FEATURE

High crop prices and conservation

Silvia Secchi, John Tyndall, Lisa A. Schulte, and Heidi Asbjornsen

Raising the Stakes

Agricultural conservation policy does not happen in a vacuum but, rather, is linked to a myriad of other policies affecting individual farms, national and international trade, and energy production and distribution. While the primary purpose of commodity subsidies is to supplement farmer income, they have also had a strong influence on cropland expansion and agricultural intensification. One result of this expansion and intensification has been burgeoning crop productivity. Another has been a decline in the provision of *ecosystem services*, the benefits that people obtain from ecosystems. The services people obtain from *agro*ecosystems include soil stabilization and enhancement, water filtration and flood control, carbon sequestration, wildlife habitat, and recreation opportunities (e.g., hunting and wildlife viewing). This tension between farmer income support and the provision of ecosystem services is inherent to the current configuration of US agricultural conservation policies such as the Conservation Reserve Program (CRP). Developed during a time of crop surpluses, CRP was originally a set-aside mechanism to reduce both soil erosion and the overall amount of crops produced. Today, the program has a stronger focus on environmental impacts.

The recent emergence of the *bioeconomy*—which we define as the production, distribution, and consumption of agricultural goods and services to meet energy demands in addition to more traditional food and feed demands—and the associated recent trend in high crop prices pose both a challenge and an opportunity for US agricultural conservation policies. There is plenty of evidence that current high crop prices are having a negative impact on conservation programs, including CRP, in the United States (USDA FSA 2007a, 2007b). While lands enrolled in such programs provide abundant ecosystem services, conservatively estimated to be worth about \$1.4 billion per year (Claassen et al. 2001), these substantial private and public benefits are threatened as landowners choose not to reenroll their acreages. One opportunity provided by high crop prices is a diminished need to provide a financial safety net for farmers in the traditional ways; hence, an opportunity exists to develop separate policy instruments for separate goals and thereby increase the efficiency and transparency of government programs. The reason goes back to a basic tenet of economic theory: if there are several policy goals, potentially in conflict with each other, they are achieved more efficiently and with the least amount of economic distortion through separate policy instruments—one policy instrument per goal.

Here we address both this challenge and this opportunity. First, we outline current trends in CRP enrollment and the threat these trends represent to the continued provision of ecosystem services from agricultural lands. Next, we offer an alternative approach to achieving the ecosystem services delivered by CRP, one that more strongly and intentionally targets the spatial placement of CRP practices and the allocation of CRP funds to maximize benefit-cost relationships (Walter et al. 2007). Finally, we outline policy mechanisms that can support this alternative conservation approach.

Silvia Secchi is an assistant professor in the Department of Agribusiness Economics, Southern Illinois University, Carbondale, Illinois. **John Tyndall** is a post-doctoral research associate, **Lisa A. Schulte** is an assistant professor, and **Heidi Asbjornsen** is an associate professor in the Department of Natural Resource Ecology and Management, Iowa State University, Ames, Iowa.

CONSERVATION RESERVE PROGRAM ENROLLMENT AND ITS IMPLICATIONS

There are two types of CRP enrollment: general (established in its current form in 1985) and continuous signup (established with the 1996 farm bill). The vast majority of CRP acres fall under the general signup. Ecosystem services are taken into account in the general signup through an Environmental Benefit Index (EBI), which ranks land parcels that farmers propose to enroll according to a complex set of criteria, including wildlife, water quality, erosion, enduring benefits, air quality, and state or national conservation priority areas (USDA FSA 2003). The continuous signup, on the other hand, rewards practices that are implemented in specific locations within agricultural landscapes—for example, within riparian areas and on wetlands—but currently consists of less than 10% of CRP lands, or less than 4 million ac (1.57×10^6 ha) (USDA FSA 2007a). An offshoot of the CRP continuous signup program is the Conservation Reserve Enhancement Program (CREP), established in 1996, which rewards specific practices including filter strips, riparian buffers, grassed waterways, and wetlands. CREP has been implemented on 1.04 million ac (4.22×10^5 ha) in the United States (USDA FSA 2007a).

Of US agricultural conservation programs, CRP payments in particular are not keeping up with land rental rates (Secchi and Babcock 2007). This is a significant national conservation issue as a large portion of CRP contracts will be expiring in the near future. Of the almost 33 million ac (1.33×10^7 ha) in the general signup (figure 1a) that the USDA Farm Service Agency reported in the fall of 2007 (USDA FSA 2007b), over 15 million ac (6.35×10^6 ha) were slated to expire by the end of the year (USDA FSA 2007a).

Reprinted from the *Journal of Soil and Water Conservation*, Volume 63, Number 3. © 2008 by the Soil and Water Conservation Society. All rights reserved.

The pace of change is very fast: there was almost a 7% reduction in CRP acreage between September and December 2007 summary reports, and several states had CRP reductions substantially higher than that, with striking changes in Wisconsin and the Dakotas (table 1). Another 12 million ac (4.89×10^6 ha) are set to expire by 2010 (table 1; FSA 2007a).

US Deputy Secretary of Agriculture Chuck Conner recently stated that, given the current high crop prices and stock levels (USDA 2007), no general signup for new CRP acres would take place. No general signup means that any new conservation lands will come from continuous signup CRP or CREP. This may be a good thing: while these programs account for less than 10% of the overall CRP acreage at present, they also likely provide a higher percentage of the environmental benefits, due to their focus on specific landscape positions or practices. In other words, in terms of conservation, the American public is likely to get more "bang for its buck" from these lands than from general signup CRP lands.

However, as rental payments for the continuous signup are linked to soil rental rates used in general signup, the acreage in continuous enrollment is being reduced as well. The enrollment acreage for both continuous signup CRP and CREP in the next signup is projected to be 83% of the last signup (USDA FSA 2007c). Thus, according to current enrollment trends and expiration schedules, the amount of land in CRP overall will likely shrink by >17% by 2010.

Two further issues need to be considered. The first is that, although the Farm Service Agency is offering a short-term reenrollment and extension (REX) program for existing general signup contracts, these REX contracts are mostly short term. The length of the reenrollment period is based on EBI scores. Of the 23 million ac (9.43×10^6 ha) reenrolling in CRP through REX, only 15% are reenrolling in long term programs (i.e., 10- and 15-year contracts). The remainder are fairly evenly spread across 2-, 3-, 4-, and 5-year renewals, implying that approximately 4 million ac (~1.6×10^7 ha) of CRP will be going back into agricultural production each year for the next five years. The second issue is that the spatial distribution of reenrollment and of land coming out of the program is not homogeneous. Midwestern states at the center of the biofuel boom tend to have reenrollment rates lower than the national average of 83% (figure 1b). In some states, such as Iowa, CRP lands provide substantial wildlife habitat, recreational opportunities, and landscape diversity where little would exist otherwise. Upwards of 65% of Iowa is in continuous crops; natural habitats and public lands are limited in extent, at 14.6% and 2.1% of the land base, respectively (Iowa Gap Analysis Program 2002; USGS 2007). In addition, many states (e.g., Iowa, Illinois, Indiana, Wisconsin) with the lowest reenrollment are also the greatest contributors of nutrients and sediment to the Mississippi (USGS 2003) and, in turn, hypoxia in the Gulf of Mexico (Rabalais et al. 2002).

Driving these trends are the recent abrupt increases in agricultural land values and rental rates resulting from sustained high crop prices. Farmland in Iowa now sells for \$3,908 ac^{-1} (\$9,657 ha^{-1}) on average, up 18% from 2006 values (Iowa State University 2007). Opportunity cost payments—that is, payments compensating farmers for lost farming revenue due to participation in conservation programs—are having trouble keeping up with market crop prices and increasing land values (Secchi and Babcock 2007). In such situations, continued cropping on marginal lands and/or renewed cropping on former CRP land becomes economically attractive to private individuals or businesses in the short term. While the ecosystem services accrued by putting or keeping those lands in CRP may be more valuable to society as a whole than the crop-based opportunity cost, such considerations have limited leverage in private decisions. This is apparent when looking at current CRP reenrollment trends, but the public benefit-private decision problem is the same for all conservation payments linked to the opportunity cost of reduced crops.

Given the limited conservation dollars available, maintaining ecosystem services in the current agricultural environment will require a more strategic approach than that posed by either general signup CRP or the more environmentally oriented, yet restricted, continuous signup CRP. Strategies that maximize "bang for the buck" by targeting practices to locations that provide disproportionate benefits are needed. Such strategies have to (1) be based on science, (2) have support from local stakeholders, *and* (3) explicitly take into account the cumulative impact of practices over whole landscapes/watersheds. The CREP offshoot of CRP offers a good example of such an approach, but it is currently having difficulties in attracting participants because of current crop prices and the complexity of the program.

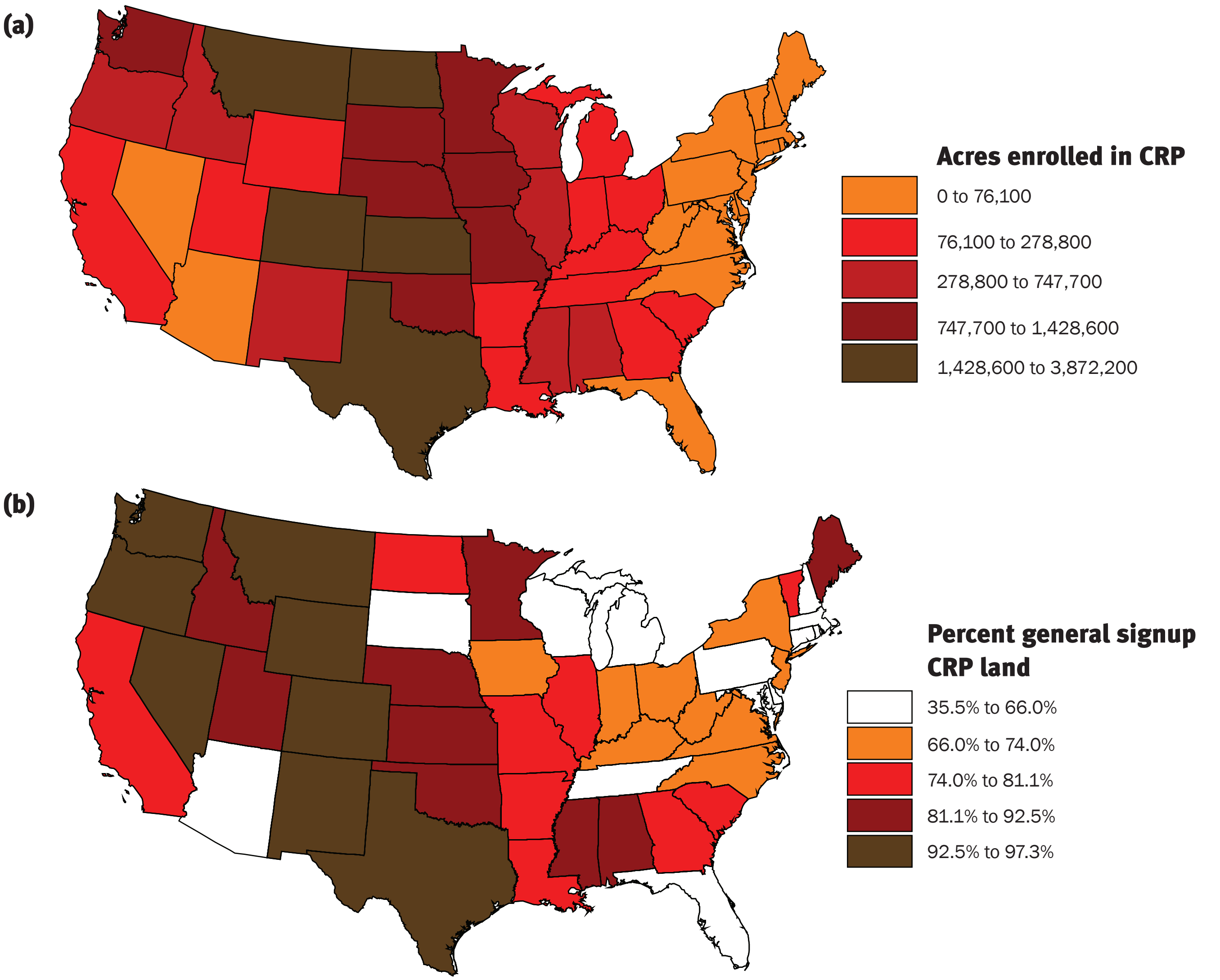
TARGETED APPROACHES: OPPORTUNITIES AND CHALLENGES

Walter et al. (2007) recently defined *targeted land management* as "the focusing of … practices on those specific portions of the landscape where they will have the greatest benefits at the lowest economic cost." We would go further and argue that a targeted conservation approach must explicitly include landscape and/or watershed considerations both from the standpoint of the land and of the people living on it to obtain the maximum amount of ecosystem services for a given budget. Targeted conservation approaches are founded on the premise that strategically placed conservation practices can produce disproportionate benefits relative to their total spatial extent (Schulte et al. 2006; Walter et al. 2007). A targeted conservation approach may, for example, establish perennial plant cover (e.g., the grasses, shrubs, and trees promoted in conservation programs) in landscape positions having particular characteristics (e.g., steep slopes, shallow soils, adjacent to water bodies), where the plant cover can have a greater impact on reducing nutrient and sediment losses compared to a more arbitrary or haphazard placement of the same practices (Dosskey et al. 2002; Tomer et al. 2003). Similarly, forming wildlife habitat networks by targeting wildlife habitat conservation or restoration efforts along species movement or migration corridors works to substantially boost population levels and/or viability over diffuse approaches (Groves 2003).

Motivations for targeting include the following: (1) crop production is only one

Figure 1

(a) Acres presently enrolled in the Conservation Reserve Program (CRP) general signup, and (b) percent total general signup CRP land with paid compliance fees for participating in the REX reenrollment and extension program (USDA FSA 2007a).



Note: Lower reenrollment occurs in Midwest states, illustrating the potential for substantial changes in the spatial distribution of CRP.

of the benefits that society expects to derive from agricultural landscapes (Pretty 2002), (2) scientific evidence attests to the greater ecological benefit to be derived from targeting conservation practices (Walter et al., 2007), and (3) the cost of conservation is not equally distributed over all portions of the landscape (Coiner et al. 2003). While agricultural landscapes supporting targeted practices would likely exhibit more complex mixtures of conservation practices, it is not expected that they would be any less productive. Because less land would need to be taken out of production in targeted compared to diffuse approaches, the total cost to both society and individuals may be similar or even lower relative to current approaches.

While the opportunity provided by targeting is intuitively simple—focus conservation effort on those areas of the landscape that provide the most "bang for the buck"—the challenges targeting poses should not be underestimated. First, the links between on-farm practices and ecosystem services are complex. The amount and type of ecosystem services delivered by a piece of land varies considerably from one site to another and over time, given variation in vegetation composition, soil conditions, and local weather among other things (Walter et al. 2007). Moreover, indicators of the quantity, quality, and duration of accrued ecosystem services through specific conservation practices are difficult to define, let alone measure (Brauman et al. 2007). For example, it is difficult to place a value on the benefit provided by a particular reconstructed wetland without long-term data on how it cycles and filters water. To further complicate matters, many environmental benefits are indirectly produced; that is, multiple ecosystem services are jointly produced by a single conservation practice, even though practices are often financed and implemented to produce a single, specific benefit. While riparian buffers are typically designed for maximizing

Table 1

Trends in Conservation Reserve Program (CRP) acres for the United States and select Midwestern states.

	General signup active acres (as of September 2007)	Percent general signup acres expiring 2007 to 2010	Total CRP active acres (as of September 2007)	Percent reduction in total CRP active acres between September and December 2007
United States	32,927,513	84.4%	36,829,377	6.07%
Illinois	664,851	68.8%	1,091,185	2.94%
Indiana	212,817	70.1%	316,932	6.75%
Iowa	1,427,153	84.9%	1,971,695	7.02%
Kansas	3,167,087	77.9%	3,259,929	3.96%
Michigan	191,729	68.8%	276,417	5.69%
Minnesota	1,453,658	76.2%	1,836,467	3.51%
Missouri	1,463,928	83.1%	1,595,910	8.61%
Nebraska	1,198,009	81.1%	1,341,522	6.85%
North Dakota	3,211,492	86.3%	3,389,686	11.59%
Ohio	222,398	69.5%	364,528	4.66%
South Dakota	1,342,533	85.1%	1,567,034	17.66%
Wisconsin	541,042	78.9%	607,262	12.35%
Midwestern states total	15,096,697	80.9%	17,618,567	7.90%

Source: USDA FSA 2007a, 2007b.

Table 2

Summary of agricultural payments and land allocations for the United States and select Midwestern states.

	Fixed direct payments ($ million) (2003 to 2006 average)	Conservation payments ($ million) (2003 to 2006 average)	Total federal payments ($ million) (2003 to 2006 average)	Thousands of acres of CRP (as of December 2007)	Thousands of acres of cultivated cropland (2003 estimates)
United States	5,549	2,557	17,420	34,594	309,867
Illinois	497	140	1,214	1,059	23,299
Indiana	253	58	609	296	12,535
Iowa	540	248	1,464	1,833	24,152
Kansas	348	133	795	3,131	24,619
Michigan	97	39	277	261	6,259
Minnesota	339	137	913	1,772	19,095
Missouri	199	135	547	1,458	10,235
Nebraska	357	100	922	1,250	17,745
North Dakota	240	124	601	2,997	22,011
Ohio	186	53	447	356	9,678
South Dakota	177	80	543	1,290	14,463
Wisconsin	122	64	447	532	7,790
Midwestern states total	3,355	1,311	8,779	16,235	501,747

Source: USDA Economic Research Service 2007; USDA FSA 2007a; USDA Natural Resources Conservation Service 2003.

nutrient uptake and sediment trapping for water quality protection/improvement purposes, they usually generate additional benefits including fish and wildlife habitat, enhanced recreation and aesthetic quality, and perhaps even biomass for bioenergy production (Schultz et al. 2004). Because a full accounting of the ecosystem services output would be so complex, difficult, and costly, quantitative estimates are perceived as incomplete or inaccurate (Diamond and Hauseman 1994). At the same time, technological advancements, such as remote sensing, geographic information systems, and ecological models, are enabling more rapid, accurate, and relatively inexpensive assessment of the impacts of land cover and land use change on the delivery of ecosystem services (Tomer et al. 2003), and may help guide the development and implementation of conservation policy in the near future.

The current lack of markets in the United States that account for ecosystem services accrued through conservation programs poses a further challenge. When well-defined markets exist for goods and services, there is often little reason for policy to interfere. However, the diffuse, complex, and public nature of air quality, water quality, carbon sequestration, wildlife habitat, open space, and other ecosystem goods and services make it very difficult to establish markets for them. An important consequence of the historical lack of markets and comprehensive valuation systems for ecosystem services is that current conservation payments simply pay for changes in land use, which *are assumed* *to* create, enhance, or protect particular ecosystem outputs deemed beneficial by society. Furthermore, in voluntary programs, practices often are applied in a somewhat piecemeal fashion and are subject to changes in landowners' decisions to participate, and conservation practices are implemented in isolation from adjacent landowners. Ultimately, the timing, duration, quantity, and quality of ecosystem services provision depends upon the consistency, management, and connectivity of conservation practices. Under the current piecemeal approach, ecological function over watershed and/or landscape scales is not guaranteed. A promising but difficult means of addressing this weakness may be to better link conservation payment systems with actual monetized benefits (Wilson and Carpenter 1999; Herriges et al. 2005; Knoche and Lupi 2007).

The many challenges associated with identifying and promoting targeted conservation practices, evaluating the ecosystem services they produce, and establishing effective markets discussed above underscore the need for more comprehensive, integrated, and effective policies. Such policies will likely rely on a portfolio of instruments ranging from market-based private incentives to voluntary, publicly funded targeting policies. The need for developing more effective targeted conservation policies is becoming increasingly urgent given the current economic environment of high crop prices and political pressure to promote energy security through the bioeconomy, juxtaposed with accelerating and potentially irreversible environmental degradation (Rhul et al. 2007). Past policies such as those established in CRP and CREP may need to be substantially modified in order to achieve conservation goals within today's rapidly changing social, political, and environmental context, as discussed below.

POLICIES IN SUPPORT OF TARGETED CONSERVATION

The public character and lack of markets for ecosystem services bring such services to the forefront of the conservation policy arena. As markets are not effective in producing these goods, policies have to be put in place to increase the provision of ecosystem services. While repeated studies have found that society highly values ecosystem services (Claassen et al. 2001; Loomis et al. 2000; Qui et al. 2006), competing demands for public dollars work to limit conservation expenditures. Policies that are firmly grounded in a targeted conservation approach may increase or improve the quality of delivered ecosystem services provided at a reasonable cost to society.

How could a targeted conservation policy work in practice? In the 2003 to 2006 period, conservation payments in the Midwest averaged \$1.3 billion (table 2). Fixed direct payments, the only commodity payments in effect at high crop prices in the current farm bill, have averaged \$3.3 billion (table 2). If we assume that both current conservation and commodity payments could be directed toward targeting, and high crop prices in the neighborhood of \$5 bu^{-1} (\$196.84 t^{-1}) for corn and \$12 bu^{-1} (\$440.92 t^{-1}) for soybeans are maintained (the Chicago Board of Trade futures markets are predicting prices similar to these for the next two years), net returns from production could average around \$325 ac^{-1} (\$803 ha^{-1}). Given these numbers, compensating farmers for the lost revenues would cost around \$4.7 billion, which is close to the total fixed direct payments and conservation payments for the region (table 2). Funding at this level would allow approximately 7% of the Midwestern agricultural landscape to be targeted for ecosystem services. Arguably, this is a very conservative estimate of the area of land that could be conserved through targeting; since much of the targeted land would be marginal (e.g., wetlands, highly erodible), it is highly likely that the net returns from production on these lands would be lower than the \$325 ac^{-1} average. In this case, a conservation program based on targeting is affordable, could more than adequately compensate farmers for lost revenues, and could alleviate criticisms of direct commodity supports under a high crop price environment.

An added benefit of such a policy is that it would explicitly decouple the historical tension between income support for farmers and provision of ecosystem services (Ribaudo et al. 2001). In the past, conservation programs have been totally voluntary with broad enrollment criteria, but in recent years policy makers have attempted to alleviate programmatic tension by focusing on the patterns of conservation practice adoption and developing better ways to link practices appropriately on the landscape. For example, enrollment in CRP is now based on the EBI. The EBI approach is a comprehensive attempt to "accumulate" environmental benefits in agricultural landscapes while addressing the tremendous logistical constraints of the existing multi-agency conservation program. Yet, the passive nature of landowner participation brings into play the classic economic "efficiency without optimality" dilemma (Baumol and Oates 1988). The missing optimality is due to the fact that the EBI cannot explicitly consider the ecosystemic connections within agricultural landscapes and watersheds. That is, funds are efficiently allocated to the landowners who walk in and sign up, but the program fails to consider ecological functionality from the landscape or watershed perspective. Under this scenario, individuals who own the key portions of ecosystems may never walk in the door and the optimal generation of durable ecosystem goods and services is not likely to occur.

Where targeting transcends the existing EBI mechanism is that it actively hooks the participation process to defined landscape conditions. Those parcels of land that can allow society to attain the biggest ecological bang for the buck are deliberately selected; as we've discussed above, the science that allows society to do so already exists. As with the EBI, this approach could also use much of the existing infrastructure, but the selection process would be active. The program would be much more focused on appealing to specific landowners and perhaps would involve a marketing campaign and/or target the time and effort of conservation professionals (e.g., USDA Natural Resources Conservation Service employees). Where the targeting approach will have to evolve is in the process of appealing to chosen landowners. The payments need to be such that all landowners in the watershed are no worse off in the long run for being selected or not selected. Better tying of payments to lost crop productivity would allow this. But the deliberate nature of the selection process would create better defined parameters and allow for a much more precise approach to economically efficient allocations, thereby creating a system that approaches "efficiency and optimality."

Effective locations to test such policy shifts are where landscape- or watershed-based, locally-led initiatives are already on the ground. For example, a bottom-up effort in the Boone River watershed of central Iowa includes a variety of stakeholders ranging from local producers to the Iowa Soybean Association and The Nature Conservancy that are involved in modeling, monitoring, and field-level conservation efforts that integrate a variety of perspectives and ecosystem services (Iowa Soybean Association 2007). The watershed is at the intersection of several efforts to increase targeted practices such as wetlands and controlled drainage, while long-term monitoring data both at the field and stream level are being collected, and the cost and performance of different management techniques across the watershed are being evaluated.

CONCLUSIONS

A conservation policy based on targeting would bring about benefits for both society and agricultural producers. With the increasing pressures being exerted on agriculture to intensify production at present, we argue that a targeted approach is timely and necessary to maintain—if not increase—the level of agroecosystem services currently provided. The targeted conservation program we outline does just this. It focuses on those portions of watersheds and/or landscapes that provide the greatest ecological benefits and more than adequately compensates farmers for taking land out of production. We further argue that a targeted approach is feasible in light of historical federal expenditures for the farm sector, and farmer compensation would more adequately reflect the quantity or quality of the conservation benefit being produced. The better targeting of resources, rather than increases in their absolute levels, is key in the provision of agroecosystem services under the current high crop price environment.

REFERENCES

Baumol, W.J., and W.E. Oates. 1988. The Theory of Environmental Policy, 2nd ed. Cambridge: Cambridge University Press.

Brauman K.A., G.C. Daley, T.K. Duarte, and H.A. Mooney. 2007. The nature and value of ecosystem services: An overview highlighting hydrological services. Annual Review of Environment and Resources 32(1):67-98.

Claassen R., L. Hansen, M. Peters, V. Breneman, M. Weinberg, A. Cattaneo, P. Feather, D. Gadsby, D. Hellerstein, J. Hopkins, P. Johnston, M. Morehart, and M. Smith. 2001. Agri-Environmental Policy at the Crossroads: Guideposts on a Changing Landscape. Agricultural Economic Report No. aer794. Washington, DC: USDA Economic Research Service. http://www.ers.usda.gov/publications/aer794/aer794.pdf.

Coiner C., J.J. Wu, and S. Polasky. 2003. Economic and environmental implications of alternative agricultural designs in the Walnut Creek watershed of Iowa. Ecological Economics 38(1):119-139.

Diamond, P.A., and J.A. Hausman. 1994. Contingent valuation: Is some number better than no number? Journal of Economic Perspectives 8(4):45-64.

Dosskey M.G., M.J. Helmers, D.E. Eisenhauer, T.G. Franti, and K.D. Hoagland. 2002. Assessment of concentrated flow through riparian buffers. Journal of Soil and Water Conservation 57(6):336-343.

Groves, C.R. 2003. Drafting a conservation blueprint: A practitioner's guide to planning for biodiversity. Washington, DC: Island Press.

Herriges, J.A., S. Secchi, and B.A. Babcock. 2005. Living with hogs in Iowa: The impact of livestock facilities on rural residential property values. Land Economics 81(4):530-545.

Iowa Gap Analysis Program. 2002. Iowa GAP stewardship lands. Ames: IA: Iowa Gap Analysis Program. http://www.iowagap.iastate.edu.

Iowa Soybean Association. 2007. Boone River Work Emerging as Model Project. Urbandale, IA: Iowa Soybean Association. http://www.iasoybeans.com/whatnew/isa082207.html.

Iowa State University. 2007. Iowa Land Value Survey. Ames, IA: Extension, Iowa State University. http://www.extension.iastate.edu/landvalue/.

Knoche S. and F. Lupi. 2007. Valuing deer hunting ecosystem services from farm landscapes. Ecological Economics 64(2):313-320.

Loomis, J, P. Kent, L. Strange, K. Fausch, and A. Covich. 2000. Measuring the total economic value of restoring ecosystem services in an impaired river basin: Results from a contingent valuation survey. Ecological Economics 33(1):103-117.

Pretty, J.N. 2002. Agriculture: Reconnecting People, Land, and Nature. London: Earthscan Publications.

Qui Z.Y., T. Prato, and G. Boehm. 2006. Economic valuation of riparian buffer and open space in a suburban watershed. Journal of the American Water Resources Association 42(6):1583-1596.

Rabalais, N.N., R.E. Turner, and D. Scavia. 2002. Beyond science into policy: Gulf of Mexico hypoxia and the Mississippi River. BioScience 52(2):129-142.

Ribaudo, M.O., D.L. Hoag, M.E. Smith, and R. Heimlich. 2001. Environmental indices and the politics of the Conservation Reserve Program. Ecological Indicators 1(1):11-20.

Ruhl J.B., S.E. Kraft, C.L. Lant. 2007. The Law and Policy of Ecosystem Services. Washington, DC: Island Press.

Schulte, L.A., M. Liebman, H. Asbjornsen, and T.R. Crow. 2006. Agroecosystem restoration through strategic integration of perennials. Journal of Soil and Water Conservation 61:164A-169A.

Schultz R.C., T.M. Isenhart, W.W. Simpkins, and J.P. Colletti. 2004. Riparian forest buffers in agroecosystems—lessons learned form the Bear Creek Watershed, central Iowa, USA. Agroforestry Systems 61:35-50.

Secchi S., and B.A. Babcock. 2007. Impact of High Crop Prices on Environmental Quality: A Case of Iowa and the Conservation Reserve Program. Working Paper 07-WP 447. Ames, IA: Center for Agricultural and Rural Development, Iowa State University.

Tomer M.D., D.E. James, and T.M. Isenhart. 2003. Optimizing the placement of riparian practices in a watershed using terrain analysis. Journal of Soil and Water Conservation 58:198-206.

USDA. 2007. Statement by Acting Secretary Chuck Conner Regarding the Conservation Reserve Program. Release number 0272.07. Washington, DC: USDA. http://www.usda.gov/wps/portal/usdahome?contentidonly=true&contentid=2007/09/0272.xml.

USDA Economic Research Service. 2007. Farm Income: Data Files. Washington, DC: USDA Economic Research Service. http://www.ers.usda.gov/Data/FarmIncome/Finfidmu.htm.

USDA FSA (USDA Farm Service Agency). 2003. Conservation Reserve Program Sign-up 26: Environmental Benefits Index. Washington, DC: USDA FSA. http://www.fsa.usda.gov/Internet/FSA_File/crpebi03.pdf.

USDA FSA. 2007a. CRP Monthly Summary: December 2007. Washington, DC: USDA FSA. http://www.fsa.usda.gov/Internet/FSA_File/dec2007.pdf.

USDA FSA. 2007b. CRP Monthly Summary: September 2007. Washington, DC: USDA FSA. http://www.fsa.usda.gov/Internet/FSA_File/sept2007.pdf.

USDA FSA. 2007c. CRP Status: December 31, 2007. Washington, DC: USDA FSA. http://www.fsa.usda.gov/Internet/FSA_File/deconepager.pdf.

USDA Natural Resource Conservation Service. 2003. National Resource Inventory: 2003 Annual NRI. Washington, DC: USDA Natural Resources Conservation Service. http://www.nrcs.usda.gov/technical/NRI/2003/statereports/all.html.

USGS (US Geological Survey). 2003. Nutrients in the Upper Mississippi River: Scientific Information to Support Management Decisions. Reston, VA: USGS. http://pubs.usgs.gov/fs/2003/fs-105-03/.

USGS. 2007. Iowa Land Cover. Reston, VA: USGS. http://landcover.usgs.gov/iowa.php.

Walter T., M. Dosskey, M. Khanna, J. Miller, M. Tomer, and J. Wiens. 2007. The science of targeting within landscapes and watersheds to improve conservation effectiveness. *In* Managing Agricultural Landscapes for Environmental Quality: Strengthening the Science Base, ed. M. Schnepf and C. Cox, 63-89. Ankeny, IA: Soil and Water Conservation Society.

Wilson M.A., and S.R. Carpenter. 1999. Economic valuation of freshwater ecosystem services in the United States: 1971–1997. Ecological Applications 9(3):772-783.