

ENGAGING STAKEHOLDERS IN YOUR CARBON DIOXIDE REMOVAL RESEARCH

Reflection Paper with Learnings & Recommendations from the CDRterra research programme

„What we would have liked to know at the beginning of our research programme.“

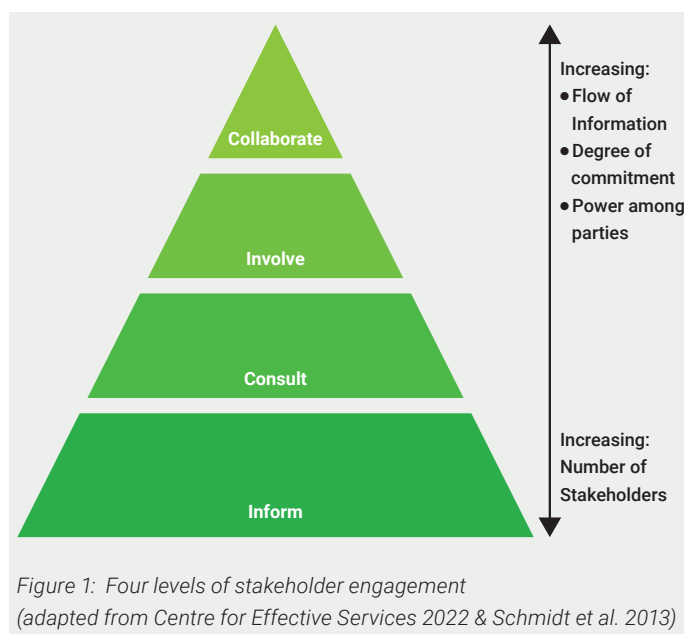
AUTHORS: Juliane El Zohbi, Lukas Fehr, Samuel Eberenz, Danny Otto, Diana Rechid, Marcos Jiménez Martínez, Fernando-Esteban Montero-de-Oliveira, Felix Gulde, Lara Bartels, Maximilian Witting, Nils Matzner, Sabine Reinecke, Samuel Fischer and Veronika Strauss.

A BRIEF READER'S GUIDE

Stakeholder engagement in Carbon Dioxide Removal (CDR) research is a relatively recent but essential element in the development and governance of CDR methods. This Reflection Paper is designed for those who conduct research in the field of CDR and want to involve stakeholders. Whether planning a project, about to embark on one, or already engaged with stakeholders, this Reflection Paper will give guidance and inspiration. Based on our own research across the CDRterra programme, we present eight diverse case studies which involve stakeholder engagement and derived key learnings. In addition, a phase-by-phase guide summarizes what to consider for stakeholder engagement through the whole research project cycle.

INTRODUCTION

Carbon Dioxide Removal (CDR) is a growing field that is getting more and more attention from a variety of stakeholders across science, economy, politics, Non-Governmental Organizations (NGOs) etc. We understand stakeholders as persons, groups and organizations that are affected by or influence a (research) topic. This interest often brings together different stakeholders to acquire basic knowledge, build networks or advocate for shared interests. Here, we do not go deeper into the “why” of stakeholder engagement in research – this is sufficiently presented in literature and frameworks for transdisciplinary and responsible research and innovation (e.g., Stilgoe et al., 2013; Bammer, 2013). Instead, we reflect on the multitudes of “whats” and “hows” of CDR-related stakeholder engagement we encountered in the research programme CDRterra. The 10 consortia within CDRterra engaged with stakeholders in many different ways. Here, we share our experiences and reflections as well as synthesize learnings on how best to proceed – for researchers already engaging with stakeholders or planning to involve stakeholders in upcoming CDR-related projects.



CDRterra is a research program funded by the German Ministry of Research and Education (BMBF) which aims to improve the knowledge base for research and climate policy decisions by the German government by researching CDR methods. The deployment and scaling up of CDR introduce unique challenges and opportunities in the realm of climate policy. CDR is a complex topic, navigating economic, ecological, and social dimensions, land use, energy and biomass distribution. Since the consortia in CDRterra followed different rationales and methods for engaging stakeholders, this project network provides the chance to explore the various dimensions of engagement practices and to acknowledge and reflect on the varied purposes it serves. In this article, we do so with a special focus on engaging in the field of CDR based on the experiences and findings from the consortia of CDRterra.

Infobox on public and stakeholder engagement

Science and technology affect almost all parts of our daily life. Engaging publics in the research, development, and decision-making over disruptive science and technology is part of democratic ideals. However, what is understood as public engagement and how scientific outreach efforts to the public are carried out is subject to constant change. Conceptualisations of engagement practices and the related notion of participation can refer to a variety of practices, from simple information events to deliberative meetings and dialog or nonlinear forms of engagement, such as grassroots citizens initiatives or protests, that do not fall into the realm of institutionalized science-public interactions (e.g. Chilvers & Kearnes 2020). Likewise, the subjects of public engagement can be constructed in many different ways, such as a “general public”, specific publics, industry, policy, etc. (Barnett et al. 2012; Marres 2012, Felt et al. 2010). One specific target group of such engagement practices are stakeholders – meaning individuals or groups that can affect or will be affected by research and policy decisions, solutions, and actions (e.g. Reed et al. 2018; Eaton et al. 2022). Again, stakeholder engagement activities cover a diverse range, encompassing workshops that communicate research findings to stakeholders and transdisciplinary approaches that integrate stakeholders into the research process from the beginning (see figure 1). Many scholars and practitioners, especially in climate research, recognize the need for collaboration across diverse disciplines and with external actors. As the applied methods and motivations behind stakeholder engagement, thus, become relevant parts of the research process, there is dire and constant need for reflection and sharing of best practices.

With this publication, we also want to reflect on the ‘how’ of stakeholder engagement. It becomes paramount, considering the disparate interpretations across research disciplines as well as between the consortia. While some integrate stakeholders directly into their research for data collection, others view engagement as a distinct task, building upon research outcomes. This diversity prompts a critical examination of the motivations driving stakeholder engagement. For example, an “honest broker” in science upholds objectivity for trust, presents the current state of research, and offers diverse problem-solving options to society without endorsing any specific solution. In contrast, an “advocate” in science emphasizes researchers’ responsibility to apply findings for societal benefit, considers research impact as a performance measure, challenges the notion of expert objectivity, and acknowledges the influence of researchers’ values, promoting awareness and transparency regarding their role (Pielke, 2007; see also Bammer, 2016).

Within the vast realm of stakeholder engagement, this Reflection Paper specifically delves into its significance within the context of climate change policy options including CDR. Climate change, an existential challenge, demands innovative solutions, making stakeholder engagement an important element. On the following pages

we provide an overview of the different consortia and their engagement activities and have boundled the experiences we made into a list of learnings and suggestions on what you should consider based on our experience.

KEY LEARNINGS

The following key learnings synthesize the knowledge we would have liked to have had at the beginning of our research programme. The learnings on CDR-related stakeholder engagement are aggregated from eight case studies, presented in greater detail further below. At the end of this Reflection Paper, we also provide a practical phase-by-phase guidance for engagement that will hopefully prove helpful for planning and implementing future engagements along the full cycle of a research project.

Levels of CDR-related knowledge of stakeholders vary largely

- When discussing CDR, start with basics to avoid misunderstandings and build a common ground
- Use clear definitions and be consistent with terms

CDR is an emerging and dynamic topic, in which many stakeholders are eager to engage

- While CDR remains an abstract future topic for many, important steps are currently being taken in policy and decision-making
- Ensure timely, relevant and user-tailored transfer of results, e.g. in dissemination materials, websites or videos

Some stakeholder groups may hesitate to engage on topic of CDR

- Find ‘entry point’, either through key stakeholders or pick them up on their specific framings and topics
- Discussing future scenarios can help to facilitate a differentiated discussion of CDR and its role in achieving net-zero
- Protect personal data well and offer non-public meetings

Researchers have a special role in the CDR world

- Make clear that the separation of research and particular interest is key
- Pay attention to your role as a researcher and define your own independent framing

Stakeholders value regional engagement

- Consider region-specific suitable CDR methods, because stakeholders representation depends on it
- Snowball sampling may be useful to involve local multipliers to identify and reach local stakeholders
- Check whether all relevant perspectives are considered

Last but not least: Don’t forget about the basics of stakeholder engagement

- A well planned engagement strategy with sufficient resources allocated (see phase-by-phase guide at the end of this document)
- Continuous information flow and regular exchange
- Openness to mutual learning
- Time, trust and recognition are key for engagements

CASE STUDY #1

CDRTERRA PROGRAM-WIDE ENGAGEMENT WITH GERMAN AND EUROPEAN STAKEHOLDERS

THE FACTS

Target audience: decision-makers in politics and society

Participation level: consultation, push communication, dialogue

Geographic scope: Germany national / European stakeholders

CDR methods: all terrestrial CDR methods that are part of CDRterra

Engagement formats: workshops, consultations, presentations, webinars, fact sheets and policy briefs

THE LEARNINGS

● **Research has a special role** when engaging with stakeholders, because the scientific perspective is perceived as very trustworthy, differentiated and not biased by self-interest like e.g. a political party or a company.

● **As an honest broker**, it is therefore crucial for researchers to stay cautious and not get carried away in the euphoria (or hype) around just one or two CDR methods – and always emphasize the downsides as well as upsides and systemic complexities.

● **CDR is a very dynamic topic** and stakeholders throughout different sectors have adopted quickly to it. After two workshops spread across one year (2022-2023), the stakeholders gained significant knowledge about CDR. Yet, there are still some knowledge gaps and false assumptions that need to be addressed. Therefore it makes sense to start with the basics of CDR in almost every engagement with stakeholders to avoid misunderstandings – but be prepared to go deeper once a basic shared understanding is achieved.

● **Some stakeholder groups did not respond** to invitations and did not partake in events even though CDR touches upon several important topics for them. E.g., various conservation and environmental protection NGOs did not get involved with CDRterra apart from comments on social media platforms. One way to still get into a dialogue with them was to have informal non-public meetings to start a conversation. Small NGOs and activists may be lacking resources to

participate and could be supported with expense allowances.

THE STORY

Knowledge transfer plays a crucial role in advancing science and research in the realm of land-based Carbon Dioxide Removal (CDR) methods. For the knowledge transfer in CDRterra a transfer manager position was included in the management team. The transfer manager developed a stakeholder engagement strategy and identified the key stakeholders through a stakeholder mapping. The mapping identified different groups of stakeholders ranging from decision-makers in politics to administration, NGOs, activist groups, CDR companies and from startups to special sectors.

As CDRterra consists of 10 research projects (consortia), it was crucial to ensure collaboration across projects. To do so, a regular “jour fixe” with all project partners engaging in transfer activities was established. This meeting served to update one another on activities and avoid stakeholder fatigue as well as develop joint events.

One recurring event were the stakeholder workshops in Potsdam and Munich. These interactions provided a platform for the exchange of ideas critical to the scientific community. Primarily this served to inform stakeholders about the current research and to involve them in the evaluation of land-based CDR methods and the development of a common assessment framework. This inclusive strategy ensured that diverse perspectives contributed to the advancement of scientific endeavors.

Another aspect of knowledge transfer is the development of dissemination materials such as policy briefs and fact sheets. They provide the essential knowledge and facilitate a deeper understanding of land-based CDR methods and the assessment framework among stakeholders. This enables them to make better-informed decisions.

Throughout the duration of the research program stakeholders approached researchers to get general information and context as well as specific details regarding certain CDR methods. Another central part of transfer is, therefore, participating in events with presentations and discussions as well as informing and advising stakeholders in their process of (re)positioning themselves on CDR.

Author: Lukas Fehr, LMU Munich

Further references:

● Geden, O., Pongratz, J., Schenuit, F., & Streifer, J. (2023). CDRterra Policy Brief „Debatte zur Kohlendioxidentnahme: Wer mitreden will, sollte diese Begriffe kennen“. <https://doi.org/10.5281/zenodo.10590684>.

● CDRterra (2023): Forschungsprogramm zu landbasierten Methoden der Kohlendioxidentnahme. <https://doi.org/10.5281/zenodo.10603985>.

● CDRterra (2024): Kohlendioxidentnahmeverfahren an Land – wie sie funktionieren und warum wir sie brauchen, um unsere Klimaziele zu erreichen. <https://doi.org/10.5281/zenodo.10997202>.

CASE STUDY #2

WHAT DO ACTORS OF THE AGRICULTURAL SECTOR THINK OF CDR AND WHAT SUPPORT DO THEY NEED FROM RESEARCH?

THE FACTS

Target audience: actors from the agricultural sector ranging from farmers, biochar producers, to associations and authorities

Participation level: consultation, dialogue

Geographic scope: northern Germany

CDR methods: all biomass-related CDR methods; mainly biochar, agroforestry, soil carbon sequestration

Engagement formats: stakeholder mapping, online and in-person interviews, email exchange

THE LEARNINGS

● **Only very few stakeholders mention CDR in their work description.** For a stakeholder mapping, searching for alternative descriptions than only CDR-related terms may help.

● **Not all stakeholders frame activities as CDR.** We experienced that stakeholders know a lot about conventional CDR methods (e.g. building up humus) but do not consider them to be CDR.

● **Not all stakeholders use correct definitions for CDR.** The term CDR or carbon farming was known by all stakeholders. It was quite apparent that some stakeholders used terms that differed from those of current science (see Geden et al. 2023).

● **In general, the interviewees were open-minded towards CDR.** Some actors from the environmental agencies asked critical questions.

● **Stakeholders who apply CDR methods are well informed.** We found that, i.e. farmers who are already actively changing their management strategies know where to get their information.

● **Farmers' associations, non-governmental and environmental organizations are eager to learn more about CDR.** When they are rather new to the topic of CDR, their motivation is to learn about CDR to provide a better knowledge base for their members.

THE STORY

CDRSynTra is the synthesis and transfer consortium of the CDRterra funding line. The focus of this case study is to consider the perspective of local actors on CDR.

The question of what experiences actors from the agricultural sector have with CO₂ removal methods and what they need to implement them is a rather unexplored field of research.

We conducted a case study in Northern Germany with a focus on the agricultural sector. We started our study with a stakeholder analysis. We defined stakeholder as any individual, group or organization interested in or influenced by carbon removal options from the agricultural sector. We identified about 120 potential stakeholders from the agricultural sector in our focus region. After prioritization, we sent out 63 initiations for interviews. The reply rate with the confirmation for an interview was 46%.

Between January and July 2023, we conducted 29 mainly online interviews, including farmers, farmers' associations, start-ups producing biochar as well as governance bodies, such as administrations and state ministries.

The interviews addressed questions such as how do farmers and agricultural stakeholders experience climate change? Do farmers and agricultural stakeholders know or apply CO₂ removal methods and which barriers have they perceived? What information about CO₂ removal or climate change do they lack for applying such methods? What is important for farmers and agricultural stakeholders to assess the success of a carbon-dioxide removal method?

The final results – expected by mid 2024 - will provide an inventory of knowledge gaps and information needs. This can provide a starting point for joint developments of information prototypes in relation to climate change. On the other side, information that reveals research gaps will be distributed to the science community.

Authors: Juliane El Zohbi, Diana Rechid, GERICS/Hereon

Further references:

● El Zohbi, J., Rechid D.: "Removing carbon dioxide from the atmosphere", Open Access Government. <https://doi.org/10.56367/OAG-041-9508>.

● El Zohbi, J., Griesing, L., Rechid, D.: "CO₂-Entnahme aus der Atmosphäre: Erfahrungsberichte aus der landwirtschaftlichen Praxis". Beitrag im Konferenzband <https://www.dafa.de/wp-content/uploads/Konferenzband-vorher-mit-Sessions-S-klein.pdf>.

CASE STUDY #3

HOW CAN AGROFORESTRY-BASED CDR BE SCALED IN WAYS THAT ARE TECHNICALLY FEASIBLE AND DESIRABLE IN POLICY AND BY SOCIETAL ACTORS?

THE FACTS

Target audience: Decision-makers in public administration, representatives from private sector, civil society, research & advisory service

Participation levels: consultation, communication

Geographic scope: Central Europe: nation-wide & regional in Germany, France, Switzerland (Upper Rhine Valley)

CDR methods: land-based agroforestry systems (AFS)

Engagement formats: online and in-person interviews, interactive discussion workshops

THE LEARNINGS

- **Data** from engagements must be collected and handled systematically and ethically. Organizing notes, transcripts, and coded English translations enhances the analysis of gathered information.

- **Reaching regional stakeholders** (e.g., farmers and administration) through stakeholder-specific events and conferences facilitates spontaneous engagement.

- **Balancing between local and national levels**, particularly in federal states or regions with municipal autonomy, is essential.

- Stakeholders valued regional engagements for **building local networks**, but faced challenges securing long-term financial support to sustain them.

- **Transfer:** Science often raises complex questions that don't easily translate into practical farm management. Learning to bridge this gap is crucial.

- Through the engagements, a number of **recommendations** for supporting AFS could be developed, tested and communicated:

- Streamline legal processes
- Bridge awareness gaps through training
- Promote collaboration and trust-building through collaborative platforms, recognition, and shared learning.

Authors: Fernando-Esteban Montero-de-Oliveira, University of Freiburg (ALU); Sabine Reinecke, ALU

Further references:

- Montero-de-Oliveira, F. E., Mayr, S., & Reinecke, S. (under review). Agroforestry-based carbon removal in Central Europe: a landscape of institutions, interests, and ideas.

- Montero-de-Oliveira, F.E.; Blundo-Canto, G.; Ezzine-de-Blas, D. (2023) Under what conditions do payments for environmental services enable forest conservation in the Amazon? A realist synthesis. *Ecological Economics*, Volume 205, 2023, 107697, ISSN 0921-8009, <https://doi.org/10.1016/j.ecolecon.2022.107697>.

THE STORY

The CDR-PoEt project examined policy instruments for CDR and their fairness implications based on recognized policy principles and stakeholder deliberations. We engaged with stakeholders in three regional case studies, grounding our conceptual work with their perspectives and experiences.

The integration of trees on farmland, known as agroforestry (AFS), is gaining attention as a cost-effective land-based biological method for carbon dioxide removal (CDR) to address global warming. AFS, combining trees with agriculture or animal production, has a long tradition in Europe, especially in the Upper Rhine Valley—shared by Germany, France, and Switzerland—a climate change hotspot. Despite similar ecological and climatic characteristics, the region varies in political, administrative, cultural, and legal conditions.

The study aimed at determining the feasibility and desirability of scaling AFS in the region, considering technical, political, and social aspects. Our investigation focused on AFS deployment in the Upper Rhine Valley, considering three aspects: i) the political and institutional support or lack thereof; ii) key actors and their interests in relation to institutions and AFS; iii) positions and ideas regarding Agroforestry policies.

Through document reviews, focus groups, and semi-structured interviews, data were collected. Workshops and interviews took place between April 2022 and October 2023, involving 31 attendee/interviewees from Germany, 30 from France, and 23 from Switzerland. The diverse interviews, conducted in French, German, English, and Portuguese, were audio recorded and transcribed.

CASE STUDY #4

STAKEHOLDER ENGAGEMENT IN THREE KEY GERMAN REGIONS. HOW ARE CHANCES AND HURDLES FOR BIOMASS-BASED CDR EVALUATED IN DIFFERENT REGIONS?

THE FACTS

Target audience: stakeholders, practitioners, NGOs and policy makers

Participation level: dialogue, feedback on research, problem framing

Geographic scope: Mecklenburg Vorpommern, Mitteldeutschland, Rhein-Neckar

CDR methods: biomass based methods (forestry, soil carbon, biochar, long-lived building materials, paludi culture, BECCS)

Engagement formats: surveys, interviews, and stakeholder workshops (online and in-person), further fact sheet feedback, push communication

THE LEARNINGS

● **A successful engagement strategy can be based on consecutive practices** starting with a survey, followed by in-depth interviews, and workshops. This includes a continuous information flow.

● **To inform stakeholders, factsheets are an ideal format.** Researchers from the BioNET project published fact sheets regarding 24 biomass-based CDR methods that were critically discussed by stakeholders.

● **Mutual learning is a promising approach.** The stakeholders came with a strong expertise in their own application though sometimes lacked knowledge of other technologies in the field of biomass based CDR.

● **Great interest but also hesitation.** In contacting various stakeholder groups, we found great interest in discussing biomass-based CDR methods, but also strong hesitation by non-governmental organizations.

● **Regional differences in availability and willingness of stakeholders were present.** Some biomass-based CDR methods were only represented by stakeholders in some regions, i.e. such as paludi culture in the rural north.

● **Using a serious game can be a valuable mapping and discus-**

sion tool. It helped to map the various biomass-based CDR technologies and the conflicts that emerge when trying to harmonize a portfolio strategy.

THE STORY

The BioNET project looked at three different regions in Germany, which are either rural north or urban-industrial south-east and south-west.

The early stage of biomass-based CDR in Germany brings about many uncertainties around the implementation of the technologies. Stakeholders criticized the tension between the urgent need to develop CDR while the political and societal support for these measures are perceived to be very low, and necessary regulatory frameworks and economic incentives are not sufficiently in place.

The BioNET project established fact sheets for a large variety of biomass-based CDR methods to inform policy makers, scholars, and other stakeholders. These fact sheets were part of the discussion in workshops with the stakeholders, where they gave feedback on knowledge transfer and information needs.

We found that there is no silver bullet for biomass-based CDR. From the stakeholder point of view, no single technology is already feasible, reliable, trusted, and accepted. There seems to be medium to high knowledge and relevance of biomass-based CDR, but there are many hurdles regarding policy and societal support. Stakeholders are lacking support from socio-political actors and are unsure about the future relevance of biomass-based CDR. Biomass providers and industry are unsure if investment into biomass-based CDR in Germany will be sustainable for their business.

After regional-focused engagement, a last cross-regional online workshop brought the stakeholders together. A serious game was developed to let stakeholders arrange CDR technologies to be implemented in Germany in the future. The trust built during the long-term stakeholder process helped with these more experimental methods

Authors: Nils Matzner, TU Munich/UFZ Leipzig, Danny Otto, UFZ Leipzig

Further references:

● BioNET fact sheets for 24 technologies: <https://datalab.dbfz.de/bionet/home>.

● Otto, D., Matzner, N. (2024): Let us Get Regional. Exploring Prospects for Biomass Biomass-Based Carbon Dioxide Removal on the Ground. C - Journal for Carbon Research. <https://doi.org/10.3390/c10010025>.

● Borchers, M., Thrän, D., Chi, Y., Dahmen, N., Dittmeyer, R., Dolch, T., et al. (2022). Scoping carbon dioxide removal options for Germany – What is their potential contribution to Net-Zero CO₂? *Frontiers in Climate*, 4, Article 810343. DOI: 10.3389/fclim.2022.810343.

● Otto, D., Thoni, T., Wittstock, F., & Beck, S. (2021). Exploring Narratives on Negative Emissions Technologies in the Post-Paris Era. *Frontiers in Climate*, 3, Article 684135. DOI: 10.3389/fclim.2021.684135.

CASE STUDY #5

WHAT CDR POTENTIALS ARISE FOR GERMANY - TAKING INTO ACCOUNT SOCIO-ECONOMIC DEVELOPMENT PATHWAYS, CLIMATE SCENARIOS, FUTURE LAND USE AND CDR POLICIES - AND WHAT ARE THE ASSOCIATED SYNERGIES/TRADE-OFFS?

THE FACTS

Target audience: stakeholders, practitioners, NGOs and policy makers

Participation levels: consultation, involvement, feedback on research and communication of results

Geographic scope: Germany national

CDR methods: BECCS, Forest management, Afforestation/Reforestation

Engagement formats: interviews and survey as well as stakeholder workshops

THE LEARNINGS

- **Background knowledge on and definitions of CDR vary greatly among stakeholders and/or institutions.** The term CDR is either used differently or not at all.

- **Great willingness among stakeholders to contribute their own expertise.** We received valuable information and suggestions for the shared socio-economic pathways (SSPs) and adapted the workshops accordingly.

- **Stakeholder mapping is crucial:** To include critical voices and different perspectives, stakeholder selection should be as heterogeneous as possible (e.g., regarding background, age, position, gender, etc.).

- **Continuity in the cooperation** with stakeholders is important for building trust and strengthening knowledge exchange. The continuity also improved the feedback during SSP development, as stakeholders progressively became familiar with the methodology.

- **Dealing with historical and future responsibility:** Stakeholders were very interested in discussing Germany's historical and future responsibility in a global context.

- **Building a network of stakeholders takes time** – with an “upcoming topic” like CDR, it is not always clearly evident/visible who is the responsible person in an organization. It took time to identify relevant actors.

- **Continuous knowledge transfer is key:** As CDR is an “upcoming topic”, stakeholders are expected to receive scientific input on current findings at each workshop.

Authors: Maximilian Witting, Felix Gulde (LMU Munich)

Further references:

- Gregor, K., Krause, A., Reyer, C.P.O., Knoke, T., Meyer, B.F., Suvanto, S., Rammig, A. (2024): Quantifying the impact of key factors on the carbon mitigation potential of managed temperate forests. Carbon Balance and Management.
- Egerer, S., Frank, S., Pongratz, J. (2023): Measures of effectiveness to compare the climate mitigation potential of afforestation and BECCS. Repository Garschagen, M., Witting, M., Gulde, F., Neuber, F., Baatz, C. (in preparation): Assessing the feasibility and desirability of Carbon Dioxide Removal Pathways – A framework for science and policy advice.
- Witting, M., Gulde, F., Langer, M., Garschagen, M. (in preparation): Narratives for land-use extended shared socioeconomic pathways for Germany.

THE STORY

The STEPSEC project aims to assess the feasibility and desirability of terrestrial CDR potentials for Germany under socio-ecological constraints. This includes, among others, the development of shared socio-economic development pathways (SSPs) together with stakeholders from NGOs, ministries, administration and lobby groups. We engaged with stakeholders in three workshops, several interviews and an online survey.

Part of the project idea was to involve the selected stakeholders in the long term and to incorporate their expertise, evaluation and experience into the research process at various points in time (all three workshops). The main challenge in the stakeholder selection process was to identify those who could provide both helpful input in the development of land-use extended SSPs and guidance on important and relevant evaluation criteria for the feasibility and desirability assessment of CDR options.

The first workshop focused on the formulation of visions for the future of CDR and land use in Germany and the identification of main factors influencing its national socio-economic development. Based on these influencing factors we developed a zero-order draft of land use extended SSPs for Germany that was discussed and validated with stakeholders during the second workshop. In addition, the SSPs were matched to the visions of future land use, allowing the identification of several potential synergies and trade-offs as well as gaps towards achieving our climate goals. Furthermore, the second workshop included the discussion of projections of previously identified indicators to quantify the SSP narratives up to 2100. These serve as input data for an agent-based model that looks at future land use in Germany under various assumptions (e.g., socio-economic, ecological, demand, climate, etc.). In a second round, the SSPs were further refined and validated through expert interviews with selected stakeholders. In addition, an online survey was conducted that aimed to obtain stakeholders' evaluation of important criteria/indicators assessing the feasibility and desirability of CDR options. In the final workshop, stakeholders discussed the research results against the background of the visions already identified. The policies necessary for the implementation of CDR in each scenario were also discussed.

CASE STUDY #6

STAKEHOLDER ENGAGEMENT WITHIN THE GONASIP PROJECT – EXPLORING STAKEHOLDERS’ PERCEPTIONS TOWARDS AGRICULTURAL AND URBAN CDR

THE FACTS

Target audience: Wide range of stakeholders related to agriculture, especially policy & administration, farmers & landowners, carbon farming business, and the general public

Participation level: Dialogue, consultation, expertise-seeking, keynotes/ expert presentations, participatory impact assessment

Geographic scope: Germany national

CDR methods: Selected land use-/biomass-based options such as agroforestry, soil carbon sequestration, afforestation, rewetting of peatlands, urban afforestation

Engagement formats: Workshops and focus group discussions with online survey-based choice experiments

THE LEARNINGS

- All involved stakeholders were very **interested** in the topic and **saw the necessity** to deploy CDR on a large scale.
- There seems to be willingness **to pay a significant amount of money** by the general public to support CDR deployment.
- According to the general public, CDR should be deployed primarily to provide ecosystem services other than the **storage of greenhouse gasses**. The latter is **mainly seen as a add-on**.
- **CDR should have already been deployed many years ago**. Many stakeholders told us that we were late to the party.
- **NGOs were hard to get in touch with** although largely willing to participate in our formats.
- **Interest in follow-up formats and learning about our research results** was expressed by many stakeholders.
- **Stakeholders prefer policy instruments that promote CDR measures** (e.g., financially) over those that restrict BAU land use options, in order to maintain sovereignty over land-use decisions.

THE STORY

The GONASIP project analyzes a set of selected CDR methods in agriculture (carbon farming) and urban afforestation. The focus is on the added value for society and costs arising from the use of the selected CDR methods. In particular, GONASIP examines what CO₂ removal potentials, co-benefits, costs, and trade-offs are heterogeneously associated with the implementation of the researched CDR measures. One of the foci is how co-benefits and costs of the CDR measures are assessed by the affected stakeholder groups. With this in mind, a first roundtable workshop with all relevant stakeholder groups. This was followed by deliberative choice experiments, which were conducted in 2023 with a representative sample for Germany’s population. A second workshop was also conducted in 2023, which aimed to understand barriers and facilitators for urban afforestation. Experts were invited to give talks, and relevant stakeholders (city administrations, NGOs) exchanged with the research team and the external experts. Insights from this workshop were used for the preparation of an experiment on urban afforestation, which aimed to understand how co-benefits and trade-offs are valued by citizens. A further workshop with stakeholders was conducted in 2024, to explore what the results from the previous workshop imply for an efficiency-oriented development of the regulatory framework for the use of CDR measures. The aim was assessing the impacts of strategies associated with different policy instruments and demonstrating specific policy options. The discussion focussed on fostering carbon farming or restricting less climate-friendly alternatives, on relevant economic, ecological and sociocultural aspects, to revise policy options based on stakeholder feedback, and identify the options with the highest added value, which can then be communicated to decision-makers. One key insight from the engagement was that certification and monitoring are hurdles to be overcome, as both are not working properly right now. Especially regarding permanence and additionality of CDR through carbon farming there is a long way to go in the certification business.

Authors: Samuel Fischer, Helmholtz-Centre for Environmental Research (UFZ); Veronika Strauss, Leibniz-Centre for Agricultural Landscape Research (ZALF); Lara Bartels, Leibniz-Zentrum für Europäische Wirtschaftsforschung (ZEW)

Further references:

- Strauss, V., Paul, C., Dönmez, C., Burkhard, B. (in preparation). Carbon farming for climate change mitigation and ecosystem services – potentials and influencing factors.

CASE STUDY #7

EXPLORING STAKEHOLDERS' DIVERSE PERSPECTIVES ON DIRECT AIR CAPTURE IN ICELAND AND POLICY INSTRUMENTS FOR CDR IN EUROPE.

THE FACTS

Target audience: Decision-makers in public administration, industry, representatives from (civil) society and research

Participation levels: Consultation, push communication, dialogue

Geographic scope: Iceland, Germany, and EU

CDR methods: DACCS, also in relation to other CDR methods

Engagement formats: Interviews, Science-Stakeholder-Workshops

THE LEARNINGS

- **Entry points to local stakeholders and trust building** are key for local case studies. Researchers from outside a country or community should make sure they get in touch with key stakeholders and avoid locally specific pitfalls. In our case, this meant early exchange with local researchers and the CO₂-storage pioneer, Carbfix.

- **Existing stakeholder platforms**, such as the Icelandic Climate Council Loftslagsráð, can be representative stakeholders. Additionally, they already have a mandate from diverse societal actors to undertake dialogue around climate change and mitigation topics.

- **Defining your own independent framing.** Be aware that “entry points” come with their own framing and biases, e.g., regarding specific CDR methods or policies. Separation of research and particular interests is key.

- **Representation can be hard work.** Next to relying on local contacts, check whether all relevant perspectives are considered, including critical voices and marginalized groups – and make an effort to engage with them as well.

- **Making time to discuss futures.** When discussing the desirability of CDR methods, the time axis along mitigation pathways can provide a valuable framing to move beyond superficial pro/con arguments. However, to get to such a differentiated exchange, time and trust is needed.

THE STORY

The second case study of CDR-PoEt focused on Direct Air Carbon Capture & Storage (DACCS).

The DACCS pilot plant run by Climeworks and Carbfix in Iceland comes with the unique opportunity to be used as one of the three case studies. For this, we conducted semi-structured interviews with 14 stakeholders from 10 different Icelandic organizations. Interviewees included representatives of the CO₂-storage provider Carbfix, as well as regional and local administration, environmental NGOs and activists, business associations, and academia. Four of the interviewees were, at the time of the interview, members or vice-members of the Icelandic Climate Council (Loftslagsráð). This council is an independent body whose role is to hold authorities accountable and provide advice on policy objectives and specific measures related to climate change. Members of Loftslagsráð are appointed by a variety of organizations, representing the business community, academia, municipalities, the labor movement, and environmental NGOs.

The interviews were analyzed qualitatively, with regard to interviewees' perspectives on the present DACCS pilot plant, framing and mental models of CDR methods discussed. They further touched on concerns and perspectives on a potential scale-up of DACCS and the storage of imported CO₂ from point sources in Europe, painting a differentiated landscape of Icelandic stakeholder perspectives (c.f. Oh et al.).

Insights from the interviews in Iceland were used as background knowledge for publications and picked up at stakeholder workshops with institutional stakeholders active on the German and EU policy level, focused on the desirability and feasibility of policy instruments (c.f. Apergi et al.). We found that stakeholders who are skeptical of DACCS today were still open to discussing the conditions under which DACCS could be desirable in 2050.

Author: Samuel Eberenz, Stiftung Risiko Dialog

Further references:

- Oh, S., Honegger, M., Eberenz, S., Wallis, O., & Michaelowa, A. (under review). Unpacking BECCS and DACCS: Actor Interests and Power Dynamics in CCS, BECCS and DACCS.

- Apergi, M., Hellmich, M., Eberenz, S., Honegger, M., Reinecke, S., & Tänzler, D. (under review). Productive in Disagreement: Stakeholder deliberation insights on carbon dioxide removal in Germany.

CASE STUDY #8

TRANSDISCIPLINARY RESEARCH TO ASSESS BENEFITS, COSTS AND RISKS FOR FARMERS CONVERTING THEIR LANDS INTO AGROFORESTRY

THE FACTS

Target audience: Farmers, decision-makers in public administration, research & advisory service, private Sector, civil society

Participation levels: consultation, communication

Geographic scope: Germany

CDR methods: Agroforestry Systems

Engagement formats: Online and in-person interviews, interactive discussion workshops

THE LEARNINGS

- **Feedback to stakeholders must be handled quickly** to minimize the possibility of them losing interest.

- **Transdisciplinary research processes are challenging** because of clashing professional calendars between the analysts (teaching mostly in winter) and farmers (lower activity season in winter).

- Within the current framework of project funding conditions, **it is difficult to financially compensate informants**. This does not help to sustain their engagement, which after all, is a consultancy service.

- **Trust-building is key in transdisciplinary research processes**. It takes time to develop this bond when the network has to be created from scratch.

- Farmers think that more agroforestry demonstration plots are necessary. The current research strategy of Germany, which finances living-lab-based projects, aims to fulfill this demand.

- Support for wider transdisciplinary research beyond a few living-labs is also necessary as another form of knowledge dissemination and to advance possible future outcomes.

THE STORY

ABCDCR assesses the benefits and trade-offs of agroforestry transitions at different scales: from the farmers' and decision makers' perspectives regarding land use, up to the global system implications of large scale agroforestry deployment.

The integration of trees on farmland, known as agroforestry systems (AFS), provides the option to mitigate global warming via many different mechanisms, including carbon dioxide removal (CDR). AFS are also gaining attention from farmers as an effective option to adapt to ongoing environmental changes. There are also a growing number of NGOs that promote AFS.

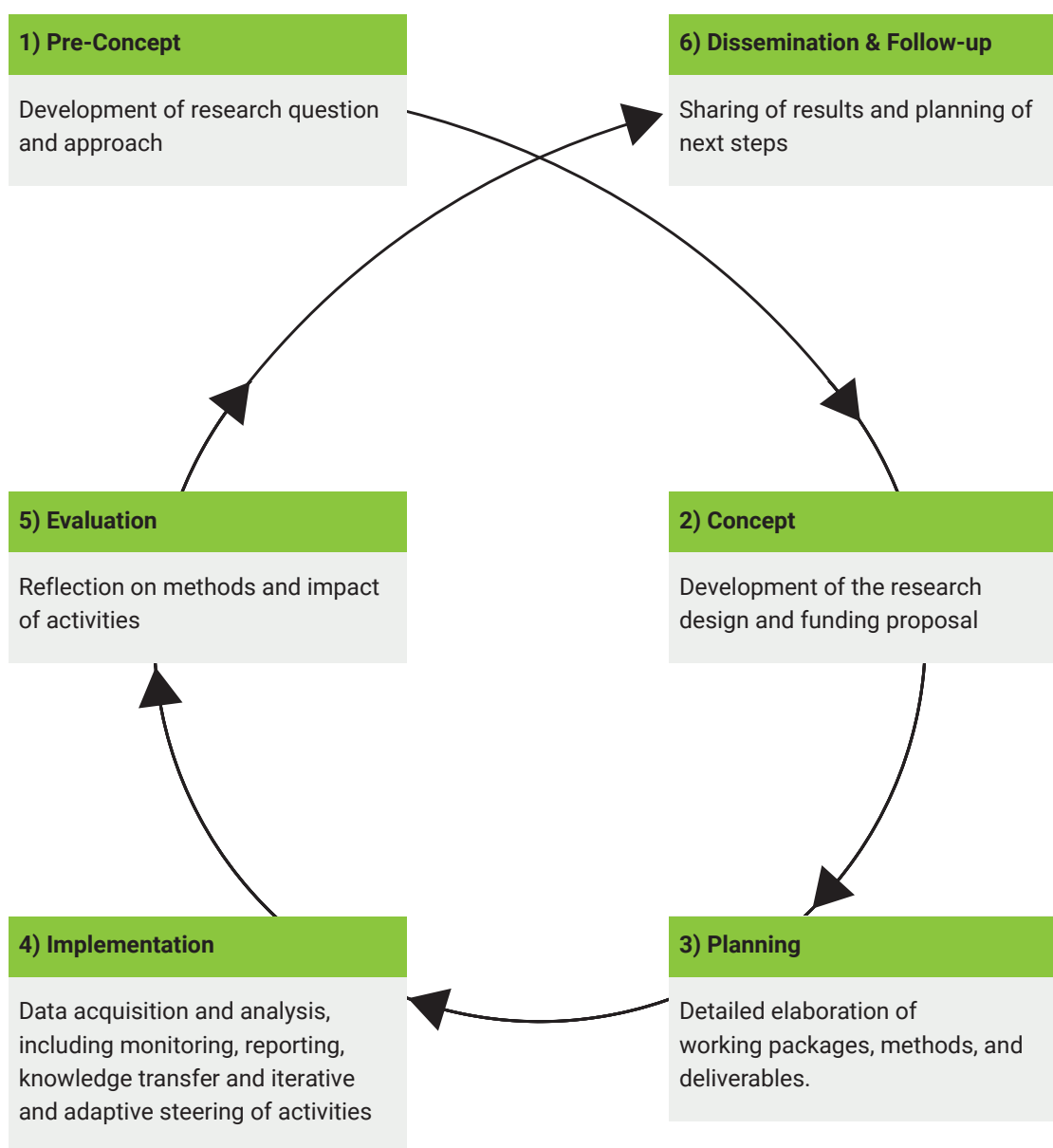
For the farm-level assessment, the project aims to determine if a farmer should consider agroforestry as a worthy land use investment to improve their livelihood: specifically, whether to integrate trees as a functional component of their agroecosystem and business model or not. The research process involved the co-development of quantitative models with practitioners, so the results would be meaningful for a wider group of farmers'. The research results can also provide useful information to develop policies coherent with national- and European governance strategies, such as the Green Deal.

The engagement with stakeholders started with an information exchange, which was followed by a transdisciplinary workshop. In the workshop, the motivations and concerns of farmers about the conversion of treeless agricultural lands into agroforestry were addressed. The changes needed to enable the adoption of AFS were also discussed. The process continued with communication via e-mail and online interviews to co-create holistic models that include all the variables relevant for a farmer to make a decision on adopting agroforestry. Several models were developed to represent the most common farm categories in Germany, defined according to administrative, biophysical, product portfolio, and functions of the woody component criteria.

Author: Marcos Jiménez Martínez, Universität Bonn

Phase-by-phase guidance for engagement along the cycle of research projects

While there was no guide that all consortia followed in the same way, there is a process for stakeholder engagement that applies in almost every project. The following step-by-step guide is an example of how a project with stakeholder engagement can be carried out.



Project-Cycle Phase	Recommendations for considerations
1) Pre-Concept Development of research question and approach	<ul style="list-style-type: none"> ● Explore which level(s) and target group(s) of engagement you are aiming for and why: Are you planning to inform, consult, involve or even collaborate and co-create with stakeholders? Be explicit about your reasons for and the consequences of these choices. ● Early informal engagement: Consider involving stakeholders early on for the framing and development of research questions.
2) Concept Development of the research design and funding proposal	<ul style="list-style-type: none"> ● Mapping: Start with an initial stakeholder mapping – this can be “quick-and-dirty” for a relatively overseeable project or more methodologically thorough. Be aware that, as CDR is a rather new topic, not all stakeholders of interest may be aware of the topic. Stakeholders can, for example, be mapped in an interest-influence matrix or in a more relational format. ● Consolidate aims and level of engagement as well as whether/how outcomes can influence the research: plan for touchpoints and resources for coordination and two-way transfer of knowledge. ● Formative questions: what are reasons and incentives for the targeted stakeholders to participate in engagement? What is your conception of your role as a researcher with which you go into the engagement (e.g., honest broker, advocate, change agent)? ● Budget for stakeholder engagement and consider involving partners in the consortia who are experienced with stakeholder engagement methods and facilitation.
3) Planning Detailed elaboration of working packages, methods, and deliverables.	<ul style="list-style-type: none"> ● Prioritize your stakeholders, identify key stakeholders and potential door-openers and entry points. ● Reflect on ethical aspects and biases of this process (e.g., affectedness, marginalization, representation, conflicts of interest) ● Exploratorily exchange with key stakeholders to reflect, complement and consolidate mapping and get introduced to relevant stakeholders. ● Review media coverage and political debates on the fast-evolving topic of CDR in your target region. ● Framing and approaches: Check against biases induced by exchange with key stakeholders and discursive/market hypes around a dynamic topic such as CDR. ● Data handling: Plan for how data are documented and exactly for what the data from engagement are used (e.g., publications) and ensure that (A) privacy requirements and consensus of participants are granted, and (B) fellow researchers are prepared to incorporate inputs and insights from the engagement in their scientific work.
4) Implementation Data acquisition and analysis, including monitoring, reporting, knowledge transfer and iterative and adaptive steering of activities	<ul style="list-style-type: none"> ● Common ground: Start each exchange with (re-)evaluating level of knowledge and adapt to low or high levels with knowledge transfer or deep-dives, staying ahead of dynamic debates and topics around CDR ● Role as research: Beware of letting the “hype” around CDR as a whole or specific CDR methods distract you from your role as a researcher and your research questions. You can still ride the hype as a conversation starter (or make it subject to your research). ● Representation: Periodically revisit the stakeholder mapping to include so far “forgotten”, “invisible” or “newly emerging” stakeholder groups of relevance, especially marginalized and/or locally affected groups - depending on your decision in the pre-phase. ● Pro-active transfer for impact: Dynamics in the context of CDR are high and findings in the final report may quickly become outdated. If you aim to support science-based policy and decision-making with your research, make sure that insights and advice from the research and the stakeholder engagement in particular is transferred (back) to policy and decision-makers in an iterative and timely manner. ● Periodical exchange between stakeholders and transfer managers and more conceptually-working researchers can help to ensure a two-way transfer and facilitate transdisciplinary co-creation of knowledge

Project-Cycle Phase	Recommendations for considerations
5) Evaluation Reflection on methods and impact of activities	<ul style="list-style-type: none"> ● Evaluate the process and impacts of a stakeholder engagement (if feasible), e.g., workshops or other intense engagements. Evaluation schemes from other fields can be adapted if nothing is available for an emerging topic such as CDR. ● Pre- and post-engagement surveys can be used to evaluate the impact of the engagement on participants' knowledge and opinions. ● Transfer within project: Evaluate within the research consortium whether the transfer of insights from the stakeholder engagements to the conceptual research and publication is actually happening and take steps to ensure this if needed.
6) Dissemination & Follow-up Sharing of results and planning of next steps	<ul style="list-style-type: none"> ● Share results, practical implementations and documentation with stakeholders – in a rolling manner and at the end of the project. ● Plan potential follow-ups or spin-off activities with those interested and share any research-related outlooks with them. ● Reflection: A final workshop or survey can be used to reflect on practical implications and receive feedback on the engagement process.

REFERENCES

- Apergi, M., Hellmich, M., Eberenz, S., Honegger, M., Reinecke, S., & Tänzler, D. (under review). Productive in Disagreement: Stakeholder deliberation insights on carbon dioxide removal in Germany.
- Bammer, G. (2016). Advocate or Honest Broker? Retrieved from <https://i2insights.org/2016/11/22/advocate-or-honest-broker>.
- Barnett, J., Burningham, K., Walker, G., & Cass, N. (2012). Imagined Publics and Engagement around Renewable Energy Technologies in the UK. *Public Understanding of Science*, 21(1), 36–50. DOI: 10.1177/09636625103656.
- Borchers, M., Thrän, D., Chi, Y., Dahmen, N., Dittmeyer, R., Dolch, T., et al. (2022). Scoping carbon dioxide removal options for Germany – What is their potential contribution to Net-Zero CO₂? *Frontiers in Climate*, 4, Article 810343. DOI: 10.3389/fclim.2022.810343.
- CDRterra (2024): Kohlendioxidentnahmeverfahren an Land – wie sie funktionieren und warum wir sie brauchen, um unsere Klimaziele zu erreichen. <https://doi.org/10.5281/zenodo.10997202>.
- CDRterra (2023): Forschungsprogramm zu landbasierten Methoden der Kohlendioxidentnahme. <https://doi.org/10.5281/zenodo.10603985>.
- Centre for Effective Services (2022). An Introductory Guide to Implementation. <https://implementation.effectiveservices.org/enablers/stakeholder-engagement>.
- Chilvers, J., & Kearnes, M. (2020). Remaking Participation in Science and Democracy. *Science, Technology, & Human Values*, 45(3), 347–380. DOI: 10.1177/01622439198508.
- Eaton, W. M. et al. (2022). Advancing the Scholarship and Practice of Stakeholder Engagement in Working Landscapes: A Co-Produced Research Agenda. *Socio-Ecological Practice Research*, 4(4), 283–304. DOI: 10.1007/s42532-022-00132-8.
- Egerer, S., Frank, S., Pongratz, J. (2023): Measures of effectiveness to compare the climate mitigation potential of afforestation and BECCS. Repository.
- El Zohbi, J., & Rechid, D. (in preparation). A stakeholder perspective on the assessment of CDR - a case study from Northern German agricultural sector.
- Felt, U., & Fochler, M. (2010). Machineries for Making Publics: Inscribing and De-scribing Publics in Public Engagement. *Minerva*, 48(3), 219–238. DOI: 10.1007/s11024-010-9155-x.
- Garschagen, M., Witting, M., Gulde, F., Neuber, F., Baatz, C. (in preparation): Assessing the feasibility and desirability of Carbon Dioxide Removal Pathways – A framework for science and policy advice.
- Geden, O., Pongratz, J., Schenuit, F., & Strefler, J. (2023). CDRterra Policy Brief “Debatte zur Kohlendioxidentnahme: Wer mitreden will, sollte diese Begriffe kennen”. <https://doi.org/10.5281/zenodo.10590684>.
- Gregor, K., Krause, A., Reyer, C.P.O., Knoke, T., Meyer, B.F., Suvanto, S., Rammig, A. (2024): Quantifying the impact of key factors on the carbon mitigation potential of managed temperate forests. *Carbon Balance and Management*.
- Marres, N. (2012). *Material Participation: Technology, the Environment and Everyday Publics*. Houndmills, Basingstoke, Hampshire; New York: Palgrave Macmillan.
- Montero-de-Oliveira, F. E., Mayr, S., & Reinecke, S. (under review). Agroforestry-based carbon removal in Central Europe: a landscape of institutions, interests, and ideas.

- Montero-de-Oliveira, F.E.; Blundo-Canto, G.; Ezzine-de-Blas, D. (2023) Under what conditions do payments for environmental services enable forest conservation in the Amazon? A realist synthesis. *Ecological Economics*, Volume 205, 2023, 107697, ISSN 0921-8009, <https://doi.org/10.1016/j.ecolecon.2022.107697>.
- Oh, S., Honegger, M., Eberenz, S., Wallis, O., & Michaelowa, A. (under review). Unpacking BECCS and DACCS: Actor Interests and Power Dynamics in CCS, BECCS and DACCS.
- Otto, D., Matzner, N. (2024): Let us Get Regional. Exploring Prospects of for Biomass Biomass-Based Carbon Dioxide Removal on the Ground. C - *Journal for Carbon Research*. DOI: <https://doi.org/10.3390/c10010025>.
- Otto, D., Thoni, T., Wittstock, F., & Beck, S. (2021). Exploring Narratives on Negative Emissions Technologies in the Post-Paris Era. *Frontiers in Climate*, 3, Article 684135. DOI: 10.3389/fclim.2021.684135.
- Pielke, R. A. (2007). *The honest broker. Making sense of science in policy and politics*. Cambridge: Cambridge University Press.
- Reed, M. S. et al. (2018). A Theory of Participation: What Makes Stakeholder and Public Engagement in Environmental Management Work? *Restoration Ecology*, 26(S1), 7–17. DOI: 10.1111/rec.12541.
- Schmidt L, Domptail S, Klintenberg P, et al (2013) Transdisciplinary research and stakeholder involvement. A review of the TFO approach. *Biodivers Ecol* 5:195–212. doi:10.7809/b-e.00275.
- Stilgoe, J., Owen, R., and Macnaghten, P. (2013). Developing a Framework for Responsible Innovation. *Research Policy* 42, no. 9: 1568–80. DOI: 10.1016/j.respol.2013.05.008.
- Strauss, V., Paul, C., Dönmez, C., Burkhard, B. (in preparation). Carbon farming for climate change mitigation and ecosystem services - potentials and influencing factors.
- Witting, M., Gulde, F., Langer, M., Garschagen, M. (in preparation): Narratives for land-use extended shared socioeconomic pathways for Germany.



PUBLISHING INFORMATION

Concept, writing, curation of case studies: Juliane El Zohbi, Lukas Fehr and Samuel Eberenz.

Contributions to text and case studies by Danny Otto, Diana Rechid, Marcos Jiménez Martínez, Fernando-Esteban Montero-de-Oliveira, Felix Gulde, Lara Bartels, Maximilian Witting, Nils Matzner, Sabine Reinecke, Samuel Fischer and Veronika Strauss.

Design and graphics: Björn Maier

Cite as: Zohbi, J., Fehr, L., Eberenz, S., Otto, D., Rechid, D., Jeménez Martínez, M., Montero-de-Oliveira, F.-E., Gulde, F., Bartels, L., Witting, M., Matzner, N., Reinecke, S., Fischer, S., Strauss, V. (2024): Engaging Stakeholders in Your Carbon Dioxide Removal Research. <https://doi.org/10.5281/zenodo.10848490>.

The authors would like to thank Mary Hellmich, Ingrid Schulte and Bettina Steuri for reviewing the reflection paper – and all other consortia members of the research program CDRterra for sharing their experiences and learnings.

This work has received funding from the Federal Ministry of Education and Research.

SPONSORED BY THE



Federal Ministry
of Education
and Research

This work is published under CC BY-SA 4.0 license.

www.cdrterra.de

2024