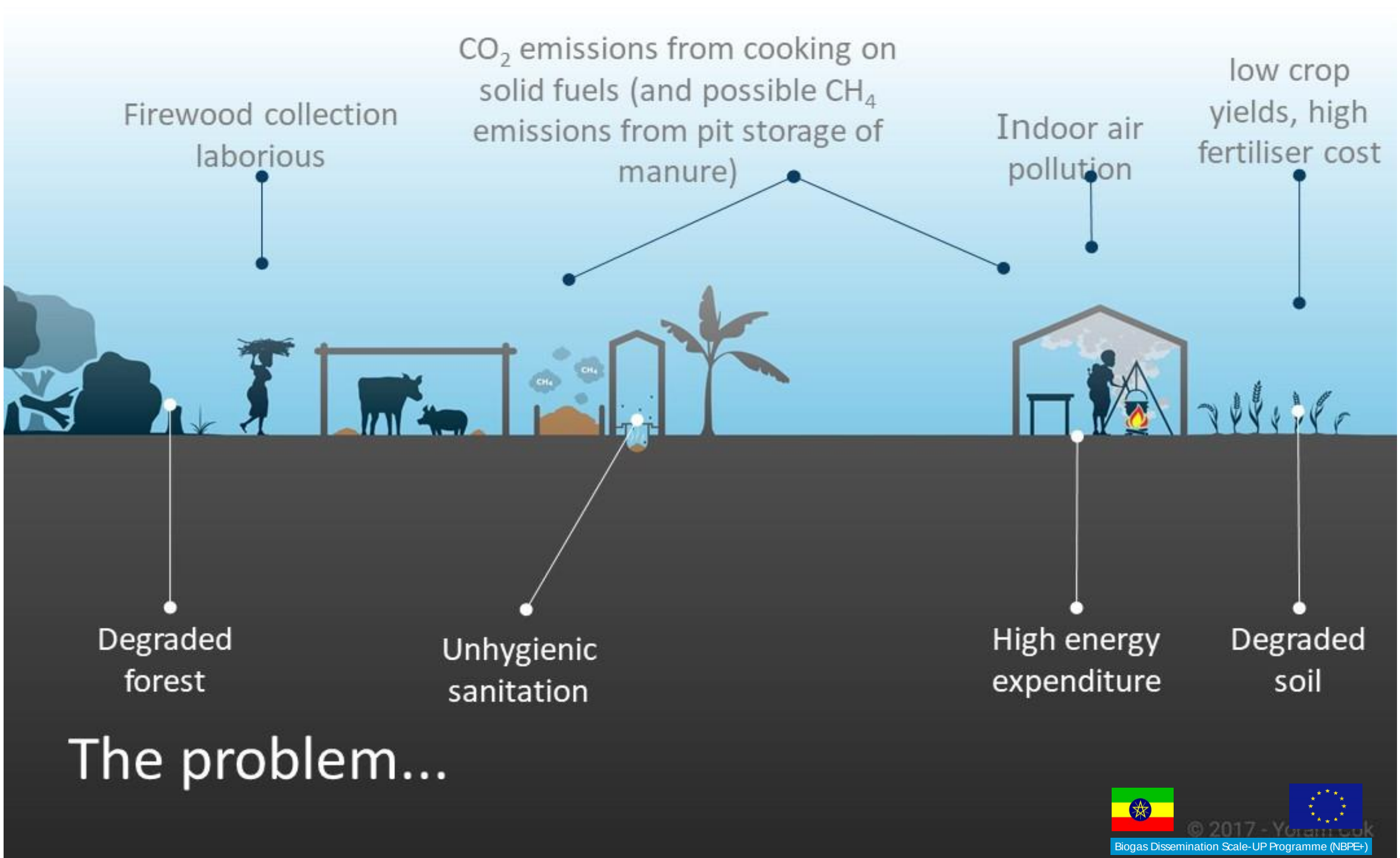


With a global team of

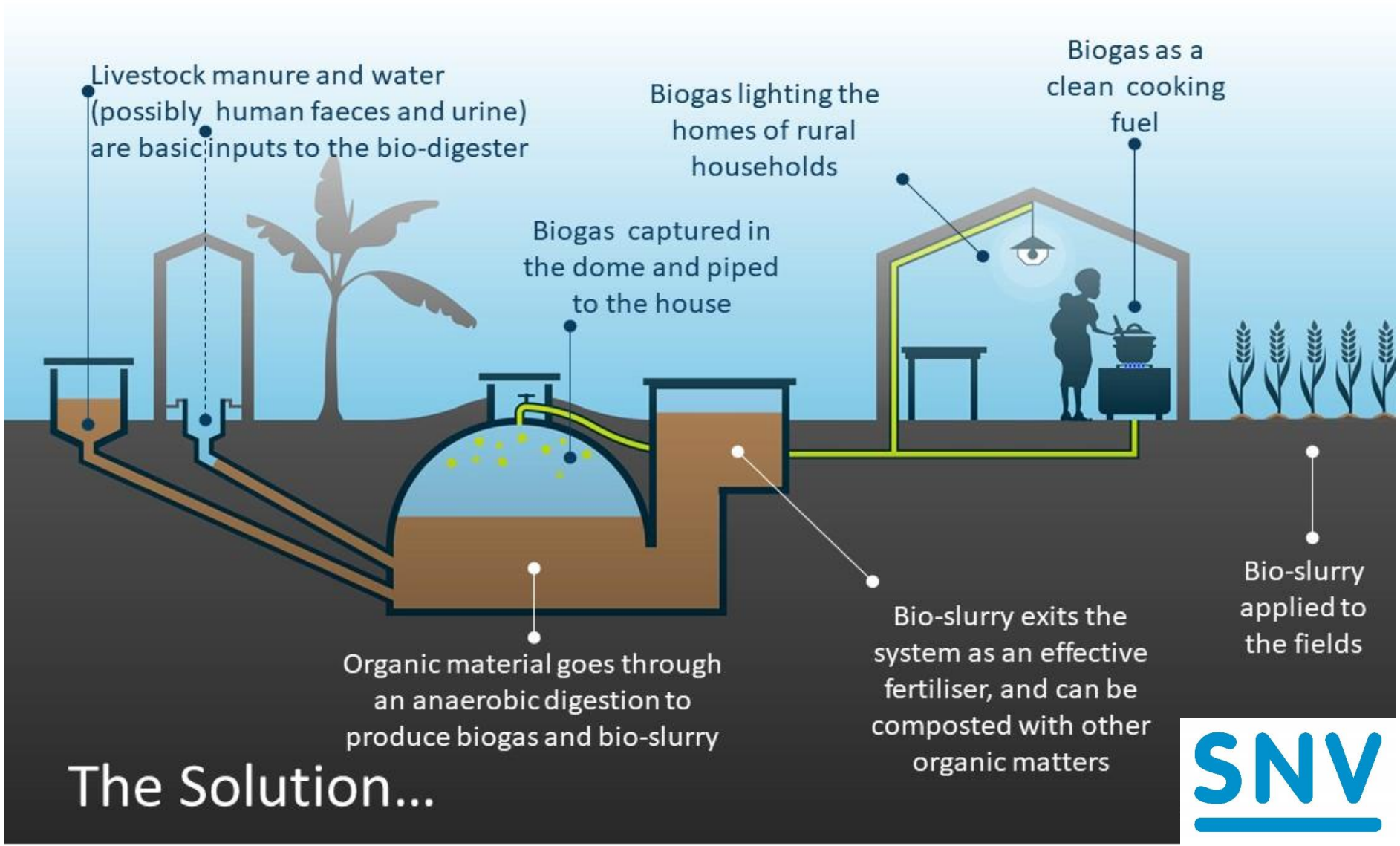
1,315 staff

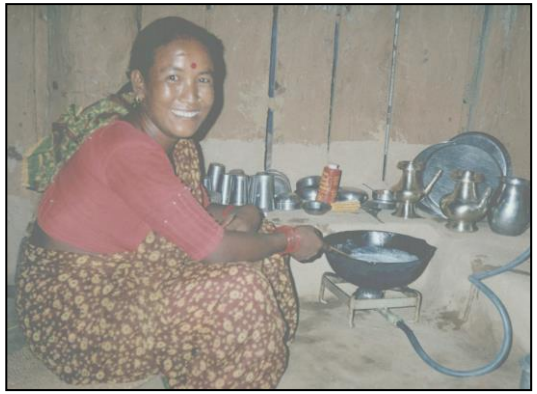
Our annual revenues amounts to about

€140 million



Multiple Solutions of Bio-digester ….





NBPE+ Summary

Biogas Dissemination Scale-UP Programme (NBPE+)

Biogas Dissemination Scale-Up Programme (NBPE+)	
Geographical Coverage:	4 large regions (Amhara, Oromia, SNNPR and Tigray) + 5 new regions (Afar, Benishangul-Gumuz, Gambella, Sidama & Somali)
Target:	1) 36,000 domestic bio-digesters 2) 40 larger size bio-digesters as pilots
Period:	81 months (Apr 12, 2017 to Jan 11, 2024-change to January 2024
Co-funded by:	EU = € 20.85M and GoE = € 2 M; Regional Governments also funding
Role of SNV:	Overall Programme Management, Quality Assurance, Technical Assistance & Implementation Support.
Role of MoWE:	Programme hosting and overall management from government side.
Role of BoWE/MEA:	Programme implementation on the ground in partnership with Woredas, private sector and others.
Role MoA/BoAs	knowledge development/Bioslurry Manual, Bioslurry promotion, support training, demonstrations, validation….
Partners	ISFM-GIZ, Universities, NGOs, Other SNV projects.

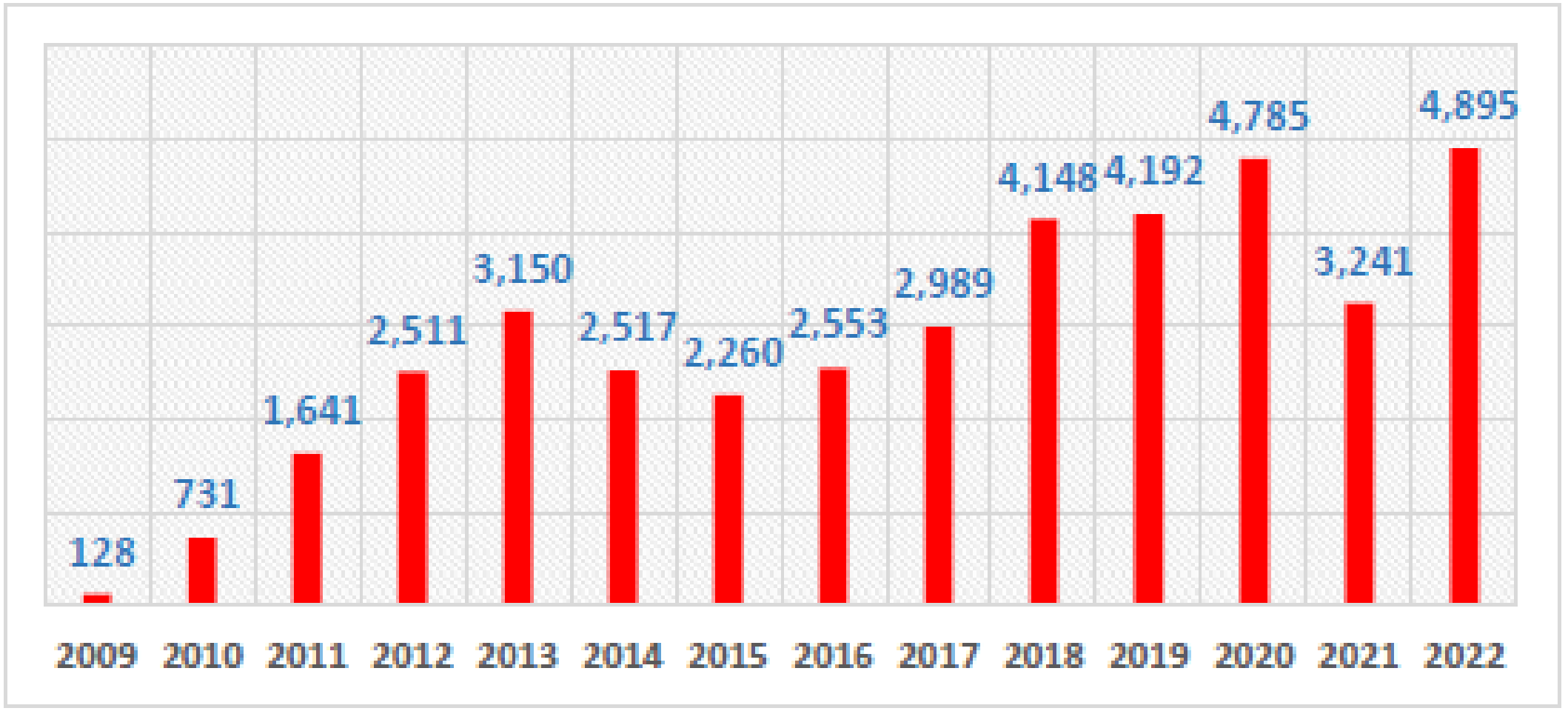
NBPE+ Summary

- The overall objective is to **improve the living standards** of farmers and their families, in the Ethiopian regions of Afar, Amhara, Benishangul-Gumuz, Gambela, Oromia, SNPPR, Somali and Tigray while **reducing the over-exploitation of biomass** cover in the 9 regions, **reducing GHG emissions and indoor pollution.**

Installation trend of household bio-digesters over the last years

Co-funded by the European Union

Biogas Dissemination Scale-UP Programme (NBPE+)



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SOIL SYMPOSIUM 2023

Biogas Federal Strategy focus/status and bioslurry mainstreaming under NBPE+ implementation

28/02/2023

Purpose of the Strategy

A multi-actor strategic plan unites stakeholders around one shared vision.

- Increase a sense of responsibility and action towards realizing a common vision.
- Help stakeholders align the Strategy to their organizational objectives
- Enhance multi-sectoral coordination, partnerships and synergy.
- Anticipate future challenges, issues, and threats and to be proactive rather than reactive
- Track progress based on strategic goals.

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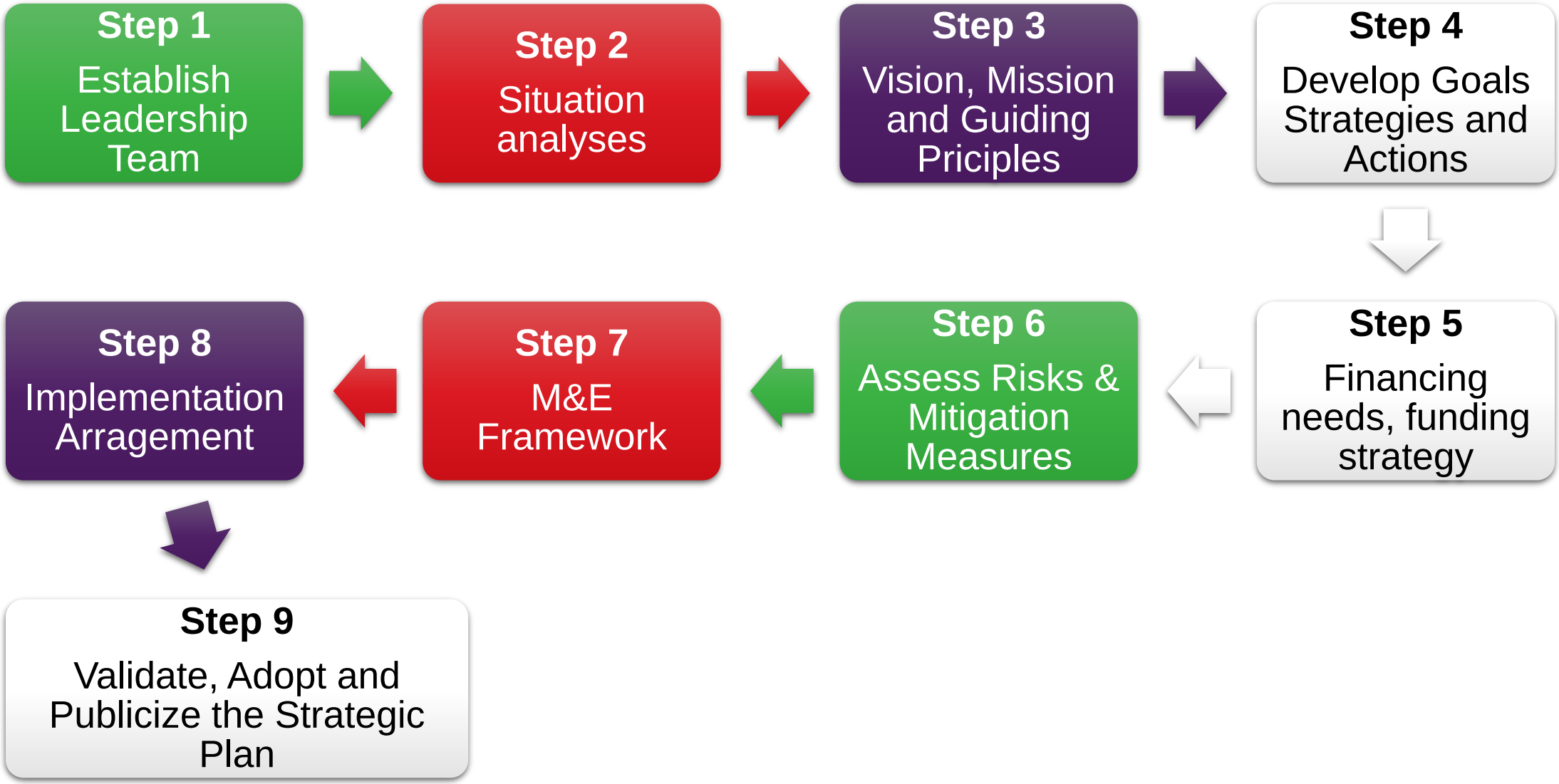
Biogas Dissemination Scale-UP Programme (NBPE+)

28/02/2023

Strategy Development Process



Key Results

- Increased market uptake and use of biodigesters
- Access to clean energy
- Increased digestate production and application
- Improved health - reduced HAP & improved sanitation
- Reduced climate and environmental impacts
- Empowered women and improved livelihoods
- Job creation in the biodigester sector

Overall Targets

1. Domestic Biodigesters from about 40,000 to 300,000 by 2030
2. Dairy farms: 50 biodigesters
3. Public & Social institutions: 200 biodigesters
4. Industries: 20 biodigesters
5. Municipalities: 5 biodigester plants

Targets (Number of Biodigesters)

Biogas Dissemination Scale-UP Programme (NBPE+)

Sector	Baseline (2022)	Target (2030)
Household	40,000	300,000
Dairy Industry		50
Public and Social institutions		200
Industries		20
Municipal Waste		5

SNV

Strategic Goals

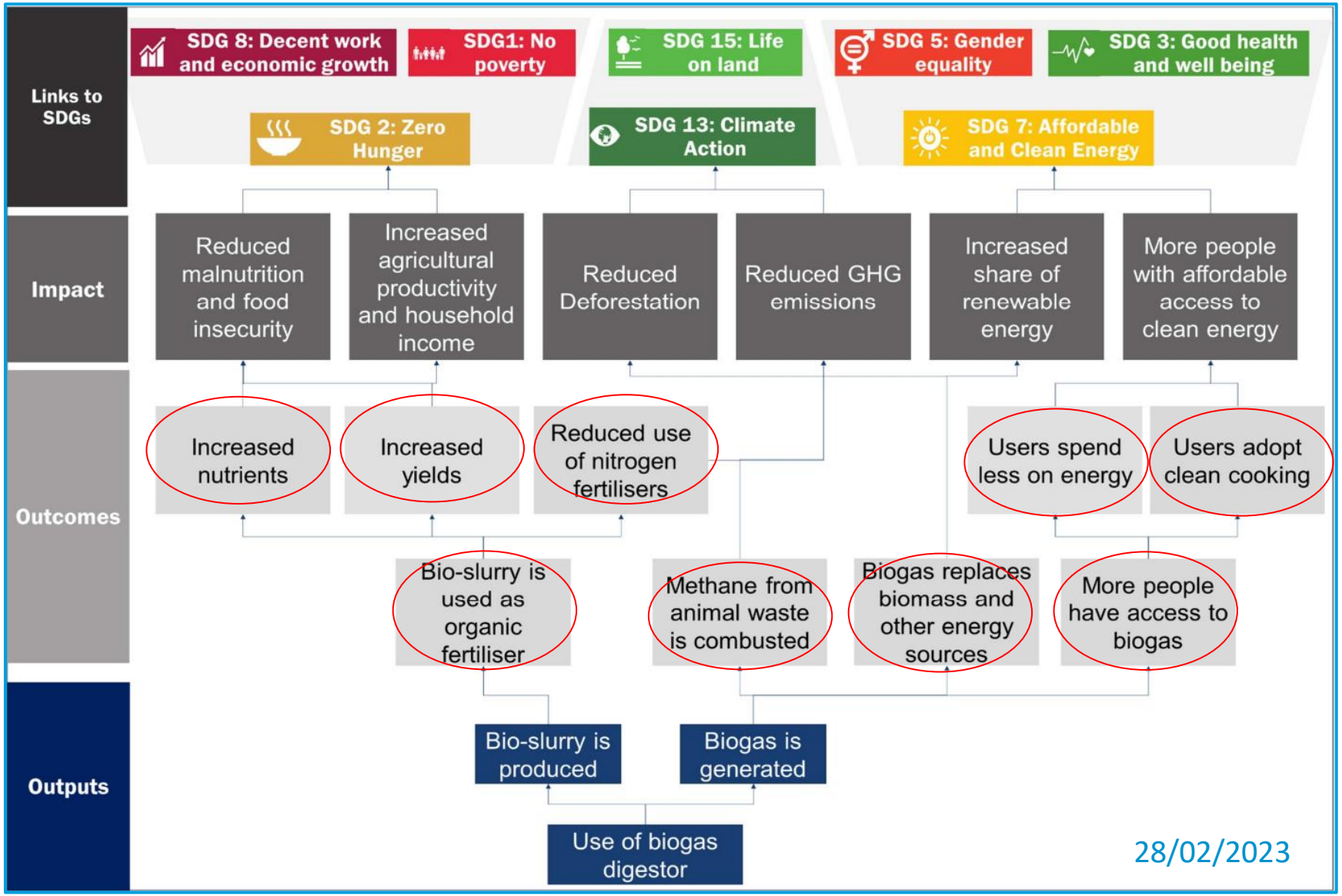
1	Improved Policy, Planning and Stakeholder Mobilization
2	Capacity strengthened (human, institutional)
3	Private Sector and Market Development.
4	Improved Gender Equality and Women's empowerment
5	Resource Mobilization
6	Evidence, Learning and Knowledge Management.

SOIL SYMPOSIUM 2023

Bioslurry mainstreaming under NBPE+ implementation

Biodigester's Contribution to SDGs …..

- A unique technology that contribute to so many (8 out of 17) SDGs (Sustainable Development Goals)



28/02/2023

2 Co-Products:
Biogas and Bio-slurry for Better Life …..

- As per WHO, **biogas is one of the widely available clean cooking solutions.**
  - Electricity, LPG and natural gas, solar cooker and ethanol are others.
- **Benefit from bio-slurry**, as a potent organic manure (as soil conditioner, seed dresser and pesticide)
  - **Outweighs benefits from biogas,** significantly improving the business case.

Nutrient content of liquid bio-slurry

No	Parameters	Unit	Household biodigesters	LSBDs
1	pH		7.33	7.15
2	Total Nitrogen(TN)	%	2.94	3.58
3	Phosphorus (P)	Mg/l	395.04	459.54
4	Potassium (K)	Mg/l	788.86	1066.34
5	Calcium (Ca)	Mg/l	1064.17	484.09
6	Magnesium (Mg)	Mg/l	281.31	219.50
7	Sodium (Na)	Mg/l	157.34	447.50
8	Sulphur (S)	Mg/l	204.15	162.84
9	Iron (Fe)	Mg/l	349.43	127.98
10	Manganese (Mn)	Mg/l	44.74	21.84
11	Copper (Cu)	Mg/l	0.96	0.69
12	Zinc (Zn)	Mg/l	1.56	1.11
13	Boron (B)	Mg/l	1.91	1.36
14	Organic Carbon (OC)	%	39.45	45.15
15	Dry Matter (DM)	%	6.78	4.92

Uses of bio-slurry

- **As Organic Fertiliser**
  - As liquid: 20k-40k litres/ha
  - In composted form: 6-10 ton/ha
- **As Seeds Dresser**
  - About 1 litre of bio-slurry for 8 kgs of seed
- **As Organic Pesticide**
  - Spraying after mixing with equal volume of water

Bioslurry Mainstreaming (SNV)

- Communicated the benefits of bio-slurry to MoA by different ways
- Printed the bio-slurry manual in 3000 copies, and shared
- Contributed as part of the federal organic fertilizers task force
- Facilitated exchange of bio-slurry among biodigester users and veggies farmers is being conducted in V4P&P woredas.
- Signed partnership agreement with MoA to implement 200 demonstrations

SNV

- **A visit was organized for higher officials of MoA visited bio-digesters in Sidama and Oromia in bio-slurry.**
- **Trained staff of 3 MSBDs in Modjo and Sebeta**

Example of some results in 2022

Co funded by the European Union

Biogas Dissemination Scale-UP Programme (NBPE+)

- Bio-slurry produced
  - 842,436 quintals of bio-slurry compost and
  - 25,750,527 litres of bio-slurry were produced and utilized
- Area covered
  - 10,751 hectares in composted form,
  - 209 hectares by seeds dressing and
  - 4,120 hectares in liquid application.
  - 12 hectares of land with exchange. p

SNV

Biogas Dissemination Scale-UP Programme (NBPE+)

SNV

"Thanks to bio-slurry, I have grown wheat (at my back) from this type of sandy soil." A user from Tigray.

Co-funded by the European Union

Biogas Dissemination Scale-UP Programme (NBPE+)

Yes, We Can!

SNV

28/02/2023

Assessing and monitoring GHG emissions from manure, agricultural residues and soil health inputs

Stefan Majer, Katja Oehmichen, Sophia Bothe, Uta Schmieder

Soil Symposium 2023; 28th February 2023

Motivation

Jagisso et al. 2019

Tappert 2021

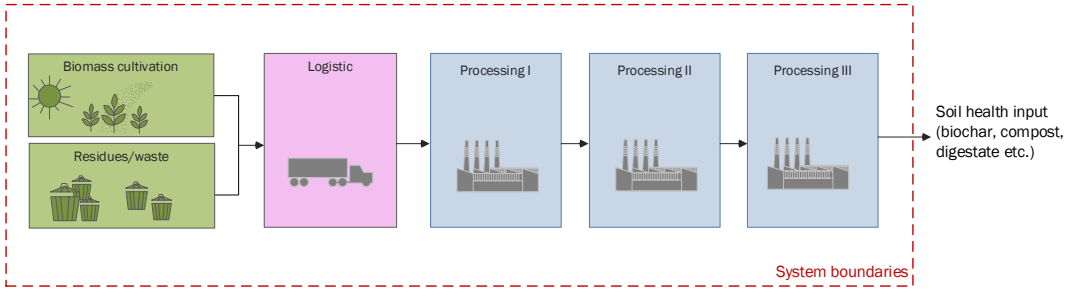
Existing resources of agricultural residues, manure and biogenic wastes can be used to produce soil health inputs in Ethiopia

- Maintain and increase soil fertility and quality
- Contribute to the long-term creation of carbon sinks
- The treatment of agricultural resides can contribute to the reduction of GHG emissions compared to the conventional handling

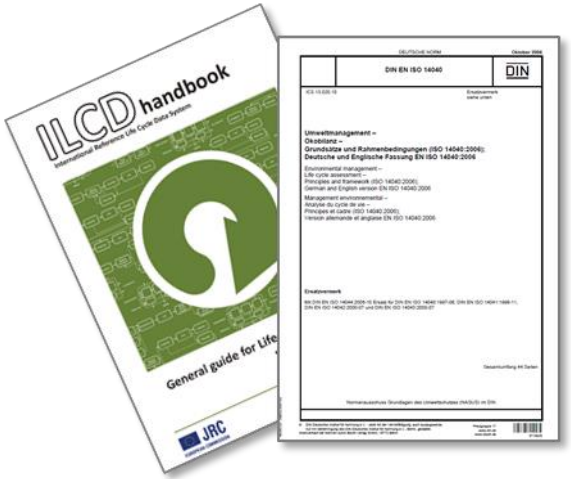
Monitoring and Assessing GHG emissions in the ETH Soil project

ETH Soil will use the LCA methodology to gain insight into climate impacts

- Life Cycle Assessments for different technologies for the production of energy and soil improvement materials
- Key technologies include: pyrolysis, composting, biogas



Oehmichen et al. exemplary supply chain for TPS

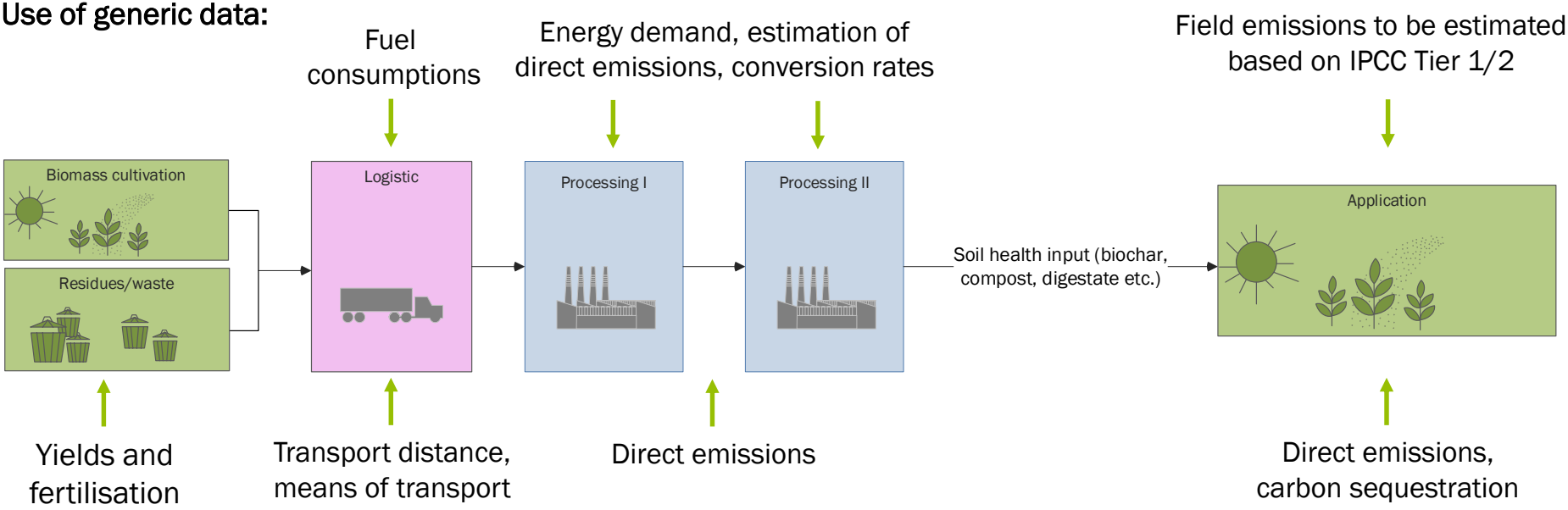


The ILCD Handbook

Monitoring and Assessing GHG emissions in the ETH Soil project

ETH-SOIL

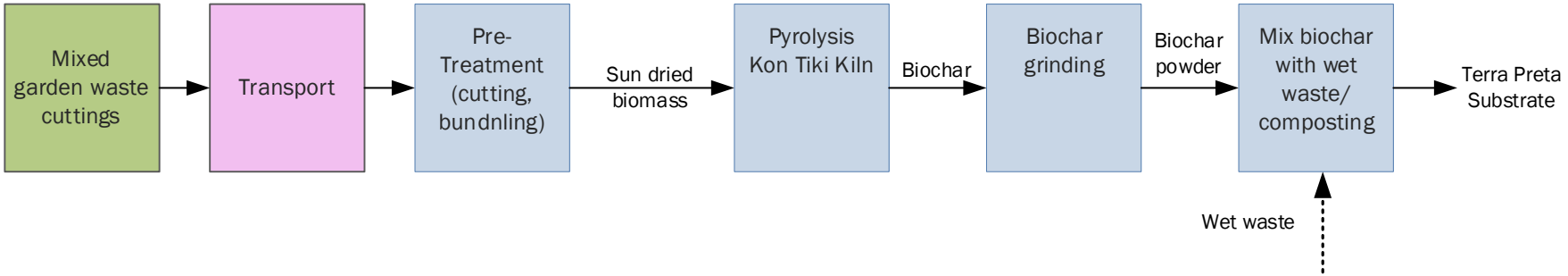
Use of generic data:



Use of actual data

GHG impacts of soil health inputs – what do we know?

Exemplary pathway to produce Terra Preta Substrates from biogenic residues

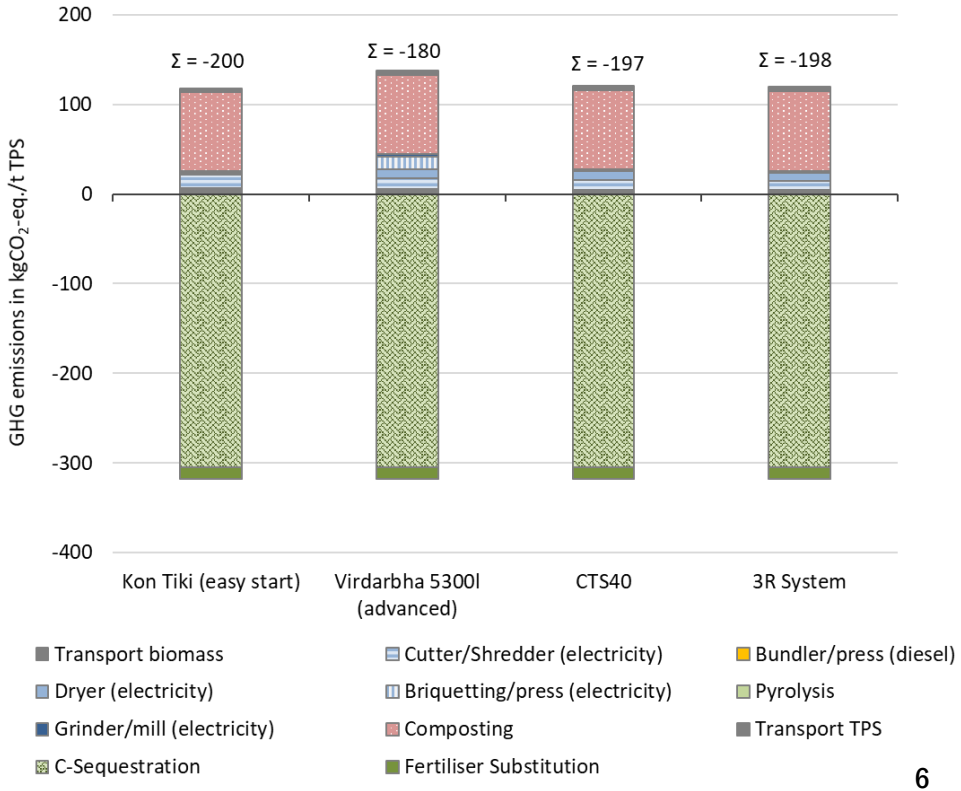


- What are decisive factors and elements?
- Where do we a regular monitoring of data to support informed decisions?

GHG impacts of soil health inputs – what do we know?

LCA can help to identify drivers

- Energy input
- Emissions from composting
- Potential credits and long term effects (N-substitution, C-sinks)

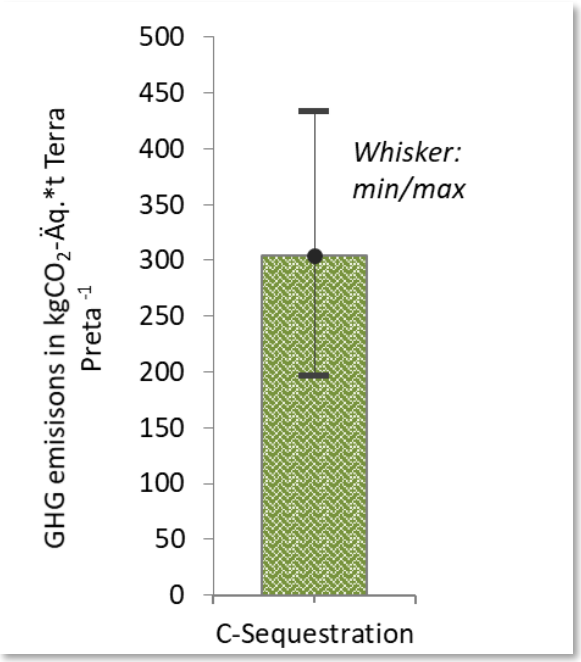


Oehmichen et al. 2023

LCA and GHG related objectives in the ETH Soil project

An LCA solely based on generic data includes high uncertainties

- **long-term stability of C-sinks from biochar application e.g.,**
  - soil and climatic conditions
  - type of soil management
  - production conditions during biomass conversion to biochar (gasification, pyrolysis, temperature).

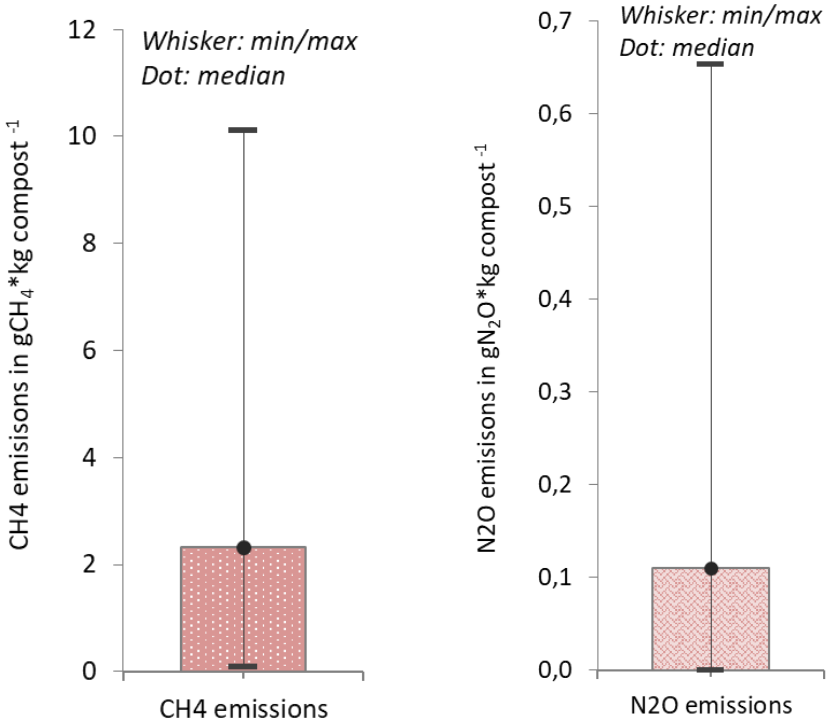


Oehmichen et al. 2023

LCA and GHG related objectives in the ETH Soil project

An LCA solely based on generic data includes high uncertainties

- **potential range of direct GHG emissions from composting**
  - type of material
  - moisture content
  - aeration, etc.

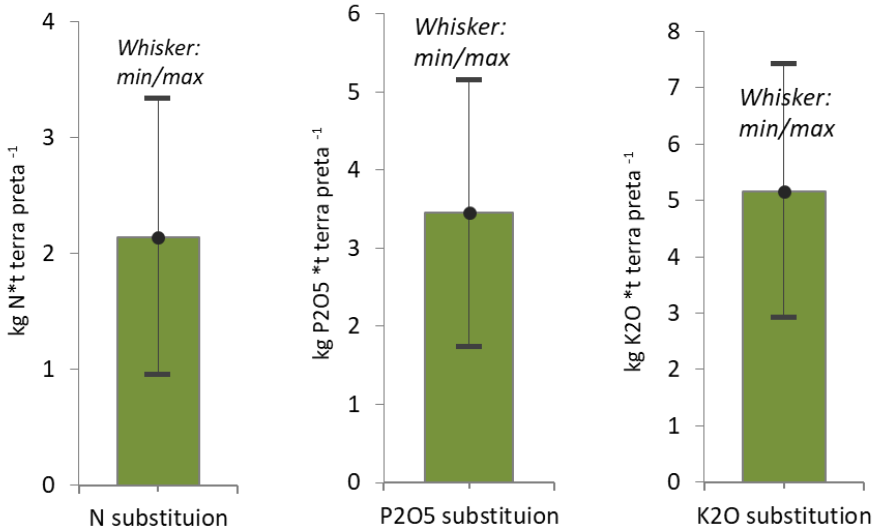


Oehmichen et al. 2023

LCA and GHG related objectives in the ETH Soil project

An LCA solely based on generic data includes high uncertainties

- **Nutrient composition in produced SHI**
  - specific amount of N, P, K included
  - reference for fertilisation



Oehmichen et al. 2023

Summary and discussion

- Dedicated soil health inputs from regional biogenic wastes and residues can help to maintain soil fertility and to create carbon sinks

- LCA is a methodology to support the practical implementation of soil health input production measures

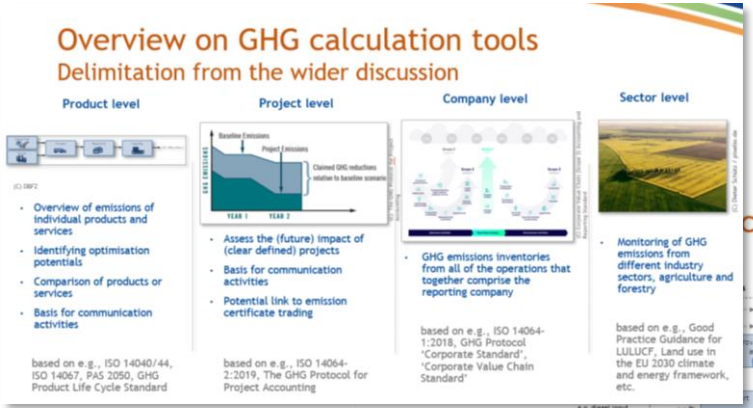
- The measurement and monitoring of actual data can reduce uncertainties in the LCA, most importantly are: direct process emissions and the development of soil organic carbon from biochar application

Potential for collaboration with the ETH Soil project

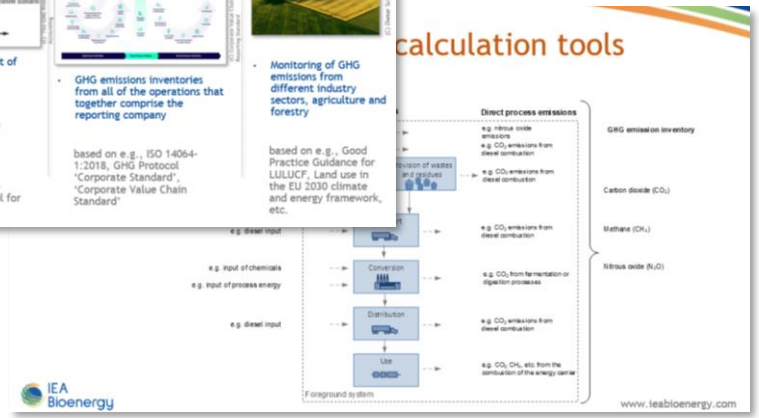
ETH-SOIL

The tools and methods developed in ETH Soil can support stakeholders in Ethiopia

- **Training and capacity buidling**
- **E-courses & webinars**
- **Tailormade guidelines and tools**
- **In-class Training**



Majer et al. 2022



Majer et al. 2022

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gemeinnützige GmbH

DBFZ

Outlook on the ETH-Soil project activities

Dr.-Ing.Volker Lenz



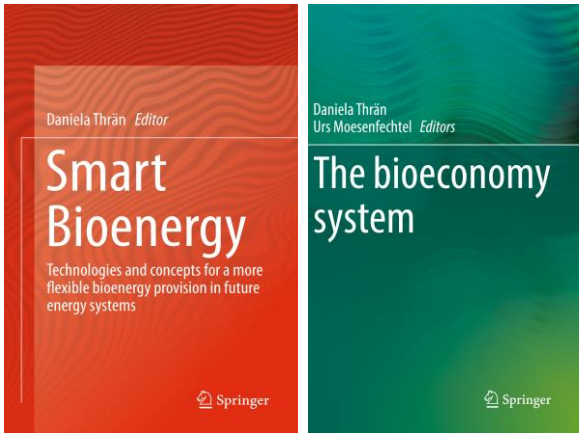


ETH-Soil – Soil Symposium 2023, 28.02.2023

Our vision: Smart Bioenergy

Secure, clean, integrated and smart use of bioenergy for a sustainable, bio-based economic system

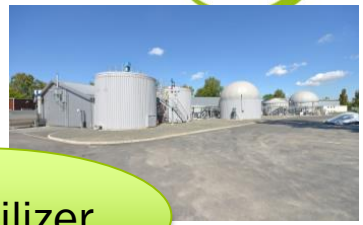
- An energy supply that is integrated, free of competition and demand-oriented
- Combined production of bio-based fuels
- Development of highly efficient and clean technologies
- Fully comprehensive sustainability monitoring
- Optimal value chain from biomass



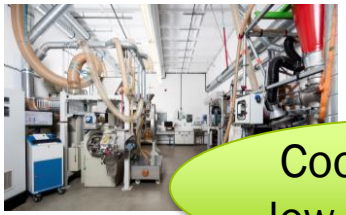
Goal: a carbon-neutral bio-economy based on renewable resources

DBFZ work and ETH-Soil perspectives

Research biogas plant – all kind of research on anaerobic digestion as different input materials, production optimisation and digestate handling



Biofertilizer



Solid fuel laboratory with washing, mixing, cutting, drying and briketting as well as compactation.

Cookers with low emissions

Fuel and analytic labs.

Thermo-chemical conversion including combustion, gasification and pyrolysis.

Emission reduction techologies.

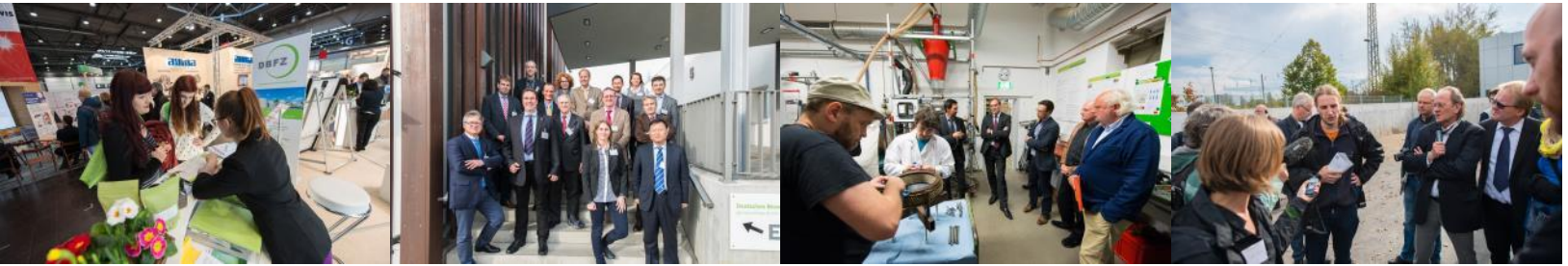
Market integration

Tools and databases for energy system and biomass potential analysis and much more…

Pictures: Jan Gutzeit / Jürgen Lösel

What we can do for you

- Applied research & development throughout the whole value chain
- National and international networking across the research landscape
- Scientifically sound decision-making aids for policy-makers, businesses and other institutions
- **In short:** We are the leading federal research institution for the integrated material & energetic use of biomass



Pictures: DBFZ

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Smart Bioenergy – Innovations for a sustainable future

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