Financing Ecosystem Service Markets: Issues and Opportunities

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The Institute for Natural Resources

Created by the Oregon Legislature through the 2001 Oregon Sustainability Act, the Institute for Natural Resources' mission is to provide Oregonians with ready access to current, relevant, science-based information, methods, and tools for better understanding natural resource management challenges and developing solutions.

The Institute for Natural Resources is an Oregon University System institute.

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FOREWORD

The Institute for Natural Resource (INR) provides Oregonians with ready access to current, relevant, science-based information and methods for better understanding resource management challenges and developing solutions. It operates as a multi-disciplinary, multi-institutional conduit between the research capacity of the Oregon University System and Oregon's natural resource decision-makers.

INR has recently engaged in research, extension and learning regarding how ecosystem service markets can promote rural sustainability in Oregon and across the West. This is part of a larger effort to better understand ecosystem service transactions of many kinds. We believe that the burgeoning interest in ecosystem service markets has the potential to bring significant new opportunities to rural landowners, both in terms of conservation activities and changed income streams. There is no magic involved. The ecosystem services enterprise – to succeed – requires time for evolution, the hard work of developing tools and mechanisms of multiple kinds, the development of trust on both supply and demand sides, and persistence despite the specter of market failures. The upside is the possibility that rural communities may be able to benefit enormously from local and regional versions of a successful restoration-based economy, from the ground up.

INR's long-term goal with this and other projects is to help revitalize rural economies and contribute to rural sustainability, while increasing ecosystem restoration and thoughtfully developing ecosystem services markets. To assist in meeting these goals, this project aims to understand and overcome a significant hurdle on the supply side of these emerging markets: the financing burden and risk shouldered by rural landowners who wish to invest in restoration activities. In order to accomplish these objectives, the project seeks to identify and apply financial mechanisms and institutional arrangements that enable landowners to access ecosystem services markets, a new and potentially long-term source of land and water stewardship income.

Our strategy for meeting these objectives combines a number of approaches including:

- policy research
- collaborative inquiry and learning with landowners and financiers
- on-the-ground pilot project development
- dissemination and outreach of project findings

Introduction

In the last few decades, structural shifts in forestry and agricultural economies have depressed many rural communities across the country, including in the Pacific Northwest. Meanwhile, prospects for upward trends in global population growth through 2050 imply increasing global demand for water, food, fiber, mineral and energy products. This suggests that careful stewardship of the productive capacity of our rural lands and waters and the social capital of rural communities is a policy imperative. At the same time our urban areas are growing rapidly, resulting in vibrant communities hard at work producing new and green technologies that are reshaping the world economy. This urban growth is placing further demands on the rural sector, not just in terms of traditional rural products, but also in terms of the ecological functions that support urban production and consumption, key among these being ecosystem support for quality of life and recreational opportunities away from urban centers.

These drivers explain the rapid rate of innovation and experimentation in the Pacific Northwest to develop market-based mechanisms for ecosystem services. The broad vision is one where stable, long-term revenues derived from the growing ecosystem restoration economy are progressively integrated with traditional primary production activities, leading to improved and sustainable economies for rural communities. Recognizing and acting on the economic value of these ecosystem linkages between urban well-being and rural well-being is central to this transition. Ideally, the nature of the urban-rural economic relationship will itself be transformed from one of extraction and disconnection to one of mutual support. These new relationships will be developed across different scales, from the local watershed, to the river basin and even to the global scale, as in the emerging carbon economy.

The use of market-based incentive mechanisms to encourage ecosystem protection and restoration is fairly well established in the United States. The development of markets, or a marketplace, for ecosystem services – currently a high priority agenda item for many government, non-profit and private sector stakeholders in the Pacific Northwest - represent a much more ambitious endeavor. While an attractive proposition, this concept needs to overcome a number of challenges. This paper explores these challenges at three levels:

1. Definitional. A fundamental precondition for market development is being precise about what is meant by “ecosystem services” and “markets”; unfortunately, the flood of interest in an “ecosystem services approach” often seems to obscure what is meant by these terms

2. Market Obstacles and Enabling Conditions. Development of ecosystem service markets is a complex endeavor and encounters a number of obstacles, which in turn suggest the enabling conditions that will be necessary for these markets to deliver on-the-ground results

3. Supply and Financing. While much of the effort to date in ecosystem services markets, particularly in the Willamette Valley, has emphasized the creation of regulatory or voluntary market demand, experience in related markets, such as those for instream water rights, suggest that the provision of supply remains itself a significant hurdle – and that a

significant constraint to the emergence of multi-credit ecosystem markets is likely to be the risk and financing of on-the-ground actions to generate these credits.

The following sections of the paper take up the foregoing challenges. The final section of the paper then relates INR's plans to conduct policy research and action learning to address these supply and financing issues as part of the larger effort to establish functioning ecosystem service markets.

Ecosystem Services and Markets

In order to be transparent and well-directed in achieving an objective it is useful to be clear about what is being pursued. The term "ecosystem services," although much in vogue, suffers from a lack of precision and a number of competing definitions (Boyd and Banzhaf 2007). This is not new in the field of conservation, much the same has occurred with the term "biodiversity." Likewise the use of the term "market" at least when it is applied in conjunction with "ecosystem services" or "biodiversity" in public discourse may have a variety of meanings to different groups of people. Ultimately, however, to be useful, policy research must appeal to policy-makers – and those carrying out policy. Correcting terms and so-called "buzz-words" to maintain a rigorous consistency in the meaning and use of words between academia, policy-makers and implementing agencies is a tall order. This section tries to convey some of the ways that these words have been interpreted in different venues, identify the substantive differences, and suggest a working definition for the purposes of the research agenda.

Ecosystem Services

The basic insight involved in coining the term ecosystem services is the effort to draw attention to the value to humans (and therefore the economy) of ecological functions – functions that only indirectly enter into human welfare and are typically neither well-understood nor well-integrated into decisions regarding the fate of ecosystems. For example fish, timber or recreation are relatively well-known products provided by ecosystems. While the economic nature of each provide challenges to natural resource managers, these and integrated in to policies and regulations. The ecological function of a tributary stream in providing spawning and rearing habitat for salmonids that are later harvested at sea or on their return migration may not be well understood. When the flow in the stream is diverted, the stream is dammed or channelized, or the riparian are is denuded of vegetation to allow grazing or farming the spawning and rearing functions are lost, the salmonid population declines, and, at some distance to the tributary, indigenous, commercial and sport fishers experience reduced availability of fish, higher fishing effort, and lower harvest levels. This yields the proposition that understanding the cause and effect involved in natural systems and the economic contribution the indirect support and protection provided by natural ecosystems for economic activity and property may prove to be a very powerful argument in conserving these systems (Aylward and Barbier 1992).

Competing notions of "ecosystem services" can largely be segregated in terms of whether they view "ecosystem services" as the full set of benefits provided by ecosystems, or whether these services are construed as a subset of the full benefits that corresponds more to specific functions

that are of particular economic significance. Daily (1997) provides an example of the latter by specifying a list of functions that have economic value (i.e. ecosystem services) including:

- purification of air and water
- mitigation of floods and droughts
- detoxification and decomposition of wastes
- generation and renewal of soil and soil fertility
- pollination of crops and natural vegetation
- control of the vast majority of potential agricultural pests
- dispersal of seeds and translocation of nutrients
- maintenance of biodiversity, from which humanity has derived key elements of its agricultural, medicinal, and industrial enterprises
- protection from the sun's harmful ultraviolet rays
- partial stabilization of climate
- moderation of temperature extremes and the force of winds and waves
- support of diverse human cultures
- providing aesthetic beauty and intellectual stimulation that lift the human spirit

This approach is distinct from that taken by the Millennium Ecosystem Assessment (MA). From 2001 to 2005, the MA assessed the consequences of ecosystem change for human well being, based on the participation of 1,360 experts worldwide. Ecosystem services are defined by the Millennium Assessment (MA) as the benefits provided by ecosystems, and grouped into four categories (Millennium Ecosystem Assessment 2005):

- provisioning services such as food, water, timber, fiber and genetic resources
- regulating services such as climate, water, erosion and natural hazard regulation
- cultural services such as recreation, aesthetic enjoyment and spiritual fulfillment
- supporting services such as soil formation, pollination and nutrient cycling

As noted by a team of ecologists and economists gathered by the National Academy of Science the MA's approach is derived from one put forward by de Groot (2002), which is based on a systematic typology of ecological function (and not ecosystem values). The NAS in turn puts forward a framework in which the structure and function of ecosystems produce ecosystem goods and services, which in turn can be classed in terms of their economic values (see Box 1). The MA and NAS approaches are effectively similar in that they consider the full suite of economic benefits associated with ecosystems (Boyd and Banzhaf 2007). The exception is that the NAS is more explicit that they are really talking about "goods and services" and not just "services". A final point on ecosystem services is that if we are to understand what

Box 1. Economic Values of Ecosystems

- consumptive use values derived from harvesting or extracting a resource, like water harvesting
- non-consumptive and direct use values like recreation
- non-consumptive and indirect use values, like habitat support,
- non-use values like existence, species preservation and biodiversity

Note: non-use values are those resulting from knowing that something exists, regardless of whether or not they are used

Source: National Research Council (2004: 241)

the value of these services to the economy tells (or does not tell) us about how to manage ecosystems themselves, then it is important to be clear in distinguishing between that component.

Given the plethora of viewpoints we opt here to pursue the fundamental intuition behind defining a new term, that of having it refer to a new and meaningful concept. Therefore, in this paper we take the term "ecosystem services" to refer to those non-consumptive and indirect use values that are part and parcel of the total economic value of ecosystems, but not equal to all the benefits. One of the advantages of this approach is that it avoids the potential trap – experienced by the MA – of confusing the fact that many of the provisioning services or goods we consume are in fact joint products of ecosystem services and conventional (human) goods and services (Boyd and Banzhaf 2007). More to the point, capturing the value of these services through incentive or market-based mechanisms could prove an important force for conservation. This is particularly true where the location, at which the ecological function that provides protection; or is used as a sink occurs at a distance from the site where the resulting ecosystem good is withdrawn, collected or harvested.

Biodiversity and Ecosystem Services

A fundamental confusion over ecosystem services arises from the omission of the term biodiversity from the MA's ecosystem services definition. This is odd given that the MA was very much designed to do for biodiversity what the Intergovernmental Panel on Climate Change (IPCC) did for climate change: bring it into the public light. Following the MA, a number of views on this conundrum prevail. Some simply take it for granted that ecosystem services include biodiversity. After all, genetic resources are clearly specified as one of the provisioning services; likewise, biodiversity is clearly one of the benefits provided by ecosystems. Another view is that ecosystem services are somehow distinct from biodiversity. Under this view it is necessary to use the phrase "ecosystem services and biodiversity" to fully capture the benefits offered by ecosystems.

Much of this definitional confusion goes back to the various definitions of the term biological diversity, or biodiversity, in the late 1980s and early 1990s. Biodiversity normally refers to the variation within and between biological organisms and is often defined at three scales: genetic, species and ecosystem diversity (WCMC 1992). While this definition is fairly clear and uncontroversial, when it came to the use of biodiversity in global environmental policy debates the term was often simplified, and oftentimes did not clearly distinguish between biological resources and biological diversity (Aylward 1991). This was particularly true when proponents of biodiversity began promoting the economic value of biodiversity (McNeely 1988: ; McNeely et al. 1990). As natural scientists began to employ economic terms like "value" they associated the economic value of biodiversity with the value of all biological resources (effectively everything in the biota). In the 1990s biodiversity became an overarching driver or rallying cry for environmental conservation generally. This reflected a muddling of the concept of the diversity of a system – and the marginal value of having more or less diversity (at a given scale) – and the entirety of the goods and services produced by the system.

The excitement that has surrounded ecosystem services over the last decade is reminiscent of that associated with biodiversity two decades ago. In a now famous article a group of largely natural scientists conducted a weeklong workshop in which they consulted approximately 100 articles on

economic value and then concluded that the value of the world's ecosystem services was twice that of global GDP (Costanza et al. 1997). The question of whether ecosystem services are just part of environmental values or the "whole enchilada" is reoccurring. Clearly, the globe and its inhabitants rely on a variety of ecosystem services; and just as clearly, wiping all these services and attendant biodiversity off the face of the planet would mean the end of civilization as we know it. However, between a perfect state of nature and the absence of nature are many points at which society must choose the level of biodiversity and ecosystem services it desires. In the terms of natural science it should be clear that at these points the diversity of organisms is related to ecological function but is not the same thing. Similarly, where diversity and ecological function support, regulate or otherwise contribute to the production of the stock of an ecosystem good there is a cause and effect between the provision of more or less diversity or ecological function and the stock of the good. These are not all or nothing questions about the biosphere, but marginal choices to which economics can contribute if properly conceptualized.

In order to ensure that the research proposed later in this paper is clearly targeted, this paper conceptualizes biodiversity as an attribute of a given system. Such diversity may then occur at different scales. But biodiversity and ecosystem goods and services are construed as distinct concepts. So, in economic terms a highly biodiverse ecosystem – such as a tropic forest or a coral reef - may be valued by people purely for the continued existence of its attribute of species richness (i.e. a non-use or existence value), but this would be separate from and in addition to the use values of the forest for timber or tourism. Likewise the support in the form of erosion control that the forest offers to the coral reef would be an additional ecosystem service provided by the forest. In this case the ecosystem service and the existence value are distinct concepts (and values) in that if properly accounted for in land use decision-making they might affect the choice to use the forest for timber, tourism or conversion to agriculture.

Ecosystems, Public Goods and Market Failure

Traditional ecosystem goods (natural resources such as timber, fish and water) are not always exchanged in perfectly functioning markets, but generally they are treated as private goods that enter directly into human preferences. They therefore differ from indirect use values and existence values that arise from ecological function and biodiversity that are rarely marketed and are often considered as public goods. Although ecosystem goods are often bought and sold in markets, they do pose management and financing challenges. For example, fugitive resources like fish or wildlife are classic cases of common pool resources that require collective action in order to be well managed. A long history of responses and solutions to these challenges exists, effectively solving the problem of exclusion and enabling these goods to be traded in regulated markets.

This is not the case for ecosystem services and biodiversity. These have public good characteristics and, historically, have been provided directly by the public sector. Biodiversity set-asides in parks and reserves is one solution. Arguably the late rise of ecosystem services as a focus of conservation concern relates to their relative obscurity and hitherto the lack of explicit efforts to conserve and manage these services. Creation of a marketplace or credit markets (as discussed below) clearly poses new challenges in implementation. Whether or not the same incentive mechanisms and financing solutions applied to ecosystem goods, biodiversity and other

types of goods and services in the economy will apply to ecosystem services is, therefore, one of the questions that needs to be asked and answered in developing such markets.

The public goods problem and market failure are underlying economic driving forces determining the availability of ecosystem services. In the absence of collective action to redress this issue, the market will not provide ecosystem services in a manner consistent with their true utility to society. As ecosystem services are one of the benefits provided by ecosystems, these ecosystems are undervalued by society. As a consequence, ecosystems are not managed for their natural attributes and are altered (or converted) to meet profitable and short-term human uses. Thus, the objective of efforts to develop alternative incentive mechanisms for providing ecosystem services is to conserve, manage and restore ecosystems (referred to jointly as ecosystem management from here on).

Due to the limited definition of ecosystem services employed here, and the presence of ecosystem goods and biodiversity as other benefits provided by ecosystems, there is now the potential to weigh all three types of benefits in determining optimal ecosystem management. That is, different levels of conservation, management and restoration of a given ecosystem may lead tradeoffs in terms of the costs and benefits associated with ecosystem goods, ecosystem services and biodiversity.

For example, it may be possible (and desirable) to maximize ecosystem service provision through active management without restoring biodiversity. For example, if a principle economic function of wetlands in a given geographic area is processing of nutrients and providing water quality, this may well be achieved by engineering a biological system that is equal to or lower in diversity than a "natural" wetland. Similarly, if provision of ecosystem services is particularly valuable in an area then it may be necessary to reduce the level of ecosystem goods that are harvested. So, if carbon is of great value, then optimal ecosystem management may reduce the volume of timber harvested (or extend the rotation) in favor of sequestering carbon. Part of the benefit of creating markets for ecosystem services is, of course, to enable decisions that optimize across the different ecosystem benefit categories. However, it is important to recognize that even if ecosystem services can be pulled into the market system in this fashion, biodiversity will often still be left undervalued. This argues for paying due attention to the interrelationship between ecosystem services and biodiversity. Ideally, efforts to manage ecosystem services would be similarly beneficial for biodiversity. However, at least partly due to the conceptual confusion over biodiversity and ecosystem services the truth or falsity of this statement is not well established.

The Ecosystem Marketplace and Multi-Credit Ecosystem Service Markets

The application of market principles to ecosystem management, while an attractive proposition, suffers from a number of difficulties. Perhaps the first issue is the design of regulatory and voluntary mechanisms necessary to overcome the public goods problem and induce individuals, groups or society to invest in ecosystem management (Freeman and Kolstad 2007). There is a wide literature on this topic, so this paper does not dwell on it; rather it begins with the premise that this essential step can be achieved. In other words, market demand exists or consumer

willingness to pay can be created through regulatory or voluntary programs; programs that seek to protect undervalued public goods such as ecosystem services and biodiversity.

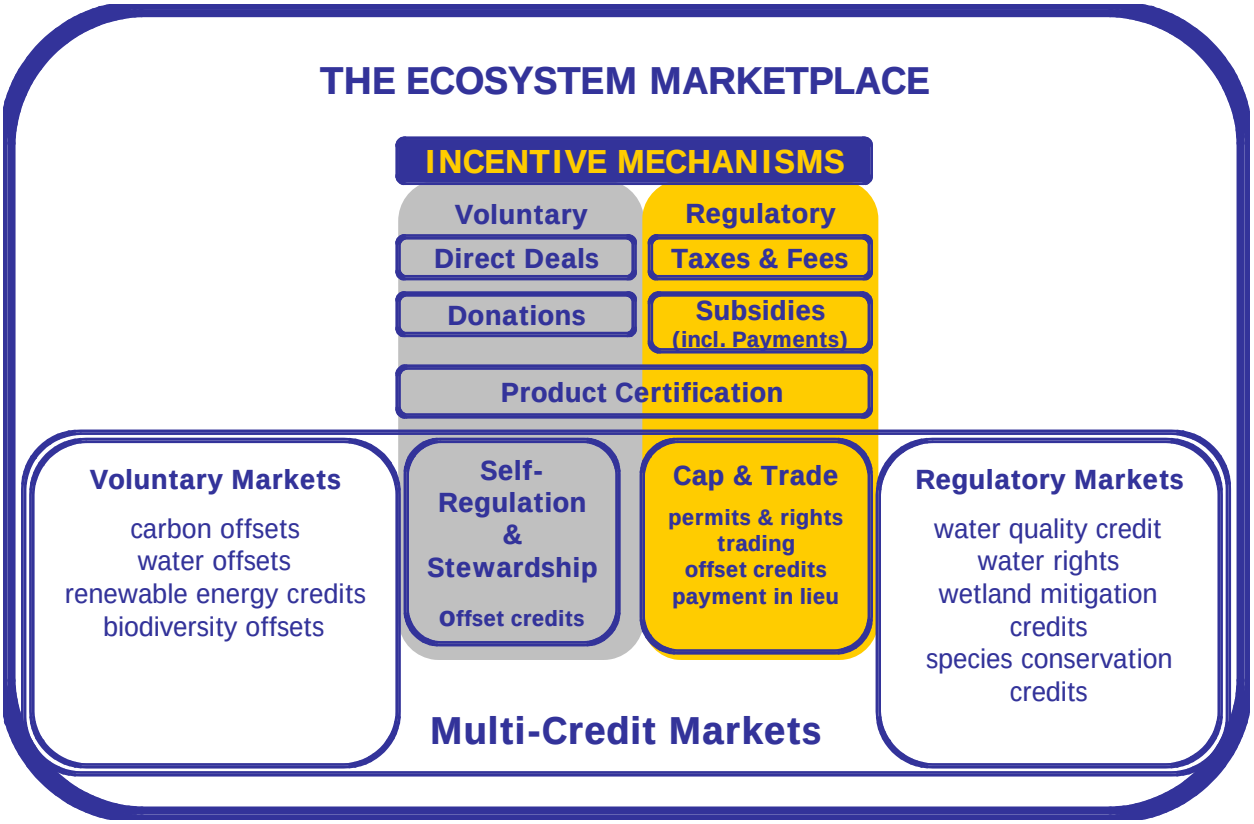
Many terms are in use to convey this application of market principles and approaches to create incentives for ecosystem management, including "payments," "markets" and "marketplace". For the purposes of the research outlined below, the difference between an ecosystem marketplace and a multi-credit ecosystem service market is defined as follows (Institute for Natural Resources 2008):

- an ecosystem marketplace in broad terms is the suite of economic incentive mechanisms that can be employed to improve incentives for ecosystem conservation and restoration
- ecosystem service markets, or more specifically multi-credit ecosystem service markets refers to a more limited set of regulatory and non-regulatory efforts to develop trading systems for credits that represent different ecosystem services

In terms of standard economic terminology, ecosystem service markets are the same as cap and trade systems. In economics cap and trade systems are typically considered as regulatory systems in which a cap is placed on pollution (or resource use), permits to pollute (or use the resource) are handed out, and permittees are allowed to trade in the permits. Such system create regulated markets that shift the incentives for pollution and resource use to coincide with the public good. While less well studied, it is also possible for such programs to be developed absent a regulatory cap. These so-called "voluntary" ecosystem service credit markets rely on the commitment of individuals, corporations or government to reduce their impact or limit their environmental footprint. The difference is that instead of merely donating funds to a good cause and taking credit (little "c), in credit markets the purchaser actually acquires a Credit (big "c") that certifies that the reduction in impact (or the restoration action) has taken place.

Cap and trade systems represent one of a number of incentive mechanisms that can be applied to maintain ecosystem services and protect biodiversity. Subsidies or payments for ecosystem services are an additional type of incentive mechanism that can be used in an ecosystem marketplace (as defined here). Similarly, taxes, fees and charges can also be employed by government to align behavior with the public good in these matters. Product certification is another method whereby the supplier takes the step of improving the environmental (or social) sustainability of production processes and markets this information in order to attain a price premium or increased market share. Figure 1 group a number of these voluntary and regulatory incentive mechanisms in order to show the distinction between the ecosystem service "market" and "marketplace." Again, not typically thought of in this manner there are often voluntary counterparts to the regulatory tools in these cases.

Figure 1. Ecosystem Marketplace Incentive Mechanisms



The term "multi-credit" in Figure 1 indicates that the intent is not simply to develop markets for one ecosystem service but for a number of services as applicable in a given location. For the remainder of this paper multi-credit ecosystem service markets are abbreviated to "ES markets."

Due to its wide-ranging coverage of ecosystems and its objective of ecosystem management as a whole, it can be asserted that in many places – and particularly in the U.S. and the state of Oregon – there is an active ecosystem marketplace. It includes a broad range of incentive mechanisms, but it is hard to argue that in a given locale (or state) those mechanisms are either coordinated or efficient (Institute for Natural Resources 2008). Nonetheless the marketplace is well advanced in comparison to the limited development of ecosystem service markets. Some analysts have suggested that these markets are already large and operational (Scherr et al. 2006). However, review of the programs and mechanisms often reveals that the bulk of the activity is not in ES markets per se, but in the ecosystem marketplace more generally. In other words, actually volume of activity is in payments and subsidies, rather than in ES markets. While the focus of this paper is not on an analysis of the status of ES markets, a brief and subjective summary of the kinds of ES markets and their level of development is useful background to a discussion of financing need.

Carbon sequestration credit markets represent probably the most well-developed voluntary and, increasingly, regulatory ES markets globally (Hamilton et al. 2007). Water rights trading to support wetlands and environmental flows is also well established regionally in the United States

and Australia (Garrick et al. 2008). Wetland mitigation banking in the US also draws on a significant track record, although again with regional centers of activity (EPA 2009). Water quality credit trading is under development, with pilot schemes in the U.S. and Australia (EPA 2009). With respect to biodiversity, species conservation credit markets are developed – though not that active – in the US, and efforts are underway globally to develop biodiversity offsets (Forest Trends 2009: ; ten Kate et al. 2004). Innovative applications of ES markets will no doubt continue to evolve. For example, the City of Portland is developing a stormwater trading credit concept to see if it will prove beneficial in encouraging and financing stormwater protection activities. In particular there is a gradual trend on the demand side to develop cap and trade approaches alongside payment in lieu mitigation programs.

In part, interest in ES markets are motivated by a desire to provide a single, integrated approach to ecosystem restoration (The Willamette Partnership 2009). Ideally, once the accounting systems and trading platforms are established for different services they can be applied in a given geographic area. This then becomes an exercise of matching the available markets and tools to the services that are in demand or supply in the given area.

By the definitions advanced above, a market in ecosystem services is only one of a number of driving forces for ecosystem management. In this paper an effort is made to focus solely on ES markets and, indeed, a single enabling condition of these ES markets: financing supply. Given that many broader ecosystem marketplace mechanisms are already functional, their financing needs are presumably already being met. Lessons that can be learned and transferred from the marketplace may be of value for ES markets. Further, existing efforts in ES markets may shed light on useful approaches. However, as discussed later in this paper, the introduction of a rural sustainability objective may limit the number of success stories and useful examples.

Developing Ecosystem Service Markets

This section examines the factors involved in the evolution of ecosystem service markets and dicusses the principal obstacles observed so far in these markets. The fundamental requirements of an ecosystem service market are then developed in order to provide a list of enabling conditions for markets. The discussion highlights that there is a need to develop the demand for ecosystem service credits and that there are actions policy-makers and planners can take to enable conditions for supply – in particular, finance tools.

Obstacles to Market Development

Despite the progress made in individual market fields it is fair to say that efforts to develop ES markets that integrate either across services or across the regulatory/voluntary spectrum have largely been frustrated to date. More mixed results have been obtained in specific service markets, particularly with geographic spread and convergence around a single standard. For example, it is reported that there are four major verification standards for carbon projects and in the voluntary market there are a large number of sellers abiding by different standards on the sell side and presenting buyers with a range of ways to calculate their carbon offset requirements. Despite the proliferation of organizations and standards, the voluntary carbon market does have a global reach. Markets for environmental flows have seen considerable innovation across

geographies as approaches are modified to basin-specific contexts. Yet, in the Murray-Darling (Australia) and in the Columbia Basin there has been more success with adopting a standard verification process, perhaps because much of the funding comes from a limited number of public or quasi-public agencies. Clearly, we need additional lessons from such experiences in terms of what stimulates an effective market in a given service.

Within Oregon, despite a number of successful pilot efforts in specific service areas like carbon, instream flows and water quality trading, it is fair to say that efforts to create comprehensive new credit markets and to integrate these markets have yet to move from the drawing board to the field. There are a number of reasons why individual ES markets – such as water quality – have not developed as quickly as anticipated (INR 2008). Some of the obstacles encountered include:

- lack of clarity or agreement with respect to prioritized ecosystem management objectives
- political willingness to be regulated (by local public entities subject to new regulations)
- lack of transparent and credible ecosystem service accounting systems (biophysical units)
- lack of established certification process (and certifiers)
- lack of central registries for credit administration
- patchwork nature of efforts to develop voluntary market
- lack of clear and agreed upon stewardship standards on which voluntary offsets can be based
- lack of interagency coordination and integration of regulatory markets

- general unfamiliarity of the public with ecosystem services

While these are essential tasks in launching a market on the demand side they may not be all the tasks necessary. It may be the case that an additional reason why demand has yet to materialize as expected is in part the lack of a ready source of supply. In a regulatory market those being regulated will be averse to regulations if the availability of credits and their cost is unclear. In a voluntary market the lack of supply may simply serve as a further disincentive for buyers to reveal their preferences to the market. Stimulating demand and providing the accounting framework, certification process, and registry are necessary to establish credit obligations and create credit supply – essential components of market development there. But there remains the "chicken and egg" question of which must come first, supply or demand. The logic that once demand is present that the private sector or the "market" will respond and provide supply is subject to a number of caveats. A review of basic market fundamentals helps illustrate the enabling conditions for a market to emerge, as well as the associated technical tasks.

Enabling Conditions for Market Development

In any market, the gains from trade must be significant and exceed any transaction costs. In other words the first requirement is that there exist gains from trade between buyers and sellers. Demand for credits may be created but if the supply of credits costs more than buyers are willing to pay, no market will emerge. In market design and development, this argues for accurate market analysis, including the sizing up of willingness to pay and the appraisal of the price at which suppliers will produce the desired ecosystem service(s). The type of market may determine the emphasis and importance of this task. For example, in voluntary markets, understanding demand may be more important than in regulatory markets – as the purchase is completely at the behest of the buyer. In regulatory markets, it is more likely that the failure to

offset or mitigate will impose large costs – putting development or business activities at risk – and, thus, the primary question is how much credits will cost.

Second, this financial calculus must also include relevant transaction costs. If the full set of costs associated with processing the transaction – such as administrative, technical and monitoring costs – exceed the gains from trade, then despite their appeal transactions will not take place. This explains why work on accounting systems, certification processes and registries is so important – when these are absent or don't function well the costs of a transaction are prohibitive. The technical, ecosystem-service accounting task may be needed on both sides of the transaction. The entity being regulated requires a calculation of their offset obligation. The supplier needs to know how many credits are produced by a given on-the-ground action or transfer of existing rights or allowances. In both cases some entity must develop the calculation and certify the resulting credit obligation or credit supply. Then a registry is required to track the transfer of credits produced and the matching of these credits with obligations. The registry and the associated contracts for purchase and sale of credits are in effect the market – i.e. where demand and supply meet.

The third requirement for supply to materialize is not just that the producer can earn a return on his/her investment, but that this investment can be financed during the start-up and operational phase. If the amount of investment required of producers – either in terms of dollars or time – is significant, then absent the required financing producers will not "adopt" the ecosystem service credit as a new product. Or more likely those with access to such financing will engage with the market, whereas those without access will stick to traditional products and markets.

A fourth requirement is obviously that suppliers are aware of and can understand the opportunities presented by ES markets. If they cannot calculate the net gains from changing their production practices they are unlikely to adopt the new approach. Economists have described a phenomenon called the endowment effect, or status quo bias. This refers to the perception of gains and losses by an individual considering the choice to participate or not in a market. Generally, people strongly prefer to avoid losses to acquiring gains. Research shows that in new markets – where there is no experience trading the good or service – the endowment effect exerts a very strong influence on behavior. This means that farmers and ranchers, for instance, will be risk averse – that is they will perceive changes in their productive practices and the status quo as a loss – when presented with the opportunity to change their behavior and gain from new market opportunities.

This is not promising for the development of ecosystem service markets. The practical implication is that it will be hard and costly to sign farmers and ranchers up for such programs. These costs will come in two ways:

1. The transaction costs of extension efforts necessary to persuade farmers and ranchers to adopt new practices and give up old practices (or rights like water rights)

2. A premium over the opportunity cost to the producer will need to be paid to get them to implement the desired changes, i.e. to get them to accept the loss

Obviously, this is not a new problem. Research into the diffusion of innovations and the techniques to encourage adoption of new technologies is a long-standing field, showing definitively that the process is incremental and takes time. It remains the case that the endowment effect will require adaptation, patience and hard work. As discussed further below, water rights are an asset that farmers have owned for generations and, yet, convincing them to focus on the potential gains from trade – and not the loss of the right – has been a long, hard sell. Ecosystem service credits have absolutely no history and it is not clear that all the certification protocols, registries and other market infrastructure that will be created to entice demand into the market will do anything to counteract the endowment effect for the sellers.

A final issue is that of collective action and organization. In developing the supply-side of the market it will be essential to thoughtfully consider what institutional arrangements and organizations can be used to create the enabling conditions for the rapid and widespread adoption of promising innovations. Cooperative associations, government agencies, private banks and many other institutions work to help their constituents obtain access to low-cost inputs, loans, insurance, marketing services and other services that improve agricultural terms of trade.

As discussed above there are parallels between the traditional rural economy and one that integrates ecosystem services into productive activities in terms of the issues that successful market development involves. Agriculture and forestry led to the production of commodities with clearly defined products and markets. Yet, supply is not left purely to the private sector. So it is fair to ask whether, from a standpoint of public policy and public investment, is it sufficient in the case of ES markets to simply work to stimulate demand and to lower transaction costs? In the discussion below we examine in more depth the issue of financing and the need to carefully consider this need in developing ES market supply. To some extent this discussion brings in the other issues of raising awareness and achieving requisite levels of organization – at least as they pertain to financing. Full consideration of how these issues will be approached in developing an ecosystem marketplace is another topic worthy of further inquiry.

Financing and Market Supply

Prior experience with ecosystem service markets and adoption of best management practices suggest that advocates assume away the issue of supply at their peril. Efforts to acquire water rights for ecosystem restoration in the western United States, and now Australia, have struggled with the problem of finding supply even in the face of rights and licenses that – at first glance – are easily tradable (and analogous to an ecosystem service credit). Demand – in the form of significant allocations of public funds – has been present but supply has been slow to materialize.

In these markets all of the issues raised above have been present. First, in many cases potential sellers have valued their rights at a much higher value than agencies and non-profits were willing to pay. Second, the transaction costs associated with transferring rights from consumptive, out-of-stream uses to non-consumptive, ecosystem uses have been substantial (Hardner and Gullison 2007). Finding workable financing, extension and organizational models has taken years of time

and collaboration between funders, state agencies, intermediary non-profits, irrigation districts and irrigators.

In the case of finance, the problems encountered in these nascent environmental water markets have included:

- the need to finance the establishment of intermediary capacity to develop, implement and monitor transactions (for the intermediary)
- the need for project finance that arises between contract signing and the closing of a deal (for the seller)
- bridge financing during interim periods between payments to sellers and receipt of funds from buyers (for the intermediary)
- financing needs for longer-term deals in order to balance financial risk (for the seller) and performance risk (for the intermediary and buyer)
- financing risks due to delays and difficulties encountered in the process of transferring water rights using state administrative procedures

In the Columbia Basin, many of these issues have been worked out in the last 15 years. While a group of state agencies and non-profits continue to work on their state or basin-specific agendas, a regional brokerage bringing funds from Bonneville Power Administration has emerged as a key financing facility for these groups. Central to the advances made in transaction volume during the first five years of the Columbia Basin Water Transactions Program – run by the National Fish and Wildlife Foundation – has been the willingness of BPA to provide grant funding for transaction development (Hardner and Gullison 2007). Environmental water transactions emerge out of close collaboration with farmers, ranchers and irrigation districts. Intermediaries such as water trusts, basin conservancies and state agencies have found that the transaction costs of developing water deals are significant. In this case, without providing funding for these transaction costs the public funds allocated to purchasing water for the environment would likely still be vastly underutilized due to a lack of deals.

The example of environmental water transactions suggests that the necessary financing for ES markets may well involve two levels of financing: first, at the level of an intermediary organization that engages in the awareness-building and extension activities necessary to promote the market to potential suppliers and second, at the level of the supplier. Indeed, for ES market transactions to target rural landowners, and family-run farm, ranch and forest operations, the need for an extension model similar to that provided by NRCS and local soil and water districts is obvious.

It can also be suggested that large-scale carbon sequestration projects coming from land use and management in the commercial forestry sector are not as likely to face this first level of financing problem. Working with large forestry companies may also alleviate the project-level financing problem as well, as such companies have the asset base and diversified production portfolio to self-finance.

In terms of the likely financing needs and structure in the private sector the example of wetland mitigation banking may be compared with that of environmental water transactions. As noted above environmental water transactions that are temporary in nature may present challenges in terms of performance, risk and finance. But permanent transfers of water rights may differ from

land-based ES transactions in that once the transfer of the water right is achieved the transaction is final and the full amount of the purchase paid. Although monitoring to ensure the water instream is advisable, the state itself actually assumes direct responsibility for meeting the new instream water right. Future performance on the part of the seller, intermediary or buyer is not an issue. In the case of wetland mitigation banking there is, on the other hand, a continuing obligation for the mitigation bank to ensure the functioning of the banked acres. There is then a continuing risk, reward and performance issues associated with these transactions – with the potential for concurrent financing needs.

In all likelihood, however, the major financing need for land-based ES transactions will be the chicken and egg issue of how to obtain funds to invest in changing management practices when the ES credits themselves will not be certified and available for purchase for some period of time. This problem is likely to differ between stages of market development. Looking down the road, when credit markets are established the market risk associated with investment in developing ecosystem service credits will be relatively well known. As a result financial institutions can price this risk. Just as with agricultural products the private sector will then be willing to provide loans and other forms of finance. This is not to say that there might not be a role for other public or local financing sources – particularly as these sources are likely to be required when ES markets are immature.

Indeed, it is in these early stages of market development that financing at the project level will be most critical. At this stage, demand and verification processes are untested, unreliable or suffer from other risks and uncertainties. The lack of experience and data mean that these will be uncertainties not risks – in the sense that an uncertainty cannot be quantified whereas a risk may be quantified. It is precisely the inability to calculate and price the risk involved that will make the private sector wary of financing such innovative transactions. In other words there is likely to be a need for some form of collective action to engage and overcome this problem – whether it is a local, cooperative solution or a higher-level state or federal solution. What these solutions might look like in terms of the financial mechanisms and institutional arrangements is the subject of the research proposed below.

The financing problem for ES markets can be illustrated by comparing it to that under the adoption of BMPs under existing marketplace programs such as USDAs Conservation Reserve Program (including CREP). These programs operate on a direct payment system. Landowners enter into contracts that specify up-front payments, cost-share on capital costs (paid on a reimbursement basis) and rental payments made for the duration of the contracts. Financing here is not much of an issue as payments and reimbursements are made by the Farm Services Agency pretty much in parallel with expenditures made by the landowner to implement the BMPs. In a direct sense the CRP programs pay for performance in terms of implementing measures on the ground and not for performance in terms of the improvement in ecosystem services.

Ecosystem service markets on the other hand will represent a much riskier proposition for the landowner. The landowner's revenue stream begins with the sale (or rental) of credits. But first these credits must be established through the certification and registry process. In order for this to happen the landowner must have implemented, or at least initiated the BMPs that will lead to the additionality required by any credit system. Ecosystem service markets will generally not be based on a landowner doing nothing, though in some cases this may produce additionality (if the

landowner would otherwise have had incentive to undertake a production process that damages ecosystem services). With an increased emphasis on ecosystem restoration – not merely avoidance of degrading activities – and the threat of invasive species it is likely that credit systems will reward only active implementation of BMPs and restoration activities. These actions will typically have significant up-front costs in terms of investment in training, adoption of new production or restoration methods requiring new equipment and technology, as well as recurring costs from lower net benefits from remaining traditional production activities. A further complication is that in some cases the yield of such investment in terms of the quantity of ecosystem services will not be immediate but rather gradual – for example as vegetation takes hold and matures.

In sum, ecosystem service markets appear to have the potential to be more robust in terms of the ecosystem services that they will provide, as opposed to existing programs like CRP. However, it is exactly the rigor of the monitoring and certification process – and the time involved – that creates the need for finance.

Policy Research into Ecosystem Service Financing

In this section a number of overarching values are considered before turning to objectives, research questions and agenda of a research effort into ecosystem service financing.

Rural Sustainability, ES Markets and Financing

Before proceeding to the research effort itself, it is useful to set out the normative assumptions that drive the policy inquiry. It is fair to say that the development of ES markets is not just a matter of environmental restoration objectives and economic efficiency. In fact the assumption here is that social objective is the overriding objective and that this objective must be one of rural sustainability. Such sustainability is best envisioned as a rural landscape in which rural producers own the land and actively participate in a rural economy that is based on the integrated production of traditional commodities (from the farm, ranch and forest) and ecosystem services. Further, the rural economy is linked to the urban economy not just as a mere paid producer of basic foodstuffs, but as a producer of critical ecological processes that provide clean water for cities, mitigate for energy production and climate change, and support recreational opportunities and cultural stewardship values associated with fish and wildlife habitat and biodiversity more generally.

It is easy then to compare this vision with a rural sector dominated by corporate agricultural and ecosystem service providers, in which rural inhabitants are in effect hired hands or sharecroppers of ecosystem services. Wetland mitigation banks are often run as private sector concerns. Although of great potential significance ecologically, such wetland banks cover a fairly insignificant portion of the rural (or urban) landscape. However, there is the prospect that just as corporations have been able to grow and displace family farms in the agricultural sector, development of the ES market might lead to another wave of corporatization and consolidation of rural lands under the management of large firms that see the opportunity presented by ecosystem services. As stated earlier the success or failure of such ventures cannot be predicted – as they also rely on demand drivers and reasonable transaction costs. However, it can be

suggested that a critical difference for such corporations will be their ability to self-finance or seek financing in the capital markets, two options typically not open to the rural landowner.

While this perspective may be exaggerated – given that it remains unclear to what extent ES markets will be a significant force across rural landscapes – it does not detract from the intent to view ES markets as one of many tools to achieve rural sustainability, not as an end in and of themselves, or purely for the purposes of ecological restoration. Indeed, the concept of services derived by humans from ecosystems is an inherently anthropocentric notion – and, thus, we must ultimately return to questions of social choice and political reality.

A related issue is how two competing models for the rural economy compare: ecosystem services production based on the rural sustainability model, versus the corporate model. If the regional economy would be stronger under the corporate model then perhaps it would be better for rural inhabitants and be more sustainable in the long run. This raises the question of the regional economics of ES markets under these two alternative models. It also raises the question of the comparison of a purely traditional agricultural model with one in which ecosystem services are integrated. At present it does not appear that these questions have been investigated. Efforts have been made to demonstrate the microeconomic or project-level economics of ecosystems service production. However, characterization of the ecosystem service regional economy using standard input-output, social accounting matrix or partial/general equilibrium models is a task yet to be undertaken.

Where, for example, a social accounting matrix is available, a useful comparative analysis of these models of the rural economy would shed light on important questions such as:

- Where and to what social groups do expenditures and receipts accrue in ecosystem service production?
- What are the employment impacts and on which social groups?
- To what extent do expenditures circulate in the local economy or leak dollars to the larger economy?

These will all be important determinants of rural sustainability and may help understand the question of how an ecosystem service economy can be financed. While not examined further here the synergies between this suite of research questions and the work introduced here is worth noting.

Objectives and Outcomes

The purpose of the policy research recently funded by the Bullitt Foundation to be undertaken by INR is to explore and develop a range of financial tools and institutions that facilitate access for rural landowners and communities to the supply side of the ecosystem marketplace. This will allow evaluation and strengthening of the connection between the marketplace and rural sustainability.

The project is important and timely for rural sustainability and the evolving restoration economy, as it identifies small- and medium-acreage, rural landowner financing needs and solutions while the window for establishing market rules is still open.

Project outcomes include:

- lowering supply-side risks and transaction costs for small- and medium-acreage landowners
- creating appropriate institutions for rural participation in the restoration economy
- providing new income streams for small- and medium-acreage landowners, thereby contributing to rural sustainability
- increasing the economic appeal of ecosystem restoration using market mechanisms
- advancing ecosystem services markets development by addressing the supply-side financing component

Policy Research Questions

The principal question to be addressed is: what types of financial mechanisms could be used to help rural communities access the emerging ecosystem service market? Both regulatory and voluntary markets will be included in the analysis. Ways to meet the need for finance for intermediary organizations and project-level finance will be explored.

For intermediary organizations, financing needs will be made explicit and existing federal, local, state, non-profit and private models will be examined for models applicable to ecosystem services. The potential role of these organizational forms in providing awareness-building, extension support, bridging finance and other services will be explored so as to elaborate the type and level of finance required.

For project financing, there are a number of traditional ways to meet financing needs, including:

- self-financing (proponents dedicates their own savings towards the project)
- loans or lines of credit from public, private (banks) and public/private (cooperatives) sources
- forward contracts and options contracts (the future acquirer of credits shares some portion of the risk and provides capital up front)
- venture capital (a private investor with a high appetite for risk and an interest in developing new business opportunity finances a pilot)
- private equity investment (a private investor with some appetite for risk acquires a stake in the business, often-times employing debt to finance and leverage their share of the project)
- structured project financing (the project is wholly financed through a project investment vehicle with provisions for the stage at which the project – once built, owned and operated – is transferred back to the landowner)

Public and public-private investment programs and other innovative approaches applied in other new product development spaces will also be reviewed for applicability.

Promising approaches will be evaluated using a simple set of evaluation criteria in order to derive a prioritized list of approaches and their potential applications. In each case the likely provider of capital will be identified and any risks and assumptions regarding their willingness to participate discussed.

Each type of financing mechanism will have a particular set of institutional needs based on sources of capital and how market participation is financed. These needs must be made explicit and likely organizational forms identified. Bearing in mind concerns over how these new markets will contribute to rural sustainability, the institutional form may represent an important factor in choosing the most promising mechanisms. In examining the institutional issues a number of questions will be addressed, including:

- what institutional constraints exist for these financial mechanisms, and how might they be overcome?
- what organizational forms and programs are appropriate for delivering financing specifically into typically risk-averse rural economies?
- what enabling conditions or institutional arrangements are necessary for proposed sources of capital to provide robust rural funding?

Action Learning Agenda

The action and learning components of the project will seek to improve and validate project findings through interviews with key informants, a series of focus groups, and targeted training and outreach workshops. Participants will include buyers, financiers, intermediary organizations and landowners. The project will focus first on Oregon, where preliminary market development components are in place and available for adaptive learning, in particular the Willamette and Deschutes basins. The Willamette provides insight into wetlands, habitat, temperature, and nutrient trading; the Deschutes experience is extensive in water quantity and quality. Early in the project the team will begin to identify potential pilot market transactions, with a view towards launching specific proposals for financing in these cases in order to test out the results of the research and consultations. The ultimate objective will be to test financing mechanisms elsewhere in the state, where market opportunities are not so well developed. This will help in the evaluation of the ground-up potential of the financing mechanisms being considered.

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