FORESTRY IDEAS, 2013, vol. 19, No 1 (45): 49–57

ECOSYSTEM SERVICES PAYMENT AND NON-MARKET VALUATION: IMPLICATIONS FOR BULGARIAN PRIVATE FOREST MANAGEMENT

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Received: 04 February 2013 Accepted: 25 April 2013

Abstract

Ecosystem services payment (ESP) is widely proposed as effective mechanism to internalize externalities. Non-market valuation techniques are often used to measure ESP. Elaborating the relationship between non-market valuation and ESP, this article emphasizes the importance of property rights and opportunity costs for ESP arrangement. The Bulgarian private forest is used as an example to highlight the potential impacts of changes in the institutional arrangement of property rights on ESP and sustainability of Bulgarian private forestry and ecosystem services.

Key words: consumer value, shadow value, willingness to pay, non-market valuation, appraisal value.

Introduction

Non-market valuation of ecosystem services has received significant attention for the past few decades. Non-market valuation is used to measure the value of products or services without market prices. An objective of non-market valuation is to inform the public of the importance of ecosystem services using monetary value, which is easier to understand, interpret and compare with other goods and services. People including ecologists who used to be reluctant to pricing ecosystems now favor the approach. While ecosystem services are critical for human beings to survive and have better quality of life, we should know that highlighting the importance of the ecosystems is not the main reason for non-market valuation. Rather it is the welfare impact of trade-offs of marginal changes in ecosystem services or between various ecosystem services that is the focus of attention in non-market valuation. The increasing demand for ecosystem services and alternative uses of natural resources make non-market valuation important. Since there is often no market to convey the marginal value and/or opportunity costs of supplying ecosystem services, non-market valuation

is used to measure them toward a better decision making. Marginal value is the additional value gained from small increment of consumption or production of a product. Marginal value is not constant but usually is diminishing for either consumer or producer. And in this context it is important to keep in mind the distinction between use-value, exchange-value and marginal value. Decisions are made at the margin rather than at the total or at average (Zhang and Li 2005).

Recently ecosystem services payment (ESP) has become a popular mechanism to internalize the costs and benefits of ecosystem services. Since there is no market for ecosystem services, suppliers do not have incentive to provide the services, leading to under supply rather than the optimal level as many of the environmental services have (positive) externalities (Arrow et al. 2000). Therefore, creating institutions that can internalize the externalities offer solutions (Pigou 1932, Coase 1960). Externalities refer to costs or benefits to other people not included in own cost and benefit analysis. For example, when a pulp and paper mill pollutes water it is a cost to many people downstream, but not included in the cost of the mill. The cost is called negative externality. Tree plantation generates benefits to society such as carbon sequestration and other ecosystem services, but the benefits are not considered by forestland owners. These are called positive externalities. It is believed that if positive externalities can be paid and negative externalities penalized, suppliers would have incentive to adjust their activities in optimal manner as externalities are internalized. This article attempts to clarify a few important questions regarding non-market valuation and ESP. Using the Bulgarian private forest as an example it discusses the potential consequences of changes in forest property rights on forest management and ecosystem services supply and sustainability of Bulgarian private forestry.

Problem Formulation

What is valued in non-market valuation?

The difference between willingness to pay (WTP) and shadow price and between total value and marginal value are very basic in economics but still often overlooked when we apply them to non-market goods. WTP is the value to the users, and is the maximum amount they are willing to forego in order to acquire a unit of some good or service. Often non-market valuation is used to value everything (total value) of some resources (e.g., species), having it or not having it at all. But in reality, we never choose these two extremes. There are plenty of choices (trade-offs) in between, such as small change of the resources. Another problem is to claim ESP using only willingness to pay.

Non-market valuation methods (e.g., contingent valuation (CVM) or travel cost method) estimate how much a consumer values a particular natural or environmental service. Consumer value is measured by the maximum WTP, and it is the utility gained from consuming an extra unit of a product. Economists also use shadow prices to measure how profit is affected by the lack of resources

(capital, labor, land and other inputs), where shadow price is defined as the marginal cost of relaxing the resource constraint by one unit. In other words, shadow price is the value of an additional unit of the resource to the firm. For example, if a manufacturing firm suffers from energy supply, the shadow price is what additional profit can be made if additional unit of energy is provided. Since willingness to pay is not shadow value of the ecosystem service, using it for the purpose of shadow value (the welfare impact of relaxing constraint) is not appropriate. Rather we need both willingness to pay and an estimate of the opportunity cost of supplying the ecosystem service when making decisions about paying for an ecosystem service.

The use of willingness to pay becomes more problematic when it is not measured at the margin. No matter how valuable the functions of ecosystems and how much natural resources contribute to individual or society welfare, the marginal value might be very low when the resource is in relative abundance. As van Kooten (1998) points out, the argument is not that the value of all natural and environmental resources may be large, but for most specific resources, such as the benefits of biodiversity, the value is small at the margin. The paradox of diamond and water is partly not considering the difference between marginal value and total value. When we say “water is so important”, it only means water as a whole resource and not the marginal unit.

Who pays who?

Prior to Coase (1960), it was believed that polluters (e.g., creating noise, dirty water) create negative externalities and should be responsible to abate pollution. Coase showed that the socially optimal level of pollution would be same regardless of who has the right to pollute if transaction costs are zero. If the polluter has the right to pollute, the affected parties have no right to stop the polluter but would need to pay or bribe the polluter not to or lower the pollution level. Conversely, if the polluter does not have right to pollute, he can pay the affected parties for polluting.

Ecosystem services are exactly the opposite of negative externalities like pollution; they are positive externalities. For example, fruit tree garden owners create positive services for bee farmers; upstream forests provide ecosystem services for downstream reservoir or hydropower corporations. It is natural to expect the beneficiaries (bee farmers and reservoir owners) to pay for the ecosystem service. However, we also see a lot of opposite cases. For example, forestland owners are not allowed to practice clear-cutting of their forests, or change their land use from forestland or wetland to cropland, suggesting the owners do not have rights, or their rights of managing their land are taken away. If they don’t provide the services, they are asked to pay or buy credits to compensate for the loss of ecosystem services. The opportunity costs or economic loss induced by an environmental policy restriction is exactly the compensation owed by the society to the land owner that supplies ecosystem services. Therefore, property right arrangements are critical to the question of who should pay ecosystem service and landowners’ incentives to supply ecosystem services.

Method

What should be ESP?

Many studies argue that ecosystem services are underpaid and poorly financed as it is claimed that willingness to pay is much larger than the payment or subsides. We should know that estimated willingness to pay cannot be used as a basis for ESP. Rather the potential level of compensation is expected to be somewhere between the opportunity cost of providing the additional ecosystem services and marginal willingness to pay for them. Let us consider an example. Suppose there is a reservoir owner downstream (player 1) and a private land owner upstream (player 2). The land can be used for (1) farming, (2) pine tree intensive monoculture for timber production, and (3) hardwood trees for multiple uses. Suppose that from the private land owner perspective, pine tree can generate the highest profit whereas from reservoir owner point of view hardwoods are beneficial. Let us further suppose that the payoff matrix for the reservoir and land owner can be characterized as Table 1. The first cell (*X*+5, 6) indicates that the gain for downstream reservoir is (*X*+5) and the farm is 6 if land is used for farming and no compensation is made by reservoir owner to the land owner. The amount X can be any number depending on the reference point. As we only care about the marginal change, it is 3 if the land use is changed from farming to pine trees, and 7 from pine trees to hardwood trees; what is the value of *X* does not matter.

Now the question is: how much compensation the reservoir should provide to the private land owner? First, let us see the non-market value of pine trees and hardwood trees? Using farming as reference (or base), WTP of the reservoir or positive externality from farming to pine is 3 units and from pine to hardwood is 7 units. But if the land owner plants pine tree, no compensation can be requested as the farm owner does not bear opportunity costs and still likes to grow pines without compensation from the reservoir owner. The result of **(*X*+8, 7)*** is called a Nash Equilibrium under non-collaboration game.

If land use is changed from pine to hardwood, 7 additional units of positive externality are generated, and the 7 units are also the WTP from pine to

Table 1. The payoff matrix between downstream water reservoir owner and the private land owner.

		Player 2: Upstream private land owner' management options		
		(1) Agricultural farming	(2) Intensive pine tree monoculture	(3) Multiple use hardwood forest management
Player 1: Downstream reservoir owner' options	Pay 0	(X+5, 6)	**(*X*+8, 7)***	(X+15, 2)
	Pay 2	(X+3, 8)	(X+6, 9)	(X+13, 4)
	Pay 4	(X+1, 10)	(X+4, 11)	(X+11, 6)
	Pay 6	(X–1, 12)	(X+2, 13)	**(*X*+9, 8)****

Modified and adopted from Zhang (1997).

hardwood for the reservoir, but the opportunity cost to the private land owner is only 5 units. It is apparent that as long as the marginal benefit to reservoir is larger than opportunity costs of the private land owner, and the opportunity cost is less than the compensation, collaboration would make both sides better off. For example, the result of **(*X*+9, 8)**** is a Nash Equilibrium under collaboration game. Under this collaboration, the landowner gains 1 than if he were to plant pine and the reservoir would gain 1 unit with 6 units as compensation to the private land owner.

The above example is based on no or little transaction cost. Considering the nature of forest management, externalities of forest management are hard to measure and monitor. Therefore, the transaction costs are usually high. Any trading would involve transaction costs which are costs of researching for information, contracting and final enforcement. The costs are loss to society. If the gain from trading cannot exceed the potential loss from transaction, either the trading would not take place or no gain made to the society. Using the above example again, if the transaction cost is larger than 2, no gain will be generated from deal. In other word, society has not gained from the change from pine to hardwood management. Interestingly, if the regulation that the forestland owner has to plant hardwood is in place and costing little to implement, the society gains, but the welfare distribution is becoming questionable.

At the societal level, marginal benefit minus opportunity cost (plus transaction cost) is the gain from the land use change from pine to hardwood production. The non-market value of externalities is really dependent on which point is used as a reference. Looking at Table 1, if agricultural farming is the reference point, then the value for hardwood is 10 but only 7 if pine is the reference point. In addition, knowing the value of externalities alone would not lead to a meaningful policy design and WTP cannot be used as ESP. ESP is not the total non-market value but a value between the opportunity costs to the land owner associated with providing the non-market service and the opportunity value to the beneficiary (the reservoir). ESP is like any other trading leading both sides to gain. The difference from other trading is that the property right arrangement is not as apparent as in the case of other products and services, and ecosystem services are often public goods.

WTP and "what should be paid" (WSP)

Considering the limitations of WTP as measurement for ESP, Zhang and Zheng (2011) for the first time proposed and discussed the concept of "what should be paid" (WSP). What should be paid measures fair compensation based on public or expert opinion or appraisal value of compensation. Appraisal value is the value made by appraiser using some methods, mostly comparing with the price of similar and recent traded property, present value of all expected income from that property and costs to create and produce a similar property. When respondent is asked for WTP, several possibilities may arise: if a respondent assumes that other people will be free-riders, WTP might potentially be lower; if the respondent tells his true consumer value (WTP), then WTP might be larger than WSP. "What should be

paid" seems subjective and not scientific, but reflects the consensus of many consumers and producers about the level of costs and values.

Zhang and Zheng (2011) argued that WSP might be an appropriate measure to determine ESP, and found that on average, willingness to donate to urban tree programs was on average $13.53 (about 24 %) less than the money respondents thought should be used to support such a program. "What should be paid" (WSP) can be derived from public opinion surveys or from professional appraisals. WTP only considers the consumer value but ignore the opportunity costs. WSP is based on the judgment of each individual of their evaluation of fair compensation for ecosystem services. Their judgment likely is based on value and costs as well as substitutes. WSP better reflects the trading price than WTP for ecosystem services and is likely easier in implementation.

WSP can also be derived from surveys consisting of various stakeholders and experts. WSP can also be derived from appraisals. Appraisers are routinely faced with situations in which no such evidence is available. In fact, appraisers are required because of the absence of a ready market. Appraisers have been doing good job in pricing of non-market goods. Appraisal value is usually defined as an amount expressed in terms of money that may reasonably be expected for a property in exchange between a willing buyer and a willing seller, neither under compulsion to buy nor to sell and when both are fully aware of all relevant facts, including the assumption that the earnings support a continuation of the product line. Appraisal value is the value measured in a hypothetical market. Appraisal method addresses the limitation of CVM and makes comparison between benefits and costs and between individual value and social value.

Empirical Application

Bulgarian private forestry and new regulation

A long restitution process has been underway in Bulgaria since 1995, involving the transfer of state forest to ownership of non-state entities. The situation at the end of 2006 indicated that about 78.6 % of the forest area was still in state ownership. The largest non-state owners included municipalities with 10 % of forest area. The individual families owned 10.6 % of the forestland. The woodlots in individual ownership are very small, most of them around 1 ha in size. Only about 5 % of the forest holdings in private ownership exceed 50 ha.

The private forest owners are considered to be unsustainable as they do not have the necessary capacity and skills of forest management. More importantly, they are either living far from the forest properties, have limited interest in managing forests or to collaborate with other forest owners under collective or cooperative management. As the public is getting more aware of the significance of the environment and ecological value of forests, it is important for private forestland owners to follow sustainable forest management criteria.

It is argued that unsustainable practices and non-suitable operations of the private forest owners can lead to the loss of important species and rare forest habitats,

especially in the low mountains, lowlands and riparian forests around wetlands and rivers. Consequently, during the development of legislation and regulations on private forests, requirements for protection and maintaining biodiversity, reduction of pollution, are going to be stronger particularly if the forests are located in critical watershed protection and close to villages or river streams. Private forest owners are asked to follow new regulations of sustainable forest management. The regulations would impose more restrictions on private forest owners, or take away some property rights. The impacts would be reduction of property value compared with no restrictions, and the owners would have less interest in the property. A worst case scenario will arise when the property is abandoned if the owners cannot gain from the property.

Toward Sustainability: market mechanism or regulation?

In order to address this issue, Table 2 illustrates a hypothetical game between the public (player 1) and a private forestland owner (player 2) and potential outcomes. Suppose the government or the public offers three options to the private forest owners: (1) no restriction, (2) must follow sustainable forest management or face some penalties, and (3) provide incentive to the owners who practice sustainable management. The forest owners could respond with three management strategies: (1) non-active management or simply giving up the ownership as no economic return is generated, (2) profit maximizing management, and (3) sustainable forest management.

If no restriction is applied, the land owner will pursue his own profit or land value maximization: suppose the profit is $P1$ and the additional ecosystem service generated is $E1$ compared to no management.

If regulations are applied and private land owners have to use sustainable forest management: suppose the profit is $P2$, and the additional ecosystem service is $E2$ compared to profit-oriented management. If $P2$ is still positive, regulation will lead to the transfer of

Table 2. The payoff matrix between the public and private forestland owners under alternative property rights arrangements.

		Player 2: Private forest owner' management options		
		(1) Non-active management	(2) Profit oriented management	(3) Sustainable forest management
Player 1: Public/ government' options	No restriction	(X, 0)	**($X+E1$, $P1$)**	($X+E1+E2$, $P2$)
	Must practice sustainable management	**(X, 0)**	($X+E1–F$, $P1–F$)	($P2$, $X+E1+E2$, $P2$)
	Subsidize A if sustainable management	(X, 0)	($X+E1$, $P1$)	**($X+E1+E2–A$, $P2+A$)**

Note: $P1>P2$

some benefit from private land owners to the general public: it is not that the public pay for the ecosystem services to the private land owner; rather the private land owner pays for the ecosystem service to the public. In case the profit *P*2 is negative (meaning it is no longer profitable), the private land owner might simply give up the ownership, and the land would become non-active management leading to reduced ecosystem service such as level *X*.

If incentive such as subsides are provided to private land owners who practice sustainable management, the question is how much incentive should be provided. Comparing the situations in (3) and (2) the additional ecosystem service from sustainable management is *E*2 which can be called welfare value or WTP of the public. It must be noted that the ecosystem from sustainable management is *E*1+*E*2 if comparing with non-active management (1). Since there is no opportunity cost for the ecosystem service *E*1, and the opportunity cost of *E*2 is reduced profit (*P*1–*P*2) for the private land owners. Therefore, the WTP is *E*2, the ESP should be between (*P*1–*P*2) and *E*2. If the land owners cannot make any income when they adopt sustainable forest management, it is likely the landowners will give up the ownerships. One possible result will be less ecosystem service and less economic return. The potential result, as shown in Table 2, will be (***X*, 0**). If ecosystem services are compensated to the land owners with ***A***, the result will be (***X*+*E*1+*E*2–*A*, *P*2+*A***) leading to gains for both the welfare of private land owners and the public from the arrangement of the ecosystem service rights.

The scenarios provided are illustrative of the private forest management and socio-economic consequences in response to public policies or property rights arrangement. They are intended to convey that the policy that force the private forest land owners to practice sustainable forest management might lead to reduced welfare for both public and private forest owner like **(*X*, 0),** which is even worse than no restriction. Alternatively, if incentive policy is provided, the result might be like **(*X*+*E*1+*E*2–*A*, *P*2+*A*).** The actual solution will be dependent on marginal benefits and opportunity costs. Thus, society should develop policies that lead to total welfare gains at least rather than simply transfer benefit from one stakeholder to another. Another important factor that should be included in the consideration is the transaction costs. No policy or regulation is costless. The costs involved include policy making, implementation and monitoring. Considering the numerous small and numerous private land owners, implementation costs could be very high. If the gain from the policy cannot exceed the potential costs of the policy, no regulation is better off.

Concluding Remarks

Ecosystems are important to humans but we often misinterpret willingness to pay (WTP), opportunity cost and ESP. WTP measures welfare or value from a consumer perspective whereas opportunity cost is the cost of supplying ecosystem services, and ESP must lie between WTP and opportunity cost (Zhang and Li 2005). Ideally, the most efficient allocation is at the point where marginal WTP is equal to marginal opportunity cost (i.e., balancing trade-offs at the margin). While it is helpful to use WTP to highlight the importance of ecosys-

tem services, it is the analysis of trade-offs at the margin that should be the main focus of non-market valuation. As Solow (1992) pointed out, “there is a lot to be gained by transforming questions of yes-or-no into questions of more-or-less. Yes-or-no lends itself to stalemate and confrontation; more-or-less lends itself to trade-offs, the tricks is to understand more of what and less of what”.

ESP mechanisms must be designed such that they lead to welfare gains rather than just welfare reallocation between stakeholders. The justification for ESP is to increase ecosystem services to the optimal level by internalizing externalities. While nothing is wrong when consumers are free riders when there is no opportunity cost, they will enjoy increased supply if externalities are internalized. We cannot simply use WTP as a measure to claim ESP; ESP is a result of the interplay between demand (willingness to pay) and supply (marginal opportunity cost). Often private forest owners are expected to comply with certain regulations. In the Bulgarian context, these regulations need to be evaluated as some unintended consequences might occur and forestland owners may give up management opportunity if ESP is not commensurate with the costs they incur. Very importantly the costs of policy and regulations need to be considered.

Acknowledgements

The authors would like to thank USDA-Borlaug Fellowship Program. All remaining errors and opinions are responsibility of the authors.

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