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Stacking Ecosystem Services Payments
Risks and Solutions

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Both authors contributed equally to this paper; senior authorship is shared

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Executive Summary

Healthy ecosystems provide many services to society, including water filtration, biodiversity, habitat protection, and carbon sequestration. A number of incentive programs and markets have arisen to pay landowners for these services,[1] raising questions about how landowners can receive multiple payments for the ecosystem services they provide from the same parcel, a practice known as *stacking*. Stacking can provide multiple revenue streams for landowners and encourage them to manage their lands for multiple ecosystem services, however if not well managed it may also lead to a net loss of services.

Stacking is currently a topic of debate among policy makers, businesses, researchers, and other stakeholders involved in the management, development, or assessment of ecosystem services programs in the United States. As yet, research and policy guidance on stacking is limited. To help fill the void, this paper defines terms, clarifies concerns, summarizes the state of legal guidance for existing programs, and begins to highlight potential problems and develop ideas on how they can be avoided.

Specifically, it describes ecosystem markets and payment programs in the United States and how their policies and guidance documents address stacking. It also provides an overview of the types of markets and programs that are "stacked." It reviews ways in which stacking may affect environmental objectives for ecosystem service markets and payment programs. Finally, it presents economic considerations and discusses policy implications of stacking.

1. Introduction

Healthy ecosystems provide many services to society, including water filtration, biodiversity habitat protection, and carbon sequestration.[2] Payments and markets for ecosystem goods and services are on the rise around the globe.[3] They hold the potential to promote sustainable resource use and to provide a stream of revenue to landowners that encourages conservation and improves land management decisions. In theory, payments for ecosystem service provision can make standing trees more valuable than cut trees and farms more valuable than suburban sprawl.[4]

A variety of environmental laws, government programs, and voluntary commitments have led to a wide variety of payments and markets for ecosystem goods and services.[5] As these payments and markets have begun to demonstrate success,[6] landowners and land managers have taken note—and begun to ask whether they can receive multiple ecosystem service payments for services generated on a single land parcel, a practice known as *stacking*. Stacking can be thought of as selling different products from a single activity, like selling both the wool and the meat from a sheep. However, ecosystem services often differ from simple commodities in that the value of the ecosystem products (services) is tied to a

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[1] In this paper, the authors differentiate ecosystem services markets and programs from environmental markets, defining ecosystem services programs to be those programs that pay for goods and services provided by landscapes and ecosystems rather than those generated by facilities or point sources.

[2] For a description of various ecosystem services, see Gretchen Daily (ed.), *Nature's Services: Societal Dependence on Natural Ecosystems* (1997). Also see Kai M. Chan, M. Rebecca Shaw, David R. Cameron, Emma C. Underwood, and Gretchen C. Daily, "Conservation Planning for Ecosystem Services," 4 *PlOS Biol.* 2138 (2006) and Elena M. Bennett, Garry D. Peterson, and Line J. Gordon, "Understanding Relationships among Multiple Ecosystem Services," 12 *Ecol. Lett.* 1394 (2009).

[3] Ecosystem goods and services are ecological processes, products, and qualities that directly or indirectly improve human welfare, for example, by cleaning air and water, protecting biological diversity, and regulating nutrients and hydrologic flows.

[4] In addition to payments for ecosystem services, information about the value of the services can affect policy and business decisions to protect or enhance them.

[5] See *infra* Section 2 for a more thorough description of specific ecosystem service markets and payment programs.

[6] See, e.g., Tara O'Shea and Lydia Olander, *Finding Successful Ecosystem Service Projects and Programs in the United States*, Nicholas Institute (2011) and D. Evan Mercer, David Cooley, and Katherine Hamilton, *Taking Stock: Payments for Forest Ecosystem Services in the United States*, Forest Trends' Ecosystem Marketplace and U.S. Forest Service (2011). The latter shows that payments to landowners for ecosystem services from forests in the United States equaled almost $1.9 billion in 2007.

regulatory requirement to offset damages or measures to prove environmental performance. Hence, where required, landowners must ensure that all environmental damages are sufficiently mitigated or performance metrics met if they are to be paid.

Stacking payments could have a number of positive outcomes. First, it could be a means to support management of multiple services by using a range of programs that each focus on the protection of single resources (for example, water quality or biodiversity). Paying for protection of multiple resources could push landowners to manage for all the ecosystem services their lands provide.[7]

Second, stacking could spur participation in ecosystem services programs, potentially increasing ecosystem service provision. A single market or payment program may not pay landowners enough to make projects cost-effective.[8] But multiple programs providing multiple payment streams could cover landowners' opportunity costs.

Third, stacking could encourage landowners to develop higher-quality projects, such as restoring a wetland for water quality benefits instead of simply planting a vegetative buffer. Higher-quality projects might not be cost-effective with a single payment stream. Again, multiple payment streams may be the solution.

Stacking is not without its critics, however. Ecosystem services payments that come from the sale of offsets or mitigation credits allow environmental impacts. Thus offset and mitigation projects must ensure that the ecosystem services they provide are sufficient to fully mitigate all the impacts they allow. Stacking multiple credits can complicate this accounting.

Another concern, particularly for those involved with carbon or greenhouse gas (GHG) offsets markets, is that stacking could result in payments to landowners that are beyond those needed to initiate the given ecosystem services project.[9] Most GHG or carbon offset programs include an "additionality" criterion that requires any payment or credit received to be associated with an increment of additional services that would not have been supplied without the payment. This is required so that the program generates new GHG emissions reductions to offset emissions by other entities.

Even for programs that do not involve offsets, giving a second payment to a landowner who requires only one payment to proceed with a conservation action can be problematic. If programs have scarce resources they may seek assurance that they will get the greatest environmental benefit from the resources they spend. These programmatic requirements for additionality and cost effectiveness could limit the potential for landowners to be paid for all the services they provide, but not all programs and sources of finance will be thus constrained.

Ecosystem services markets face several other challenges, including measurement of service provision, spatial redistribution of services,[10] and tradeoffs in which an increase in one service decreases provision

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[7] Many papers in the scientific literature demonstrate that managing for one ecosystem service does not necessarily result in increased provision of other services. See, e.g., Bennett et al., *supra* note 2, and Benis Egoh, Belina Reyers, Mathieu Rouget, David M. Richardson, David C. Le Maitre, and Albert S. van Jaarsveld, "Mapping Ecosystem Services for Planning and Management," 127 *Agric., Ecosys. and Env't* 135. See also Daniel F. Morris, *Ecosystem Service Stacking: Can Money Grow on Trees?* Resources for the Future, Weathervane blog, available at http://www.rff.org/wv/archive/2009/08/03/ecosystem-service-stacking-can-money-grow-on-trees.aspx, and Defenders of Wildlife, *Bundling and Stacking Ecosystem Service Credits*, http://www.defenders.org/programs_and_policy/biodiversity_partners/ecosystem_marketplace/mfn/bundling_and_stacking.php.

[8] Nicholas Bianco, *Stacking Payments for Ecosystem Services,* World Resources Institute Fact Sheet 2 (2009), http://pdf.wri.org/factsheets/factsheet_stacking_payments_for_ecosystem_services.pdf.

[9] This phenomenon is sometimes described as financial additionality in carbon offset protocols.

[10] *See, e.g.*, J.B. Ruhl and James Salzman, *The Effects of Wetland Mitigation Banking on People*, 28(2) NAT'L WETL. NEWSL 1, 8-13 (2006) (demonstrating that wetland mitigation banks redistribute ecosystem services from urban to rural areas).

of another service.[11] These challenges arise even in single-service transactions, and stacking itself does not necessarily have a positive or negative effect on them. This paper focuses on issues directly affected by or caused by stacking.

A somewhat sparse but helpful literature is developing on the topic of stacking. The World Resources Institute has a fact sheet on the additionality concerns of credit stacking.[12] Jessica Fox laid out some of the basic concepts in an earlier paper,[13] and she and others conducted a survey of ecosystem service practitioners on the state of credit stacking in the United States.[14] J.B. Ruhl wrote an overview of some of the legal and policy issues with stacking.[15] Richard Woodward published a paper on the economics of stacking multiple ecosystem payments.[16] In addition, the firm Kieser and Associates issued a concept paper on selling multiple ecosystem services.[17] Suzie Greenhalgh also wrote a paper on the related topic of bundling.[18]

However, these contributions have not lessened confusion about how policies and regulations should address stacking. While policy makers, researchers, and practitioners debate what constitutes stacking and whether it should be encouraged or discouraged, project developers and landowners are left to wonder about the validity of current projects and the potential to participate in future ecosystem programs.

2. U.S. Policies Governing Stacking of Ecosystem Services Markets and Payment Programs

Stacking of ecosystem service markets and payments has only become an issue because landowners are beginning to have opportunities to receive multiple payments for the ecosystem services they provide. Ecosystem service markets and payment programs can be roughly divided into two categories: (1) offsets and mitigation credits, which allow other entities to impact the environment, and (2) conservation payments and incentives, which are designed to promote conservation or improved ecosystem management. In each case, the entity making the payment can be the government, a private entity, or a nonprofit organization.

2.1. Offsets and mitigation credits

In the United States, different agencies oversee different pollutant loads or management actions on the same ecosystems. In addition, different laws, such as the Clean Water Act[19] and the Endangered Species Act,[20] protect specific aspects of environmental quality. Regulated entities have the option to comply with these laws by offsetting or mitigating their environment impacts through payments for ecosystem services. The laws have driven development of different markets with different types of credit for

[11] See e.g., Robert B. Jackson et al., "Trading Water for Carbon with Biological Carbon Sequestration," 310 *Sci.* 1944, 1944 (2005). The authors (finding that planting trees for carbon sequestration can reduce available water quantity, decreasing stream flow in some cases).
[12] Nicholas Bianco, *supra* note 8.
[13] Jessica Fox, "Getting Two for One: Opportunities and Challenges in Credit Stacking" in *Conservation and Biodiversity Banking: A Guide to Setting up and Running Biodiversity Credit Trading Systems.* Ed. R. Bayon. London. Earthscan Publications (2007).
[14] Jessica Fox, Royal C. Gardner, and Todd Maki, "Stacking Opportunities and Risks in Environmental Credit Markets," 41 *ELR* 10121 (2011).
[15] J.B. Ruhl, "Stacking and Bundling and Bears, Oh My!" *Nat'l Wetl. News.* 24–25 (January–February 2010).
[16] Richard Woodward, *Double Dipping in Environmental Markets*. 61 *J. of Envt'l Econ. and Manag.* 153–169 (2011).
[17] Kieser and Associates, *Ecosystem Multiple Markets: A White Paper* (2004). Available at http://www.envtn.org/uploads/EMM_WHITE_PAPERApril04.pdf.
[18] Suzie Greenhalgh, "Bundled Ecosystem Service Markets—Are They the Future?" Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Orlando, FL, July 27–29, 2008. Available at http://ageconsearch.umn.edu/bitstream/6166/2/467628.pdf.
[19] 33 U.S.C. §§ 1251, *et seq.* (2009).
[20] 16 U.S.C. §§ 1531-1544 (2009).

ecosystem services. Some of the credits represent individual ecosystem services, such as water quality protection, whereas others—so-called bundled credits—represent all the services provided by a particular ecosystem. Some credits are designed to offset impacts from a point source, such as a facility smokestack or effluent pipe; others (bundled credits) are designed to mitigate ecosystem services impacts, such as damage to a stream. No matter the type of offsets or mitigation credit, landowners are paid to generate ecosystem services that are used to compensate for environmental damages that happen elsewhere.

Although federal agencies have issued guidance documents[21] concerning ecosystem services markets, they have promulgated few regulations that could clarify the potential for stacking.

Water quality credits are an optional tool for compliance with the Clean Water Act (CWA). The CWA regulates point source polluters, such as wastewater treatment plants or industrial facilities, through National Pollutant Discharge Elimination System (NPDES) permits,[22] but many watersheds face significant water quality problems from nonpoint sources, such as agriculture, which are not regulated as point sources.[23] In watersheds where stringent regulation of point sources has been insufficient to achieve necessary water quality improvements, regulators would continue permitting point sources only under the condition that they pay for pollutant reductions from nonpoint sources. This type of water quality trading involves an entity with a regulatory compliance obligation and a landowner who does not have a compliance obligation but who voluntarily participates in the trade. For example, a facility with a NPDES permit could meet compliance in part by paying a farmer who does not have a compliance obligation to plant a forested riparian buffer to capture nitrogen flowing off her crop fields before it enters the waterway. In this way, nitrogen pollution from the facility is offset by the decrease in pollution by the farmer, and the overall amount of pollution in the waterway remains unchanged. Oregon's Tualatin basin has an NPDES permit which includes nonpoint trading using vegetated buffers to shade streams and reduce water temperature. Most other water quality trading programs that allow nonpoint trading have been established to comply with more stringent state regulations for a variety of pollutants, including nitrogen and phosphorus.[24] However, many of these programs have had few trades, and several are funded through grants rather than by point sources, and thus are voluntary on both sides.[25] If nonpoint sources were covered by nutrient regulations, trading would be between two entities with regulatory compliance obligations. However, no water quality trading systems in the United States appear to have taken this approach.

Wetland and stream credits are used to achieve compliance with section 404 of the Clean Water Act,[26] under which developers may impact a wetland or stream only if their impacts are offset through the restoration, creation, or enhancement of a wetland or stream elsewhere. Wetland and stream credits are a type of bundled credit, which is designed to offset a range of critical functions and services lost to the impacted wetland.[27] This mitigation program is one of the few ecosystem service programs governed by regulations, rather than guidance documents. According to those regulations, a mitigation project "should be located where it is most likely to successfully replace lost functions and services."[28] In practice, regulators typically identify a subset of ecosystem functions and services to assess for compliance. For

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[21] Unlike regulations, guidance documents do not carry the force of law.
[22] National Pollution Discharge Elimination System. *See* 33 U.S.C. § 1342 (2009).
[23] 33 U.S.C. § 502(14) (2009).
[24] See Environmental Protection Agency, Water Quality Trading, List of All Trading Programs. Available at http://water.epa.gov/type/watersheds/trading/upload/tradingprograminfo.xls (accessed January 12, 2011).
[25] For a discussion of legal and institutional barriers to implementing trades between point and nonpoint sources that make trading programs less market-like in practice than many researchers and policy makers suggest, see Kurt Stephenson and Leonard Shabman, "Rhetoric and Reality of Water Quality Trading and the Potential for Market-like Reform," 47 *J. Amer. Water Res. Assn.* 15–28 (2011).
[26] 33 U.S.C. § 1344 (2009).
[27] 33 C.F.R.§ 332.3(b)(1) (2010).
[28] *Id.*

example, the North Carolina Wetland Assessment Method (NC WAM) assesses three wetland functions: hydrology, water quality, and habitat.[29]

Endangered species habitat credits are used to achieve compliance with section 10 of the Endangered Species Act (ESA),[30] which allows landowners to impact endangered species habitat if they obtain a permit from the U.S. Fish and Wildlife Service (FWS) or the National Marine Fisheries Service (NMFS). FWS has implemented this policy by allowing the establishment of conservation banks, which restore, create, or otherwise protect endangered species habitat.[31] Landowners who seek to impact endangered species habitat may purchase credits from conservation banks to offset their impacts. Like wetland credits, species or habitat credits are a type of bundled credit, because the credited habitat is expected to have all of the critical elements to support populations of the endangered species. Strictly speaking, conservation banking might not be considered an ecosystem services market, because the banks are intended to benefit endangered species and not necessarily to benefit humans.[32] However, these banks can be included in stacks of other, more human-oriented environmental markets and tend to provide a number of ecosystem services as co-benefits, and thus are relevant to this discussion.

Carbon offsets are ecosystem payments for actions that sequester or avoid emissions of carbon dioxide or other greenhouse gases (GHGs), which are not currently required by federal law.[33] However, two smaller regulatory programs in the United States (one state and one regional) place a cap on GHG emissions from some sources, and allow these capped entities to purchase carbon offsets from uncapped sources as an option for meeting compliance. Under Assembly Bill 32,[34] California has developed a cap-and-trade program that allows a range of land management-based offsets, including forest management and avoided forest conversion,[35] and it is considering some activities involving improved agricultural management. Ten states in the Northeast and Mid-Atlantic have joined to form the Regional Greenhouse Gas Initiative (RGGI), which limits carbon emissions from the power sector and allows land management-based offsets, including afforestation and agricultural manure management.[36] In practice, however, offsets have not been an active part of the RGGI program due in part to the low cost of obtaining allowances from other point sources.

Carbon offsets are also available in voluntary markets.[37] These markets support a wide range of activities that increase sequestration or avoid GHG emissions, such as tree planting, changes in livestock manure management, or changes in fertilizer use.[38] Voluntary markets for other ecosystem services have recently

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[29] N.C. Dept. of Trans., Corps of Engineers, N.C. Dept. of Env't and Nat. Res., EPA, U.S. Fish and Wildlife Service, North Carolina Wetland Assessment Method User Manual (2010). Available at http://portal.ncdenr.org/web/wq/swp/ws/pdu/ncwam [hereinafter NC WAM].

[30] 16 U.S.C. § 1539 (2009).

[31] U.S. Fish and Wildlife Service. Guidance for the Establishment, Use, and Operation of Conservation Banks (2003), [hereinafter Guidance for Conservation Banks].

[32] *See supra* note 3.

[33] Several bills have been introduced in Congress to address climate change, including the American Clean Energy and Security Act (H.R. 2454, 2009), the Clean Energy Jobs and American Power Act (S. 1733, 2009), and the American Power Act (discussion draft, 2010, available at http://kerry.senate.gov/imo/media/doc/APAbill3.pdf). Each of these bills would have placed a limit on GHG emissions, while allowing regulated entities to purchase offsets from land use and other activities.

[34] California Health and Safety Code §§ 38500, *et seq.* (2010).

[35] California Environmental Protection Agency, Air Resources Board, Proposed Regulation to Implement the California Cap-and-Trade Program Part V: Staff Report and Compliance Offset Protocol: U.S. Forest Projects (2010). Available at http://www.arb.ca.gov/regact/2010/capandtrade10/cappt5.pdf.

[36] Regional Greenhouse Gas Initiative Model Rule 91 (2008).

[37] Kate Hamilton, Molly Peters-Stanley, and Thomas Marcello, *Building Bridges: State of the Voluntary Carbon Markets 2010*, Ecosystem Marketplace (2010).

[38] Details on the various offset types found in the voluntary markets can be found on the registry websites: Climate Action Reserve (CAR) www.climateactionreserve.org; Voluntary Carbon Standard (VCS) www.v-c-s.org; American Carbon Registry (ACR) www.americancarbonregistry.org. CAR offers voluntary credits in addition to compliance-grade credits for use in the California cap-and-trade program.

emerged. The American Forest Foundation and World Resources Institute have developed a crediting system for gopher tortoise habitat, which is not yet regulated under the ESA.[39] The Willamette Partnership in Oregon is developing credits for restoration of prairie habitat, which currently lacks a policy driver.[40] The Business and Biodiversity Offset Program is developing pilot projects, including one in the United States,[41] in which businesses offset their biodiversity impacts. The Bonneville Environmental Foundation has created a voluntary market for water restoration credits, providing incentives for water rights holders to leave water in water-scarce ecosystems.[42]

Table 1. Number of ecosystem markets and projects in the United States.

Ecosystem service market	Number of projects
Water quality trading	14 trading programs[43]
Wetland and stream mitigation banks	797 banks[44]
Endangered species/conservation banks	116 banks[45]
Carbon offsets	73 projects[46]

2.2. Conservation payments and incentives

The federal government and various state governments have developed numerous programs to incentivize conservation practices, including several programs authorized by the Farm Bill.[47] These conservation incentive programs include both land retirement programs, such as the Conservation Reserve Program (CRP),[48] through which land is taken out of agricultural production, and working lands programs, such as the Environmental Quality Incentives Program (EQIP),[49] which offers incentives for improved management practices on working farms and forests. The lands enrolled in these incentive programs provide a variety of ecosystem services, and may be eligible to participate in other ecosystem markets or payment programs.[50]

Some government incentives come not in the form of direct payments, but as loan guarantees, tax incentives, and other public financing options. A common tax incentive to promote conservation is the *conservation easement*. Under a conservation easement, a landowner retains ownership of his or her land but cedes certain rights to develop the land. In general, conservation easements are flexible instruments, and the details of allowed management can change from contract to contract. For example, most conservation easements preclude commercial or residential development, but some may allow agricultural use or periodic timber harvest.[51] Easements often do not explicitly outline who owns the ecosystem

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[39] Willamette Partnership, *Measuring Up: Synchronizing Biodiversity Measurement Systems for Markets and Other Incentive Programs*,17 (2011). Available at http://willamettepartnership.org/measuring-up/Measuring Up w appendices final.pdf.
[40] Willamette Partnership, Upland Prairie Habitat. Available at http://willamettepartnership.org/ecosystem-credit-accounting/prairie/copy_of_upland-prairie-habitat.
[41] Business and Biodiversity Offset Program, http://bbop.forest-trends.org/.
[42] Bonneville Environmental Foundation, http://www.b-e-f.org/business/products/wrcs/.
[43] Environmental Protection Agency, State and Individual Trading Programs. Available at http://water.epa.gov/type/watersheds/trading/tradingmap.cfm. At least five of these "trading programs" appear to be one-time trades or deals. How many projects have been developed within the other programs is unknown.
[44] Becca Madsen, Nathaniel Carroll, and Kelly Moore Brands. *State of Biodiversity Markets Report: Offset and Compensation Programs Worldwide*, 11 (2010) Available at http://www.ecosystemmarketplace.com/documents/acrobat/sbdmr.pdf.
[45] *Id*. at 18. This number includes 19 sold-out banks and 20 pending banks.
[46] Climate Action Reserve, https://thereserve1.apx.com/myModule/rpt/myrpt.asp?r=111; The Climate Trust, http://climatetrust.org/sequestration.html; American Carbon Registry, http://www.americancarbonregistry.org/carbon-registry/projects. This vast majority of these projects are from the Climate Action Reserve, and most of those (65) are listed, but not fully registered.
[47] The Food, Conservation, and Energy Act of 2008 (P.L. 110-234) (2008).
[48] 7 C.F.R. §§ 1410.1, *et seq*. (2010).
[49] *Id*, at 1466.1, *et seq.* (2010).
[50] See *infra* note 66 and accompanying text.
[51] Land Trust Alliance, *Conservation Easements*, http://www.landtrustalliance.org/conservation/landowners/conservation-easements.

services generated by the eased land—the landowner or the easement holder. Easements are often held by land trusts or other conservation organizations that manage the lands for a landowner. Whether a landowner who has sold a conservation easement retains rights to sell ecosystem services remains unclear. Although conservation easements are a ceding of development rights, they are not necessarily a ceding of the right to sell ecosystem services. This issue will not be resolved for existing contracts until a court decision interprets the arrangement or statutory guidance is created. Nevertheless, new conservation easements can be written so as to clarify which party retains ownership of the ecosystem services generated by a project.[52]

Voluntary payments for biodiversity also exist. For example, the Nature Services Exchange, a project of the University of Rhode Island and EcoAsset Markets Inc., allowed people who valued grass-nesting bird species, such as the bobolink, to pay farmers to delay their hay harvests until after the nesting season.[53] In addition, Walmart has joined with the National Fish and Wildlife Foundation to create the Acres for America program, through which Walmart pledges to protect one acre of important habitat or open space for every acre occupied by Walmart's U.S. facilities.[54]

2.3. Stacking policies

Existing policy contains little guidance on stacking of ecosystem service payments in U.S. programs. In the absence of such guidance, some suggest that stacking be viewed through the lens of property rights. Under traditional common law, owning real property comes with a series of rights, colloquially referred to as the "bundle of sticks." These rights include the right to exclude others from the land, to use the property as the owner wishes, and to give that property away whenever and to whomever the owner wishes. Owners also can harvest the natural resources of their land as long as one use does not harm another. He or she can sell rights to mine on the land and can give another the right to grow crops on it or build windmills to harvest energy on it. Under this traditional property definition, a landowner's ability to stack ecosystem service credits would be unlimited as long as the generation of one service does not harm other services. The rights to sell carbon sequestration, wetland acres, or water quality credits would be distinct, fundamental property rights of land ownership. Without any other policy, traditional property rights would be the underlying default legal position on stacking; stacking, whether beneficial or problematic, would be implicitly allowed in all cases. However, ecosystem services credits are not necessarily like other property rights. Although a landowner may have the right to sell them, some credits only have value because demand for them is driven by government regulations, which could contain various restrictions on rights.

Federal guidance on water quality trading programs is largely silent on the issue of stacking.[55] Regulations for wetland and stream mitigation banking[56] and guidelines for conservation banking[57] address the question of stacking with other ecosystem services payments largely indirectly. Wetland and stream banking regulations state that that "where appropriate, compensatory mitigation projects … may be designed to holistically address requirements under multiple programs and authorities for the same

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[52] For a discussion of potential language to be inserted into conservation easements intended for carbon offsets projects, see James L. Olmstead, *Carbon Dieting: Latent Ancillary Rights to Carbon Offsets in Conservation Easements*, 29 *J. Land, Res., and Envt'l Law* 121–141 (2009).
[53] Nature Services Exchange. Available at http://www.natureservicesexchange.com/ (accessed May 3, 2011).
[54] As of 2010, Walmart had committed $35 million, conserving 625,000 acres. http://walmartstores.com/Sustainability/5127.aspx (accessed January 14, 2010). Other examples of voluntary biodiversity offsets include the Business and Biodiversity Offsets Program, which has a pilot project in which the city of Bainbridge Island, Washington, is protecting important habitat on the island to offset impacts from residential development. http://bbop.forest-trends.org/guidelines/low_bainbridge-case-study.pdf (accessed January 13, 2011).
[55] Environmental Protection Agency, 2003 Water Quality Trading Policy. Available at http://water.epa.gov/type/watersheds/trading/tradingpolicy.cfm (accessed November 3, 2010).
[56] 33 C.F.R. § 332.1 *et seq.* (2010).
[57] Guidance for Conservation Banks, s*upra* note 31.

activity."[58] This language appears to leave the door open to the possibility of stacking. In particular, the regulations state that "[c]ompensatory mitigation projects may also be used to provide compensatory mitigation under the Endangered Species Act."[59] However, both wetland and stream banking regulations[60] and guidelines for conservation banking[61] clearly disallow stacking mitigation credits on top of restoration projects that have already received funding from a federal payment program.

In terms of the carbon market, guidance and protocols from the voluntary carbon market, rules for RGGI and the California program under the Climate Action Reserve, and the proposed federal program under the American Clean Energy and Security Act (ACES)[62] are all also silent on this issue. Only the proposed federal American Power Act (APA)[63] states that projects are not necessarily excluded from providing carbon offsets if they receive payments for providing other ecosystem services, including government conservation payments. However, it also instructs the EPA and USDA to develop procedures and guidelines for determining eligibility for such projects.[64] The carbon markets typically include rules for additionality to ensure that credited activities would not have occurred in the absence of the project, which may preclude stacking. For example, CAR does not allow projects to generate credits if the land was covered by a conservation easement for more than one year before the start of the project.[65]

By contrast, regulations concerning almost all of the Farm Bill conservation incentive programs, including the Conservation Reserve Program (CRP) and the Environmental Quality Incentives Program (EQIP), expressly allow the sale of environmental credits from enrolled lands.[66] Each program has slightly different language, but in general, the regulations state "USDA recognizes that environmental benefits will be achieved and environmental credits may be gained [by landowners] by implementing conservation practices and activities funded through these payment programs. USDA asserts no direct or indirect interest in these credits. However, USDA retains the authority to ensure that the requirements of their program are met."

3. What Is Being Stacked and Different Forms of Stacking

A wide range of credits and payment types can be stacked, and they can be stacked in multiple ways. An understanding of these possibilities allows assessment of the interaction of the various programs and markets.

3.1. Types of stacked credits

As discussed above, ecosystem service markets and payment programs can be roughly divided into two categories: (1) offsets and mitigation credits and (2) conservation payments and incentives (hereinafter PES, for payments for ecosystem services). Offsets and mitigation credits are distinct from one another in that offsets are typically meant to offset emissions of a single pollutant, such as carbon dioxide emissions or discharge of nitrogen to a waterway, whereas mitigation typically refers to credits to offset impacts to whole ecosystems, such as wetland or endangered species habitat.

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[58] 33 C.F.R. § 332.3(j)(1)(ii) (2010).
[59] *Id*. at 332.3(j)(3) (2010).
[60] *Id*. at 332.3(j)(2) (2010).
[61] Guidance for Conservation Banks, 6, s*upra* note 31. Conservation banks only partly funded by federal money can generate credits proportional to the nonfederal funds used to establish the bank. For example, a bank funded 50 percent by federal funds would only receive half of the credits that it would otherwise receive.
[62] H.R. 2454 (2009).
[63] Available at http://kerry.senate.gov/imo/media/doc/APAbill3.pdf (accessed October 27, 2010).
[64] American Power Act § 735(f) (2010).
[65] Climate Action Reserve, Forest Carbon Protocol Version 3.2, 12 (2010).
[66] These programs include the Conservation Reserve Program, 7 C.F.R. 1410.63(c)(6); the Grassland Reserve Program, 7 CFR § 1415.10(h); the Environmental Quality Incentives Program, 7 CFR § 1466.36; the Wetlands Reserve Program, 7 CFR § 1467.20(b)(1); the Conservation Stewardship Program, 7 CFR § 1470.37; the Farm and Ranch Lands Protection Program, 7 CFR § 1491.21(g); and the Wildlife Habitat Incentives Program, 7 CFR § 363.21.

These types of credits and payments can be stacked in three ways:

- *PES with PES*, which would not directly allow any environmental impacts elsewhere and thus would have no negative effect on ecosystem services due to stacking;
- *PES with offsets or mitigation credits*; and
- *offsets or mitigation credits with other offsets or mitigation credits*.

Offsets and mitigation credits can be further subdivided based on whether the credit seller or buyer is covered by government regulation:

- *Regulated-regulated* trades occur when a regulated entity sells emissions allowances that it does not need to another regulated entity. These trades could occur in a cap-and-trade system.
- *Regulated-voluntary* trades occur when a regulated entity offsets its emissions by paying for reductions by an unregulated (or voluntary) entity.
- *Voluntary-voluntary* trades occur when an unregulated entity voluntarily purchases offsets from another unregulated entity. Such trades occur in the voluntary carbon market.

The carbon market currently has several *voluntary-voluntary* projects. Efforts to regulate greenhouse gases at the state or federal level could lead to *regulated-voluntary* projects if forests and other nonpoint sources are excluded from the cap or to *regulated-regulated* projects if they are included.

The water quality market has a few examples of *regulated-voluntary* trades, in which landowners voluntarily supply nutrient or temperature reductions to point sources, but much of the activity in this market has been *voluntary-voluntary* trades, because it has been funded by grants rather than driven by regulation. *Regulated-regulated* water quality projects appear not to exist, because nonpoint sources typically do not have regulatory compliance obligations.

Wetland, stream, and species banking are generally *regulated-voluntary* trades, in which a landowner voluntarily supplies wetland, stream, or species credits to those that need them. Some efforts to credit *voluntary-voluntary* species credits are under way.

3.2. Different forms of stacking

3.2.1. Stacking

Stacking occurs when a landowner receives more than one payment from an ecosystem service market or payment program on a single property parcel. Stacking can take three forms:

Horizontal stacking occurs when a project performs more than one distinct management practice on non-spatially overlapping areas and the project participant receives a single payment for each practice. For example, a landowner plants trees and receives nutrient credits for the forested buffer along a stream and carbon credits for the trees in the upland part of the property. Because the credits are sold for spatially distinct parts of the same property, this practice may not be considered true stacking and can also be called credit grouping.

Vertical stacking occurs when a project participant receives multiple payments for a single management activity on spatially overlapping areas (that is, on the same acre). For example, a landowner plants a forested riparian buffer to receive both water quality credits and carbon credits. This type of stacking is comparable to the general definition of stacking used by Fox et al.: "Establishing more than one credit type on spatially overlapping areas, *i.e.* in the same acre,"[67] but that definition focuses only on stacking of credits from markets.

[67] Fox et al., *supra* note 14.

Temporal stacking is similar to vertical stacking in that the project involves only one management activity, but payments are disbursed over time. For example, a landowner restores habitat to receive endangered species credits. Later, when a carbon market develops, the landowner receives carbon offset credits.

In any type of stacking, payments can include credits from ecosystem service markets, public financing, or other incentives. Of the three types of stacking described here, horizontal stacking is the least controversial, because each management activity is credited only once. Hence, this paper focuses primarily on issues associated with vertical and temporal stacking.

3.2.2. Bundling

Bundling occurs when a project participant receives a single payment for providing multiple ecosystem services. Generally, no attempt is made to add up the individual values of the ecosystem service to determine the payment levels. Wetland mitigation banking is an example of a bundled ecosystem service credit: a single payment is made for provision of multiple ecosystem services, including water quality improvements, biodiversity habitat, and hydrologic functioning, but the price of the credit is not necessarily based on the value of the individual services. Conservation easements are another example of a bundled credit in which the purchaser protects all of the ecosystem services on the parcel with a single payment. Bundled credits in the United States have been developed to mitigate or offset full ecosystem impacts, like loss of a wetland or endangered species habitat. They are measured in units that encompass the services—acres of wetland, for example—but they do not necessarily measure all the services directly.

These different types of credits (PES vs. offsets or mitigation credits, regulated vs. voluntary, single service credits vs. bundles) can be stacked in many different ways (see Table 2 and Appendix). In the section below we explore the risks inherent in various combinations of stacking for ecosystem services outcome.

4. A Conceptual Framework for Assessing the Ecosystem Services Outcomes of Stacking

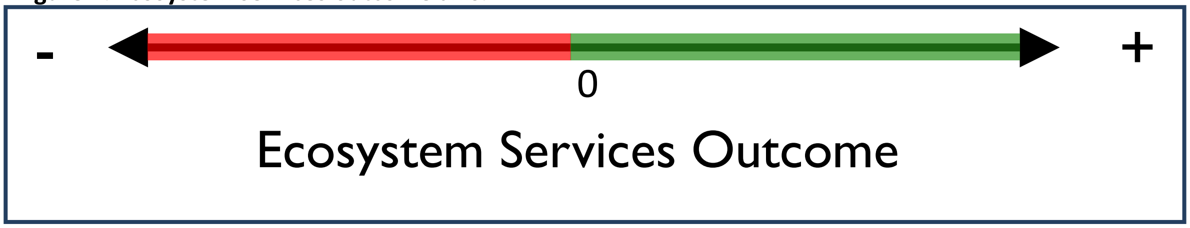
Given the general lack of law and policy to address stacking and growing concern and confusion about the subject, this report presents a simple conceptual framework to assess the ecosystem service outcomes of this practice. The framework is constructed to assess the primary objective of ecosystem service markets and payment programs: replacement or enhancement of ecosystem goods and services. The goal is to find common ground in distinguishing the types of stacking that offer few or no problems in achieving this objective from those that are more problematic. The hope is that the framework will help policy makers and program managers design more effective policies.

In vertical and temporal stacking, where offset and mitigation programs are part of the stack, negative ecosystem services outcomes are possible, because credit purchasers are allowed to impact the environment.

Stacked projects must fully account for and mitigate the environmental impacts allowed by the sale of credits. Figure 1 presents an axis of net ecosystem services outcomes. Where a stacked project falls along this axis is determined by the following equation:

A stacked project in which the (negative) impacts allowed are greater than the services provided will produce a net negative outcome, and it will fall in the red area toward the left of the axis. A stacked project that provides services sufficient to offset all impacts would fall in the middle at the zero point, and a stacked project that provides more than enough services to offset impacts would be positive, falling in the green area to the right side of the axis.[68] In theory, most ecosystem services markets aim to replace ecosystem services lost to environmental impacts, which would place them at the zero point; however, with conservative crediting and trading ratios, transactions could lead to a net gain of ecosystem services, pushing a project—and a stack of which it is a part—to the green side of the axis.

Figure 1. Ecosystem services outcome axis.



Stacking ecosystems service credits can complicate the task of accounting, making it more difficult to ensure that all damages have been fully mitigated, especially because ecosystem services are not always fully separable. The framework presented here could be used as an accounting framework for bilateral trades in which environmental impacts and mitigation activities are connected, allowing regulators or project developers to track which impact each credit was intended to mitigate or offset. For example, if a project developer restores a coastal wetland and sells the resulting wetland mitigation credits directly to a party impacting a wetland, the project developer could potentially determine whether his or her wetland project provided "extra" ecosystem services,[69] such as GHG sequestration beyond that which is necessary to offset GHG emissions from the impacted wetland. These extra services could potentially be credited. Most bundled credits, such as wetland credits, are used in bilateral trades, so it could be possible to use the direct accounting presented here, given sufficient metrics and data. However, this accounting is not easy to implement even for single-credit transactions, given ecological complexity, interconnected functions, and scientific uncertainty about the ecosystem service provision resulting from different management or restoration activities.[70]

In a market-based system, however, credits are supposed to be fungible, and when they are traded, ownership is independent of the project that generated them. Credits trading in units such as tons of GHG equivalents or pounds of nitrogen can exchange freely. Thus, directly linking impacts at one site to mitigation at another would not be possible. However, this accounting framework can still help policy makers understand when and why the ecosystem services outcomes of stacking can be negative.

4.1. Where stacking might be a problem

Two circumstances could lead to a negative ecosystem services outcome as a result of stacking. One is double counting, whereby one ecosystem service is sold twice to offset two separate impacts. The other, identified by the carbon markets, is lack of additionality, whereby projects would have occurred without

[68] An important implicit assumption of evaluating different ecosystem services on one axis is that they can be measured in the same units. If all the stacked services offset all the allowed impacts, this assumption does not pose much of a problem. However, some projects could result, for example, in a net positive gain for one service, such as carbon sequestration, and a net loss for another service, such as endangered species habitat. Using the equation above, the net gain in carbon sequestration could potentially be used to compensate for the habitat loss. Perhaps the most straightforward way to address this situation is to require that each service in a stacked transaction completely offset each impact it allows. However, policy makers could choose to take a more nuanced approach by establishing weights for each service on the basis of stakeholder preferences, which could be used to evaluate tradeoffs among services in a stacked transaction. Therefore, a net gain in carbon sequestration could potentially compensate for habitat loss, if the preference for carbon sequestration is weighted heavily enough.

[69] In this example, the wetland project is assumed to follow the intent of the regulations to replace all services and thus the GHG impacts would be included. Hence, "extra" implies GHG benefits beyond those needed to replace lost services.

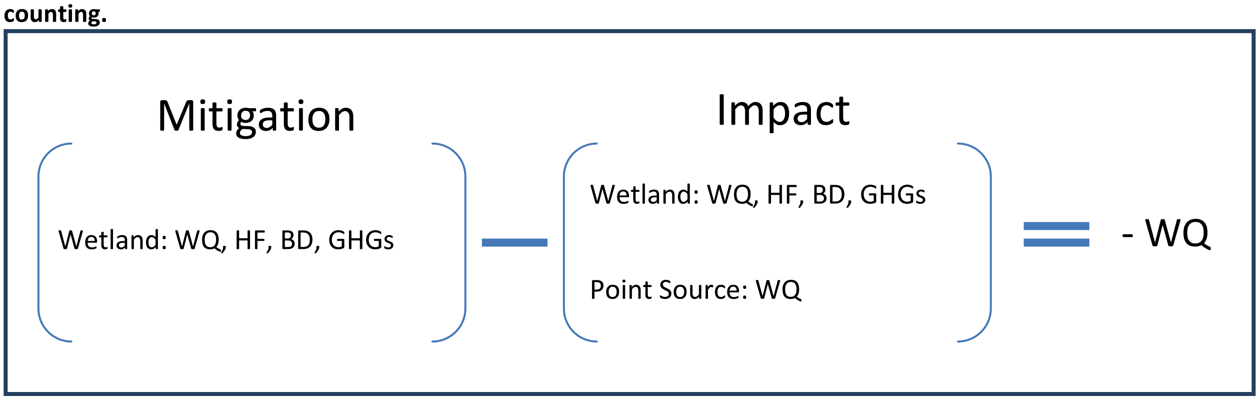
[70] See, *e.g.*, Charles Abdalla, Tatiana Borisova, Doug Parker, and Kristen Saacke Blunk, "Water Quality Credit Trading and Agriculture: Recognizing the Challenges and Policy Issues Ahead," 22 *Choices* 117, 120 (2007), and Shelley Burgin, "'Mitigation Banks' for Wetland Conservation: A Major Success or an Unmitigated Disaster? 18 *Wetl. Ecol. Manag.* 49 (2010).

the credit payment (landowners would utilize the payment from the other stacked credits) and thus do not generate additional benefits to offset the impacts (which are point source emissions in the case of carbon markets).

4.1.1. Double counting

Double counting occurs when stacked credits include redundant services. This situation is most likely to occur when bundles of services overlap with another single-service credit or another bundle. One example is wetland mitigation credits and water quality credits. The wetland bundle would include the water quality services provided by the wetland. If a wetland mitigation project sells the bundled wetland credits to one buyer for a wetland impact and the single water quality credits to a different point source buyer for the water quality impact (Figure 2), only one supply of water quality services would cover two impacts on water quality, resulting in a net negative ecosystem service outcome using the framework presented here.

Figure 2. An example of a negative ecosystem services outcome due to double counting.



Note: Impacts on the wetland will have effects on several ecosystem services, including water quality (WQ), hydrologic functioning (HF), biodiversity (BD), and greenhouse gases (GHGs). Because the mitigation site sells its WQ benefits twice—to offset both the affected wetland and the point source impacts—a net loss of water quality occurs.

At least one real-world example of this type of stacking problem exists. In 2000, a company[71] developed a project in eastern North Carolina to sell wetland and stream credits to the N.C. Department of Transportation to offset impacts to wetlands and streams from road building projects. In 2009, this company sold water quality credits from the same project—without performing any additional management activities—to the N.C. Department of Environment and Natural Resources to offset nitrogen impacts to the Neuse River Basin.[72] At the time, the state had no regulations governing this type of credit stacking. According to local experts, if all other existing, already-sold mitigation sites were allowed to stack nitrogen credits, the market could be flooded with 1.1 million pounds of nitrogen credits, exceeding all credits generated since the program began in 2001.[73] The state has not allowed additional trades of this sort and has since developed a proposed rule that would completely disallow stacking of nutrient offset credits or buffer credits from projects that provide wetland credits.[74]

To address the risks of double counting programs and policies could consider additional environmental review when credits are stacked, limiting projects to horizontal stacking (like the Willamette approach),[75] or perhaps even restricting stacking of bundles with other credits. Regulations and guidance must be clear

[71] Environmental Bank and Exchange (EBX).
[72] Dan Kane, "EBX Is Paid Twice for Wetlands Work," *News and Observer*, Dec. 8, 2009.
[73] Martin Doyle and Todd BenDor, "Stream Restoration: Who Really Benefits?" *News and Observer*, Dec. 16, 2009.
[74] 15A N.C.A.C. 02B .0295. Available at http://portal.ncdenr.org/c/document_library/get_file?p_l_id=1169848&folderId=1727035&name=DLFE-26311.pdf.
[75] See *infra* notes 96 and 97, and accompanying text.

about what credits are and are not included in bundles. Given that bundled credits tend to be part of bilateral trades, policy makers may be able to assess ecosystem services outcomes on a project-by-project basis to determine if extra services can be sold.

4.1.2. Additionality

For programs and markets focused on carbon or greenhouse gases, additionality has been a key criterion for project eligibility. The purpose is to ensure that carbon offsets are generated only from activities that would not have occurred in the absence of a payment.[76] For carbon credits to be considered real and to compensate for point source emissions, they must go beyond business as usual (or an established baseline)—beyond what would have happened anyway. For GHG programs—in both regulatory and voluntary markets—additionality is the primary concern related to stacking.[77] Additionality has not been a fundamental tenant of other ecosystem service programs, but it may be an important consideration.

Additionality is often tied to two related objectives: one for individual projects and credits and the other for programs as a whole. The first objective is to ensure that *offsets* are a real and additional enhancement in ecosystem services to compensate for the allowed environmental impact; this environmental objective has economic consequences because paying for non-additional projects is inefficient. The second objective is to increase the cost-effectiveness of *programs*. If programs pay only for activities that are additional (that would not have occurred otherwise), they save money; this economic objective has environmental consequences because the saved money can be used to finance even more environmental benefits. The conceptual framework proposed in this paper is based on environmental outcomes, and thus these outcomes are the primary objective of additionality in this assessment of stacking. The economic objectives and consequences for programs are discussed below.

For an example of how additionality affects the net ecosystem services outcome, consider a project that creates a stream buffer that will reduce nitrogen loading for a water quality benefit and sequester carbon. In the context of the environmental axis and without consideration of the additionality criterion, the accounting framework in this report shows that all impacts are offset with a net ecosystem services outcome of zero (Figure 3a). However, if the water quality program provides sufficient payment for the project to move forward on its own, the project did not need a carbon payment. The carbon payment would not generate *additional* carbon storage to offset the *additional* GHGs emitted, so GHGs would be released into the atmosphere that would not be offset, resulting in a net negative ecosystem services outcome (Figure 3b). If the project generated additional carbon storage that would not have been generated by the activity associated with the water quality credit—for example, tree planting that was not required for the landowner to receive the water quality payment—horizontal stacking is occurring. As noted above, such stacking does not pose additionality concerns.

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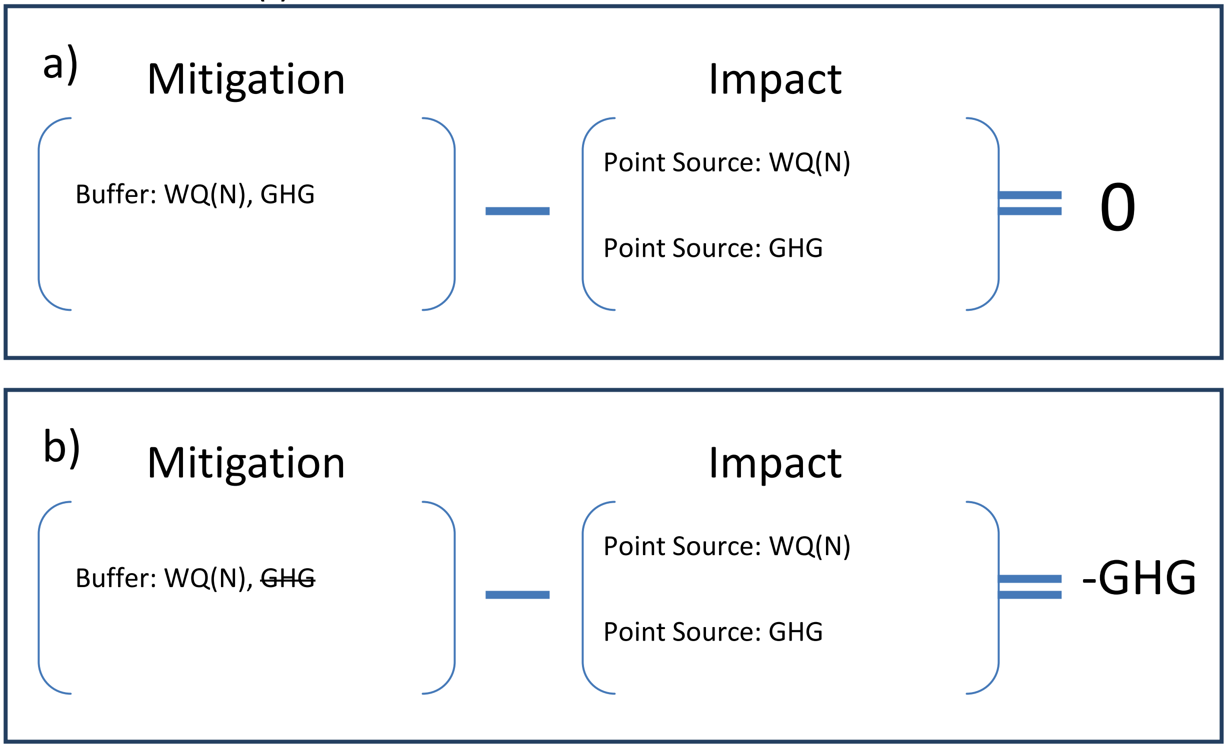
[76] See, e.g., Mark Trexler, Derik Broekhoff, and Laura Kosloff, "A Statistically-Driven Approach to Offset-Based GHG Additionality Determinations: What Can We Learn?" 6 *Sustainable Dev. L. & Pol'y* 30, 31 (2006).
[77] See Bianco, *supra* note 8.

Figure 3. Two examples of ecosystem services outcomes: one (a) that does not take additionality into consideration and one (b) that does.



Note: These examples illustrate the net ecosystem services outcomes of a riparian buffer project that stacks water quality nitrogen (WQ(N)) and GHG credits and in which one payment is sufficient to pay for the project.

Resolving the additionality issue requires knowledge of what would have happened in the absence of the program or market and therefore is theoretically impossible. However, it can be somewhat addressed in practice. Determining when a specified activity is not occurring under current economic conditions and is therefore unambiguously additional is easy. It is also possible to identify activities that are being implemented and will need to be assessed for additionality using a variety of imperfect tools and tests.

Many tests can be used to help programs distinguish likely non-additional projects.[78] One test is a timing test. If an already-implemented project applies for carbon credits, it probably did not need the extra funding, so it would not be considered eligible. If such a project was created with funding from one type of credit, it would not be eligible for carbon credits too (a case of temporal stacking). Another relevant test is a financial additionality test, which requires determining whether a project needs a payment to be financially viable. If a project is eligible for two ecosystem service markets or payments, and one payment is sufficient to pay the full costs of the project, it would fail this additionality test. If, however, neither payment alone provided sufficient funding, additionality would not be an issue, and stacking would be allowed.

Programs may use a timing test to exclude projects outright if they are already established and receiving a payment or credit stream. But given that costs and payments can change over time, it may make sense to use timing as a preliminary screen but not as a final test to exclude projects. Programs differ in how they apply financial additionality; some use a project-specific test of financial barriers, whereas others use standardized tests of common practice to infer financial additionality. Project-specific tests have been viewed as subjective and complicated and slow to verify; standardized tests are considered more

[78] See generally Trexler et al., *supra* note 76.

objective, transparent and simple to apply, but limiting to participation.[79] Under a project-specific approach, a project would have to show that payments for other environmental services were not sufficient to initiate and maintain the project by themselves. Under a standardized approach, a program would develop criteria based on trends in existing markets or programs. Ideally, the program would have data on relative adoption rates for each relevant practice, in different regions, and for different systems over time to parse out a "propensity score" to use as a threshold or to set a crediting value. Often data are insufficient. In these cases, estimates of average costs for a particular project type (practice) must be used in lieu of expected credit value to assess whether multiple payments are needed. When performance standards are generated without sufficient data, non-additional projects are more likely to be allowed and good additional projects, to be left out. If a program declares one payment sufficient to cover costs, projects must give up rights to sell the other credit types if they want to participate, basically creating a bundle out of the co-benefits from the project.

Everyone recognizes the imperfections of offsets markets and additionality, and many continue to work toward improved approaches. Changing circumstances alter business as usual over time which shifts whether projects need multiple payments and thus what is really additional. This reality is particularly problematic for investors who want to know whether they can stack additional payments to meet projected project costs. Given the complexities of addressing additionality in program implementation, programs may choose to explore different policy approaches, including trading ratios and discounting or system-wide adjustments, but these approaches introduce different complexities and create different winners and losers in the system.[80]

If the criterion of additionality is not applied, and many landowners are paid for projects that do not achieve additional benefits, more projects will be necessary to meet any set target or objective. In this case, one alternative policy option is a trading ratio whereby, for example, two or more tons of carbon or pounds of nitrogen reduced are required for every one ton or pound of carbon or nitrogen credit awarded; this ratio will lower the value for each reduction, spreading the burden of non-additionality across all projects and sellers. Many ecosystem service markets already use conservative trading ratios and discounting to reduce risk from scientific or measurement uncertainty. If stacking is allowed, trading ratios would also have to account for the impacts of stacking on achieving the program target or objective. If stacking increased the non-additional projects, the trading ratio would need to increase, further decreasing the value of credits. If regulations are sufficiently stringent to keep values high (two or more times the opportunity and real costs), trading ratios and discounts might work.[81]

4.2. Where stacking is not a problem

Horizontal stacking of incentive payments or market credits in any combination involves non-spatially overlapping parts of a single property. Because each part of the property is credited only once, this type of stacking is uncontroversial. Some may not even consider it stacking.

Vertical stacking of incentive payments with other incentive payments will create no problems in terms of ecosystem services outcome. Because none of the payments allow environmental impacts elsewhere, they cannot lead to negative ecosystem services outcomes. However, they could entail economic consequences.

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[79] Derik Broekhoff, "Expanding Global Emissions Trading: Prospects for Standardized Carbon Offset Crediting," International Emissions Trading Association (2007).

[80] Brian C. Murray and W. Aaron Jenkins, "Designing Cap and Trade to Account for 'Imperfect' Offsets," Duke Environmental Economics Working Paper EE 10-03, Duke University, at 10 (2010).

[81] Trading ratios are often conservative to account for scientific or measurement uncertainty. Lydia Olander, "Designing Offsets Policy for the U.S.," Nicholas Institute Report 08-01, p. 40 (2008). These ratios have been suggested as a means to address additionality. See Karen Bennett, "Additionality: The Next Step for Ecosystem Service Markets," 20 *Duke Environmental Law and Policy Forum* 432 (2010).

Vertical stacking of market credits can also lead to a net zero, or positive, ecosystem service outcome, if the project fully accounted for all impacts and is additional. For example, consider a landowner who plants a forested riparian buffer that generates both water quality and carbon credits, neither of which is sufficient on its own to pay for the buffer. If the carbon credits are sold to offset GHG emissions from a point source (and the transaction does not lead to negative water quality impacts), and the water quality credits are sold to a separate point source (and this transaction does not lead to increased GHG emissions), the project accounts for all of its impacts and has no negative environmental outcome (Figure 3a).

If there were complete regulatory coverage of ecosystem impacts across sectors, additionality would no longer be a necessary requirement. Business-as-usual activities can receive credit under a regulatory cap as part of political deal making with the assumption that the cap will be ratcheted down over time, eliminating the free riders. This phenomenon was called "hot air" in the development of the Kyoto Protocol.[82]

4.3. Summary: Where stacking does and does not work

Vertically or temporally stacked offset and mitigation credits—for programs designed to replace losses to ecosystem services—can sometimes, but not always, be problematic. Incentive payments and horizontally stacked credits are usually not problematic. Table 2 lists all the combinations of major types of ecosystem services credits now available and under consideration in the United States. It also indicates potentially problematic combinations.

Two general findings emerge. First, stacking bundled mitigation credits with other offsets can result in double counting (also called "double dipping"). Second, all transactions involving offsets and mitigation credits may face additionality concerns, except those involving *regulated-to-regulated* trades. Only activities not subject to a cap (unregulated/voluntary activities) need to demonstrate additionality.

Table 2. Combinations of ecosystem service credits and their potential types of stacking risks.

Credit/Payment #1	Credit/Payment #2	Double Counting	Additionality
PES	PES		
PES	Offsets/mitigation (bundled)		Maybe
PES	Offsets/mitigation (single service)		Maybe
Offsets/mitigation (bundled)	Offsets/mitigation (bundled)	Likely	Maybe
Offsets/mitigation (bundled)	Offsets/mitigation (single service)	Maybe	Maybe
Offsets/mitigation (single service)	Offsets/mitigation (single service)		Maybe

4.4. Incomplete coverage

Incomplete coverage of impacts is another issue that is not necessarily unique to stacking but it can interact with stacking. Incomplete coverage of impacts occurs when programs and policies to cover various co-occurring ecosystem services impacts do not exist or are voluntary. When co-occurring

[82] *See, e.g.*, Christoph Böhringer, Ulf Moslener, and Bodo Sturm, "Hot Air for Sale: A Quantitative Assessment of Russia's Near-term Climate Policy Options," 38 *Envt'l Res. Econ.* 545 (2007).

impacts are not accounted for, they are not mitigated or offset. This situation can arise when regulatory programs cover only some types of nonpoint impacts. The United States has made great strides in covering environmental impacts from point sources (GHG emissions are a notable exception), but in most cases nonpoint sources remain unregulated.

Coverage of some nonpoint impacts—for example, water quality impacts from deforestation—but not others—for example, the GHG impacts from deforestation—can lead to a negative ecosystem services outcome. If the water quality impact from forest loss is offset with the purchase of water quality credits from a tree planting buffer project, the coincident GHG benefits from the tree planting will help offset the GHG impacts from the deforestation. However, if the tree planting buffer project is allowed to stack offsets, and it sells its GHG benefits to some other party, the GHG impacts from the deforestation will remain unmitigated. If stacking is not allowed, some uncovered impacts may be mitigated by the co-benefits provided by other projects. However, this strategy penalizes projects for a flaw in the system. The alternative would be to extend regulations to cover the relevant impacts.

Incomplete coverage is unlikely to be a problem when stacking offsets to point source impacts, most of which are captured by one regulation or another. This type of credit most commonly traded. However, stacking of nonpoint source credits may raise a transitional problem if the regulatory programs for nonpoint sources develop at different times or in an uncoordinated fashion.

5. Economic Considerations for Stacking

Stacking can change the costs and revenues of projects and programs. Moreover, it may not be an efficient approach to spurring conservation of at-risk land.

5.1. Can stacking lead to "overpayment" of projects?

For offsets programs, consideration of financial additionality seems to suggest a problem of paying too much, but it is really a problem of payments that produce no additional environmental benefit—an environmental rather than a cost concern even though it has economic consequences. But in the context of incentive programs (payment for ecosystem services), for which funding may be limited, stacking may primarily raise concern about paying more than is needed. For an incentive program, seeking to conserve lands or incentivize improved management with limited resources, each dollar spent paying a project participant more than what he or she needs to recoup costs stops inducing the behavioral change entailed by the project and is a dollar that cannot be spent to fund another ecosystem services project. However, from a project perspective, there is no problem with projects receiving more payment than is necessary—that is, earning a profit—as long as the environmental objective is met. Any "overpayment" of a project simply represents a "rent" or transfer of funds from one entity to another, which is not necessarily economically inefficient.

Farm bill conservation programs allow stacking, but they are not currently designed to adjust their payments to account for copayment by a market credit.[83] Thus private market funding cannot be used to reduce program costs or spread the federal resources to additional land. If farm bill conservation programs included a reverse auction or bid-down mechanism to allow the level of payment to change, participants

[83] According to the USDA Farm Service Agency's Conservation Reserve Program (http://www.fsa.usda.gov/FSA/newsReleases?area=newsroom&subject=landing&topic=pfs&newstype=prfactsheet&type=detail&item=pf_20100726_consv_en_ebi_39.html), applicants can submit bids for payment below the maximum per-acre payment rate, which may increase their chances of having their application accepted. It has been suggested that other conservation programs, such as the Grasslands Reserve Program and Wetlands Reserve Program, could benefit from a more direct bidding process, such as a reverse auction. Felix Spinelli, "Pro's and Con's of a Reverse Auction to Evaluate Conservation Easements," paper prepared for presentation at the Agricultural & Applied Economics Association's 2011 AAEA & NAREA Joint Annual Meeting, Pittsburgh, Pennsylvania, July 24–26, 2011.

might be willing to accept a lower payment from these programs if they also are receiving payments from another ecosystem services program.

5.2. How does stacking affect the value of credits?

Stacking can change the value of ecosystem credits by increasing their overall supply and reducing their prices. A landowner, who previously could only sell one of his or her ecosystem services, can now sell multiple services from the same project, and at a lower price than that he or she would accept if only one service could be sold. Thus, by allowing landowners to tap into multiple payment streams, stacking can decrease the price they receive from each stream.[84] For example, if most landowners who plant a forested riparian buffer receive both water quality payments and carbon offsets, the supply of each credit type will increase, and the price for each will decrease. The above-noted example of stacking from North Carolina illustrates this dynamic; if all existing wetland restoration projects were allowed to sell water quality credits, the supply of these credits would increase dramatically, and their price would crash.[85]

Ecosystem services programs can be designed to be more or less responsive to shifts in credit prices. Mitigation or conservation banks or offset programs that use administratively set credit fees (for example, in-lieu fee systems) will likely not adjust pricing or will adjust it slowly. Competitive bidding could make credit prices respond more quickly to market conditions as would more open market programs. Similarly, stacking could reduce the overall costs of incentive programs that have flexible payment systems.[86]

These considerations have implications for additionality. If stacking brings down prices, adding a new ecosystem service market to the system can change what is deemed additional; projects that initially could cover their costs by selling one credit may need to sell two types of credit if prices drop. Therefore, some projects, which were originally considered non-additional because their costs were covered by one credit stream, may later be additional. As credit prices adjust to stacking, more projects will need to stack payments to meet costs, and thus fewer projects will be non-additional.

Project developers and landowners need ecosystem services payments that meet or exceed opportunity costs so they can, at a minimum, break even. Although stacking may seem a great idea to help landowners profit from the services they provide, they should realize that it can bring down credit prices. As a result, they may have to engage in more credit markets over time.[87]

5.3. Can stacking be used to conserve land at risk of conversion?

Some landowners or conservation-minded organizations, like land trusts, may look to stacking of ecosystem services credits as a means to allow landowners to generate enough revenue to prevent conversion of land to other uses. Many ecosystem services programs target shifts in land management (for example, adding buffers, changing forest stocking) and thus are likely to provide funding sufficient only to meet the opportunity costs of such shifts. Stacking credits in an attempt to meet the opportunity costs of avoided conversion is an imperfect approach. Areas at risk of conversion tend to have high land prices; therefore, the opportunity costs of conversion may be too high to be met by stacking credits focused on management changes. A better approach would be to design programs targeting avoided conversion. For example, avoided forest-conversion projects can be developed for carbon credits through the Climate Action Reserve[88] and international projects to reduce emissions from deforestation are possible through the Verified Carbon Standard and American Carbon Registry. The carbon value of forest lands with high

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[84] See Woodward, *supra* note 16 and accompanying text.
[85] See Doyle and BenDor, *supra* note 73.
[86] Perhaps recognizing these potential benefits, the Natural Resources Conservation Service and the Farm Services Agency currently allow stacking of ecosystem services credits on top of most of their payment programs. *See supra* note 66.
[87] See Woodward, *supra* note 16 and accompanying text.
[88] The Climate Action Reserve currently has registered nine avoided conversion projects, none of which has yet earned offset credit. See http://www.climateactionreserve.org/how/projects/ (accessed January 10, 2011).

aboveground carbon stocks is enough to avert conversion of these lands when funds are provided upfront. These particular programs will only help conserve lands with high carbon stocks, which are not necessarily lands with other conservation priorities (such as hydrological, spiritual, or biodiversity services). Including other conservation priorities in avoided conversion programs would require a policy that would target conservation of land for these other values or for the bundled value. Conservation of bundled values also tends to be addressed through some payment for ecosystem services programs and tools like conservation easements and tradable development rights, rather than through ecosystem services markets. However, some wetland and stream mitigation programs include provisions to allow avoided loss to mitigate impacts.[89] In 2005 20% of wetland and stream mitigation was in the form of "preservation".[90]

6. Policy Implications of Stacking

Many different agencies and laws regulate, manage, and incentivize the conservation and enhancement of ecosystem services, which has resulted in the development of numerous payments and credit types. Stacking these payments can sometimes lead to negative outcomes. However, policy makers have several options for avoiding such problems.

6.1. Double counting

Double counting occurs when one of the credit types being stacked is designed to mitigate impact to a full ecosystem, requiring a bundle of services. Any other credit type stacked with such a bundle will likely overlap with one of the services that is included in the bundle. If so, the result is two separate impacts and only one offsetting activity, leading to a net loss of ecosystem services.

Given that ecosystem services programs are run by different agencies at different levels of governance, regulators may need to clarify program guidance for bundled mitigation programs to ensure that only generation of extra services (services beyond those expected to be damaged) can be stacked. Otherwise, the bundled programs may need to disallow stacking altogether. In most states, current regulations and guidance for bundled mitigation do not require regulators to ascertain whether a project is stacking credits.

Federal regulations for compensatory mitigation instruct developers "to successfully replace lost functions and services,"[91] suggesting that services are intended to be fully covered. This regulation appears to argue against stacking credits in such cases. Other regulations and guidance apparently leave the door open for stacking.[92] Neither the law nor the guidance addresses stacking with offset credits directly, and no legal cases have questioned the intent of the law on whether stacking would be allowed to provide clarifying precedent. State and regional guidance documents used for program implementation are more specific, but they can increase confusion by directly specifying some services within the bundle, while not specifying others, implying that unspecified services might not be included in the bundle. For example, guidance for the North Carolina Wetland Assessment Method specifies that the services being replaced include hydrologic services, water quality, and biodiversity, but it does not mention greenhouse

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[89] See, *e.g.*, U.S. Army Corps of Engineers, Wilmington District Regulatory Program, "Mitigation Banks." Available at http://www.saw.usace.army.mil/wetlands/mitigation/mitbanks.html (showing that mitigation banks can preserve, rather than restore, wetlands to generate credits, but preserve wetlands face a higher trading ratio (5:1) compared to restored wetlands (1:1)).
[90] Becca Madsen, Nathaniel Carroll, and Kelly Moore Brands. *State of Biodiversity Markets Report.* Ecosystem Marketplace. (2010).
[91] 33 C.F.R. § 332.3(b) (2010).
[92] *Id*. at 332.3(j)(1)(ii) (2010).

gases.[93] With growing interest in coastal wetland restoration as a potential GHG mitigation approach for offsets markets, stacking for coastal restoration may become a real issue for coastal wetlands.[94]

Two accounting approaches under development attempt to address concerns with double counting. The environmental engineering firm Parametrix has developed an approach called EcoMetrix that divides each potentially creditable ecosystem service into component ecosystem functions to ensure that each underlying function is credited only once.[95] The Willamette Partnership has an approach for the sale of multiple credits being tested in several of its pilot projects.[96] Under its approach, projects eligible to sell multiple credits would link the credits it sells. For example, if a landowner sells half of his or her wetland credits, his or her available habitat and water quality credits would be reduced by half.[97] This approach could be considered a form of horizontal stacking in that the project area cannot sell more than 100% of any of its credit types.

6.2. Policy for additionality

The inclusion of additionality as a criterion for carbon or GHG offset markets is designed to ensure that payment was required for a project to move forward. If credit types are stacked but only one payment was needed, it can be argued that the second set of credits is non-additional. Thus, the impacts they allow would result in a net negative ecosystem services outcome.

The cleanest way to avoid problems with additionality in the carbon market is to include all impacts (sources) under the regulatory cap. However, when this strategy is not politically feasible, programs use tests or rules of thumb to help avoid non-additional projects when stacking. No policy solution for additionality is perfect, but researchers continue to collect data and explore new ways to design programs to reduce the impacts of non-additional credits. If the additionality criterion is not a desirable policy choice, programs can move toward conservative discounting or trading ratios, but these measures will have different distributional effects on funding flows.[98]

6.3. Incomplete coverage

Incomplete coverage of impacts results when services are not covered by a regulatory program; because the services are not accounted for when they are impacted, they may not be replaced. Given the fairly strong regulatory network covering point sources in the United States, incomplete coverage is less of a problem for point source impacts than nonpoint sources, which are currently mostly unregulated. Most of the trading occurring in the United States now involves nonpoint source-point source trading; however, discussion of regulation for nonpoint impacts leaves the door open for nonpoint-nonpoint trading. One example is the state of Maryland's proposed policy of no net loss of forest resources.[99] Attempts to extend coverage of environmental policies to nonpoint impacts should consider that extending coverage for only some impacts could lead to a net loss of ecosystem services if credit stacking is allowed. This problem

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93 NC WAM, *supra* note 29.

94 See Philip Williams and Associates, Ltd., *Greenhouse Gas Mitigation Typology Issues Paper: Tidal Wetland Restoration* (2009). Available at http://www.climateactionreserve.org/how/protocols/future-protocol-development/#tidalwetland.

95 This approach divides each ecosystem services into component ecosystem functions and then divides each ecosystem function in to component ecosystem attributes (e.g., soil, vegetation), which are measured on the landscape. Some ecosystem services will have ecosystem functions in common with other services. In these cases, whenever one service is credited, all its component functions are made ineligible for additional crediting, such that if another service has that same function, the allowable amount to be credited is decreased. Parametrix, *EcoMetrix tool*. Available at http://www.parametrix.com/cap/nat/_ecosystems_ecometrix.html.

96 Willamette Partnership. Available at http://willamettepartnership.org/ecosystem-credit-accounting/pilot-projects (accessed June 6, 2011).

97 Devin Judge-Lord, Willamette Partnership, personal communication, June 3, 2011.

98 See Murray and Jenkins, *supra* note 80.

99 Md. Ann. Code Natural Resources Article 5-104.

would be solved with a more integrated approach to environmental management of nonpoint impacts in the United States.

6.4. Federal incentive programs

If federal payment programs like those funded through the Farm Bill (for example, the Conservation Reserve Program and Wetland Reserve Program) wish to leverage funding from regulatory and voluntary market programs, they will need to change their rules. The federal programs would need to specify how ecosystem service benefits should be parsed (or unbundled) so that projects could use market funds for certain benefits, while obtaining separate incentive funds for other benefits not covered by existing markets. The federal programs would also need to allow farmers to reduce their bids for incentive payment funding on the basis of their level of market funding. This shift in policy would favor projects that could receive some complementary market funds over those that could not—a program design consideration. An assessment of the ways in which the shift in project types will affect environmental outcomes is needed to ensure that the desired objectives are achieved.

7. Conclusions

Stacking could provide a way to integrate the various laws, policies, and voluntary programs that have emerged in the United States. It could help landowners to manage for the multiple ecosystem services their lands provide and avoid the risks of focusing on a single service. Those optimistic about the growth of ecosystem services programs and markets suggest that stacking could also be a way for landowners to gain sufficient revenues from their land so that ecosystem services production would become a profitable alternative to more traditional types of land management.

Although stacking of various credit types can, in theory, lead to systematic losses of ecosystem services, this risk can be avoided. In addition, many ecosystem services programs use bilateral trades, wherein credits are sold and then retired to meet voluntary targets or mandatory requirements. In this case, it may be possible to directly account for ecosystem services outcomes and to ensure that stacking of credits results in no net loss of ecosystem services. Bundled projects could ensure that they are generating the stacked service in excess of that lost at the original impact site. And where nonpoint impacts are the target, impacts to other ecosystem services can be tracked to ensure they are replaced by the mitigation project. This type of accounting to ensure that all impacts are addressed is difficult and expensive. Metrics for measuring various ecosystem services are in various stages of development and are often fairly rough.[100] They are a focus of the ecosystem services community and an active area of research. Because ecosystem services credits and payments are governed and regulated by a variety of agencies, accurately accounting for the services provided and impacts allowed by stacked projects will require significant coordination across agencies and across levels of government. One option could be to create a database of all ecosystem services projects, which would allow regulators to identify the projects participating in multiple markets or programs.

Although current policy is largely silent with regard to stacking, the potential risks are known and can be addressed by clarifying policies for double counting, by carefully considering nonpoint source impacts in stacked trades until coverage of nonpoint sources is more complete, and by applying additionality tests where required. Where bilateral trades are the norm, acceptable metrics are needed to track ecosystem services impacts and offsets in order to avoid net environmental loss. Stacking can provide many benefits to the environment and to landowners, but good policy will be required to prevent possible negative outcomes.

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[100] See generally James Boyd and Spencer Banzhaf, **"**What Are Ecosystem Services? The Need for Standardized Environmental Accounting Units," 63 *Ecol. Econ.* 616 (2007), and Christian Layke, "Measuring Nature's Benefits: A Preliminary Roadmap for Improving Ecosystem Service Indicators," World Resources Institute Working Paper (2009). Available at http://pdf.wri.org/measuring_natures_benefits.pdf.

Appendix

Table A1. All possible combinations of the major ecosystem services credits available now or under consideration in the United States.*

Credit #1			Credit #2			Double Counting	Additionality	
Credit type	***Service***	***Reg or Vol***	***Credit type***	***Service***	***Reg or Vol***		***Credit #1***	***Credit #2***
PES	n/a	n/a	PES	n/a	n/a			
PES	n/a	n/a	Offsets/mitigation	W/S	Reg-vol			Maybe
PES	n/a	n/a	Offsets/mitigation	WQ	Reg-reg			Maybe
PES	n/a	n/a	Offsets/mitigation	WQ	Reg-vol			Maybe
PES	n/a	n/a	Offsets/mitigation	WQ	Vol-vol			Maybe
PES	n/a	n/a	Offsets/mitigation	Carbon	Reg-reg			Maybe
PES	n/a	n/a	Offsets/mitigation	Carbon	Reg-vol			Maybe
PES	n/a	n/a	Offsets/mitigation	Carbon	Vol-vol			Maybe
PES	n/a	n/a	Offsets/mitigation	Species	Reg-vol			Maybe
PES	n/a	n/a	Offsets/mitigation	Species	Vol-vol			Maybe
Offsets/mitigation	W/S	Reg-vol	Offsets/mitigation	WQ	Reg-reg	Likely	Maybe	
Offsets/mitigation	W/S	Reg-vol	Offsets/mitigation	WQ	Reg-vol	Likely	Maybe	Maybe
Offsets/mitigation	W/S	Reg-vol	Offsets/mitigation	WQ	Vol-vol	Likely	Maybe	Maybe
Offsets/mitigation	W/S	Reg-vol	Offsets/mitigation	Carbon	Reg-reg	Maybe	Maybe	
Offsets/mitigation	W/S	Reg-vol	Offsets/mitigation	Carbon	Reg-vol	Maybe	Maybe	Maybe
Offsets/mitigation	W/S	Reg-vol	Offsets/mitigation	Carbon	Vol-vol	Maybe	Maybe	Maybe
Offsets/mitigation	W/S	Reg-vol	Offsets/mitigation	Species	Reg-vol	Likely	Maybe	Maybe
Offsets/mitigation	W/S	Reg-vol	Offsets/mitigation	Species	Vol-vol	Likely	Maybe	Maybe
Offsets/mitigation	Species	Reg-vol	Offsets/mitigation	WQ	Reg-reg	Maybe		Maybe
Offsets/mitigation	Species	Reg-vol	Offsets/mitigation	WQ	Reg-vol	Maybe	Maybe	Maybe
Offsets/mitigation	Species	Reg-vol	Offsets/mitigation	WQ	Vol-vol	Maybe	Maybe	Maybe
Offsets/mitigation	Species	Reg-vol	Offsets/mitigation	Carbon	Reg-reg	Maybe	Maybe	

Credit #1			Credit #2			Double Counting	Additionality	
Credit type	***Service***	***Reg or Vol***	***Credit type***	***Service***	***Reg or Vol***		***Credit #1***	***Credit #2***
Offsets/mitigation	Species	Reg-vol	Offsets/mitigation	Carbon	Reg-vol	Maybe	Maybe	Maybe
Offsets/mitigation	Species	Reg-vol	Offsets/mitigation	Carbon	Vol-vol	Maybe	Maybe	Maybe
Offsets/mitigation	Species	Vol-vol	Offsets/mitigation	WQ	Reg-reg	Maybe	Maybe	
Offsets/mitigation	Species	Vol-vol	Offsets/mitigation	WQ	Reg-vol	Maybe	Maybe	Maybe
Offsets/mitigation	Species	Vol-vol	Offsets/mitigation	WQ	Vol-vol	Maybe	Maybe	Maybe
Offsets/mitigation	Species	Vol-vol	Offsets/mitigation	Carbon	Reg-reg	Maybe	Maybe	
Offsets/mitigation	Species	Vol-vol	Offsets/mitigation	Carbon	Reg-vol	Maybe	Maybe	Maybe
Offsets/mitigation	Species	Vol-vol	Offsets/mitigation	Carbon	Vol-vol	Maybe	Maybe	Maybe
Offsets/mitigation	WQ	Reg-reg	Offsets/mitigation	Carbon	Reg-reg			
Offsets/mitigation	WQ	Reg-reg	Offsets/mitigation	Carbon	Reg-vol			Maybe
Offsets/mitigation	WQ	Reg-reg	Offsets/mitigation	Carbon	Vol-vol			Maybe
Offsets/mitigation	WQ	Reg-vol	Offsets/mitigation	Carbon	Reg-reg		Maybe	
Offsets/mitigation	WQ	Reg-vol	Offsets/mitigation	Carbon	Reg-vol		Maybe	Maybe
Offsets/mitigation	WQ	Reg-vol	Offsets/mitigation	Carbon	Vol-vol		Maybe	Maybe
Offsets/mitigation	WQ	Vol-vol	Offsets/mitigation	Carbon	Reg-reg		Maybe	
Offsets/mitigation	WQ	Vol-vol	Offsets/mitigation	Carbon	Reg-vol		Maybe	Maybe
Offsets/mitigation	WQ	Vol-vol	Offsets/mitigation	Carbon	Vol-vol		Maybe	Maybe

[*]Combinations not listed are unlikely to occur (or are impossible to implement) in the United States.

Notes: PES = payments for ecosystem services or PES; *W/S* stands for wetland or stream mitigation credits; *WQ* stands for water quality credits, which can include nitrogen, phosphorus, temperature, or other pollutants. “Reg” and “vol” indicates whether the trade is *regulated-regulated, regulated-voluntary*, or *voluntary-voluntary*.
Additionality can be viewed in terms of each credit in the stack; PES and *reg-reg* credits do not face requirements to show additionality. For this reason, additionality has been divided into two columns.