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"How can you put a price on the environment?" Farmer perspectives on stewardship and payment for ecosystem services

A.C. White, J.W. Faulkner, D.S. Conner, V.E. Méndez, and M.T. Niles

Abstract: As agricultural conservation priorities evolve to address new complex social-ecological problems and emerging social priorities, new conservation incentive program participation and success can be enhanced by incorporating local stakeholder preferences into program design. Our research explores how farmers incorporate ecosystem services into management decisions, their willingness to participate in payment for ecosystem services programs, and factors beyond compensation level that would influence participation. We conducted three focus groups with 24 participants between January of 2019 and May of 2019 in Vermont. Our study revealed that a strong, intrinsic stewardship ethic motivates farmers to enhance ecosystem service provisioning from their farms, though financial pressures often limit decision-making. These results suggest that programs with sufficient levels of payment may attract participation, at least among some types of farmers, to enhance ecosystem services from farms in Vermont. However, farmers may be deterred from participating by perceived unfairness and distrust of the government based on previous experiences with regulations and conservation incentive structures. Farmers also expressed distrust of information about ecosystem services supply that conflicts with their perceptions of agroecosystem functioning, unless delivered by trusted individuals from the extension system. The delivery of context-specific information on how management changes impact ecosystem service performance from trusted sources could enhance farmers' decisions, and would aptly complement payments. Additionally, farmers expressed a desire to see a program that both achieves additionality and rewards farms who have been stewards, goals that are potentially at odds. Our findings offer important insights for policy makers and program administrators who need to understand factors that will influence farmers' willingness to participate in payment for ecosystem service programs and other conservation practice adoption initiatives, in Vermont and elsewhere.

Key words: agriculture—conservation programs—ecosystem services—farm management—payment for ecosystem services

Individual decision-making on the part of farmers as they manage their land for agricultural production determines the fate of ecosystem service provisioning from these agroecosystems (Foley et al. 2005; Zhang et al. 2007; Power 2010), placing increasing pressure on government to incentivize greater adoption of conservation practices as part of solutions to complex social ecological challenges (Shortle et al. 2012). Over 40% of all US land is farmland, and of the 260.2 million ha of agricultural lands in the United States, private ownership controls 99% of croplands and 61% of rangelands (Vesterby and Krupa 2001; USDA NASS 2017, 2014). Globally, payment for ecosystem services (PES) programs are considered a promising conservation incentive strategy to simultaneously achieve multiple social and ecological goals for agriculture and the environment (Kinzig et al. 2011; Smith and Sullivan 2014). However, the impact of PES programs often falls short of expectations due to suboptimal participation (Page and Bellotti 2015), among other factors. Payment alone is insufficient to attract participation (Sorice et al. 2018). Designing effective conservation incentive programs is enhanced by understanding farmers' decision-making processes and prioritization of outcomes (Ma et al. 2012; Wynne-Jones 2013; Smith and Sullivan 2014).

This paper explores farmers' willingness to participate in PES programs, and identifies factors beyond compensation level that would influence participation in a PES program. Limited research has been done on how farmers' perceptions of ecosystem services influence decision-making and act as feedbacks in social ecological systems (Meyfroidt 2013; Lamarque et al. 2014), and no research, to our knowledge, has been conducted on this in Vermont or the eastern United States. Though PES program design considerations should be tailored to local contexts, our inquiry may have transferrable lessons for other regions (Wilson and Hart 2000). Our research offers insight for a PES program design to complement existing incentives and motivations that enhance environmental outcomes. This study also contributes to the growing body of scholarship exploring how farmers' perspectives influence ecosystem service provisioning and participation in new conservation incentives.

This study takes a transdisciplinary, action-oriented agroecological approach (Méndez et al. 2015). Agroecologists in this

Alissa C. White is a postdoctoral research associate at the Gund Institute for Environment, University of Vermont, Burlington, Vermont. **Joshua W. Faulkner** is research assistant professor at the University of Vermont Extension Center for Sustainable Agriculture, University of Vermont, Burlington, Vermont. **David S. Conner** is a professor of community development and applied economics, University of Vermont, Burlington, Vermont. **V. Ernesto Méndez** is professor of agroecology and co-director of the Agroecology and Livelihoods Collaborative (ALC), in the Department of Plant and Soil Science, at University of Vermont, Burlington, Vermont. **Meredith T. Niles** is an associate professor in food systems and policy in the Department of Nutrition and Food Sciences at the University of Vermont, and the associate director of the UVM USDA Agricultural Research Service Food Systems Research Center, Burlington, Vermont.

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new tradition engage the wider social science literature on food systems, incorporate transdisciplinary knowledge, and often adopt a problem-based focus to agricultural research. Transdisciplinary agroecology emphasizes and values the local, experiential, and indigenous knowledge of farmers. This tradition draws from scholars who link the benefits of democratic participation and cooperation to problem solving, going back to the action research of Lewin (Marrow 1977), emancipatory education of Paolo Friere (Friere 1972), and the Farmers First theory of sustainable development of Scoones and Thompson (1994) and others in the 1980s and 1990s. Theories posited by these scholars suggest that acknowledging the agency of farmers and engaging them in designing community development interventions will produce solutions that best fit the contextualized needs of those farmers. Given the highly nuanced and contextual nature of ecosystem services, agricultural management, and related policy, the local knowledge and perspectives of farmers is key to developing relevant and workable solutions.

Relevant Scholarship on Farmers' Adoption of Conservation Practices. Farmers' decisions to adopt conservation practices, or to make other changes that enhance the supply of ecosystem services from their farm, are influenced by both individual and structural factors. Among individual factors, the role of nonfinancial motivations in conservation behaviors draws from strong theoretical foundations. Individual motivations are conceptualized as norms, attitudes, and beliefs in the Norm Activation Theory (Schwartz 1977) and Reasoned Action Approach (Fishbein and Azjen 2011). Norm Activation Theory suggests that when individuals both understand the consequences of their behavior and take responsibility for them, their personal norms are activated to motivate behavior. However, individual decision-making draws upon both farmers' willingness and their capacity to make changes (Mills et al. 2017). Financial considerations are important factors incorporated into farmer decision-making, and payments offered by programs can help farmers overcome reluctance to make big changes or support their capacity to invest in new practices (Conner et al. 2016). Structural factors, beyond the control of individuals, can also influence their capacity to make management changes (Flora et al. 2018; Risbey et al. 1999; Roesch-Mcnally et al. 2018; Rodríguez-Cruz and Niles 2021). This includes the institutions, environment, social capital, and technology that mediate farmers' access to capital and information, and expose them to external risks. It has been argued that studies on farmers' decisions to adopt conservation practices in the United States have largely ignored these structural factors (Prokopy et al. 2019). They draw on rational actor theories, which emphasize the influences of norms, attitudes, and beliefs on individual decision-making. Comparatively, the Sustainable Livelihoods Approach (Scoones 1998) emphasizes the way external structural factors and available assets influence the capacity to invest in changes, and has been applied consistently in sustainable development work. Diffusion of Innovations theory offers a useful lens for understanding how a farmer's willingness to adopt a new conservation practice is influenced by perceptions of the practice, social learning, the policy environment, and cultural context (Rogers 2003). This framework, among others, has been used to study how management decisions are embedded within social structures, and are also influenced by the perceived complexity, advantage, and compatibility of a new practice (Wejnert 2002).

Recent research dedicated to understanding the factors that influence farmers' decisions to adopt conservation practices indicates that the decision to adopt conservation practices among farmers is (1) influenced by many different factors, (2) heterogeneous among farmers, and (3) highly context dependent (Teixeira et al. 2018). Recent reviews on adoption of conservation practices found that a plethora of factors and considerations influence farmers' willingness and actual adoption of conservation practices (Niles et al. 2019; Prokopy et al. 2019; Liu et al. 2018; Baumgart-Getz et al. 2012; Ranjan et al. 2019). The literature reveals a lack of consistency in determinants of adoption (Prokopy et al. 2019) and highlights the need for contextualized and localized research on the community of interest (Ranjan et al. 2019). Despite overall inconsistency, positive attitudes toward conservation programs and practices emerged as the strongest predictor of adoption among a review of 93 studies (Prokopy et al. 2019). This aligns with the Reasoned Action Approach (Fishbein and Ajzen 2011), and the findings of many qualitative studies into the same phenomenon.

Payment for Ecosystem Services and Conservation Incentive Programs. Changes in farmers' conservation behaviors is the desired outcome of PES programs, but a different body of research has explored the ways that PES and conservation incentive program implementation influence participation and ecosystem service provisioning impact. The two bodies of scholarship are related, and there is some overlap. The former is relevant to our research goals in setting the context for farmer decisions, whereas the latter has a narrower focus on the how decisions impact ecosystem service provisioning and how PES program implementation influences behavior.

Adequate information and nonfinancial motivations have been identified as influences on participation in PES (Page and Bellotti 2015). Conservation incentive programs that aim to strengthen ecosystem provisioning from farms should consider farmers' diverse perceptions and use of specific strategies for different farmer types (Teixeira et al. 2018). When evaluating new information, farmers usually place more weight on the personal relationship and reputation of individuals delivering information, than they do professional titles (Wood et al. 2014). This suggests that the way incentive programs are designed to interface or share information with farmers may influence farmers' willingness to participate or use information. Managing for ecosystem services requires deep knowledge of the nuances of a farm, its interactions with neighboring ecosystems (Toffolini et al. 2017), and how ecosystem services provisioning is spatially and temporally heterogeneous within a region (Swinton et al. 2007). In order to be able to manage for ecosystem services outcomes, they must be quantifiable, and farmers must have notions about how management influences these outcomes (Swinton et al. 2007). Cultural ecosystems are nonmaterial benefits obtained from ecosystems, often the outcome of dynamic, complex, physical, or spiritual relationships between ecosystems and humans (Hirons et al. 2016). Some of the most meaningful and important ecosystem services are cultural, and because they are challenging to measure quantitatively, they are frequently left out of assessments (Hirons et al. 2016; Gould and Lincoln 2017; van Riper et al. 2017). How cultural ecosystem and relational values are operationalized into PES or influenced by PES is an important and emerging line of inquiry.

Relational values are preferences, principles, and virtues about relationships among people and nature, or among people via

nature (Chan et al. 2018), and can be discerned in the way farmers talk about their relationship with the landscape and stewardship ethic. Both PES program design and participants' perceptions of programs have influenced relational values. While there is evidence that financial motivations introduced by PES programs may crowd out existing stewardship ethics (Luck et al. 2012), recent research from Chapman et al. (2020) suggests that farmers may impose their own perceived values of PES as compensation for stewardship on top of a program's stated goals. These values include market values, ecosystem services values, and relational values, and this is a useful framework for understanding farmers' perceptions of PES. Chapman et al. (2020) link participants' perceived values of PES to the way intermediaries frame and communicate about the programs. Program framing, and the communication of intermediaries, may have important implications for the way farmers' motivations and relational values are crowded-out, or crowded-in, by PES. Luck et al. (2012) suggest that "initiatives will more successfully appeal to intrinsic and instrumental motivations if they are explicit about the moral value of an action and also offer technical or financial assistance—or both—toward that action."

PES programs often emerge as policy instruments that promise to achieve environmental goals, but designing PES programs as rural development and framing them as compensation for stewardship could be better suited to achieve long-term goals (Rosa et al. 2003; Kandel and Cuéllar 2011). Empowering local actors with resources, autonomy, and reinforcing relational values supports the commitment and capacity of rural farmers to provision environmental services (van Noordwijk and Leimona 2010; Kandel and Cuéllar 2011; Akers and Yasué 2019). Perceived fairness, or rather, lack of fairness, is one of the primary reasons PES programs fail to achieve their goals (Miller et al. 2012; Oldekop et al. 2016; van Noordwijk and Leimona 2010), and recent evidence indicates that perceptions of fairness in policy can be the most important factor in determining acceptance of climate change policies (Bergquist et al. 2021). PES program design weighs efficiency versus these rural development goals (Salzman et al. 2018). Finally, the institution with whom farmers interact to enroll in a PES program may have implications for participation. Negative attitudes toward government and conservation incentive programs can deter both participation and transitions to more sustainable practices (Gronewold et al. 2012; Hall and Pretty 2008). Successful PES incentives also require nuanced policies that can adapt to the scale and configuration of specialized socio-ecological settings (Swinton et al. 2007).

Stewardship is at its core a moral sense of responsibility to the environment, articulated by Aldo Leopold as a "land ethic" in 1949 (Leopold 1949). Stewardship requires simultaneously dimensions of care, knowledge, and agency (Enqvist et al. 2018). "Care" refers to foundational personal values, a sense of responsibility, and notions of morality in caretaking; "knowledge" is an understanding of the landscape and ecosystem that underpins notions of what care means for a land; and "agency" is the capacity of individuals to engage in stewardship action (Enqvist et al. 2018). Stewardship, as care in action, may change as new information and understandings are gained, or capabilities evolve. In relation to ecosystem services, stewardship connotes a moral duty to understand and care for the way ecosystem health on a farm is related to the wellbeing of the broader community and society—a responsibility for the environmental outcomes from land.

Context. Our study was situated in Vermont, a state in the United States, where PES has emerged as a promising solution to address dual environmental and agricultural crises—decades of excess phosphorus (P) loading into Lake Champlain, and a challenging agricultural economy (Dolan 2015; Ross et al. 2018; Hammond Wagner et al. 2019; VAAFM 2020). Agricultural nonpoint source pollution is one of many contributors to aquatic nutrient imbalances in the Lake Champlain basin, but was identified as the most cost-effective place to remediate problematic P pollution at the watershed scale (Sharpley et al. 2000; USEPA 2016), creating new social and policy pressures for farms. Concurrently, both the number of farms and total area of land in farms has declined in Vermont over the last decade (USDA NASS 2017) due to a confluence of multiple factors including intergeneration transfer, land access, and commodity market fluctuations (Ross et al. 2018). Despite the stresses, agriculture in Vermont is widely recognized as "essential to Vermont's character and the working landscape; they are major drivers of the tourism industry and foundations for many other external values and benefits" (Sherman 2009). In fact, 97% of Vermonters endorse the value of the working landscape as key to Vermont's future above any other value (Sevoian 2016). In the face of these forces, the state of Vermont has been a crucible for shifting paradigms in sustainable agriculture, with bold visions for a future of agriculture against the backdrop of increasing farms closures due to commodity market failures (Ross et al. 2018). Performance-based PES that incentivize multiple ecosystem services from agriculture have been proposed and explored at the state scale by local farmer associations, University of Vermont Extension, the Vermont Agency of Agriculture, Food and Markets, and a coalition of state and nonprofit organizations (VAAFM 2020; Kemp et al. 2019; Ross et al. 2018). PES program development in Vermont has been viewed as a tool that can simultaneously incentivize conservation and land stewardship, while also enhancing quality of life for farmers by catalyzing a "paradigm shift in how farmers are acknowledged and empowered to perform their essential roles of environmental stewardship" (VAAFM 2020), and also provide a new income source for farmers. In 2018 a group of leaders from Vermont's food system advocated for "programs that compensate farmers and landowners for the social and environmental benefits of responsible land stewardship" (Ross et al. 2018). In 2019, a coalition of farmer watershed groups and extension advisors proposed that the State of Vermont "develop a system which monitors, evaluates and monetizes ecosystem services provided by agriculture and delivers both environmental and food security" (Kemp et al. 2019). Subsequently, a graduate class at the University of Vermont designed a P PES program (Hammond Wagner et al. 2019), and Vermont Act 83 of 2019 formalized a multistakeholder Soil Conservation and Payment for Ecosystem Services Working Group tasked with recommending financial incentives designed to encourage farmers in Vermont to implement agricultural practices that improve soil health, enhance crop resilience, increase carbon (C) storage and storm water storage capacity, and reduce agricultural runoff to waters (VAAFM 2020). While a PES system, by definition, would be focused on these various outcomes, in practice farmer decision-making dictates these outcomes through management choices made regarding adoption of various soil

health management practices (e.g., cover crops, conservation tillage, and crop rotation), practices targeted more directly at nutrient management (e.g., manure injection and split nutrient applications), and a variety of structural and other practices (e.g., riparian buffers, farmstead runoff collection, and rotational grazing). To be successful, PES programs must consider a contextually informed understanding of the values and concerns of the participants they aim to enroll (Page and Bellotti 2015). Our study fills this gap using qualitative focus group analysis to understand the challenges and opportunities for optimal PES program design in Vermont at a unique time when performance-based PES concepts are increasingly being discussed among the agricultural community.

Research Questions. Our aim in this paper was to understand the factors that will influence farmers' participation in a PES, and what influences farmers' management to enhance provisioning of ecosystem services. We can also phrase that as the following two research questions:

1. How are ecosystem services considered in farm management decisions?
2. What are the most salient concerns farmers have about participating in a PES scheme?

Materials and Methods

Our study used focus groups with farmers and qualitative analysis to explore the diverse and multifaceted perspectives of Vermont farmers. Focus groups can capture the nuances of norms, context and structural factors that constrain adoption (Carlisle 2016; Roesch-McNally et al. 2018; Ranjan et al. 2019), how norms and identities influence attitudes toward conservation and adoption (Floress et al. 2017), and the complex interplay between factors motivating and hindering conservation adoption (Ranjan et al. 2019).

In order to capture a breadth of perspectives in Vermont's agricultural community we used a purposeful stratified approach to include farmers from different production contexts and geographic regions of the state. We conducted three focus groups with Vermont farmers between January and May of 2019, which captured perspectives of 24 farmers between the ages of 29 to 81, three of whom were female (table 1). A diversity of production contexts and geographic regions were represented in our participants (table 2), including dairy farmers, pasture-based livestock farmers, vegetable and fruit farmers, maple sugar producers, and highly diversified farms. Focus group protocols and questions were approved by the University of Vermont Office for Human Research Protections.

Focus groups were guided by a semistructured interview guide and lasted between 60 to 90 minutes. Researchers facilitated the conversation among participants by prompting the discussion with questions, offering each participant an opportunity to answer each prompt, and allowing each group of farmers the space to discuss, ask questions, and talk about the ideas and topics they were most concerned with. Discussions began by prompting each farmer to share the most important things they consider when making management changes on their farm. A series of prompts then asked participants to consider the way environmental impacts played into their farm decision-making and the adoption of new practices, systematically prompting discussion of impacts on greenhouse gas emissions, C sequestration, water quality, and then finally climate resilience. Farmers were also asked to share stories about making challenging decisions, and to describe situations where they had to weigh environmental impacts against economic outcomes. Finally, the discussion ended with a rich and open conversation about PES that was prompted by asking participants if they would be willing to be paid for ecosystem services from their farms, their concerns, and their general thoughts about PES in Vermont. Focus groups were recorded with consent and transcribed verbatim. Inductive thematic analysis guided by Grounded Theory (Cohen et al. 1969; Charmaz 2006; Charmaz and Belgrave 2012) was conducted using NVivo software to develop a set of codes based on the content of the focus group discussions. Transcripts were initially single-coded by the first author. Themes were organized using hierarchy, and iteratively revisited and grouped during repeated readings of the transcripts to generate meaningful categories and organization that reflected the phenomenon under inquiry (Cohen et al. 1969).

Results and Discussion

Thematic analysis reflected the categories that correspond to primary discussion topics prompted by our line of questioning during the focus groups: factors influencing farm management decision-making, management for ecosystem services, and perspectives on PES. Our analysis also identified subthemes that emerged across these topics of conversation. Information and trust emerged as foundationally important to much of farmers' past choices, intended decisions, and opinions of PES program design. A tension between stewardship ethic and financial constraints both makes management decisions challenging and also played into farmers'

Table 1
Demographic summary of all focus groups.

Age range of participants	Male farmers	Female farmers
29 to 81 years old	21	3

Table 2
Description of focus groups and participants.

Geographic region of Vermont in which each focus group was hosted	Number of attendees	Management types represented
Northwest (Missisquoi River Valley and St Alban's Bay of the Champlain Valley)	8	Confinement dairy, pasture-based livestock and dairy, custom service operator, maple
Eastern (Connecticut River Valley)	10	Pasture-based livestock and dairy, diversified farms
Central (Greater Winooski River Valley)	6	Pasture-based livestock and dairy, vegetables, diversified farms, fruit, maple

considerations of equity in PES program design. Soil health was another theme that connected and integrated many of the discussions about decision-making, ecosystem services, and payments. Here, we present the results by starting with the concerns and motivations that influence decision-making when farmers think about ecosystem services on their farms. This exploration of the decision-making context is followed by sections on the perceived challenges and opportunities for PES.

Factors Influencing Management for Ecosystem Services. Here we begin by describing the most salient concerns and motivations in farmers' decision-making context. First, we explore the breadth of factors that farmers identified as important to them when making management decisions, and the way they are often connected. Financial concerns emerged as among the strongest themes. We then highlight the depth of discussions about stewardship motivations and farmers' understandings of ecosystem services provisioning.

When asked about the most important considerations for making decisions on their farms, farmers discussed navigating the many pressures, risks, and challenges of sustaining a farm business while maintaining their personal goals, quality of life, and standard of ecological stewardship. Among the farmers who participated in our focus groups, many factors emerged as important in driving and constraining management decisions, highlighting how context-specific and diverse farmers, farms, and their decisions can be. Farmers primarily mentioned finances, quality of life, local ecological impacts, and conservation of inputs. They also discussed time, long-term sustainability, keeping their farm in agriculture, regulatory compliance, tractor time, community, soil compaction, crop health, soil health, animal health, food quality, pest pressures, efficiency, co-benefits, nutrient retention, and odor. Table 3 presents themes and quotations representing a diversity of the major factors influencing decisions mentioned by participants in our study.

Each farmer described a complex of diverse and interconnected factors that interact to influence decisions, including financial, ecological, social, and regulatory considerations. Farmers described how new and urgent challenges often dominate their available time and resources, as one farmer described, "We'll try to eliminate our biggest problem, at the timing that it is. One year it's one thing, and one year it's another thing. It's never always just one thing." Temporally dynamic changes in impact, personal capability, and new conditions were also described by participants, indicating the way short-term and long-term risks are often factored into short-term management decisions. When asked about the most important thing considered in making management decisions, one farmer talked through the many things he incorporates in his decision-making process:

> What's the impact of this practice right here and right now? Also,…the risks of getting involved in this decision…if I for some reason don't manage this well… Could something change? I think there's a diversity of considerations related to quality of life, economics, and ecosystem integrity on the land, and perhaps things like…future production capacity. Would taking on this management affect other aspects of management on the farm? So, it's not simple question to answer, but there's a bunch of factors.

Farmers described how economic pressure constrained their capacity to invest in management changes, including conservation practices and enhanced ecological stewardship. This was a strong theme that repeatedly emerged in all the focus group discussions, but was sharply emphasized in the discussions with dairy farmers, many of whom described personal experience with enormous debt loads, business deficits, and milk market patterns that had already put many of their fellow farmers out of business. Farmers told stories about wanting to invest in management changes for climate resilience, water quality, and soil health, but cited the dairy economy and price of milk as reasons they couldn't make the changes they had hoped to. As one dairy farmer explained:

> I got equity, but cash? I'm cash poor…it's the milk price that has done that … What we do in the environment, we do the best job we can, but if we can't survive with the milk price, we're not going to farm [like that]. We can't afford to. We're not going to do it to lose all our investments. And right now, to sell your investment, you're getting 50 cents on the dollar… that's why most people are still staying in, because you can't afford to get out.

Farmers in our study expressed a sense of stewardship and caretaking to multiple scales as motivating their decisions. Some farmers described a sense of stewardship to the agricultural landscape, their household, and future of farming in Vermont by sustaining healthy, productive soils and viable farming enterprises to pass on to the next generation of farmers. Farmers also described how their management decisions consider impacts on various nested scales of community surrounding the farm, starting with their own household and farm, radiating out to larger scales of beneficiaries. For example, one farmer described:

> When I'm thinking about decisions right now, I'm thinking about how it's impacting the community that we've created around the farm and then the greater community of the town in which we live in. And then beyond that, the state of Vermont.

Many farmers described how, through farm management, they hoped to make contributions to the well-being of society and planetary health, by "feeding the world" or mitigating drivers of climate change. Additionally, maintaining the aesthetic of a working farming landscape was understood to be valuable to the surrounding community's sense of place, and tourist appeal.

When describing ecosystem services, farmers discussed their interconnected nature, and how management decisions can mean uncertain tradeoffs among outcomes. One farmer reflected on how transitioning from winter bale grazing their cows in pasture to bringing the cows in during the winter and installing a manure lagoon may have presented tradeoffs for water quality and greenhouse gas emissions. After telling his story, he remarked, "I have greatly improved water quality around my operation, but it might've drastically increased the emissions. I don't know. I didn't measure either one." Conversations also revealed a consistent perception of synergy among ecosystem service provisioning that was linked by soil health. One farmer explained, "It all goes back to focusing on the soil and what does the soil need, and then it all falls into place." Another farmer described this logic of how managing for soil health aligns joint management of farm goals and ecosystem services more specifically, saying, "I think for us it's just

all about building that soil, and that drives productivity, that drives clean water, after it drives sequestration, and it all goes towards the same goal."

Farmers' knowledge of ecosystem function places soil organic matter as foundational to natural soil processes that have benefits to people and the surrounding ecosystem. Farmers understand that increasing soil organic matter is the primary way their soils can serve as a C sink, and they see this as one way they can contribute to addressing the global climate crisis. Although, when farmers talked about mitigating greenhouse gas emissions and addressing drivers of climate change, many considered reducing fuel consumption, driving their tractors less, establishing perennial plants, and using less inputs as most important. Farmers also valued soil organic matter as a means to increase climate resilience, by enhancing the water holding capacity of soils during drought, protecting from erosion during times of heavy precipitation, and improving infiltration and internal drainage. Farmers often used this as a heuristic for thinking about how their farm interacts with nutrient flows into waterbodies.

Challenges for Payment for Ecosystem Services. In the following section, we describe concerns and perceived challenges that may inhibit participation in PES programs. This includes distrust of government, perceived unfairness in compensation, trust in information sources, and skepticism about impact.

Conversations regarding water quality stewardship brought up tensions among farmers and distrust of state government. Most farmers shared frustration about how water quality regulations were enacted in the state. Dairy farmers described feeling demonized in the eyes of the community, and frustrated that some practice-based regulations they have to comply with may have little impact on nutrient flows off their farms. Some based their distrust and dissatisfaction with policy makers on previous experiences. One dairy farmer connected his past experience with concerns about new programs, saying, "You'd get on the bandwagon with them, and they change the rules and regulations down the road where farmers are gonna bow out or make it tougher for them." Some of the smaller and diversified farmers perceived that water quality regulations were not being enforced strictly enough on the larger dairy farms, and were frustrated that pesticide and chemical pollutants are not addressed by water quality policies. As one farmer put it:

> I'm upset that the conversation about water quality in Vermont is always

Table 3
A diversity of factors are considered by farmers when making management decisions. Farmers discussed these ideas at various scales, thinking about management at the level of farm, household, state, and globe.

Theme	Example quotation
Keeping the farm in agricultural production	"We think about what's going to keep that farm in agriculture, because there's so many things working to take that farm out of agriculture."
Economic viability constrains other goals	"What can we do with what we have? For us its often finances that are limiting things, or our time, and that's often in relationship to finances."
Quality of life	"There's a quality of life component, like you were talking about the tractor time."
Decisions are influenced by complexity/multiple factors	"I think there's a diversity of considerations related to quality of life, economics, and ecosystem integrity on the land, and perhaps things like how would it affect, you know, future production capacity. Would taking on this management affect other aspects of management on the farm, etc. So, it's not simple question to, to answer but there's a bunch of factors."
Ecological stewardship	"A management decision would have to meet certain criteria. One would be that it would need to enhance our livelihood, so it would be an economic decision but with all of that we also think about the impact we're having on the ecosystem around us. So, we take that into account because we are not going to trade one off for the other, but it has to be both."
Regulatory pressure	"Another one is regulatory and that's depending: One, on if we sort of respect the regulation in place. Two, like how likely are we gonna get in trouble for this? If you don't respect the regulation. Three, how much cost to comply. Those are like those other questions that affect our management decisions."
Farm heir and legacy	"There's so many things because we were also in transition to the next generation, my son and his wife, it's been expansion, expansion."
Soil health and tillage practices	"As time has gone on, we've been first interested in soil health because it would result in animal health and quality food and had hoped that the market would reward that."
Pests and disease	"Swede midge and leek moth has really rocked our world. And um, you know, we talk about using less plastic, but so many of our crops have to use insect netting now and we don't like buying that stuff, but it's either that or have your yield go down significantly."
Reducing inputs and using less trash (conservation ethic)	"The choice whether to use black plastic mulch and the amount of trash that I generate, is pretty significant for the size operation that I run. Um, yeah, so there's like a direct kind of financial, ecological trade-off there that I kind of grapple with every year and the climate change issues coming into the climate change play directly into my choices around black plastic and row cover, all the types of high tunnels and stuff, that I rely on that type of controlling for."
Animal health	"Highest priority for me is animal health and welfare."

> just pretty much about phosphorus. Not about herbicides. We have these water-soluble chemicals that are getting into our surface and ground water. People are not paying attention to that, they are unseen, but I'm pretty sure that they have a lot of ecological impacts and a lot of health impacts on humans.

Some farmers reported dissatisfaction with new information about negative environmental implications of farm management, which contradicted their personal understandings of agroecosystem functioning. Conflicting information about environmental impacts of farm management from different sources can be challenging for farmers to navigate, and one farmer described what we interpret as confirmation bias having some influence on the way he discerned information about the conflicting science of grazing practices. He said:

> I think about who and what and where that information is coming from, because I see that information change and flux. And you could have this one source say "cows are horrible for the planet," and this other source say, "well they're only bad if you don't feed them kelp," and then this other source is like "no, they're actually fine and they're great and they can do really good work." So who do you listen to?…Sometimes you could have well-funded, well-intentioned researchers and science coming out that says kind of the antithesis of what actually might be true.

He then talked about trusting "information … that we feel good about," which came from, "people that are more tapped into this stuff, and smarter in these areas that we trust." While this phenomenon occurred only once during our limited study, it suggests that information that aligns with a farmer's existing perception of agroecosystem dynamics and also comes from trusted sources may influence a farmer's perception and use of science-based information in this community.

Perceived unfairness was a frequently mentioned perception of existing programs and potential new programs. Participants understood that the way the programs are structured may benefit some farmers more than others. It is often farmers who fail to implement best management practices (BMPs) on their own who qualify for support. Many lamented the way many existing programs are designed to put more money and resources toward farms with bigger problems. Participants expressed a perspective that some conservation programs have incentivized farmers to create environmental problems in order to qualify for enrollment. A dairy farmer described the way he sees some of the program currently working:

> If you've got a violation on your farm there's money for that. But if you want to do something that's better for your farm, but you're not in violation, you don't get no money because you're not in violation yet. So, you almost have to do it to be in violation, so you can get some funding, which is stupid.

Much of the discussion revealed skepticism from farmers about PES having real impact on either ecological or economic outcomes. Most growers do not see PES as a silver bullet for the agricultural economy, and fear payments may not make enough of a difference to keep them competitive in their markets. One farmer worried, "is it going to save the farm or not?" Other farmers lamented that a PES would be unlikely to support the transition toward a more equitable, just, and ecologically sound food system that they see as important. For example, a farmer said, "I'm just concerned, I want to know that those systems are actually functional at reducing carbon emissions, and redistributing wealth."

Opportunities for Payment for Ecosystem Services. Here we share the opportunities and resource needs described by farmers during the focus groups, which reveal valuable insights for a path forward. Farmers discussed the potential for a PES with cautious optimism. Discussions highlighted a shared hope that a PES would mitigate structural financial pressures on farm viability by adding an additional income stream for farms, and enhance public trust by recognizing the dedication of many farmers to environmental stewardship. Farmers perceived a new PES as an opportunity to incentivize multiple ecosystem services, create a more holistic conversation about water quality, and be acknowledged for the many public benefits that come from their farms.

Farmers in our study frequently expressed a desire for more contextualized information that matches their information needs for farm management decisions. Site and soil characteristics are perceived as important in influencing environmental outcomes, and there was a high level of interest in measurement, knowing what kind of impact their farm is having on the environment, and to what extent. One farmer remarked, "I bet it's really specific farm by farm." Participants in our study expressed desire to be confident that changes made would actually contribute to positive, measurable outcomes. A PES program was described as hopefully offering more information that would verify that management changes are "going to have an impact, and that the practice will have the impact its promising" to society, not just the farm.

Farmers want more information about the C budgets and impacts for practices and specific sites, and they described wanting credible information delivered from trusted people and advice from experts about how to shift management to reduce their C footprint or sequester C. Farmers desired accurate measurements of the specific impact their farm was having on environmental outcomes, in the form of on-farm monitoring, or even a "carbon auditor" who could come and assess their farm's C balance. If farmers had regionally or site-specific information about environmental outcomes from their farm management, they indicated that they would use that data to inform decisions. One farmer described how trusted information would inspire farmers to do more, saying, "If that's the case, everybody should be doing it and you should be going at it in a, in a wild way, but we need to be verified."

Information sources also have important implications for management changes—farmers indicated that they are more likely to consider and use information delivered by trusted individuals with whom they have developed relationships. One farmer contested the expertise from sources they didn't have personal relationships with, but described increased willingness to accept this kind of information if it was recommended or delivered by trusted people. He said,

> If I talk to you guys, and you guys are like, "yeah this is really good science, this is really good research. I really think you should follow this." That would have a lot more weight to me than reading a random article.

Many farmers described a need for adequate financial compensation from a PES in order to participate. This was framed as a need to reduce risk, to cover the time and clerical costs of completing paperwork, and to cover opportunity costs. This reflected the financially constrained decision-making context discussion in the first portion of the focus groups. The burden of time spent on paperwork was one of the most frequently mentioned concerns. As one farmer described, "I think there'd be a lot of questions on how much paperwork is there." Another remarked, "Even if you break even, then you got to do five hours' worth of paperwork…I'm not donating five hours of my time…those hours are hard to come by now." To illustrate the way adequate payment levels can be critical resources to help actualize conservation implementation for ecosystem services, one farmer explained:

> Those financial incentives, when they come in…that can be the tipping point. And that can be the thing that, whether it's water quality or greenhouse gas emissions or pollinator habitat or something else, that you already want to do this...those can be the things that kind of put you over the top to be able to implement or initiate different practices or modify practices.

Many farmers remarked on how important it is that a new PES program be compatible with, not replace, conservation incentives that are already working well and support them in their current capacity to provide ecosystem services from their landscapes. This includes organic certification, land appraisal tax incentives, a variety of easement programs, federal cost shares, and state water quality improvement grants. Some farmers described the Vermont organic certification program as a good working model of an independent agency that does evaluation, verification, and certification. Others talked about how the USDA Natural Resources Conservation Service (NRCS) programs could expand their funding pools and structures to accommodate evolving goals associated with ecosystem services. Smaller farms described how programs that cover establishment costs are critical because they have limited capital. Referring to programs that offer road-front signage for farmers acknowledging their conservation investments without payments, farmers said that recognition is not enough; "I can make my own sign," said one farmer.

Our conversations with farmers in Vermont revealed diverse perceptions of the values imparted by a PES program, which present opportunities for framing and design (table 4). When talking about a potential PES program, farmers in our focus groups expressed a desire to see a program framed around ecosystem services support the viability of farmers who have already invested time and capital into environmental stewardship. One farmer described another farmer who already invests time and money in stewardship, saying with a sense of fairness, "My thoughts are that he's been doing a good job and he's probably invested a lot of his own money to do it…I think he's the guy who should see the better benefit."

Some farmers described PES as prodviding market values, describing it as a mechanism for providing an additional income stream, and as a way to support farm viability and persistence in the face of low food prices and commodity market failures. PES programs were also described as mechanisms to redistribute the externalized cost of environmental impacts in agriculture to food corporations. Other farmers described PES as imparting an ecosystem services value, calling it a payment that was directly linked to quantifiable environmental benefits to society and the surrounding community. Finally, some farmers described it as providing compensation for their stewardship, and their relationship with the agroecosystem, which reflected relational values. PES programs designed to support all of these values may garner participation from more farmers (table 4). However, while many farmers find the market valuation appealing, some farmers perceived monetary values to be at odds with an intrinsic stewardship ethic. Finding the concept of monetizing nature a bit perverse, one dairy farmer reflected, "How can you put a price on the environment?"

Discussion. Our study explored Vermont farmers' perspectives on decision-making, ecosystem services, and government-run PES using an inductive qualitative approach. From the perspectives of participants in our study, state sponsored PES programs could support them in enhancing ecosystem services from their farms by providing sufficient financial support for management changes and delivering information about their agroecosystem performance. However, uncertainty and ecological complexity present communication and program design challenges for the performance-based PES programs described by participants. Our study identified trust and perceived fairness as important elements of a new program that may influence participation by farmers. PES programs should carefully consider how to build trust, fairness, information, and adequate compensation in order to optimize participation.

We found that Vermont farmers consider diverse factors at multiple scales when making management decisions, often weighing both long-term and short-term impacts, and nimbly adjusting to keep their business afloat in light of unexpected and new challenges. Our findings align with recommendations by Teixeira et al. (2018) and Carlisle (2016) that conservation incentive programs should consider diverse factors that make up the decision-making context.

Our study found economic constraints to be one of the most important factors governing farmers' decision-making complex. This diverges from recent synthesis of factors influencing the adoption of soil health practices, which found economic factors to be secondary (Carlisle 2016). However, a dominating theme of perceived limits to capability does align with some previous research (Flora et al. 2018, Risbey et al. 1999; Roesch-Mcnally et al. 2018). Our research was conducted at a time when milk prices were below the cost of production for dairy farmers (Ross et al. 2018). Stresses from commodity market fluctuations may change the extent to which economic factors influence management decisions and conservation program participation. Future research should explore the extent to which external and structural factors limit famer decision-making and strategies that are used to address this constraint. Low incentive cost-share payment levels have previously been linked to under-adoption among Vermont farmers (Conner et al. 2016), and our findings also emphasize that adequate payment levels will influence farmers' willingness to participate in a new PES program and enhance their capacity to invest in ecosystem services provisioning.

Farmers' desire to reward farmers who have already been good stewards is potentially at odds with their desire to ensure a state sponsored program achieves true additionality. Most ecosystem services from farms have a maximum threshold, such as soil C

Table 4

Values imparted by payment for ecosystem services (PES), as described by Vermont farmers. Comparative analysis with Chapman et al. (2020) reveals that perspectives in our study context included the same three primary types of PES values described in their study (market, ecosystem services, and relational). The relational and market values that emerged in our study differed slightly when compared to Chapman et al. (2020).

Value	Thematic code	Example quotation
Market value	Opportunity cost	"You're going to have a result on an acre of land and you lose half your production to get that... we gotta be compensated for the loss of crop, or whatever we did. You know, I just want to help the environment. That's one thing, but..."
	Income	"The farmers have been price takers, not price setters, so they have to absorb all the additional costs. So, we're trying to bring money into that watershed to absorb the costs of the manure injection, absorb the cost of some of these."
	Equitable food system	"That's one of the steps of making this more of a just food system is actually taking into account all the yields and all the externalities."
Ecosystem services value	Public as beneficiaries	"We try to think about like what are the diversity of benefits that we can grow in our farming operation or provide, and water quality is one of them."
	Compensation	"Any kind of support or additional money for ecological services, for doing the right thing, for the soil, for water quality, for emissions. We know we ought to be paying people to do those services."
Relational value	Stewardship ethic as motivation	"That's like the tail that wags the dog for us, this idea of reducing our carbon footprint or even how we can sequester carbon. That's how we're really making our decisions... That's really the paramount question for us because we feel like as stewards of the land, the problems we're seeing in the world today are all based on land management, and that's where the solutions are going to come from, so we try to lead in that area and model that."

and water infiltration, and those farmers who have not previously invested in conservation practices likely have greater possible gains to make in increasing the supply of these ecosystem services. PES programs that prioritize measured environmental gains make greater payments to these farms with greater resource concerns. The lack of programs that prioritize rewarding farmers who have already independently invested in increased supply of ecosystem services has resulted in a sense of unfairness among farmers, which may impact participation. Perceptions of fairness in payment structure and eligibility are known to influence participation elsewhere (Miller et al. 2012; Oldekop et al. 2016; van Noordwijk and Leimona 2010). In Vermont, this implies two different directions for state sponsored PES program implementation—either a program that invests in the financial viability of farmers who are proactive about stewardship, or one that invests in greater environmental gains in the near term. Building differentiated payments into the program design to address this, as suggested for Vermont by Hammond Wagner et al. (2019), would address this tradeoff, but could contribute to additional administrative workload or reduced program efficiency. Setting high performance baselines for participation could also alleviate some perceived unfairness and ensure that some base level of stewardship is required to be eligible for payment.

Along with financial constraints, farmers in our study described information as among the most important factors limiting their management for enhanced ecosystem services. This aligns with research by Page and Bellotti (2015), who found inadequate information impeded participation in conservation schemes. Participants in our study shared a confidence in knowledge about how some management decisions would cause synergies or tradeoffs in ecosystem services from their landscapes, and expressed a desire for site-specific information on the extent to which their management changes influence ecosystem service provisioning from their agroecosystem. Information on agroecosystem function can be a valuable nonmonetary benefit for farmers from PES, which may enhance participation and inform adaptive decision-making to enhance ecosystem service provisioning (Swinton et al. 2007). Farmers' interest in context specific information and curiosity in the measured impact of management changes on their farm suggests that a performance-based PES program will appeal to farmers' desire for data on ecosystem service provisioning from their landscape.

PES has the potential to contribute to meeting some of the many goals that have been set for this new tool, but it may not be a silver bullet for all the challenges agriculture is facing in Vermont at this moment. The extent to which the program supports rural economic development is potentially at odds with environmental efficiency, and PES may not "save the farm" unless substantial payment rates are part of the design—for farms with significant debt, payments would need to be far above and beyond the cost of implementing conservation practices. If PES payment rates are set at or below the cost to farmers for investing in conservation, it may not support the growth or sustainability of agriculture. Based on our research, many farmers would not enroll if payment rates were low. However, if framed correctly, a program with modest payment rates may still respond to farmers' desire to be recognized for environmental stewardship, and could also provide them with the performance information they are interested in.

Farmers in our study use a heuristic for understanding ecosystem service provisioning, which places soil health as central to synergizing multiple beneficial outcomes, including enhanced productivity, resilience to extreme weather, C sequestration, and water filtration. Farmers in the Midwest have similarly described how they see soil health stewardship as resolving tradeoffs between productivity and environmental outcomes (Roesch-McNally et al. 2018). While much of this aligns with science-based understandings of agroecosystem functioning (Masciandaro et al. 2018), a recent body of research indicates that enhancements in soil health can be at odds with P water quality outcomes (Duncan et al. 2019). Communicating the potential tradeoffs of soil health is challenging. Our research finds that some farmers may be hesitant to accept information that

counters their existing beliefs, but are more willing to accept it when delivered by extension professionals with whom they have established trusting relationships. This aligns with other research on how trust plays into the role of extension in the delivery of challenging information (Easton and Faulkner 2016; Brugger and Crimmins 2015; Wood et al. 2014; Carolan 2006). Together, this has a few important implications. First, extension professionals who have established trusted relationships with farmers are an important asset to the socio-ecological context, with a unique position to advance change in land management by being able to deliver science-based knowledge that may make important and needed changes for environmental outcomes. Second, delivering information that counters farmers' perceptions of agroecosystem functioning may be risky for intermediaries who have not established trust yet. PES participation is likely to be influenced by perceptions of trustworthiness in the program vehicle, and distrust of regulatory agencies is likely to deter farmer participation, implying that trust building should be an important focus of PES design.

A sense of stewardship and deep caretaking is embedded in the agricultural livelihoods of Vermont farmers, and though participants expressed this sense of caretaking and stewardship to different scales and spheres of influence, it weaves a common thread through their considerations of management decisions, motivation for ecosystem service provisioning, and participation in PES. These stewardship attitudes and norms set the stage for action in much of the social psychology theory that is applied to farmer conservation behaviors. The formation of these attitudes and individual norms are certainly important, but what our study shows is that they may not drive action when farmers face structural and financial barriers. The activation of stewardship norms may facilitate conservation among farmers, but farmers are often limited in their capability to do more without financial, informational, or technical assistance. Personal stewardship norms play an important role in motivating farmers to engage in conservation behaviors without payment. Certainly, that has been the case for many farmers who participated in our study. However, our study points to the need for more financial supports that enable farmers to engage in more conservation behaviors.

Importantly, the existing stewardship motivations that emerged in our research are potentially at risk of being crowded out by financial motivations emphasized by a PES, which have been documented to sometimes replace or overwhelm stewardship motivations with financial motivations (Rode et al. 2015; Chan et al. 2017). This is especially concerning if participants are being paid to pollute less, rather than generate new ecosystem services, because they may feel entitled to pollute when financial payments are no longer made (Chan et al. 2017). Framing a program as a reward for stewardship, rather than payment for pollution, could address this risk of motivational crowding out. Chan et al. (2017) suggest that PES programs may be designed deliberately to crowd *in* altruistic motivations, reinforce stewardship ethics as social norms, and secure long-term sustainability through careful program framing and a focus on community-scale additionality, rather than individual actions. These policy implications are particularly relevant to our findings and context. A government-run PES in Vermont that emphasizes stewardship norms rather than payment for reduced P pollution may better secure long-term stewardship motivations and behaviors among famers. To best address these considerations, further research should explore how key program design decisions, stakeholder input processes, and program framing influence motivational crowding out among farmers prior to the implementation of large-scale PES programs. Farmer surveys and interviews associated with scenario-based workshops or pilot programs are well-suited to explore this potential.

Farmers in our study expressed preferences for PES programs to both incorporate multiple ecosystem services and reduce transaction costs, specifically paperwork. However, these preferences have contradictory implications for PES program design. Additional ecosystem services in a program will require additional paperwork. Paperwork had been identified in previous research as one of the most important factors limiting participation in conservation schemes, and has emerged in research with Vermont farmers as well (Page and Bellotti 2015; Niles n.d.). The vehicle for a PES program will be burdened with balancing these contradictory preferences. Successfully striking a balance of farmers' preferences with program efficiency, and framing a program around farmers' needs and values could overcome prior experiences that engendered distrust of government.

Our research also found possible differentiation in perceived PES goals and values among Vermont farmers. Divergent goals for PES programs expressed by the study participants indicates that particular framings and program designs could appeal to subsets of farmers. Thoughtful design and communication that takes this into account can ensure a program achieves participation of target farmers. Our work aligns with that of Chapman et al. (2020) in finding that stewardship and relational values are important influences on farmers' decisions to participate in PES and engage in conservation behaviors, and complementary to financial value motivations. Thus, emphasizing both market and relational values may enhance broader appeal and participation of a PES.

Taking an action-oriented approach to research on agricultural sustainability (Méndez et al. 2015) has revealed important elements of program design, which will better meet farmers' needs and meet program goals. However, our research found many contradictions among goals and revealed that it will be challenging to design a PES that meets all goals or benefits all farmers. While our focus groups have been helpful in drawing out farmers' perspectives on PES as a community development and policy tool, they fall short of the action-oriented and emancipatory vision of Lewin and Friere (Marrow 1977; Friere 1972). From here, the next step is to engage farmers in the actual program design process. This may better address challenging decisions about which kinds of farmers are rewarded by a new program and how equity is balanced with efficiency.

Implications. PES policy design is likely to impact the existing stewardship values and motivations that influence conservation management decisions by farmers. The risk of financial motivations overwhelming stewardship motivations should be deliberately avoided in program design and policy development, in order to preserve the altruistic motivations that may outlast a new program. PES presents an opportunity for policy design and extension professionals to coordinate in strategically reinforcing and galvanizing stewardship norms among farmers through program framing and differentiated payment structures that reward high levels of stewardship.

Performance-based PES will appeal to farmers' desire for more information about agroecosystem dynamics. However, unless this information is delivered by trusted intermediaries, farmers may distrust or reject a program that exposes the complexity and tradeoffs in ecosystem service supply. Our research implies that investments in relationship-building by extension professionals are crucial to supporting the incorporation of science-based information that may counter farmers' existing beliefs or paint their management in a bad light. Confirmation bias is the interpretation of evidence in ways that are partial to existing beliefs (Nickerson 1998), and although evidence of confirmation bias emerged only once in our research, it does suggest that some farmers may be making management decisions based on information that aligns with their existing beliefs or comes from information channels they are accustomed to. This may be linked to the variability in messaging to farmers as scientific understandings about agroecosystem functioning evolve and undergo debate. Together, this implies that investment in extension and partnership with trusted intermediaries who can support interpretation of new research for local contexts will be crucial to the success of a performance-based PES program. Likewise, engaging more farmers in research about ecosystem service provisioning through citizen science or participatory action research approaches will increase the salience and use of that information (Kindon et al. 2007). This may be an increasingly important consideration as digital media information paradigms shape increased exposure to narratives that are congruent with established viewpoints—a phenomenon sometimes called informational "echo-chambers" (Sikder et al. 2020).

Finally, our research indicates that many farmers in Vermont need adequate compensation in order to make management changes, and transitions toward increased sustainability and ecosystem services supply in agriculture will require significant capital or market changes that are not accessible to many farmers yet. PES may be only one tool among many to enhance a farmer's capacity to make management changes, and should be considered alongside other instruments, like existing cost-share programs, market development, tax incentives, and regulatory baselines that limit pollution.

Regulatory baselines that limit pollution and ecosystem disservices can play an important role in mediating perceptions of fairness about which farmers are rewarded by PES. While regulations are generally disliked by farmers because they present both financial and time burdens to comply and document compliance, some regulatory baseline thresholds of performance may help address fairness concerns among farmers and the public, by ensuring that polluters are excluded from eligibility for payment. Certainly, this is what is being proposed in many new PES schemes—baseline conditions that must be met, with additional payments for additionality. In the case of agricultural P pollution in Vermont, a forthcoming performance-based pilot PES program will require farmers to comply with a regulatory baseline of Vermont's Required Agricultural Practices before enrolling, and then pay them to reduce P loading that goes above and beyond compliance with water quality best practices (VAAFM 2018 n.d.). Among new soil health PES propositions in Vermont and elsewhere, and also among emerging soil C offset markets in the United States, the way baselines are set determine the extent of additionality, and by extension, public perceptions of fairness.

Future Research. Our study was exploratory in nature and contributes valuable insights that should be more extensively explored through interviews and surveys. Interviews could further explore the types of values farmers perceive from PES, and explore how those perceived values may relate to typologies of farmers based on business model, size, or social connectivity. This would better inform program differentiation by farmer context. In-depth research on the extent to which confirmation bias influences farmers' use of information is needed. Surveys or interviews conducted before and after a pilot program or scenario-building workshops are suited to identify the outreach and program design elements that may influence changes in values and motivations. A follow-up survey with a larger sample size could represent the perspectives of all Vermont farmers and identify the minimum threshold for PES payment levels. This could be framed as the percentage of cost of adoption that should be covered, or what payment per acre should be offered. A representative survey should also ask direct questions about equity and tradeoffs in program design, such as how to balance paperwork and reward multiple ecosystem services. Finally, such a study could pointedly ask farmers to identify characteristics of PES program design that would deter them from enrollment.

While this research did not provide generalizable, predictive information, it offers insight and some lessons into the most important factors influencing conservation adoption among farmers in Vermont's current context, which could apply to developing PES in New England and beyond. The information has a high level of relevance to current developments in conservation incentive programs in the United States and elsewhere. This exploratory qualitative study identifies important themes and nuances of debate, which sets the foundation for follow-up quantitative explanatory studies.

Limitations. Participation in our study includes a breadth of farming production contexts and perspectives in Vermont, but it is small and not representative. Our sample is also less gender balanced than the state's farming population, 42% of whom are female (USDA NASS 2017). However, future research could seek to engage a more representative and diverse sample, including grain growers and poultry farmers. Due to the small sample size and selection bias of participants it is not appropriate to generalize our voluntary focus group results to the entire population of US farmers.

Summary and Conclusions

Our research provides insight on the phenomena of farmer decision-making and perspectives on PES program design that will be of interest to policy makers and conservation program designers. We explored factors that influence participation in state-sponsored PES through focus groups with Vermont farmers.

Soil health is perceived to deliver multiple ecosystem service co-benefits, offering a positive, unifying heuristic through which farmers understand ecosystem service provisioning. However, policy built around farmers' soil health heuristic is likely to be at odds with the reality of complexity in ecosystem service supply because there is potential for soil health to generate unintended ecosystem dis-services. Alternatively, policy built to reflect the real complexity of ecosystem service supply from agriculture is likely to be both complex, and poten-

tially at odds with farmers' understandings. A program based on science that is at odds with farmers' understandings may have additional challenges to farmer participation, particularly the unifying soil health heuristic identified in our study.

Although farmers expressed a desire for more information about ecosystem services performance, our study identified the potential for tradeoffs and ecological complexity to confound the use of this information. Ecological complexity additionally presents communication and program design challenges for PES programs. Trusted intermediaries emerged as critical to communicating information about tradeoffs and the complexity of ecosystem service provisioning from farms. Extension professionals were identified as the trusted advisors in Vermont who supported farmers in accepting and understanding challenging information, and may be the key to successfully addressing the more complex challenges in PES implementation that our study exposed.

Our conversations revealed a strong stewardship ethic among farmers and a diversity of perceptions about the values imparted by a PES program. Program design and framing that reinforces stewardship may preserve this altruistic motivation, whereas a program designed and framed around financial compensation may crowd out stewardship motivations. Long-term sustainability, and potentially ecological impact, will be best served by a program that preserves and galvanizes long-term stewardship among farmers, but this may be at odds with immediate program efficiency in meeting specific environmental goals.

We found that participation in PES could be enhanced by programs that appeal to stewardship motivations, deliver adequate compensation to enable management changes, use trusted intermediaries to communicate, and deliver context-specific information on how farm management impacts measurable ecosystem service provisioning. Designing a program that meets all of farmers' stated goals is unlikely, as many goals have contradictory implications for program design. Thus, PES has the potential to enhance adoption of conservation practices and the supply of ecosystem services, but its development must make hard decisions about priorities and desired impact.

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