

REVIEW

Private Landowner Conservation Behavior Following Participation in Voluntary Incentive Programs: Recommendations to Facilitate Behavioral Persistence

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Abstract

Voluntary incentive programs are a keystone policy tool for increasing private landowner conservation behavior. Although landowner participation in conservation incentive programs is well studied, limited empirical research has focused on whether and why landowners continue to conduct conservation practices on their land after payments end, which we term *persistence*. The assumption is that a landowner who participates in an incentive program will likely continue the conservation practice after the payments end. This assumption fits with conservation policies that limit the number of years or times a landowner can receive payments for a given practice. If persistence occurs, it would provide cost-effective outcomes from conservation funding investments. However, there is little published information to support persistence. Based on the narrow body of research on persistence of landowner conservation behavior, as well as persistence research in other fields, we identified five pathways that may support persistence outcomes and insights for when persistence could be expected. We then provide recommendations for policy, practice, and research. With billions of dollars invested annually in programs to incentivize landowners to take conservation action, an empirical examination of landowner conservation behavior persistence is sorely needed for shaping more effective incentive programs and policies.

Introduction

Financial incentives are a popular policy tool for promoting private land conservation. In the United States, federal conservation programs can be traced to the Dust Bowl in the 1930s (Claassen *et al.* 2008). Their purview has expanded from soil conservation to a wide range of conservation practices and programs, such as wildlife habitat conservation (Ciuzio *et al.* 2013). Similarly, Australia and the United Kingdom also have a long history of voluntary incentive programs (Kamal *et al.* 2015). As Kamal *et al.* (2015) describe, these incentive programs utilize both outright purchasing of private land and conservation easements. In this article, we focus on a third strategy that does not have the same level of conservation security as the first two categories: financial

incentive programs and contracts that allow landowners to voluntarily participate in conservation activities while maintaining their ownership of the land (Kamal *et al.* 2015). These programs generally have a fixed term (e.g., 1–20 years) (Kuhfuss *et al.* 2015), although the contracts may be extended, depending on factors such as landowner preference, funding availability, and program policies. Financial incentives may be monetary (e.g., cash payments), nonmonetary (e.g., tax credits, technical assistance), or cost share agreements with landowners (Doremus 2003). This approach has been lauded as an effective way to encourage voluntary behavior change by landowners, who are often resistant to government intervention on their lands through regulation (Doremus 2003) or simply struggling to make ends meet on their lands (Swann & Richards 2016). Conservation incentive

programs create substantial environmental benefits, such as the production of critical wildlife habitat on private lands (Ciuzio *et al.* 2013; DiGaudio *et al.* 2015).

Public agricultural institutions, state wildlife and natural resources agencies, nongovernmental organizations, and collaborations of agencies and organizations across the globe invest large sums in implementing voluntary financial incentive programs. While no bundled expenditure total is available on a global scale, the magnitude of investment is easily apparent on a discrete basis. For example, United States Department of Agriculture's Natural Resource Conservation Service (NRCS) conservation program expenditures under the current U.S. Farm Bill (the Agricultural Act of 2014) were \$5.7 billion in 2015 (ERS 2016). Expenditures on agri-environment measures in the European Union amounted to 20 billion EUR from 2007 to 2013 (European Commission 2017).

Given the substantial expenditure globally, an increasing emphasis is being made on strategically prioritizing investments. Recent changes in U.S. Farm Bill programs to become more regional and highly focused on critical conservation outcomes (e.g., Working Lands for Wildlife, Regional Conservation Partnership Program (RCPP)) reflect this shift (Ciuzio *et al.* 2013; Reimer 2015). For example, the RCPP creates regional conservation initiatives that are up to 5 years in length and generates assistance from multiple partners using fund-matching and a competitive application process (Reimer 2015). Strategic investment decisions, such as which RCPP initiative to fund, have been primarily defined biologically, rather than socially. Programs tend to be justified based upon the conservation status of a species or another resource that will benefit from conservation practices, and they are typically evaluated based on biophysical outcomes (e.g., acres treated, bird response). Further, while programs are rarely designed in terms of targeted social outcomes (e.g., landowner conservation stewardship attitude change, durability of landowner behavior change), positive social outcomes appear to be assumed (Burton *et al.* 2008; Race & Curtis 2013).

Landowner adoption of conservation practices (Prokopy *et al.* 2008; Baumgart-Getz *et al.* 2012) and participation in voluntary incentive programs (e.g., Sorice *et al.* 2011; Reimer & Prokopy 2014) have been well studied. However, research on landowners' continued use of conservation practices through time is lacking, which Reimer *et al.* (2014) highlight as problematic given that most conservation gains rely on sustained behavior changes. In particular, little empirical research has focused on whether and why landowners continue their conservation behaviors after short-term financial incentive payments end (Swann & Richards 2016). We term this "persistence," as it is a continuation of a

course of action or behavior (see Figure 1). The term "persistence" has also been used in literature outside of landowner research, such as on household energy conservation behavior related to behaviors continuing after an intervention has ended (Frey & Rogers 2014). Existing research on landowner continuation of agricultural innovations in general has used the terms continuance, maintenance, or confirmation (e.g., Dunn *et al.* 2016), but these terms do not distinguish the important context of postprogram behavior. The reverse behavior, when a landowner returns to the precontract management behavior s/he was previously using (i.e., returning a retired field to crop production, as in the case of the Conservation Reserve Program (CRP)), has been termed disadoption (Claassen & Ribaudo 2016), discontinuance (Rogers 2003), or reversion (Kuhfuss *et al.* 2015). While it is often assumed that satisfied landowners progress from enrollment to reenrollment (if permitted) to persistence (Figure 1), what remains largely unknown is what happens when payments stop: persistence or reversion? And why?

Given the need for attention to persistence of landowner conservation activities, the purpose of this article is to explore (1) the rationale of persistence as a goal for conservation incentive programs; (2) what information exists to substantiate the assumption that persistence happens postprogram when payments end, particularly in the cases of behaviors that must be continued on a regular basis; (3) what is known about factors that predict persistence (or not); and (4) the policy and program implications of this review, as well as research needs.

Persistence as a goal of conservation incentive programs

Conservation incentive programs around the world appear to have ambitions for landowner activities extending beyond payment contracts. Programs and policies have aimed to develop stewardship ethics and enduring attitude change, with long-term management changes implied as a result. In Australia, for example, conservation programs such as the National Landcare Program are based on the idea that investments will lead to long-term changes in landowner management practices (Race & Curtis 2013). Specifically, Curtis & De Lacy (1997) concluded that the National Landcare Program was meant to achieve sustainability goals, in part, by developing a stewardship ethic among participants. In the European Union, cultural changes, such as proenvironment attitude shifts, are also an implicit goal of voluntary agri-environmental programs (Burton *et al.* 2008). Similarly, changing landowner stewardship ethics and attitudes are

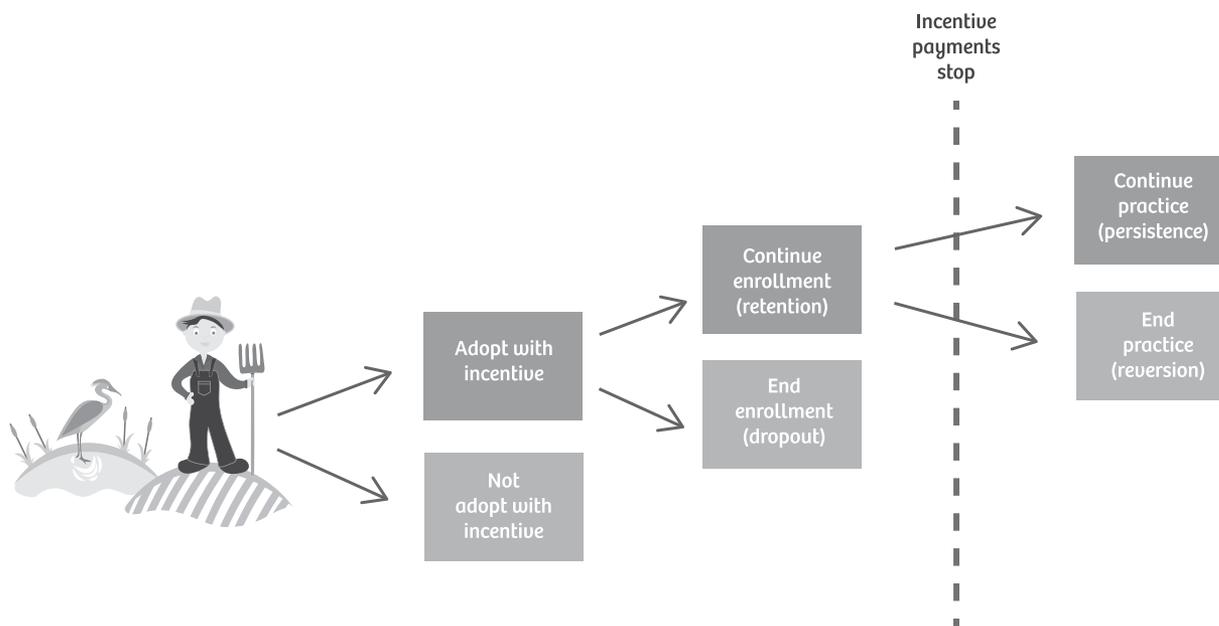


Figure 1 Steps of landowner participation in incentive programs—the model for persistence.

considered important goals for the NRCS in the United States. Language used by the former NRCS chief (White 2011), specific conservation programs (e.g., Florida NRCS 2007), and the agency's National Planning Procedures Handbook (NRCS 2013) provide evidence to support this claim. Changes in landowner attitudes toward conservation and land stewardship may have immediate benefits for management effectiveness under contract, but we expect the primary agency motivation is more likely to affect long-term behavioral changes.

While official positions on landowner persistence are mostly implicit, persistence could be an important consideration for conservation incentive programs to achieve conservation goals while most strategically using funds. It has been argued that short-term conservation incentive programs are “temporary bribes, shallow in operation, and transitory in effect” (Morris & Potter 1995) unless they create lasting changes in participant attitudes and behaviors (Burton *et al.* 2008). If conservation funding is limited, landowner persistence becomes crucial to obtaining long-term ecological benefits through voluntary incentive programs. The most direct benefit of persistence outcomes is cost-effective conservation. This thinking is reflected in a U.S. Department of Agriculture Economic Research Service report:

The ultimate goal of transition incentive payments, however, is to encourage farmers to adopt conservation management practices for the long run. When a short-term payment leverages a long-term change

in practices, the environmental benefits can be much larger than if the practice is dropped when the payments end. (Claassen *et al.* 2014)

While Claassen *et al.* (2014) were referring to farming management practices that would be profitable in the long term, the cost–benefit logic is the same for other conservation practices that use short-term contracts.

Persistence is particularly important in cases where a limited pool of landowners are available for enrollment because a small number of landowners meet the program requirements, own appropriate land for the conservation practices, or express interest in enrolling in a program. If saturation of potential program participants occurs and there is a limit on reenrollment, then it is even more important that persistence occurs. If no persistence occurred, there would be few new landowners to enroll, while past enrollees would no longer be conducting the conservation behavior, having reverted to past practices. In this case, conservation behavior could only be achieved again through enrollment in a different program, if the pool of landowners expanded (e.g., fewer restrictions), or if landowners changed their mind and persisted with the behavior. An example of this saturation likely occurred in the NRCS Waterbird Habitat Enhancement Program in northern California (Figure 2). The number of producers enrolled in the program peaked in 2014, then decreased each year as contracts were phased out of the program and landowners were unable to reenroll due to contract time limits. A follow-up program was

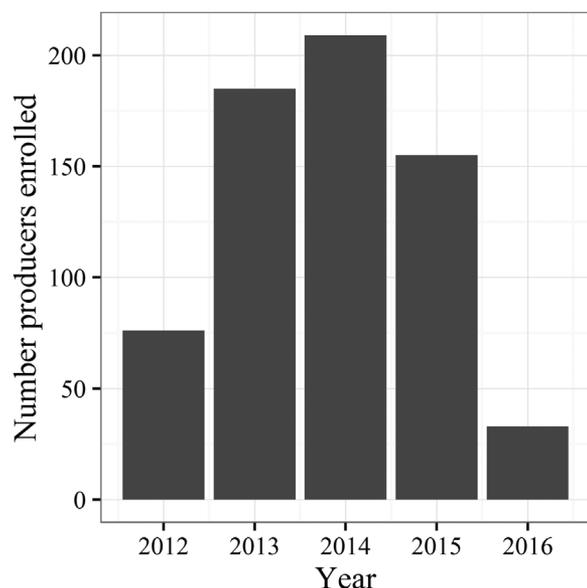


Figure 2 Number of producers enrolled each year in the NRCS Waterbird Habitat Enhancement Program in northern California (MBCP 2014). Most producers enrolled for the maximum of 3 years. The sharp decrease in the number of enrolled producers is likely a result of saturation of willing landowners in the program area.

created under an RCPP; about half the previous participants reenrolled. Persistence remains a concern, however, as these RCPP contracts are still only for a maximum of 3 years.

For conservation programs that provide wildlife habitat using short-term incentive funding, persistence could be highly important for wildlife conservation goals. Newly created or appropriately managed habitat may revert without landowner behavioral persistence. The effects of this unstable habitat provision would depend upon the natural disturbance regime of the habitat involved and the natural history of the wildlife species targeted. If the habitat is dynamic by nature, then species that rely on it likely evolved to move with the habitat; short-term contracts changing location on the landscape likely mimics how the habitat originally moved. Waterbirds using postharvest rice fields provide a good example of this scenario since water is naturally patchy on the landscape depending on precipitation (Elphick 2008). Many birds (e.g., waterfowl, shorebirds; Farmer & Parent 1997; Ackerman *et al.* 2006) and some fish (e.g., Sacramento splittail [*Pogonichthys macrolepidotus*]; Sommer *et al.* 1997) are mobile and can take advantage of newly formed habitat. The above-mentioned NRCS Waterbird Habitat Enhancement Program incentivized the flooding of rice fields which provided habitat for many waterbirds using this spatially dynamic flooded habitat. For this type of program, if persistence does not occur and reenrollment

is not an option, conservation gains would be ephemeral regardless of whether the system is naturally dynamic. If the system is less dynamic or if its dynamism is on longer time scales (e.g., fire regimes), the relatively short length of conservation contracts may not provide enough time to meet specific conservation goals. In addition, if target species are not highly mobile (e.g., small, terrestrial species such as giant garter snake [*Thamnophis gigas*; Halstead *et al.* 2013]) and appropriate connectivity to existing habitat does not exist, these species may have a harder time taking advantage of short-term habitat. Even worse, short-term habitat could become an ecological trap (Hale & Swearer 2016) if individuals settle in habitat that disappears as land reverts, rather than persists, when payments end.

Consistent, renewable funding—at program and landowner contract levels—could secure long-term environmental benefits and address issues such as enrollment pool saturation and habitat stability. Yet, this is not always a viable solution and is not the current direction of strategic conservation efforts, at least in the United States. For example, RCPP initiatives are limited to 5 years of funding with no option for an individual initiative to be renewed in its current form. Thus, facilitation of persistence of landowner conservation behaviors beyond the life of payments becomes even more critical.

Empirical evidence of postprogram behavior

A recent literature review by Swann & Richards (2016) highlighted the scarcity of research on landowners' conservation behavior postincentive payments. The authors reviewed behavioral persistence, which they termed "long-term behavior change," following conservation incentive programs in developed countries. The literature review analyzed 42 papers from peer-reviewed journals and gray literature pertaining to conservation behavior persistence. Yet, based on our analysis of these papers, only five papers attempted to explain persistence intentions/outcomes with empirical evidence, limiting the utility of this meta-analysis. We found three additional empirical studies of persistence through our literature search from August to October 2016 using Web of Science and Google Scholar. Two sets of search phrases were used "(‘conservation program’ OR ‘incentive program’ OR ‘agri-environment* program’) AND (disadopt* OR confirmation OR reversion OR maintenance OR persist*)" and "(landowner OR farmer OR ‘private land’) AND (‘post contract’ OR ‘after contract’ OR ‘long term’) AND (behavior OR practice OR management)." Articles were also forward and backward citation searched within

Table 1 Empirical studies focused on behavioral persistence following conservation incentive programs

Study authors	Location	Program	Behavioral intention
Skaggs <i>et al.</i> (1994)	New Mexico, United States	Conservation Reserve Program	Farmland retirement
Johnson <i>et al.</i> (1997)	Texas, High Plains Region, United States	Conservation Reserve Program	Farmland retirement
Roberts & Lubowski (2007)	Contiguous United States	Conservation Reserve Program	Farmland retirement
Jackson-Smith <i>et al.</i> (2010)	Little Bear River watershed, Northern Utah, United States	Little Bear River Watershed Project	*Water quality best management practices
Ramsdell <i>et al.</i> (2015)	Nebraska, United States	Rocky Mountain Bird Observatory mountain plover program	Practices related to plover nest protection, marking
Kuhfuss <i>et al.</i> (2015)	France	Mesures Agro-Environnementales territorialisees	Range of agri-environmental practices
Race & Curtis (2013)	Southeast Australia	Multiple natural resource management programs	Natural resource management practices
Hayes (2012)	Colombia	Payment for Ecosystem Services Silvopastoral program	Silvopastoral management practices

*This study measured actual landowner behavior instead of behavioral intention.

those databases. Geographically, these eight total empirical studies were located in the United States (5), Australia (1), Europe (1), and Colombia (1) (Table 1).

Seven of these eight empirical persistence studies focused on behavioral intentions, rather than documenting actual behavioral persistence (Table 1). This is potentially problematic because stated intentions, while informative, do not fully predict human behavior (Webb & Sheeran 2006). The reliability of intentions to causally determine behavior is particularly weak in contexts that involve social reactions, low behavioral control, and the potential for habit-forming (Webb & Sheeran 2006), all of which may be relevant for land management behaviors. These studies of landowner intentions following conservation program contracts show highly variable persistence rates. Landowner intentions to persist with conservation practices following incentive programs have been as low as 31% (Johnson *et al.* 1997) or as high as about 85% (Jackson-Smith *et al.* 2010; Hayes 2012).

In the United States, persistence research has been primarily concentrated on quantifying reversion rates after CRP participation, with less attention on understanding why landowners persist or revert. A few publications surveyed landowner intentions to return CRP land to crop production after program exit, or modeled this same land use decision (for example, Skaggs *et al.* 1994; Johnson *et al.* 1997; Roberts & Lubowski 2007). While these studies are valuable, a focus on land retirement programs has limitations because research suggests conservation practice type has an influence on persistence outcomes. Jackson-Smith *et al.* (2010) found an actual persistence rate of about 83% for structural, planting, clearing, and leveling agricultural best management practices, in contrast with continuous management practices that were continued by less than half of the landowners once payments ended. Hayes (2012) found similar results

in a Colombian program designed to decrease deforestation from agricultural expansion by improving pasture quality and promoting sustainable pasture management. After program participation, 85% of participants intended to continue using fences created from live trees, while only 41% intended to continue using pasture fertilizers.

Pathways to persistence

While these few studies on landowner persistence intentions offer some initial insights, in order to fully understand, predict, and influence persistence likelihoods it is critical to better understand the social mechanisms underlying persistence outcomes. Social science theory-based explanations for behavioral persistence can help us understand why conservation behaviors may or may not persist beyond the life of incentive program payments. We have identified five theory-based pathways by which landowners' conservation behaviors could be expected to persist or revert when conservation incentive payments end. Explanatory frameworks for behavioral persistence have been recently developed in other research contexts, including home energy use (Frey & Rogers 2014) and public health (Kwasnicka *et al.* 2016). Our proposed pathways (Table 2) are informed by these frameworks and by the extensive literature on landowner behavior, including the limited research on landowner persistence. While presented as five independent pathways, these pathways likely covary and influence/interact with each other.

Landowner cognitions

Landowner cognitions including environmental attitudes (Baumgart-Getz *et al.* 2012), attitudes toward specific practices (e.g., Dayer *et al.* 2016), and an individual's

Table 2 Proposed pathways for understanding landowner persistence behavior and example studies

Landowner persistence pathway	Description	Related landowner studies
Landowner cognitions	Landowners' attitudes toward, or perceptions of, the conservation behavior support continued use	Hayes (2012); Race & Curtis (2013); Kuhfuss <i>et al.</i> (2015)
Sustaining motivations	Motivations for performing a conservation behavior endure	Skaggs <i>et al.</i> (1994); Johnson <i>et al.</i> (1997); Ramsdell <i>et al.</i> (2015)
Habit forming	Performance of conservation behaviors becomes habitual	Sheeder & Lynne (2011)
Resources	Sufficient resources to maintain conservation behavior and/or overcome opportunity costs are available	Skaggs <i>et al.</i> (1994); Roberts & Lubowski (2007); Kuhfuss <i>et al.</i> (2015)
Social influence	Social norms and cultures support conservation behaviors	Burton <i>et al.</i> (2008); Kuhfuss <i>et al.</i> (2015)

perception of their ability to perform a given behavior (behavior control; Fishbein & Ajzen 2010) (e.g., Lynne *et al.* 1995) can influence landowner adoption of conservation practices. Cognitions such as these can also be changed by specific interventions (Frey & Rogers 2014), or through repeated performance of a behavior (Kwasnicka *et al.* 2016). If incentive program participation generated positive changes in landowner cognitions, persistence outcomes postincentive payments would be more likely.

Landowner attitudes and attitude changes have long been considered important for behavioral outcomes before and after conservation programs (Morris & Potter 1995; Wilson & Hart 2001). While attitudes can be difficult to change, research in other settings has shown that behavior change can lead to attitude change (Lokhorst *et al.* 2011). Yet, empirical evidence of landowner attitude change from conservation program participation has been mixed (Burton & Paragahawewa 2011). Previous research has focused on general attitudes toward conservation or the environment (Burton & Paragahawewa 2011), overlooking the possibility of attitude change toward specific conservation practices. Attitudes toward specific practices would be expected to have a closer causal influence on persistence outcomes, and deserve further scrutiny in this context. Positive program outcomes may influence landowner attitudes toward conservation practices and increase behavior persistence. For example, French farmers that perceived a higher quality of life during participation in an agri-environmental program were more likely to state their intention to persist with conservation behaviors after payments ended (Kuhfuss *et al.* 2015). Similarly, Race & Curtis (2013) suggested that Australian landowners were more likely to maintain natural resource management behaviors they perceived to be successful.

Landowner perceptions of behavioral control have been shown to affect conservation practice use. For example, landowners with a greater sense of control over the process of conservation practice adoption are more likely to adopt those practices (Lynne *et al.* 1995).

Perceptions of behavioral control are likely important after conservation programs as well, with landowners who feel more in control and capable of implementing conservation practices more likely to do so following an incentive program. Additionally, there is some evidence that incentive programs can increase landowner perceptions of behavioral control over specific conservation practices (Hayes 2012), which could facilitate persistence outcomes.

Changes in landowner cognitions can also be negative and counter persistence. For example, Hayes (2012) found that 89% of new conservation program participants thought the program would greatly improve their land, compared to only 47% among landowners who had completed the program. Negative experiences with a conservation behavior or program could cause a landowner to feel the behavior was not as desirable or controllable as initially thought (Kwasnicka *et al.* 2016). This reevaluation process could explain Kuhfuss *et al.*'s (2015) finding that French farmers who had experienced technical difficulties during conservation practice implementation had 50% lower persistence intentions.

Sustaining motivations

Landowner motivations, such as enjoyment of a behavior or satisfaction with behavioral outcomes, could provide a basis for behavioral persistence if the motivations endure beyond incentive payments (de Snoo *et al.* 2013; Kwasnicka *et al.* 2016). Landowner motivations to perform conservation behaviors have been broadly categorized as motivation to receive external rewards such as financial incentives (extrinsic motivation) or for internal satisfaction (intrinsic motivation). Intrinsic motivation is hypothesized to be more durable and more likely to result in persistence effects (Ryan & Deci 2000; Kwasnicka *et al.* 2016), although not all landowners have intrinsic motivation. Extrinsic rewards that may endure beyond financial incentives include spillover benefits from conservation practices, such as enhanced recreation opportunities. For example, Baumgart-Getz (2010) found that

farmers motivated by hunting opportunities were more likely to maintain fallow field best management practices.

Landowner motivations have been significantly correlated with landowner postprogram intentions. Skaggs *et al.* (1994) found farmers who were motivated to stop erosion on their property were more likely to persist with land retirement following CRP contracts. In another study of post-CRP decision-making, farmers who considered the financial value of the crop base in their decisions were more likely to revert to cropping after CRP contracts (Johnson *et al.* 1997). Finally, Ramsdell *et al.* (2015) found landowner self-determined motivation (a composite of intrinsic motivation and some types of extrinsic motivation) was positively related with farmer intentions to persist with mountain plover conservation practices.

Like the landowner cognitions discussed previously, participation in conservation programs could affect landowner motivations (de Snoo *et al.* 2013). When landowners receive financial incentives to conduct conservation behaviors, this may disrupt and “crowd out” existing internal motivation to perform that behavior (Rode *et al.* 2015). If “crowding out” occurred for a landowner with intrinsic motivation, persistence would be less likely to result. In contrast, under some conditions, financial incentives may cause the opposite effect and “crowd in” intrinsic motivation (Rode *et al.* 2015). “Crowding in” could be expected to increase intrinsic motivation and persistence outcomes regardless of prior motivation. Unfortunately, limited empirical evidence of crowding effects precludes conclusions about specific conditions in which crowding would influence persistence outcomes (Rode *et al.* 2015).

Habit forming

Research on public health and home energy conservation behaviors have proposed habits as another mechanism for persistence effects (Frey & Rogers 2014; Kwasnicka *et al.* 2016). Habits are defined as “an automated tendency to repeat a specific behavioral response,” such as turning off lights when you leave a room (Frey & Rogers 2014). Behaviors that are repeated frequently in the same environmental context are best suited for habit formation (Frey & Rogers 2014). Habits have been shown to exert a greater influence when behaviors are performed daily or weekly, while they are less important for annual behaviors (Ouellette & Wood 1998). Habits are relevant for a wide range of environmental behaviors including transportation use, waste reduction behavior, and home energy conservation behavior (Klockner 2015).

One commonly used indicator for habit strength is an individual’s past behavior (see Fishbein & Ajzen 2010). Using a similar definition, Sheeder & Lynne (2011) found

that landowners who had implemented conservation tillage in the past were more likely to adopt the behavior again, and concluded habits were responsible for this effect. Yet, this assumption that past behavior equates with habit formation is problematic as past behavior could operate in other ways (e.g., changing attitudes). The role of habits in landowner behavior has not been well studied. We expect that habits may particularly influence frequently repeated and simple conservation actions such as mowing fields or cutting shrubs.

Resources

Landowners may require resources such as time, capital, labor, knowledge, and equipment to continue conservation behaviors after incentive programs end. Resource needs are context-dependent but, in general, landowners with sufficient resources to maintain behaviors will be more likely to demonstrate behavioral persistence following conservation programs (Kwasnicka *et al.* 2016). While financial interests are not the primary consideration for every landowner, the financial costs and benefits of conservation practices remain a significant factor in landowner decision-making (e.g., Kuhfuss *et al.* 2015; Dunn *et al.* 2016). This relationship suggests persistence will be a challenge when payments end for landowners below a certain and unknown level of financial means.

Some conservation practices (e.g., forest management through timber harvest) may yield financial benefits for a landowner in addition to incentive payments. Practices that directly benefit a landowner and are either inexpensive or otherwise profitable to continue would thereby be better suited for persistence. For example, Kuhfuss *et al.* (2015) found that when incentivized practices had generated a better sale value for farm products (e.g., ecofriendly crops) farmer persistence intentions were higher. Incentive payments would primarily help landowners overcome initial investment costs required to transition to these new practices (Frey & Rogers 2014).

Conservation behaviors can also diverge from a landowner’s financial interests, such as by reducing financially driven land use for habitat protection. Persistence could be discouraged if conservation practices were too costly for landowners to maintain or if opportunity costs of continuing conservation behaviors were high. Opportunity costs are certainly relevant for land retirement programs such as CRP, where there is evidence farmers reverted CRP parcels to conventional production when commodity prices for corn peaked around 2012 (Wright & Wimberly 2013). Higher farmland quality (Roberts & Lubowski 2007) and larger enrolled areas (Skaggs *et al.* 1994) have also been significantly related

to farmer intentions to revert to cropping after land retirement programs. Other variables that may affect opportunity costs could include enrolled cover type (e.g., trees/wildlife habitat or grasses/legumes; Roberts & Lubowski 2007), and property location.

Social influence

Landowners make management decisions in social contexts that may or may not support persistence of conservation practices. A landowner's decision-making may be influenced by their beliefs about what other landowners are doing (descriptive norms) and what behaviors are socially approved (injunctive norms) (Fishbein & Ajzen 2010). These two types of social norms are tied to the specific community and culture in which a landowner is embedded. Social norms can have important impacts on persistence outcomes; Kuhfuss *et al.* (2015) found that farmer intentions to persist following a conservation incentive program were affected by information about other participants' persistence intentions. Additionally, landowners who perceived social acknowledgement of their conservation behaviors were more likely to state an intention to persist after the program (Kuhfuss *et al.* 2015). Social contexts are so critical that some authors have argued that conservation programs and practices must be adapted for existing norms and cultural frameworks (Burton *et al.* 2008).

Social norms are particularly relevant when conservation practices produce highly visible aesthetic consequences that can be judged by a landowner and their community. In these contexts, the persistence suitability of a conservation practice may depend on whether the resulting appearance of managed land is socially supported (Burton & Paragahawewa 2011; Riley 2016). For example, in a farming community that values visible outcomes of skilled behavior, stonewall construction and meadow habitat management, are likely better suited for persistence than unmanaged habitat reserves (Riley 2016).

It is plausible that cultural preferences and norms may change through conservation program exposure (de Snoo *et al.* 2013). After a 10-year period of incentive program participation, Riley (2016) found evidence for an alignment between farmer concepts of good farming and environmentally friendly farming practices. Conservation incentive programs that work with social norms and incorporate norm-based messaging may more effectively achieve persistence outcomes. Yet, research indicates that norms are often less predictive of landowner behavior, compared to other psychological variables such as attitudes and perceived behavior control (Dayer *et al.* 2016).

Recommendations for policy, practice, and research

Despite the importance of landowner behavior after voluntary conservation incentive program payments end, there is a scarcity of research on behavioral persistence. While agencies worldwide emphasize the development of a stewardship ethic or attitude change as positive social benefits of their programs, we identified a much richer set of five pathways by which conservation behavior could persist when incentive payments end. Notably, the evidence is mixed and often context or practice-specific, limiting conclusions about whether persistence should be expected or not. Basing any policy or programmatic decisions on an assumption that incentive program participation will lead to behavioral persistence when payments end appears problematic. This is particularly the case for management practices requiring costly and frequent landowner behaviors, as opposed to structural investments that are one-time costs. Based on our pathways, we believe practices with the following characteristics may be more likely to lead to persistence after payments end:

- (1) become easier to conduct over time or with practice,
- (2) create spillover benefits,
- (3) are compatible with landowners' motivations, needs, and goals for their land,
- (4) develop conservation habits,
- (5) provide financial benefits, or at least not lead to opportunity costs, and
- (6) are socially supported.

Similarly, persistence may be more likely with certain types of landowners. Particularly, those with financial resources to implement conservation practices without funding, those with intrinsic motivations, and those more (or less, depending on the context) driven by norms.

Given the above insights and others from our review, we offer the following recommendations for incentive program design and policies:

- (1) do not limit the number of reenrollments allowed for an individual landowner if a limited number of landowners is likely interested in the program or maintaining a best quality habitat on specific private lands is necessary;
- (2) do not limit the number of reenrollments for programs where landowners must continually apply a practice (on an annual or more frequent basis);
- (3) design programs that explicitly promote persistence when payments end (e.g., facilitate habit development, provide social support for behavioral

persistence by communicating the value of continued behavior);

- (4) incorporate persistence likelihood into proposal ranking formula by considering landowner or practice characteristics; and
- (5) prioritize funding longer term contracts and easements to ensure sustainability of conservation investments.

It is also apparent that social science research on landowner behavior persistence is essential. Priorities for such research include:

- (1) understand to what extent persistence is occurring after landowners stop participating in incentive programs.
- (2) learn more about what predicts persistence by researching which of the pathways we describe contribute to persistence and which do not. This is critical from an applied perspective to better design approaches to promote persistence (for example, does it help to maintain technical support and communication after payments end?).
- (3) study actual conservation behaviors after programs end (rather than behavioral intentions) to understand why landowners have or have not continued behaviors.

Such research priorities might be incorporated into monitoring and evaluation program priorities, such as the Conservation Effects Assessment Program (CEAP), a multiagency effort of the United States Department of Agriculture. Created in 2004, CEAP is charged with quantifying environmental effects of conservation practices and programs to better guide conservation policy (Briske et al. 2017). While CEAP has documented substantial environmental gains resulting from NRCS private lands conservation programs (e.g., Tomer et al. 2014), the long-term fate of many environmental benefits derived from short-term private land conservation programs depends on landowner decision-making after contracts expire. Thus, it would be worthwhile for this program to invest in understanding landowner conservation behavior in general, and persistence specifically. In order to ensure this research is possible, legal and administrative barriers (such as the 2008 Farm Bill's elimination of access to parcel-level data for enrolled lands) preventing social scientists from accessing conservation program participant information must be addressed (Rissman et al. 2017).

Conclusion

From a conservation perspective, landowner conservation behavior persistence after incentive program

payments end is desirable, providing for current and future conservation outcomes from current investments of taxpayer dollars. Yet, persistence cannot be assumed to be the outcome. Research to enhance understanding of the extent of behavioral persistence and its drivers must be prioritized, followed by strategic programs and policies that incorporate these insights.

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