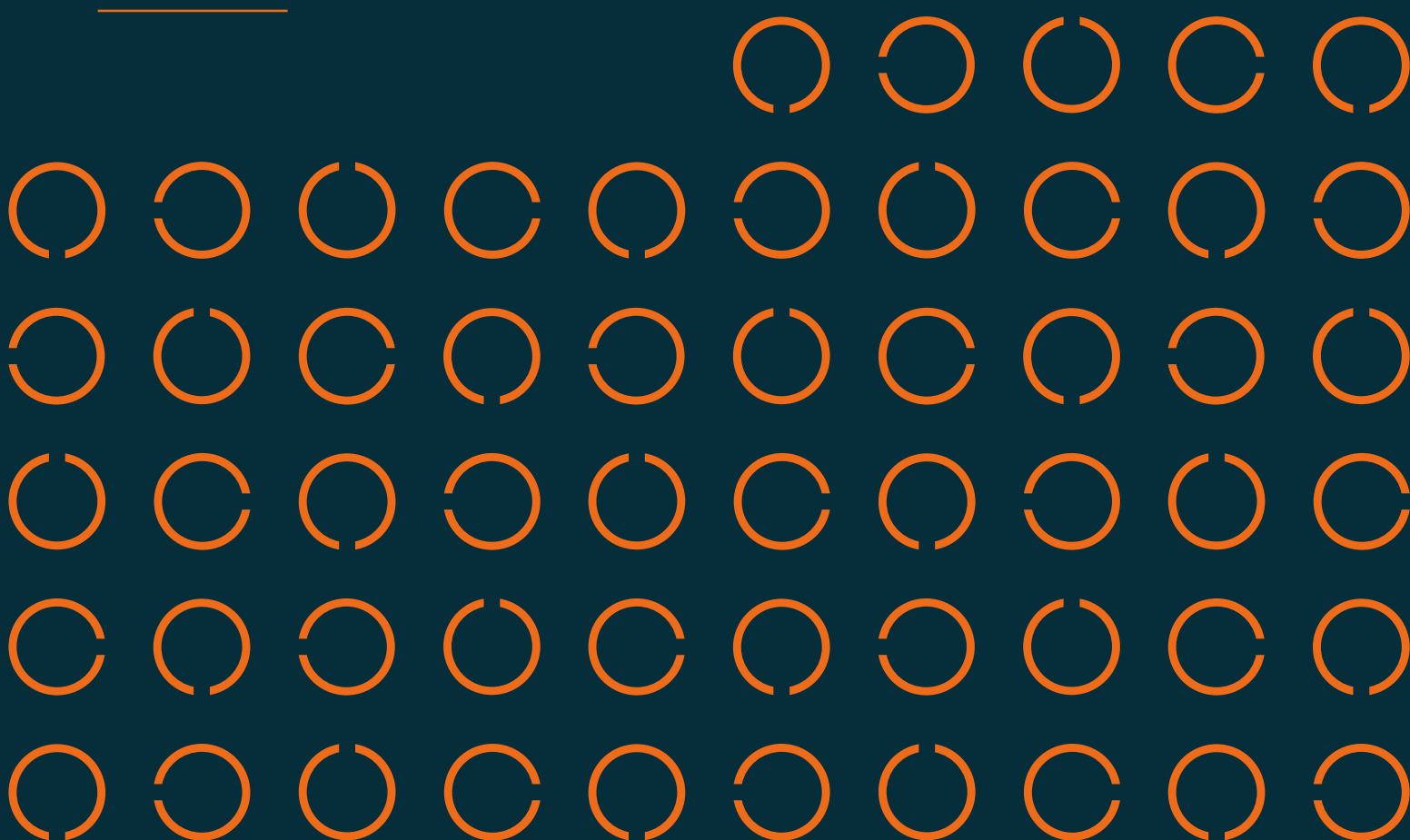


MRV Workshop

Evidence to Inform Credible and Achievable MRV

3rd July 2023



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Acronyms

AI: Artificial Intelligence	ETS: Emissions Trading Scheme
BECCS: Bioenergy with Carbon Capture and Storage	EU: European Union
CBD: Convention on Biological Diversity	GGR: Greenhouse Gas Removal
CCD: Convention to Combat Desertification	IPCC: The Intergovernmental Panel on Climate Change
CDR: Carbon Dioxide Removal	LCA: Life Cycle Analysis
CORSIA: Carbon Offsetting and Reduction Scheme for International Aviation	MRV: Monitoring, Reporting and Verification
DACCS: Direct Air Carbon Capture and Storage	NBS: Nature Based Solutions
DEFRA: Department for Environment Food & Rural Affairs	NMF: Nature Markets Framework
DESNZ: Department for Energy Security & Net Zero	UNFCCC: United Nations Framework Convention on Climate Change
ERW: Enhanced Rock Weathering	VCM: Voluntary Carbon Markets
ETC: Energy Transitions Commission	WCC: Woodland Carbon Code

Executive Summary

This document presents the output of a workshop hosted by CO₂RE¹ on 3rd July 2023 on MRV of GGR. A descriptive summary of the proceedings of the workshop is provided and the positions expressed do not necessarily represent the views of all participants or the hosts.

The purpose of the workshop was to understand different user needs and priorities in relation to credible and achievable MRV which would help in framing the perspectives in a review of the current landscape of MRV regulations, protocols, frameworks, certification, standards, and schemes for GGR. The workshop provided an opportunity to hear from academics and experts in the field of MRV, as well as to allow for participant discussion on the current gaps, barriers, opportunities, (un)certainties, and user priorities. There were 42 registrations (36 attended in person and 6 were solely online), with government, academics, and environmental non-governmental organisations represented.

The workshop was conducted over three sessions. The first session consisted of brief presentations on aspects of MRV such as the CO₂RE approach to MRV, the mapping of existing frameworks, standards, protocols etc., MRV law and regulation, challenges and opportunities beyond carbon, international UNFCCC/EU approaches, and perspectives from DESNZ and DEFRA. This led into the second session which included an interactive activity to gain perspectives on “accuracy vs pragmatism”, followed by a plenary

¹ [CO₂RE](#) is a multi-disciplinary, multi-centre national research hub on GGR, funded by UK Research & Innovation (Grant Ref: NE/V013106/1). It conducts research, coordinates demonstration projects around the UK, connects to other relevant national and international programmes, and commissions grants through a flexible fund.

discussion. A carousel of workshops then provided the opportunity for smaller groups to discuss the four specific topics of permanence; baselines, counterfactuals, and additionality; beyond carbon; and who should be leading on MRV for the best outcomes. The last session provided a summary of the breakout group highlights and solicited participants' responses on future collaborative work planning. The aim was to understand the range of perspectives on MRV, rather than to achieve consensus.

From the workshop the following tentative observations, which are relevant to the credibility and achievability of accurate, transparent, consistent, comparable, and complete MRV, were drawn:

- The current MRV landscape is complex and fragmented. The nature of the transition from VCM (which enables organisations and individuals to purchase carbon credits on a voluntary basis) to a compliance market (which is mandatory and regulated) is uncertain which is affecting business plans and investment.
- Whilst there is a degree of commonality on core principles for MRV it is not yet clear how, and from where, a consensus might emerge.
- There needs to be transparency, accessibility, and rigour of MRV, alongside clear responsibilities and traceability, to build trust. This includes transparency of the uncertainties.
- Without accurate and transparent systems of MRV, it is not possible to track the deployment and effectiveness of GGR.
- MRV frameworks need protocols and regulation that create a level playing field across GGR technologies and allow consistency between selling platforms (and in future compliance regimes) operating internationally. Fairness is needed in how outcomes are rewarded, and risks are shared between different actors.
- MRV approaches need to reflect the realities of technologies or land-management practices, incentivise the right actions and not be too burdensome, especially for smaller-scale actors.
- Technologies and methods such as remote sensing, modelling, automation, digitisation and machine learning could play a role in improving the efficiency and effectiveness of MRV over time. Improvements might be iterative as the technologies develop.
- There is a need to further develop the sense of a shared common purpose with greater engagement throughout the diverse community, with emphasis on how the natural and social sciences can work together.

Session 1: Introduction and presentations (Morning session chair: Jo House, CO₂RE Hub)

The purpose of this session was to introduce the workshop and provide brief thought-provoking summaries on current research and perspectives on MRV. The aim of the workshop was to discuss what credible and achievable MRV could look like when taking into account user viewpoints, needs, and requirements. By discussing what already exists or is in the pipeline, including the CO₂RE Hub research mapping exercise, it was hoped that gaps, barriers, and opportunities would be apparent. An understanding of current MRV will help in determining current actions, prioritisations for short term actions and what would be needed to raise standards and credibility in the longer term.

CO₂RE approach to MRV (Jo House): The UNFCCC/IPCC pillars and the CO₂RE principles for MRV are accuracy, transparency, consistency, comparability, and completeness¹. Whilst not only applying to National reporting and accounting, they give credibility and confidence to project-based MRV for policy makers, investors and the public. The CO₂RE Principles for Credible Removals evaluation framework has six key elements: removal, environmental, social, systems, business models, and legal, which are critical for public acceptability, climate justice, meeting the needs of international conventions (including CBD, CCD) and sustainable scaling-up. Current CO₂RE research has considered the full lifecycle supply chain, and the need to go beyond carbon². MRV currently raises lots of questions, such as who should measure what, how and how often, to whom and for how long? How achievable is it, and how expensive? Who should undertake verification, stipulate accuracy, and how should it relate to baselines and additionality?

Presentation: Mapping of existing MRV frameworks, standards, protocols etc. against user needs (Sue Rodway-Dyer): CO₂RE Hub research currently includes a mapping exercise of current MRV regulations, protocols, frameworks, certification, schemes etc. noting gaps, barriers, opportunities, (un)certainities, research priorities and ways forward for rapid action and longer-term goals. The mapping collates information on types of operation, capture and storage methods, any MRV statements, environmental and social impacts, LCA, geographical scale of application, approaches, nomenclature, and permanence. In a rapidly moving field, there are many relevant standards, protocols and approaches; however current findings indicate that MRV is not harmonised, and it varies between GGR types. Whilst there is a plethora of methods for quantifying removals, not all GGR types have certification or standards or internationally agreed standards for projects. The research has noted that methods used are often not publicly reported or are extremely well hidden, and in a lot of cases, MRV is not evidenced or mentioned at all, with vague statements of ambition which are not clearly defined in practice. Verification by a third party is often stated, but it is not clear who the third party is, or the standard, and very rarely does it say how often it occurs. Baseline definitions vary, if there is one, and units and certificates etc. differ in timescale. Transparent and robust MRV is needed to support the scaling up of GGR, and this needs to happen quickly as the development of new standards becomes more complex.

Presentation: Driving Sustainable Removals: MRV and Regulation (Navraj Ghaleigh and Luka Štrubelj): GGR encompasses a heterogeneous set of technologies, with a range of technological maturities, while individual GGR methods may comprise multiple processes, and as such they present a challenge for developing governance systems. In the UK, the extent of regulatory coverage of GGR methods varies but there is an overarching absence of legal instruments for addressing GGR MRV comprehensively. In the EU the European Commission has proposed a Carbon Removal Certification Framework Regulation³, with a principle-orientated approach, detailed certification methodologies and procedures, and governance of certification schemes. The question posed was whether regulatory approaches should be compliance-orientated or meta-regulatory. A compliance-orientated approach would include detailed, prescriptive methods and rules for MRV, with verifiers having a limited scope of obligations and a passive role. Such an approach would limit proliferation of standards for nascent GGR methods, with the breadth and manner of monitoring being level. A meta-regulatory approach would mean principle-based national requirements with a recognised standard-setting body which would design cost-effective systems of MRV. This would mean technological heterogeneity and nascent GGR methods would support development, with the breadth of monitoring having multiple information channels.

¹ IPCC. (2022). Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.

² <https://co2re.org/ggr-evaluation>

³ European Commission (2022) Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing a Union certification framework for carbon removals.

DESNZ perspective on MRV: The 2021 MRV GGR Task and Finish Group Report¹ distinguishes between “nature-based” (e.g. afforestation, forest management, and soil carbon sequestration) and “engineering-based” approaches (e.g. DACCS, BECCS, wood in construction, biochar, and ERW). Engineered GGRs are considered essential to balance residual emissions from hard to decarbonise sectors and will provide new economic opportunities for the UK. The Net Zero Strategy is committed to deploying GGRs at scale by 2030 and the 2022 GGR Business Model Consultation Response² suggested principles to guide decision-making on the MRV framework for GGRs which include that MRV needs to be accurate, consistent, with continuous improvement and environmental safeguards, and that it is simple, has parity, and is transparent. The criteria for robust negative emissions are that the CO₂ source is carbon directly captured from the atmosphere or seawater, that there is net negativity, where supply chain CO₂ emissions are lower than the total amount of stored carbon, and finally that there is permanence i.e. once captured, carbon must be sequestered in a highly durable store. The assessment of permanence should consider durability and ‘risk of reversal’ (likelihood of captured carbon being re-emitted to the atmosphere)³.

DEFRA perspective on MRV: DEFRA’s focus is on increasing deployment of “nature-based” GGR solutions, which it defines to include tree planting, agroforestry, hedgerows, and peat restoration. The Government is committed to the Net Zero Growth Plan⁴ which includes having a harmonised approach towards measuring carbon emissions from farms, with support to farmers to understand their emission sources through carbon audits. MRV is critical to the integrity of nature markets which are growing rapidly, but with some already well established including the UK WCC⁵ and the UK Peatland Code⁶. The NMF highlights key principles for effective MRV: benefits must reflect genuine, lasting, and additional environmental improvements, which are robustly verified and transparently documented, with no double counting or room for misleading claims or greenwash.

MRV beyond carbon: Challenges and Opportunities (John Lynch): GHG removal may have positive co-benefits (e.g. renewable energy supplies, increased biodiversity) or negative trade-off effects (e.g. pollution, loss of biodiversity) beyond climate change mitigation. This has implications for MRV, as there is limited research on life-cycle assessment of GHG removal for impact categories beyond climate. Policy is starting to recognise the importance of broader sustainability: the EU Proposal for a Regulation on an EU certification for carbon removals dictates that carbon removal activity should have neutral impacts or provide co-benefits with regard to climate change adaptation, sustainable use and protection of water and marine resources, transition to a circular economy, pollution prevention and control, and protection and restoration of biodiversity and ecosystems, but how these will be assessed remains unclear. A single project or activity can potentially generate increased revenue if it is recognised that multiple environmental goods are provided. This could be through ‘stacking’ independent credits (e.g. separate carbon and biodiversity crediting schemes) or ‘bundling’ a set of outputs into a single unit (for example a ‘premium’ carbon credit reflecting additional value from biodiversity gain, in addition to carbon removal). There may be potential to streamline MRV by integrating assessment methods across different outputs, but there are also challenges in ensuring additionality of secondary benefits. Participants debated the challenges of creating policy and practical systems that allow multiple benefits to be rewarded.

International UNFCCC and EU approaches (Jo House): Before the Paris Agreement⁷ the expectations for the level of MRV of GHG emissions and removals differed between developed countries, with mandatory reporting requirements, and developing countries,

¹ BEIS (2021) Monitoring, Reporting and Verification of Greenhouse Gas Removals Task and Finish Group Report.

² Department for Business Energy & Industrial Strategy (2022) Business Models for Engineered Greenhouse Gas Removals A consultation on accelerating investment in engineered carbon removals.

³ DESNZ (2023) Engineered Greenhouse Gas Removals: Government response to the consultation on a GGR Business Model.

⁴ HM Government (2023) Powering up Britain - The Net Zero Growth Plan.

⁵ <https://woodlandcarboncode.org.uk/>

⁶ IUCN National Committee United Kingdom (2023) Peatland Code Version 2.0.

⁷ https://unfccc.int/sites/default/files/resource/parisagreement_publication.pdf

where it was more voluntary. The IPCC guideline methods contain different tiers and approaches for countries with different capacities and capabilities to report in different ways. The Paris Agreement changed this: all countries had to report their GHG inventories, and progress in implementing and achieving nationally determined contributions, along with a technical expert review. This forms part of the UNFCCC approach to quality control (internal compilation), assurance (third party review) and verification (external bodies). The IPCC Guidelines for Greenhouse Gas Inventories provide general guidance and reporting methods for sectors such as energy, waste etc.¹ The IPCC Guidelines do deal with removals such as carbon capture and storage for the sectors in which it occurs, such as transport emissions, geological storage, biological capture etc. However, there are no guidelines for DACCS, ERW, or ocean storage. IPCC Guidelines are divided by sectors, whereas a lot of the work that CO₂RE is doing is cross-sector, looking at lifecycle from beginning to end throughout a project which tries to avoid double counting or missing data. Often counting is country based and does not allow for cross-border issues; the Paris Agreement² Article 6.2 refers to carbon credits and Article 6.4 addresses the global carbon market which is overseen by a UN supervisory body.

Session 2: Accuracy vs pragmatism (chaired by Mark Workman, CO₂RE Hub)

This session began with a slide providing an overview of how MRV could vary along a spectrum from being accurate, rigorous, transparent and credible to investors, to being pragmatic where it is not overly burdensome to producers (Figure 1). This highlighted how there is a need to consider ease of use, capacity, and cost. This was followed by an interactive activity which involved participants adding post-it notes onto wall posters with their views on four themes on the topic of MRV accuracy vs pragmatism. Accuracy allows for consequential or indirect impacts across a wider system, whereas pragmatism would only allow for direct attributional impacts. This was followed by a summing up of the views, with the opportunity to discuss and question statements.

¹ <https://www.ipcc.ch/report/2019-refinement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/>

² https://unfccc.int/sites/default/files/resource/parisagreement_publication.pdf

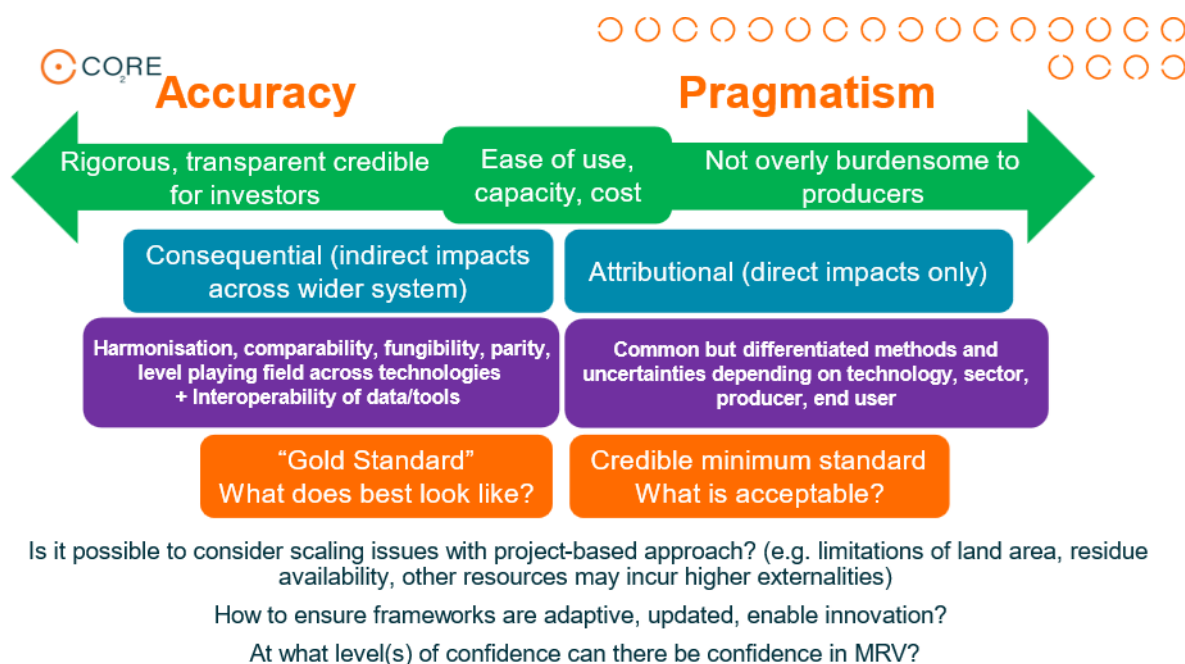


Figure 1: A visualisation of accuracy versus pragmatism in Monitoring Reporting and Verification (MRV) of Greenhouse Gas Removals (GGR), and questions posed to aid stakeholder discussions.

Interoperability of data/tools: Participants thought that this was not just a national issue, but a global one, and that the ideal is a set of international standards with data, at a minimum, comparable for individual types of GGR, and ideally comparable across all. It was suggested that currently, private-sector MRV standards tend to be fairly onerous, with a ‘laundry list’ of requirements. It is hoped this could ease as scientific understanding of different GGR methods deepens. Early MRV data helps to develop understanding and it was noted by many that it is important to build on what has already been done and works, such as ETC¹, VCM, and the WCC². However, it was also noted that inaccuracy of mitigation and claims has bedevilled the VCM (avoided deforestation, renewable energy, etc.), with the carbon market assuming that projects are doing a lot better than the reality. The importance of transparency and mandating disclosure at the project level in the public domain was stated along with the need for standardisation of nomenclature. Automation of approaches and integration with models was clearly important, however it was understood that there would be different data requirements depending on size, scale, and environmental impact.

Standardisation and harmonisation across technologies and approaches: This included thoughts on what a credible minimum standard, or level of assurance would look like, and how this can be harmonised across different GGR activities and methods for comparability. Who should decide on a minimum standard as opinions would vary on what is acceptable? It was questioned whether first-mover project developers should be supported – or even mandated – to collect and share data for others to learn from. It was proposed that an equitable payment system is needed, so that if the cost of carbon is traded at a standard price, then it needs to allow for the fact that the cost of different strategies varies, for example, tree planting vs DACCS. When discussing minimum standards, confidence is needed on knowing if the process has resulted in negative emissions and what is truly additional i.e. removal would not have happened in the absence of the project. It is essential to know what the uncertainties are, and how permanent the carbon storage is, which affects questions of fungibility. There are different levels of durability in carbon storage

¹ <https://www.energy-transitions.org/>

² <https://woodlandcarboncode.org.uk/>

solutions; with biological storage options not generally considered fungible with geological storage options due to the decadal versus millennial-scale lifetimes of permanence. It was suggested that it needs to be openly acknowledged that biomass residue availability will not be sufficient, and that it would be pragmatic to accept the need for dedicated GGR feedstocks. There is a need for MRV for farm-level carbon accounting, currently completed by farmers themselves, to provide the baseline for future change. It was suggested that a 'soil health' asset could state benefits beyond carbon, although this is complicated by the variance of soil at small scales (within fields) which make it expensive to establish the baseline, so what would be acceptable? It was felt that standards should cover common issues with clearly defined boundaries with common 'good practice' which was split between direct or indirect measurements and modelling. The issue of what to call the 'standards', such as "Gold.....", was raised in relation to what could work commercially and not cause confusion with other registry names, but also who should decide the minimum standard and what the public would find acceptable. It was also suggested that there needs to be clear differentiation between 'standards' and 'methodologies'.

Boundary issues, scaling, adaptive and technology neutrality: Attributional (direct impacts) vs. consequential (indirect impacts across the wider system) approaches need to be considered. It was asked whether it is possible to consider scaling issues when taking a project-based approach to MRV LCA when there are limitations such as land area, residue availability, and when other resources may incur higher externalities. How is it possible to ensure frameworks are adaptive going forward, enabling innovation and updating emerging methods, technology etc? When considering technology, neutrality and fungibility/parity/equality across technologies to achieve a level playing field, could there be different levels of MRV and acceptable uncertainties depending on technology/who is reporting/how info used/ capacity etc.? It was highlighted how MRV needs to be able to work and be recognised across international boundaries, and that this needed to cover displaced activities, such as land-use changes abroad. The time of accounting was also considered important, so when delivery of removal happens relative to when and how removals are measured, reported, and justified, whilst frameworks would need revising every ~5 years to keep up to date with the latest technology. Many participants mentioned the need for two credit types, e.g. "engineered" and "NBS" (nomenclature varied), due to the difference in handling and the need to facilitate interoperability of input/activity data within agriculture etc. Soil carbon cannot easily be measured, whereas land management actions can be, and it was suggested that permanence for biological removals should be ditched. The topic of baselines here included the need for efficient methodologies for baseline assessments. It was proposed that payment should be for practices and processes, as opposed to measured outcomes, with payments structured around continuing processes. Finally, the importance of parity rather than neutrality was suggested in one message.

Thresholds for confidence in MRV: The participants suggested that this can happen when there is (near real-time) transparent data-driven understanding, with transparency of methods/rules and of uncertainties and with clear responsibility, to make it robust. This would allow for confidence from markets, developers, governments, and the public. One message suggested that it would be when "the risk of doing is less than the risk of not doing, with regard to climate impacts", which can be related to statements on having different levels of confidence which are not necessarily binary and might vary according to different scales of projects. The need for both engineered e.g. geological sequestration and in-situ biosphere storage was a common point although again, the nomenclature varied. The need for user-friendly MRV was mentioned, so that project developers could engage in multiple methods rather than just opt for the easiest, but also, it would increase the confidence of users. Confidence was also seen as essential for clear knowledge on the CO₂ source, net neutrality and system boundaries, as well as permanence, along with the need to monitor for re-release, as part of a regular monitoring programme occurring at frequent intervals. The issue of cradle to grave emission calculations was pointed out, as was the need for conservative calculations. A clear message was that many attendees thought that there are already good examples of best practice, but that the UK needs a single landscape approach to GGR which is not just about carbon. It should take into consideration benefits beyond carbon with key defined outcomes, such as soil health.

Finally, in the discussion it was suggested that it should not be accuracy versus pragmatism but that instead we should be pragmatic to drive accuracy, and that perhaps accuracy should be replaced with complexity as even very simple methods can be accurate.

Session 3: Workshop carousel (chaired by Mikal Mast, CO₂RE Hub)

This workshop carousel session was designed to solicit the input of workshop participants regarding the key themes of permanence; baselines, counterfactuals, and additionality; beyond carbon - externalities of GGR; and who should lead on MRV for the best outcomes. The in-person attendees were allocated to groups whilst the online participants had discussions led by one of the attendees for each topic. Each of the four themes had a set of thought-provoking questions to aid discussion (see Table 1), along with the over-arching themes of LCA, questions on what data is needed and available, how it should be measured, and its accuracy, and the frequency of reporting/verification. After 20 minutes the group moved to the next theme. Brief summaries were presented to all participants for each theme for all four in-person groups and the online group. Table 1 also contains a summary of comments and questions raised by the participants.

Table 1: Workshop carousel themes:

Theme A: Permanence	Facilitated in-person by: Mark Workman, Sue Rodway-Dyer, Astley Hastings Facilitated online by: Steve Smith Suggestion(s)
Questions	• How permanent is permanent according to different frameworks and users? • How is/could fungibility be approached (e.g. discounting for less permanent solutions)? • What are the methods used and accuracy/uncertainty for tracking carbon and leaks? • For how long should monitoring take place? • How will permanence vary according to climate scenarios and land-use?
Summary of group discussions	Permanence: there was much discussion with opposing views on the need to focus efforts and deployment on engineered versus combined engineered and NBS (whole carbon market). Storage is transient for NBS as carbon is eventually released, and management can change over time, while geological storage is for 1000 years and beyond. Reporting for engineered methods has to be water-tight, but the permanence is relatively clear and simple; e.g. BECCS/DACCS – storage is more robust. In what situations is carbon assumed to have returned to the atmosphere once monitoring is complete? How to go about liability transfer for different GGRs? Deploy non-permanent solutions now and then in the future more permanent methods will become available to deploy. Parity is needed so certain methods do not dominate. It is crucial for the GGR process to be net negative and durable; however some removals may be valuable for other reasons. The Government has a role in creating a framework where a credit is a promise for a certain time period. Biochar under Puro is 100 years. Over-fixation on 1000+ years, needs to be 100 years. Should not be a commodity market. Condone offsetting as a contribution. Do not want biosphere approaches to look like the poor relation of engineered approaches.

	Maximise biodiversity aspects. There is a need to understand climate change impacts on permanence such as drier soils, flooding etc. Should certain sectors be restricted from using certain methods e.g. oil and gas cannot use trees. Aviation uses biofuels as a cycle. Bottom line: cannot have the same approaches for nature-based (uncertain/not permanent/not possible to calculate all lifecycle emissions– but can change management) and engineered (permanent/LCA/ etc).
	Fungibility: LCA is possible for engineered removals. For BECCS, there is a cross-over from land-based to engineered along the value chain - possible to calculate carbon for the engineered components (including transport); but uncertainty in relation to soil carbon. Need fungibility thought of as time periods, bundles etc. If considering the whole LCA, should we be paying for measurement or outcome?
	Accuracy of methods: a hard number for engineered methods. For NBS, modelling/ estimates required, and you have to guess certainty (can audit a hedgerow but harder to measure for soil – proxy indicators). But not beyond measurement, and there has been monitoring occurring. Importantly, need to keep measuring and understanding for the bigger picture.
	Monitoring timeline: need a minimum turnover time. At least 5 years interval? NBS needs at least 25 years as 20-30 years from planting to storing of carbon. Corporates with fossil-based emissions should only be allowed to use engineered approaches for offsetting. 100-year blocks as want to be able to monitor releases and compare to control. Liability should be for 100 years for storage.
	Payment: Should payment be for actions or outcomes? NBS for adaptation and ecosystem restoration – carbon as the co-benefit? A need to minimise barriers to NBS with government incentives and payment for management. Or outcomes for planting. Treasury may see nature-based solutions as cheap? 50-year schemes are scary to farmers across generations, so there needs to be an intermediary body with money in trust for certain time periods. Removal costs vary considerably: £10 for nature-based vs £100 for engineered.
	Land is limited: Do not rely on land-based CDR. Land removals should only be available to “offset” agriculture. Need to prioritise reduce farming emissions, alongside deploying GGR. Certain methods have smaller land requirements: e.g. lower land impact of DACCS.
	Climate scenarios: NBS will vary according to future climate; engineered removals not affected in the same way. Changes in climate may need a changed baseline.
Theme B: Baselines, counterfactuals, additionality	Facilitated in-person by: Isabela Butnar, Philippa Westbury, Genevieve Hodgins Facilitated online by: Steve Smith Suggestion(s)
Questions	• What are different approaches in existing frameworks (e.g. base year, doing nothing, historical management)? • What is credible and consistent across approaches?

	What do users think is credible?
Summary of group discussions	Baselines: should be project and site-specific (but a question about how these relate to the national picture) and distinguish between the implementation of the project and when it actually starts removing carbon e.g. NBS may take longer to establish and deliver removals. If redefine the baseline when the project is in progress does it reduce the credibility? Different definitions (e.g. static such as point in time vs dynamic over a time series) may impact business incentives differently. Clear distinction needed between avoided emissions (counterfactuals) and removals e.g. credits sold for protecting forest but not a GGR whereas afforestation is a GGR. Complicated e.g. Peatland code is avoided emissions but will eventually become net removals, building up stores. Difficulties in scale and moral issues in distinguishing emissions reductions and removals. Agreement that direct land-use change would be part of the baseline, indirect would be counterfactual. Trying to create something standardised would be misguided, as you cannot do it across the different technologies, and there are too many variables, including scaling for each GGR method. Additionality: financial or climate or both? Financial additionality relates to both government subsidies and markets and is hard for both engineered and NBS. Climate additionality harder for land-based. Complexity and lack of clarity puts off project developers and affects public and private sectors willingness to pay. Business model needs certainty and to know what is truly additional. Private and public sector stacking for farmers and landowners but unfortunately the intention / saying there has been no duplication may be different from the reality. Whose money is additional, and making it happen? Can end up rewarding those who did badly to start with e.g. farmer has damaged soil then paid to look after it. Measurements and data: currently at learning stage and sharing data should be rewarded. Conservative MRV requirements for now but as understanding increases, the requirements could decrease. How to incentivise the early projects? Boundaries should be consistent across different practices e.g. manufacturer should include transport to a farm for complete footprint. There is a lot of responsibility on developers, skills needed, and cost for high levels of accuracy. It is possible to measure a lot of things, and a tendency to try and measure everything, so need to be prescriptive. Need large investments in the foundational science base to build MRV protocols. Projects should be rewarded for data collection, even if the project is not the best, so expectations of the value of the data have to be reasonable. Credibility: (for public, farmers and others) good transparency, accessibility; good communication; needs to reflect actual farming practices on the land. Bad practice should not be rewarded. Public and media misunderstand carbon cycles, so there is a credibility gap. Language has to be appropriate for the user (investors in credits, farmers etc.). A tiered approach: different requirements according to the scale of impact that the project will have? Ability to use national/regional data to supplement farm data, and farmers contribute own business data, but minimise admin burden on smaller producer.

Theme C: Beyond carbon - externalities of GGR	Facilitated in-person by: John Lynch, Alyssa Gilbert, Chris Pearce Facilitated online by: Steve Smith Suggestion(s)
Questions	• MRV of environmental, social, and economic co-benefits and trade-offs (e.g. flood risk, biodiversity, food, jobs/income) • Methods or other approaches to evaluation (e.g. data or activity based, importance of “place”) • 'do no harm' principle (e.g. sustainability criteria addressed) vs. stacking/valuing/measuring different externalities • Which externalities are users interested in, and how might they be prioritised (e.g. core set with flexible additional considerations)
Summary of group discussions	Different viewpoints: Everyone recognises GGR removals may be associated with externalities and co-benefits, but different priorities over which broader impacts are most significant and how potential trade-offs should be assessed. Will require some additional measurement beyond tracking GGR removal quantities to monitor wider effects (even if not convinced perfect), with value in pulling methods together.
	Concerns: about unintended negative consequences on environment (e.g. ERW and biochar downstream effects on rivers and oceans – cannot undo the impacts); jobs (decline in typical farming jobs and lifestyles?), equity (do local communities have a say in and support local GGR removals?), competing activities and increasing competition for land (e.g. flood management vs biodiversity targets, food security), LCA of emissions associated with getting inputs to a farm; macro-economic benefits; technical issues; social acceptability including how people will respond to the technologies; and community-based benefits. [Civic pride as a co-benefit – architectural competition for DACCS]. MRV to avoid fraud and imposters – how do we regulate against that versus ensuring benefits/impacts realised? How to optimise for one or more outcome when you have solutions that can deliver a wide range of benefits. Ownership of carbon. Concerns about how things will be measured and monitored, how long government schemes will last for. Who takes responsibility for broader sustainability assessment – suggested many aspects would fall within remit of Environment Agency, but is there capacity to properly assess if GGR removals scale-up at speed suggested by net-zero pathways? Who to trust. Lack of clarity on the outcomes of science through to policy. Scientific challenge: attribution of LCA. Difficult trade-offs.
	Equitable access to GGR: not the first adopters taking up the cheaper/easier options. Solutions: that deliver multiple benefits at one time – carbon, biodiversity, environmental health, jobs (environmental management), levelling up (more equitable access to nature and ecosystem services). How can we understand what the benefits are and which ones we are optimising for? Recognition of co-benefits and attributing further value for a project resulting from them can support GGR business models, but implementation and assessment is challenging, and lack of clear systems to achieve this at present.

	Some established carbon credit frameworks already consider broader effects in their design, e.g. woodland and peatland code. Is there a space to use AI effectively in data. Lots of companies out there using AI? Permitting and planning system already ready to be used/adapted for any MRV system. Given wider environmental challenges and need for ecological recovery to support further ends, potential for strong and integrated land management to provide greater landscape resilience, climate change adaptation, support biodiversity: carbon sequestration and habitat storage as one of many co-benefits (not necessarily primary driver of more sustainable land management). Translate understanding of externalities into something practical: stacking and bundling. Translate increased understanding of benefits into policy. Avoid fraud. Where is the regulatory baseline, and not paying people for what is already required. Scaling and time: different issues today versus the future when GGR scaled. Need to think about these at the same time. What can we do now? E.g. try all methods to improve understanding and identify what is acceptable. Need MRV to see what does and does not work. Where are the impacts at scale and who makes the decisions? Future benefit, ensuring that we can offer cost-effective long-term supply of removals for our own needs. Pace and scale: International and global acceptability or just UK based. Want other benefits included in the thinking for standards and MRV, to ensure that the co-benefits are delivered.
Theme D: Who should lead on MRV for best outcomes	Facilitated in-person by: Navraj Ghaleigh, Luka Strubelj, Beatrice Ifie Facilitated online by: Steve Smith Suggestion(s)
Questions	• Compliance-oriented versus meta-regulatory approach to MRV: Which is more effective in scaling GGR and ensuring its environmentally sound, and legitimate? • Has the European Commission adopted the correct approach in proposing the Carbon Removal Certification Framework? • Verification: by whom, how, how often should regulation happen to ensure credibility, transparency, and confidence? Which entity(ies) would be best placed to regulate GGR MRV in the UK? Is there a case for a new body to be constituted (e.g., Office for Carbon Removal)?
Summary of group discussions	Compliance-oriented versus meta-regulatory approach: some role for private standard-setters, but compliance is also important, as is government support. Very importantly, it should not stifle innovation. Much existing good practice (CORSIA, California, EU etc), and parallel conversations in different geographies, so do not reinvent the wheel. Rules need to be clarified with certainty and address the risk of reversibility. MRV will differ across different technology types: there is a need to balance accuracy and precision with cost for developers and prevent 'pricing out' some CDR types. Important to differentiate between carbon credits that comes from different sources (i.e. DACCS vs afforestation) and need to avoid a blanket approach.

	Comparative approaches: EU guaranteeing certainty with setting their own carbon credit/certification model, while the US Inflation Reduction Act incentivising development. UK sits in the middle and risks inaction, but has the opportunity to be pro-active and forward thinking. UN has recommendations on removals and principles and technologies.
	MRV is key: Consistency, transparency, and credibility, along with resources will be needed across different compliance regimes to cover cross-national supply chains and to ensure legitimacy of the sector. Regulation needs long term finance. How will the public see the importance of financial factors over the environment? Regulation must be flexible to simultaneously enable technology development but also to enable (stronger) regulation down the line – certainty is crucial (starting with light touch). Needs fundamental definitions of durability and permanence laid out.
	New body not needed: The Environment Agency already regulates the UK ETS (in England)-endow with additional powers to deal with GGR MRV. But this is subject to credibility, resources, and expertise. Credibility is vital to guarantee independence from other government institutions. Current activity focused around the VCM as no government scheme as yet, but a transition to compliance is likely in the future. Multiple standards mean uncertainty for investors, project developers and carbon registries; this affects investment decisions. Core principles are mainly agreed, but variations in the detail of methodologies. Does need over-arching, standardised form of certification.
	Clear structure: On who is liable for handling reversal: who is responsible; what action is required; and in what timeframe.

Workshop feedback:

Feedback from the workshop highlighted the value of meeting different stakeholders who are helping to shape how the sector will be regulated; the opportunity for debate and gathering of different viewpoints; the assessment of the current GGR MRV landscape across active registries and certifications, the uncertainty of the present landscape, the developments in CDR policy; and the value of starting to build an MRV community with a common purpose of greater engagement within the diverse community. Attendees appreciated the engagement, openness, and support of the different MRV stakeholders, along with the opportunity to network and develop collaborations.

Appendix

Table 2: Agenda:

Time	Agenda	
11:00 – 11:30	Arrival: Tea, coffee, biscuits	
11:30 – 11:40	Jo House (Bristol)	Brief introduction to workshop and CO2RE approach to MRV
11:40 – 11:50	Sue Rodway-Dyer (Bristol)	Mapping existing MRV frameworks, standards, protocols etc. against user needs
11:50 - 12:05	Luka Štrubelj (Oxford) Navraj Ghaleigh (Edinburgh)	MRV law and regulation
12:05 – 12:20	DESNZ	DESNZ perspective on MRV
12:20 – 12:30	John Lynch (Oxford)	MRV beyond carbon challenges and opportunities
12:30 – 12:45	DEFRA	DEFRA perspective on MRV
12:45 – 12:55	Jo House (Bristol)	International UNFCC/EU approaches
12:55 – 1:15	Jo House (Bristol)	- Participant introductions & interests in MRV - Interactive activity – post-it notes on thoughts on “accuracy vs pragmatism”
1:15 – 2:15	Lunch and networking	
2:15 – 2:35	Mark Workman (Imperial)	Plenary discussion: Accuracy vs pragmatism
2:35 – 2:55	Workshop breakout groups (carousel A, B, C, D)	See potential topics below, all to include discussions on: - Limitations in data availability or methods - Data sharing and curation
2:55 – 3:15		
3:15 – 3:35		
3:35 – 3:55		
3:55 – 4:05	Comfort break	
4:05 – 4:35	Mark Workman (Imperial) Jo House (Bristol) Sue Rodway-Dyer (Bristol)	Workshop breakout group highlights and future collaborative work planning



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Funded through the UKRI SPF Greenhouse Gas Removal Demonstrators (GGR-D) Programme, CO₂RE co-ordinates the Programme and conducts solutions-led research to evaluate a balanced portfolio of economically, socially and environmentally scalable Greenhouse Gas Removal options, with associated policy design, engagement and outreach.



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