Patch

Rebalance the planet

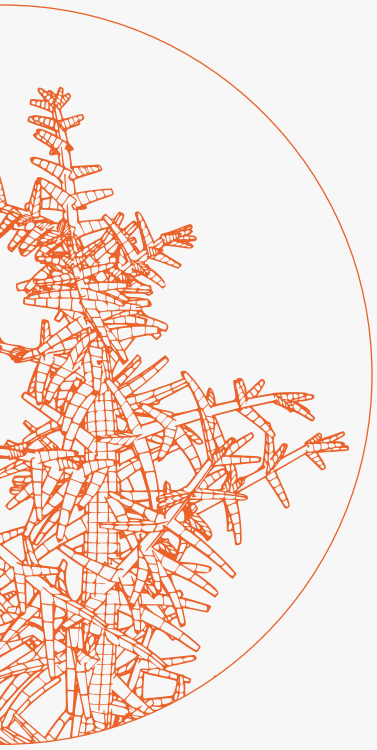
patch.io

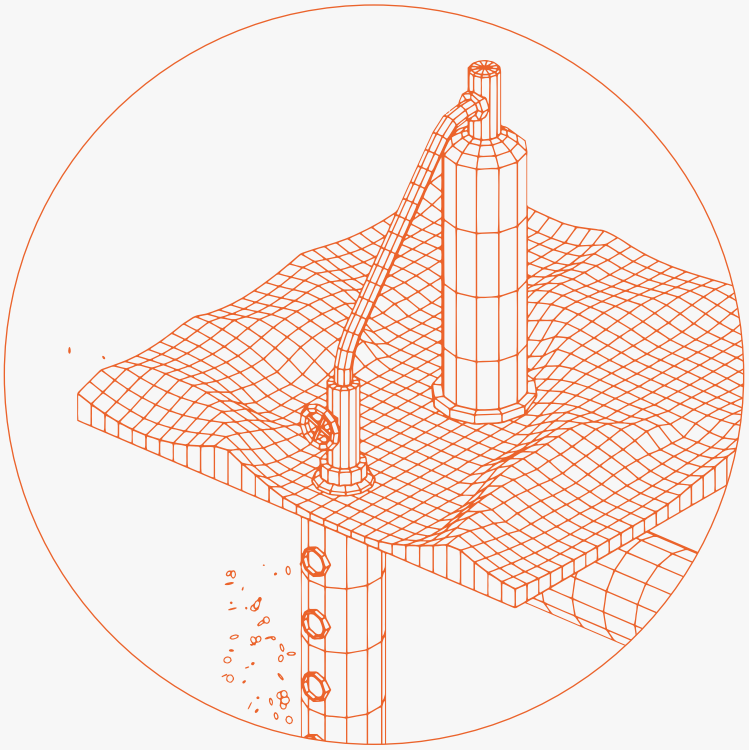
info@patch.io

September 2024

Trust and safety

A framework to reduce risk and increase transparency in carbon markets





"When used with integrity, voluntary carbon markets unlock much-needed financing that can accelerate climate action. **Transparency and robust standards are fundamental to these markets delivering this goal**, and it is great to see how Patch's approach to trust and safety can contribute to instilling confidence in the market."

Lydia Sheldrake
Director of Policy & Partnerships, VCMI

VCMI Voluntary Carbon Markets Integrity Initiative

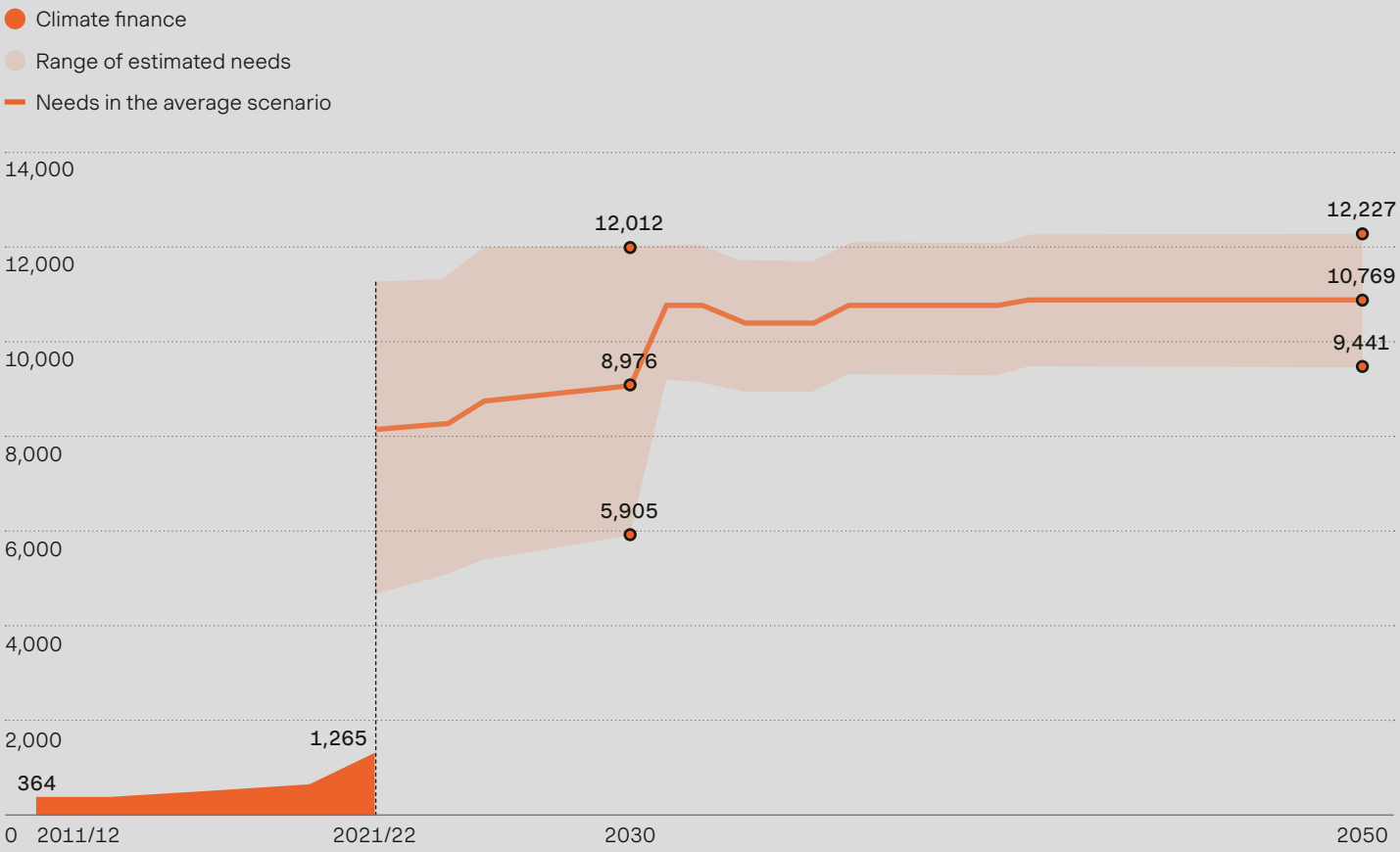
01 The Patch approach to integrity

Climate change isn't an engineering problem — it's a *social* engineering problem.

Imagine a world where all technological progress on the technologies we're developing to avoid the emission of greenhouse gasses or remove them from the atmosphere suddenly stopped where it is today. We'd still have all the tools we needed to solve the climate crisis — just not at the scale necessary. Improving our existing methods and inventing new ones will certainly help, but that doesn't address the underlying issue:

All of us, from governments to citizens to companies, aren't working fast enough or ambitiously enough.

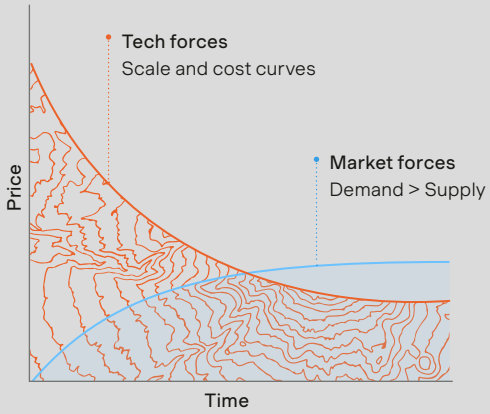
The gap between where we are in climate finance and where we need to be[1]
(USD, billions)



1 Buchner, Barbara, Baysa Naran, Rajashree Padmanabhi, Sean Stout, Costanza Strinati, Dharshan Wignarajah, Gaoyi Miao, Jake Connolly, and Nikita Marini. 2023. "Global Landscape of Climate Finance 2023 - CPI." *Climate Policy Initiative.*

Participating in the emerging voluntary carbon market can pay off for companies and the climate

Illustrative evolution of carbon markets



A major barrier to deploying climate solutions at scale is the high cost of cutting-edge methods. Carbon markets work by creating revenue streams for project developers that incentivize them to reduce costs and accelerate capacity.

One avenue for corporate climate leaders to deploy huge amounts of capital immediately toward effective solutions is the emerging voluntary carbon market. By unleashing the power of market incentives and redirecting them at climate change, this industry has the potential to pay off for the planet — and for business.

This market is in the process of scaling, and a scaling industry is by definition evolving and imperfect. In the case of the voluntary carbon market, both the standards for how to engage and the solutions being financed are rapidly advancing. This continued improvement is a sign of a healthy, growing market.

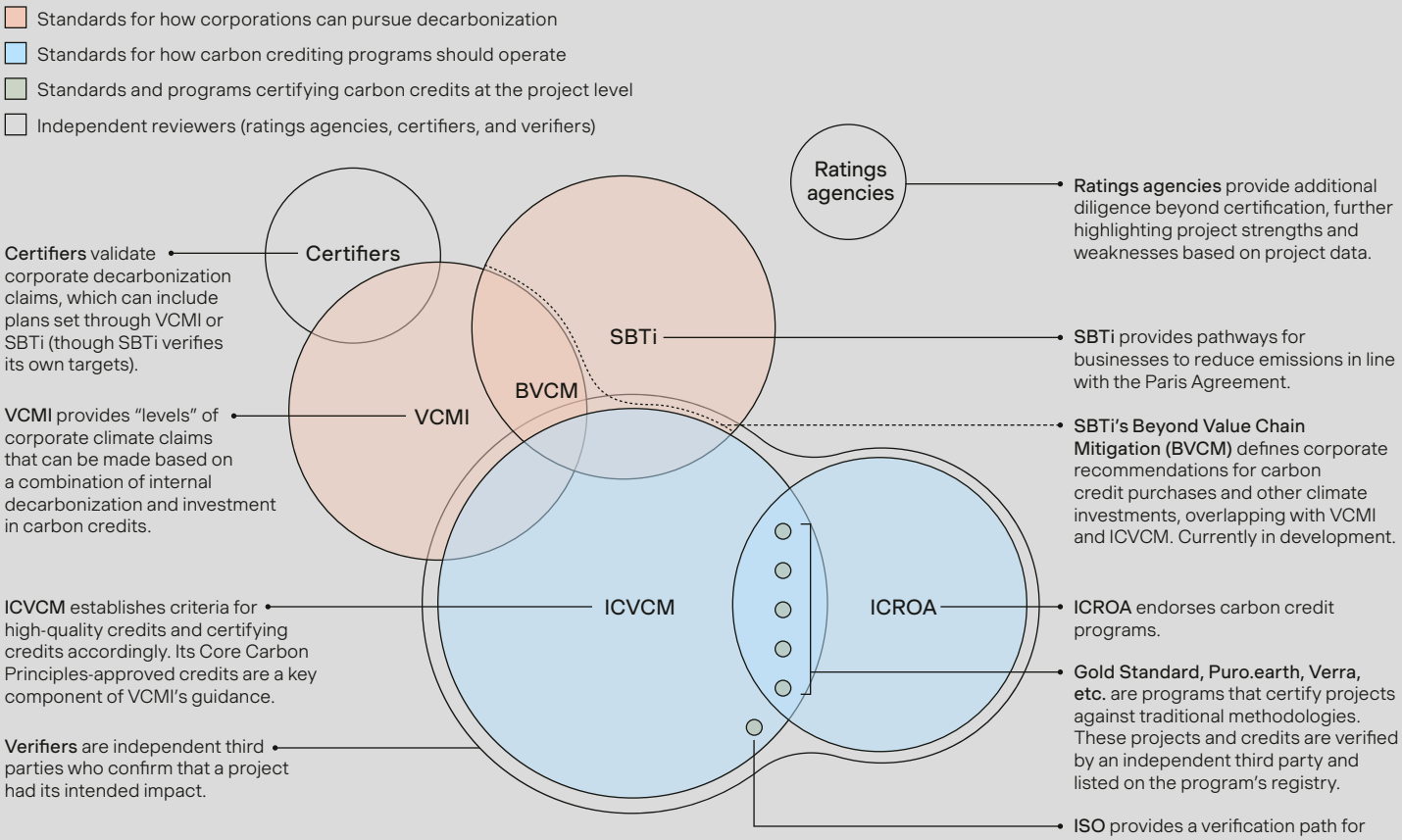
And as with any scaling industry, but particularly for an industry scaling climate solutions, we cannot wait for perfection. Participating in carbon markets now means investing in developing, testing and ultimately scaling the climate solutions the world will need over the next few decades.

Patch brings together best-in-class criteria from across the market

Even though the voluntary carbon market is young relative to other markets, the ecosystem of international standards is robust. There are many sophisticated organizations with strong foundations in science that provide guardrails for measuring, certifying, and verifying carbon credit projects.

Because of this, there's no need for Patch to "reinvent the wheel." Instead, we focus on bringing together the best of what experts from across the field are doing. Our project acceptance criteria represents a curation of leading criteria and the latest science. It offers buyers a comprehensive view of the entire market across technology types, climate objectives, co-benefits, and geographies.

Key roles and overlaps in the shifting VCM ecosystem

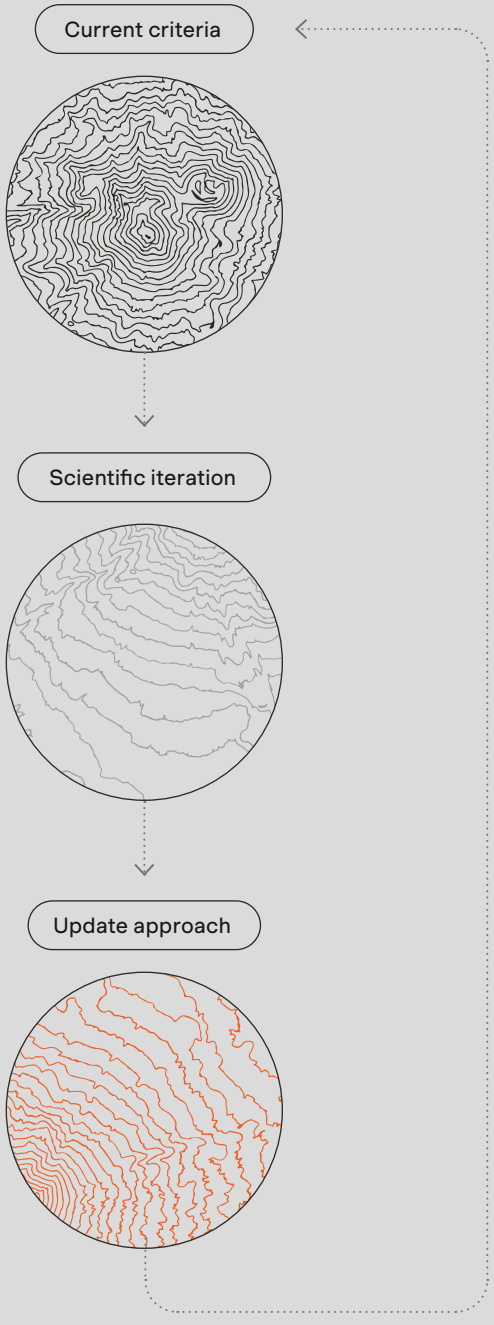


For more definitions, see the glossary (p. 49)

Our process is purpose-built for iteration so that we can always offer the latest science and standards

Science and technology will evolve over time and so too will our project acceptance criteria. Patch's approach is purpose built to be extremely responsive to changes in the standards and market landscape, enabling us to reflect the current best science in this rapidly-evolving space.

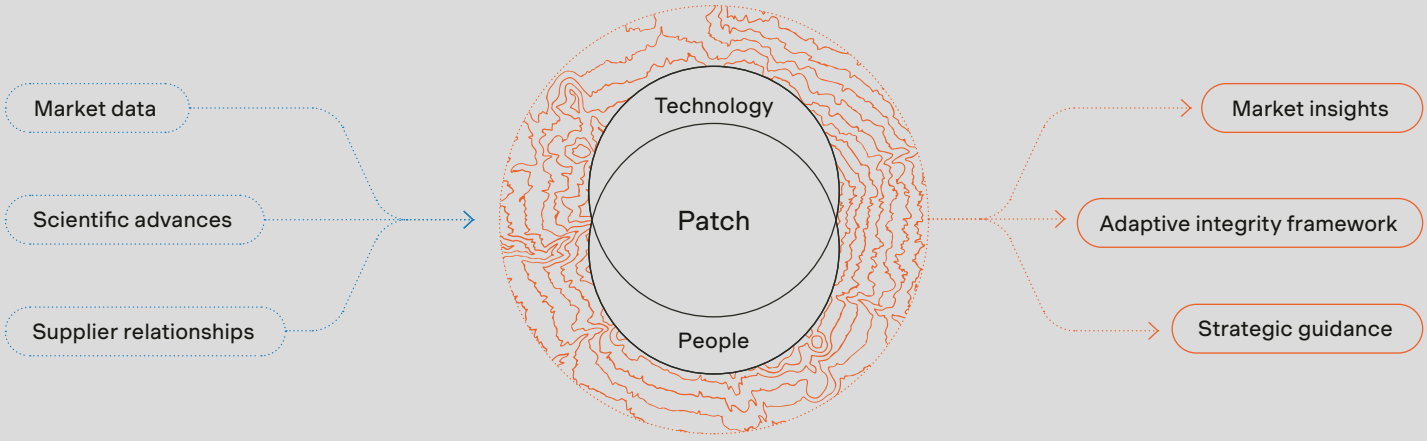
Our deep relationships with project developers and standards bodies keeps us so close to these shifts in the market, we're regularly ahead of the curve when it comes to updating our project acceptance criteria.



Centralization and human translation are integral to buyer success

Patch was founded as a technology company. Scaling through software is in our DNA. Our technology platform enables us to centralize and openly share the latest project data and documentation.

But in a complex market, this is often not enough. Our experts keep a pulse on the market and translate impacts relevant to our customers. Our goal is for Patch customers to have a sense of stability within the Patch purchase process, even as the market changes around us. Our approach offers a solid baseline, room to iterate and improve as science and standards evolve and, perhaps most importantly, a means to share this progress with our partners as the market continues to grow.



02 How Patch ensures trust and safety

Trust that every project has passed a comprehensive integrity review based on the latest science and market standards

Most fundamentally, buyers need to have confidence that their carbon credit purchase will deliver on its anticipated climate impact. As such, every project on the Patch platform is individually reviewed by our integrity experts and must pass our stringent project acceptance criteria, which are laid out in detail in this whitepaper.

To develop these criteria, Patch built on a foundation of deep understanding of the existing standards in the market, including ICVCM's Core Carbon Principles and the U.N. Article 6 Standards. We synthesized the best of the standards across the market, then we went a step further and relied on industry experts to support Patch in developing additional integrity criteria.

This is necessary because (for example) measuring integrity for a direct air capture (DAC) project requires drastically different inputs and expertise than measuring integrity for an avoided deforestation project. Measuring how much carbon a DAC project removes is much more straightforward than quantifying the complex dynamics of ecosystem change and human behavior inherent to reducing deforestation. On the other hand, as a more mature project type, forestry has more standardized rubrics compared to emerging engineered removal methods.

Evaluating projects by type is an additional step that allows us to leverage the best-available criteria for any given project type, from across the climate community. It's iterative by design, and extremely responsive to changes in the market landscape, which our experts can translate into the best advice for your sustainability strategy.

Expert contributors to the development of the Patch project acceptance criteria:

CLIMATE FOCUS

Simon Koenig
MSc | Managing Partner
REDD+, ARR, IFM

Sara Minoli
PhD | Land Use Consultant
REDD+, ARR, IFM

Rosario Uribe
PhD | Consultant
REDD+, ARR, IFM

Hilda Galt
MSc | Lead Consultant
Cookstoves

MSCI

Tristan Loffler
M.B.A. | Executive Director,
Head of Carbon Projects and Integrity
Landfill Gas, Renewable Energy

ASU Center for Negative Carbon Emissions
Arizona State University

Klaus Lackner
PhD
Engineered Removals

Robert Page
PhD
Engineered Removals

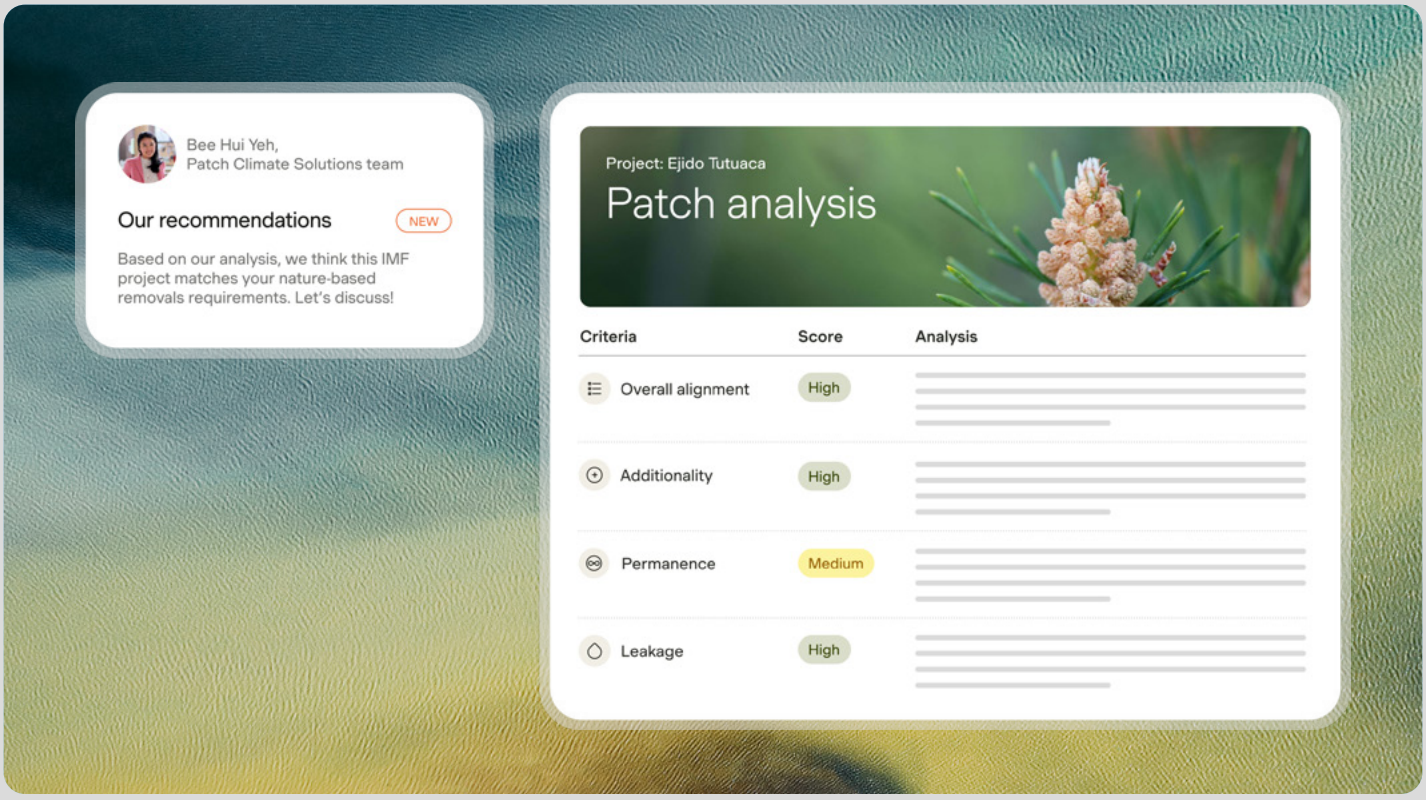
Stephanie Arcusa
PhD
Engineered Removals

Evaluate projects against your specific criteria with tailored due diligence from our climate experts

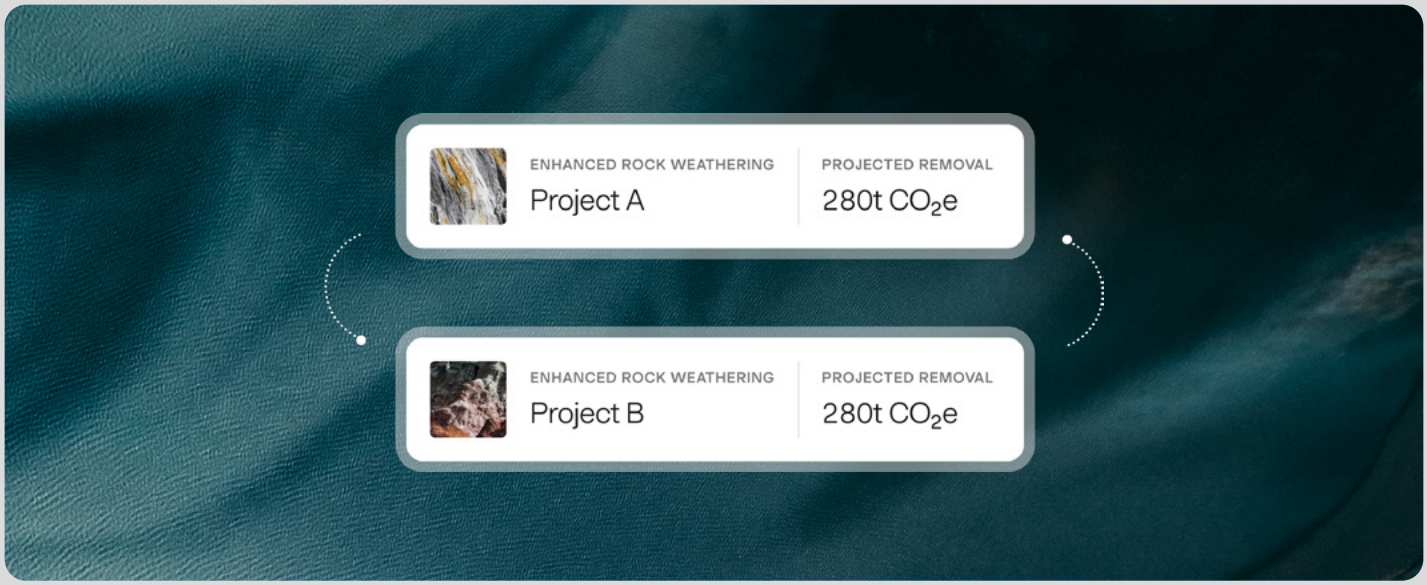
A major barrier to participation in the voluntary carbon market is the time and focus it takes to stay on top of the latest science and standards across the huge number of projects and project types. Most buyers don't have a huge staff of experts doing constant diligence. They need a trusted guide with a process built to keep pace with the rate the science is improving.

Patch's Climate Strategy + Solutions team is an extension of your sustainability arm. Our experts do the work of staying ahead of the market, identifying projects that meet your unique criteria and helping guide you through the integrity of each project. And since Patch doesn't own credits, you can count on the neutrality of our experts.

Plus, the Patch technology platform centralizes the most comprehensive set of project data, which our team can translate into answers to your due diligence questions at your level of fluency. Whether it's breaking down complex topics or diving deep into specific scientific variables, we want to meet you where you are. Our software enables us to maintain and openly share the latest project data and documentation, and walk you through exactly what it means for the risks and benefits of any given project.



Mitigate any remaining risks of a project not delivering on its climate impact



Patch can't eliminate all risk. Our criteria creates a high bar for integrity, and our team is here to help you navigate any pitfalls in the market — but it's still a market, and markets have risk. Our goal is for Patch customers to have a sense of stability within the Patch purchase process, even as the market changes around us. And there are actions we can take to reduce the remaining risks inherent to engaging with carbon markets to make that sense of stability more concrete.

First, we make it as simple as possible to build a diversified carbon credit portfolio with a mix of traditional and nascent technologies from multiple suppliers within a single contract. Second, if any projects fail to deliver a future credit vintage, we can replace those credits with ones with similar project types and prices for no additional fee.

From landfill gas capture to enhanced rock weathering and every project type in between, these solutions are doing the work to mitigate climate change now and scale to gigatonne status for the future. They're accelerating the technology. Patch is accelerating the finance by reducing the risk of participating in the carbon market. When buyers have confidence, they can act decisively.

This whitepaper and the detailed project acceptance criteria within are built to give you confidence in the process, the people, and the technology working to make sure every credit you buy with Patch has integrity.

03 Project acceptance criteria

Understanding our project acceptance criteria

Patch's project acceptance criteria serve as the foundation of our approach to trust. They take into account what we see as the strengths and areas of overlap among the leading international standards and take the next logical step, filtering the major methodology types for best-in-class projects.

This criteria was developed through close research and analysis of all the major standards. Through many consultations with policy experts, scientists, suppliers, standards bodies, and market actors, we've created both a process and strict criteria for accepting projects onto our platform.

The Patch project acceptance criteria has two levels:

1 **Core criteria:**
Every project must meet Patch's core criteria, which is aligned to ICVCM Core Carbon Principles and Article 6 standards.

2 **Project type criteria:**
Since the inputs needed to determine feasibility and climate value vary significantly based on the methodology used by the climate project, every project evaluation includes an assessment unique and specific to the project type.

1. Core criteria

These requirements ensure every project on the Patch marketplace has had its methodology, project, and outcomes verified by a third party. There are further safeguards built to ensure retirement is transparent, all local regulations are followed, and certain riskier credits are not accepted.

Verification and validation requirements

This process looks different for traditional projects going through a large certification body like Verra than it does for cutting-edge projects that don't qualify for traditional verification. Verra, for example, has established methodologies that can accommodate some projects, whereas new technologies may also require new methodologies.

The Patch process was built to accommodate all project types and ensure each has gone through a legitimate screening process.

Projects may demonstrate that they've met Patch's verification and validation requirements by submitting an active link for a project registered against a certification standard. For a project that's not eligible to be certified under an existing standard or for a developer that elects not to be certified under a traditional methodology, it may or may not be possible to develop and verify all elements of a project with one third-party organization.

In these cases, we'll look for third-party verification of each step in the process. However, it's acceptable if this comes from different organizations. In fact, some organizations recommend that suppliers verify a project's methodology as part of a fully separate process from their project verification, because this ensures the project is optimized for its science and not its potential to issue credits.

Our approach increases the number of paths to getting this third-party stamp of approval. This will help newer projects scale with integrity more quickly.

OVERVIEW

Requirements at a glance

- **Methodology:** The project has a scientific methodology that has been verified by a qualified third-party reviewer.
- **Project design:** The project design document (PDD) for issuing carbon credits has been verified by a qualified third-party reviewer.
- **Outcomes:** The project's outcomes have or will be verified by a qualified third-party reviewer by the time the credit is issued and retired
- **Retirement:** The project's credit issuances and retirements are or will be publicly tracked on a single registry.

Methodology requirements

The methodology is scientifically reviewed and endorsed by a qualified and independent third party.

- **Qualified third party:** An expert with an advanced degree in a relevant field, ICROA-endorsed verifier, or an ISO- or ANSI-certified verifier
- **Endorsement:** A certification of this methodology or a statement from a verifier attesting to this approach
- **Independent entity:** A party that has no investment or employment interests with the project developer that is able to provide an unbiased evaluation of the project
- **Iteration:** The methodology must be re-reviewed by a qualified and independent third party at least every five years

Project design requirements

The project design document (PDD) for issuing carbon credits is verified by a qualified and independent third-party reviewer.

- **Qualified third party:** An ICROA-endorsed verifier or an ISO- or ANSI-certified verifier
- **Verification:** Certification against a specific methodology (e.g. VM0023) or verification against a specific standard (e.g. ISO 14064-2)
- **Independent entity:** A party that has no investment or employment interests with the project developer that is able to provide an unbiased evaluation of the project
- **Iteration:** The PDD will be re-reviewed 1) whenever the methodology is re-reviewed, 2) the project goes through an additional verification cycle, or 3) there are any updates to the PDD to reflect changes in project implementation

Outcome requirements

The outcomes included as part of a monitoring report are or will be verified by a qualified third-party reviewer.

- **Qualified third party:** An ICROA-endorsed verifier, or an ISO- or ANSI-certified verifier
- **Ex-ante project flag:** A project that has not already issued verified credits at the time of listing must attest that a monitoring report will be developed, and its credits will be verified by a qualified third-party reviewer before the time the credits are sold and delivered

Attribution requirements

Project developers will provide assurance that no two parties are claiming credit for the same climate impact. This will take the form of a supplier attestation in its agreement with Patch.

Patch defines a registry as any entity that publicly tracks issuances and retirements of credits. This does not have to be the same entity as the qualified third-party reviewer to validate the organization's methodology or PDD.

- Registry: All credits from a project will be tracked on a single registry that must facilitate publicly-tracked and serialized issuances and retirements of credits
- Tracking: There is or will be a mechanism in place to track issuing, selling, and retiring of credits

FOR CARBON CREDIT SUPPLIERS

ICVCM alignment

Each project must align with the ICVCM Core Carbon Principles, and adhere to CCP-approved methodologies when applicable. PDDs will include an explanation of the following:

Project Summary

- Brief project summary, which includes: project goals, location, greenhouse gas (GHG) assessment boundary, methodology eligibility, project team/developer, etc.

Project benefits and relevant metrics

- The metrics you're using to track project impact

Governance

- The supplier is tracking credits on a single registry, sharing all project documents publicly, and has considered legal status and property rights
- Information on project governance and analysis of project financials

Emissions impact

- Information on the project's GHG impact and monitoring plan, including how it will address baselining, permanence, and leakage

Sustainable development

- Information on the community and ecosystem co-benefits of the project

Funding and revenue

- Information regarding the project funding model, barriers to scaling, and capacity of the project to scale

Additional core requirements

These additional eligibility requirements aim to fill in the gaps where, historically, verification has not been enough to reduce or eliminate risk. These criteria are the most responsive to changes in the market.

The project must attest that it complies with local laws and regulations

Project governance is a key tenet of the new ICVCM Core Carbon Principles. Projects that do not comply with local laws and regulations are more likely to be cut short, underperform with respect to long-term permanence, or have detrimental impacts to local communities where the projects are based.

The project must be in compliance with the U.S. Department of the Treasury Office of Foreign Assets Control (OFAC) Sanctions and Embargo Programs and other applicable international sanctions

Patch maintains and regularly reviews a list of sanctions related to countries where we have suppliers or clients to ensure that we are compliant with any applicable legislation or restrictions. We have a process for identifying and reviewing suppliers that are located in countries where either individuals — or the countries themselves — have been sanctioned by the United States and other countries where our buyers are located to ensure projects are in compliance with applicable sanctions / embargoes.

The credits are of a vintage at most five years before the current calendar year

The scientific process is iterative. As we've studied ecosystems, we've refined our process for accurately measuring and monitoring carbon. At the same time, new technology has made carbon measurement and monitoring easier and more precise. As a result, newer credits tend to be less risky than older credits because they are more likely to come from projects with newer methodologies or better monitoring approaches.

Additionally, credits sold from newer vintages are more likely to come from ongoing projects that are actively contributing to new climate mitigation (vs. older projects that are phasing out). Investing in newer projects can increase the chance that credit revenues will support scaling these approaches, and ultimately additional carbon avoidance or removal.

Projects measuring permanence using tonne-year accounting are ineligible
Tonne-year accounting is a new approach to quantifying permanence that allows a carbon credit's impact to be measured in single year increments. At this point in time, Verra, ICVCM, and Article 6 have decided not to accept projects using tonne-year accounting until these processes are more established. We see tonne-year accounting as a process to watch, and will re-examine its integration into our framework when more standard guidance exists to support its climate impact.

Ex-ante credit acceptance requirements
Most credits are issued ex-post, meaning the climate impact has occurred and project outcomes have been verified. However, in some cases, a credit may be issued ex-ante to reflect climate impact that is expected to take place over decades in the future.

Ex-ante credits may be sold on the Patch platform *as long as the mitigation activity has occurred at the point of credit issuance*. Developers are otherwise responsible for the same validation and verification requirements: 1) verifying both their project and methodology, and 2) demonstrating a reasonable timeline for verifying outcomes.

For many new project developers, lack of early stage funding can be a huge barrier to scaling. That's common to start-ups of any kind. Because of this, we think it's important to integrate ex-ante crediting into our process in order to meet these new suppliers where they are and help them more easily overcome these early hurdles.

Tokenized credits are ineligible for listing
Tokenized credits are a digital representation of a credit that can be bought or sold via blockchain on a cryptocurrency platform. The market for tokenized credits via blockchain rose dramatically in 2022 and evolved so quickly that standards like Verra and ACR have temporarily prohibited their credits to be used on crypto platforms for double counting and environmental integrity concerns. We see tokenized credits as another place to watch for changes in the market. As soon as there are more standardized processes in place for evaluating these crediting processes, we'll revisit tokenized credits as part of our approach.

Suppliers are required to disclose their relationships with projects
We know that many buyers don't work directly with carbon credit developers,and that building trust with an anonymous developer can be hard. We've built this set of requirements to hold carbon credit suppliers accountable — from small start-ups to international aggregators. All suppliers must disclose details related to their carbon credits':

- Project development
- Project financing
- Project sales & marketing
- Project management
- Project data analysis and tracking
- Other (must describe)

If the supplier is not also the project developer, they must disclose the name of the project developer. Every project must adhere to the ICVCM Core Carbon Principles (this will be validated as part of a supplier's project design requirements). Among other things, this requires suppliers to disclose information on their organizations revenues, expenses,and net assets over the past year, as well as provide an overview of major programs, activities, and governance

2. Project type criteria

The scientific diligence it takes to ensure a biochar project, for example, has integrity is extremely different from, say, an afforestation project. The inputs and the measurement are unique, and therefore, they need unique approaches to determining their climate impact beyond our general core criteria.

DEEP DIVE

Attributes affecting carbon credit integrity

Real and verifiable:
The project is using a scientifically rigorous methodology for monitoring and verification that has been reviewed by a group of experts in an appropriate field related to the project. There is a plan in place to re-review the methodology on a regular cadence at a minimum of every five years.

Additional:
Climate mitigation would not have occurred without this project, whether due to lack of funding, lack of policy, or lack of efficacy of traditional methods.

Permanent and durable:
The project's methodology addresses permanence and durability (i.e., how long the carbon will be mitigated through avoidance, reduction, or removal).

Leakage:
The project confirms it is not knowingly contributing to an unintended increase in emissions or shift of emissions from one place to another. The project also has a plan in place to account for any potential leakage. The methodology referenced above provides assurances around leakage management.

MRV plans:
The additionality, durability, or leakage of a carbon credit project can only be reliably determined by accurate MRV methods. How the project plans to ensure this accuracy over its lifespan is critical to its integrity.

Enforceability:
The project is not double-counted, when multiple parties claim the same carbon mitigation.

Negativity:
The project results in a net negative reduction in atmospheric CO_2 (i.e. it does not generate more emissions to create the credit than the credit itself).

Baselining strategy:
For projects crediting against a baseline or counterfactual scenario, the strategy used to ensure the baseline is accurate must be scientifically sound.

Project types:

While we have criteria for most project types, we don't have it for every single project type that exists. For projects we don't have detailed project type criteria for, we're actively working on building it by working with scientists who are experts in those methodologies.

In the meantime, due diligence for these projects is conducted thoroughly by our in-house climate experts against the attributes listed above to ensure they meet our bar for integrity. Should you be interested in any of these projects, we will show you our work transparently just as we would for projects we do have project type criteria for.

Nature-based solutions

Nature-based solutions (NBS) projects come in a few fundamental types of activities:

- Avoiding carbon loss from forest land (reducing logging, avoiding deforestation, avoiding conversion of forests, etc.)
- Removing carbon by growing new trees (restoration, reforestation, and improved forest management to improve productivity, etc.)
- Transitioning agricultural practices (moving from conventional agriculture to regenerative agriculture to improve soil carbon stocks)

Given that many NBS projects have overlapping project elements, certain criteria will span all project types, but there are also certain risks and benefits that are unique to specific project types. Below, Patch will cover variables important to NBS projects at a high level, and then review specific criteria per tech type.

Summary of key NBS variables

Additionality

Additionality is a principle that aims to ensure that the project scenario would not have occurred in the absence of carbon finance. For projects that are conducted on productive lands (such as farms or timber plantations) this is reliant on understanding the range of barriers that prevent land owners from transitioning to a project's proposed activities, or that there are no financial or legal incentives in place guiding land owners to transition towards project activities.

Baselines

The baseline scenario is defined as the most likely land use scenario that would have occurred in the absence of a carbon project (e.g., conversion of forest land to agriculture, or continuation of cattle ranching). A project's baseline is impacted by the following characteristics:

- Understanding the baseline rate of forest/ecosystem change, or the rate of change in forest cover area (hectares/year), that would occur in the project area in the absence of the project activities. This may refer to the rates of deforestation/degradation in the baseline scenario (REDD and IFM), or rates of natural regeneration in the baseline scenario (ARR).
- Accurate estimation of the ecosystem's carbon stock, or the total carbon content (in metric tonnes) that is stored within a defined land area and at a defined point in time. Projects must have both a rigorous sampling process and ensure that forest carbon stocks are accurate and representative of the project region's activities and environment.

Actual rates of deforestation

This variable represents the rate of deforestation or degradation that is monitored during the project crediting period. Evaluating actual deforestation rates during the project is critical to determining project effectiveness in protecting forests and delivering real emission reductions.

Leakage

Leakage is defined as the displacement of baseline activities and associated emissions outside the project boundaries.

- Activity shifting leakage occurs when baseline agents shift their activities outside the project area, causing emissions where activities are shifted to (e.g. a plantation project that displaces farmers and leads them to clear adjacent forests).
- Market leakage occurs when supply of commodities is significantly reduced as a result of the project, but market forces result in such supply being made up elsewhere (e.g. avoided deforestation practices in the project jurisdiction shifts demand to other areas where it becomes more profitable to deforest for crop or livestock production).

Leakage will reduce the climate impact of the project by creating additional emissions outside of project boundaries. Leakage risks can be evaluated by considering both leakage exposure (i.e. the risk that a deforestation agent will move their practices elsewhere) as well as evaluating the strategies a project has implemented to mitigate leakage.

Non-permanence risk

Non-permanence risk refers to the likelihood that carbon storage will be reversed through deforestation or forest degradation over different timeframes. Permanence can be subject to a range of internal project risks (like challenges with the duration of legally binding project agreements), external risks (like land tenure changes or political change) and natural risks (like forest fires, pest outbreaks, and extreme weather). Good project design has not only quantified potential project risks, but implemented a mitigation strategy to protect the project from the variety of potential project risks.

NATURE-BASED SOLUTIONS CRITERIA

Afforestation, reforestation and revegetation

Afforestation, reforestation and revegetation (ARR) projects are removals projects that build carbon stocks through active reforestation and regeneration of non-forest land.

- **Afforestation:** forestation of a land that is non-forest in its natural state (like natural grasslands)
- **Reforestation**: re-establishment of forests on lands that have previously undergone tree-cover loss due to deforestation, land degradation, or land-use change
- **Revegetation**: re-establishment of other types of woody vegetation on degraded lands

ARR projects can have a number of primary objectives, including re-establishing forests that mimic a natural ecosystem, establishing agroforestry systems, or establishing forest plantations. All of these project types enhance carbon stocks, but each may require a distinct assessment of project aspects such as additionality.

Additionality

- Patch will not accept projects that include commercial timber plantations in well-established markets, as such projects may be sufficiently profitable without carbon finance.
- Projects must present a sound financial analysis through their validated PDD.

Baseline

- Projects must use a dynamic performance benchmark (as in VCS methodology VM0047) or are subject to additional baseline assessments.

Accurate estimation of forest carbon stocks

- Carbon stock estimates must be based on a forest inventory with permanent sample plots or a combination of permanent sample plots and remote sensing.
- Patch will collect data from project developers on inventory design including forestry types and the number of sample plots per forest type to evaluate whether estimates are representative.
- While satellite mapping may not be financially feasible year-on-year, a project must demonstrate that their monitoring efforts are comparable and robust.

Leakage

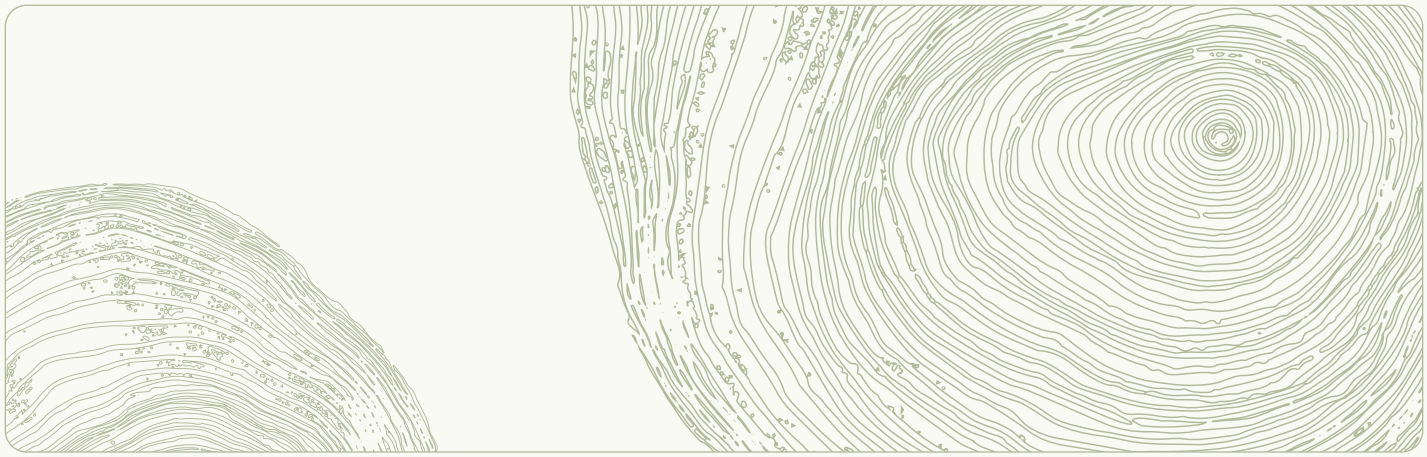
- If baseline production activities (e.g., agriculture of livestock production) are not affected, the project faced no leakage risk.
- If production is reduced within the project area, projects must have a robust leakage mitigation plan in place.
- Projects without an adequate mitigation plan are ineligible.

Non-permanence risk analysis

- A project is eligible if it has a non-permanence buffer pool higher than 20%.
- If a project's buffer pool is lower than 20%, a project must demonstrate that it has legitimately assessed internal, external and natural risks, and developed a robust mitigation plan for those risks.
- Credit volumes must be calculated based on annual removal rates vs. long-term averages to ensure year-on-year risk is accounted for within issuance cycles.

NATURE-BASED SOLUTIONS CRITERIA

REDD+



REDD+ (Reduced Emissions from Deforestation and Degradation plus the enhancement of carbon stocks among other elements) and IFM projects that conserve loggable forests (CLF) mitigate climate change by reducing GHG emissions from human-driven deforestation, and forest degradation.

- **Avoiding unplanned deforestation or degradation (AUD):** Avoiding unauthorized deforestation or forest degradation, such as encroachment into protected areas or private land for the establishment of cropping systems, pastures, or illegal logging.
- **Avoiding planned deforestation (APD):** Avoiding authorized deforestation, such as the authorized conversion of private land to establish commercial agriculture or cattle pastures.
- **Conservation of loggable forests (CLF):** Improved forest management projects that aim to conserve existing carbon stocks by halting harvesting practices. Even though CLF is categorized under most standards as IFM, such projects face similar risks as APD projects.

REDD+ projects to date have been some of the most heavily scrutinized in the market. Certain projects have been known to overestimate baselines for deforestation, which results in subsequent over-crediting. Others have not been able to fully protect the project area from deforestation at all times, resulting in ongoing carbon loss. High-integrity REDD+ projects have both accurate baselines and effective, long-term measures in place to prevent deforestation.

Additionality

- Projects that only rely on carbon revenues are financially additional. *This is most common for AUD projects.*
- If a project halts planned deforestation or logging practices, the project must conduct a barrier and financial analysis that demonstrate the baseline scenario is not prevented by significant financial, logistical, or other constraints. *This is most common for APD and CLF projects.*

Baseline

Because project proponents are paid for how much deforestation is avoided relative to the project's baseline, they may be incentivized to develop a baseline scenario under which a large forest area would be lost in the absence of the project to maximize crediting. Under different standards and methodologies, baselines can either be set by projects or by third parties (e.g., by a jurisdictional program managed by a government or by a carbon standard such as VCS under its new methodology VM0048. Baselines developed by projects are associated with a higher level of risk due to perverse incentives.

- Projects need to demonstrate compliance with VCS methodology VM0048 using an allocated baseline, or are subject to additional baseline assessment to ensure conservativeness.

NATURE-BASED SOLUTIONS CRITERIA

REDD+ cont'd

Accurate estimation of forest carbon stocks

- Carbon stock estimates must be based on a forest inventory with permanent sample plots or a combination of permanent sample plots and remote sensing.
- Patch will collect data from project developers on inventory design including forestry types and the number of sample plots per forest type to evaluate whether estimates are representative.
- While satellite mapping may not be financially feasible year-on-year, a project must demonstrate that their monitoring efforts are comparable and robust.

Setting APD and CLF baselines relies on accurately evaluating existing and commonly applied deforestation or logging practices.

- Projects must demonstrate how their rate of logging / deforestation is aligned with the baseline agent's prior activity and regional common practice logging / deforestation rates.
- Baseline logging / deforestation activities must be formally approved by the relevant authorities and have obtained any required permits.

Actual deforestation rates

AUD projects may not fully control the activities of baseline agents (e.g., illegal settlers or loggers) and therefore could struggle to fully halt deforestation and degradation. That means a small, residual amount of deforestation or degradation should be allowable. APD and CLF projects on the other hand either directly control or are themselves the baseline agent and should therefore be in a position to fully halt deforestation or degradation aside from natural forest loss events.

- **AUD:** Deforestation rates during project activity must be less than 0.1% per year.
- **APD/CLF:** Ensure project has no deforestation or degradation within a given monitoring period.

Illustrative project zoning for AUD leakage monitoring

Leakage

AUD: Unplanned deforestation projects rely on monitoring "leakage belts," or areas of land outside a project's boundaries where activity-shifting is most likely to occur.

- Patch will collect data on whether deforestation agents are local or mobile entities. This variable will not impact eligibility, but mobile agents pose a higher risk of moving deforestation practices elsewhere.
- Projects must use a leakage belt that is at least the size of the project area at the project start date.

APD: APD projects mitigate leakage by ensuring a project's deforestation agent (the organization responsible for changing behavior in order to implement project activities) does not move deforestation activities outside of project boundaries.

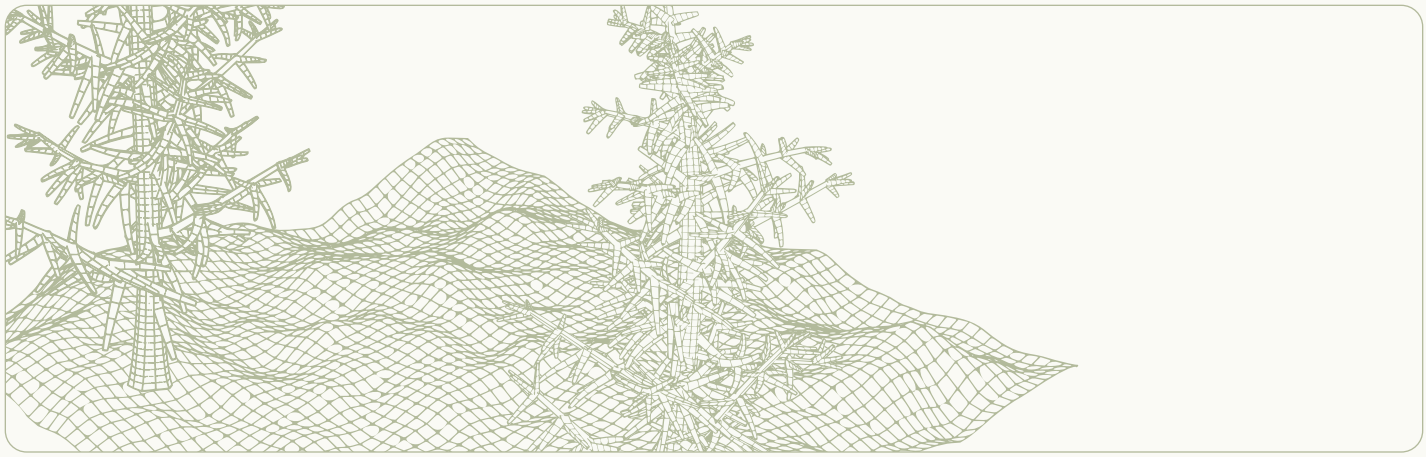
- If a project's deforestation agent is known, the project must monitor deforestation rates across the entire land under control of the same owner.
- If a project's deforestation agent is unknown, the project must present a clear plan for monitoring deforestation activity outside of the project area.
- If the baseline scenario is associated with timber harvesting or commodity production, the project must ensure it is making up for lost production volumes or applying a leakage deduction of at least 20%.

Non-permanence risk analysis

- Projects must apply a non-permanence buffer pool higher than 20%.
- If a project's buffer pool is lower than 20%, the project must assess internal, external, and natural risks, and have a mitigation plan in place to account for these risks.

NATURE-BASED SOLUTIONS CRITERIA

Improved forest management (IFM)



Improved forest management (IFM) projects reduce emissions and improve carbon stocks in managed forest land (commonly used for timber production) through mechanisms such as reducing logging, increasing forest productivity, or optimizing carbon stocks through silvicultural treatments. IFM projects can be diverse, and often include a combination of goals aimed to both reduce and remove emissions.

One of the most complex aspects of an IFM project is ensuring that the baseline adequately reflects forest management that would have happened in the absence of the project. IFM projects that reduce production within a project area also have a higher inherent risk of market leakage because reduced timber supply can be readily made up through increased harvesting in other timber lands.

Additionality

- Projects must ensure that development or existing conservation easements do not overlap with project boundaries. If a developer receives future income from development or conservation easements, a financial analysis is required to demonstrate that such financing is required for ongoing maintenance.
- Projects must present a sound financial analysis through their validated PDD.

Baseline

- The project baseline must integrate historical plans/management data in addition to common practice analysis.
- Projects must account for emissions removals associated with natural regeneration within the project area that would occur in the absence of the project.
- Baseline forest management activities must be formally approved by the relevant authorities and have obtained any required permits

Accurate estimation of forest carbon stocks

- Baseline stocks at year 0 must be estimated using project-level forest inventories and robust local studies.
- Carbon stock estimates must be based on a forest inventory with permanent sample plots or a combination of permanent sample plots and remote sensing.
- Patch will collect data from project developers on inventory design including forestry types and the number of sample plots per forest type to evaluate whether estimates are representative.
- While satellite mapping may not be financially feasible year-on-year, a project must demonstrate that their monitoring efforts are comparable and robust.

NATURE-BASED SOLUTIONS CRITERIA

Improved forest management (IFM) cont'd

Leakage

- Projects that do not reduce production are eligible.
- If a project reduces production, the project must ensure:
- harvesting in other lands owned by the project developer is not increased.
- No additional lands are acquired to increase harvesting.
- There is a plan in place to make up for lost baseline production volumes OR the project has applied a leakage deduction of at least 30% applied consistently across crediting periods.

Non-permanence risk analysis

- A project is eligible if it has a non-permanence buffer pool higher than 20%.
- If a project's buffer pool is lower than 20%, the project must be evaluated to have legitimately assessed internal, external, and natural risks, and have developed a mitigation plan for those risks.

NATURE-BASED SOLUTIONS CRITERIA

Agriculture land management

Agriculture land management (ALM) projects may focus on increasing carbon stocks by enhancing soil carbon, changing agricultural practices to promote sustainable and regenerative management, or sequestering carbon in woody biomass. Many ALM projects rely on contracting with small, individual farmers and landowners, so special attention should be paid to how contracts are structured to avoid risk of reversal over the long term.

These removals projects have many similar risks and benefits to ARR projects, so at a high level, the criteria for this set of projects is quite similar. Patch will continue to develop more specialized criteria for this set of projects (with a focus on quantifying soil organic carbon, which is a complex and rapidly emerging sector for carbon projects) as they become more prominent on the market, and this review can now be conducted case by case.

Additionality

- Projects must present a sound financial analysis through their validated PDD.
- A project must present a legitimate case that it drives a real change toward effective regenerative practices, as opposed to modest changes to conventional agriculture.

Baseline

- Projects must demonstrate that the baseline represents the status quo from the last 10 years.

Accurate estimation of forest carbon stocks

- Carbon stock estimates must be based on permanent sample plots or a combination of permanent sample plots and remote sensing.
- Patch will collect data from project developers on inventory design including forestry types and the number of sample plots per forest type to evaluate whether estimates are representative.
- While satellite mapping may not be financially feasible year-on-year, a project must demonstrate that their monitoring efforts are comparable and robust.

Leakage

- If production (i.e. livestock grazing) is not impacted by project activities, a project does not face market or activity leakage risks.
- If production is reduced within the project area, projects must have a validated leakage mitigation plan in place.
- Projects without an adequate mitigation plan are ineligible.

Non-permanence risk analysis

- A project is eligible if it has a non-permanence buffer pool higher than 20%.
- If a project's buffer pool is lower than 20%, the project must demonstrate that it has legitimately assessed internal, external, and natural risks, and developed a mitigation plan for those risks. In particular, risk assessments should address drought and flood risk.
- Credit volumes must be calculated based on annual removal rates vs. long-term averages to ensure year-on-year risk is accounted for within issuance cycles.
- The project must have a legitimate agreement in place with farmers to protect against non-permanence.

NATURE-BASED SOLUTIONS CRITERIA

Blue carbon

Blue carbon projects focus on capturing and sequestering carbon in oceans and coastal ecosystems, such as seagrasses and mangroves. There is a lot of potential variety in blue carbon projects, from avoided emissions work that closely resembles REDD+ to mangrove reforestation projects.

This particular assessment will cover the range of water-based reforestation projects that most closely mirror ARR projects. As the market and ecosystem for blue carbon projects evolves, Patch will develop more comprehensive criteria that closely match different subsections of blue carbon projects.

Additionality

- Projects must present a sound financial analysis through their validated PDD.

Baseline

- Projects must demonstrate that the baseline represents the status quo from the last 10 years.

Accurate estimation of forest carbon stocks

- Carbon stock estimates must be based on permanent sample plots or a combination of permanent sample plots and remote sensing.
- Patch will collect data from project developers on the quantity of sample plots relative to the project area to evaluate whether estimates are representative.
- While satellite mapping may not be financially feasible year-on-year, a project must demonstrate that their monitoring efforts are comparable and robust.

Leakage

- If production (e.g. seaweed harvesting) is not impacted by project activities, a project does not face market or activity leakage risks.
- If production is reduced within the project area, projects must have a validated leakage mitigation plan in place.
- Projects without an adequate mitigation plan are ineligible.

Non-permanence risk analysis

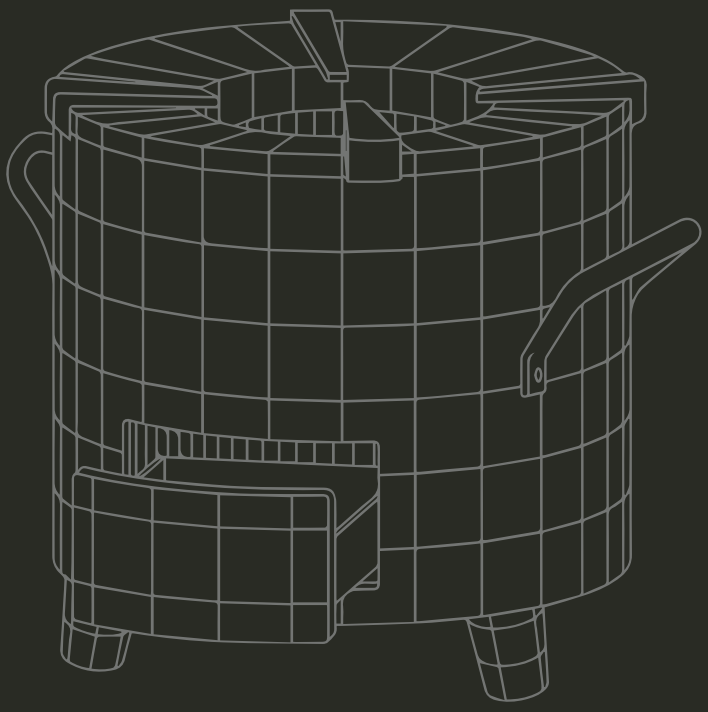
- A project is eligible if it has a non-permanence buffer pool higher than 20%.
- If a project's buffer pool is lower than 20%, a project must demonstrate that it has legitimately assessed internal, external, and natural risks, and developed a mitigation plan for those risks. For blue carbon projects, risk assessments should consider impacts due to sea level rise, ocean acidification, and ocean warming.
- Credit volumes must be calculated based on annual removal rates vs. long-term averages to ensure year-on-year risk is accounted for within issuance cycles.

Cookstoves

Cookstove projects introduce a clean or improved cookstove technology or fuel into households or institutions (e.g. schools) that either reduces the amount of fuel used for cooking or switches the cookstove to renewable or less carbon-intensive fuel. The cookstove project category can broadly be divided into two project activity types:

Improved efficiency cookstoves projects swap out traditional firewood- or charcoal-burning cookstoves with more efficient varieties. When the cooking process is more efficient, less fuel is required to cook the same amount of food.

Fuel-switching cookstoves projects involve transitioning from traditional firewood- or charcoal-burning cookstoves to those using lower-emissions fuel, such as Liquified Petroleum Gas (LPG), domestic biogas, or electricity.



CRITERIA

Cookstoves

Fraction of non-renewable biomass rate

The fraction of non-renewable biomass (fNRB) is the portion of wood fuel used in a carbon project that is unsustainable and contributes to long-term loss of biomass carbon stocks. The fNRB is a critical input into the emission reduction calculation of clean and improved cooking carbon projects as the amount of fuel used before and during the project is multiplied by this share to estimate net changes in emissions." If projects use fNRB estimates that are higher than the actual value, then they are claiming more emission reductions than their projects are achieving.

Ideally, fNRB rates would be based on place specific data. In place of local data, most methodologies allow applying a global conservative default fNRB of 0.3, applying a value sourced from peer-reviewed literature, or using a methodological tool (Tool 30) developed by the UNFCCC. While the first two options are the easiest to apply and are transparent, applying Tool 30 generally results in higher fNRB values and, consequently, higher rates of crediting.

In addition, older projects apply the Clean Development Mechanism's (CDM) default values that were valid until between 2017 and 2020. As the default fNRB values established under the CDM were between 65–100%, this set a precedent for fNRB values to be in this range. More recent research has shown that the fNRB values should be in the range of 1–62%. Given the difference between the CDM's default values and those published in recent literature, project developers often choose to apply Tool 30.

Patch will compare a project's fNRB values to those published in peer-reviewed scientific literature. As there will inevitably be local variability project to project from country averages, Patch will permit project fNRB rates to vary within 20% of peer reviewed values.

- Projects will be eligible if they are within 20% greater than the value published by the report: Updated fNRB Values for Woodfuel Interventions.

Note: A vast quantity of existing projects on the market apply overinflated fNRB rates. However, a number of projects may also be undercrediting due to their emissions factor for fuelwood (see next criterion). Below, we'll describe where projects with overinflated fNRB rates may be eligible.

Emission factor of fuelwood

The emission factor of fuelwood represents the amount of CO_2e released into the atmosphere per unit of energy that the combusted fuel contains. The IPCC has established a default emission factor for fuelwood of 112 tonnes (t) of CO_2e per terajoule (TJ) energy delivered. However, CDM methodologies require projects to apply a much more conservative value based on fossil fuels — between 63.9–85.7 tCO_2e/TJ. As this is a source of undercrediting, it makes a project more conservative.

- If the project applies an emission factor that is lower than 112 tCO_2e/TJ, Patch will calculate the difference between the applied value and 112 tCO_2e/TJ. If a project overestimates fNRB but also overestimates the emission factor of fuelwood by a minimum ratio of 1:1, the project is eligible.

Amount of fuel used in the baseline

In cookstove projects, the amount of emission reductions achieved by a project depends on the reduction of baseline fuel used. There are several approaches to determining baseline fuel use, including applying global default values, use of national household/demographic surveys or baseline surveys, back-calculating the baseline based on energy or fuel used during the project, and using a kitchen performance test (which involves physically weighing the amount of fuel used for cooking over a three-day period during an in-kitchen test). Kitchen performance tests tend to be the most reliable, since they are evaluating local data. Project-specific baselines should be compared to local, peer reviewed values within a buffer, as individual projects will always have some variability.

- Projects using a global default value or kitchen performance test are eligible.
- Any project-specific baselines must fall within 30% of peer-reviewed values.

Efficiency of project stove use

The thermal efficiency of the project stove refers to the portion of heat transferred to a cooking pot relative to the overall amount of energy generated during a combustion event. Since the thermal efficiency is based on a lab-based test, stoves are unlikely to perform at their rated efficiency in the real-world setting. Therefore, projects that employ a project stove with a thermal efficiency at or below 25% efficiency risk achieving no real emission reductions at all. The most up-to-date methodologies no longer allow efficiency rates below 25% for this reason.

- Project stove efficiency must be greater than 25%.

CRITERIA

Cookstoves cont'd

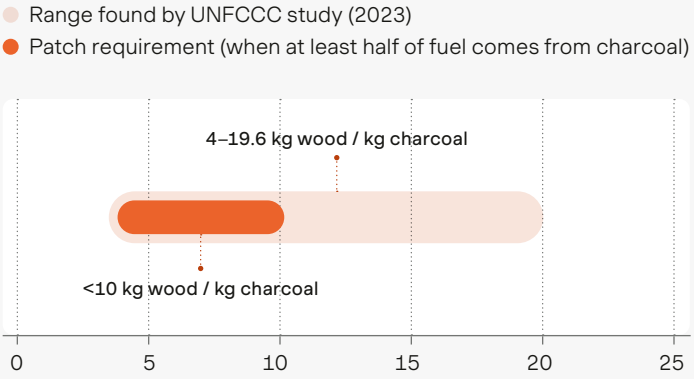
Wood-to-charcoal conversion factor

The wood-to-charcoal conversion factor expresses the units of firewood that are needed to produce one unit of charcoal. The conversion factor is impacted by the density of the wood used, its moisture content, and the efficiency of the kiln used.

Historically, the firewood-charcoal conversion default proposed under the CDM was 6 kg wood / kg charcoal. This has recently been adjusted to be more conservative by assuming a default factor of 4 kilograms of wood / kg charcoal. A 2023 UNFCCC's study found the conversion factors can range from 4–19.6 kilograms of wood / kg charcoal. This more substantial variation is a result of the charcoal production technique, the type of kiln used, the moisture content of the wood, weather conditions at the time of production, and other factors. In order to remain conservative, Patch will exclude working with these higher-end conversion factors.

- Patch requires projects to have a wood to charcoal conversion factor less than 10kg wood / kg charcoal when at least half of project fuel use comes from charcoal.

Recommended wood to charcoal conversion factor (kg)



Share of project devices in use

A cookstove project can only be successful in reducing emissions if the project device is used. Therefore, projects need to monitor how much the project stove is used, and to what extent the baseline stove is displaced. Project use can be interpreted using direct testing as well as surveying. While the share of project devices in use is an important parameter in the calculation of emission reductions, there is no approach of judging whether a surveyed parameter applied is reasonable.

- If the criterion is monitored through a stove use monitor or direct metering (e.g. for electric stoves), or if the project fuel is tracked (e.g. through fuel sales of bioethanol), then this project is eligible for listing by Patch.
- If the criterion is monitored via survey, Patch will record the usage rate applied in each year but will not use this variable as a filtering criterion for eligibility.

Claims that exceed a 95% usage rate by the end of the second year of operation will be carefully considered on a case-by-case basis, since these projects are at risk of overinflating their impact.

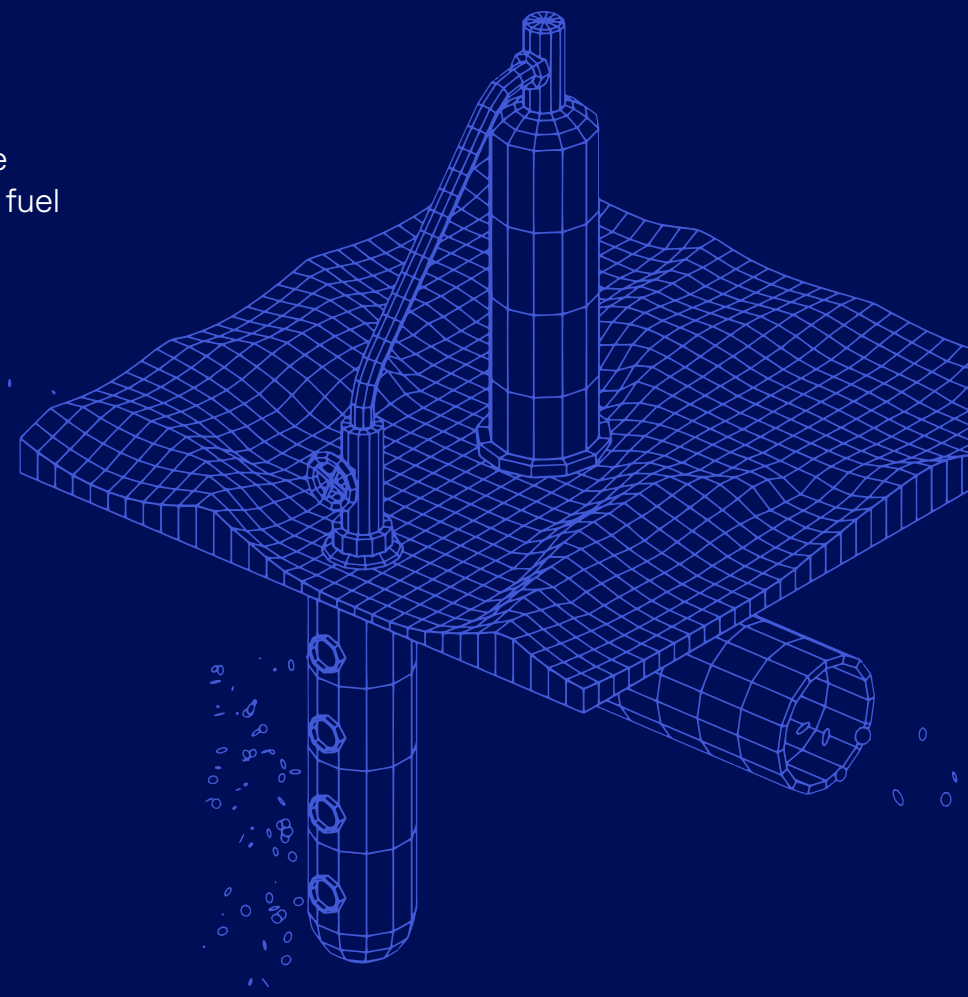
Landfill gas

Landfill gas projects capture methane before it is released into the atmosphere and either flare it or use it to generate electricity. After waste is deposited in landfills, organic material decomposes to create landfill gas. If the right infrastructure and systems are put in place at waste sites, the methane can be captured and converted into energy to generate electricity or heat.

Flaring only projects reduce methane emissions from escaping landfills.

Flaring and electricity projects reduce methane emissions and displace fossil fuel grid electricity.

Flaring and electricity projects will undergo a deeper diligence process since projects are more complex and there are more potential sources of income that can impact a project's additionality.



CRITERIA

Landfill gas

Evaluation of legal incentives
A project's legal context is one of the most important indicators of its additionality. Increasingly, governments are seeking to reduce the emissions coming from landfill sites as part of wider environmental strategies. In the extreme, these policies may mandate the implementation of certain activities, therefore making any carbon credit claims un-additional (assuming appropriate policy enforcement). Other policies may exist that do not mandate an activity, but still incentivize it, and therefore may influence a project to go ahead even without carbon credits.

Every Patch-listed project must demonstrate that it has low legal incentives in order to be eligible for review by demonstrating a presence of no more than one of the following incentives:

- Jurisdictional technical assistance or training programs for execution of landfill gas projects that reduce barriers to implementation
- Tax credits
- Grants and funding support
- Feed-in tariffs for electricity produced from landfill gas sites
- Direct mandates for all landfills to control methane emissions, or mandates just for large landfills

Project screening variables
On average, projects that are smaller-scale and located in a United Nations Least Developed Country (LDC) will face significantly higher barriers to implementation without credit revenues. For example, access to financing and technological know-how will be more limited for these types of projects.

Projects will be eligible if they meet one of the following conditions:

- The project is a flaring only project
- The project is a small-scale flaring and electricity project (<15MW)
- The project is a flaring and electricity project based in an LDC

All additional projects will need to undergo subsequent review based on the remaining criteria.

Proportion of revenue from carbon credits
Projects that would have been profitable without carbon credits using alternative revenue sources or incentives act as key additionality risks. Flaring and electricity projects typically generate electricity that represents ~80% of total revenue, with carbon credits representing under 20% of total project revenues on average. Overall, the importance of carbon credit revenues for this project type is, on average, much more significant than it is for renewable energy projects (where it's more standard for less than 5% of revenues to come from carbon credits).

Patch intends to set a high bar for financial additionality of landfill gas projects. If carbon credits represent over 25% of project revenue, this is a good demonstration that the project is only financially viable because of carbon credits.

$$\text{\% of Revenue from Carbon Credits} = \frac{\text{Carbon Credit Revenue}}{\text{Total Revenue (Carbon Credit Revenue + Electricity Revenue)}}$$

Patch will calculate data on expected / actual annual electricity generation, expected carbon credit issuance, electricity tariff price, expected credit issuances, and average carbon credit price to evaluate carbon credit and electricity revenues.

- Credit revenues must exceed 25% of total project revenues for a project to be eligible.

Conservativeness regarding electricity generation
For flaring and electricity projects, the impact of displaced electricity can represent a significant proportion of the total emission reduction from landfill gas utilization projects. Projects that exclude this source of emissions impact from their calculations can therefore significantly under-estimate their overall emissions impact.

- Projects that exclude the impact of displaced electricity are eligible.
- Projects that do not exclude displaced electricity must be reviewed against the three subsequent variables.

CRITERIA

Landfill gas cont’d

Global warming potential of methane
To convert the emissions impact of avoided methane into a CO_2 value, projects use an estimate of the global warming potential (GWP) of methane from the most recent IPCC assessment reports. As these values are updated regularly, the use of a low GWP figure may lead to an under-estimation of the project’s emission impact. GWP will likely reflect the year a project was first registered, and is unlikely to be updated in subsequent crediting periods.

The current IPCC GWP for methane is 28. Projects using lower GWPs for methane will underestimate the project’s emissions impact.

Accuracy of electricity grid emissions factors
Emissions factors (EFs) convert activities into associated emissions (such as converting grid electricity use into emissions). If a flaring and electricity project displaces grid electricity, the emissions factor used by the project should broadly resemble the emission factor of the grid that the project is a part of. Projects that use an emission factor significantly higher than that of the grid are likely over-estimating this displacement impact.

- Project EFs must not be more than two times greater than published, third-party verified EFs from national datasets or global sources.

This higher threshold is used to allow the assessment to be conducted in a more binary way, and to account for individual project contexts that may justify a slightly higher combined margin emission factor than that represented by the grid currently.

Oxidation factor
Methane generated in a landfill site’s interior passes through a topsoil layer before being released into the atmosphere. For landfills not covered by a synthetic layer, as methane passes through the topsoil layer, the methane will be partly oxidized to carbon dioxide by microorganisms. The avoided methane impact therefore depends on the amount of methane generated and on how much would have been oxidized in the topsoil. Projects that under-estimate the amount of oxidation that would have occurred will overestimate the avoided methane compared to the baseline scenario.

Some projects choose to apply an oxidation discount rate when not using a synthetic cover to mitigate this potential for overestimation. While different standards have different requirements for oxidation discount rates, common rates fall within 10–35%.

- Projects must include a synthetic layer, or apply an oxidation discount rate of at least 10% (IPCC default value) to emissions calculations to account for this impact.

Renewable energy

Renewable energy projects were first popular as a mechanism for growing the renewables industry when implementation was low. As adoption grows, there are increasing subsidies and other incentives in place that reduce additionality of new projects. However, credit financing can still have a huge impact for small scale, offgrid projects in developing countries where adoption rates are low. Therefore, Patch's listing criteria focuses heavily on project size and location, market penetration rates, and how credit revenues contribute to project success.

CRITERIA

Renewable energy

Project scale and country screeners
On average, projects that are smaller-scale and located in a United Nations Least Developed Country (LDC) will face significantly higher financial barriers to implementing the project without carbon credits.

Furthermore, the extent to which a project is already common practice in that country is also highly dependent on its subtype, scale, and country. Offshore wind and organic waste projects, micro-scale projects, and renewable technologies in LDCs are significantly less popular than other types of renewable energy. Therefore, presence of one of these characteristics indicates higher inherent additionality.

Verra and Gold Standard have existing policies in place that require projects to be small-scale, based in an LDC *or* in locations where penetration is lower than 5% for a given subtype. But many of these projects are still identified as higher risk by external ratings organizations. Adopting a set of project screening variables *and* a lower adoption threshold (see next criterion) can minimize this risk and ensure Patch is selecting best-in-class renewable energy projects.

To be listed on the Patch platform, projects must be one of the following:

- Small-scale (<15MW) or micro-scale (<5MW)
- Non-grid connected
- Based in an LDC
- Offshore wind or organic waste
- Additionally, all projects must have completed an environmental impact assessment to be considered for further review.

Common practice / market penetration
This is defined as the penetration of the renewable energy subtype within that country on the date in which the project started. If an activity was already common practice within a region at the time a project started, then it suggests that its activities could have been implemented without carbon credits. Higher penetration of the project's activity in that region indicates higher common practice and higher additionality risks.

However, adoption rate can be seen as a lagging indicator, as it can take a few years to build a power plant, so the rate of growth in new projects tends to vastly exceed adoption rates. Given how the renewable energy industry has scaled, Patch believes this 5% cutoff is high for most renewable energy technologies, especially wind and solar, and has elected to implement a more stringent adoption rate to focus on truly emerging markets.

- Market penetration for a given subtype must be less than 2% in the year the project was registered.

Proportion of revenues from carbon credits
Projects that would have been profitable without carbon credits are not additional. It is therefore important to evaluate the importance of carbon credits to the revenue mix of the project. Across renewable energy sub-types, it is standard for between 3% and ~10% of project revenues to come from the sale of carbon credits. This proportion tends to be lowest for solar and hydro projects, and highest for small-scale and bioenergy projects.

Patch intends to set a high bar for financial additionality of renewable energy projects. If carbon credits represent *less than 10% of project revenues*, then the project may have been financially viable even without credits.

$$\text{\% of Revenue from Carbon Credits} = \frac{\text{Carbon Credit Revenue}}{\text{Total Revenue (Carbon Credit Revenue + Electricity Revenue)}}$$

Patch will calculate data on expected / actual annual electricity generation, expected carbon credit issuance, electricity tariff price, expected credit issuances, and average carbon credit price to evaluate carbon credit and electricity revenues.

- Credit revenues must exceed 10% of total project revenues for a project to be eligible.

CRITERIA

Renewable energy cont’d

Accuracy of electricity grid emissions factors
Emissions factors convert activities into associated emissions (such as converting grid electricity use into emissions). Given that renewable energy projects are displacing grid electricity, the emission factor used by the project should broadly resemble the emission factor of the grid that it is a part of. Patch will compare a project’s emissions factors to published emissions factors for a project’s region.

Given the variety in individual project use cases, it is standard for project-specific emissions factors to fall within twice their national third-party benchmarks. Any project that uses an emission factor significantly higher than that of the grid is likely overestimating this displacement impact.

- Project emissions factors must not be two times higher than the third-party benchmarks.

Sourcing and integrity variables
Biogas can be created using a range of different organic feedstocks. Because of the wide variety of options, the impact of a biogas feedstock on the ecosystem can also vary. For example, burning or decomposition of crop waste can be a net source of emissions if not managed. Alternatively, purpose-grown crops (crops with an alternative purpose, such as feedstock for animals) are at high risk for creating economic leakage, land use change, and additional resource consumption if applied to a biogas project.

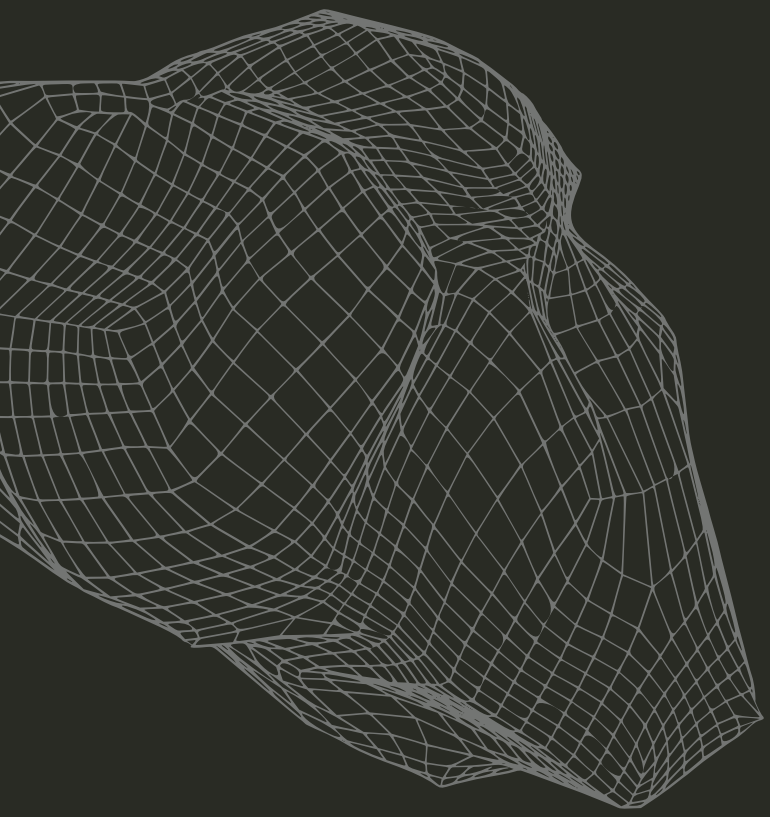
- Projects using feedstock from wood and crop waste are eligible.
- Alternative sources of feedstock may apply to be considered case by case. These projects will need to provide a thorough assessment of:
  - Sustainability and scalability of the feedstock
  - Proof that feedstock will not impact biodiversity or food production
  - Testing to demonstrate feedstock is not contaminated

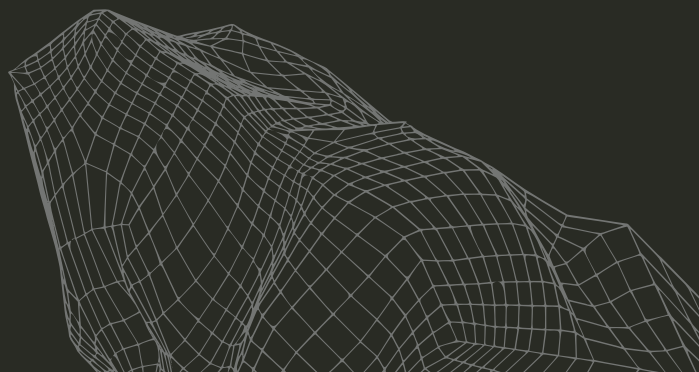
Biochar

Biochar is a solid product generated from biomass through pyrolysis, i.e., the exposure of biomass to high temperatures with no or limited access to oxygen. Biochar sequestration is a form of biomass-based carbon dioxide removal (CDR) that partially converts biomass into biochar that is stable for decades or centuries. Biochar has a range of uses. Most commonly, it can be used as an additive to agricultural fields to enhance yields, but may also be used as filler for concrete, roofing material, and enhancements for cattle feed.

Industrial-scale projects use automated pyrolyzers or gasifiers that can continuously produce biochar. These projects tend to be the most efficient at capturing gasses produced during the pyrolysis process, but may have higher emissions associated with transportation of biochar.

Smaller scale artisanal projects rely on using open fires or kilns to create small batches of biochar. There are greater process-level emissions associated with artisanal projects because it's much harder to capture all gas created during pyrolysis. But these projects create economic opportunities for small communities and can be installed directly at farms.





CRITERIA

Biochar

Biomass sourcing and integrity variables

Biochar can be produced through pyrolysis of nearly any organic material. Because of the wide variety of options, the impact of a biochar feedstock on the ecosystem can also vary. For example, burning or decomposition of crop waste can be a net source of emissions if not managed, so using crop waste as a source of feedstock can help reduce these emissions.

Alternatively, purpose-grown crops (crops with an alternative purpose, such as feedstock for animals) are at high risk for creating economic leakage, land use change, and additional resource consumption if applied to a biochar project. Puro.Earth and Verra require feedstock baselines to be set at zero, meaning the project is conservatively not accounting for emissions caused by the decay of feedstock.

- Projects using feedstock from wood and crop waste are eligible.
- Alternative sources of feedstock may apply to be considered case by case. These projects will need to provide a thorough assessment of:
  - Sustainability and scalability of the feedstock
  - Proof that feedstock will not impact biodiversity or food production
  - Testing to demonstrate feedstock is not contaminated
- Projects may not use feedstock from non-waste, purpose-grown crops or long-lived biomass (standing, mature forests)
- Patch will report on whether the feedstock emissions baseline is set at zero.

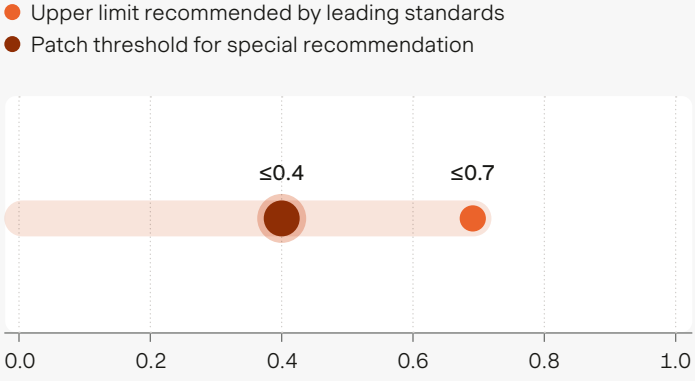
Stability and chemical composition of biochar

The stability of biochar depends on the underlying composition of the feedstock, particle size, and the conditions under which pyrolysis was performed. Higher temperatures during pyrolysis tend to create more stable biochar, because more volatile gasses are lost throughout the process. However, lower temperatures create a biochar that is better suited to improving soil quality and may be preferential given the final application of the material. Some studies, such as Sanei et. al,[2] have found that temperatures in the range of 500°C can be a threshold for stability, but this can vary due to differences in biochar chemistry.

A project's hydrogen to carbon (H:C) ratio can also be a measure of stability. Many leading standards (European Biochar Certificate, Puro.Earth, and Verra) note that H:C ratios above 0.7 are considered unstable.

- Patch will collect data on where / how biochar is applied.
- H:C ratios must be lower than 0.7.
- Patch will note whether a project's H:C ratio is lower than 0.4, as that ratio has been demonstrated to sequester carbon for longer.
- Patch will collect data on a project's pyrolysis temperature to flag any potential for volatile components to be retained after the process.
- Projects with likelihood of volatile compounds must account for carbon losses through the establishment of a defined buffer pool.

Recommended hydrogen to carbon (H:C) ratio



2 Sanei, Hamed. "Assessing biochar's permanence: An inertinite benchmark." International Journal of Coal Geology, vol 281 January 2024, Science Direct

CRITERIA

Biochar cont'd

Quantification of project emissions

The application of biochar can serve as an additional emissions source or sink, depending on the composition of the biochar and where/how it is applied. It is critical that biochar application is included in a project's life cycle assessment (LCA) to ensure the project is a net removal of carbon. Process emissions will likely differ substantially between industrial and artisanal biochar projects. While industrial pyrolysis projects may have higher transportation or processing emissions, artisanal projects are more likely to lose heat or gasses during the pyrolysis process. Project LCAs can be used to flag these important sources of emissions throughout the production process.

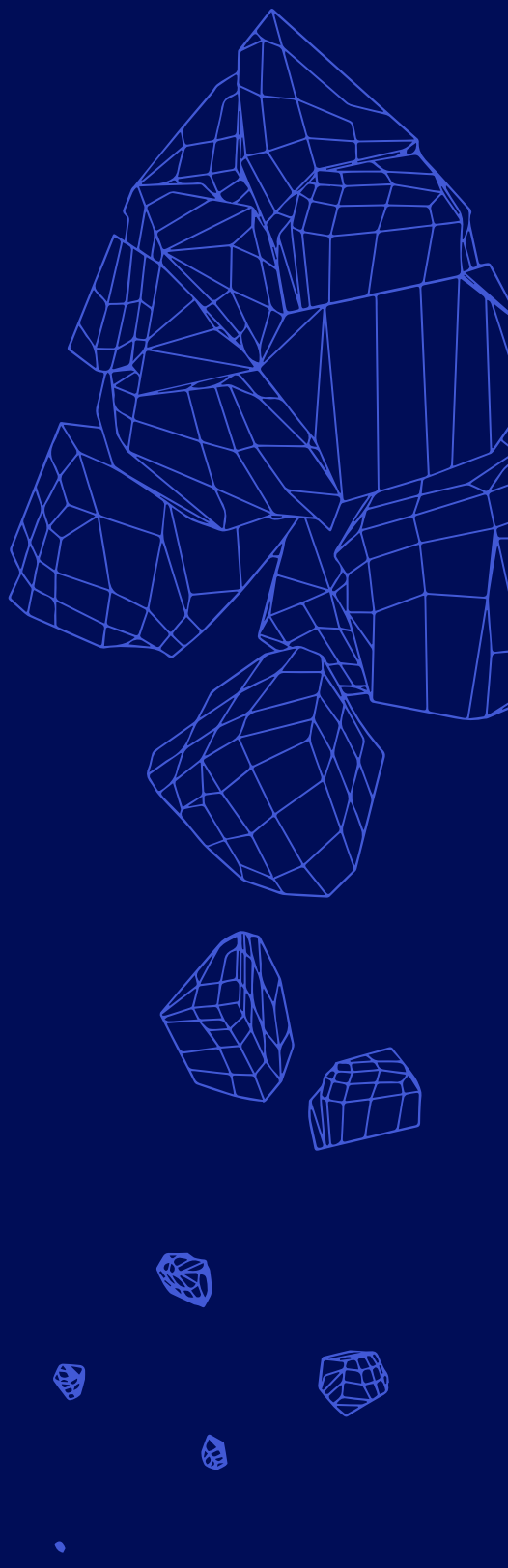
- Projects must complete a life cycle assessment that covers cradle to grave emissions.
- **Industrial Projects:** 100% of pyrolysis gasses must be recovered or combusted & accounted for in a project's emissions inventory.
- **Artisanal Projects:** Projects must disclose percentage of heat and gas lost through pyrolysis and integrate those into life cycle assessments.
- Projects should only credit for removals associated with biochar production, and not for any use case emissions (e.g. soil amendment, concrete filler).
- Patch will note whether any particular aspects of biochar development are likely to lead to high process emissions, which reduces overall project efficiency.

By-products and financial additionality

Biochar projects create a range of potential byproducts that could potentially be sold to generate additional project revenue (such as syngas). Therefore, the additionality of a biochar project is dependent on understanding how the sales of these materials impact the underlying viability of the project.

- Patch will collect data on whether a project is selling or donating created biochar.
- Projects must present a convincing argument for financial additionality that integrates revenue made from biochar, and any additional sold byproducts.
- Projects that produce and sell syngas or biochar as a future source of fuel are not eligible.

Enhanced rock weathering



Enhanced rock weathering (ERW) sequestration builds on a naturally occurring process that captures CO_2 from the atmosphere and stores it in minerals. Reactive rocks may be deposited on farmlands, near water bodies, or directly in the ocean (which will not be covered in this particular overview). The location of deposition, environmental conditions, and rock chemistry all have an impact on the rate of weathering and overall carbon benefit of the project. This means that quantification and review of ERW projects can vary substantially based on the material source and local environmental conditions.

ERW projects are still fairly new, and as a result, long-term impacts are untested. The level of scrutiny to date is quite modest compared to what is likely to come. Even among leading standards (Puro.Earth, CSI, Isometric) there is significant variability in terms of locations allowed, usable feedstocks, baselining requirements, and other criteria for projects. As a new removal technology, the most critical risks will relate to the chemistry of their feedstock, how they measure, monitor, and model capture and storage, their agricultural impacts, and emissions from their entire supply chain.

CRITERIA

Enhanced rock weathering

Feedstock chemistry and source

The two most important feedstock criteria are chemistry and source.

- **Chemistry:** Feedstocks can come from a variety of rocks or minerals rich in calcium, magnesium, and iron. Common feedstocks include olivine, basalt, and wollastonite. Different rocks and minerals will have varying grain sizes and chemical compositions, which impact ideal application setting as well as longer-term mineralization rates and potential.
- **Source**: Feedstock can be obtained from a range of sources including treated/untreated mine tailings, dedicated mines, industrial waste streams, all of which have varying risks and benefits. Mined rock can be the most mineralogically consistent, but is at highest risk for creating additional adverse sustainability impacts. If that mined rock had an alternative purpose at its origin, the project will have a higher risk of leakage if additional mining is needed to fill a resource void created by project activities.

On the other hand, feedstock from mine tailings or industrial waste can be more mineralogically variable, and have a higher risk of heavy metal contamination. Mineralogical variability can impact weathering rates, which affects the ability to predict long-term carbon storage with certainty.

- Patch will collect information on the chemistry and source of the feedstock.
- If using mine tailings or waste materials:
  - Projects must assess feedstock for contaminants.
  - Projects must assess mineralogical variability within feedstock.
- Projects that rely on dedicated mines are not eligible.
- The project must make a convincing argument that the feedstock does not contribute to economic / market leakage.

Reaction with environment

Rock type, grain size, temperature, moisture, soil pH, and energy input will all impact mineralization rates and removal capacity at the project location. Therefore, optimizing a specific project's weathering conditions will depend on studying how a material will respond with its environment. Sites with a warm and humid climate tend to be optimal for mineralization, which makes certain locations (including Central America, India, and Brazil) ideal candidates for ERW projects.

- The project must describe the process for evaluating soil suitability and weathering rates.
- The project must conduct in situ testing or rely on local, validated studies to determine how variables like soil moisture, pH, and local vegetation impact long-term mineralization rates and durability.
- The project must account for potential sources of carbon losses over the project's lifespan.

Monitoring plan

The most significant area of uncertainty for ERW projects is the estimation of CO_2 uptake and the definition of the reservoir boundaries. Due to the cost of in situ data collection, most early-stage ERW projects rely on modeling to project out future impact and removals. This includes modeling of dissolution rates as well as modeling of material movement (dissolved carbon will, over time, transport into water bodies where additional chemical reactions can take place).

A strong reliance on models will increase uncertainty in a project's outcomes. Monitoring on site and supplementing monitoring work with physical data collection will help ground truth the model assumptions and results. Due to the variability in removal rates due to rock type and grain size, climate, soils, and agricultural practices, average values are likely to be erroneous. This suggests that each site location would need its own data collection to validate models.

CRITERIA

Enhanced rock weathering cont'd

Ex-ante projections can be data-driven using site specific environmental information or rely on average values. Relying on average, non-specific values will be considered high-risk given the high variability of ERW performance even for sites in similar climatic conditions. Periodic verification of projections through site specific data collection would reduce the risk of non-performance.

- Patch will collect information on a project's full monitoring plan.
  - » Models / counterfactuals must be grounded in actual / local data.
  - » Patch will collect data on how project boundaries are defined and ensure project accounting methods factor in all immediate water reservoirs into project boundaries.
- Ex-ante credits must rely on data-driven, site specific projections. These projections must continue to be periodically validated using site-specific data collection over time.

Measurement and application

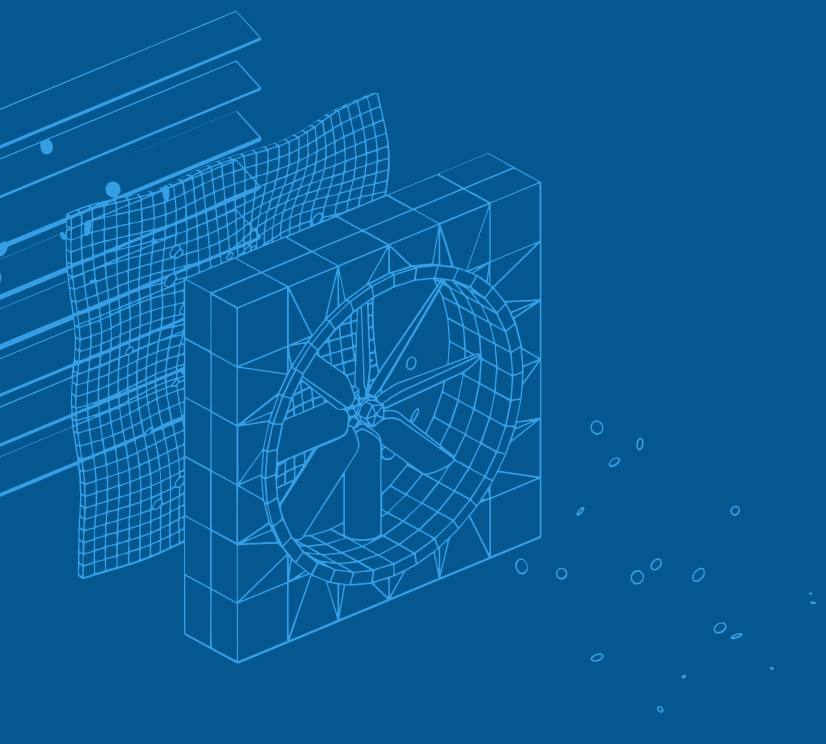
While all project emissions will be captured within a project's life cycle assessment, the complexity of a project's supply chain can be a real source of risk that can impact project success and long-term options. Additionally, the more emissions intensive a new project is, the harder it will be for that project to scale and remain viable over time. While all emissions listed below must be integrated within crediting, a more emissions-intensive process impacts project efficiency, which can create risks for long-term scalability and project viability for a project type that is already constrained due to costs associated with measuring and monitoring testing locations and carbon uptake over time.

- Patch will collect information on the process for collecting, processing, transporting and applying feedstock.
- A project's life cycle assessment (LCA) must integrate emissions associated with feedstock procurement, rock grinding / preparation, transportation, post-processing, and application.
- **Agriculture Projects:** LCAs should consider impacts (positive or negative) to local crops and ensure that process emissions are included in LCA, but that they do not impact crediting.

Engineered capture and storage

Engineered capture and storage refers to the wide variety of technological approaches to capturing carbon from the atmosphere and storing that carbon somewhere where it won't leak. There are many emerging strategies for both capturing and storing carbon that won't be covered in depth here. As this market matures, Patch will iterate on our process to increase our depth of assessment for each of these different strategies.

Engineered capture is appealing because it has the largest storage scale potential out of all removal methods, but it is also incredibly costly to develop and scale. At this stage, many risks of engineered capture are focused around untested technology and application.



Engineered capture

- **Point source capture (PSC):** The capture of CO_2 from incoming gas or combustion exhaust from industrial processes including fossil fuel production, glass fabrication, and steel furnace combustion. These are typically avoided emissions projects that prevent additional emissions from entering the atmosphere.
- **Direct air capture (DAC):** The process of using equipment and chemical processes (such as mechanical fans, natural forces like wind, or sorbents and solvents) to remove CO_2 directly from the air.

Storage

This is the process of storing captured carbon in the ground or another stable material. The means of storage is independent of the collection method. Storage options often include depleted oil and gas wells (on land or offshore), injection into rock formations, and mineralization (in rock or materials like concrete). All these reservoirs are likely to be considered permanent on geological timescales after a period of monitoring.

CRITERIA

Engineered capture and storage

Projects optimizing extractive processes
Certain PSC projects aim to capture emissions directly from fossil power plants. Enhanced Oil Recovery (EOR) is a storage mechanism for direct air capture where CO_2 is pumped into oil wells, enhancing the efficiency of oil extraction. While these processes can reduce the carbon intensity of oil extraction, they may also incentivize future oil extraction by making processes more efficient.

- Point source capture projects supporting fossil power plants will be ineligible.
- Projects using enhanced oil recovery will be ineligible.

Technology readiness
Engineered capture and storage has the advantage of precise measurement. But because the technology is new, capacity for capture and storage across technological approaches can vary, and can be uncertain without strong testing and calibration. Risks can be reduced by reviewing what these technologies are claiming, and what they can prove.

- Patch will collect information on the project's technology readiness level.
- Projects must confirm the efficiency of capture, along with information on technological testing or research that confirm the efficiency of carbon capture.
- Projects must demonstrate how they meet local regulations and environmental assurances.

Complexity and life cycle assessment
While many nature-focused engineered projects like biochar and enhanced rock weathering projects have the complexity of uncertainty in their chemistry, engineered solutions have the complexity of equipment, supply chain, operating personnel, and similar variables. Simpler project designs tend to have less risks and uncertainty.

Projects may choose to quantify stored carbon only, regardless of the source. It is more complicated to account for net removal, tracing emissions in the operations, transport, and possibly throughout the supply chain. This approach is more complicated because it requires multiple variables and data types, but is more likely to lead to real, net-negative impact.

Additionally, engineered capture can be counterproductive if the process requires more fossil carbon than it can sequester.

Projects that rely on energy from the grid (even intermittently, when renewable energy isn't available), may not generate negative emissions overall.

- Life cycle assessments (LCAs) and crediting must cover cradle-to-grave emissions. If independent organizations are covering carbon capture and carbon storage, the collaborative effort must collectively cover cradle-to-grave emissions.
- Projects must have stable access to a renewable energy source.
- Projects must share how various process emissions are integrated into crediting.

Storage durability
Durability of the storage is entirely dependent on the reservoir, but storage within depleted oil and gas wells, saline aquifers, and mineralization in basalts is understood to be stable over thousands to millions of years. Although storage in concrete is likely to remain contained for millions of years, the concrete is a product with an end of life that may impact durability.

The highest risk to high-durability storage is the potential for gas to leak from the storage site. Other storage risks tend to be uncommon and location specific. For example, volcanic activity is the biggest risk for storage in a basalt reservoir, where engineering failure is the greatest risk for storage in an abandoned oil and gas well.

- Projects must employ a thorough MRV process to validate gasses injected, and rate of gas leakage, to ensure loss of CO_2 is known.
- Projects must share each basin's storage capacity and the capacity used.
- The project's storage option must share a comprehensive and validated study for durability including an assessment of any risks of reversal.

BiCRS

Biomass with carbon removal and storage (BiCRS) projects represent the full range of projects where different forms of biomass are processed, then stored or sequestered to remove the carbon over geologic timescales. BiCRS projects can utilize different forms of biomass, different forms of processing, and different forms of storage. But the ultimate goal is to prioritize long-term carbon removals. Because these projects have overlapping elements with both biochar projects and the storage components of engineered capture and storage projects, these frameworks will represent a fusion of those two assessment frameworks.

CRITERIA

BiCRS

Biomass sourcing and integrity variables

Different sources of biomass feedstock can create different net ecosystem risks or benefits. For example, burning or decomposition of crop waste can be a net source of emissions if not managed, so utilizing crop waste as a source of feedstock can help reduce these emissions.

Alternatively, purpose-grown crops (crops with an alternative purpose, such as feedstock for animals) are at high risk for creating economic leakage, land use change, and additional resource consumption if used as a biomass feedstock.

- Projects using feedstock from wood and crop waste are eligible.
- Alternative sources of feedstock may apply to be considered case by case. These projects will need to provide a thorough assessment of:
  - Sustainability and scalability of the feedstock.
  - Proof that feedstock will not impact biodiversity or food production.
  - Testing to demonstrate feedstock is not contaminated.
- Projects may not use feedstock from non-waste, purpose-grown crops, or long-lived biomass (standing, mature forests).
- Patch will report on whether the feedstock emissions baseline is set at zero.

Complexity and life cycle assessment

To create truly carbon negative projects, BiCRS projects must quantify emissions from feedstock development and processing through storage, regardless of the source. It is more complicated to account for net removal, needing to trace emissions in operations and transport, and possibly throughout the supply chain. This approach is more complicated because it requires multiple variables and data types, but is more likely to lead to real, net-negative impact.

- Life cycle assessments and crediting must cover cradle-to-grave emissions. If independent organizations are covering carbon capture and carbon storage, the collaborative effort must collectively cover cradle-to-grave emissions.
- Projects must have stable access to a renewable energy source.
- Projects must share how various process emissions are integrated into crediting.
- Projects must demonstrate how they meet local regulations and environmental assurances.

Storage durability

Durability of the storage is entirely dependent on the reservoir, but storage within depleted oil and gas wells, saline aquifers, and mineralization in basalts is understood to be stable over thousands to millions of years. Although storage in concrete is likely to remain contained for millions of years, the concrete is a product with an end of life that may impact durability.

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- Projects must employ a thorough MRV process to validate gasses injected, and rate of gas leakage, to ensure loss of CO_2 is known.
- Projects must share each basin's storage capacity and the capacity used.
- The project's storage option must share a comprehensive and validated study for durability including an assessment of any risks of reversal.

04 Glossary

Terms

ALM	Agriculture land management projects may focus on increasing carbon stocks by enhancing soil quality, changing agricultural practices to promote sustainable and regenerative management, or sequestering carbon in woody biomass.
APD	Avoiding planned deforestation projects avoid authorized deforestation, such as the authorized conversion of private land to establish commercial agriculture or cattle pastures.
ARR	Afforestation, reforestation, and revegetation projects are removals projects that build carbon stocks through active reforestation and regeneration of depleted forests.
AUD	Avoiding unplanned deforestation or degradation projects avoid unauthorized deforestation or forest degradation, such as encroachment into protected areas or private land for the establishment of smallholder cropping systems, pastures, or illegal logging.
Article 6	Article 6 of the Paris Agreement established an accounting framework for international transfer of carbon credits and a central UN mechanism to trade credits. Essentially, it amounts to rules for international carbon markets.
BiCRS	Biomass with carbon removal and storage is a project type that involves processing and sequestering biologically-derived carbon, such as crop waste, wood, or other organic residues.
BVCM	Beyond Value Chain Mitigation refers to SBTi's guidance for deploying climate finance above and beyond making emissions reductions within their value chain, including purchasing carbon credits. These guidelines have been released for public consultation, but have not been finalized.
Carbon credit	An economic unit representing one metric tonne of carbon dioxide that has been avoided or removed from the atmosphere.
CDM	The Clean Development Mechanism is a United Nations program that allows a country with an emissions reduction or limitation commitment under the Kyoto Protocol to invest in emissions reductions in a developing country and count those reductions toward their own targets.

Terms continued

CLF	Conservation of loggable forest projects are improved forest management projects that aim to conserve existing carbon stocks by halting harvesting practices. While focused on current productive lands instead of active deforestation zones, project risks and benefits are comparable to APD projects.
Co-benefit	An additional positive outcome associated with a carbon credit, such as ecological benefits, biodiversity, energy security, improved air quality, and many more.
DAC	Direct Air Capture refers to any technology that chemically removes CO_2 from the atmosphere.
EF	An emissions factor is a mathematical formula calculating the amount of a pollutant or greenhouse gas that can be associated with an activity like burning wood for cooking.
EOR	Enhanced Oil Recovery is a technology that involves injecting CO_2 into oil wells to allow for the extraction of fossil fuels.
ERW	Enhanced rock weathering is a method of carbon removal that leverages and improves the ability of minerals to naturally capture and store CO_2
Ex-ante	Ex-ante credits constitute an emissions reduction that is expected to take place in the future.
Ex-post	Ex-post credits constitute an emissions reduction that has verified to have already happened.
fNRB	The fraction of non-renewable biomass is the portion of wood fuel used in a carbon project that is unsustainable and contributes to long-term loss of biomass carbon stocks.
GHG	Greenhouse Gasses including CO_2, methane, HFCs, and others.
GWP	Global warming potential refers to the amount a given greenhouse gas will contribute to the heating of the atmosphere. Methane, for example, has a GWP approximately 30 times greater than CO_2.
HFCs	Hydrofluorocarbons are greenhouse gasses that are used in refrigeration and insulation and can be thousands of times more harmful than CO_2.
LCA	A Lifecycle Assessment is a calculation of the total greenhouse gas emissions or environmental impact associated with a product from the beginning to the end of its existence.

Terms continued

LDCs	Least Developed Countries are defined by the United Nations as low-income countries with structural impediments to sustainable development.
MRV	Measurement, reporting, and verification refers to the scientific process of monitoring the climate impact of a carbon credit project, reporting on that impact, and verifying the impact.
The Oxford Principles	A set of four principles developed by climate scientists at University of Oxford to guide the use of carbon offsetting.
Patch project acceptance criteria	The process and standards by which a carbon credit process may be accepted onto the Patch platform.
PDD	A project design document is detailed documentation for a project's methodology, implementation, expected climate outcomes, calculated emissions reductions or removal, baseline conditions, personnel, data management and reporting, and much more.
Tokenized credit	A digital representation of a credit that can be bought or soldvia blockchain on a cryptocurrency platform.
VCM	The Voluntary Carbon Market is an economic ecosystem in which carbon credits are produced, sold, and ultimately retired. Not to be confused with compliance markets, participants in the VCM are not required to engage due to governmental policy or regulation.

Organizations

ANSI	The American National Standards Institute is a nonprofit organization that oversees voluntary standards for various technologies and activities in the U.S.
BeZero	A private company based in the U.K. that provides publicly available risk assessments and ratings for carbon credits.
Change Climate	A nonprofit organization that manages the Climate Neutral Certified Label, a standard for corporate carbon accountability.
European Biochar Certificate	A voluntary industry standard developed by the Ithaka Institute to guide the use of biochar technology in Europe.
Gold Standard	A certification standard for carbon credit projects focused on energy efficiency and renewable energy run by The Gold Standard Foundation, a nonprofit based in Switzerland.

Organizations continued

ICROA	The International Carbon Reduction and Offset Alliance is a nonprofit organization that manages an accreditation program for certifying best practices in the use of carbon credits.
ICVCM	The Integrity Council for the Voluntary Carbon Market is an independent governance body setting and enforcing a global standard for carbon credits known as the Core Carbon Principles (CCPs).
ISO	A standard development organization headquartered in Switzerland that creates international standards for technology and manufacturing.
OFAC	The Office of Foreign Assets Control of the U.S. Treasury Department that administers and enforces international trade sanctions.
Patch	A software company founded in 2020 to create modern infrastructure and market acceleration to scale the VCM.
Puro.earth	A global standard and registry headquartered in Finland for engineered carbon removal projects and their carbon credits.
SBTi	The Science Based Targets Initiative is a partnership between CDP, United Nations Global Compact, World Resources Institute (WRI), and the World Wide Fund for Nature (WWF) that developed the first net-zero standard, as well as science-based guidelines for meeting it.
Sylvera	A private company based in the U.K. that analyzes and rates the integrity of carbon credit projects.
UNFCCC	The United Nations Framework Convention on Climate Change is a United Nations treaty first adopted in 1992 with the aim of preventing dangerous human interference with the Earth's climate.
VCMI	The Voluntary Carbon Markets Integrity Initiative is a non-profit standards organization. Its Claims Code of Practice provides rules for how companies may engage with the carbon credits in line with net-zero pathways.
Verra	A nonprofit organization headquartered in Washington, D.C. that manages the Verified Carbon Standard (VCS) program, a standard for certifying carbon credits focused on forestry, agriculture, and plastic waste.

A rebalanced planet depends on the climate solutions carbon markets are working to accelerate. Patch's trust and safety approach is designed to give carbon credit buyers the confidence they need to help create a livable future.

Patch trust and safety framework version 3.0
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Patch

Get in touch with our climate team
Whether you have an established climate strategy or are just getting started, let's talk.

patch.io info@patch.io