Hochschule Fulda
University of Applied Sciences

Discussion Papers in Business and Economics

Sebastian Bleuel[a], Carsten Müller[b]

Unlocking the Potential: Expert Insights on the Long-Term Compatibility of Forest Carbon Credits with the EU ETS

Discussion Paper No 24
August 2023

[a] Ulm University, Institute of Strategic Management and Finance, Helmholtzstraße 22, 89081 Ulm, Germany.

[b] Fulda University of Applied Sciences, Department of Business, Leipziger Straße 123, 36037 Fulda, Germany.

Herausgeber/Editor:
Hochschule Fulda/Fulda University of Applied Sciences
Fachbereich Wirtschaft/Faculty of Business
Marquardstraße 35
36039 Fulda
Deutschland/Germany
www.hs-fulda.de/wirtschaft

ISSN: 2194-7309

Abstract

Forest-based carbon credits are crucial in most Emissions Trading Schemes as they offer a cost-efficient means of offsetting hard-to-abate emissions. To date, this has not been the case in the European Union Emissions Trading Scheme (EU ETS). However with the Paris Agreement rulebook now finalized, there could be an opportunity to revive this flexibility mechanism in European climate policy. Based on 24 expert interviews, we examined the forest potential within the EU ETS across short, medium, and long-term time frames. We found that the compliance system will remain blocked until 2030, but there is a greater likelihood of transitioning towards the inclusion of forest-based removals and reductions in the long term. Although forestry projects have faced significant reluctance in the EU, there is unanimous agreement on the importance of both technological solutions and such initiatives for climate protection. To fully leverage the potential of forest activity in the future, it will be necessary to adopt different methods and tools (e.g., liability regimes), stricter legislation on socio-economic factors (e.g., land use rights), overcoming implementation hurdles (e.g., do not compromise deterrence through mitigation), and maintaining an open political stance. This study provides a comprehensive perspective on the barriers and potentials of forestry projects within the compliance system of the EU which is essential to be addressed when re-opening the discussion on future eligibility. The implication of the findings suggest an immediate start to adopt to the barriers for carbon credit readiness in the next phase of the EU ETS beginning of 2030.

Keywords

European Emissions Trading Scheme, Paris Agreement, Forest carbon, Forest carbon sequestration, Trade barriers

Table of Contents

List of Figures

List of Tables

1. Introduction

In November 2022, the Conference of Parties (CoP27) in Sharm el-Shaik ended with an unequivocally short-term demand for climate action: *"The IPCC report […], told us that global emissions need to start a downward trajectory by 2025. That's only two years away. The IPCC also told us to cut emissions by nearly half by 2030. That's only seven years away. In this text, we have been given reassurances that there is no room for backsliding"* (UNFCCC, 2022). It is crucial to keep the Paris Agreement (PA) goal alive of limiting the global temperature rise to well below 2° Celsius, and preferably to 1.5° Celsius, compared to pre-industrial levels (Peters et al., 2013).

The PA superseded the Kyoto Protocol and was enforced in 2016. Whereas the Kyoto Protocol employed a top-down strategy to allocate greenhouse gas emissions (GHGs) reduction targets, the core element of the PA is a bottom-up approach to self-commitments. Nationally determined contributions (NDCs) reflect the parties' mitigation and adaptation activities submitted throughout a five-year cycle, with each submission exhibiting increasingly ambitious targets (UBA, 2021). A key component of the PA is the fostering of voluntary international cooperation through market mechanisms based on the long-sought Article 6 rulebook finalization (UNFCCC, ND; Marcu 2021).

This study focuses on the European Union Emissions Trading Scheme (EU ETS), which is not only the world's first and still largest cap-and-trade system, but also the EU's key climate instrument for achieving its NDCs. This accounts for approximately 41% of total EU emissions. According to the current proposal to amend the EU ETS, the emissions reduction target will increase from 43% to 61% by 2030 compared to 2005 levels, and the linear reduction factor (cap increase) will increase from 2.2% to 4.2% p.a. by 2021 (European Commission, 2021b). Whereas the European Union is an active participant in CoP meetings and UN-level negotiations, such as the Article 6 rulebook, it does not intend to make use of newly established instruments to meet national targets. The use of international credit, including domestic credit, has been prohibited under the EU ETS since 2021 (European Commission, 2021a) and the European Union recognizes the imperative for more ambitious in reducing emissions.

Against this background, this study explores the primary impediments to the tradability of carbon credits EU ETS, particularly those stemming from forestry projects. Based on this understanding, the second objective of this study is to identify key design elements to address the hurdles and contribute to policy discussions about the European climate strategy and its main instrument, the EU ETS.

The stage is set by a concise holistic review of the regulatory perspective of carbon credits, broken down into forestry projects (Section 2). We supplement the regulatory perspective using a qualitative research approach and interviews with European experts from different disciplines (Section 4). By following this approach, we obtain a well-rounded perspective that enables us to propose policy adjustments in the EU ETS and conclude the paper (Section 5).

Our study addresses the following research questions: 1) What is the perspective of the EU ETS in trading Phase IV (until 2030) regarding flexibility mechanisms? 2) Does the ambition to increase and achieve net zero facilitate the reflection of carbon credits under the EU ETS? 3) What challenges must be addressed to increase the likelihood of forest carbon credits in the EU ETS compliance regime? 4) What are the determinants of improving the probability of future reflection of forest carbon credits in the compliance market?

2. Emissions Trading Schemes globally and in the EU

This section serves as the basis for the interlink between an Emissions Trading System in the form of cap-and-trade (e.g., EU ETS) and a crediting mechanism (e.g., Clean Development Mechanism), both of which present carbon market mechanisms. We examine globally-rising ETSs that are regularly combined with a crediting mechanism, albeit limited. Finally, our viewpoint is based on a European perspective, with a specific focus on carbon credits derived from forestry projects.

2.1 Cap-and-trade schemes design issue: carbon credits for offsetting purposes

Emissions Trading Schemes (ETS) are a market-based approach to developing a cap-and-trade system or a baseline-and-credit system (World Bank, 2021). We consider an ETS as a cap-and-trade system, which is widely regarded as a cost-efficient instrument for reducing GHG emissions and stimulating investments in carbon-reducing technologies.

The Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC) laid the foundations for the first international emissions-trading scheme, which was accompanied by two flexibility mechanisms: Clean Development Mechanism (CDM) and Joint Implementation (JI). The CDM and the JI are examples of crediting mechanisms that are also regularly referred to as offset mechanisms[1]. Credit mechanisms are generally voluntary

[1] We understand offsetting as a verb and therefore do not use carbon offsets, but carbon credits for offsetting purposes (or shortly carbon credits). Offsetting means that a unit of CO_{2e} (carbon dioxide or carbon dioxide equivalent) is reduced, sequestered, or avoided in a different location but used for compensation purposes.

market mechanisms in which demand is derived from individuals or governments to fulfill self-imposed goals or for reputational reasons (Michaelowa et al, 2019; York et al, 2020).

Forestry and Land Use projects account for the majority of transactions in terms of value and CO_2 volume in the voluntary carbon markets (VCM), and some compliance trading systems may be used to meet regulatory requirements (Forest Trends' Ecosystem Marketplace, 2022; Prag et al., 2012). Typically, this must be addressed in the core design features of an ETS, as depicted in Figure 1. Allowing for carbon credits raises additional questions regarding their extent and design, as indicated in Table 1.

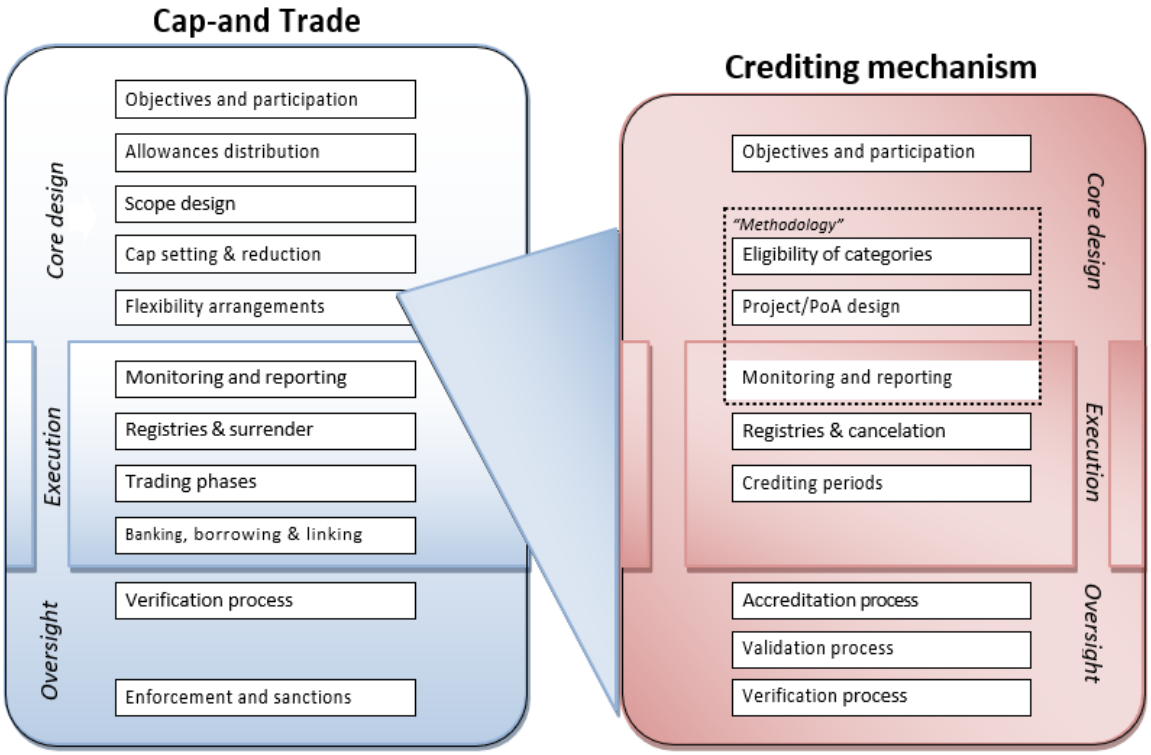


Figure 1: Design of cap-and-trade mechanism, modification of Prag et al., 2012

Table 1: Design questions of carbon credits

a)	Category of carbon credits? (e.g., land use and forestry, renewables, and energy efficiency)
b)	The geographical scope of credits? (e.g., domestic, international)
c)	Governance of credits? (e.g., jurisdictional vs. project-level, own accreditation vs. third-party accreditation)
d)	Origin of crediting system? (e.g., self-established crediting mechanism and existing crediting mechanism)

e)	Scope of application? (e.g., quantitative limits and qualitative criteria, such as additional safeguards)

Moreover, there are far-reaching consequences when considering the linking of ETS systems, which can undermine efforts to extend carbon markets (Narassimhan et al., 2018; Riehl et al., 2016; Santikarn et al., 2018).

The latest report from the International Carbon Action Partnership (ICAP) demonstrates that approximately 17% of global GHG emissions are covered by the ETS, which encompasses approximately one-third of the global population, and jurisdictions comprising approximately 55% of global GDP are (partially) regulated by an Emissions Trading System. As of January 2023, according to the ICAP report, 26 ETSs were in effect, and 23 were either under consideration (14 ETSs) or under development (9 ETSs) (ICAP, 2022; ICAP, 2023). Reviewing the acceptance of flexibilities of the ETS in force, we discovered that the majority allowed for carbon credit use to comply with obligations (18 of 26). Domestic forestry projects at the project level play a vital role as an eligible category under the ETS regimes (16 of 18). (ICAP, 2022). See Appendix (Table A1.1) for more detailed information.

Caused by the expiration of the Kyoto Protocol at the end of the second commitment period in 2020 and the finalization of Article 6 of the PA landmark, the start of a new age of market mechanism might be permitted under an ETS.

2.2 Carbon credits from forestry projects in the EU ETS

We focused our investigation on forest carbon credits because PA targets cannot be attained without lowering greenhouse gas emissions produced by deforestation and unsustainable land use (Graham et al, 2018). According to Griscom et al. (2017), the mitigation potential in the forest and land sectors may account for over one-third of the climate solution of not exceeding global warming of 2 °C. Tropical deforestation is estimated to account for 15–20% (Bellassen et al., 2009) to 25% (Eliasch, 2008) of the total man-made greenhouse gas emissions.

The European cap-and-trade system entered into force in 2005 with its regulatory basis the Directive 2003/87/EC of the European Parliament and the Council from 2003. Table 2 provides an overview of the allowance of carbon credits in the EU ETS. Since the commencement of the operating system, carbon credits have been gradually phased out.

Table 2: Carbon Credits in the EU ETS, own illustration based on European Commission (2021a)

Phase	Period	Credits permitted	Quantitative Limits	Qualitative Limits
I	2005 – 2007	Yes	unlimited usage	exclusion of Nuclear energy projects Afforestation and reforestation activities (LULUCF) Projects involving destruction of industrial gases + strict conditions for hydro projects
II	2008 – 2012	Yes	limits based on country's National Allocation Plans (NAP)	as per Phase I
III	2013 – 2020	Yes	different cases for stationary installations- either 11% of its allocation (2008– 2012) or maximum 4.5% of verified emissions (2013–2020)	addition to Phase I – new projects (post 2012) need to originate from Least Developed Countries (LDCs)
IV	2021 – 2030	No	./.	./.

This applies not just to the categories of available projects, but also to the diminishing quantitative restrictions. The Linking Directive of 2004 (Directive 2004/101/EC) was the most significant change in allowing carbon credits from the CDM and JI mechanisms (European Parliament, 2020).

Certified Emission Reductions (CERs) and Emission Reduction Units (ERUs) from land use, land-use change, and forestry (LULUCF) from nuclear power plants and industrial gas destruction projects are not permitted to trade under the EU ETS per Articles 11 a 3 (European Parliament, 2004). The CDM only permitted afforestation and reforestation (A/R) forestry projects, but did not consider other types, such as avoided deforestation or improved land management. Projects from REDD+ (and its antecedent frameworks) only formally materialized during CoP13 in Bali and therefore were not part of Directive 2004/101/EC. In addition to hundreds of local REDD+ projects, which are regularly small scale and initiated by Non-Governmental Organizations (NGOs) or for-profit companies primarily with a VCM orientation, jurisdictional REDD+ programs have been developed.

These are government-led, local, or national governments, which are spread over a larger governmental area or jurisdiction by applying a single reference baseline. Aligning REDD+ projects with jurisdictional REDD+ programs, a process known as nesting, presents technical challenges owing to diverging forest reference emission levels (FREL). To fully realize the potential of tropical and subtropical forests towards the PA, upscaling REDD+ projects by more than 40 times would be necessary (Atmadja et al., 2022).

Although the UNFCCC approved certain types of forestry projects, the EU opposed this perspective and rejected their use. A review of regulatory sources highlighted concerns about the environmental integrity and quality of forest projects. The risks identified relate to the *non-permanence* of forest projects because carbon dioxide removed from the atmosphere is not eternally sequestered in forests. The *additionality* of forestry projects requires that these projects would not be implemented without revenues from carbon credits. *Leakage* is related to the risk of deforestation actions occurring outside the project area, shifting the achieved emissions removal to another location. In addition, *uncertainties* related to *accounting* and *monitoring* are noted. Robust *accounting* is key to achieving environmental integrity. Challenges towards guaranteeing robust accounting exist owing to various scopes, metrics, and times, facilitating the concern of different forms of double counting (Schneider and La Hoz Theuer, 2018). Varying baselines or measurement methods and reference period abuse are examples that contribute to accounting issues. Moreover, forests provide important habitat for indigenous populations and a variety of species that can be negatively impacted by forest projects; such risks are described as *socio-economic and environmental impacts* (European Parliament, 2004; ECCP, 2002; European Commission, 2003a; European Commission, 2003b).

3. Methods

We initially addressed our research questions with a literature review on the underlying regulatory sources along the legislative process of the European Union, *inter alia*, by analyzing directives, official statements, and proposals. We extended the literature research by peer-reviewing literature and gray literature documents as well as publications from websites (e.g., public authorities), newspapers, and blogs. While we gained a comprehensive understanding of the historical reasons for carbon credit exclusion from trading under the EU ETS, our interest shifted to the qualitative research that provides insights into process expertise and interpretive knowledge. Process expertise offers insights into courses of action, interactions, and events where experts are involved, and thus exceeds pure technical knowledge. Interpretative knowledge was only relevant when it came to viewpoints and

interpretations; for instance, in the assessment of the further course and success of certain initiatives (Bogner et al., 2014, pp. 17). We conducted semi-structured interviews with experts, dividing them into six different expert groups to obtain information that could not be generated by other sources (Kaiser, 2014, pp. 31).

3.1 Selection of experts and interviews

The combination of expertise areas, the EU ETS and carbon credits from forestry projects, posed challenges in the identification and selection of relevant experts from different expert groups. Interviewing multiple experts also reduced the risk of information bias. To address selection bias, we primarily contacted organizations and institutions and requested that they forward our interview request to the appropriate experts in the field. We selected organizations and institutions that were involved in regulatory and consulting processes, acted as market observers for carbon markets, or published articles in the related fields. Particularly from political institutions, primarily at European Union level, we received limited responses to our interview requests. This study was a part of a larger research project. In total, we conducted 21 interviews, with 20 experts and one double interview, via video conference tools (Zoom and WebEx), for approximately 60 minutes each from January to April 2022. Three more experts responded to the guided questions via email as they could not participate in the interview. Small sample sizes are common in qualitative research, such as Edwards and Kleinschmidt (2012) (N=10), Tröger and Reese (2021) (N=21), and Günther et al. (2022) (N=15). The interview process ended when only a few additional pieces of information were available (saturation). A recent study by Young and Casey (2018) indicates that 6–12 interviews already showed sufficient code saturation.

Table 3 provides an overview of the six expert groups and the final area of activity for grouping. The NGO group encompasses organizations dealing with carbon markets in the voluntary and compliance spheres as well as with climate-related issues. Within the Academic/Research Center group, we gained experts from forestry, law, political science, and so on. Geographically, we focused on the European Union (including the United Kingdom) and on experts from the United States and New Zealand (see Figure 2). Most experts (20 out of 24) had at least 10 years of experience in the field of research. Experts' opinions did not necessarily reflect the knowledge and experience of their affiliated organizations.

Table 3: Expert group identifiers and experiences in years

Expert group	Identifier[2]	Experience in years			#
		X ≤ 10	10 < X ≤ 20	X > 20	
Non-Governmental Organization	NGO	2	6		8
Academic/ Research center	ARS		2	5	7
Political institution	PI		1	1	2
Consultant	CO		1	1	2
Project developer	PD			2	2
Standard developer/Certifier	SD	2	1		3
Total		4	11	9	24

Figure 2: Location from experts interviewed

3.2 Thematic analysis of data

Interviews were audio- and video-recorded and subsequently fully transcribed and anonymized. For analysis, we used MAXQDA as the Qualitative Data Analysis (QDA) software,

[2] Identifier for experts assigned consecutively, based on the interview dates.

which supports a systematic analysis of qualitative data (Raediker and Kuckartz, 2020, p. 12; VERBI Software, 2021). We selected Thematic Analysis (TA), also referred to as *Reflexive Thematic Analysis*, to identify the patterns in the interview data. TA follows a systematic six-phase process[3] regularly associated with Braun and Clarke (2006/2014/2022). The advantage of this method lies in its flexibility, which allows for the inductive and deductive coding of data. Based on the questionnaire, we could generate expected codes (deductive) but also wanted to allow for codes emerging from the data (inductive), which we finally could condense into themes. Reflexivity, as proposed by Braun and Clarke (2022, p.15), has subordinate importance, although we acknowledge the subjectivity inherent to working with qualitative data. The quantification of data is regularly critically assessed, *inter alia,* owing to small sample sizes and the open method of collecting data (Braun and Clarke, 2014, pp. 261).

However, we conducted a frequency analysis in certain areas of research, as it fosters visibility and emphasis on distinct aspects. In addition, TA is an open method that can be used to complement other approaches (Braun and Clarke, 2022, pp. 254). Furthermore, frequencies provide a good tool for the identification of patterns, which are supplemented by the reasoning of the respective expert. We present the results by summarizing the main themes identified and providing an indication of the experts' perspectives. Using selected quotations from the interviews, we aimed to exemplify relevant key messages and relate them to additional literature.

4. Results and discussion

We derived new knowledge about the perspective of the EU ETS, an enriched overview of excluding factors regarding carbon credits, and key design elements to be reflected. Hence, we start with the current EU ETS arrangement, which is regarded as robust and appropriate by most experts despite not incorporating a flexibility mechanism. From a longer perspective (2040s to 2050 or thereafter), the paradigm change due to the Paris regime becomes more prevalent, and we identify aspects of the reopening of the discussion on carbon credits under the EU ETS. Second, in these three levels, we elaborate on the challenges associated with carbon credits. The numerous hurdles necessitate a more thorough classification of components, but they also demonstrate the validity of the discovered regulatory impediments. Third, we obtained insights into the relevant aspects to improve the certification of carbon credits from forestry projects.

[3] Step 1: Familiarization with the data set; Step 2: Coding data; Step 3: Initial generation of themes; Step 4: Review of themes; Step 5: Refinement of themes; Step 6: Writing up the findings

4.1 Mid- to long-term transition

Initially, we asked the experts for their perspective on the European Union's climate strategy and why the instruments seem to focus on the EU. An emphasis on the EU territory indicates a contradiction to the aim of fighting climate change through close international cooperation (European Commission, 2021c). The prevailing view of experts indicates that the centricity on the European Union's territory is comprehensive and is caused by monitoring and enforcement possibilities. *"What the European Union can govern and what they cannot govern […] But we should also acknowledge that both, member states and the European Commission have spent a lot of financing on climate measures also in other countries" (ARS2)*. While the primary instruments focus on the EU as a significant contributor to climate protection, they are not sufficient on their own. Financing from REDD+ plays an essential role. From 2008 to 2015, EU states provided approximately €5.9 billion (out of a total of roughly €19.4 billion) in financing (European Commission, 2018).

Moreover, a significant untapped potential exists within the EU for emission reduction. The EU is a "*trailblazer*" (*ARS4*) within the global community and as consisting out of wealthy industrialized countries it must prove "*that their target is to be achieved within the EU. And there is considerable pride in the fact that they do not do international trading"* (*NGO1*). This perspective opposes the potential of international trading to handle hard-to-abate emissions efficiently, and acknowledges different geographical conditions (*SD3*). The trajectory of the European Union's climate strategy can be comprised of *"reduce first, remove later"* and prioritizes the emission reductions as much as possible, and only the residual emissions, which cannot be abated, or only at disproportionately high costs, need to be compensated by removal activities (*NGO5, PD1, PI2, PD2, ARS5, and NGO8*).

Hence, carbon credits for compensation purposes are not part of the EU's current trajectory, and are supported by most expert groups. Apart from the expert group, project developers and some academics argue for carbon credits, including forest carbon credits, in compliance with the urgency of action and the foregone potential of experience gains by integrating them from the beginning of history (*I4P5, PD1, and PD2*). Indisputably, significant additional emission reduction efforts are needed to reach the climate target, and dilution of the system by questionable carbon credits needs to be prevented. The EU's efforts to reflect the Green Deal proposals are just enough to achieve a close to 2º Celsius increase target (CAT, 2022). Designated experts noted that it is highly unlikely that the EU will revise the policy, allowing for flexibility within Phase IV (until 2030) (*ARS7, SD3, PI1, CO1, ARS1NGO3, ARS2, NGO4, ARS4, and SD1*). As the following quotation demonstrates, the rejection of forestry projects

into the EU ETS is much stronger: "*Personally, I don't really see any possibility for including international forest credits in the EU ETS. There had been efforts in this direction when the Kyoto Protocol was in force, but people encountered some fundamental and insurmountable challenges"* (*NGO9*).

In contrast, when experts were asked about the mid- to long-term perspective, which encompasses the period after 2030 until the mid-century and beyond, they addressed the resurgence of carbon credits in the compliance market. The experts we interviewed held ambivalent views on the resurgence of the topic of carbon credits under the EU ETS. Some were critical, while others were more open to discussion. The ambivalence stems from the fact that certain sectors, such as the cement industry, find it difficult to abate emissions to zero after the cap. However, to achieve long-term targets, there is a need to remove historic emissions. In addition, the lobbying of industries arguing for the benefits of natural solutions, paired with more ambitious targets, increases the likelihood of future reflection (*SD3*, *PI1, I2P1, and ARS1NGO3*). Lobbyism has had a significant effect on environmental policy design and the sharpening of the EU ETS (Efthymiou and Papatheodorou, 2019).

Given the decarbonization trajectory of the EU, I find it hard to believe they will not use markets. […] much depends on WHEN the EU will change its position for example (*NGO5*). Carbon dioxide removals (CDRs) from technological or hybrid solutions were predominantly found to be more likely to be reflected under the EU ETS in the longer term. This includes discussions of Bioenergy with Carbon Capture & Storage (BECCS) as a hybrid solution and Direct Air Capture (DAC) as a technological solution (*CO1 and ARS2*). Technological removal has some merit, but the current availability, needed scale, and current cost also require natural solutions, such as afforestation and reforestation or avoided deforestation. As our study focused on natural solutions, we did not critically assess the justification and drawbacks of technological solutions. Experts from political institutions, NGOs, and academics have emphasized the importance of utilizing all removal options, which is also supported by the IPCC's recognition of the significance of sinks (*PI1*, *NGO2*, *I4P5, and NGO5*).

An internationally coordinated long-term perspective is expected, which is supported by cooperative approaches under Article 6 of the PA but also acknowledges the different economic and geographical structures and abatement opportunities (*NGO5, ARS5*). We expect that this decision to not be irrevocable. We see this with the New Zealand Emissions Trading Scheme (NZ ETS), which abandoned international credits in 2015, but they are still open to reconsidering international trading within their ETS once a robust mechanism has been determined (*NGO7*).

As the results from the experts indicate, negotiations about the future usage of carbon credits after 2030 for offsetting purposes and forestry projects are likely to return.

4.2 Challenges and barriers of carbon credits

Carbon credits used for offsetting purposes rather than lowering emissions are regularly criticized in gray literature, such as newspapers or white papers. Even though the EU ETS phased out carbon credits in the current phase, expert interviews revealed recurring discussions. Therefore, we are interested in receiving a detailed picture of the main barriers associated with carbon credits, with an emphasis on carbon credits from forestry projects. It is not an exhaustive listing of challenges because we did not ask for all issues but rather which factors were deemed critical. We conclude that the experts address the most pressing issues first. Forestry projects are a dominant category in the VCM and form a relevant part of Natural Climate Solutions (NCS). NCS not only contribute as a carbon stock and can increase carbon storage, but also deliver co-benefits. According to a study by Griscom et al. (2020),[4] NCS play a central role in delivering NDCs, in the future higher ambition of NDCs, and in balancing emissions by the mid-century.

Only a few studies have addressed the obstacles of trading carbon credits under compliance regimes. According to Shrestha et al. (2021), 16 experts from five global carbon markets were interviewed (European Union (N=3), California (N=4), China (N=5), New Zealand (N=1), Quebec (N=1), and Ontario (N=2)), and it was found that experts from the EU ETS were skeptical about including forest carbon credits in the compliance scheme. Additionally, it was subsumed that there is an overall positive political view towards exploring the future of carbon credits from forestry projects, given the urgency for global reduction of GHG emissions the need to explore this further (Shrestha et al., 2021).

The results of the interviews revealed concerns in three layers (see Figure 3). Referring to Figure 1 the link between the objectives of the cap-and-trade system and the credit mechanism became evident. Most concerns must be addressed when defining the methodological components of the crediting mechanism. Hence, we identified elements i) guaranteeing the "purity" of the EU ETS, ii) related to carbon credits in general, and iii) additional and specific factors related to forestry projects. The results are presented through frequency analysis, which involves counting the number of mentions per document. In cases

[4] The study from Griscom et al. (2020) assesses NCS on a tropical country-level which means to lever this potential international carbon credits also from tropical countries need to be allowed. The study considers 12 different pathways ranging from protection to management and restoration activities.

where a factor is repeatedly addressed by a respondent in an interview, it is only counted once to avoid duplicating the count.

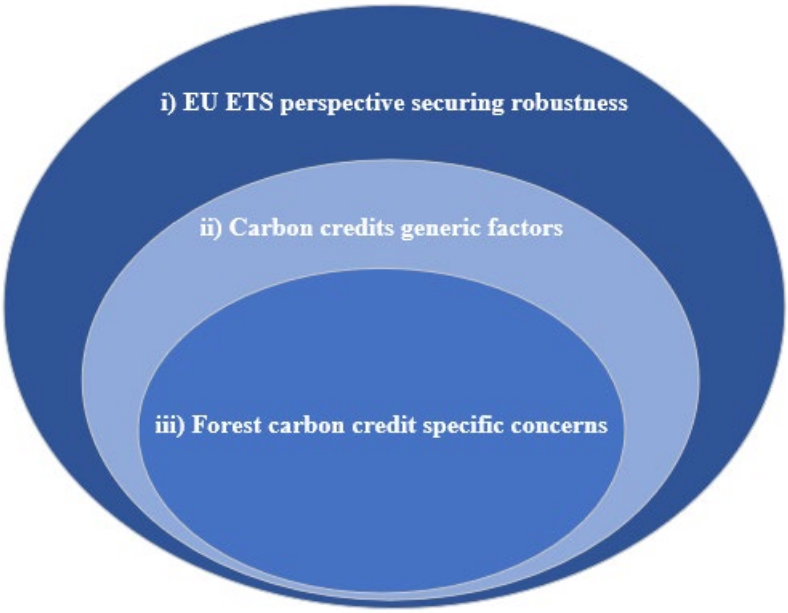
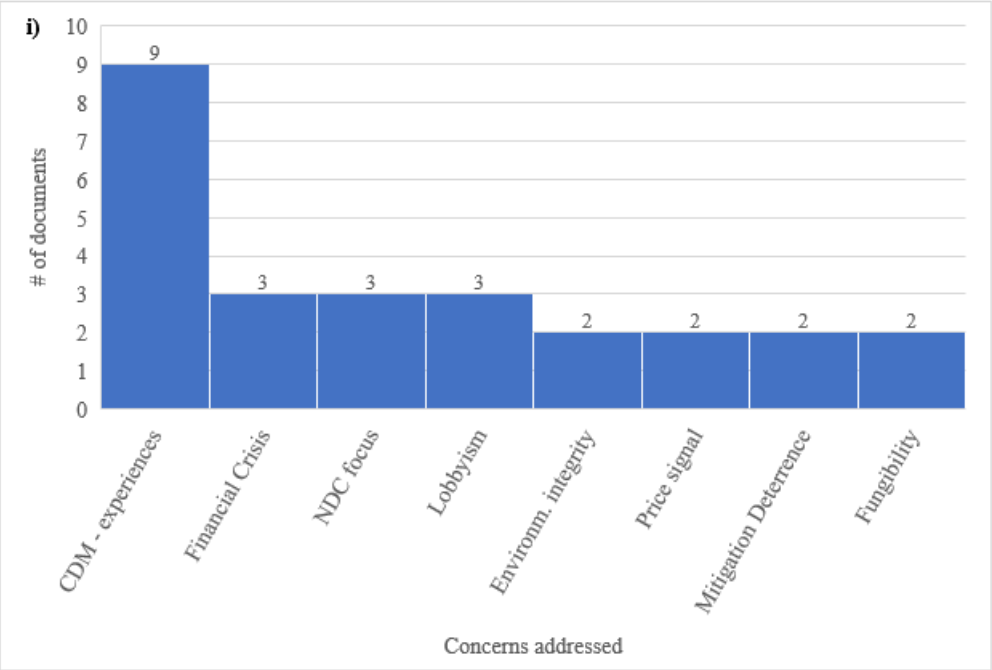


Figure 3: Layers of identified concerns

In the outer layer, experts shared their experiences and perceptions of accepting carbon credits within the EU ETS. In 13 of the 24 documents, the experts raised 17 different concerns, of which 8 concerns were repeatedly raised (see Table 4). We only depicted concerns that were addressed by at least two experts. See Appendix for more details (Tables A1.2; A1.3; A1.4). Our findings indicate that most of the reservations expressed by experts are related to negative experiences (*"CDM-experiences" (9))* in the past. International credit stemming from CDM projects is regarded as inferior in quality and prone to errors with inflated baselines or subject to fraudulent behavior. A 2016 analysis conducted by the Oeko-Institut e.V. supports this assessment, finding that approximately 80% of CDM projects failed with additionality and overstated the effect (Cames et al., 2016). Moreover, the sharp decline in allowance prices during and after the Financial Crisis (*"Financial Crisis" (3))* to the allowance of carbon credits for offsetting purposes. These experiences, particularly during trading phase II, have had enduring effects which is well exemplified in the quote *"[…] those people in the commission, they stay for a long time, and they have long memories" (NGO1)*.

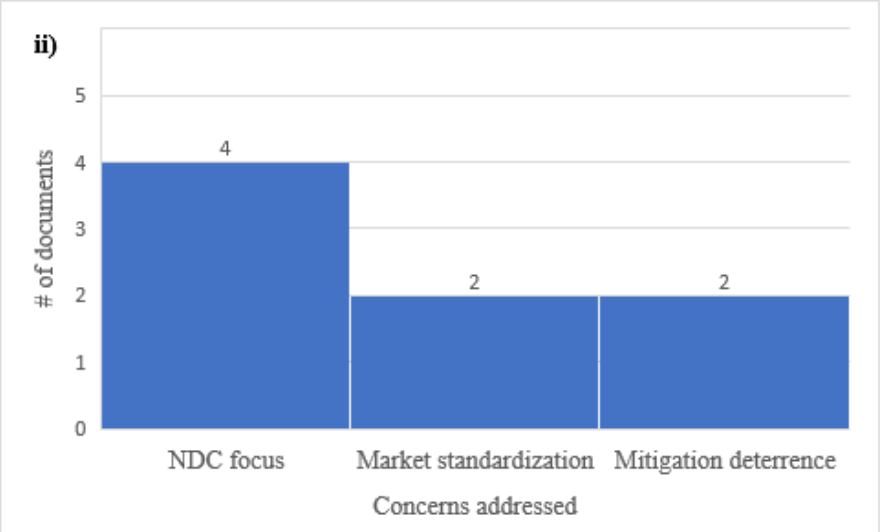
Table 4: ETS related concerns on carbon credits



Concerns about carbon credits[5] were expressed in 9 of the 24 interviews (see Table 5) for the coded segments. Most concerns raised are on an international scale. The *"NDC focus opposes trading"* and *"Mitigation deterrence"* critically reflect that under the PA regime, the trading of emission reductions or removals should cease. If countries set ambitious targets within their NDCs, they will need to make use of their potential and not sell them to other countries. Thus far, risk exists in setting lower reduction/removal targets and instead selling credits for profit. Mitigation deterrence similarly addresses the risk of postponing one's efforts but from a buyer's perspective. Experts recognize the importance of cost-efficiency in seeking the lowest costs to reduce emissions; however, this approach may potentially undermine the incentive to reduce emission. This is especially critical if there is no limit to the recognition of credits for compliance purposes. The code *"Market standardization requirement"* implies the need to standardize projects that are often very context specific. Standardization, in the best possible way, would mean a unified approach on a global scale. This is regarded as critical, as it limits room for flexibility but also threatens small-to medium-sized projects.

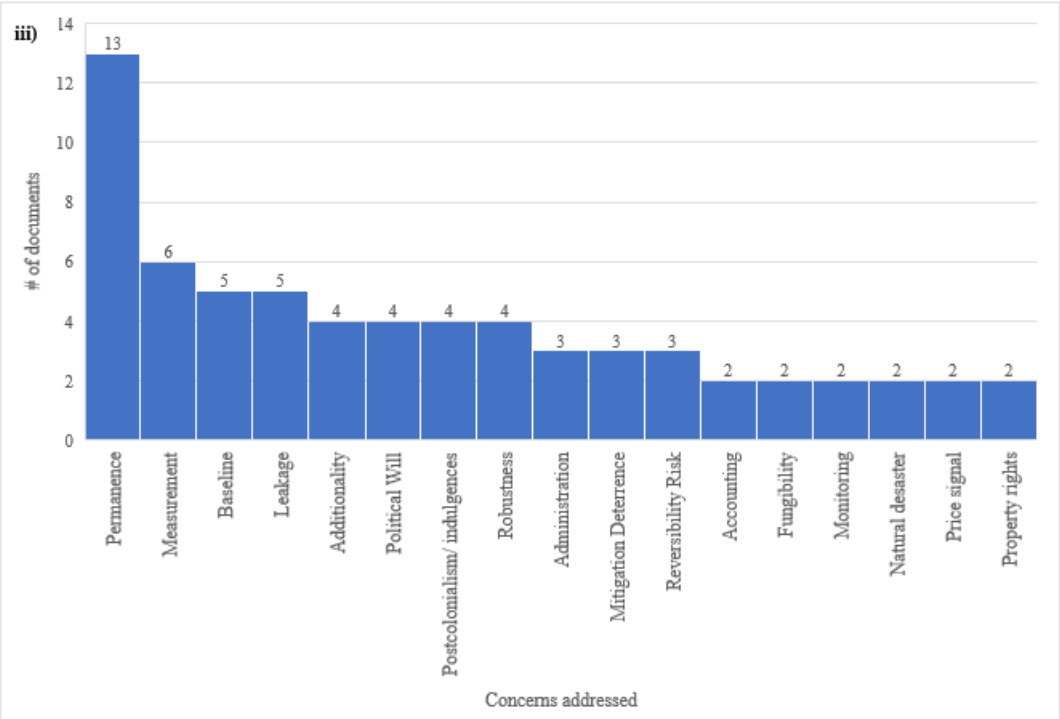
[5] These observations are not in relation to a specific project category such as forestry or renewables but on a meta level.

Table 5: Carbon credits related concerns



More specifically, the hurdles preventing forestry activities from being reflected are presented in Table 6. A total of 28 concerns were raised across 21 out of the 24 documents, with 17 of them being noted at least twice. The most frequently addressed concern is the missing permanence of forestry projects (13), which describes the temporary nature of removal for nature and the risk of reversing stored carbon dioxide into the atmosphere (Schneider et al., 2020). This is mentioned before the measurement (6) and baseline (5) issues, which comprise the uncertainties with regard to accounting for, for instance, carbon fluxes on an annual basis, the measurement method, or the existence of an inventory with high-quality data; nonetheless, related questions on the relevant baseline to which achieved reduction or removal are compared. Upon comparing the interviewees' responses, it was found that the regulatory concerns outlined in Section 2 from the early 2000s are still regarded as valid from the perspective of the experts. Moreover, we confirmed our hypothesis that additional factors must be considered. The code *"Political will"* describes the factor of rejecting forestry carbon credit projects due to ideological, cultural, or political influences, as well as strategic misalignment. *"Well, I mean this particular topic is very political. Heavily political. […] there is not a lot of agreement on sort of many of the fundamentals (I4P5)*. Political resistance also evokes the other risk factors addressed, which is a sign of high dependency among concerns.

Table 6: Forestry-related concerns (including REDD+ projects)



Our research findings are consistent with those of Shrestha et al. (2021), who identified similar main concerns, including a) leakage, b) permanence, c) additionality, d) complexity (MMRV[6]), e) offsetting outside one's own ETS, f) governance and jurisdictional challenges, g) missing price signals, and h) lack of information, policy, and communication to foster double counting.

In the next step, we built clusters of the coded segments and linked the three layers to obtain more concise overview of the main challenges addressed by the experts (see Table 7 for the 13 most frequent categories). This merger allowed for an integrated perspective of the smallest unit forest projects as carbon credits in the EU ETS.

Table 7: Top 13 most addressed issues in clusters

#	Cluster	Number of responses	Subsumed concerns
1	Accounting	17	Accounting, Baseline, Measurement, Overstatement, Double-Counting, "Hot Air"

[6] Abbreviation for measuring, monitoring, reporting, and verifying.

#	Cluster	Number of responses	Subsumed concerns
2	Permanence	16	Permanence, Reversibility
3	Experiences (negative)	13	CDM-experiences, Financial crisis, CDM-scandals
4	Mitigation Deterrence	8	Mitigation deterrence, Purpose deterrence
5	Paradigm Shift	7	NDC focus
6	Lobbyism	6	Lobbyism, "Low Hanging Fruits"
7	Leakage	5	Leakage
8	Postcolonialism	5	Postcolonialism
9	Additionality	4	Additionality
10	Political Will	4	Political Will
11	Price Signal	4	Price signal
12	Robustness	4	Robustness
13	Fungibility	4	Fungibility

Table 8: Concerns divided into categories

Category	Number of responses
Methodological	57
Implementation	53
Socio-economic and environmental	15
Total	125

Ultimately, by making the key challenges visible, prioritization and comparison can offer a sequence of actions. In a recent review by Pan et al. (2022), a systematic literature review of 53 papers (based on the Clarivate Analytics Web of Science) was conducted to identify the challenges and barriers associated with forest carbon offsets (FCOs), independent of whether they were used in the VCM or compliance regimes. Second, they review four main voluntary standards to determine how to approach risks. The study identified three thematic categories of challenges: methodological, socioeconomic, and implementation-related challenges. Methodological barriers were found in 46% of the reviewed papers before socioeconomic challenges (35%) and implementation challenges (19%). Among the

methodological challenges, additionality (45%), permanence (43%), leakage (30%), and co-benefit-related issues (6%) were discussed the most (Pan et al., 2022).

Our expert interview revealed methodological challenges as the main category (see Table 8), with "*accounting*" related issues at the top (17), before *"permanence"* (16) and *"leakage"* (5). Accounting-related issues do not seem to play a vital role in the literature, whereas our results indicate them to be highly relevant. The relevance of accounting can also be seen in the long negotiations on Article 6 of the PA (Hatherick, 2021). Thus far, the absence of this factor was surprising. Experts have criticized the subjective nature of additionality (4) as a key criterion standards typically use a financial additionality test, which means that a project would not be realized without payments outside of certification (McDonald et al., 2021; Pan et al., 2022). However, it is difficult to regularly test the motives of the project participants.

Regarding socioeconomic challenges, Pan et al. (2022) identified transaction costs (28%), price (25%), social costs (23%), and opportunity costs (19%) as the most critical aspects. In our assessment, *"price"* (4), *"property rights"* (3), and *"environmental impacts" (3)* were dominantly addressed. The risk of a diluted price signal is a shared concern and the property rights issue is subsumed as a social cost in the review article. Environmental integrity is part of the co-benefits in Pan et al. (2022), and we connect this to the socioeconomic perspective.

Our results indicate more concerns regarding the implementation of carbon credits compared to the socioeconomic and environmental impacts. Pan et al. (2022) identified issues with verification (21%), reporting (17%), and monitoring (15%) (MRV), whereas we see as a major implementation barrier overcoming the *"negative experiences due to the CDM"* (13), as well as resolute the conflicts of *"mitigation deterrence"* (8) from a buyer perspective and the ambition increase by *"focusing on the NDC"* (7) from a seller's perspective. As we found in our research focusing on the EU ETS, there are even more fundamental questions to be considered when implementing carbon credits that deal with the overall objective and how to implement it in practice.

4.3 Approaches to identified concerns on forestry projects

As outlined in the previous section, a multitude of concerns exist regarding allowing carbon credits for compensation usage within the three layers of the EU ETS. There is little research on forestry projects within compliance systems; therefore, in our interviews, we asked about the prerequisites, developments, and improvement potentials within this project category. Efficient policy design is required to make use of the low-cost opportunities provided by

forests (Gren and Aklilu, 2016). In 15 of the 24 documents, experts stated that design elements should be considered to increase the likelihood of tradability.

Table 9 provides an overview of the results by addressing whether there was a change to the certification/system, addressed concerns, and thematic classification.

Table 9: Changes in forestry projects

Certificate/ System	Classification	Concern	Theme	Count	Sample
Certificate	Jurisdictional programs	Leakage	Methodological	5	NGO1, CO1, ARS5, NGO8, SD2
Certificate	Limitation clauses (quantitative/qualitative)	Permanence	Methodological	4	PI1, CO1, ARS4, SD2
Certificate	Insurance program	Permanence	Methodological	3	PI1, PD1, SD2
Certificate	Liability clauses	Permanence	Methodological	2	PI1, ARS2
Certificate	Intermediary financial product	Permanence	Methodological	1	PI1
Certificate	Long-term offtake agreement	Permanence	Methodological	2	PD2, NGO8
Certificate	Financial and social benefits to communities	Socio-Economic	Socio-Economic	2	SD1, SD2
Certificate	Strengthening property rights	Socio-Economic	Socio-Economic	1	ARS3
Certificate	Measurement certainty related pricing	Accounting	Methodological	1	ARS3
Certificate	MRV through LiDAR	Accounting	Methodological	1	ARS6
System	Sustainable Carbon Cycles	Misc.	Other	3	ARS7, PI1, ARS2
System	ETS revenue surplus foster forestry sector	Misc.	Other	2	NGO6, PI2

Some of the suggestions not only address one concern but also contribute positively to the akin factor. We attribute this to the concern that it contributed the most. Predominantly, changes to the methodologies have been addressed, which relate to concerns about missing permanence, leakage, and accounting issues. Most experts commenting on the design of forest carbon credits suggest a jurisdictional program instead of a project-level design and refer to Jurisdictional REDD+ as an example of government-led activities. By applying

forestry projects on a jurisdictional basis, the risk of leakage is reduced, as it is governed at the governmental level. A common criticism of these kinds of programs is that they eliminate small- to medium-scale projects due to missing scales, long implementation durations, etc. Nevertheless, the necessity of a robust methodology outweighs the possible disadvantages. Best practices based on other compliance regimes, such as the carbon tax system in Columbia, which foresees jurisdictional REDD+ programs, can assist in balancing the advantages and disadvantages (Hamrick et al., 2021). According to the interviewed experts, strong reliance on the project level is not sufficient for reflection on the EU ETS. Leakage is commonly considered at the project level, primarily at the national scale. Standards under the NZ ETS or Woodland carbon code also assume no leakage risk or ask for an identification of leakage risk (qualitative identification) and verbally describe how these are minimized or managed. In some standards, leakage risk is quantified, leading to a reduction in gross removal (McDonald et al., 2021; Pan et al., 2022).

The key concern of non-permanence is also addressed. Forestry projects are reversible, but the risk of non-permanence can be countered by designing certificates in different ways (certificate solutions). Experts advocate for the expiry of the carbon credit and the liability to renew credit after a certain period. The finite nature of credit was compared with the depreciation of real estate or credit portfolios, where there is a need for action at the end of the expiration period. Companies use this approach for many tangible assets that can also be converted to carbon credits. Replacement strategies encompass either new temporary carbon removal (e.g., afforestation projects) or permanent removal (such as BECCS). Temporary credits are not a new phenomenon, but exist as temporary CERs (tCERs) and long-term CERs (lCERs), although they have never gained traction as a solution toward non-permanence (Locatelli and Pedroni, 2004). Experts confirmed the ignorance of tCERs usage because of the inherent liability for replacement, the lack of a registry process, and the more convenient buffer solution (*I12, P13, PD2, NGO8, and SD2*). Alternatively, long-term offtake agreements form a possible solution for short-term behavior. Buffer solutions are the preferred option in most standards for holding participants liable. In particular, they differ by 10 to 25% of the expected reduction (McDonald et al., 2021; Pan et al., 2022).

Another relevant aspect is to guarantee that during the term of validity, risks, such as natural disasters or human interference, do not lead to invalid claims. Questions about the liable-holding participants were raised. Historically, this subject could not be agreed upon and the EU rejected taking over the risk in the case of claim invalidity. From an expert's perspective, it is imperative to include a liability arrangement that can be further addressed by insurance. These also exist in other areas, such as elementary insurance, and there is a growing interest in this area (*PI1 and ARS2*). Defining the liable party is critical and complex, as it inherits the

principal–agent problem, making reliable assertions about the additionality of asymmetric information between the project developer, seller, and buyer of credit. In theory, this problem can be solved; however, in practice, it is often difficult to solve (van Kooten, 2016). Building upon existing knowledge, the Quebec cap-and-trade system or the NZ ETS[7] facilitates the formation of structures.

Regarding accounting, two statements have been made to address concerns around measurement. The Copernicus Climate Change Service (C3S) has been used to collect forest-related data within the EU (EEA, 2019), but it has been criticized for being developed for land cover and not suitable for land use practices and carbon reporting (*ARS6*). Alternatively, light detection and ranging (Lidar) technology provides greater accuracy in carbon reporting practices (Marsh, 2021). Another expert proposed linking pricing with measurement accuracy, where credits with low measurement uncertainty and high certainty of future development would be priced higher.

From a socioeconomic perspective, land and property rights as well as the need to govern the participation of communities have been raised. One expert criticized the application of the "no harm" rule as too passive and suggested that regulations actively demand a significant share of the proceeds towards local communities per regulation. This also increases the likelihood of long-term projects, which positively influences permanence. Land and property rights are critical issues, especially in developing countries. Strengthening property rights, increasing transparency, and consulting with locals are mandatory.

We designated alternative solutions that were not associated with any of the three previously built categories as miscellaneous. Additionally, the suggested changes occurred at the system level and not at the certificate level. References were made to the current efforts of the EU under the Sustainable Carbon Cycles[8], with the aim of carbon removal pathways, upcoming regulations, and certification. In December 2021, the European Commission adopted a communication in which the land use sector (carbon farming) played a relevant role, and the proposal of a certification standard by the end of 2022 was foreseen (European Commission, 2021d). Acknowledgment and growing importance were interpreted as positive

[7] New Zealand ETS is the only ETS that includes forestry as a sector. The NZ ETS and Permanent Forest Sink Initiative (PFSI), which will be replaced in 2023 by the new category "permanent forestry", initiated liability rules for the participants to purchase equivalent units in case of declining sequestration (McDonald et al., 2021; Ministry of Primary Industries, 2021).

[8] Initiative of the European Commission with the aim of EU-wide actions to promote carbon farming as well as industrial solutions at scale for a substantial reduction of carbon emissions and increase of carbon removals. It is one regulatory tool to meet the decarbonization goals by an overarching approach, harmonizing natural and artificial solutions.

signs toward a robust system with the potential for integration into the EU ETS. Sustainable Carbon Cycles facilitate the transition from domestic to internationally accepted systems.

The second finding from the interviews at the system level is the use of auction revenue from selling EU-Allowances (EUA) to direct biodiversity and forestry funds. This is an alternative method of funding projects in natural solutions. This identified approach has already occurred via the modernization fund, for example, for funding energy efficiency and storage investment, or the innovation fund, funding low-carbon technologies such as carbon capture and storage (CCS) (Dorsch et al., 2020).

Experts underscore the importance of fungibility between carbon credits and EUA, suggest that this criterion should reflect the flexibility mechanism in the EU ETS, in order to avoid harming the system and to be of a cost-efficient solution pathway.

5. Conclusion

Reviewing the design elements of an Emissions Trading Scheme and decisions about flexibilities have far-reaching consequences for the effectiveness of the instrument. Our findings demonstrate that cap-and-trade systems are on the surge internationally, and the majority (18 out of 26) allow carbon credits to offset purposes to some extent, while the EU ETS phased (international) carbon credits of all categories gradually out. In trading phase IV (2021–2030) all CERs are abandoned. CERs from forestry projects have never been eligible under the EU ETS owing to concerns regarding *permanence, leakage, additionality, uncertainties with accounting and monitoring,* as well as *socio-economic and environmental impacts*.

Recent events fuel our interest in the role of flexibility instruments under the EU ETS within the current trading phase and from a mid- to long-term perspective. These events include the discontinuation of the Kyoto Protocol at the end of 2020, the full effectiveness of the PA, the finalization of Article 6 of the PA proposing a new market mechanism, and the increasing recognition of removals, *inter alia*, from the forestry sector.

Expert interviews (N=24) revealed that the exclusion of flexibilities is predominantly supported, and reopening within the current decade is considered unlikely. Carbon credits especially from forestry projects are critically seen because they oppose the "*reduce first, remove later*" trajectory. However, the results show an increasing need to consider removal in the upcoming decades to remove historic emissions and balance unavoidable emissions. Avoiding the necessity of maintaining carbon storage. Technological and hybrid solutions

may prevail, but it is also becoming evident that natural removal is justified as a cost-efficient solution that also provides co-benefits.

Readiness is a critical aspect in policy decision-making, as it requires time and a science-based, open discussion. Effective communication and open conversations are essential for overcoming policymakers' resistance (Baranzani et al, 2018). We found three hurdles: (i) from an ETS perspective, (ii) carbon credits in general, and (iii) additional concerns regarding forestry projects. Looking at this issue from the EU ETS perspective (i) we find a strong focus on past experiences, which are mostly negative. On ii), experts question whether credit trading can be performed adequately and does not undermine emissions reduction or foster lower mitigation ambitions. On iii) the other hand, historically identified regulatory concerns remain valid, and methodology concerns about non-permanence, accounting uncertainties, and leakage risks have been raised. In general, a highly political dimension and dragging from lobbyists against carbon credits has become evident, which prevents open-minded discussions.

Contributing to a more open policy discussion, we are also interested in suggestions on design features to improve the robustness of forestry activities and address the concerns raised. The main findings are related to the risks associated with permanence, accounting, leakage, and socioeconomic factors. Therefore, jurisdictional programs should be considered instead of project-level activities, and strict quantity- and quality-related measures towards forestry projects. Strong safeguards for local communities are necessary, and they must form part of the contracts for carbon credit projects.

Forestry projects and REDD+ require a carbon market for funding scaling (Hein et al, 2018). However, if compliance markets in the form of an ETS reflect future forestry projects, REDD+ will be subject to intense developments that guarantee transparency, environmental integrity, and governance. Our study provides a comprehensive expert overview of barriers to integrating forest carbon credits in the EU compliance scheme, as well as the first set of approaches to counter some of the challenges. More research is needed not only to build upon existing solutions, but also to consider new and different ways of mitigating concerns to foster readiness within the EU ETS.

References

Atmadja, S.S., Duchelle, A.E., De Sy, V., Selviana, V., & Komalasari, M., (2022). How do REDD+ projects contribute to the goals of the Paris Agreement? *Environmental Research Letters*, 17, 044038. https://doi.org/10.1088/1748-9326/ac5669.

Baranzini, A., Borzykowski, N., & Carattini, S., (2018). Carbon offsets out of the woods? Acceptability of domestic vs. international reforestation programmes in the lab. *Journal of Forest Economics*, 32(1), 1-12. http://dx.doi.org/10.1016/j.jfe.2018.02.004.

Bellassen, V., Crassous, R., Dietzsch, L., & Schwartzman, S., (2009). Reducing Emissions from Deforestation and Degradation: What Contribution from Carbon Markets? *Iop Conference Series: Earth and Environmental Science 6*. http://doi.org/10.1088/1755-1307/6/25/252020.

Bogner, A., Littig, B., & Menz, W., (2014). Interviews mit Experten: Eine praxisorientierte Einführung. Springer Fachmedien. https://doi.org/10.1007/978-3-531-19416-5.

Braun, V., & Clarke, V., (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101. https://doi.org/10.1191/1478088706qp063oa.

Braun, V., & Clarke, V., (2014). Successful Qualitative Research: A Practical Guide for Beginners. Sage Publications Ltd. https://doi.org/10.1177/0959353515614115.

Braun, V., & Clarke, V., (2022). Thematic Analysis: A Practical Guide. Sage Publications Ltd.

https://doi.org/10.1177/1035719X211058251.

Cames, M., Harthan, R., Füssler, J., Lazarus, M., Lee, C.M., Erickson, P., & Spalding-Fecher, R., (2016). How additional is the Clean Development Mechanism: Analysis of the application of current tools and propose alternatives. Oeko-Institut e.V.

Climate Action Tracker (CAT), (2022). Policies & action: EU. Available at: https://climateactiontracker.org/countries/eu/policies-action/ (accessed 13 March 2023).

Dorsch, M., Flachsland, C., & Kornek, U., (2020). Building and enhancing climate policy ambition with transfers: Allowance allocation and revenue spending in the EU ETS. *Environmental Politics*, 29, 781-803. https://doi.org/10.1080/09644016.2019.1659576.

Edwards, P., & Kleinschmit, D., (2012). Towards a European forest policy- Conflicting courses. *Forest Policy and Economics*, 33, 87-93. https://doi.org/10.1016/j.forpol.2012.06.002.

Efthymiou, M., Papatheodorou, A., (2019). EU Emissions Trading scheme in aviation: Policy analysis and suggestions. *Journal of Cleaner Production*, 237, 117734. https://doi.org/10.1016/j.jclepro.2019.117734.

Eliasch, J., (2008). Climate Change: Financing global forests. Earthscan/James & James.

European Climate Change Programme (ECCP), (2002). ECCP Working Group on JI/CDM Conclusions 15 November 2002. Available at: https://ec.europa.eu/clima/system/files/2016-11/jicdm_final_conclusions_en.pdf (accessed 13 March 2023).

European Commission, (2003a). Proposal for a Directive of the European Parliament and the Council amending Directive establishing a system for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanism. COM (2003) 403 final. Available at: https://www.europarl.europa.eu/RegData/docs_autres_institutions/commission_europeenne/com/2003/0403/COM_COM(2003)0403_EN.pdf (accessed 13 March 2023).

European Commission, (2003b). Commission Staff Working Paper. Extended Impact Assessment on the Directive of the European Parliament and of the Council amending Directive establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project-based mechanisms. SEC (2003), 785. Available at: https://ec.europa.eu/transparency/documents-register/detail?ref=SEC(2003)785&lang=de (accessed 13 March 2023).

European Commission, (2018). Directorate-General for Climate Action. Study on EU financing of REDD+ related activities, and results-based payments pre and post 2020: Sources, Cost-Effectiveness and Fair Allocation of Incentives. https://data.europa.eu/doi/10.2834/687514.

European Commission, (2021a). Use of international credits. Available at: https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets/use-international-credits_en (accessed 13 March 2023).

European Commission, (2021b). Proposal for a Directive of the European Parliament and the Council amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union: Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and Regulation (EU) 2015/757. COM (2021) 551 final. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R1119&from=EN .

European Commission, (2021c). Climate Action. Climate change and you. European Commission. Available at: https://ec.europa.eu/clima/citizens/climate-change-and-you_en (accessed 13 March 2023).

European Commission, (2021d). Communication from the Commission to the European Parliament and the Council. Sustainable Carbon Cycle COM (2021), 800 final. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=COM:2021:800:FIN&from=EN.

European Parliament, (2004). Directive 2004/101/EC of the European Parliament and the Council of 27 October 2004 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanism. L338/18. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32004L0101&qid=1623162021056&from=DE.

European Parliament, (2020). Directive 2003/87/EC of the European Parliament and the Council of 13 October 2003 establishing a system for greenhouse gas emission allowance trading within the Union and amending Council Directive 96/61/EC, 02003L0087. Available at: https://eur-lex.europa.eu/legal-content/DE/TXT/PDF/?uri=CELEX:02003L0087-20200101&qid=1623161241409&from=DE.

European Environmental Agency (EEA), (2019). European Forest Areas based on Copernicus data. Available at: https://www.eea.europa.eu/data-and-maps/data/european-forest-areas-based-on (accessed 13 March 2023).

Forest Trends' Ecosystem Marketplace, (2022). The Art of Integrity: State of Voluntary Carbon Markets. Q3 Insights Briefing. Forest Trends Association.

Graham, P., Thoumi, G., Drazen, E., & Seymour, F., (2018). Mining Global Financial Data to Increase Transparency and Reduce Drivers of Deforestation, Working Paper. World Resources Institute.

Gren, I-M., & Aklilu, A.Z., (2016). Policy design for forest carbon sequestration: A review of the literature. *Forest Policy and Economics*, 70, 128-136. https://doi.org/10.1016/j.forpol.2016.06.008.

Griscom, B. W., Adams, J., Ellis, P.W., Houghton, R.A., Lomax, G., Miteva, D.A., Schlesinger,

W.H., Shoch, D., Siikamäki, J.V., Smith, P., Woodbury, P., Zganjar, C., Blackman, A., Campari, J., Conant, R.T., Delgado, C., Elias, P., Gopalakrishna, T., Hamsik, M.R., Herrero, M., Kiesecker, J., Landis, E., Laestadius, L., Leavitt, S.M., …, & Fargione, J., (2017). *Natural Climate Solutions*. Proceedings of the National Academy of Sciences of the United States of America, 114(44), 11645-11650.

Griscom, B.W., Busch, S.C., Cook-Patton, S.C., Ellis, P.W., Funk, J., Leavitt, S.M., Lomax, G., Turner, W.R., Chapman, M., Engelmann, J., Gurwick, N.P., Landis, E., Lawrence, D., Malhi, Y., Schindler Murry, L., Navarrete, D., Roe, S., Scull, S., Smith, P., Streck, C., …., & Worthington, T., (2020). National mitigation potential from natural climate solutions in the tropics. *Philosophical transactions of the Royal Society of London*, 375: 20190126. http://doi.org/10.1098/rstb.2019.0126.

Günther, J., Overbeck, A.K., Muster, S., Tempel, B.J., Schaal, S., Schaal, S., Kühner, E., & Otto, S., (2022). Outcome indicator development: Defining education for sustainable development outcomes for the individual level and connecting them to the SDGs. *Global Environmental Change*, 74, 102526. https://doi.org/10.1016/j.gloenvcha.2022.102526.

Hamrick, K., Webb, C., & Ellis, R., (2021). Nesting REDD+: Pathways to Bridge Project and Jurisdictional Programs. *The Nature Conservancy.* Available at: https://www.nature.org/content/dam/tnc/nature/en/documents/REDDPlus_PathwaystoBridgeProjectandJurisdictionalPrograms.pdf (accessed 13 March 2023).

Hatherick, V, (2021). Key issues for Cop 26: Article 6 rulebook. Argus. Available at: https://www.argusmedia.com/en/blog/2021/june/28/key-issues-for-cop-26-article-6-rulebook (accessed 13 March 2023).

Hein, J., Guarin, A., Fromme, E., & Pauw, P., (2018). Deforestation and the Paris climate agreement: An assessment of REDD+ in the national climate action plans. *Forest Policy and Economics*, 90, 7-11. https://doi.org/10.1016/j.forpol.2018.01.005.

ICAP, (*2022*). Emissions Trading Worldwide: Status Report 2022. International Carbon Action Partnership. Available at: https://icapcarbonaction.com/en/publications/emissions-trading-worldwide-2022-icap-status-report (accessed 23 March 2023).

ICAP, (2023). Welcome to the ICAP ETS Map: International Carbon Action Partnership. Available at: https://icapcarbonaction.com/en/ets (accessed 23 March 2023).

Kaiser, R., (2014). Qualitative Experteninterviews: Konzeptionelle Grundlagen und praktische Durchführung. Springer Fachmedien. https://doi.org/10.1007/978-3-658-02479-6.

Locatelli, B., & Pedroni, L., (2004). Accounting methods for carbon credits: impacts on the minimum area of forestry projects under the Clean Development Mechanism. *Climate Policy*, 4, 193-204. https://doi.org/ 10.1080/14693062.2004.9685520.

Marcu, A., (2021). Article 6 rule book: A POST COP26 ASSESSMENT. ERCST. Roundtable on Climate Change and Sustainable Transition. Available at: https://ercst.org/wp-content/uploads/2021/11/20211122-COP26-Art6-final.pdf (accessed 13 March 2023).

Marsh, P., (2021). Using LIDAR data to help accelerate to move to carbon-neutral farming. *Envirotec*. Available at: https://envirotecmagazine.com/2021/10/05/using-lidar-data-to-help-accelerate-the-move-to-carbon-neutral-farming/ (accessed 13 March 2023).

McDonald, H., Bey, N., Duin, L., Frelih-Larsen, A., Maya-Drysdale, L.M., Stewart, R., Pätz, C., Hornsleth, M.N., Heller, C., & Zakkour, P., (2021). Certification of Carbon Removals Part 2: A

review of carbon removal certification mechanism and methodologies. Environment Agency Austria.

Michaelowa, A., Shishlov, I., Hoch, S., Bofill, P., & Espelage, A., (2019). Overview and comparison of existing carbon crediting schemes: Nordic Initiative for Cooperative Approaches (NICA). Available at: https://www.nefco.int/wp-content/uploads/2019/05/NICA-Crediting-Mechanisms-Final-February-2019.pdf (accessed 13 March 2023).

Ministry for Primary Industries, (2021). Permanent forests in the ETS. NZ Government. Available at: https://www.mpi.govt.nz/forestry/forestry-in-the-emissions-trading-scheme/permanent-forests-in-the-ets/ (accessed 13 March 2023).

Narassimhan, E., Gallagher, K.S., Koester, S., & Alejo, J.R., (2018). Carbon pricing in practice: a review of existing emissions trading systems. *Climate Policy*, 18(8), 967-991. https://doi.org/10.1080/14693062.2018.1467827.

Pan, C., Shrestha, A., Innes, J.L., Zhou, G., Li, N., Li, J., He, Y., Sheng, C., Niles, J-O., & Wang, G., (2022). Key challenges and approaches to addressing barriers in forest carbon offset projects. *Journal of Forestry Research*, 33, 1109-1122. https://doi.org/10.1007/s11676-022-01488-z.

Peters, G., Andrew, R., Boden, T., Canadell, J.G., Ciais, P., Le Quéré, C., Marland, G., Raupach, M.R., & Wilson, C., (2013). The challenge to keep global warming below 2 °C. *Nature Climate Change* 3, 4–6. https://doi.org/10.1038/nclimate1783.

Prag, A., Briner, G., & Hood, C., (2012). Making Markets. Design and Governance of Carbon Market Mechanisms. OECD. COM/ENV/EPOC/IEA/SLT (2012) 4. Available at: https://www.oecd.org/env/cc/(2012)4%20-%20Market%20Mechanisms_AE%20(2).pdf (accessed 13 March 2023).

Raediker, S., & Kuckartz, U., (2020). Focused Analysis of Qualitative Interviews with MAXQDA: Step by Step. MAXQDA Press. https://doi.org/10.36192/978-3-948768072.

Riehl, B., Wang, G., Eshpeter, S., Zhang, H., Innes, J.L., Li, N., Li, Jinliang, & Niles, J.O., 2016. Lessons Learned in Mandatory Carbon Market Development. *International Review of Environmental and Resource Economics*, Vol. 10: 3-4, 227-268. http://dx.doi.org/10.1561/101.00000087.

Santikarn, M., Li, L., La Hoz Theuer, S., & Haug, C., (2018). A Guide to Linking Emissions

Trading Systems. ICAP. Creative Commons Attribution CC BY 3.0 IGO.

Schneider, L., Healy, S., Fallasch, F., De León, F., Rambharos, M., Schallert, B., Holler, J., Kizzier, K., Petsonk, A., & Hanafi, A., (2020). What makes a high-quality carbon credit? Phase 1 of the "Carbon Credit Guidance for Buyers" projects: Definition of criteria for assessing the quality of carbon credits. World Wildlife Fund (WWF-US), Environmental Defense Fund (EDF), Oeko-Institut.

Schneider, L., & La Hoz Theuer, S., (2018). Environmental integrity of international carbon market mechanisms under the Paris Agreement. *Climate Policy*. 19, 386-400. https://doi.org/10.1080/14693062.2018.1521332.

Shrestha, A., Eshpeter, S., Li, N., Jinliang, L., Nile, J.O., & Wang, G., (2021). Inclusion of forestry offsets in emission trading schemes: insights from global experts. *Journal of Forestry Research*, 33, 279-287. https://doi.org/10.1007/s11676-021-01329-5.

Tröger, J., & Reese, G., (2021). Talkin' bout a revolution: an expert interview study exploring barriers and keys to engender change towards societal sufficiency orientation. *Sustainability Science*, 16, 827-840. https://doi.org/10.1007/s11625-020-00871-1.

Umweltbundesamt (UBA), (2021). Übereinkommen von Paris. Available at: https://www.umweltbundesamt.de/themen/klima-energie/internationale-eu-klimapolitik/uebereinkommen-von-paris#unterschiede-zum-kyoto-protokoll (accessed 13 March 2023).

United Nations Framework Convention on Climate Change (UNFCCC), n.d. Key aspects of the Paris Agreement. Available at: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement/key-aspects-of-the-paris-agreement (accessed 13 March 2023).

United Nations Framework Convention on Climate Change (UNFCCC), (2022). COP27 Closing Remarks by the UN Climate Change Executive Secretary. Available at: https://unfccc.int/news/cop27-closing-remarks-by-the-un-climate-change-executive-secretary (accessed 13 March 2023).

Van Kooten, G.C., (2016). Forest carbon offsets and carbon emissions trading: Problems of contracting. *Forest Policy and Economics*. 75, 83-88. https://doi.org/10.1016/j.forpol.2016.12.006.

VERBI Software, (2021). MAXQDA 2022. Computer program. VERBI Software

World Bank, (2021). State and Trends of Carbon Pricing 2021. World Bank.

Young, D.S., & Casey, E.A., 2018. An Examination of the Sufficiency of Small Qualitative Samples. *Social Work Research*. 43(1), 53-58. https://doi.org/10.1093/swr/svy026.

York, I., Kerschner, S., & *Smithers Excell, J., (2020): Voluntary Carbon Markets: A Blueprint. White & Case LLP. Avail*able at: https://www.whitecase.com/publications/alert/voluntary-carbon-markets-blueprint, (accessed 13 March 2023)

Appendix

A1.1: Review of Emissions Trading Systems and the reflection of flexibility instruments, own illustration based on ICAP (2022) and ICAP (2023)

ETS	ETS start	Category		Geographics		Governance of		Certification		Scope of application		
		Forestry	Other	Domestic **	Internat.	Jurisdic.	Project -level	Own	Existing	Quantitative limits	Qualitative limits	Safeguards
Austrian National Emissions Trading System	2022	./.	./.	./.	./.	./.	./.	./.	./.	./.	./.	./.
Canada- Nova Scotia	2019	./.	./.	./.	./.	./.	./.	./.	./.	./.	./.	./.
Canada- Québec Cap- and Trade System	2013		X	X			X	X		Up to 8%	Limitation of available credit types	Carbon credits are guaranteed and need to be replaced in case of illegitimate issuance. Fallback mechanism by the minister's environmental integrity account, in case of missing credit recovery possibility

ETS	ETS start	Category		Geographics		Governance of		Certification		Scope of application		
		Forestry	Other	Domestic **	Internat.	Jurisdic.	Project -level	Own	Existing	Quantitative limits	Qualitative limits	Safeguards
China-Beijing pilot	2013	X	X	X			X	X		Up to 5%*	Limitation of available credit types	Projects start date from 2013 onwards (exception for carbon sink projects from February 2005 onwards)
China-Chongqing pilot	2014	X	X	X			X	X		Up to 8%	Limitation of available credit types	Reductions must be achieved after 2010 (except for carbon sink projects)
China-Fujian pilot	2016	X	X	X			X	X		Up to 5%*	Limitation of available credit types	For forestry projects, implementation after mid- February 2005 and independent legal project developer
China-Guangdong pilot ETS	2013	X	X	X			X	X		Up to 10%*	Limitation of available credit types	Projects must primarily lead to reduction of CO2 and CH4

ETS	ETS start	Category		Geographics		Governance of		Certification		Scope of application		
		Forestry	Other	Domestic **	Internat.	Jurisdic.	Project -level	Own	Existing	Quantitative limits	Qualitative limits	Safeguards
China-Hubei pilot ETS	2014	X	X	X			X	X		Up to 10%	Limitation of available credit types	Reductions must be achieved between 2013-2015
China-National ETS	2021	X	X	X			X	X		Up to 5%*	Generated from projects not covered by the national ETS	
China-Shanghai pilot ETS	2013	X	X	X			X	X		Up to 5%	Limitation of available credit types	Projects start date from 2013 onwards
China-Shenzen pilot ETS	2013	X	X	X			X	X		Up to 10%	Limitation of available credit types	
China-Tianjin pilot	2013	X	X	X			X	X		Up to 10%	Limitation of available credit types	Emission reductions must have been achieved after 2013
EU Emissions Trading System (EU ETS)	2005	./.	./.	./.	./.	./.	./.	./.	./.	./.	./.	./.

ETS	ETS start	Category		Geographics		Governance of		Certification		Scope of application		
		Forestry	Other	Domestic **	Internat.	Jurisdic.	Project -level	Own	Existing	Quantitative limits	Qualitative limits	Safeguards
German National Emissions Trading System	2021	./.	./.	./.	./.	./.	./.	./.	./.	./.	./.	./.
Japan- Saitama Target Setting Emissions Trading System	2011	X	X	X			X	X		Only for credits generated outside Saitama (further restrictions)	Limitation of available credit types	Vintage limitations exist (usage from 2011 onwards)
Japan- Tokyo Cap-and Trade Program	2010		X	X			X	X		Only for credits generated outside Tokyo (further restrictions)	Limitation of available credit types	For compliance purposes after 2010 onwards
Kazakhstan Emissions Trading System	2013	X	X	X			X		X	No limits	Generated from projects not covered by	Application of IPCC methodologies and rules developed by Ministry of Ecology,

ETS	ETS start	Category		Geographics		Governance of		Certification		Scope of application	
		Forestry	Other	Domestic **	Internat.	Jurisdic.	Project -level	Own	Existing	Quantitative limits	Qualitative limits	Safeguards
											the national ETS	Geology and National Resources
Korea Emissions Trading Scheme	2015	X	X	X	X			X	X	Up to 5%	Generated from projects not covered by the national ETS an CDM with Korean content requirements	Projects start date from June 2016 onwards
Mexican Pilot ETS	2020	X	X	X			X	X	X	Up to 10%	Limitation of available credit types	Validation and verification under internationally and domestically recognized protocols (further restrictions)

ETS	ETS start	Category		Geographics		Governance of		Certification		Scope of application		
		Forestry	Other	Domestic **	Internat.	Jurisdic.	Project -level	Own	Existing	Quantitative limits	Qualitative limits	Safeguards
New Zealand Emissions Trading Scheme	2008	./.	./.	./.	./.	./.	./.	./.	./.	./.	./.	./.
Swiss ETS	2008	./.	./.	./.	./.	./.	./.	./.	./.	./.	./.	./.
United Kingdom ETS	2021	./.	./.	./.	./.	./.	./.	./.	./.	./.	./.	./.
USA- California Cap- and Trade Program	2012	X	X	X			X		X	Up to 4%*	Limitation of available credit types	Principle of buyer liability, in case of non-conformance a substitute must be surrendered
USA- Massachusetts Limits on Emissions from Electricity Generators	2018	./.	./.	./.	./.	./.	./.	./.	./.	./.	./.	./.

ETS	ETS start	Category		Geographics		Governance of		Certification		Scope of application		
		Forestry	Other	Domestic **	Internat.	Jurisdic.	Project -level	Own	Existing	Quantitative limits	Qualitative limits	Safeguards
USA- Oregon	2022		X	X			X	X		Up to 10%*	Limitation of available credit types	Automatic cancellation if credit not used in two consecutive compliance periods
USA- Regional Greenhous Gas Initiative (RGGI)	2010	X	X	X			X	X		Up to 3.3%	Limitation of available credit types	

* Additional requirements to be met

A1.2: Complete list of concerns addressed from an EU ETS perspective

Concern	Number of responses	Sample
CDM-experiences	9	NGO9, PI1, NGO1, NGO3, ARS2, NGO5, NGO6, PD1, PD2
Financial crisis	3	PI1, NGO1, SD1
NDC focus	3	NGO2, NGO3, SD1
Lobbyism	3	NGO2, ARS1, NGO3
Environmental integrity	2	PI1, NGO3
Price signal	2	NGO1, SD1
Mitigation deterrence	2	NGO1, NGO6
Fungibility	2	NGO6, SD2
Abatement cost	1	NGO3
Adverse selection	1	NGO6
Competition issues	1	PI1
Conflict of interest	1	PI1
Windful profits	1	NGO3
Double-counting	1	NGO3
CDM-scandals	1	NGO1
Purpose deterrence	1	NGO6
Trading "Hot Air"	1	PI2

A1.3: Complete list of concerns addressed with regards to carbon credits

Concern	Number of responses	Sample
NDC focus	4	AR2, NGO4, PD1, ARS4
Market standardization	2	ARS2, SD1
Mitigation deterrence	2	CO2, NGO6
Trading "Hot Air"	1	NGO3
Lobbyism activity	1	NGO3
"Postcolonialism"	1	SD1
Project level activity	1	NGO3
Speculation risk	1	SD1

A1.4: Complete list of concerns addressed on forestry related carbon credits

Concern	Number of responses	Sample
Permanence	13	PI1, CO1, ARS1, NGO3, ARS2, NGO4, NGO5, NGO6, ARS3, PD1, PI2, SD1, SD2
Measurement	6	PI1, ARS1, CO2, NGO6, ARS3, PD2
Baseline	5	PI1, NGO6, PD1, PI2, SD2
Leakage	5	NGO3, ARS6, CO2, NGO6, PD1
Additionality	4	ARS1, CO2, NGO6, PD1
Political Will	4	ARS1, ARS6, CO2, NGO6, PD
"Postcolonialism"	4	CO2, ARS3, PD1, ARS4
Robustness	4	NGO9, PI1, NGO1, PI2
Administration	3	ARS2, CO2, ARS3
Mitigation deterrence	3	ARS3, PI2, SD2
Reversibility risk	3	ARS2, NGO4, SD1
Accounting	2	PI1, ARS6
Fungibility	2	NGO5, ARS3
Monitoring	2	NGO1, ARS1
Natural disaster	2	NGO3, SD1
Price Signal	2	NGO1, NGO7
Property rights	2	PD1, SD1
Accuracy MRV	1	NGO8
Complexity	1	NGO1
Decreasing revenue	1	ARS2
Environmental integrity	1	ARS4
Exclusivity	1	CO2
Governance	1	NGO3
Land grabbing	1	CO1
Liability	1	PI1
Lobbyism	1	PD1
"Low Hanging Fruits"	1	ARS4
Overstatement	1	NGO6

Bisherige Beiträge

- No 23: Müller, Carsten/ Behr, Patrick/Orgen, Papa: Portfolio Allocation and Optimization with Carbon Offsets: Is it Worth the While?, 2023
- No 22: Müller, Carsten/Behr, Patrick/Bleuel, Sebastian/Nowak, Eric: Rethinking voluntary carbon credit markets and the EU ETS: A critical review, 2022.
- No 21: Hillebrand, Rainer: IMF and World Bank Institutional Set-up, Criticisms and Challenges, 2017.
- No 20: Maurer, Kai-Oliver: Small is beautiful? The Baltic States and Germany in the Greek Debt Crisis, 2017.
- No 19: Huth, Michael/Düerkop, Sascha/Romeike, Frank: RIMA-KIL – Risikomanagement für kritische Infrastrukturen in der Logistik, Abschlussbericht, 2017.
- No 18: Skauradszun, Dominik: Synthetische Sekundärinsolvenzverfahren und „echter" Rechtsschutz, 2016.
- No 17: Huth, Michael/Lohre, Dirk: Risikomanagement in der Spreditions- und Logistikbranche: Bestandsaufnahme zu Verbreitung und Reifegrad, 2015.
- No 16: Kreipl, Claudia: Compliance Management: Ein Konzept (auch) für kleine und mittelständige Unternehmen, 2015.
- No 15: Thies, Anja/Deinert, Stefanie/Huth, Michael: Soziale Nachhaltigkeit bei Gewinnung und Bindung von Berufskraftfahrerinnen und -fahrern in der Logistikbranche, 2015
- No 14: Kohler, Irina/Dehmel, Lisa: Wertschöpfung durch Unternehmenskommunikation - Evaluation der Erfolgswirkung durch Kommunikations-Controlling, 2015
- No 13: Kohler, Irina/Ingerl, Carina: Beitrag des Controllings zur Umsetzung von Corporate Governance in Familienunternehmen, 2015
- No 12: Slapnicar, Dr. Klaus W.: Wirtschaftsrecht à jour, 2015
- No 11: Kohler, Irina: Fuldaer Supply Chain Management-Dialog: Trends und Herausforderungen im Supply Chain Controlling, 2014
- No 10: Hillebrand, Rainer: Germany and the eurozone crisis: evidence for the country's "normalisation"?, 2014
- No 9: Kohler, Irina/Ingerl, Carina: Unternehmensnachfolge und Family Business Governance im Mittelstand: eine empirische Studie zur Nachfolgeproblematik in der Region Fulda, 2014
- No 8: Neuert, Josef: Business Management Strategies and Research Development, 2013
- No 7: Huth, Michael/Goele, Hannes: Potenzial der Ersatzteillogistik von produzierenden Unternehmen in der Region Berlin/Brandenburg, 2013

- No 6: Kreipl, Claudia/Preißing, Dagmar/Huth, Michael/Lohre, Dirk/Och, Dominik/Neuert, Josef: Contributions to Applied International Business Management Research, 2013
- No 5: Boelsche, Dorit: Performance measurement in humanitarian logistics, 2013
- No 4: Conrad, Peter/Hummel, Thomas R.: Transitions: Individuelle Handhabung und Verarbeitungsformen institutionellen Wandels, 2012
- No 3: Hummel, Thomas R./Turovskaya, Maria S.: Project Studies in Specific Business, Legal and Economic Topics: video conference presentations, 2011
- No 2: Hans, Lothar: Zur Konzeption eines Verwaltungscontrollings, 2011
- No 1: nicht veröffentlicht/not published.

Alle Beiträge stehen auf der Homepage des Fachbereichs Wirtschaft als Download zur Verfügung: www.hs-fulda.de/wirtschaft.

The papers can be downloaded from the homepage of the Faculty of Business: www.hs-fulda.de/wirtschaft.