

Introduction

Farmers and ranchers produce a wide variety of agricultural commodities, which are sold in well-established markets. Farms and ranches can also produce a variety of environmental services that are often unintended consequences of production practices or land use decisions. Some examples are air and water, flood mitigation, drought mitigation, and wildlife. Even when unintended, these services provide benefits to people. Agricultural producers' actions can increase or decrease the provision of environmental services. Understanding how agricultural producers make their production and land management decisions is critical in designing strategies for enhancing those environmental services that people value.

Well-functioning commodity and input markets use prices to signal farmers and ranchers what to produce with their land and how to allocate resources most efficiently to maximize profits. In contrast, for a variety of reasons, markets for environmental services have generally not developed. As a result, producers' responses to market signals lead them to produce agricultural commodities rather than environmental services. Environmental services therefore may be underprovided from society's point of view.

Yet, with growing population and incomes, society increasingly values the environmental services agriculture can produce (Antle, 1999). Since markets typically undersupply environmental services, Federal, State, and local governments have developed a range of approaches for increasing their production (table 1.1). Most rely on policy tools, such as financial and technical assistance, regulation, and education. Although these approaches may be relatively simple to implement, basic economic principles suggest that they cannot allocate resources as efficiently as working markets, assuming such markets can exist.

The U.S. Department of Agriculture (USDA) and other groups have expressed great interest in the use of market-based policy instruments as a more efficient way of providing environmental quality and other environmental services. In 2006, USDA outlined its role in "market-based environmental stewardship." USDA is seeking to broaden the use of markets for environmental goods and services to "...encourage competition, spur innovation, and achieve environmental benefits..." (USDA, Natural Resources Conservation Service, 2006b). Some of the approaches that can be used to promote markets include credit trading, mitigation banking, and eco-labeling. To emphasize USDA's growing role, the Food, Conservation, and Energy Act of 2008 includes a provision directing USDA to facilitate the participation of farmers, ranchers, and forest landowners in environmental services markets. The U.S. Environmental Protection Agency (EPA) is promoting emissions trading as a way of reducing the cost of meeting air and water quality goals. The Organisation for Economic Co-Operation and Development is also promoting the use of market mechanisms for the provision of environmental services (Organisation for Economic Co-Operation and Development, 2005).

Table 1.1

Matrix of Federal agricultural conservation/environmental policy instruments and problems

	Participation							
	Involuntary			Voluntary				Facilitative
	Regulation	Conservation compliance	Taxes	Land retirement	Cost sharing	Incentive payments	Markets (Trading/offsets/labeling) ¹	Education/technical assistance
Problem:	Instrument							
Erosion: Soil productivity		Sodbuster/compliance (1985)		Soil Bank (1956-60) CRP (1985)	ACP (1936-96) EQIP (1996)	CSP (2002) EQIP (1996)		CTA (1936) CEP (1914)
Erosion: sedimentation	CZARA (1990)	Sodbuster/compliance (1990)		CRP (1990)	ACP (1936-96) EQIP (1996)	WQIP (1990-96) EQIP (1996) CSP (2002)		CTA (1936) CEP (1914)
Erosion: airborne dust	Clean Air Act	Sodbuster/compliance (1990)		CRP (1996)	ACP (1936-96) EQIP (1996)	WQIP (1990-96) EQIP (1996) CSP (2002)		CTA (1936) CEP (1914)
Wetlands	CWA Section 404 (1972)	Swampbuster (1985)		Water Bank (1970-95) CRP (1988) WRP (1990) EWRP (1993)			Mitigation banking (1995)	CTPA (1936) CE (1914)
Water quality: nutrients	CWA Section 402 (2003)			CRP (1996)	EQIP (1996)	WQIP (1990-96) EQIP (1996) CSP (2002)	CWA (1990)	CTA (1936) CEP (1914)
Water quality: pesticides	FIFRA (1947) CZARA (1990)			CRP (1996)	EQIP (1996)	WQIP (1990-96) EQIP (1996) CSP (2002)		CTA (1936) CEP (1914)
Wildlife habitat	ESA (1973)			CRP (1996) GRP (2002)	WHIP (1996)	EQIP (1996) CSP (2002)	Conservation banking (2003) Eco-labeling	CTA (1936) CEP (1914)

Acronyms:

ACP—Agricultural Conservation Program, CEP—Cooperative Extension, CRP—Conservation Reserve Program, CSP—Conservation Security Program, CTA—Conservation Technical Assistance, CWA—Clean Water Act, CZARA—Coastal Zone Act Reauthorization Amendments, EQIP—Environmental Quality Incentives Program, ESA—Endangered Species Act, EWRP—Emergency Wetland Reserve Program, FIFRA—Federal Insecticide, Fungicide, and Rodenticide Act, GRP—Grassland Reserve Program, WHIP—Wildlife Habitat Incentives Program, WQIP—Water Quality Improvement Program, WRP—Wetland Reserve Program.

Note: Year denotes first year Federal program authorized

¹Trading and offsets rely on regulatory measures to create a market. However, agriculture's participation is currently voluntary.

Creating markets for environmental services is no simple task. A key measure of a well-functioning market is how well it facilitates interaction between consumers and producers, which involves much more than simply the *sale* of environmental services.¹ A sustainable market should be based on more-or-less direct interaction between demanders and suppliers without constant government intervention when unanticipated changes occur.

The purpose of this report is to explore the conditions under which markets for environmental services from agriculture might arise and when and how government intervention might help environmental service markets succeed. This report presents an extensive review of the types of environmental services farmers can produce, what is required for a market to form, and the problems these markets might face in functioning smoothly. We consider potential roles for government in creating and supporting a market, with a focus on reducing transaction costs.

The report also assesses the potential supply of environmental services to provide a perspective on the potential scale of such markets. By providing a clearer, stronger, more systematic motivation for government intervention in the development of environmental service markets, this report provides insight on ways in which government actions might link the public's demand for environmental services to agriculture's supply of these services and on conditions under which the formation of markets, despite government actions, is impracticable.

¹Payments to agricultural producers for the production of environmental services are fairly common. USDA currently supports the production of environmental services through conservation programs, such as the Environmental Quality Incentive Program, Wildlife Habitat Incentive Program, Conservation Reserve Program, and Wetland Reserve Program. Land trusts, such as the Nature Conservancy and Ducks Unlimited, purchase land or easement to land in order to protect the flow of environmental services, primarily wildlife or biodiversity.