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Insight, part of a Special Feature on Private Land Conservation – Landowner Motives, Policies, and Outcomes of Conservation Measures in Unprotected Landscapes

The Capacity-Building Stewardship Model: assessment of an agricultural network as a mechanism for improving regional agroecosystem sustainability

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ABSTRACT. Working lands have potential to meet agricultural production targets while serving as reservoirs of biological diversity and as sources of ecological services. Yet agricultural policy creates disincentives for this integration of conservation and production goals. While necessary, the development of a policy context that promotes agroecosystem sustainability will take time, and successful implementation will depend on a receptive agricultural audience. As the demands placed on working lands grow, there is a need for regional support networks that build agricultural producers' capacity for land stewardship. We used a social-ecological system framework to illustrate the Healthy Grown Potato Program as an agricultural network case study. Our Capacity-Building Stewardship Model reflects a 20-year experience working in collaboration with potato growers certified under an ecolabel in Wisconsin, USA. The model applies an evolving, modular farm stewardship standard to the entire farm—croplands and noncroplands. The model demonstrates an effective process for facilitating communication and shared learning among program participants, including agricultural producers, university extension specialists, nonprofit conservation partners, and industry representatives. The limitation of the model in practice has been securing funding to support expansion of the program and to ensure that the ecolabel standard is responsive to changes in the social-ecological system. Despite this constraint, the Capacity-Building Stewardship Model reveals an important mechanism for building regional commitment to conservation, with agricultural producers in a leadership role as architects, adopters, and advocates for stewardship behavior. Our experience provides important insight for the application of agri-environment schemes on private lands. The durability of a conservation ethic on working farms is likely to be enhanced when networks engage and support producers in an ongoing stewardship dialogue. Stewardship networks provide a means for coordination of conservation practices across property boundaries; with sufficient enrollment, they can achieve the spatial scale necessary to enhance regional agroecosystem sustainability.

Key Words: *agroecosystem; Capacity-Building Stewardship Model; ecolabel; ecosystem services; social-ecological system framework; stewardship network; sustainability; working lands*

INTRODUCTION

The human population is expected to grow to more than 9 billion by 2050 (United Nations 2013), which raises questions about our ability to meet global demand for agricultural products while maintaining ecosystem services—the benefits of nature on which human society depends (Tilman et al. 2002, Foley et al. 2011, Jarchow et al. 2012). Advancing sustainability (as described by Pretty 2008) in working landscapes will require a paradigm shift, in which agricultural operations are diversified to include production of ecosystem services as well as agricultural commodities. We use the term stewardship to describe this active management of the whole farm as an agroecological system, with practices applied to both croplands and noncroplands, and production of ecosystem services as an explicit function of the agricultural operation.

National conservation programs targeting working lands have been important in lessening the negative environmental externalities produced by agriculture. The advantage of national programs is that they can operate at the spatial scale necessary to improve conservation outcomes. These programs, however, have been relatively ineffective in building landowner stewardship capacity due to their reliance on generalized management prescriptions and an emphasis on single-resource rather than ecosystem-based management. In the policy context, private agricultural lands have been viewed and managed as a patchwork consisting of distinct production and nonproduction lands. Although public investment in farm conservation has yielded significant private and public benefits (Heard et al. 2000, Primdahl et al. 2003, Haufler 2005, Lant et al. 2005, Donald and Evans 2006, Belden et al. 2012), reliance on incentive payments as the primary method for attaining landowner commitment makes these programs vulnerable to changing market and policy contexts (Oñate et al. 2007, Hellerstein and Malcolm 2011, Uthes et al. 2011, Ribeiro et al. 2014). Effecting landscape-scale change through short-term contracts with individual landowners is financially unsustainable without strategic investment in long-term farm stewardship capacity.

Stewardship networks provide a mechanism for building regional expertise within the agricultural community and support for management of farms as agroecosystems. Engagement in a heterogeneous network moves all participants toward a better understanding of the social-ecological system, and the constraints and opportunities that exist for integrating conservation and production goals. However, an effective network must operate with sufficient support to facilitate communication, advance research to answer important questions concerning regional agroecosystem sustainability, and continue to adapt to a dynamic working landscape.

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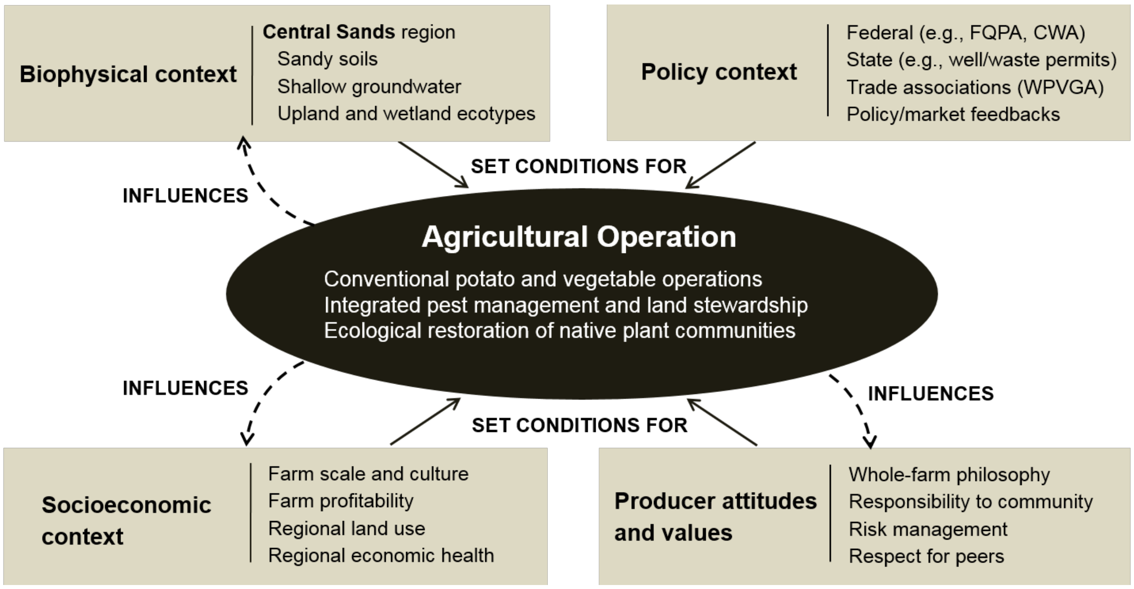
Fig. 1. Relationships among biophysical, social, economic, and actor contextual factors and their influence on the agricultural operation(s) enrolled in the stewardship network. To be effective tools for improving farm sustainability, management prescriptions and outreach initiatives must account for the social-ecological context of the agricultural operation. Solid arrows represent direct links between drivers; dashed arrows represent feedback interactions. Adapted from Ostrom 2007. (FQPA: U.S. Food Quality Protection Act; CWA: U.S. Clean Water Act; WPVGA: Wisconsin Potato and Vegetable Growers Association).



The social-ecological system (SES) framework is a useful tool for analysis of complex resource systems operating at multiple spatial and temporal scales (Ostrom 2007, McGinnis and Ostrom 2014). This framework can be applied to diverse agricultural systems, which are nested within interacting social, institutional, and biophysical contexts. Together, these contextual factors establish the ecological, legal, societal, and economic constraints within which an agricultural producer can operate (Fig. 1). The SES framework is particularly valuable for assessment of feedbacks between social and ecological components of the system, and in making predictions for how these interactions may change system components over different time scales (Binder et al. 2013). Our 20-year experience working with growers enrolled in the Wisconsin Healthy Grown Potato Program has demonstrated the potential for an agricultural network to advance regional agroecosystem sustainability, and merits further exploration. In the next section, we provide background about the Healthy Grown Potato Program, followed by a qualitative SES framework assessment of the relevant variables in our case study.

ASSESSMENT OF THE AGRICULTURAL STEWARDSHIP NETWORK

Program history, challenges, and evidence of success

When the Wisconsin Healthy Grown Potato Program was launched in the mid-1990s, one of the original goals of the network was the creation of an ecolabel—Healthy Grown®—which would generate a price premium for enrolled producers that was designed to offset the added costs of the program (Lynch et al. 2000). To date, the ecolabel has not generated a price premium in the marketplace, and evidence for consumer support of ecolabeled products is ambiguous (Loureiro et al. 2001, Peattie 2010, Moser and Raffaelli 2012). Consequently, the program does not generate financial support for sustainability improvements to the farm operations, and proceeds from the ecolabel are unavailable to fund operations of the stewardship network. Enrolled producers have communicated, however, that their participation in the network has improved their access to retailers interested in sustainably produced potatoes. This advantage has extended to the entire Wisconsin potato industry, as the leadership of the enrolled producers in advancing sustainability of potato production has contributed to the perception that Wisconsin potatoes are "greener" than those produced in other regions. The land base enrolled in Healthy Grown has grown steadily in recent years as new growers have recognized the benefits of access to innovative research, farm management recommendations, and the stewardship advice of other producers in the network.

Interest in the sustainability goals (Table 1) of the Wisconsin Healthy Grown Potato Program remains high. The network has retained its founding members for more than two decades, and in 2015, more than 3400 cultivated hectares were enrolled in the program. This area represents more than 20% of Wisconsin's fresh potato production (Wisconsin Potato and Vegetable Growers Association, 2015, *personal communication*). Enrolled farms also include 100 ha of nonproduction land managed for conservation of biological diversity and ecosystem services. Vegetation surveys conducted in 2012 revealed high-quality ecological remnants—including both wetland and upland ecosystems—with 447 native plant species identified on four sampled farms (total sampling area = 8.5 ha) (Duff 2014). We found that enrolled farms serve as reservoirs of regional biodiversity, and it is in the interest of the stewardship network to build the capacity of enrollees to protect that diversity.

Table 1. Early participants in the Wisconsin Healthy Grown agricultural network developed a shared vision that was translated into five sustainability goals.

Sustainability goals of the Wisconsin Healthy Grown Potato Program
Increased adoption of integrated pest management practices across the Wisconsin potato industry
Reductions in the use of pesticides with high human and environmental risks
Conservation of regional biodiversity
Increased access to national agricultural policy discussions
Development of marketplace incentives to fund the network and generate a return to producers

Identifying variables of the social-ecological system

Using the SES framework, we categorized descriptive variables, modified from examples provided in McGinnis and Ostrom (2014), that represent the social-ecological system components and action situations relevant to our stewardship network. We identified the components and relationships in the system that are directly and indirectly influenced by the work of the Wisconsin Healthy Grown Potato Program; in the next section, we provide example action situations from our case study to illustrate our Capacity-Building Stewardship Model. These examples demonstrate the role of the stewardship network in generating or changing interactions in ways that improve agroecosystem sustainability.

McGinnis and Ostrom (2014) describe seven interacting first-tier variables that affect sustainability of social-ecological systems: actors (A), resource systems (RS), resource units (RU), governance systems (GS), action situations (I, O), related ecosystems (ECO), and social, economic, and political settings (S). Each of the first-tier variables can be subdivided into a hierarchy of nested variables that represent more detailed characteristics of that component of the system and are relevant to the Wisconsin Healthy Grown Potato Program case study (Table 2).

Actors are consumers or producers (extractors) of resources. The Healthy Grown network includes agricultural producers as well as actors representing academic, industry, nonprofit, and government institutions. The agricultural network originated as a collaboration between the Wisconsin Potato and Vegetable Growers Association (WPVGA) and the World Wildlife Fund (WWF). At a National Potato Council meeting, agricultural producers representing the Wisconsin potato industry and staff from WWF had identified a shared interest in advancing stewardship on potato farms (Bussan et al. 2012). After subsequent discussions, a Memorandum of Understanding between WWF and WPVGA was signed in 1997 (Sexson, 2006, *personal communication*). This collaboration immediately attracted a small number of agricultural producers who were considered leaders within the Wisconsin vegetable-growing community. Shortly thereafter, the network grew to include more agricultural producers, the University of Wisconsin-Madison as a research partner, and two additional nongovernmental conservation partners, the International Crane Foundation and Defenders of Wildlife, who were interested in the network's sustainability goals. By 2000, all the engaged parties were official members of the Healthy Grown Potato Program.

The resource system relevant to this case study includes the farms from which network participants are producing agricultural commodities and ecosystem services. The Central Sands, the leading potato-growing region in Wisconsin, is the biophysical context for potato production. It is a region known for its high-quality recreational waters, shallow groundwater, and well-drained, sandy soils (Benbrook et al. 2002). These environmental characteristics make the system vulnerable to groundwater contamination (Bland 1999, Kraft and Stites 2003) and competing demands for natural resources (Kraft et al. 2012), which adds complexity to the regional social-ecological context.

Resource units in the Central Sands include the agricultural yield of potatoes and other crops in the rotation. Ecosystem services, however, can be measured in a variety of ways depending on the service of interest. Due to funding constraints, direct measurement of ecosystem services has not been a function of the agricultural network, though it is of interest to participants. Farm stewardship activities are also intended to conserve or enhance biological diversity, which can be measured in terms of abundance, species richness, biomass, or calculation of diversity indices.

Government agencies set the regulatory framework within which the agricultural producers operate, through interacting local, state, and federal laws. The Wisconsin Healthy Grown Potato Program, however, serves as an important governance system by setting stewardship standards that are higher than those established in the regulatory environment. The WPVGA, a nonprofit trade association, also influences social norms and expectations concerning resource use and management of the agroecological system.

Social, economic, and political settings and related ecosystems are the two first-tier variables that are external to the focal social-ecological system. The three examples for ecosystem variables provided by McGinnis and Ostrom (2014)—climate patterns, pollution patterns, and ecological flows into and out of the focal system—are also relevant to our experience. We have added groundwater as a third tier under the ecological flows subcategory. Regional economic development, demographic trends, and markets are external social, economic, and political settings variables that are relevant to this case study (Table 2). Notably, sustainability initiatives under development by national and international business interests (and, often in collaboration with national conservation and agricultural organizations) influence the context for the stewardship network, and act as external governance systems. The Healthy Grown Potato Program must be innovative so that enrolled producers can meet changing marketplace demands without compromising the regional sustainability goals of the network.

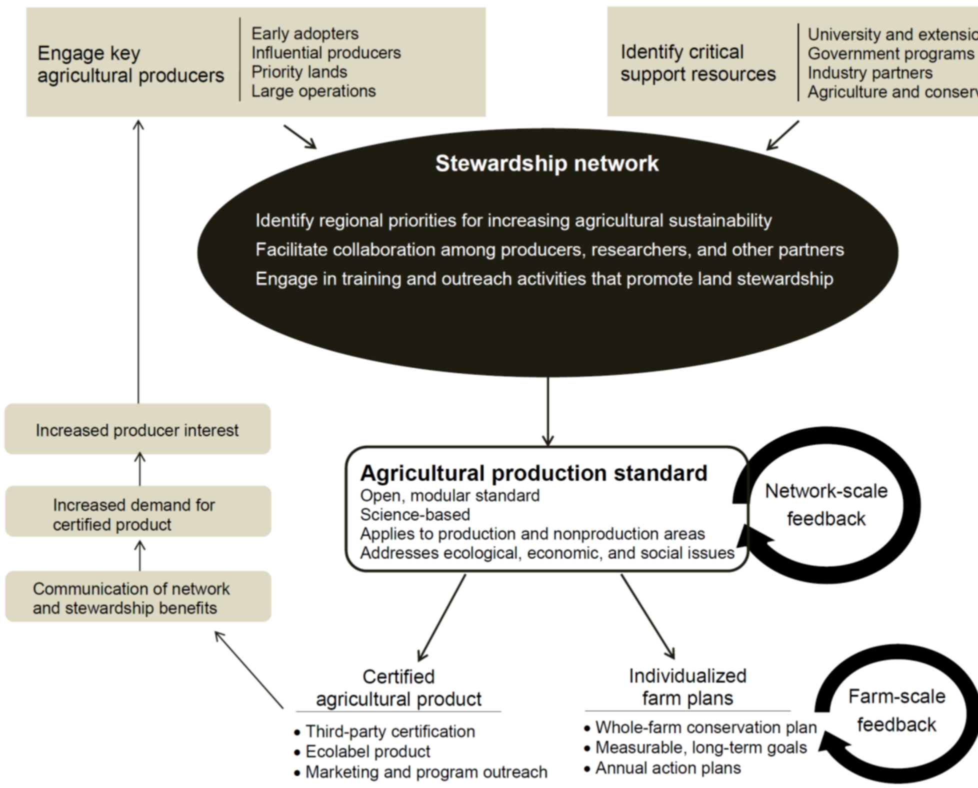
THE CAPACITY-BUILDING STEWARDSHIP MODEL

A successful model for building on-farm stewardship capacity must be applicable to a diversity of agricultural operations, and be responsive to the broad range in ecological, economic, and social conditions experienced by agricultural producers (Cunningham et al. 2013). The challenge for any conservation program applied to working lands is to be sufficiently responsive

Table 2. First-, second-, and third-tier variables of the social-ecological system (SES) that are relevant to the Healthy Grown stewardship network. Modified from McGinnis and Ostrom (2014).

First- and second-tier variables	Third-tier variables
Actors (A) - Participants in the Healthy Grown Potato Program	
A1 - Number of relevant actors	A1.1 - Number of network agricultural producers
	A1.2 - Number of network support personnel
	A1.3 - Number of network social scientists
	A1.4 - Number of network natural scientists
	A1.5 - Number of network collaborative organizations (by organization type)
A2 - Socioeconomic attributes	
A3 - History or past experiences	A3.1 - Time engaged in the stewardship network
	A3.2 - Expertise related to farm sustainability
A5 - Leadership	A5.1 - Leadership role(s) within the network
	A5.2 - Leadership role(s) outside the network
A6 - Norms (trust-reciprocity)/social capital	
A7 - Knowledge of SES	
A9 - Technologies available	A9.1 - Agricultural technologies
	A9.2 - Ecological technologies
	A9.3 - Social technologies
Resource systems (RS) - Central Sands Region	
RS1 - Sector	RS1.1 - Agriculture
	RS1.2 - Native and surrogate natural areas
	RS1.3 - Forestry
RS2 - Clarity of system boundaries	
RS3 - Size of resource system	
RS5 - Productivity of the system	RS5.1 - Productivity (agricultural)
	RS5.2 - Productivity (ecosystem services)
	RS5.3 - Productivity (biological diversity)
RS6 - Equilibrium properties	
RS7 - Predictability of system dynamics	
RS9 - Location	
Resource units (RU) - Measures of agricultural commodities and ecosystem services	
RU3 - Interaction among resource units	
RU4 - Economic value	
RU5 - Number of units	
RU6 - Distinctive characteristics	
RU7 - Spatial and temporal distribution	
Governance systems (GS)	
GS1 - Government organizations	
GS2 - Nongovernment organizations	
GS3 - Network structure	
Action situations (I →? O) - transformed by the Healthy Grown stewardship network	
I2 - Information sharing	I2.1 - Within the agricultural network
	I2.2 - Network information sharing with outside entities
I3 - Deliberation processes	I3.1 - Deliberations within the agricultural network
	I3.2 - Network deliberations with other entities
	I3.3 - Deliberations outside the agricultural network
I4 - Conflicts	I4.1 - Within the agricultural network
	I4.2 - Conflicts between the network or network participants and outside entities
	I4.3 - Conflicts external to the network
I8 - Networking activities	
I9 - Monitoring activities	I9.1 - Annual farm record-keeping
I10 - Evaluative activities	I10.1 - Independent, third-party certification
O1 - Social performance measures	O1.1 - Sustainability
	O1.2 - Economic performance
	O1.3 - Community support
O2 - Ecological performance measures	O2.1 - Resilience
	O2.2 - Biodiversity
	O2.3 - Sustainability
	O2.4 - Ecosystem services production
O3 - Externalities to other SESs	
Related ecosystems (ECO)	
ECO1 - Climate patterns	
ECO2 - Pollution patterns	ECO2.1 - Nutrient pollution
	ECO2.2 - Pesticide pollution
ECO3 - Flows into and out of the focal SES	ECO3.1 - Groundwater
Social, economic, and political settings (S)	
S1 - Economic development	
S2 - Demographic trends	
S4 - Other governance systems	S4.1 - National sustainability programs
S5 - Markets	S5.1 - Agricultural
	S5.2 - Ecosystem services

Fig. 2. The Capacity-Building Stewardship Model. Note that while the certified agricultural product is described as one result of the process, other products of the agricultural production standard, which applies to both production areas and nonproduction areas, include improved ecological services and biological diversity conservation. If the marketing of the certified agricultural product is successful in securing a price premium, this will facilitate expansion of the program to landscape scales that are ecologically meaningful.



to this variation while providing a viable template for decision-making that can be applied across systems. Furthermore, to retain founding members and attract new actors, an effective stewardship network must impart both economic and noneconomic value to participants. It is through long-term involvement that the greatest gains in stewardship capacity can occur.

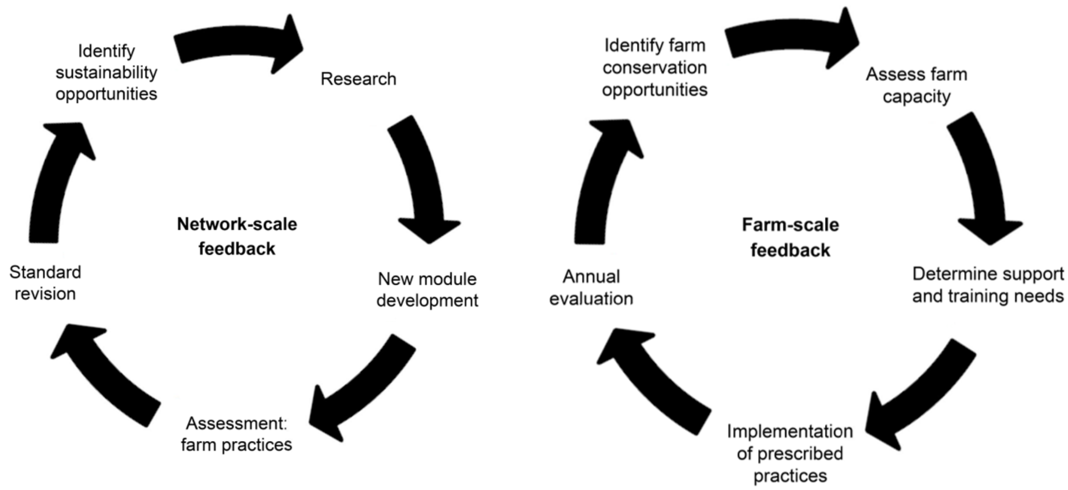
We have developed a generalized model (Fig. 2) that can be applied to other social-ecological systems in which stewardship capacity limits the advancement of regional agroecosystem sustainability. We are not proposing that stewardship networks can or should replace national agri-environment programs or marketplace incentives for conservation; each of these approaches has strengths and weaknesses, and sustainability is most likely to be achieved through integration of complementary approaches. In practice, national programs and markets can be an important source of funding and services that allow expansion of stewardship action over large spatial scales, while stewardship networks build the capacity and commitment of local or regional agricultural communities over sustained temporal scales.

Network recruitment and development

For ecologists and agricultural scientists, an agricultural stewardship network presents an opportunity to grow regional capacity for conservation of biological diversity and ecological services in addition to commodity production. For agricultural producers, it is important that the network make it possible for them to earn a living from the land when integrating conservation and production goals.

Actors (A) are brought together by an initiating entity. This process must be carefully planned, and led by individuals or institutions with the respect and credibility of stakeholders with varied perspectives and expertise (A3, A7) concerning sustainability in agroecological systems. Engagement in a heterogeneous stewardship network (GS3) is important, as this diversity has greater potential to transform social norms concerning environmental responsibility (Levin 2006). The composition of the network is fundamental to ensuring that interactions within the network and with the components of the larger social-ecological system are productive in enhancing regional agroecosystem sustainability. For example, information sharing (I2) and deliberation processes (I3) among agricultural producers, university extension professionals, agricultural industry representatives, and nonprofit conservation scientists yield sustainability solutions that are better suited to the social-ecological system. As the network produces benefits (O1, O2) for its participants and their community, the social capital (A6) of the network grows.

Fig. 3. Positive feedbacks for building network and farm stewardship capacity. The network-scale feedback (left) is used to advance the agricultural productions standard through a continual process of review and response to issues of regional sustainability. The farm-scale feedback (right) advances the stewardship capacity of enrolled producers through a conservation planning process that is responsive to the circumstances of each farm.



In our experience, the early (and continuing) leadership (A5) of agricultural producers in the development of the program is critically important to network performance (O1, O2). There is extensive literature on the role of peer-to-peer knowledge transfer in agricultural systems (e.g., Morton 2008, Atwell et al. 2009, McGuire et al. 2013), and agricultural producers are uniquely positioned to address the challenges of integrating land stewardship with agricultural production. The Wisconsin Healthy Potato Grown Program has benefited from the involvement of engaged and knowledgeable producers who are influential within the state potato and vegetable industry. Key agricultural producers who are important to network success may be those who meet one or more of the following conditions: (1) described as "early adopters" (i.e., producers who are particularly receptive to trying new practices); (2) hold leadership positions within their community or industry; (3) own or manage lands that are strategically important to meeting regional conservation goals; (4) own or manage significantly large or profitable operations, and are thus instrumental in affecting regional stewardship outcomes.

Network-scale feedback: the agricultural production standard

An important function of the network is its effectiveness in creating a shared vision (I2, I3) and implementation plan for agroecosystem sustainability. In our case study example, the network successfully translated its early shared goals (Table 1) into the Healthy Grown Potato Standard (WPVGA 2015), an open, modular, science-based set of best practices that are implemented by enrolled agricultural producers (Fig. 2). The open format allows for regular revision and expansion of the standard as the conditions of the social-ecological system change, in response to issues raised by program participants (I3), or with scientific advances (A9) related to agroecosystem management. By 2004, network members expressed interest in adding new modules to the standard, including the management of remnant and idle areas (Zedler et al. 2009). Agricultural producers described this idea as "managing their farm as a whole," while ecologists involved with the program discussed "restoration of native ecosystems."

The involvement of an interdisciplinary team of scientists as actor participants is important for ensuring the science-based credibility of the program, and for producing farm management recommendations that address the environmental, economic, and social conditions of the agroecosystem. A dynamic agricultural production standard also requires consistent funding for research and assessment, and to build the capacity of enrolled producers to integrate new practices into their farming operation. Dedicated staff time is needed to facilitate communication across constituencies in the network, so modules in the standard can be continually amended to incorporate new scientific and practice-based knowledge (Fig. 3). This has been the greatest challenge for the Healthy Grown Potato Program; for example, due to resource constraints, we have not yet added modules that are considered priorities among participating actors (e.g., groundwater conservation).

The agricultural production standard also serves as a vehicle for communicating the goals and practices of the network to members of the agricultural supply chain, Wisconsin agricultural producers, consumers, and the general public. The agricultural production standard, in effect, sets new performance expectations for agricultural production that exceed the minimum requirements established in the regulatory environment. These minimum requirements have proven ineffective for maintaining ecosystems services and biological diversity in landscapes with a high proportion of agricultural land use (Pretty et al. 2001, Stuart

2009, Morton et al. 2013). Agricultural producers enrolled in the Healthy Grown Potato Program test new farming practices through the agricultural production standard; those that are demonstrated to be effective in advancing farm sustainability are often adopted by agricultural producers outside the network.

Farm-scale feedback: the individualized farm plan

There is a substantial body of literature concerning adoption of best management practices within agricultural systems. The response of an agricultural producer to conservation recommendations varies with a number of factors, including geography, local culture, farmer experience, and the characteristics of the farming system (Knowler and Bradshaw 2007, Prokopy et al. 2008). While there is compelling evidence that awareness about environmental issues is a predictor of conservation behavior (Prokopy et al. 2008), this relationship is constrained by farm stewardship capacity, particularly as the complexity of prescribed management increases (Llewellyn 2007).

The vision developed by the participants in the Healthy Grown agricultural network is that the agricultural production standard be applied to the whole farm, including both croplands and noncroplands. In practice, time and financial resources limit agricultural producers' capacity to actively manage their entire farm for ecosystem services production. Participating Healthy Grown farms vary in ecological context, spatial scale, and business complexity, and we have found that building long-term farm stewardship capacity requires flexibility to adjust to these differences. To meet this need, the network-scale feedback is coupled with a farm-scale feedback (Fig. 3). Our approach has been to connect enrolled producers with support personnel from the University of Wisconsin-Extension and our partner conservation organizations. Each year, farm owners or managing staff work with network partners to identify the farm-scale issues and management recommendations that relate to each component of the agricultural production standard.

While the Healthy Grown agricultural network has successfully expanded cropland enrollment to 3400 ha, it has been challenging expanding noncropland stewardship (currently ~100 ha) at the same rate. Generally, noncroplands represent a smaller proportion of the agricultural operations than croplands. Yet even for those farms with more than one-third of their land base in remnant wetland and upland ecosystems, farm capacity for active management is limited, and without stewardship, biological diversity declines. Currently, our program facilitates planning for noncropland stewardship work, and we are able to provide staffing or funding support for implementation of only some of the required and recommended practices. A significant component of the annual planning support applied to the noncroplands is captured in the farm stewardship plan. Until 2015, enrolled producers worked with an ecologist each year to identify a list of priority actions that would improve conditions on ecological remnants or restored native ecosystems (e.g., application of prescribed fire, planting native vegetation, or control of invasive species). Enrolled agricultural producers have since asked for a more holistic, long-term approach to managing biological diversity and ecosystem services. Longer term planning opens the opportunity for implementation of more extensive and effective ecosystem restoration projects. In 2016, we piloted a process for development of long-term ecological management plans for all enrolled farms. We believe this process will be important for building long-term stewardship capacity by directly engaging enrolled producers in a conservation visioning process for their land. Annual management prescriptions, in turn, will be developed each year to meet the long-term objectives of this farm plan.

The long-term ecological management plans, like the agricultural production standard and the annual stewardship prescriptions, are important products of the agricultural network. Each requires significant investment by the Healthy Grown Potato Program that is not ordinarily supported through agricultural extension or technical support services. As with advancing the standard through new module development or revision, funding constraints have limited the training and advising capacity of the network, even as enrolled agricultural producers have advocated for greater stewardship gains.

Sustaining the network: continuous improvement, enrollment, and outreach

The open, modular agricultural standard provides a process through which network actors can continue to evaluate the sustainability of their agroecosystem. Continued evaluation, in turn, leads to standard improvement and expansion as new research or changes in the social-ecological context develop. Interactions among network participants also reveal knowledge or resource gaps, and highlight leverage points for growing regional stewardship capacity. Outreach and training events are then designed to meet these needs, and to communicate the accomplishments of the program to audiences outside the network.

There is often an assumption that the role of network participants from academic, industry, nonprofit, and government organizations is to inform or teach agricultural producers; this assumption constrains the potential of the network to develop sustainability solutions that are relevant and feasible within the farming context. It is critically important that the depth of experience that agricultural producers have with their land and production system is used in standard development, and in prioritizing network research, outreach, and training needs. This shared respect for actor expertise and responsiveness to social-ecological context increases the likelihood that the network will attract and retain participants.

The Healthy Grown ecolabel was one of the originating ideas of the agricultural network. Despite the limited market traction of the ecolabel, we have maintained a third-party certification process to ensure the credibility of the agricultural production standard to consumers, other agricultural producers, and the general public. Certified products can serve as an effective tool for communicating producer and industry commitment to stewardship practices, and, as in our experience, provide access to retailers interested in sustainably produced commodities.

Participants from the Healthy Grown Potato Program attend meetings and events where they can communicate the accomplishments and lessons of the network in practice. Yet it is often the unplanned conversations and interactions that circulate the expertise and shared experience of the network actors. When the network includes producers who are respected in the agricultural community, their example can shift the expectations concerning environmental stewardship in working landscapes. As enrolled agricultural producers gain experience and find value in stewardship practices, transformation of agricultural operations beyond the network becomes possible through peer-to-peer knowledge transfer (Miller et al. 2012).

CONCLUSION

Sustaining the health of Earth's systems will require the availability of an extensive land base for stewardship action. It is already clear that conservation of protected areas is insufficient for reversing current declines in biodiversity and ecological function (Perrings et al. 2006). Growing concerns about the negative environmental externalities produced by agriculture (Pretty et al. 2001, Power 2010, Meehan et al. 2011) and increasing global demand for agricultural products (Godfray et al. 2010) necessitate that we reconsider the important functions of the agricultural land base for human society. We have found that many agricultural producers want to be leaders in this transition.

The idea that agricultural producers already have a land ethic is not new (Leopold 1939). We assert that this land ethic requires a practical support system that nurtures the development of agricultural producers as land stewards of sustainable farms. This support system requires tools and partnerships that will fund the higher cost of sustainable whole-farm stewardship. The Capacity-Building Stewardship Model illustrates an important process for promoting and sustaining farm stewardship behavior, and when coupled with stable financial sources for stewardship implementation and innovation, networks can achieve the spatial scale necessary to improve regional environmental, economic, and social outcomes.

While the Wisconsin agricultural landscape still contains a relatively high proportion of remnant ecosystems, the Capacity-Building Stewardship Model is relevant even where remnant ecosystems are rare. Where diverse, functioning ecological communities persist in agricultural landscapes, agricultural networks can provide necessary support for building agricultural producers' capacity to protect and maintain these resources. In areas where little remains of the native biota, stewardship activities should prioritize restoration of ecological function and identification of management practices and land use that will be most likely to improve the sustainability of the regional social-ecological system.

Agricultural production comprises the dominant land use in many regions of the world, and management decisions applied to working lands may benefit or impair regional ecosystems. Although a conservation plan applied to one agricultural operation is unlikely to reverse regional declines in ecosystem health, the cumulative effect of coordinated stewardship across many farms can significantly improve regional environmental outcomes (Stuart and Gillon 2013). We recommend greater institutional and policy investment in stewardship networks as a mechanism for advancing regional agroecosystem sustainability. We have developed the Capacity-Building Stewardship Model as a template for initiation of agricultural networks in other regions.

Responses to this article can be read online at:
http://www.ecologyandsociety.org/issues/responses.php/9146

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