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Verification in Markets for Water Quality & Habitat

A report funded by the U.S. Department of Agriculture Office of Environmental Markets

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Summary

Put simply, verification is the practice of confirming whether an assertion is true, in that it conforms to set expectations under an agreed level of scrutiny. Verification plays a central role in substantiating the validity of credits in environmental markets. Verification of credit-generating projects includes administrative and technical review, as well as confirmation that the project has been implemented as promised. Verification systems are used to support programs in the regulatory and voluntary crediting context, and to support robust internal tracking systems. Verification systems should seek to provide trusted confirmation that credits represent real environmental benefit. Those designing a verification system will need to make decisions about who conducts verification review and what qualifications they need, what information is reviewed, and the frequency with which verification should occur. Options and examples are used to explore tradeoffs inherent in making these decisions such that the resulting system supports transparency and accountability, ensures costs do not detract from the ability to provide greater environmental benefits, and builds opportunities to learn and improve programs quickly.

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1. INTRODUCTION

Put simply, verification is the practice of confirming whether an assertion is true, in that it conforms to set expectations under an agreed level of scrutiny. It is a fundamental and logical process that can be applied to individuals, organizations, projects, or processes in a wide range of contexts. Parents verify whether rooms are clean and beds are made, nations investigate the validity of other nations' promises, auditors evaluate financial practices relative to legal standards – each confirming the reality of a claim and seeking a balance between trusting that participants claims are true and confirming them independently.

Verification plays a central role in substantiating the validity of credits in environmental markets. *Credits* are tradable units representing the benefits of specific actions that improve environmental quality or the provision of ecosystem services, often through conservation or restoration (Willamette Partnership, 2013). Credits can be bought, sold, or used to account for environmental gains or losses. Credits are often used to meet regulatory obligations that mitigate environmental impacts, such as the loss of habitat or release of a pollutant into the air or water. Water quality and carbon trading programs use verification procedures to ensure that credits represent actual pollution reductions. More broadly within the environmental markets context, verification systems are applied to products and projects by ecolabeling organizations (e.g., USDA Organic, Salmon-Safe, Oregon Tilth), conservation incentive programs (e.g., USDA Farm Bill payments, New York State Department of Environmental Conservation's Landowner Incentive Program), and internal corporate sustainability tracking (e.g., REI's aspiration to become an organization with zero waste-to-landfill by 2020 (REI, 2014)).

The duty of conducting verification review is assigned amongst the participating parties, either by allowing the party undergoing verification to corroborate its own claims (self-verification); having the regulatory agency, or other controlling party, confirm the assertions (agency-led verification); or through review by an independent entity (third party verification).

> **Protocols & Standards**
>
> Within each verification system is a set of protocols and/or standards against which the project or product is reviewed. *Protocols* describe the actions, sequencing, and documentation that are provided to support generating credits, as well as the rules for how credits can be bought, sold, and tracked. *Standards* are thresholds that must be met at various stages of the credit generation process, often including eligibility requirements, specifications for installation of a given conservation action, and performance targets that represent delivery of environmental benefits.

The following discussion explores key concepts and considerations for verifying the environmental benefits of conservation and restoration actions toward the generation of water quality and habitat credits in US markets, but will pull widely from carbon emissions trading, ecolabel standards, and voluntary incentive programs to explain and illustrate shared components and concepts within verification.

1.1 Value of Verification in Crediting Systems

Currently in the United States, there are active markets for credits including wetland habitat, endangered species habitat, reductions in emission of air pollutants, water quantity, and pollutant reductions that improve water quality.

Unlike many agricultural or other products, it can be difficult for credit buyers to confirm first-hand the quantity or quality of their credits because the underlying actions tend to be implemented in dispersed locations across dynamic landscapes. Furthermore, environmental benefits underlying credits may stem from complex biological or ecological processes that are difficult or impossible to see (e.g., changes in soil infiltration or erosion rates, carbon sequestration, etc.). In order for the buyer to have confidence that they are purchasing real environmental benefits, and in order for regulators to have confidence that obligations are truly being met, systems must be in place to confirm that the conservation practices used are eligible, credits were calculated accurately, and the practices used to generate credits are indeed installed and being maintained. Verification plays a central role in filling this gap and substantiating the validity of a credit.

1.2 Components of Credit Verification

Credit-generating projects are typically reviewed in the first year of project implementation, a process referred to hereafter as "initial verification," and in subsequent years of the project life, referred to hereafter as "ongoing verification." The following components of review are frequently included in the initial and ongoing verification of credit-generating projects to confirm that credits were created according to approved protocols and meet program standards:

1. **Administrative review** – Review of documentation for the credit-generating project to confirm conformance with program protocols and standards. Administrative review typically covers completeness – that all necessary documentation has been provided – and consistency with program standards – confirmation that documentation demonstrates conformance with the programs protocols and standards.

2. **Technical review** – Evaluation of the accuracy and documentation of the modeling, measurement, or other method applied to determine credit quantity. For modeling approaches to credit quantification, this may include review of modeling inputs and assumptions or a full independent recalculation of credit quantity. For measurement-based approaches, this may include review of monitoring plans and datasets, the data collection quality assurance and quality control plan, and/or device calibration procedures.

3. **Confirmation of project implementation and/or performance** – Confirmation, often visual, that conservation or restoration actions have been installed in accordance with relevant guidelines or quality standards and are functioning in accordance with any performance criteria. This may occur through an onsite inspection, self-reporting, or use of remote sensing (e.g., photographic, video, aerial, and/or LIDAR images).

The term "verification" has been used to refer to systems that cover some or all components of review. For example, trading programs in many Chesapeake Bay states (Virginia, West Virginia, Pennsylvania) use the term "verification" to refer only to the confirmation of project implementation and/or performance (Virginia DEQ, 2008; West Virginia DEP, 2009; 25 Pa. Code § 96.8(a)). In contrast, the Ohio River Basin Interstate Trading Project and Willamette Partnership's Ecosystem Credit Accounting System (ECAS) each use the term to encapsulate all components of review (EPRI, 2012; Willamette Partnership, 2013).

The latter usage – that verification encompasses administrative review, technical review, and confirmation of project implementation – is how the term will be used here.

One Component of a Larger System to Mitigate Risk and Uncertainty

Verification is one component within the greater spectrum of tools to ensure credits represent an actual environmental benefit. Other crediting procedures include:

- Standard protocol to follow in credit development.
- Threshold eligibility criteria that filter projects based on additionality,[1] ecological suitability, and sustainability (e.g., financial and administrative plans are in place order to support maintenance and monitoring over the life of the credit).
- Quality standards for project implementation and performance.
- Use of conservative assumptions or values in estimating the benefits provided by a given action.
- Trading ratios that adjust the number of credits to account for uncertainty and other risk factors.
- Reserve or insurance pool of credits that can be accessed in the event of project failure.
- Posting project information for public review.

Further discussion of methods to mitigate risk and uncertainty in credit markets can be found in Walker and Selman (2014).

2. A Short History of Environmental Verification

The International Standards Organization (ISO) provided an early basis for verification that is evident in the structure commonly used in verification systems today. Although many verification systems exist outside of the ISO, its development can still provide valuable history and context for their content and function.

The ISO as a Basis for Verification

The International Standards Organization (ISO) is a non-governmental organization made up of member nations that work with governments and other organizations to establish international sector-specific standards. The two ISO standards most relevant to verification include the procedurally-focused 14000 series related to the development of systems to manage environmental impacts within the company's production line and the more substantive standard on greenhouse gas (GHG) verification systems, which has more directly become the basis for many carbon crediting standards and verification processes (Mikulich, 2003).

The international activity surrounding GHG markets in the late 1990s and early 2000s prompted ISO to develop standards for measuring, quantifying, validating, and verifying carbon emissions from projects seeking to reduce GHG emissions in exchange for credits. A four-layered structure for verification can be derived from the GHG standards (standards, verifier, accreditor, and recognition body):

- The "project standard," ISO 14064-2, explains how to plan and implement an individual GHG project.
- The "verifier standard," ISO 14064-3, provides guidelines for use by the verifier to confirm a claimant's GHG project assertions.
- The "accreditation and recognition standard," ISO 14065, provides a basis for assessing whether a verifier is qualified or otherwise able to confirm a claimant's assertion. The verifier's authority is generally derived from a governmental entity.
- The "verifier competency standard," ISO 14066, provides a basis for assessing whether a verifier has the subject matter expertise needed to review a claimant's GHG assertion.

[1] The concept of additionality arises most familiarly in the climate change context within the Kyoto Protocol, where Article 6(1)(b) allows nations to engage in carbon trading so long as the "reduction in emissions by sources" or the "enhancement of removals by sinks" are indeed "additional to any that would otherwise occur[.]"

Roles Played in a Verification System

The following describes the various verification roles played by parties. These need to be clearly and explicitly defined, as each verification system uses its own preferred terms.

- **Claimant, client, responsible party, project developer:** The claimant, also called the client, responsible party (ISO 14066), or project developer, is the person or entity seeking verification for the assertion.
- **Verifier**: The person or organization conducting verification review for the claimant.
- **Accreditor**: The person, organization, or other entity recognizing the verifier's competency in conducting verification duties. An accreditor may also train the verifier.
- **Recognition body**: The entity delegating authority to the accreditor. The recognition body may also act as the accreditor.
- **Intended user, buyer:** The person(s) relying on the verified assertion to make decisions (ISO 14066). In credit markets, this is typically the regulated entity, such as a property developer or permittee likely to impact wetland or endangered species habitat. This could also be a consumer using an ecolabel to make an environmentally friendly buying decision, or a shareholder hearing about a corporation's sustainability efforts.

Many of the verification systems in place today either pull directly from ISO standards or reflect the basic structure. Climate protocols used worldwide retain much of the ISO terminology, as well as the basic structure. The Verified Carbon Standard, for example, bases its framework on ISO standards, and utilizes the terms embodied in the ISO structure (Verified Carbon Standard, 2013a). The Climate Action Reserve also utilizes ISO standards, in addition to its own (Climate Action Reserve, 2010).

While there are no ISO standards directly related to water quality trading, habitat credit trading, or crediting for other environmental benefits, the basic framework of the ISO standards is evident in these environmental market programs. For example, in many mitigation, trading, or offset programs, a project developer acts as a *claimant* by implementing conservation practices and seeking to generate credits; a *verifier* inspects the project developer's project against the *standards*; the *accreditor* trains and accredits the verifiers; and the agency, or *recognition body*, accepts the credits against the buyers' regulatory obligations.

Environmental Benefits without Standards
Some programs do not lend themselves to a predetermined verification system and instead conduct internal verification on a case-by-case basis. For example, the U.S. Fish and Wildlife Service's (USFWS) Conservation Banking program does not endorse a prescribed set of verification steps, but rather makes more general use of verification concepts in the process of approving a mitigation bank (USFWS, 2003).[2] Other programs utilize an extremely limited verification system. For food labels such as "All natural" and "Cage free," for example, USDA has articulated the processes that should be associated with these terms; however, the company's assertions are not audited by any third party or regulating entity (Agricultural Marketing Service, 2012).

There are several reasons why a program may choose not to use the third party verification system and/or one built out of the ISO structure. It may be that the quality of the action or product is evident to the intended buyer, or the added credibility is not needed or not of sufficient value for their purposes given the cost of establishing and maintaining a rigorous verification system. The risk is that without verification, the intended users may doubt the validity of the designation, undermining the program's effectiveness.

3. Building a Robust & Trusted Verification System

The following sections provide guidance on the principles, characteristics, and key decisions in the process of building a verification system. Many of these decisions will be driven by the objectives of the verification system, which depend on the intended users of the crediting system and the purpose of the credits. The examples used here draw from existing crediting programs, ecolabel programs, and internal sustainability tracking mechanisms. The differing users and objectives for these program types are reflected in the design of

[2] The Conservation Banking Guidance states, "One way to increase the likelihood of success is to require some method of ensuring performance, such as authorizing sale of credits only upon completion and verification of restoration outcomes."

the associated verification systems. Defining characteristics of these different applications include:

- **Regulatory:** Credits developed for regulatory compliance typically require the greatest level of rigor and transparency. Regulated entities may face fines or legal action if credits do not meet requirements, and often that legal and financial liability gets passed on to project developers through contractual mechanisms.
- **Voluntary:** Voluntary programs, such as voluntary crediting programs, environmental incentives, or ecolabels, offer rewards in terms of reputation and access to premium markets in return for adherence to standards. A program's reputation can be placed in jeopardy if the public or governments view its verification system as ineffective.
- **Internal Tracking:** A company developing its own internal standards, as part of a marketing strategy or to launch an in-house sustainability program, may face the least external pressure regarding verification. Often, the company is accountable to its own board of directors and shareholders, or, if operating under a marketing campaign, may need to provide evidence of claims sufficient to avoid false or misleading advertising complaints and to satisfy its customers.

3.1 Intent of a Verification System

Verification systems are typically established with the intent to:

1. Confirm that credits represent real environmental benefit by effectively identifying those projects that do not conform to program standards as early as possible and allowing high quality projects to advance through the system. This lends robustness and credibility to the market's reputation.

2. Give each party in the crediting program a greater sense of certainty. Credit buyers should gain confidence in the quality and quantity of the benefits they purchase. Project developers should understand what is expected of them and have certainty that verified credits will be saleable. Regulators should feel assured that transactions represent improvement toward desired environmental outcomes, consistent with the number of credits issued.

3. Ensure integrity, transparency, and impartiality in the review of credit-generating projects, such that all entities can participate in good faith, knowing that they will be treated fairly.

4. Attain a balance between the frequency and intensity of project review and costs of delivery that is consistent with crediting program objectives. Program needs, objectives, and audience should guide the evaluation of the associated costs of implementing a verification system against the scrutiny needed to ensure practices are generating environmental improvements.

3.2 Characteristics of a Verification System

To achieve the outcomes above, a verification system should be clear and consistent, accurate, transparent, and practical.

- **Clarity and consistency** in standards and reporting requirements help verifiers and project developers understand what the verification process includes and what information will be reviewed.
- **Accuracy** in verification means that the review results in a true reflection of credit validity and quantity, and is effective in identifying instances of poor performance or fraud.
- **Transparency** builds trust in the system by giving observers the tools to understand what the verification process entails and the standards to which projects are held.
  By keeping verification open and candid, the public is also allowed to participate in holding claimants and governments accountable through informed consumer decisions, voting, and citizen lawsuits.
- **Practicality** built into verification systems reduces administrative costs and inconvenience of participation, allowing more time and money to support conservation and restoration actions.
- **Opportunities to learn** are not often explicit in verification, but can be a very important part of overall program improvement. The review process can benefit the design and operation of individual projects, make markets more efficient, and improve program overall outcomes.

3.3 Key Decisions in Designing a Verification System

Establishing a verification system requires decisions on aspects of the participant roles, requisite qualifications of verifiers, timing, and information reviewed, specifically: 1) Who will conduct verification? 2) What qualifications does the verifier need? 3) What information is reviewed? 4) How often does verification occur?

3.3.1 Roles & Responsibilities in Verification

Verification within crediting systems requires the cooperation of several entities, including the project developer, the regulator or other standards body, and potentially third parties. Because demand for water quality and endangered species credits most often comes from legal requirements under federal and/or state law, the regulator, often a government agency, holds authority over implementing any trades and, by extension, is responsible for setting bounds on who should conduct verification activities. Typically, this is either the regulatory agency itself or a third party; in some cases, a project developer may self-report.

A. Agency-led verification

In agency-led verification, agencies retain oversight and full control over the timing, frequency, and content of project review. This is a good fit where agency staff are the most knowledgeable of the program and its place within the broader regulatory structure. For example, USFWS exercises broad control over conservation banking without specific verification guidance (U.S. Fish & Wildlife Service, 2003). USFWS staff are experts in species and their habitat needs and are qualified to develop case-by-case banking guidelines for a particular species and site. Further, because the agency holds authority to implement the program, staff may be able to more quickly resolve disputes.

Agency-led verification may be less ideal for private landowners, who may not like the idea of regulatory personnel visiting their property for site inspections, or having access to a record of their practices. Consistent funding can also be a challenge for agency-led verification, particularly where the agency's budget is strained and/or subject to frequent fluctuation, or where it is difficult for the agency to set fees that recoup costs (e.g., if a rule or law is required to set fees).

B. Third party-led verification

Third party verification is common in both voluntary and regulated environmental markets. For regulated systems, third party verifiers usually operate under sideboards for acceptable crediting programs approved or accepted by the agency. For example, Willamette Partnership's ECAS verifies water quality credits to the specifications of individual NPDES permits in Oregon as those credits are being used for permit compliance (Willamette Partnership, 2013). Similarly, the California Air Resources Board accepts projects that follow Climate Action Reserve, Verified Carbon Protocol, and American Carbon Registry protocols (Air Resources Board, 2014).[3]

One advantage to using third party verifiers is the ability to utilize individuals knowledgeable about the specific practices being implemented. For example, conservation district staff or agricultural professionals often work closely with landowners to implement farm best management practices (BMPs) that improve water quality, which helps them accurately evaluate credit-generating projects. Third parties may more easily charge fees and have more flexibility in staffing such that they can grow and shrink more rapidly in response to larger or smaller transaction volumes.

If trading participants elect to use a third party to conduct verification, there may need to be a formal mechanism by which the third party obtains authority from the relevant recognition body/regulating agency. For example, a regulatory agency could formally assign tasks to the third party or refer to the third party's power within a permit or trading plan. Without a formal designation, a third party may face challenges from project developers who disagree with its verification outcomes. Further, in a third party-led system, the agency typically retains the legal responsibility and duty to accomplish the mission of the relevant regulatory program, even though they are less involved in oversight of day to day operations, which can present a risk to them without trusted and well-trained third parties.

[3] Currently, the California Air Resources board only accepts protocols designed prior to October 20, 2011; the Board is reviewing recent changes to these protocols to determine whether they will remain valid for carbon trading in California (Air Resources Board, 2014).

Figure 3.3.1. Training and accreditation programs for third party verifiers promote consistent review between individuals and provide an opportunity for verifiers and the recognition body to learn from each other.

C. Self-verification

A third option is to allow the project developer or permittee to "self-verify" credit-generating projects. Similar to third party-led verification, standards and protocols for verification are typically developed by the relevant recognition body/regulatory agency, or may be developed by the project developer with approval by the recognition body. The project developer then conducts verification and submits any required paperwork. For example, the Natural Resources Conservation Service (NRCS) and the Farm Service Agency (FSA) allow landowners participating in the Wetland Conservation and Highly Erodible Land Conservation programs to self-report on compliance with program provisions (FSA, 2012).

The most common criticism of self-verification is that it creates the potential for conflicts of interest and the appearance of bias because the project developer often has more incentive to allow a greater degree of leniency in their review. In addition to the risk of false or falsely inflated credit estimates, this may cause distrust by observers and program participants. Self-verification works best where other mechanisms are in place to encourage timely and truthful reporting. For example, compliance with permit conditions in the NPDES permit program utilizes a self-reporting system (40 C.F.R. § 122.41) and is backed up by provisions for citizen suits (33 U.S.C. § 1365), strong penalties for false reporting (33 U.S.C. § 1319(c)(4)), and a clear understanding that liability cannot be transferred from the permittee (*Kelly v. U.S. EPA*, 203 F.3d 519, 523 (7th Cir. 2000) (holding compliance with a NPDES permit to be subject to strict liability)).

Further, if many project developers are personally conducting verification in slightly different ways, it may be difficult for observers to understand and trust the system overall. Standardization of procedures and reporting for all project developers in the program can make it easier to build understanding and trust around the crediting program's verification system.

3.3.2 Verifier Qualifications

A verification system should establish minimum requirements or a training and/or accreditation program to ensure that verifiers are familiar with the practices they are reviewing and the standards against which those practices are being evaluated.

Minimum qualifications for verifiers may include education and training (e.g., graduate degree in wildlife biology or related field), the length of experience in a related field (e.g., no fewer than two years in irrigation system installation and maintenance), or other similar certifications (e.g., certified engineer). This approach works best when the verifier's reviewing duties are closely related to a specific academic discipline, degree, or technical certification program. For example, a certified stormwater engineer who reviews how urban development will influence runoff and overflow could be used to conduct the technical review of credit-generating stormwater BMPs with similar hydrological demands. This approach is less appropriate where verification involves an evaluation relative to the trading program's own standards. For example, that same certified engineer would not necessarily be familiar with all the requirements for a stormwater offset in Washington, D.C.'s program.

Another way to standardize the knowledge of project verifiers is through use of a training and/or accreditation program. In this context, accreditation is the process of certifying the competency of an individual to perform verification procedures. Accreditation is often paired with a training program to provide the necessary understanding of program standards, quantification methods, and verification procedures. Training may also cover concepts of neutrality and dispute resolution to assist the verifiers in their interactions with project developers. By standardizing the knowledge of individual verifiers, an accreditation program can increase the overall consistency and rigor of the system and can provide greater certainty for project developers for what to expect during project review.

Finally, regardless of how they are trained or accredited, verifiers need to manage potential professional liability issues associated with verification. Their decision to confirm or reject credits has financial implications for several parties. Some programs require verifiers to carry professional liability insurance, and others carry coverage on behalf of their verifiers. Verifiers need to be comfortable with the possibility of disputes with landowners, project developers, agencies, or buyers. They also need to be able to protect the confidentiality of information according to the program's standards.

3.3.4 Scope of Verification Review

Developing a clear understanding of what information will be reviewed and at what depth is important for all three components of verification review. Clarity on this topic increases the overall efficiency of a system because all parties are operating under the same assumptions about what information will receive scrutiny and the standard to which it will be held.

At one end of the spectrum, the process can be an in-depth review, essentially a second set of eyes examining all aspects of the project. The time, labor, and administrative costs of preparing and reviewing project documentation for this may be significant, but it provides the public and regulated entities with the highest level of certainty. At the other end, the review may be a spot check of key criteria. The verification system's audience and objectives should drive where verification lands between those points.

A. Administrative review

Administrative review focuses on confirming the completeness of project documentation and conformance with program protocols and standards. In review for completeness, verifiers confirm that all required documents have been provided. This is generally straightforward, though ambiguity can arise when it's not clear how much detail should be provided. Should the project description include ecological context? In the project design, is it sufficient to provide specifications of the planned activities, or should the project developer also include justification for design decisions made? Example documentation and clear templates are helpful in addressing this and setting clear expectations.

In the review for "correctness," or consistency with program standards, the process is most straightforward where it is clear what will be reviewed and at what depth, and review criteria are developed such that a verifier can quickly identify their presence or absence. For example, where the program standard requires that legal protection be in place for the life of all credit-generating projects, the verifier may be tasked to review that the length of the contract matches the project life, or that the contract allows access for maintenance, bars disturbing proximal land use, and contains no at-will termination clauses.

For standards that do not lend themselves to binary assessment, or early in the application of a verification system where review criteria have not been entirely fleshed out, verifiers may be asked to do a more general review of project documentation, identifying any "red flags" that they encounter related to the standard. In the example of reviewing contracts provide legal protection to credit-generating projects, this might mean identifying portions of the contract in which the strength of protection or enforceability could be improved. However, this kind of open-ended evaluation may be more time consuming and expensive than a series of binary criteria. It may also bring a high level of subjectivity into the process, creating uncertainty for project developers around the standard to which they will be held.

Providing clear templates and examples along with clear descriptions of the acceptable content for project design and maintenance plans and project protection documents is a great way to encourage high quality submissions and facilitate smooth review (Willamette Partnership, 2013).

B. Technical review

Technical review provides confirmation that any calculations or models were utilized correctly and that the number of credits issued is correct. Where a crediting program uses a standard rate for credits awarded per action (e.g., 20 lbs. of phosphorous/acre/year for application of cover crop), confirming the correct application is straightforward. Where moderate to complex models are employed, there are numerous subjective decisions that must be made to characterize the project activities and/or site. In this case, starting from a blank page would require significant time and expertise for a verifier. More frequently, technical review for complex calculations or models includes checking the logic of the characterization, good documentation of model inputs, and correct application of the model according to a set protocol.

Programs typically develop standards for acceptable levels of error (or differences in opinion) in terms of qualitative and quantitative criteria. *Quantitative errors* are those stemming from incorrect protocol calculations, transcription errors, or the use of incorrect default and numeric values (Verified Carbon Standard, 2013b). For example, Willamette Partnership sets error at 15%. *Qualitative errors* occur when a project fails to conform to the standard's rules and methodology requirements (Verified Carbon Standard, 2013b). These include, but are not limited to, inaccurate project boundaries, missing documentation of eligibility, or other information that does not appropriately describe project conditions and differs greatly from the verifier's assessment of that same information (Verified Carbon Standard, 2013b).

C. Confirming implementation

Visual confirmation that conservation or restoration actions have been installed in accordance with quality standards and are functioning in accordance with any performance criteria may occur through site inspections or images (e.g., photo point monitoring, aerial images). Onsite inspections involve the verifier visiting the site of the credit-generating activities. The cost of onsite inspections is higher because of travel time and labor expense but provides the verifier opportunity to observe the project site and activities first-hand. The use of spot checks can cut down on the costs of onsite inspections by requiring an in-person reality check for only a certain sample of projects and is explored further in Section 5. NRCS does spot checks on 5% of the practices in its Farm Bill programs. Farm Service Agency and USDA can use aerial photos to monitor the land on which practices are conducted, throughout the life of the contract. Photos are acquired on a 3-year cycle (NRCS, 2009).

Photo point monitoring and remotely sensed images can also act as visual confirmation. Photos taken by the project developer are a form of self-reporting, and as such, the approach creates the potential for and potential perception of bias and conflict of interest. Use of aerial photos, satellite imagery, and other emerging technologies (e.g., unmanned aerial vehicles) are discussed further in Section 5.

3.3.5 Initial & Ongoing Verification

Initial verification is typically a rigorous and comprehensive process, and includes all the components described in Sections 1.2 and 3.3.4: administrative review for completeness and correctness, technical review, and confirmation of project performance (via onsite inspection or other methodologies). For short-term projects (e.g., seasonal or annual practices), verification may occur just once. Ongoing verification is needed when it is important to confirm that the project continues to function as planned over time, as in the case of long-lasting BMPs (e.g., animal exclusion fences and irrigation upgrades may last 10 – 20 years; species habitat is often expected to remain in perpetuity) or restoration projects which may take years to mature and provide their full ecological function (e.g., riparian forest restoration, wetland restoration). The depth of review for ongoing verification varies between crediting programs. Ongoing review may be identical to initial verification, reduced in scope or depth, or a combination of the two, occurring on a cycle.

A. Full review in all ongoing years

Ongoing verification that includes all components of review each year is the most costly approach, but may provide the greatest assurance to observers that projects continue to function as expected. This kind of comprehensive ongoing verification is frequently used in conjunction with phased release of credits for projects that take time to mature. Phased credit releases match the timing of credit verification and credit issuance with the realization of ecological benefits from restoration projects. This provides greater assurance that credits represent real and current benefits, but may create a financing barrier for project developers, who will experience a slower return on investments associated with project installation. This approach is commonly used where there is a high risk of project failure and/or high consequences for failure, such as in regulatory mitigation contexts. In compensatory mitigation for wetlands, U.S. EPA recommends annual site inspections by the Mitigation Bank Review Team (a collection of federal agencies and, where appropriate, state and local entities with the authority to facilitate mitigation banks) and the release of credits phased with the attainment of site-specific performance standards representing site function. (U.S. Army Corps of Engineers et al., 1995).

B. Balancing cost & rigor for ongoing verification

Balancing cost and rigor in designing an approach to ongoing verification can be challenging, but there are a number of options to achieve this. In some cases, the scope of ongoing verification may be reduced to review only select criteria, such as those that are deemed representative of project status, most likely to change over time, or otherwise most important to monitor. The underlying assumption is that after a project is established and performing consistently, the risk of failure or nonconformance with standards is reduced, and it is therefore appropriate to reduce the frequency and depth of review. For example, confirming implementation of a restoration project may be done through a site visit in the first year and through cyclical photo point monitoring thereafter, and the legal protections for the project activities may not be reviewed after initial verification unless the underlying contract has changed.

Verification may occur on a cycle wherein, after full review during initial verification, a less comprehensive interim review is conducted on an annual basis, and site visits occur periodically on a regular cycle (e.g., every five years or associated with phased releases). Other options include the use of sampling approaches, in which a representative subset of projects are reviewed each year, or a risk assessment, in which an analysis of the qualitative or quantitative sources of risk is used to identify the riskiest times and criteria that could affect the delivery of environmental benefits. U.S. EPA's Chesapeake Bay Trading and Offset Working group is considering a sampling approach for verifying BMP's in the region's water quality trading program (EPA, 2014). The Climate Action Reserve uses a risk-based verification approach in which the verifier focuses more heavily on those projects and components of projects that are deemed to be higher-risk (Climate Action Reserve, 2010).

C. Managing conflict of interest in ongoing verification

A final consideration for ongoing verification of long-term projects is conflict of interest between the verifier and project developer. Verification protocols should have a clear approach to minimizing potential conflicts of interest.

Conflicts of interest can develop if a single verifier remains connected with particular projects for long periods of time such that particular projects or project developers become a sole or substantial portion of that individual's revenue. To address this, a program may want to rotate the verifier regularly to ensure the verification itself remains unbiased and to avoid conflicts of interest that could develop. The Climate Action Reserve requires third party verifiers to be rotated every 6 years (Climate Action Reserve, 2010). Willamette Partnership's ECAS rotates its verifiers every 5 years (Willamette Partnership, 2013).

How verifiers are assigned to projects can also reduce potential conflicts. Some environmental markets maintain a roster of verifiers who are assigned randomly to projects as they come in the door (Climate Action Reserve, 2010). Others use an iterative process where verifiers are matched to a project based on: A) qualifications; B) proximity to reduce travel cost; and C) the verifier who has not worked on other recent projects (Willamette Partnership, 2013).

Other measures to reduce conflicts of interest include ensuring a verifier is not also advising on other parts of a project, does not have a financial stake in the credit quantity, or is not reliant on the client for a majority of business.

In many emerging environmental markets, a lot of learning occurs in the first few years of a program. Verification protocols that strictly guard independence in verification may limit opportunities for project developers to access the knowledge and expertise of verifiers and vice versa. For example, a verifier might have suggestions about how to manage for invasive species or reduce maintenance costs on a dairy waste digester. A project developer may have suggestions on the performance criteria most important to monitor and review. Without supporting the exchange of information between parties, this kind of cross-pollination cannot occur.

This balance of learning with independence is important.

4. Financing Verification

Most verification processes are funded via transaction fees paid by project developers. This works where there is a high enough volume of projects to support the fixed costs of maintaining a verification process.

Often, however, environmental markets have low volumes, potentially making other business models more appropriate. For example, verification of some types of projects could be revenue-positive, generating funds to support the verification of projects that are not. In other programs, grant funds have helped support verification in the first few years of a program until transaction volumes pick up (NRCS, 2011).

If third parties are expected to lead verification, the recognition body or agency may need to require use of approved third parties. Otherwise, it may be difficult for some buyers to justify paying the cost of verification if it is not explicitly required.

5. The Path Forward for Verification Systems

Environmental markets, especially tied to regulatory compliance, have a conundrum. There are generally low volumes with very high expectations for rigor. The future of verification in environmental markets needs to balance these factors, but also ensure transaction costs do not take away from the ability to generate more environmental benefit.

5.1 Audit & Sampling

Audit and sampling approaches, described above, warrant further exploration as a cost-effective alternative to reviewing every project every year. Sampling approaches are ubiquitous in scientific study from medicine to political polling, and where crediting activity includes a large number of BMP projects using similar, well-understood BMPs, a representative sampling approach could be implemented, addressing these stakeholder concerns. Observers may not feel comfortable with the idea that not all projects are inspected, or that public access to data is available on only a subset, particularly in a program's early years. In this case, program managers can consider reviewing every project in the early years of program implementation to identify key indicators of risk and

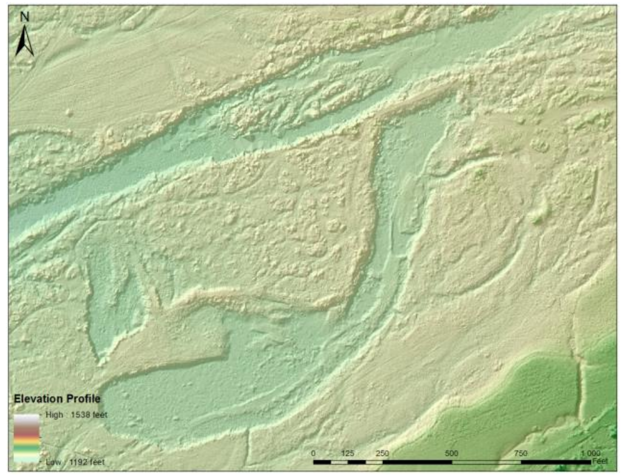

Figure 5. LIDAR images are used to create high-resolution maps and may be a way to confirm project implementation or performance.

frequent sources of error, and then moving into a randomized or otherwise statistically-valid sampling approach. Alternatively, all projects might undergo an administrative review with a subsample also selected for technical review, or a sampling approach approved only after a given project developer has demonstrated a track record of good performance.

5.2 Remote sensing, new technology, & crowd sourcing

A. Remote sensing

Use of remotely sensed data is another area of active interest and exploration. Public and private sources of high quality aerial or satellite images, LIDAR, and multispectral images (collectively "remote data") provide a promising way to obtain confirmation of project implementation, including across large areas, and without the expense of a site visit. LIDAR images provide highly accurate information on ground surface profile and height of vegetation of structures. Near-infrared images can be analyzed to identify vegetation composition and even plant health. It can be challenging, however, to obtain images that reflect the status of the parameter of interest with sufficient resolution and coverage to see entire project activities, at the specific time period relevant for delivery of environmental benefits, and delivered at an effective price point. This is a tall order, but an enticing one. As innovation brings down the cost of high quality data and analytic techniques are developed to derive indicators of credited ecological function (e.g., carbon storage, provision of habitat) from remotely sensed parameters (often reflection of visible light, near infrared, short wave infrared from the earth's surface, etc.), program administrators may be able to verify projects from the office, conducting only occasional site visits to ground truth the submitted information.[4]

B. New technology (UAVs)

The use of unmanned aerial vehicles (UAVs) in verification, also commonly referred to as remotely piloted aircraft (RPA) or drones, also has the potential to reduce the costs of verification. UAVs have significantly dropped in price over the past decade and are being applied to a number of agricultural purposes, including timing of harvest and environmental monitoring. UAVs can provide low-cost high-resolution images and can fly below clouds to capture images that are obscured for satellite sensors. Drawbacks include a small image footprint, requiring numerous images to be taken and stitched together, and limited availability of appropriate software for environmental monitoring applications (UNEP, 2013). Landowner concerns about privacy are another challenge with the application of UAVs, though these may decrease as UAVs become common in precision agriculture operations or monitoring of large forestry and agricultural operations.

C. Crowd sourcing

Soliciting and utilizing voluntary submissions from a large group of interested citizens, often referred to as "crowd sourcing," is highly consistent with the Clean Water Act's transparency and citizen suit-based approach to data gathering and enforcement. Widespread and mobile access to web-enabled technology (e.g., smart phones, tablets) is creating a society that is more connected than ever, and tapping into this network of interested citizens has been discussed as a way to support verification and monitoring efforts. Data availability from crowd sourcing will be greatest for urban BMPs (e.g., stormwater credits) located in public and/or highly trafficked areas, but difficult to obtain for activities in rural areas. Data quality control is a challenge with crowd sourcing, since the submissions come from multiple sources, most untrained. Quality control will be easiest where the information solicited is objective and collected in a form that can be later interpreted by trained professionals (e.g., submitted photos, step-by-step app to guide users), allowing managers to target needy areas more effectively. For further discussion of crowd sourcing information to support water quality monitoring, see Burke and Allenby (2014).

6. Conclusion

The concept of verification is simple—confirm that environmental benefits exist and are being maintained. Yet, the implementation of a verification program calls for numerous choices that balance time, expense, certainty, and transparency to create a system that meets the needs of its users.

Verification in environmental markets is complex, but essential. In the end, verification needs to foster trust that environmental benefits are real; support transparency and accountability; ensure costs do not detract from the ability to provide greater environmental benefits; and build opportunities to learn and improve programs quickly.

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