VALUING FORESTLAND ENVIRONMENTAL SERVICES: A CASE STUDY FOR CALIFORNIA'S OAK WOODLANDS

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ABSTRACT

California's oak woodlands cover 10 percent of the state, and provide important environmental services. This paper presents analytical approaches for assessing the market value of these services, providing a framework for other Pacific Rim forest areas. Positive programming is used to assess a forest landowner's amenity values. Contingent valuation is used to assess the value of different stand structures. Hedonic regression is used to decompose land and housing prices of an urban area near a dedicated oak woodland open space to assess the value of the open space on an overall community. The policy issues and conservation strategies associated with these environmental service values are discussed.

Key Words – Environmental services, hedonic prices, contingent valuation, positive programming

1. INTRODUCTION

California's 4 million hectares of oak woodlands represent approximately 10 percent of the state's land area, and are a dominant forest type in the state (Waddell and Barrett 2005). These forests contain the highest level of biological diversity of any broad habitat in the state (Allen-Diaz *et al*. 2007). Most of the state's water flows through these lands, and they supply aesthetics and recreational values (Standiford and Tinnin 1996). These public values are mainly supplied by private landowners, who own over 80 percent of the state's oak woodlands (Waddell and Barrett 2005). Over two-thirds of all oak woodlands are grazed by domestic livestock and managed as silvopastoral enterprises (Huntsinger et al., 1997).

Valuing environmental services is an essential component of forest conservation policy. There has been significant work done on developing approaches to assess values for the wide range of services provided by these forests. The continued supply of public values from these private oak woodlands depends on the how the production value of silvopastoral enterprises and the value of environmental services expressed in the marketplace, compares with the opportunity costs of competing land uses, such as urban developments, intensive agricultural enterprises, and rural subdivisions.

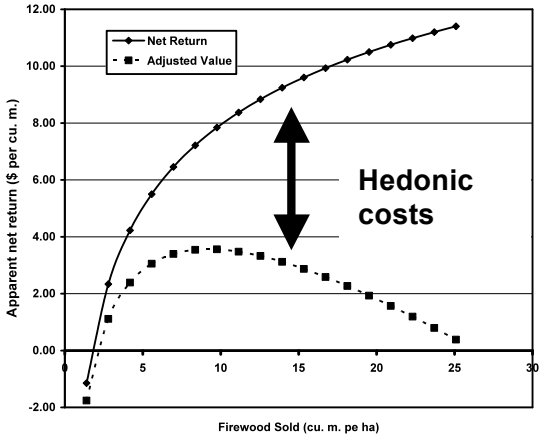
2. LANDOWNER ENVIRONMENTAL VALUES

Policy models to evaluate likely management decisions by oak woodland private owners must accurately predict landowners' utility for environmental services produced on their lands. Failure to account for this undervalues a landowner's personal consumption of amenity and environmental services, and leads to incorrect conclusions about likely management strategies and appropriate public polices.

Standiford and Howitt (1992) demonstrate the importance of incorporating a landowner's personal valuation of environmental services. A normative dynamic oak woodland optimization model incorporating cattle, firewood and hunting products, concludes that current markets for these products would lead to oak clearing to increase forage yield for livestock production. Although common in the 1940's to 1970's, this behavior has been rare in recent years (Standiford et al. 1996). The model shortcomings were due to failure to accurately account for a landowner's utility from retaining oaks for their amenity value. A positive mathematical programming (PMP) approach (Howitt 1995) was used to derive missing elements of the true costs and returns of oak harvest omitted from the normative model. The dynamic optimization model was constrained by actual landowner behavior (Bolsinger 1988) to derive these missing values. The shadow prices from the behavior constraint represents the marginal benefit of retaining trees from what might otherwise be predicted.

Figure 1 shows the effect of incorporating these shadow prices into a firewood revenue model. The difference between the two curves represents the landowner's utility derived from retaining trees. We refer to this as the hedonic cost of overcutting trees. Standiford and Howitt (1992) compare the trajectory of optimal oak tree cover for both the normative and positive model. Incorporation of the actual behavior into the model specification gives a more realistic prediction of actual landowner behavior than a model which omits the value a landowner places on tree retention.

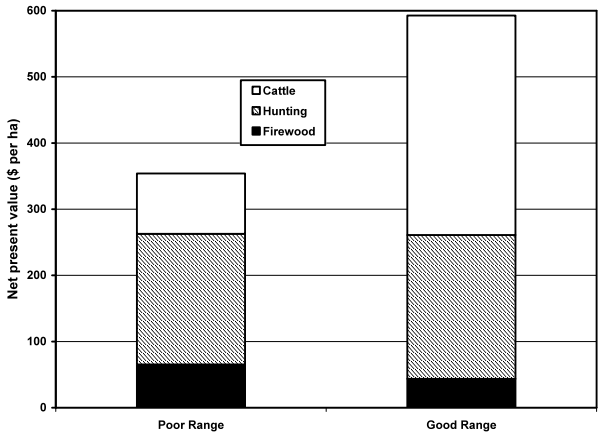
Figure 1. Net firewood return per cubic meter as function of amount of wood harvested (Standiford and Howitt 1992).



3. VALUES OF SILVOPASTORAL SYSTEMS

This optimization model, incorporating landowner utility, is used to evaluate oak cover, firewood harvest, and cattle grazing under different risk and land productivity conditions (Standiford and Howitt 1992). Figure 2 shows the contribution of the three major commercial enterprises to total net present value of California oak woodlands with an initial oak volume of 50 cubic meters per hectare (Standiford and Howitt 1993). Cow-calf enterprises in these silvopastoral systems on average have a positive economic value. Fee hunting can be an important enterprise contributing from 40 percent (on good range sites) to 70 percent (on poor range sites) of the total value. The economic contribution of wood harvest is generally low.

Figure 2. Net present value of California oak woodlands from various commercial enterprises (Standiford and Howitt 1993).



The model also shows that diversification of silvopastoral enterprises reduces the intensity of tree harvesting and cattle grazing. The marginal value of retaining oaks for wildlife habitat for hunt clubs exceeds the marginal value of the extra forage or firewood harvest (Standiford and Howitt 1992). Wood harvest is more likely in years with poor forage production or low livestock prices. The capital value of the trees is a hedge against years with low livestock profitability. Inclusion of a risk term shows that firewood harvest and livestock grazing intensity both increase. Policies reducing landowners' risk, such as a loan program and insurance program during poor forage production or low livestock price years, might reduce the need to liquidate oak tree capital assets.

4. OPPORTUNITY COSTS OF OAK WOODLANDS

In many areas of California, the commercial values from management of oak woodlands represent only a small fraction of the actual land value. Alternative land uses such as intensively managed agricultural products or subdivision for residential housing usually have much higher market values than extensively managed oak woodlands. Many of these higher value land uses, unless carefully planned, convert and fragment oak woodland habitats, diminishing their capacity to supply public amenity values (Merenlender et al. 1998).

These alternative land uses create an opportunity cost for owners. For example, in the Central Coast of California, land value for grazing and wood products may be worth less than 10 percent of the value of the land for intensive agricultural use for wine grapes, or less than 1 percent of its value for residential uses (CALASFMRA 2008), creating tremendous pressure to move to land uses that may cause higher environmental costs.

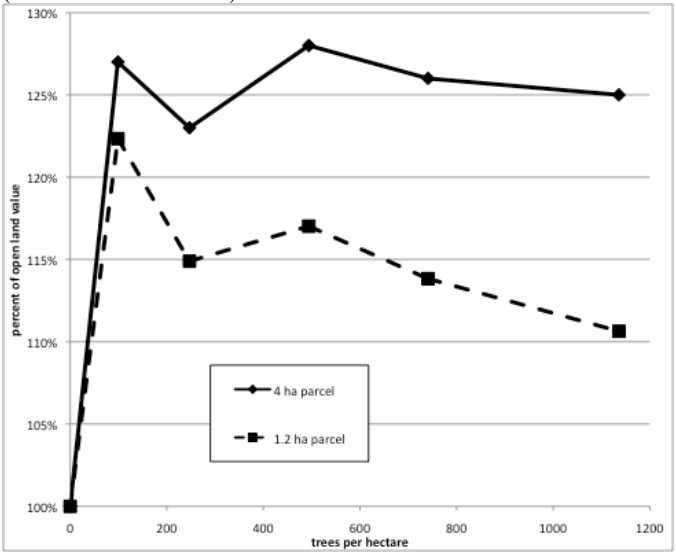
5. VALUE OF DIFFERENT STAND STRUCTURES

One of the reasons for the migration of Californians from urban areas to oak woodlands is because of their amenity values, which is reflected in their land value. The oaks on the property, the presence of oaks in a surrounding neighborhood, and the presence of oak woodland open space adjacent to a property, all affect property values.

Figure 3 shows how the results of a contingent valuation approach to assess different oak woodland stand structures to determine how oak cover affects property value (Diamond et al. 1987). On four-hectare lots, oak woodlands with at least 100 trees per hectare were worth 27 percent more than open land. There was a similar value for open to heavy tree stocking (100 to 1140 trees per hectare) on these four-hectare lots. Similar trends were also observed on smaller 1.2-hectare lots, with 100 trees per hectare being worth 22 percent more than bare land. However, denser areas (over 100 trees per hectare) on these smaller parcels

had lower value than the more open 100 tree per acre stand structure, but still had higher value than bare land.

Figure 3. Contingent valuation of oak woodland stand structures by parcel size and numbers of trees per hectare (Diamond et al. 1988).



6. EFFECT OF OAK WOODLANDS OPEN SPACE ON URBAN PROPERTY

The effect of a 3400 hectare oak woodland open space in southern California on overall community land and home value was evaluated using hedonic pricing (Standiford and Scott 2001). It was hypothesized that housing and land value is a function of the characteristics of the housing (size, number of rooms, presence of swimming pools, etc.), location of the units (access to job location, condition of roads), the improvements at the site (roads, fencing, utilities), and the amenity aspects of the area (view, forest type, access to open space trails). Hedonic regression was used to decompose the relative contribution of these various components to the overall value of the property (Rosen 1974, Edmonds 1984). The distance to the edge of the oak woodland open space and the distance to the nearest native oak stand were highly significant variables for both home and land prices for the over 3000 parcels included in the study. The cumulative home and land value of the community in the study area was $420 million (Standiford and Scott 2001). A one percent increase in oak woodlands in the study area would increase community home and land values by $2 million, increasing property taxes by over $20,000 annually. Each additional hectare of oak woodland open space adds $11,250 to the overall value of the community based on enhancing of both house and land value.

Private owners are willing to pay a premium to be located adjacent to dedicated oak woodland open space. Conservation of these areas increases the land and home value for an entire community because of the value added by these environmental assets. The resulting increases in annual property tax accruing to local government can be used to justify public financing of local oak restoration efforts, or the purchase of development rights or fee title for permanent open space.

7. POLICY ISSUES

With the large private ownership of California's oak woodlands, and high opportunity costs of maintaining silvopastoral working landscapes, new approaches are needed to conserve these lands. Land trusts, tax policies, and new energy and carbon policies are utilizing some of these environmental service values to justify their use in conservation strategies.

7.1 Conservation Easements and Land Trusts

Currently, one of the largest sources of funding for oak woodland conservation in California comes through a diverse set of institutions known as "the land trust movement." Land trusts are organizations that act directly to conserve land. These vary in scale from localized groups, operating with volunteer staffs and little to no direct budget, to regional groups with staffs and some funding, to large international groups, such as The Nature Conservancy. In California, there are 132 land trusts, conserving over 400,000 hectares of land (LTA 2000).

Land trusts purchase directly, or accept donations, of conservation easements. Conservation easements are contracts that divide the bundle of rights involved in land ownership (development rights, timber rights, grazing rights, mineral rights, water rights, etc.) between the landowner and the holder of the easement, in this case a land trust. The conservation easement creates a permanently deeded restriction on the limits and kinds of development for a property. For example, the urban development rights for an oak woodland property may be sold or donated to a land trust, who hold these rights in perpetuity. The landowner receives benefits from the capital value of the rights donated or sold, and society benefits by the maintenance of the ecological value of the land.

Funding for conservation easement purchases comes from private sources, such as foundations, as well as from public sources. Considerable oak woodland area has been placed into conservation easements in Sonoma County in California, funded by a local sales tax surcharge for the county (Mackenzie and Merenlender 2001). In the Northern Sierra, The Nature Conservancy, working with a state organization called The Rangeland Trust, has acquired conservation easements on blue oak woodlands using private foundation funding sources (Reiner et al. 2002).

Another type of conservation easement transaction involves donations of the easement to a land trust. The market value of the portion of the property rights donated represents a reduction in the land's basis. This can be considered a charitable donation, reducing the landowner's taxable income. Lowering the land basis also reduces the inheritance tax as the land passes from generation to generation. This reduces the need to liquidate some of the opportunity costs of the land in order to pay inheritance taxes.

7.2 Tax Policies

The California Land Conservation Act (CLCA), also known as the Williamson Act, is one attempt to reduce the conversion pressure by basing annual property tax on current land use, rather than its "highest and best use" (Carmen 1977). This policy requires landowners to maintain their extensive agricultural use for ten years.

Estate taxes of oak woodland parcels are determined by their "highest and best use" derived through the land market. High estate taxes, driven by these opportunity costs, have been identified as one of the largest constraints to inter-generational transfers of large, extensively managed oak woodland parcels (Johnson 1997). U.S. estate tax reform is being considered to reduce conversion pressures on agricultural lands, including oak woodlands.

7.3 Emerging Carbon and Energy Markets

California has an emerging market for biomass energy, mainly utilizing cogeneration facilities throughout the state. There have been opportunities for utilization of solid wood for cogeneration through various incentive programs (Bioenergy Interagency Working Group 2006). The overall wood volume from oak woodlands is substantially lower than on commercial conifer forestlands, which are only break-even at best at this time. Delivered wood prices are currently quite low, with high transportation costs.

With the passage of California's Global Warming Solutions Act (Assembly Bill 32) by the state legislature in 2006, the state set limits on greenhouse gas (GHG) emissions (ARB 2006). The law reduces GHG to 1990 levels by 2020 – a reduction of 30 percent – and another 80 percent reduction by 2050. The new law establishes as cap-and-trade program to develop markets designed to sequester carbon. Preliminary analysis of the implications on oak woodlands shows only $0.70 per hectare per year for central Sierra Nevada oak woodlands based on current markets (Forero, Standiford and Stewart 2010t is expected, however, that as the implications of AB 32 on California's economy develops, that the prices for sequestering carbon on oak woodlands, will increase, and create new market opportunities for silvopastoral management.

8. CONCLUSIONS

Environmental services for forestland can be quantified in the marketplace using a diverse array of analytical tools, including positive programming, contingent valuation and hedonic pricing. These values serve to justify policies to conserve woodlands, and also shows where market forces alone may not adequately conserve important ecological values. Oak woodlands are examples of privately managed forest landscapes, supplying high environmental service values to Californians. Much of the production of these environmental values comes from landowners' utility for these values. These amenity and environmental values of oak woodlands create incentives for landowners to maintain the health and vigor of trees.

Owners have motivation to maintain oak stands in areas that may be developed, because of the higher value for these lots. Also, since forested neighborhoods have higher value, it may be wise for homeowner associations to utilize Covenants, Codes, and Restrictions (CC&R's) to maintain overall oak stands in a neighborhood. The positive effect of extensively managed open space on enhancing adjacent property values, points to the role of compensation of large ownerships through land trusts, because of the economic, as well as the conservation value of these types of lands. Private forest management can offer cost-effective means to provide environmental services to the adjacent community. New approaches to evaluating the self-consumption of environmental services, and the quantification of the real utility of amenity values observed in the market offer promising approaches to better represent their value to landowners and society. These tools can be used to evaluate new conservation policies for California's oak woodland resources.

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