Ecosystem Service Market Development: The Role and Opportunity for Finance

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for the
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Executive Summary

Intact ecosystems on rural lands provide critical services to residents of Oregon and other regions. These services include but are not limited to regulation of climate through carbon sequestration, provision of clean freshwater for cities and towns, support of fisheries that sustain us, and preservation of intact, wild landscapes of great spiritual and recreational value. Historically, these services have been available for free as landowners do not receive payments for the value they provide through sustainable management. Typically, they were noticed only when reduced or eliminated. Perceiving their loss as a failure of a market economy to provide for the common good, environmental economists advocated for payments for ecosystem services as a way to align economic incentives with land and water stewardship. The creation of tradable credits for the development or preservation of ecosystem services has emerged as a method to provide such payments. These credits are financial assets that can be sold to fund landowners' investment in stewardship projects. Earning a financial return for good environmental stewardship of property holds the promise of simultaneously protecting the environment and providing economic opportunity in rural areas, thus supporting societal interests in rural sustainability.

Though markets for different types of ecosystem services credits vary, a paucity of transactions in the early stages of market development is a challenge. The extreme thinness of markets can be self-reinforcing, with few landowners willing to develop additional credits without strong prospects for a sale. The lack of supply of credits, in turn, leaves potential buyers discouraged. This broad chicken-and-egg dynamic has meant that the potential to harness credit markets to meet environmental goals has been largely unrealized.

One potential obstacle to the emergence of markets for these credits is a lack of financing for projects seeking to develop ecosystem services and their credits (hereafter ES projects). The research effort described here seeks to develop innovative financial mechanisms and approaches to meet this need. This report presents findings from research including a theoretical inquiry, interviews with national and international leaders in ES finance, and the proceedings of a workshop entitled Enhancing Rural Sustainability: Financial Tools for Ecosystem Services Transactions. The workshop, held on December 1, 2009, brought financial industry professionals together with non-government and government leaders active in developing ecosystem services markets to discuss the challenges and opportunities in helping ES projects access financing. This report includes recommendations for improving ES project access to finance, some of which will be tested in pilot projects in a second phase of this effort. A longer-term objective is to unlock ES project development as an environmentally beneficial economic opportunity in rural communities.

Finance in Context

This research project recognizes that finding funds to pay for the specific actions needed to generate and maintain credits is critical to the eventual success of any markets for ES credits. For some potential participants in these markets, a dearth of financing is their primary barrier to supplying credits. Others see finance as just one of many areas where additional work is needed to lay the groundwork for viable market transactions. A third notion held by stakeholders is that while financing for these projects is not readily available, this reflects the immaturity of markets and speculative nature of ES development rather than a failure of financing *per se*. For example, to summarize one discussion thread from the workshop, financial mechanisms may be irrelevant until market rules and regulatory obligations are established, at which point we may find that adequate financing is available if project development promises a market rate of financial return.

Given the major differences between markets for various types of ES credits, there is likely no single appropriate understanding of the criticality of finance relative to other enabling components of functioning credit markets. The varied views on the importance of this work suggests that functioning financial mechanisms are a necessary, but not sufficient, ingredient in a functioning market.

The Need for Finance in Ecosystem Service Production

A sound link between ES projects and sources of finance is important for two primary reasons. First, there are upfront and ongoing costs to landowners developing ES projects. Financing is necessary to cover these costs if lands are to be managed for ES. Second, it allows landowners to monetize ES projects. If a landowner cannot capture the financial value of developing ES on his property, then he is unlikely to undertake the project if there is an opportunity cost in terms of foregone income from traditional land uses. This is expected to be the case even if funding for ES project development is available.

Figure ES-1: Ecosystem Service Credit Production, Cash Flow, and Landowner Financing Need

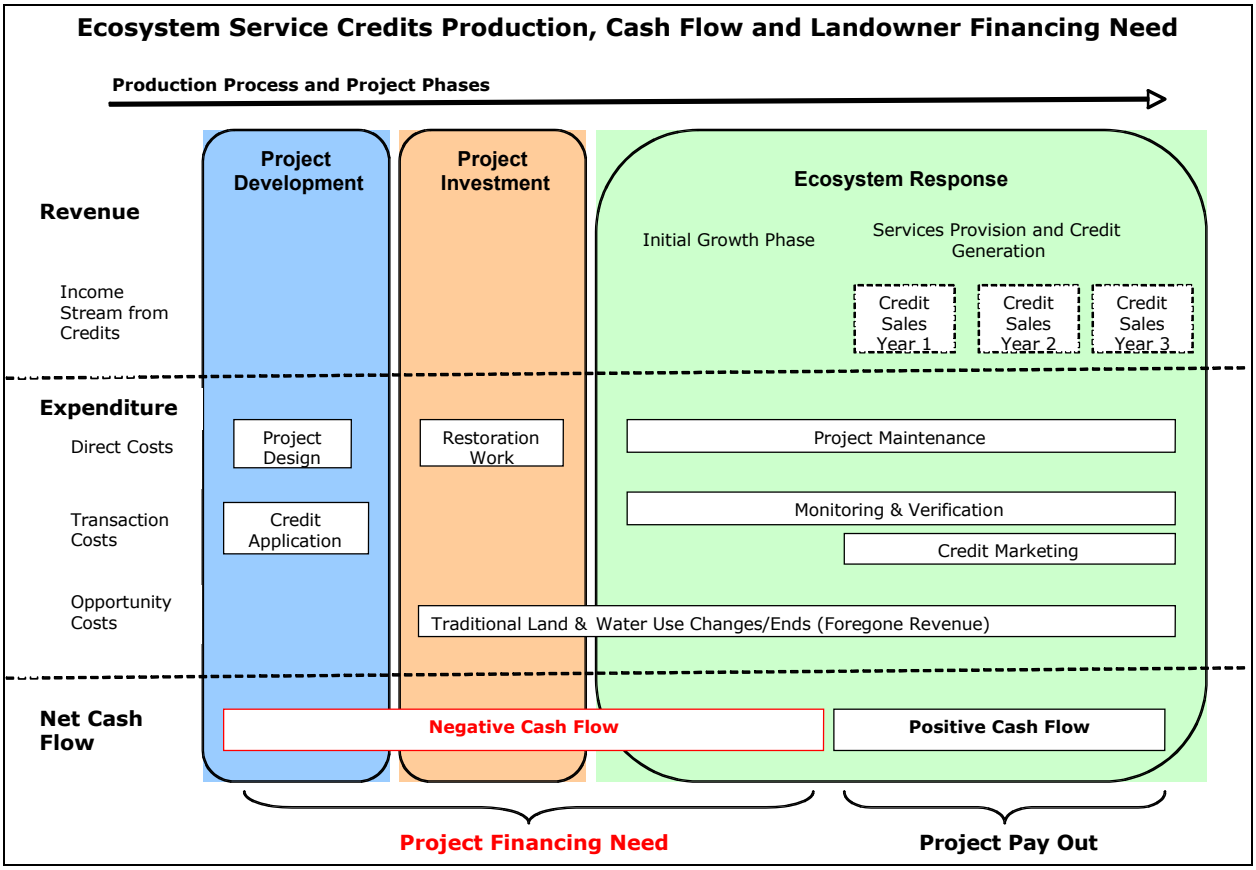


Figure 1 is a generic illustration of the relative timing, certainty, and magnitude of the financial flows in the production of ecosystem service credits. Positive revenue flows (benefits) are presented in the top section of the figure, while expenditures (costs) appear below. Costs are identified either as direct costs of production, transaction costs or opportunity costs. Three phases in the production cycle are defined across the top: a project development phase, a project investment phase, and an ecosystem response phase. Further, activities or revenue flows that entail a significant element of uncertainty are denoted by

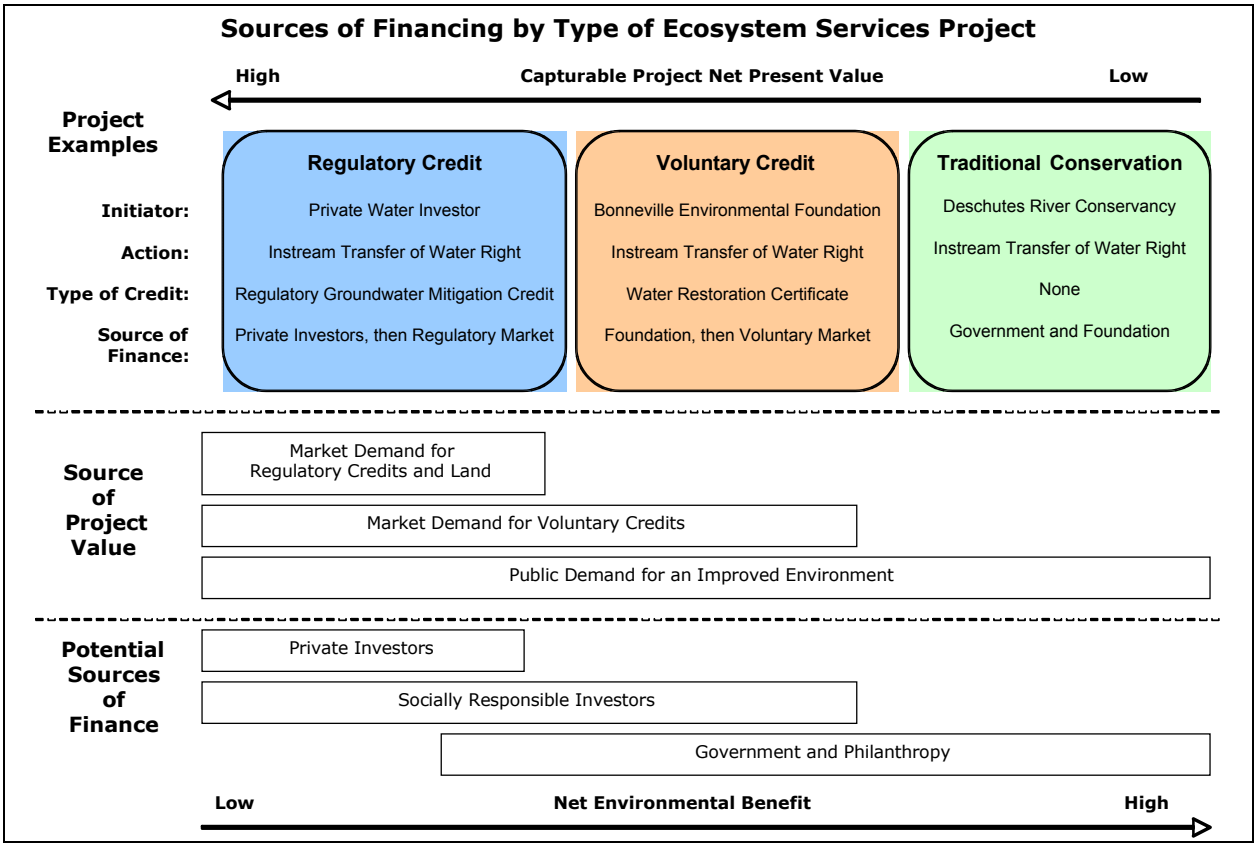
dashed boxes. Regarding the two major needs for financing described above, the project development costs appear on the lower left, while the monetization of the value of ES is depicted in the upper right.

This graphic can also be used to understand the economic value of developing an ES project from the landowner perspective. If the risk-adjusted value of the revenues from credit sales (upper section of the graphic) is greater than the total of the costs (lower portion of the graphic) when discounted to the present, then the project has a positive net present value (NPV) and is an economic opportunity for the landowner. Theoretically, such an opportunity should be able to attract financing because it is a good investment. The reality is more complex because of variations in the understanding of project economics, variation in the timing of payment for services, and differences in objectives of financiers. It is also confounded at present by the absence of such infrastructure as standards for the functioning of a larger marketplace. In many cases, project economics entail significant upfront investment costs needed to develop credits that may, if all goes well, be sold in the future for a profit – a situation that has been generally unable to attract financing.

Sources of Finance

To the landowner, it should not matter where funding to develop ES projects comes from. Philanthropic foundations, government programs, or private sector finance will suffice as long as the funding is available to both develop and monetize the value from the project. In practice, while philanthropic funding and government incentives have been the catalyst behind significant preservation and enhancement of ecosystem services, there is consensus that these sources alone are not adequate to fund and maintain ES project development at the scale needed to safeguard our environment for the long term. Therefore, a primary challenge is how to move beyond public and non-profit funding to access the much larger pool of financing from private capital markets. Understanding how a project can access private capital can help the environmental community better plan which types of finance to pursue for which projects, ultimately increasing the number of projects moving from concept to reality. As stated above, projects with positive capturable net present value represent desirable investment opportunities and should be able to attract financing. In reality, estimates of net present value are imprecise and will vary with context-specific assumptions – often, a project that is highly valuable to society does not afford an opportunity for a private investor to capture this value, resulting in a "good" project that cannot access private capital.

Figure ES-2: Sources of Financing by Type of Ecosystem Services Project



The continuum of ecosystems services financing sources is shown in Figure 2, relating these sources to project structure for a hypothetical instream transfer of a water right. Notably, it is clear that the same on-the-ground environmental improvement will provide different capturable value to investors and will have commensurate varying access to finance depending on how it is structured. Several key points are evident:

- Ecosystem services projects can include a full range of project types from traditional, publicly-funded environmental conservation projects (which produce ecosystem services that are not certificated as credits) to targeted credit development projects under tradable permit frameworks.

- Financing is available for this spectrum of project structures, but not all structures will have access to all funding sources.

- As projects are structured differently, they will create value for different groups. These sources of value will in turn determine which sources of finance they may access.

- As projects are structured to access different sources of finance, the net environmental benefit of the project may vary.

As depicted in Figure 2, projects can solve the challenge of ecosystem services financing by increasing the capturable value they provide to potential investors, moving potential projects from the right to the

left of the picture. A project developer's ability to succeed in this effort will vary by project type – some important environmental investments are better suited to market finance than others. The remainder of this paper presents recommendations for increasing rural landowners' access to finance through the different pathways depicted in Figure 2.

Financing Tools and Recommendations

Recommendations for increasing the availability of financing for ES projects are presented below, grouped by primary strategy. These recommendations were developed through our research and conversation with financiers and other stakeholders. In practice, some recommendations will work better than others, and the same approach may yield dramatically different results in different credit markets. Major strategic approaches include the following:

- Building financial and market infrastructure will help to manage transaction costs and enable basic deals.
- Reducing project risk can increase capturable value by managing the volatility of potential returns.
- Increasing project value through policy or other mechanisms can attract financing.
- Structuring projects differently can help match the economic opportunities of ES projects with investor and financier priorities to increase access to funding.
- Providing financing directly through public policy is an approach that reduces the need to reposition projects as private investment opportunities.
- A separate suite of potential tools can ensure that rural sustainability goals are supported through ES finance.

Build financial and market infrastructure

- **Develop contracts and appraisal techniques to support finance** – Low transaction costs are key to attracting project funding on viable terms, but a lack of standard contracts, appraisal protocols, and other financial infrastructure poses challenges to quickly doing deals. Market rules are critical for enabling simple agreements and easy transactions. Credit registries and appraisal techniques provide the documentation of prospective cash flows necessary to acquire debt finance from traditional banking sources. Much of this basic financial infrastructure does not exist in ES markets, and its development should be a high priority. Selling ES credits from a specific land use amounts to an easement or lien on the property – the primary mortgage holder on the property may not allow this.
- **Create simple crediting protocols that can reduce transaction costs** – A lack of clear crediting protocols in many ES markets creates major uncertainty that hinders project planning and poses unpalatable financial risks to investors. The need for clarity in markets with respect to awarding credits to specific projects was universally identified as a critical step in generating transaction in ES markets. From a financial standpoint easy protocols are critical to reducing risk and reducing project development and transaction costs. Crediting calculators are one potential approach to implementing simple protocols.

Reducing project risk

- **Establish clear and simple crediting and trading rules** – A risk in project development is uncertainty regarding credit establishment, especially in new crediting schemes. Reducing this uncertainty will increase investor confidence and support project finance. Prescriptive obligations, in which regulators commit to awarding credits for certain actions that are precursors of, or proxies for, desired changes in ecosystem services, are one potential tool that can be used to reduce risk.

- **Establish secondary markets for ecosystem services credits** – Concentration of risk is a characterization of many investments in ecosystem services development. The lack of a secondary market for many types of credits means that project developers must often hold their investment over a long time horizon until credit sale (frequently through a bilateral transaction to a buyer that will retire the credit to meet a regulatory obligation). Establishing a secondary market for credits or credit futures (if credits are not yet certified) would allow initial financiers to recoup their money by selling credits to other investors prior to their ultimate sale to a regulated purchaser, thus lowering investment risk for potential financiers.

- **Experiment with insurance, options, and other financial mechanisms to manage risk** – There are many financial product types that could be used to manage risk around the ecosystem services projects. Insurance contracts could manage project performance risk, while futures contracts and options or other hedging mechanisms could manage risk related to prices of future credits. The state could also play a role in reducing risk, for example by selling insurance or using payment in lieu structures to guarantee performance.

Increasing project value

- **Develop regulatory and voluntary markets** – When market demand for ecosystem services credits is well established, projects producing these credits will be more valuable and will have less difficulty attracting financing. Broadening regulatory obligations to offset environmental impacts of economic activity will obviously increase demand for credits and increase project value. Voluntary markets can be similarly cultivated to support the value of credits – marketing ES credits for their public relations value may have the potential to spur demand, increase value, and attract finance.

- **Use tax policy to increase project value** – Tax advantages, including property tax deferrals, can be used to provide additional upside to landowners considering investing in ES production. This benefit is difficult to transfer independent of land, and so its role in project finance is to support the landowners in self-financing a greater portion of a project. Opportunity zones or other place-based special tax incentives can be used to target project development in specific areas.

- **Route projects through "safe" institutions to reach a wider market** – Projects can be made more appealing to risk-averse purchasers by routing them through governments and other institutions that are more stable than small project developers. Routing projects through these institutions can increase costs but may also increase marketability of credits by lowering perceived performance risk, particularly with risk-averse public-sector potential purchasers.

- **Expedite project permitting and approval** – Projects that require permit approval from regulatory agencies can have high transaction costs due to permitting timelines. To the extent that approvals can be expedited, development costs are lowered and eventual revenue generation is accelerated, improving project value.

Structuring projects to manage economics

- **Aggregate small projects to improve project value** – Small-scale projects, which typify many rural settings, tend to have limited access to financing from capital markets because transaction costs erode their net present value. Aggregation, combining multiple like-projects into one larger project, can improve economics by creating the critical mass necessary to attract private finance. In addition, aggregated projects can be less risky by virtue of diversification in their constituent sub-projects. Aggregated projects may also access returns to scale that create additional value. For example, the value premium associated with large areas of contiguous habitat might mean that a conservation buyer will be willing to pay for an easement if and only if all area landowners are willing to participate – in this case the aggregation creates ES value and attracts finance because the sum is worth more than the parts. Aggregation can also create a critical mass of projects in one area, potentially offering advantages from a community development/rural sustainability perspective.

- **Structure projects as hybrid ecosystem services - natural resource investments** – Several investors active in the market for ecosystem services and their credits structure projects to incorporate economics both of ES and traditional natural resource investments. This approach typically involves purchase of land with some value in traditional uses (e.g. forestry, grazing, etc.) and simultaneous targeted ES project development. The core investment in the land and income stream from traditional land use limits downside risk while the ES opportunity provides potentially large upside returns. This asymmetric financial profile is attractive to potential financiers.

- **Use option contracts to access revenues before incurring credit certification costs** – As depicted in Figure 1, the net present value of ES projects is lowered by the timing of the revenues and project expenditures. Developers are forced to develop and certify credits before selling credits on the market (if they can). Using options, developers can sell the right to purchase future credits to potential buyers prior to incurring many project expenses. This increases project value by frontloading more revenues. It can also help manage risk because a developer need only incur credit certification and registration costs if and when a buyer for credits has been found, lowering risk.

- **Manage project investment incorporating option values** – The project economics depicted in Figure 1 imply that a project developer or investor makes a go/no-go decision at the beginning of project development and accepts all costs and revenues from that point on. In reality, as information improves over time, a project developer will be able to incur certain costs only if they are a good investment at the time. For example, if a market for credits does not materialize, then credit monitoring costs can be avoided, partially offsetting the revenue shortfall. Understanding project economics incorporating options will increase net present value and lower risk.

Providing financing directly

- **Subsidize credit for development of ES projects** – The state can directly provide finance to ES projects by subsidizing or guaranteeing credit used on the projects. Potential mechanisms already exist in the market for student loans, where the government mandates reasonable retail interest rates in exchange for guaranteeing loans made by private lenders. Revolving loan funds are one additional approach.

- **Establish a minimum future price for ecosystem service credits** – The state can establish a minimum future price for ecosystem services credits, acting as buyer of last resort. In this

scenario, the government commits to purchasing credits from project developers for a specified price in the future. This guaranteed floor on the value of credits reduces risk and increases project value, allowing private financiers to invest in projects with limited downside risk (and significant upside potential).

Supporting Rural Sustainability

- **Establish a different participation mechanism for small landowners** – Experience to date has shown that it is difficult to complete transactions in ES markets even when large physical project size affords significant economies of scale. Given high transaction and monitoring costs, transactions pursued at small scale with small landowners face acute economic challenges. It may be that these challenges to participation by small rural landowners mean that they are unlikely to engage in these projects through the same credit market systems available to larger landowners. Instead, creative options for their participation in credit-like markets may be needed. One possibility is establishing a different set of credit and project requirements, perhaps targeting the voluntary mitigation market, in order to allow small-acreage property owners to participate in ES provision while acknowledging the very real challenges of competing in full-fledged markets with industrial scale landowners.

- **Use policy to direct investment in ES projects to support rural sustainability aims** – Tax policy, crediting rules, and assignment of mitigation obligations can all be shaped to ensure that ES project development occurs in a way that supports rural sustainability. For example, techniques of urban economics, including tax-advantaged enterprise zones, can be used to direct investment to particular geographic areas or project scales.

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1. Introduction

Intact ecosystems on rural lands provide critical services to residents of Oregon as in the rest of the world. These services include but are not limited to regulation of climate through carbon sequestration, provision of clean freshwater for cities and towns, support of fisheries that sustain us, and preservation of intact, wild landscapes of great spiritual and recreational value. Historically, these services have been available for free as landowners received no payment for the value they provide through sustainable management. Typically, they were noticed only when reduced or eliminated. Perceiving their loss as a failure of a market economy to provide for the common good, environmental economists advocated for payments for ecosystem services as a way to align economic incentives with land and water stewardship. The creation of tradable credits for the development or preservation of ecosystem services has emerged as one way to provide such payments. These credits are financial assets[1] that can be sold to fund landowners' investment in stewardship projects. Earning a financial return for good environmental stewardship of their property holds the promise of simultaneously protecting the environment and providing economic opportunity in rural areas, thus supporting societal interests in rural sustainability.

Though markets for different types of ecosystem services credits vary, a paucity of transactions in the early stages of market development is a frequent challenge. The extreme thinness of markets can be self-reinforcing, with few landowners willing to develop additional credits without strong prospects for a sale. The lack of supply of credits, in turn, leaves potential buyers discouraged. This broad chicken-and-egg dynamic has meant that the potential to harness credit markets to meet environmental goals has remained largely unrealized.

One potential obstacle to the emergence of markets for these credits is a lack of financing for projects seeking to develop ecosystem services and their credits (hereafter ES projects).[2] The research effort described here seeks to develop innovative financial mechanisms and approaches to meet this need. This report presents findings from research including a theoretical inquiry, interviews with national leaders in ES finance, and the proceedings of a workshop entitled Enhancing Rural Sustainability: Financial Tools for Ecosystem Services Transactions. The workshop, held on December 1, 2009, brought financial industry professionals together with NGO and government leaders active in developing ecosystem services markets to discuss the challenges and opportunities in helping ES projects access financing. This report includes recommendations for improving ES project access to finance, some of which will be tested in pilot projects in a second phase of this effort. A longer-term objective is to unlock ES project development as an environmentally beneficial economic opportunity in rural communities.

This report is laid out as a progressive exploration of how the economics of ES production interacts with finance, broadly construed, in actual credit transactions. The inquiry proceeds in several steps. First, the economics of ecosystem services production is explored to provide critical context for potential financing approaches. This section examines dynamics of production under a number of incentive mechanisms currently employed to produce ecosystem services and also considers how economic incentives affect policy goals. The paper next turns to the role of finance in ES production, examining project cash flows

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[1] For a more comprehensive definition of this and other terms in this paper, please refer to the glossary.

[2] For an introduction to the topic see the prior paper in this series: Aylward, B., R. Hartwell, S. Lurie, and S. Duncan. 2009. Financing Ecosystem Service Markets: Issues and Opportunities. Corvallis, OR: Institute of Natural Resources, Oregon State University. http://inr.oregonstate.edu/reports_environment.html

and how financing directly enables development of ES credits through on-the-ground projects. The following section considers the breadth of sources for project finance, with a particular focus on how project design and characteristics shape access to government, philanthropic, and private capital sources. With this framework established, financing tools and recommendations are explored with an emphasis on how different approaches can influence key drivers of access to project funding. Input from stakeholder and financier interviews, as well as workshop findings, are integrated throughout. A brief conclusion completes the report.

2. Finance in Context: Economics of Rural Ecosystem Service Production

Recently, increased recognition of the importance of ecosystem services in supporting society has led to substantial policy innovation designed to restore our damaged environment and correct market failure. Moreover, the rise of market- or incentive-based approaches to solving environmental problems has meant that economic incentives that previously drove environmentally destructive practices are being harnessed to catalyze restoration. Across ecosystems, industries, and geographies, there is an effort to use the market to drive environmental restoration. Some parties are increasingly looking at whether this process can be shaped and directed to promote rural sustainability. Under this market-based approach, ensuring that financial resources are available to support these policy objectives emerges as a critical issue.

This research project recognizes that finding funds to pay for the specific actions needed to generate and maintain credits is critical to the eventual success of any markets for ES credits. For some potential participants in these markets, a dearth of financing is their primary barrier to supplying credits. Others see finance as just one of many areas where additional work is needed to lay the groundwork for viable market transactions. A third notion held by stakeholders is that while financing for these projects is not readily available, this reflects the immaturity of markets and speculative nature of ES development rather than a failure of financing *per se*. For example, to summarize one discussion thread from the workshop, financial mechanisms may be irrelevant until market rules and regulatory obligations are established, at which point we may find that adequate financing is available if project development promises a market rate of financial return. This possibility was broadly reflected in interviews and the financiers' workshop, where targeted inquiry into financial tools and mechanisms often gravitated towards broad discussion of market design.

Given the major differences between markets for various types of ES credits, there is likely no single appropriate understanding of the criticality of finance relative to other enabling components of functioning credit markets. The varied views on the importance of this work suggest that functioning financial mechanisms are a necessary, but not sufficient, ingredient in a functioning market.

This section examines the context of finance in ES production, focusing on what economic conditions lead to the production and eventual sale of ecosystem services credits in rural areas. Fundamentally, finance exists to support and enable transactions in the real economy. While the current economic crisis has drawn much attention to abstract financial products and the rise to prominence of financial engineering, money and other financial assets have only instrumental value when used to purchase goods or services in the real economy. This lack of intrinsic value is nowhere more apparent than when contrasted with the ecosystem services that support our lives and prosperity. Under ES crediting and trading schemes, there is now both demand for ecosystem service production, as well as a financial asset class (ES credits) to enable market transactions driven by this demand.

2.1 Demand, Supply, and Gains from Trade in Ecosystem Service Production

Market transactions and the production of goods are driven by the interaction between supply and demand. Demand for wood from the building industry interacted with the supply of timber on forestlands; when demand, expressed in market price, was high enough, then market transactions, in this case the physical production of marketable timber through logging, took place. The market transaction and the production were essentially the same act. In the same way, production of ecosystem services will only occur when the interaction between supply and demand reaches the point at which trade takes place. One question for those interested in increasing production of ecosystem services is how to engineer this critical interaction between supply and demand.

2.1.1 Demand

The primary focus of this inquiry is the role of finance in enabling the production, or supply, of ecosystem services. It is also critical to examine demand-side economics since it shapes the value of ecosystem service credits, and therefore has a direct impact on supply-side finance. In ecosystem service credit markets, most relevant demand arises from regulatory obligations that call for the creation of credits that are transacted so that a developer can meet a regulatory no net loss (or harm) requirement. For example:

- In the European Trading System, polluters that emit more carbon than they have allowances for must acquire carbon offsets in order to avoid any further net accumulation of carbon emissions from their productive activity. These credits can be purchased on the market but originate from willing sellers who undertake one of a number of prescribed mitigation actions, such as providing new electric power from renewable sources.

- The State of Oregon requires prospective ground water developers in the Deschutes Basin to offset the consumptive use of new groundwater wells by transferring existing water rights to instream restoration use. Credits representing such transfers are used as a unit of trade to facilitate this process.

- Pursuant to the Clean Water Act, developers who displace wetlands as part of projects are required to offset their impact by the creation or restoration of other wetlands. Wetland mitigation banks generate wetland credits which can be sold to the developer to offset their impact.

- Clean Water Services (CWS), the wastewater authority for Washington County, Oregon, is required by the Environmental Protection Agency to avoid further impact on stream temperatures in the Tualatin River associated with new discharge permits. CWS has obtained a National Pollutant Discharge Elimination System (NPDES) permit authorized under the federal Clean Water Act that allows flexibility to do this in different ways, including both restoration of streamside vegetation to create shade and releasing stored water to cool stream temperatures. These projects effectively create credits used to offset the new permit under the water quality trading rule.

There are also examples of voluntary demand for ecosystem services, such as the purchase of carbon offsets by those concerned about global warming. Recently, Bonneville Environmental Foundation launched a Water Restoration Certificates program that allows certificate buyers to reduce their water footprint by funding stream flow restoration for the purpose of environmental benefits. A key distinction related to voluntary demand is that it is not necessarily tied to any real world metric; while the concerned citizen may choose to fully offset the emissions of a ski trip through the purchase of carbon offsets, not doing so will not affect their trip in any direct way. In contrast, failure to acquire the correct amount of

ecosystem service credits in a regulatory context results in regulatory non-compliance and denial of permission to undertake some other activity. The exception would be corporations that engage in voluntary offsets or footprint reduction at least in part to gain some market advantage. In this case the failure to participate in the voluntary market does imply opportunity costs to the firm. Nevertheless, it may generally be stated that voluntary demand for ecosystem services will remain more elastic than regulatory demand. Demand arising from regulation will have varying elasticity depending on the economics of the particular situation.

Regulatory demand arises, by definition, from some real world activity. This activity typically has economic value – if it did not, then no one would be willing to accept acquisition of ecosystem service credits as a factor in its production. This productive value of the regulated activity, in turn, is the value that will attract investment capital, i.e. finance. With regulation-driven markets, the main concern underlying most demand for ecosystem services production is meeting a regulatory obligation so that a regulated activity can be completed. We can assume that the environmental benefit of ecosystem services production is of secondary, if any, interest to the purchaser. Just as most citizens are inspired more by legal obligation than civic-mindedness when paying income tax, a golf course developer in the Deschutes Basin is more interested in completing his project than in restoring rivers. This implies that there is a ceiling on the value of ecosystem services credits that derives from the role of those credits as a factor of production in some regulated activity. This value constraint is essential in our evaluation of the supply side of ecosystem service production.

2.1.2 Supply

Potential ecosystem services suppliers are those who control, typically through land ownership or water rights, the means of production of ecosystem services. In practice, the number and location of these suppliers will vary on a case-by-case basis depending on the nature of the service and the corresponding regulatory or voluntary market program:

- In a global market, such as that for carbon sequestration, the number of participants will be wide ranging, through both time and space;

- Localized mitigation markets may have few or even single potential suppliers of services – in the case of an effort to offset water quality impact on a small stream, potential suppliers of the service of riparian planting may be limited to a small number of landowners with streamfront property or a few water right holders.

In addition, the rules governing mitigation obligations on the demand side will of course shape market participation on the supply side. If a regulatory scheme for carbon allows forest conservation (i.e. preservation of intact forest) to count as a valid activity underlying a carbon offset, then owners of intact forests are potential suppliers of ecosystem services. Restricting eligible mitigation projects to reforestation only will limit supply.

There are clear trade-offs here. Liberal use of simplifying assumptions in market design is generally expected to lower costs of both administration and ecosystem services production and increase market efficiency. At the same time, such assumptions entail risk of failure to fully offset the impact of a given activity, potentially leading to environmental harm. This risk can be managed by imposing a higher regulatory burden in the rules (i.e. simple credits, but requiring a higher trading ratio), but this can increase costs and potentially thwart gains from trade. Regulators and policymakers demarcate the potential supply of ecosystem services when they establish regulatory requirements. As explicitly acknowledged at the workshop, these market design decisions are fraught for those seeking to increase transactions in ES credits. There is explicit tension because simplified rules and liberal crediting policies,

though conducive to market development, may result in trade in credits that paradoxically does not meet the initial environmental promise that attracted interest.

Regardless of the number of potential ecosystem services suppliers, their goal as suppliers is to increase the return on the capital invested in their land, water rights, or other natural resources.[3] If demand for ecosystem services is not sufficient to make their production more profitable than other uses of land and resources, then landowners will not supply services. In addition, community concerns, cultural traditions, and local institutions may impose additional costs, both psychological and financial, on the switch to production of ecosystem services, particularly in rural areas. For example, farmers may be reluctant to abandon a family and community tradition of agriculture, even if the economics of a change are appealing. Irrigation districts may impose exit fees on those wishing to transfer water rights to non-agricultural uses. As on the supply side, interest in the environmental benefit of providing ecosystem services will be a secondary consideration relative to the economic case. In sum:

- Maximizing return on the capital invested in land and other resources will be the main consideration for potential ecosystem service providers

- Transitioning to the production of ecosystem services from traditional land uses may entail more costs than are initially evident, including potential psychological costs, costs of institutional barriers, and tax considerations;

- In the case of small-scale ecosystem services providers, timing of income can be just as important as maximizing return on investment: ecosystem services production must meet landowner needs for income over time and therefore out–year payoffs can be inadequate even if large;

- For small-scale providers, risk will be a key factor in decision-making. If there is significant risk that an investment in change of practice will not result in salable credits and actual income, supply will either not materialize or will materialize only at a high price. Specific risks include regulatory or oversight caprice, non-performance of conservation projects, and counterparty breach.

Naturally, financial resources are required to enable suppliers to produce ecosystem services. The dynamics presented above are key in defining the opportunity that financial innovation presents in supporting ecosystem services production.

2.2 Managing Policy Goals through Markets

If the basic conditions explained above for bringing together demand and supply are present, then market transactions—in this case the production of ecosystem services— can be reasonably expected to occur. Although some volume of transactions is necessary for ecosystem services markets to succeed in their

[3] The notion that landowners seek to maximize the economic value of their holdings is subject to several caveats. Specifically, the endowment effect and aversion to loss can be drivers of landowner behavior; the result is that an actual change in land use may only occur after the economic incentive to abandon the status quo is large. Input from stakeholders at the financiers' workshop highlights the fact that landowner interests are not uniform, and that in some instances there seem to be at least two classes of ES suppliers – those who seek to maximize profit and those who seek a financially viable project but who are willing to accept less compensation out of an independent interest in land stewardship. Because the former, profit-maximizing landowners are believed to predominate, this inquiry focuses on their behavior and generally explores solutions that will work without relying on "double bottom line" landowners.

potential to foster environmental stewardship, trade alone is not sufficient ensure this outcome or to address other policy concerns. First, active markets for ecosystem service credits may or may not be environmentally benign in aggregate – the overall impact will depend on the permitted activities that underlie demand for the credits and the design of the regulatory scheme (i.e., do credits fully offset the impact of a regulated activity, or do they merely mitigate the resulting harm?). Second, transactions alone do not necessarily meet rural sustainability and other social goals; in fact, if poorly designed or executed, projects have the potential to harm rural communities. In this section, major drivers are examined from the perspective of the government (i.e. environmental regulators) and society with respect to environmental protection and rural sustainability.

2.2.1 Environmental Protection and Stewardship

Concern for the environment is a primary driver for policies designed to safeguard and produce ecosystem services, including the creation of ecosystem service credit markets. While the aggregate environmental benefit of these activities are clearly positive in the case of voluntary or public demand (i.e. public purchase), the impact is less clear in the case of regulatory demand, which typically offsets an activity that causes environmental harm. Still, well-designed mitigation markets are an obvious source of demand for ecosystem services that avoid reliance on philanthropy and elegantly adhere to the polluter pays principle.

The obvious metric for evaluation of a regulatory mitigation program is whether it meets any statutory or regulatory requirements. This will presumably be the operative design criteria, though any determination of regulatory compliance will certainly depend on scientific and ecological assumptions. A separate question is risk tolerance – is it ever acceptable for a mitigation scheme to not fully meet its environmental goals? Risk can of course be managed, but at great cost, either economic, administrative, or both. In sum, major regulatory drivers include:

- Regulating agencies making rules for mitigation schemes that shape ecosystem service markets are driven to meet statutory/legislative requirements;

- Concern about failing on the primary goal will typically result in a risk-averse approach potentially including management of output rather than inputs, extensive and ongoing monitoring/oversight programs, and few simplifying assumptions;

- Risk-averse approaches can have real costs both in terms of administration and lost opportunities for gains from trade due to high regulatory mitigation costs.

These dynamics shape the economic production of ecosystem services and therefore have implications for potential financial approaches. From an economic standpoint, the factors driving regulatory design may be prone to ignore the returns to integration of environmental mitigation projects. Specifically, the environmental benefit of a coordinated effort to direct ecosystem service credit development to an area where there are positive returns to the scale of production (for example, non-linear benefits of protection of adjacent habitat) may be ignored by regulators. Clearly if these additional benefits can be captured in an efficient manner then society will be better off, though there is a question of where the possible becomes the quixotic in ES market design. As part of this inquiry, we will examine whether practicable financial tools are available to encourage and enable capturing to this environmental benefit from coordination.

2.2.2 Rural Sustainability

Rural sustainability is an additional policy goal related to the design of markets for ecosystem services. Understanding what financial methods are appropriate in the context of rural sustainability requires defining what we mean by the term. Sustainability generally implies managing and using natural resources in ways that link current and long-term societal, economic and environmental vitality. Sustainability is defined here as land use practices coupled with economic exchanges that maintain or enhance the natural resource base in ways that contribute to the local economy and that help maintain local community social systems and economic self determination. Rural can be defined as those communities at some distance from an urban community and where dominant livelihoods that contribute to the local economy include manufacturing, government, services, and natural resource dependent industries such as forestry and agricultural production.

The market production of ecosystem services would ideally:

- Improve or restore the environment in rural areas where local communities have disproportionately suffered from long-term natural resource extraction;

- Enhance, or at least not undermine, local economic opportunity in rural areas.

Rural sustainability demands place-based environmental justice criteria for design of ecosystem service markets. Whereas regulators may be content with market activity that has net environmental benefit over a wide region, ecosystem service markets are only beneficial in rural, formerly resource producing communities if they can begin to restore the environmental and socio-economic viability of those areas. Specifically, much of the past environmental harm in these areas resulted from resource extraction to satisfy urban demand; if rural communities are now going to be looked on as a supply of ecosystem services for urban demand, then avoiding a boom and bust cycle in the ecosystem services market is critical. Unfortunately, it is all too easy to envision a scenario where large corporate entities or private investors acquire large tracts of land and convert their holdings to ecosystem service production, potentially eliminating jobs and harming the social fabric of the rural community in the process. Ecosystem services markets should be designed to guard against shuttering of rural communities through creation of a sort of ecosystem services production reserve. Ideally, ecosystem service production retains a significant ongoing local economic benefit, but this may not always be the case – and therefore the need to be explicit about the objectives of ecosystem service production and the necessary supporting policies.

Unsurprisingly, there are tradeoffs inherent in guiding markets to meet rural sustainability needs. Policymakers can certainly craft rules that will target specific areas, ecosystems, or landowners, but they have the effect of limiting supply and driving up costs. Preserving rural employment poses larger challenges – ideally a shift from traditional land or resource use to ecosystem service production would create like numbers of jobs that could be filled by any displaced workers. An example would be a transition from an agricultural and forestry based economy to a recreation, tourism and retirement economy. In practice, this seems unlikely to be the case across the board – in some case economic opportunities may increase; in others they may decrease. Support service employment is of similar concern; at some point, conversion to ecosystem service production can undermine opportunities for work in specialized support services such as millwork, farm equipment, etc., through a sort of reverse multiplier effect. This can be avoided through planning, but securing these rural sustainability benefits entails costs. In sum:

- Aggregate environmental benefit from ecosystem service production does not guarantee prioritized and effective restoration in any local area;

- While ecosystem service production will be designed to have salutary environmental effects, local socio-economic effects can be mixed.

As with the economic dynamics related to environmental objectives and ecosystem services suppliers, the question is how finance can be leveraged to better manage the challenges to rural sustainability that may arise from ecosystem services market development. This is a second potential role for finance, where the question is whether financial approaches can, in addition to supporting ES credit transactions, support the transactions that are most desirable as regards other policy goals. As with so many other considerations in ES market design, tools are available to shape and/or measure outcomes, but these tools may prove impractical in implementation. Specifically, rules will tend to increase the costs of ES credits. If the costs drive prices too high, then credit demand will wane, and transactions will not occur. The economic specifics will vary on a case-by-case basis, but there is potential that pursuit of a "perfect" transaction will cause forfeit of gains from trade from a "good" project.

2.2.3 The Role of Finance in Managing Policy Objectives

The discussion above explains the major drivers that will shape market outcomes in the production of ecosystem services. Depending on how market design shapes the interaction between supply and demand, potential ecosystem services suppliers may or may not actually participate in the market production of ecosystem services and associated credits. When they do, potential gains from trade are realized, typically through a financial medium of exchange – ecosystem services are produced in exchange for money.

The role of finance in this process is as complex as it is critical. Finance is necessary for the production of ecosystem services in markets, but it is not sufficient to produce trade – this relies on real final demand for mitigation credits. The interplay between supply and demand and the resulting volume of market transactions will also be context specific, and it is an oversimplification to imply that a financial failure is broadly responsible when a lack of market activity is observed in ecosystem services markets. In reality, several scenarios may be present:

- Policy failure: Regulatory costs, as expressed in market design, are either too high or too uncertain to drive transaction demand. Financing is not the issue; it is reluctance to pursue investments that entail the mitigation obligation.

- Financial failure: The regulatory framework enables gains from trade in the production of ecosystem services but financing is not available to support these transactions.

- Market failure: Transactions that produce external costs and benefits, such as impacts on rural communities, are not included in the market or cannot attract financing, even though there are opportunities for utility gains.

Often these three types of failures will be present simultaneously and will interact. Specifically, the lack of familiarity with the process of certifying certain types of mitigation credits creates risk that capricious agency decisions will strand investments in ecosystem service credit development that were made in good faith. This risk drives up the cost of finance, potentially to prohibitive levels, and also seeds reluctance on the part of the regulated to proceed with projects because their risk-weighted return on investment is lowered. Disaggregating which failure is ultimately responsible for a lack of market activity is difficult and in some ways irrelevant.

The bottom line is that without supportive policy, finance may not be available, and the inability to secure finance may be a symptom of poor market or regulatory design rather than a constraint that unfairly thwarts promising transactions. This interpretation is entirely consistent with mainstream financial theory,

including the efficient capital market hypothesis. Plainly, prices in finance can be interpreted as measurements of various phenomena in the real economy. If the cost of loans or financing are high in ecosystem services markets, then this is an expression of the risk in those projects (risk of default, in the case of debt, and risk of poor performance in the case of equity). A risky investment in the production of ecosystem services will have low equity value and will encounter high costs of borrowing.

By way of context, contrast the cost of borrowing for a profitable, regulated utility operating in a stable regulatory and legal environment with that of a new company with no profits operating in a politically unstable area of the world. The regulated utility might be able to borrow at 5 percent while the new company may face rates many times that. However, given the risks involved, it does not follow that this is a failure of finance. Investors will demand greater returns to compensate them for assuming risk, and it is no surprise that costs of finance will be high in new markets, including that for ecosystem service production. Highlighting this role of risk in attracting or repelling finance, one workshop participant summarized that "unforeseeable is uninvestable." This lack of visibility (on rules, potential purchasers, financial potential, etc) characterizes many nascent "markets" for ecosystem services credits. In these terms, one question on which there was not consensus at the financiers' workshop is whether ES markets are truly unforeseeable (i.e., bad, speculative investments) or whether financiers fail to see the potential.

This is not to say that transactions in ecosystem services are bad investments or should not occur. Instead, it is to reemphasize the implication of a central point – that financial conditions will reflect conditions in the real economy. In the case of newly designed regulation-driven markets for ecosystem services, this means that policy design that creates certainty and minimizes risk related to making real investments in ecosystem service production will generally reduce financial risk and increase the availability of financing. In this broad economic context, the need for finance in ES production is explored below.

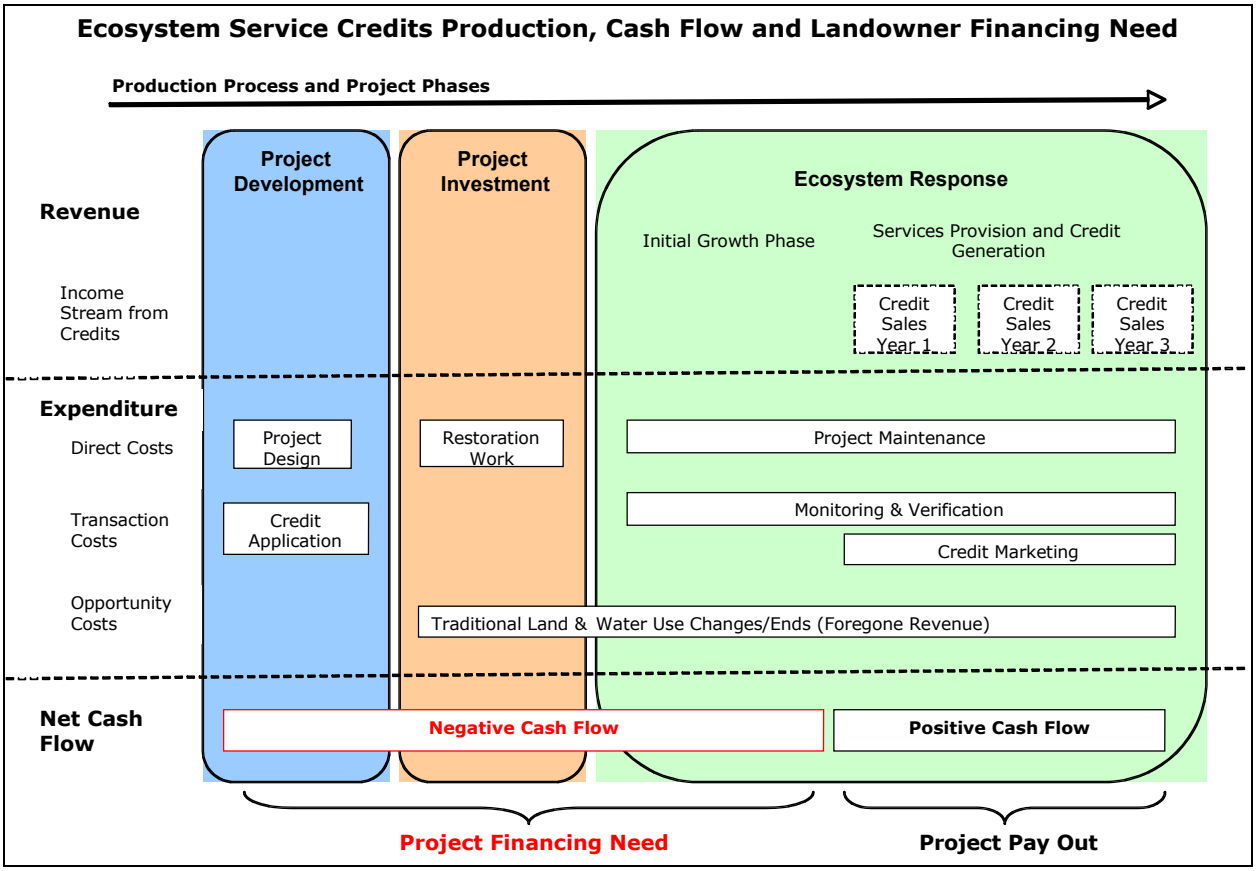
3. The Need for Finance in ES Production

A sound link between ES projects and sources of finance is important for two primary reasons. First, there are upfront and ongoing costs to landowners developing ES projects. Financing is necessary to cover these costs if lands are to be managed for ES. Second, it allows landowners to monetize ES projects. If a landowner cannot capture the financial value of developing ES on his property, then he is unlikely to undertake the project if there is an opportunity cost in terms of foregone income from traditional land uses. This is expected to be the case even if funding for ES project development is available.

3.1 Cash Flows

Examination of the cash flows associated with the development and eventual sale of ES credits illustrates the primary need for financing in ES markets. Figure 1 is a generic illustration of the relative timing, certainty, and magnitude of the financial flows in the production of ecosystem service credits. Positive revenue flows (benefits) are presented in the top section of the figure, while expenditures (costs) appear in the middle band. Costs are identified either as direct costs of production, transaction costs or opportunity costs. Three phases in the production cycle are defined across the top: a project development phase, a project investment phase, and an ecosystem response phase. Further, activities or revenue flows that entail a significant element of uncertainty are denoted by dashed boxes. Regarding the two major needs for financing described above, the project development costs appear on the lower left, while the monetization of the value of ES is depicted in the upper right. Notably, given the emerging status of many markets for ES credits, the revenue from credits sales is denoted as uncertain. This is a critical point because credit sales are the only revenues associated with projects and as such are a primary determinant of potential profitability.

Figure 1. Ecosystem Service Credit Production, Cash Flow, and Landowner Financing Need



This graphic can also be used to understand the economic value of developing an ecosystem services project from the landowner perspective. If the risk adjusted value of the revenues from credit sales (upper section of the graphic) is greater than the total of the costs (below) when discounted to the present, then the project has a positive net present value (NPV) and is an economic opportunity for the landowner. Theoretically, such an opportunity should be able to attract financing because it is a good investment. The reality is more complex because of variations in the understanding of project economics, variation in the timing of payment for services, and differences in objectives of financiers. It is also confounded at present by the absence of such infrastructure as standards and investment rating systems for the functioning of a larger marketplace. In many cases, project economics entail significant upfront investment costs needed to develop credits that may, if all goes well, be sold in the future for a profit – a situation that has been generally unable to attract financing. In sum:

- The costs, chiefly in terms of ecosystem service production and foregone revenue from traditional land use, occur early in the production process with high certainty.

- The benefits are less certain, both in terms of timing and magnitude, and occur later in the production process.

While the risk-weighted present value of the benefits of ecosystem service production must outweigh the benefits for significant market activity to emerge, this is a necessary but not sufficient condition. In addition, given the timing of the revenue streams, a potential supplier will only be able to proceed if financing is available to offset the initial investment that must be made prior to the generation of any

revenue. This timing challenge is at the core of our research effort, whose aim is to ensure that sufficient financing is available to support promising transactions. However, financial approaches may be used in other applications within this model, chiefly around the management of risk related to the magnitude or timing of key financial flows. Potential financial mechanisms to support both of these needs are addressed later in this paper.

It is important to highlight that the timing of investment and sale of credit underpins the financing need. It is worth asking, therefore, whether and why there is likely to be a gap in the timing of these cash flows. Why would the regulated buyer of ES credits not buy them immediately, or better yet invest directly in the project? Some participants in the workshop noted that the timing of the actual production and sale of credits may vary – in some cases a portion of potential credits can be sold early on—that is, before the ecosystem response. The fundamental point is, however, that if effective mitigation is to be provided by a regulatory program, the credit cannot really be judged as in place and effective in advance of the provision of the compensating ecosystem service. If a buyer can buy a credit before the service is provided this is not so much an ecosystem service credit market as an in-lieu fee program – or the purchase of an option to acquire the actual credits once they are finalized. From an environmental standpoint, the advantage of a true credit system is that third party monitoring and enforcement provides the necessary assurances that the mitigation is in place and effective. Any sale and use of a credit as mitigation, prior to finalization of the credit defeats one of the purposes of moving to regulated ecosystems service credit markets.

So, the answer to the original question is that a regulated buyer may choose to buy credits (or options on such credits) earlier on in the process, but in doing so will likely demand a discount in the per credit price. The earlier the purchase and the riskier the process to final certification of credits the larger this discount will be – and the bigger the risk assumed by the buyer. At some point, the up-front finance that can be garnered in this fashion will fail to be sufficient to provide the landowner with the incentive to invest in ecosystem service production. If large potential gains can be obtained by waiting until final certification to sell credits to regulated buyers, then debt or equity financing may provide the landowner with the most economical approach. That said, the appetite on the part of the landowner for risk versus reward will drive his or her behavior in the market, just as it will the regulated buyer.

With regard to the distinction made earlier between regulatory and voluntary markets, a relevant question is whether in the eyes of the service provider—i.e. the rural landowner—these two sources of demand are the same. On the one hand, if credit certification processes are similar for like ecosystem service markets, then whether the ultimate buyer is making a voluntary decision or is compelled to participate in the market to pursue his or her business should not be a major factor. The structure of the project and certification process will define the financing need. However, there is evidence to suggest that landowners often do care about the source of the funds they are receiving. In that case, landowners may exhibit a preference for voluntary over regulatory markets. Whether such a preference might play a role—and be a significant factor—driving the extent of financing need or risk is the question. On the other hand, regulatory demand is expected to be less elastic and more dependable, reducing the risk related to the project.

3.2 Secondary Markets and Risk Management

Another major need for financing in ecosystem services markets pertains to investors, financiers, and the suppliers of project financing. As explained above, if the net present value of a project to investors, weighing all risk, is sufficiently large, then landowners should be able to attract project financing based on the business case for the project. This financing could come in many forms, though the ultimate package will generally be composed of debt, equity, or some combination of the two. Under debt finance,

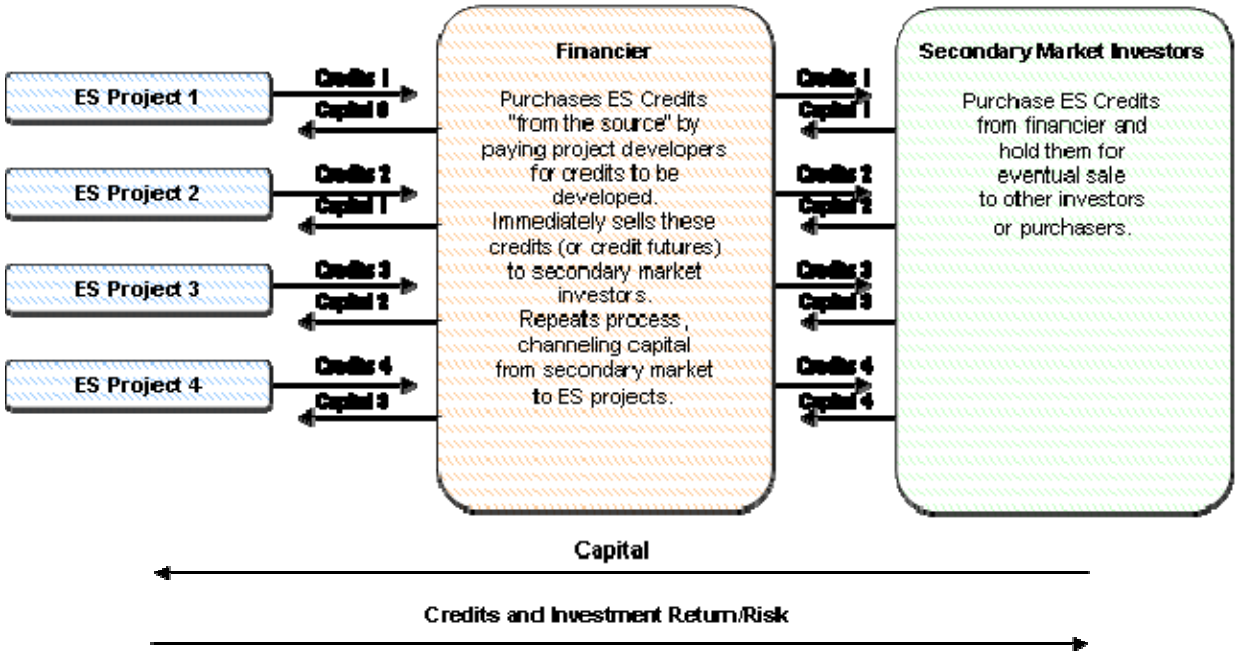
a financier (usually a banker) lends the landowner money to pursue the project. The lender requires some form of collateral to secure the loan. This collateral could be a lien on the property itself (making the loan essentially a home equity loan that does not hinge on the performance of the actual ES project) or a lien on the ecosystem services credits themselves. Under an equity approach, the financier is an investor in the project, providing money to the landowner for project development in exchange for a share of the value of the project (i.e. an interest in the ES credits). In both debt and equity financing, the financier will often share an interest in the ES credit, whether through ownership or a lien (as collateral).

Because both debt and equity primary project financiers will have an interest in the value of the ES credits produced, they will be more willing to finance projects the higher that value. Holders of ES credits can capture their financial value through sales, as illustrated in Figure 1. In the basic framework depicted in that figure, an investor reaps the return on his investment through sale of the credit to someone in need of mitigation (i.e. someone subject to a regulatory obligation). If the credit cannot be sold on schedule or at all, the financier is unable to extract value from his investment, and has the potential to lose money. This possibility makes the project less attractive from the start, limiting financier interest and/or increasing cost of finance.

Secondary markets for credits can play a critical role in mitigating this risk. In a secondary market, the primary financier funding the real investment in ES production sells the credits (or a future interest in credits under development) to other investors (see Figure 2). This process is analogous to an investment bank offering shares of stock to the public in an initial public offer – the company has already received money from the investment bank for the shares, and the investment bank reaps its return by selling the stock to the public on the stock exchange. Robust secondary markets play a critical role in supporting finance in two ways. First, if a financier is confident that he can sell credits to other investors easily, then he can avoid the concentrated risk of holding credits until a regulated mitigation buyer can be found. In the unfortunate case where the project fails to produce credits or find a buyer, many investors sustain a small financial loss rather than one single financier absorbing all of the loss.

Secondly, if a financier can reap a return on the initial project through sale to investors on a secondary market, the financier can then use the money to finance another project. This is essentially a mechanism whereby private capital from investors can be channeled through financiers to ES projects, extending access to finance beyond whatever money the financier may have on hand. Hence, secondary markets are a critical means to increase project value by reducing financier risk, simultaneously increasing the supply of money available to support ES projects.

Figure 2. Secondary Markets – Increasing Supply of Finance and Shifting Risk



3.3 Net Present Value and the Availability of Finance

Project net present value represents a critical, real world constraint on finance. Absent subsidy, the maximum amount available to support the production of ecosystem services (through any set of rules) is the willingness to pay of the regulated demander of these services, as expressed in the sales price of credits. This willingness to pay will, in turn, be determined by the value of the activity enabled by purchase of the credits (and satisfaction of the mitigation obligation). Therefore, if the value of some ecosystem service as a factor in the production of a good or service in the real economy is X, then if the set of rules and requirements of the ecosystem service market drives the cost of that ecosystem service above X, there will be no production, no gains from trade, and no ecosystem services credit transaction.

In some cases, non-production is precisely the point. If an industrial process is so economically marginal that it will not proceed without the effective subsidy of the ability to pollute local rivers without limit, then society is presumably better off without that activity. On the other hand, policymakers have much to lose if mitigation obligations that drive ecosystem service demand are so large as to go beyond an appropriate internalization of environmental costs, trending toward a tax on development with the attendant deadweight loss.

This constraint is key to the possibilities, and limits, of finance with respect to ecosystem service credit markets because it puts an upper bound on the financing that such markets can attract without subsidy.[4] Subsidy is of course a possibility in market design, and may be appropriate given the public aims of

[4] This concept is pervasive in more established areas of finance. One cannot typically obtain a mortgage for an amount above the appraised value of a home, and similarly, one cannot insure an item beyond its worth.

market development. That said, it makes sense to first see if an incentive structure can meet policy aims and produce transactions without subsidy – at the very least to test the theoretical argument for market-based regulatory approaches. Stated differently, if public subsidy is a first-best option for producing ecosystem services, policymakers should at least ask whether it makes sense to develop the extensive accounting and trading rules and fund the significant administration required to access private capital for the market, as opposed to directly investing in environmental protection.

3.4 Demand-Side Finance for Ecosystem Services

Although this inquiry is primarily concerned with financing the production of ecosystem services on the supply side, a brief treatment of demand-side finance is warranted. On the demand side, the most obvious way for market participants to finance production of ecosystem services is to use their own sources of funding if they have it. While the availability of a self-financing option is not universal, there are reasons to expect that it will be quite common with many purchasers of ecosystem service credits.

Specifically, many purchasers are large regulated industries with existing financial relationships related to their businesses. As a result, they have the operational stability to secure credit as needed for investment, including investment in ecosystem service credit purchases. Further, for municipalities, solid revenue streams enable them to issue both general obligation and revenue bonds that are tax exempt. In the case of private companies that are regulated as public utilities, revenue bonds are particularly appropriate because the purchase of ecosystem services typically enables a continuation or expansion of revenue generating service. Status as a regulated monopoly should translate into low risk. For example, if the City of Bend, Oregon requires mitigation credits to offset the impacts of a new well, then they should easily be able to secure financing on capital markets at low rates, servicing the debt with revenue from water sales. If such a transaction is not forthcoming, it is hard to imagine that lack of financing is the cause – rather, the municipality has probably not determined how to meet their mitigation obligation.

Similarly, private developers should be able to finance purchases related to mitigation obligations on similar terms to those with which they financed projects. In other words, they will not need a specific source of *ecosystem services finance per se*, but rather can simply pay for the cost of any credits through the same means they use to pay for land, labor, and other project costs.

Finally, there are some market participants who will self-finance in the purest sense by using their savings to purchase ecosystem services. This will chiefly involve purchases unrelated to an economically profitable project. For example, a hobby farmer may require a small number of mitigation credits to offset well pumping used to irrigate a pasture. Self-financing will be the likely option, or, more precisely, any financing will be obtained without regard for its use purchasing ecosystem services (a home equity loan could be the source of funds).

Finance from the demand side, however, does not help in a context where there is no supply of credits. For example, if a hobby farmer cannot find a supply of credits, then his access to self-finance through a home equity loan or savings is insufficient to enable a transaction. The farmer could in theory negotiate a bilateral transaction with a potential supplier for the development of credits, though this is likely to be expensive, time consuming, and perhaps even impossible. At the very least, it will entail transaction costs and will leave the financier-purchaser exposed to risk of contract breach with the supplier. Contracting with an individual for delivery of a certain ecological outcome entails much more risk of delivery failure than purchase of a certified credit.

In sum, most demanders of ecosystem services should be able to obtain financing through channels unrelated to ecosystem services, *per se*, but absent supply this leave several challenges unresolved. This

approach is much less applicable to the supply side of the market, where costs and risk are large if a landowner (or entrepreneur) is contemplating producing ecosystems services to create credits for an unknown eventual buyer (if a buyer is identified, then buyer self-finance is possible). While it is conceivable that a landowner might invest in producing ecosystem services, foregoing income from other activities and using his or her own savings or other source of credit, this seems unlikely. Nevertheless, corporate entities created specifically to develop and market ecosystem services, such as Wildlands, Inc., may acquire lands from landowners and self-finance ecosystem service production directly.

4. Opportunities and Sources of Finance

4.1 Financial Objectives and Opportunities

As presented above, the balancing of private and public objectives in the design for a regulation-driven market for the production of ecosystem services has crucial implications for the market's ability to attract finance and, ultimately, to produce ecosystem services by consummation of potential trades. The primary sticking points are not financial *per se* but rather arise from the concerns of the four major parties who will potentially be affected by this market: demanders, suppliers, regulators, and the public. The major objective from a financial perspective is ensuring that financial resources are available on terms that enable the goal of increasing production of ecosystem services in a way that enhances, or at least does not undermine, the sustainability of rural communities.

Even though impediments to ecosystem service development are often not financial in nature, finance does hold enormous potential to manage these concerns and support a market that will produce ecosystem services in a way that meets the multiple objectives of our parties. This harnessing of finance to promote ecosystem service production is the primary goal of this project. Specifically, the concerns of all potential market participants can be characterized as an aversion to risk, and one of the major functions of finance is the management of risk. Finance can also aid market participants in dealing with the timing of returns from real investment in a way that will meet their needs. Further, many public policies that can support market outcomes are operationalized through financial approaches, often with participation of financial institutions.

One caveat bears noting: the scale of the finance at play in ecosystem service markets may be very small, particularly for local mitigation markets (say, Oregon's Deschutes or Willamette basins). The entire discussion is consistent with this, as finance is framed as a tool that can help clear market blockages and enable *some* trade of credits for ecosystem service production. This means that this financial discussion will usually take place in the context of extremely thin markets which will not approach the efficiency seen on the Chicago Climate Exchange—an oft-cited example of an ecosystem services market platform—much less a national securities, debt, or commodity market (the emerging market for carbon offsets is one major exception to this expected small scale). Though some organizations active in the development of ES markets advocate for "volume and velocity" – i.e. the notion that the value of learning-by-doing and getting to scale justifies assumption of some initial risk, even a scaled-up ES market would remain very small relative to global capital markets. The primary impact of this small scale is that the cost of transactions (both with respect to the financial and real aspects of ecosystem service production) will be much greater than what we may be accustomed to when discussing markets.

This cost reflects the fact that most financing approaches will be developed on a case-by-case basis – there will be little commodification in these markets. There is no reason why a local ecosystem service market cannot utilize a full range of financial approaches, from debt through insurance and derivatives, but the cost will be much higher and the potential proportionately less because these approaches will not

be operationalized in standardized products. Consider transaction costs in equity, real estate, and ecosystem services markets. In equity markets, flat fee commissions are commonplace and transaction costs can easily be below 0.1 percent even for modest transactions. Real estate markets, where the objects of trade are not standardized and counterparty risk is real, see costs between 3 percent and 6 percent of sales prices – this despite well-established infrastructure and thousands of transactions per day. In this light, it is unsurprising that transaction costs for ecosystem service markets, where there are few transactions or established protocols, will be very high.

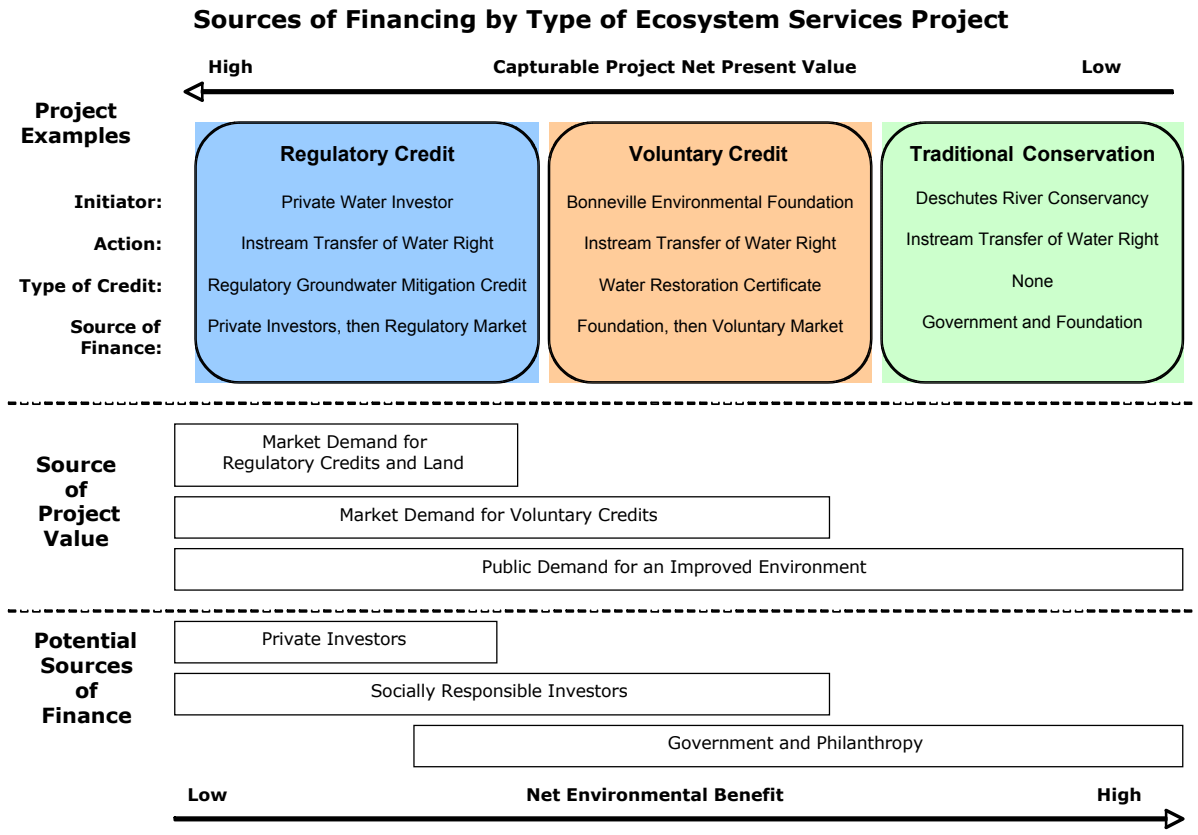
4.2 Sources of Finance

To the landowner, it should not matter where funding to develop ES projects comes from. Philanthropic foundations, government programs, or private sector finance all will suffice as long as the funding is available to both develop and monetize the value from the project. In practice, while foundation funding and government incentives have been the catalyst behind significant preservation and enhancement of ecosystem services, there is consensus that these sources alone are not adequate to fund ES project development at the scale needed to safeguard our environment for the long term. Therefore, a primary challenge is how to move beyond public and non-profit funding to access the much larger pool of financing from private capital markets. Understanding how a project can access private capital can help the environmental community better plan which types of finance to pursue for which projects, ultimately increasing the number of projects moving from concept to reality. As stated above, projects with positive capturable net present value represent an attractive investment opportunity and should be able to attract financing. This assumes that markets are fully functional and that all costs and benefits related to production of ES and alternative land uses are internalized in prices. If this is the case, then society should pursue projects only if they have a positive net present value. In reality, estimates of net present value are imprecise and will vary with context-specific assumptions – often, a project that is highly valuable to society does not afford an opportunity for a private investor to capture this value, resulting in a "good" project that cannot access private capital.

The continuum of ecosystems services financing sources is shown in Figure 2, relating these sources to project structure for a hypothetical instream transfer of a water right. Notably, the figure illustrates that the same on-the-ground environmental improvement will provide different capturable value to investors and will have commensurate varying access to finance depending on how it is structured as pertains to ES credit markets.

In the first tier of the figure, an instream transfer of a water right to augment natural stream flow is presented in three different project structures that vary in terms of their interaction with ecosystem services credit generation. On the left, a private investor purchases the water right and transfers it instream to create a regulatory groundwater mitigation credit for eventual sale, either to secondary market investors or to a regulated party. In the middle, the same water right purchase and instream transfer is undertaken by the Bonneville Environmental Foundation (BEF) to create a water restoration credit for eventual sale to unregulated consumers interested in purchasing voluntary credits. On the right side of the figure, the Deschutes River Conservancy (DRC) purchases the same water right and transfers it instream for restoration purposes. This creates no credits for sale.

Figure 3. Sources of Financing by Type of Ecosystem Services Project



Because each of these hypothetical examples involves the same instream transfer of a water right, the environmental and societal benefit of the projects are initially equivalent. However, because the different project structures create different ecosystem service credits, they have different ability to capture project value through credit sales. The DRC's project creates no credits and therefore has no option to sell credits and capture the financial value of the instream transfer in ecosystem service markets. The BEF voluntary credits have salable value that can be captured, though demand for these credits is expected to be less robust than demand for regulatory mitigation credit. As a result, the private water investor's project is expected to have more capturable net present value than the BEF voluntary credit project, which in turn is expected to have more capturable value than the DRC restoration action.

This difference between the environmental and societal value of the projects and their capturable values is explained by demand 'sources' of project value depicted in the second tier of the figure. All three projects result in improved stream flow, meeting the public demand for an improved environment. The private investor and BEF projects both create some form of credits that can satisfy unregulated voluntary demand for credits. Finally, only the project that produces regulatory groundwater mitigation credits can satisfy market demand for regulatory credits (which is tied to demand for land development, in which water mitigation credits are a factor of production). In sum, the type and extent to which credits are created will determine whether a project provides value to different sources of demand.

This question of to whom a project provides value will, in turn, determine which sources of finance are available to the project developer. This dynamic is illustrated in the third tier of Figure 2. In general, projects that are structured to provide private, capturable value through the creation of salable ecosystem service credits will have access to private finance. Conversely, projects that only provide public value will

not be able to access private finance. For example, the DRC restoration project is pursued purely for the sake of environmental goals and provides value to the public and environment. As a result, it will have access to financing from parties who invest in public and environmental benefit, namely the government and philanthropic foundations. Private investors will not wish to finance DRC projects because there is no potential private return available due to the projects structure. In this context, private finance would amount to philanthropy, a donation rather than an investment. The voluntary credits developed by BEF will provide value both to the private market (because some people are willing to purchase credits) and to the public because voluntary credit sales are environmentally beneficial. As a result, likely sources of financing includes both the public/non-profit sectors as well as some investors. In the graphic, these investors are described as socially responsible, defined as those who are motivated both by financial returns and philanthropic environmental outcomes. This dual motivation manifests itself as a willingness to invest in low return or higher risk projects, such as the development and sale of voluntary credits, because of the social or environmental value of the project itself. On the left hand side of the graphic, regulatory credit development is expected to have access to financing from both private (profit-motivated) and socially responsible investors, but not from the government or philanthropic sectors. Regulatory demand for credits should be more certain than voluntary demand, and therefore should be able to attract private finance from parties who are not willing to compromise return.

A final observation is that as capturable net present value of the projects increases as one moves along the spectrum from traditional conservation projects to the regulatory ecosystem service credit development, the expected net environmental benefit of projects decreases. This is expected by definition, as a regulatory credit is developed to be sold to meet a mitigation obligation incurred through a regulated, environmentally impactful activity. As a result, the benefit of increased stream flow is offset by the water development that incurred the regulatory obligation. This low to zero *net* environmental benefit explains the expectation that government and philanthropy will be unwilling to finance regulatory credit development. On the other hand, while the traditional conservation activity of the DRC does not create salable credits, this means it does not underwrite any regulated environmental impacts, resulting in a large environmental benefit that is appropriately deserving of public and philanthropic investment.

Several key points are evident:

- ES projects can include a full range of project types from traditional, publicly funded environmental conservation projects (which produce ecosystem services that are not certificated as credits) to targeted credit development projects under tradable permit frameworks.

- Financing is available for this spectrum of project structures, but not all structures will have access to all funding sources.

- As projects are structured differently, they will create value for different groups. These sources of value will in turn determine which sources of finance they may access.

- As projects are structured to access different sources of finance, the net environmental benefit of the project may vary.

This exposition of how project structure relates to potential sources of financing can be used to help identify opportunities to generate more financing for project development. As depicted in Figure 2, projects can solve the challenge of ecosystem services financing by increasing the capturable value they provide to potential investors, moving potential projects from the right to the left of the picture. A project developer's ability to succeed in this effort will vary by project type – some important environmental investments are better suited to market finance than others. On the one hand this is common sense: good projects create value, constitute good investment opportunities, and can attract financing. However,

several drivers of capturable value emerge as levers that can potentially be used to increase access to finance. These include:

- Risk – Reducing risk related to the eventual price at which credits are sold will increase project value.
- Timeline – Decreasing the time between project development expenditures and credit sale will increase project value by shortening the investment period.
- Demand – Increasing demand for credits will drive prices higher and increase project value.
- Cost – Reducing the cost associated with credit development and monitoring will increase the net present value of projects.

The remainder of this paper presents recommendations for increasing rural landowners' access to finance through the different pathways depicted in Figure 2.

5. Financing Tools and Recommendations

Recommendations for increasing the availability of financing for ES projects and managing rural sustainability objectives are presented below, grouped by primary strategy. The strategies, in turn, often leverage one or more of the major drivers of project value described above, with a focus on improving the terms of a potential ES credit development project to attract financing. The approaches outlined below include private sector innovations as well as public finance techniques that require government action for implementation. These public approaches include subsidization, whether directly, through tax policy, or through risk mitigation. As noted previously, perhaps the single most important public opportunity to enable financing for ecosystem service development is the design of simple, unambiguous, and workable regulatory design of a mitigation market that will avoid pitfalls toxic to private finance. Still, even with exemplary market design, it may make sense in the future to support ecosystem markets through public finance. Because there is often a choice between policy and financial approaches to supporting ecosystem service markets, policy options are presented alongside solutions that are more strictly understood as traditional finance. Major strategic approaches include:

- Building financial and market infrastructure to manage transaction costs and enable basic deals.
- Reducing project risk to increase capturable value by managing the volatility of potential returns.
- Increasing project value through policy or other mechanisms.
- Structuring projects differently to help match the economic opportunities of ES projects with investor and financier priorities to increase access to funding.
- Providing financing directly through public policy to minimize or offset the need for private investment.
- A separate suite of potential tools can ensure that rural sustainability goals are supported through ES Finance.

The recommendations below were developed through research and conversation with financiers and other stakeholders. In practice, some recommendations will work better than others, and the same approach may yield dramatically different results in different credit markets.

5.1 Build financial and market infrastructure

5.1.1 Develop contracts and appraisal techniques to support finance.

Low transaction costs are key to attracting project funding on viable terms, but a lack of standard contracts, appraisal and accounting protocols, and other financial infrastructure poses challenges to quickly doing deals. Building financial and market infrastructure to allow ES credits to interact with existing financial processes is key to extending access to financing.

Rules of various kinds are critical for enabling simple agreements and easy transactions in financial markets. With equity financing, deals currently require a lengthy and burdensome set of contract development and execution activities that drive up costs. Standardization of contract terms would reduce transaction costs in enable more trade. This trade in turn can support a liquid secondary market for credits, which helps reduce risk and is a valuable source of additional financing. Credit registries or exchanges can help reduce the costs associated with due diligence around credit verification prior to deals. Further, central registries or trading platforms can reduce counterparty risk that is inherent in bilateral transactions.

Bank loan finance is an obvious source of project funding. Financial institutions lend money to potential suppliers of ES to effect projects in exchange for interest and repayment of principle. The likely problem in this case is that the loan will come at a high cost due to the risky nature of the business venture (unless this is mitigated in the course of market design or through public finance). In part due to this risk, a loan requires defensible documentation of prospective cash flows necessary to provide some assurance to lenders that transactions will not entail unmanageable levels of risk. In home loans, for example, established appraisal techniques afford such documentation and allow low cost processing of loans. However, there is currently no established appraisal technique for ecosystem service credits. An additional challenge, particularly with respect to small rural landowners, is the potential for conflict between existing liens on a property from a first mortgage and any use of ES credits in development as collateral in support of an ES project loan. Specifically, there is no established way to separate the right to any ecosystem service credits underwritten by specific land use plans from rights to the land itself. This is a problem because most ES deals will require some long-term agreement to manage land in a certain way. From the perspective of a primary mortgage holder, this commitment devalues the collateral – as a result the landowner might well be barred from pursuing the ES project by the primary mortgage holder. At present there is no standard technique for resolving this potential conflict, and until a workable protocol is developed, debt financing for ES projects will be difficult if not impossible to arrange for small landowners.

5.1.2 Create simple crediting protocols that can reduce transaction costs

A lack of clear crediting protocols in many ES markets creates major uncertainty that hinders project planning and poses unpalatable financial risks to investors. The need for clarity in markets with respect to awarding credits to specific projects was universally identified as a critical step in generating transaction in ES markets. From a financial standpoint easy protocols are critical to reducing risk and reducing project development and transaction costs, which of course increases project value from the perspective of potential financiers. Crediting calculators are one potential approach to implementing simple protocols. These tools standardize and greatly accelerate the estimation of credits resulting from a project. An

outstanding question relating to crediting calculators is whether they are used to estimate credits that will later be confirmed through some other process, or whether the calculator is accepted by regulators as the official process for establishing credits. From a financial point of view, the more certainty a potential project investor can have in the number of credits a project will generate, the lower the risk and the higher the risk-adjusted net present value of the project. Therefore, binding official calculators are more conducive to accessing project finance, though they of course require broad acceptance of project performance risk by regulators. In this respect, the use of a crediting calculator can be similar to a prescriptive obligation approach (described below).

5.2 Reducing project risk

5.2.1 Establish clear and simple crediting and trading rules

A risk in project development is uncertainty regarding credit establishment, especially in new crediting schemes. Reducing this uncertainty will increase investor confidence and support project finance.

Prescriptive obligations, in which regulators commit to awarding credits for certain actions independent of actual ecosystem impact, are one potential tool that can be used to reduce risk. Under such an approach, the state awards credit for regulatory compliance if certain actions are taken, regardless of whether subsequent physical processes actually produce ecosystem services in quantities sufficient to meet the original mitigation or other regulatory obligation. This approach can be characterized as a subsidy because it exposes the state to costs; in the event of nonperformance the state will either have to accept environmental damage or fund remediation.

The financial benefit provided by prescriptive obligations or any simplified crediting approach is to reduce the risk related to an investment in credit development. This reduced risk increases project value and increases the attractiveness of a project to potential financiers. In effect, if "unforeseeable is uninvestable," then simplified crediting approaches attempt to reduce the unforeseeable.

5.2.2 Establish secondary markets for ecosystem services credits

Concentration of risk is a characterization of many investments in ecosystem services development. The lack of a secondary market for many types of credits means that project developers must often hold their investment over a long time horizon until credit sale (frequently through a bilateral transaction to a buyer that will retire the credit to meet a regulatory obligation). Establishing a secondary market for credits or credit futures (if credits are not yet certified) would allow initial financiers to recoup their money by selling credits to other investors prior to their sale to a regulated purchaser, thus lowering investment risk for potential financiers. In addition, financiers selling credits to investors on the secondary market allows private investment capital to support ES finance.

The importance and potential of secondary markets in finance, previously described in section 3.2, is certain. More difficult is the question of how to increase the sales of credits on a secondary market. On the one hand, resolution of some of the market design issues associated with ES finance should naturally help increase secondary market sales. In some areas such as renewable energy credits, hedge funds and other large investors have flooded the secondary market (largely out of speculative interest, which can be frustrating to the conservation buyer who may be priced out of the market). Creation of a trading platform, contract rules, and other basic market infrastructure will all contribute to secondary market development.

5.2.3 Experiment with insurance, options, and other financial mechanisms to manage risk

There are many financial instruments that could be used to manage risk around the ecosystem services projects. Insurance contracts could manage project performance risk, while futures contracts and options or other hedging mechanisms could manage risk related to prices of future credits. The state could also play a role in reducing risk, for example by selling insurance or using payment in lieu structures or other market design approaches to eliminate performance concerns.

If credit development rules require the supplier/developer of an ES credit has to warrant out-year performance or see initial investment through some certification threshold prior to credit certification (and sale), then there is a natural opportunity to use insurance to manage the risk of project failure. Insurance is a simple financial instrument in which an unlikely adverse event triggers a payout meant to compensate the party impacted by the event. Because the event is unlikely, financial institutions can issue policies at reasonable cost and allow project developers to pool risk. In a market like that for certain ecosystem services credits, the lack of experience with project performance is expected to make insurance difficult to price because the likelihood of payout is unknown. For this reason, prices are likely to be high if insurance is available at all. This unknown risk level is a natural opportunity for the state to provide insurance. This could be done either directly, through subsidization of private insurance, or indirectly through policy design (using prescriptive obligations, for example). This has been done in areas where the private sector fails to provide insurance on acceptable (however defined) terms (as with flood insurance). Depending on the state's risk tolerance and policy preferences, state mitigation projects or assets can underlie a public insurance pool.

In addition to credit certification risk, project developers and potential financiers or investors face enormous uncertainty around the future market value of any credits they develop. This price risk is structurally similar to that in any number of other assets, but is extreme in many ecosystem service markets due to the lack of track record, changing regulatory environment, and small numbers of transactions in certain local markets. This concern was reflected at the workshop, where financiers expressed some ability to deal with volatile returns, but drew the line at the extreme risk of inchoate markets where there was a very real possibility that an investor would "break the buck" (i.e. realize a negative return). Fundamental questions about whether there was a customer for the credits being developed underscored the extent of this issue.

Financial derivatives including options and futures can be used to manage this risk. In an option, a project financier might execute a contract that guarantees the right, but not the obligation, to sell a number of ecosystem services credits at a specified future date for a specific price. In that way, investors can purchase certainty that they will have access to some minimum amount of revenue from their investment. Futures differ from options in that they are binding – they are agreements to sell at a future date at a specified price. Lack of market experience and extreme risk will be a challenge in pricing either of these financial instruments. In the case of futures, the future sales price will likely be low as purchasers are unwilling to commit to purchasing something of unknown future value at a high price. This may in practice limit the value of these tools.

If there is a timing issue in the market where the identification of suppliers takes too long, such that there is no inventory available when demand arises, then an entrepreneur or broker could pay for an option to convert one's land to ecosystem service production when demand arises (that is, an option on project development rather than on the credit itself). That way, a landowner gets extra income and does not have to assume the risk of developing the assets without a buyer. Depending on the timeline intrinsic in credit creation, this approach can at least reduce the time between development and first revenue.

Any of the above financial instruments can be implemented to support the market for ecosystem services by reducing risk. What is less certain is whether costs of doing so would be at levels that market participants will bear.

5.3 Increasing project value

5.3.1 Develop regulatory and voluntary markets

When market demand for ecosystem services credits is well established, projects producing these credits will be more valuable and will have less difficulty attracting financing. Broadening regulatory obligations to offset environmental impacts of economic activity will obviously increase demand for credits and increase project value.

Voluntary markets can be similarly cultivated to support the value of credits – marketing ES credits for their public relations value may have the potential to spur demand, increase value, and attract finance. This notion calls attention to the fact that demand for credits is not static, particularly when it comes to voluntary credits. While the market potential of the voluntary ES credit markets is not expected to approach that of the regulatory market, demand for voluntary credits including carbon offsets has grown enormously over the past decade, in part due to cultivation through marketing. Tax policy could be used to spur growth. While the purchase of voluntary credits provided by non-profit entities are typically tax deductible (on par with charitable contributions), extending this policy to for-profit entities might stimulate demand. There is some logic to this approach because purchase of a voluntary credit is arguably equivalent to environmental philanthropy. In fact, there is some question as to whether purchase of voluntary ES credits might displace contributions to traditional environmental non-profits. The difference being of course that the buyer of a credit has some assurances that the "donation" leads to demonstrated environmental benefit. Increased demand for credits should increase prices, reduce risk, and increase the value of ES project investments, enabling them more successfully to attract finance.

5.3.2 Use tax policy to increase project value

Tax advantages, including property tax deferrals, can be used to provide additional upside to landowners considering investing in ES production. This benefit is difficult to transfer independent of land, and so its role in project finance is to support the landowners in self-financing a greater portion of a project. Specifically, property tax assessments can be handled differently for land used to produce ecosystem services (as they are currently for farmland). Alternatively, tax credits or deductions could support investments in ecosystem service production (as is currently done with certain energy investments). There are many other approaches to incentivizing production of ecosystem services, but concern for pragmatism suggests adapting or extending an approach that currently applies to other industries. One additional point merits emphasis – current fiscal policy at both the state and federal level may actually disadvantage landowners interested in production of ecosystem services. For example, if state property tax deferral or federal farm subsidies are lost when converting to ecosystem services production, then that transition will be commensurately more costly and less attractive. At a bare minimum, experience suggests that a level playing field will be needed to induce production of ecosystem services. Depending on public policy priorities, additional subsidy may be appropriate.

5.3.3 Route projects through "safe" institutions to reach a wider market

Projects can be made more appealing to risk-averse purchasers by routing them through governments and other institutions that are more stable than small project developers. Routing projects through these institutions can increase costs but may also increase marketability of credits by lowering perceived performance risk, particularly with risk-averse public-sector potential purchasers. For example, one

financier cited experience with a small-scale developer of effluent mitigation credits in which the developer executed one deal with a municipality for all of the credits developed, including quantities of credits beyond what the municipality required. The municipality was able to sell the credits on to other cities, which initially had been reluctant to work with the project developer.

5.3.4 Expedite project permitting and approval

Projects that require permit approval from regulatory agencies can have high transaction costs due to permitting timelines. To the extent that approvals can be expedited, development costs are lowered and eventual revenue generation is accelerated, improving project value. In Oregon, the Freshwater Trust's StreamBank program is working to provide a centralized platform for project approval that will result in less time between project conception and execution. Tightening the project timeline increases project value and is expected to afford additional access to finance.

5.4 Structuring projects to manage economics

5.4.1 Aggregate small projects to improve project value

Small-scale projects, which typify many rural settings, tend to have limited access to financing from capital markets because transaction costs erode their net present value. Aggregation, combining multiple like-projects into one larger project, can improve economics by creating the critical mass necessary to attract private finance. In addition, aggregated projects can be less risky by virtue of diversification in their constituent sub-projects. Aggregated projects may also access returns to scale that create additional value. For example, the value premium associated with large areas of contiguous habitat might mean that a conservation buyer will be willing to pay for an easement if and only if all area landowners are willing to participate – in this case the aggregation creates ES value and attracts finance because the sum is worth more than the parts. Aggregation can also create a critical mass of projects in one area, potentially offering advantages from a community development/rural sustainability perspective.

5.4.2 Structure projects as hybrid ecosystem services - natural resource investments

Several investors active in the market for ecosystem services and their credits structure projects to incorporate economics both of ES and traditional natural resource investments. This approach typically involves purchase of land with some value in traditional uses (e.g. forestry, grazing, etc) and simultaneous targeted ES project development. The core investment in the land and income stream from traditional land use limits downside risk while the ES opportunity provides potentially large upside returns. This asymmetric financial profile is attractive to potential financiers.

5.4.3 Use option contracts to access revenues before incurring credit certification costs

As depicted in Figure 1, the net present value of ecosystem service projects is lowered by the gap in timing of the revenues and project expenditures. Developers are forced to develop and certify credits before selling credits on the market (if they can). Using options, developers can sell the right to purchase future credits to potential buyers prior to incurring many project expenses. This increases project value by frontloading more revenues. In fact, if the advance sale of credits can be moved to the beginning of the project, the need for other financing can be eliminated. It can also help manage risk because a developer need only incur credit certification and registration costs if and when a buyer for credits has been found, lowering risk.

5.4.4 Manage project investment incorporating option values

The project economics depicted in Figure 1 imply that a project developer or investor makes a go/no-go decision at the beginning of project development and accepts all costs and revenues from that point on. In reality, as information improves over time, a project developer will be able to incur certain costs only if they are a good investment at the time. For example, if a market for credits does not materialize, then credit monitoring costs can be avoided, partially offsetting the revenue shortfall. Understanding project economics incorporating options will increase net present value and lower risk.

5.5 Providing financing directly

5.5.1 Subsidize credit for development of ecosystem services projects

The state can directly provide finance to ES projects by subsidizing or guaranteeing credit used on the projects. Potential mechanisms already exist in the market for student loans, where the government mandates reasonable retail interest rates in exchange for guaranteeing loans made by private lenders. Loan guarantees are a potentially attractive means for the state to catalyze financing by absorbing risk that may be paralyzing ES finance. Particularly if the default rate on loans is expected to be low, then a small pool of public funding can leverage significant private capital to jump start lending for ES project. In practice, the lack of clarity and experience in ES markets means that the extent of the risk absorbed by a loan guarantee program is unknown. Just as it is for the private sector, this uncertainty can thwart public finance of a loan pool.

The idea of using a revolving loan fund, potentially supported by state agency funding, to bolster supply of project financing emerged at the financiers' workshop. Specifically, funding currently used for environmental restoration matching grants could in part be diverted to a revolving loan fund that would, in theory, support more projects as initial loans were repaid. While some attendees were enthusiastic about the idea, skeptics pointed out that without any real track record or experience in the market for ES credits, there was significant risk of loans not being repaid. While there is not currently enough information to judge the likeliness of this happening, it is clear that revolving loan funds represent one of many potential means of state provision of financing, and as such should be considered deliberately alongside other approaches and structures.

5.5.2 Establish a minimum future price for ecosystem service credits

The state can establish a minimum future price for ecosystem services credits, acting as buyer of last resort. In this scenario, the government commits to purchasing credits from project developers for a specified price in the future. This guaranteed floor on the value of credits reduces risk and increases project value, allowing private financiers to invest in projects with limited downside risk (and significant upside potential). This, in turn, will give them increased confidence to invest and may also increase the availability of financing in the same way that loan guarantees do. Notably, though this can be characterized as a subsidy, it may be attractive on policy grounds. If the state considers ecosystem services a public good and wishes to increase the total amount of services produced, then establishing a fixed willingness to pay for these credits can be solid policy even absent a regulatory market for the credits. This presents a potentially elegant solution to reconciliation of a regulatory scope that authorizes mitigation of actual impacts with societal goals of net environmental restoration – a single system can support both aims in a way that also supports supply side market development. (Notably, non-profit organizations interested in supporting the development of ecosystem services markets can fill this same function subject to their budget constraints. If mitigation credits purchased in this way are not used to meet a mitigation obligation, then they are effectively a form of environmental restoration. Alternatively,

they could be held for eventual potential sale under the right circumstances. Either way, if the credits are supported by projects that meet the organization's aims, there is a potential opportunity to support ecosystem service market development without the organization bearing unacceptable risk.)

Another form of subsidy is by assumption of risk: providing payment in lieu provisions in the context of a regulation driven ecosystem services marketplace. These provisions allow those in need of mitigation to pay the state a certain amount in order to meet their obligation instead of purchasing credits from an actual project. The risk here is that the payment will be too low to cover the cost of mitigation, which itself can be hard to forecast. The character and magnitude of the subsidy in this case depends on what the state does with the payment and at what price this payment is set. Payment in lieu is politically attractive because it gives regulated parties an upper bound for the cost of regulation. If the price set for payment is too low, however, there will not be sufficient funds to meet environmental objectives. How the state should use these funds and whether they can do so efficiently is an open question.

5.6 Supporting Rural Sustainability

5.6.1 Establish a different participation mechanism for small landowners

Experience to date has shown that it is difficult to complete transactions in ES markets even when large physical project size affords significant economies of scale. Given high transaction and monitoring costs, transactions pursued at small scale with small landowners face acute economic challenges. One possibility is establishing a different set of credit and project requirements, perhaps targeting the voluntary mitigation market, in order to allow small holders to participate in ES provision while acknowledging the very real challenges of competing in full-fledged markets with industrial scale landowners. While there is of course not the desire to compromise on credit quality, oversight or monitoring protocols could be pursued on a sample basis to reduce participation costs. Alternatively, subsidies or tax advantages could be scaled to help reduce the barriers to small landowners' participation in these markets if warranted.

5.6.2 Use policy to direct investment in ES project to support rural sustainability aims

Tax policy, crediting rules, and assignment of mitigation obligations can all be shaped to ensure that ES project development occurs in a way that supports rural sustainability. For example, techniques of urban economics, including tax-advantaged enterprise zones, can be used to direct investment to particular geographic areas or project scales.

Establishing opportunity zones that confer financial benefits to producers of ecosystem services *produced in specific areas or meeting specific parameters* can be a powerful tool to meeting rural sustainability aims of ES production. Under such an arrangement, ES production might be tax advantaged if pursued in a targeted area, with the goal of shaping the development of the ecosystem services industry. There are several criteria by which this activity might be directed. Environmental objectives are an obvious application. In that case, using an opportunity zone is a financial analog to weighting crediting criteria to provide more credits for activities pursued in ecological priority areas. Another, perhaps more appropriate approach is to use opportunity zones to meet rural sustainability goals, just as these zones are used in cities for urban renewal. In this application, the goal is to direct the *economic* activity of ecosystem services markets so that it will both (a) provide a critical mass of activity in one area in order to stimulate a sustainable ecosystem services industry, leveraging localization economies and (b) provide the foundation for economically viable support industries, including opportunities for local residents to maintain and manage lands for ecosystem services as there will be enough local activity to allow companies based in rural areas to succeed.

In this way, opportunity zones could allow for the direction of both the economic and ecological benefits of the ecosystem service market, avoiding a scenario in which locals are locked out as lands are used to meet ecosystem services demand. That is, place-based public finance policy can be used to meet both environmental and rural sustainability goals of ecosystem service market development.

5.6.3 Leverage institutional design to ensure ES markets unfold consistent with policy and rural sustainability aims

Beyond the purview of public finance, the public sector can use other means to manage risk and balance efficiency, social, and environmental priorities in ecosystem services markets. These methods are included here both because they may be more appropriate than purely financial approaches and to provide a comprehensive framework in which to discuss ecosystem service market design and regulation. Development of any market-based approach to environmental regulation involves tradeoffs between the potential efficiency gains of harnessing market forces and the risks that those forces, perhaps due to some oversight, will cause unintended and harmful effects. This is particularly the case with the ecosystem services marketplace, where caution is required to make sure that the economic "case" for participation in the market by private investors is not based on exploitation of an unforeseen "loophole" in policy design. As highlighted above, two major concerns are that market participants seeking only to create salable credits that have value toward regulatory obligations might either cause environmental harm (or insufficient environmental mitigation benefit) or undermine the economic viability of a local community.

These concerns lead to the understandable temptation to keep tight control of the market through any number of approaches, while still preserving the efficiencies of the free market. Fortunately, there are established approaches to guarding against undesirable market outcomes in industries of critical public concern. Two approaches in particular may hold relevance: a public utility model and participant certification.

Public Utility Model. The regulatory framework used to manage for-profit utilities may have much to lend to ecosystem service market regulation. Specifically, utilities accept regulation by state commissions in exchange for exclusive rights to serve a specific geographic area. Price establishment and activity require regulatory approval, but utilities do not face competition and are allowed steady profits. The economic rationale for this arrangement hinges on the concept of a natural monopoly – given the high cost of establishing the infrastructure to deliver certain services such as water, roads, and electric power, it makes no sense to have traditional independent competition and attendant redundant investment. At the same time, once a single provider is established in an area, regulation is justified on efficiency grounds to guard against monopolistic behavior and reduced aggregate economic utility.

On the one hand, it is hard to argue that provision of ecosystem services to satisfy mitigation obligations in regulatory markets is a natural monopoly. Infrastructure needed to support this investment is minimal and there is no reason to fear monopolistic behavior and the related economic harm. On the other hand, given the small scale of many markets and extensive local knowledge needed to develop successful projects, one could argue that participation is too costly without some guarantee of business and that private firms will not pursue the development of credits. In this case, there may be a justification for granting a regulated monopoly franchise to a developer of ecosystem services credits in order to increase the economic viability of the enterprise. Because investment in the expertise to develop ecosystem service credits is costly relative to the value of the credits, it is economically inefficient to allow competition (or rather, if we allow competition, there will be an underprovision of services due to the level of risk). A public utility model can help address this problem.

The public utility model has additional relevance in specifically recognizing that societal comfort with reliance on market forces to improve provision of ecosystem services essential to life may be contingent

on knowing market participants and providing a forum for ongoing policy adjustment and course correction. A public utility model seems to offer both of these options, first because some operating license could be required to control entry into the marketplace and second because oversight by a commission or governing body would provide a forum for control of activity in the market. The model is also appropriate in that it would presumably allow for cost recovery and a reasonable return on investment. Thus, public utility regulation may offer a path towards balancing equity and efficiency in a way that is not toxic to market participants and financiers.

Participant Certification. A public utility model implies repeated iterations of well-established processes for managing prices and activity in the market for ecosystem services by a single regulated entity in a well-controlled environment. In some cases, this level of regulation may be unnecessary. Specifically, certification or licensing of market participants may be sufficient to ensure market outcomes that meet environmental and rural sustainability goals. A license could be required to sell ecosystem services, and licenses might be issued only on meeting certain requirements, potentially including minimum bonding and insurance provisions. License renewal might provide an opportunity for review of activity and course correction in the event that market outcomes were not meeting goals.

With either of these approaches, the difficulty in implementation is arguably in the details. Even if market players are willing to accept ongoing scrutiny and activity oversight, they will presumably want to understand the parameters on this regulation prior to investing significant time or money. Establishing new regulatory frameworks, bodies, and rules is complex and may be costly, particularly if the location-specific nature of regulatory aim is such that each new market requires its own process.

Beyond administrative costs, an outstanding question with respect to taking the regulated market approach is whether the market will be economically attractive to participants under a given regulatory scheme. Crafting regulatory processes that protect policy aims is in some ways straightforward – rules can be drafted to target market activity. Whether transactions will materialize is another question entirely. In some cases, there is evidence that regulation has limited interest to non-profit organizations (see below). Naturally, subsidies can be added to regulatory markets to mitigate this effect, but there is a basic irony to developing a market-based regulatory framework that cannot attract participants without subsidy unless oversight is relaxed to unacceptable levels.

5.6.4 Mitigate for any unavoidable adverse impacts to rural communities

Earmarked taxation is a commonly used policy approach that has relevance to efforts to safeguard rural sustainability as ecosystem services markets are developed. In this case, tax revenues are earmarked for programs designed to mitigate rural sustainability impacts of ecosystem services development. Depending on policy aims, the source or use of these funds could be specifically prescribed. Further, any fund could be established in a way that is integrated with ecosystem service markets, though this is not a requirement. To offset lost tax revenues from withdrawal of federal lands for national forests, federal payments to counties from national forests have been in place since 1908, when the Department of Agriculture Appropriations Act specified that 25 percent of Forest Service revenues from activities such as logging, mining and grazing be returned to states containing national forest lands. After receipts from timber sales dropped sharply in the late 1990s due to substantial changes in Forest Service management practices, Congress passed the Secure Rural Schools and Community Self-Determination Act of 2000 to stabilize payments to counties. Though this approach does provide replacement revenue, the stability of the funding is subject to the political process and many would argue that a transfer payment made to general government funds leaves much to be desired in terms of sustainability goals.

6. Conclusion

Production of ecosystem services credits at scale holds the dual promise of efficiently achieving environmental stewardship goals and concurrently supporting rural communities. At the same time, markets for these credits have been slow to emerge. There are many reasons for this, including typically small project size, a lack of clarity about market rules, high levels of project performance risk, and unclear demand for eventual credits. Initial financing is broadly recognized as prerequisite for project implementation and attendant credit development, but such financing is not consistently available. To some, this lack of financing is a market failure whose resolution will catalyze market development. Others see financiers' unwillingness to fund projects as an indicator that ES credits are a high-risk or even bad investment, asserting that when projects are competitive with other market opportunities, financing will be available.

This report examined barriers and potential solutions to this lack of financing for ES projects. These solutions were wide ranging. Some addressed the high investment risk that is toxic to finance, using approaches ranging from design of market rules to financial hedging. Others concentrated on increasing project value, leveraging the simple fact that more valuable (potentially profitable) investments should be more able to attract investors. Strengthening basic market infrastructure, including standard contracts, appraisal techniques, and other mechanisms also could help overcome institutional barriers to using standard financing approaches in these emerging markets. Direct government provision of project financing characterizes another broad suite of solutions. Finally, options for managing rural sustainability goals through finance were also considered.

Major policy questions remain for those developing markets for ecosystem services. The suite of tools presented in this report presents the opportunity to resolve financing challenges to development of ES credits. However, many of the tools require government support, whether financial or through assumption of risk. As with the private sector, the precise scale of the risk is uncertain and perhaps unquantifiable – policy makers must weigh the potential benefits of developing ES markets with the very real costs of doing so. At the same time, Oregon is well positioned to lead the way in this innovative approach to achieving environmental stewardship goals.

Public and non-profit sector financing has paid for environmental water purchases across Oregon, following development by non-profit (i.e., tax exempt) conservation organizations. Millions of dollars have also been devoted to laying the market groundwork for ecosystem services transactions. Several transactions that have occurred to date have seen the public bear performance risks (e.g., water leases where contracts are let with no caveats for low flows or regulation). Finally, a huge portion of environmental conservation work is publicly funded (e.g., Oregon Watershed Enhancement Board); and while it has not been accounted for in an ecosystem services crediting framework, much of it is substantially equivalent to a state purchase of ecosystem service credits for restoration purposes. In short, many current conservation activities of the state or non-profit organizations can, with only slight modification, be used to simultaneously meet environmental and ecosystem service market development goals. In this way, it should be possible to responsibly adjust current activities to enable continued development of ES markets supported by adequate sources of financing.

7. Glossary of Terms

There is significant variation in the terminology used in discussion of emerging markets for ecosystem services and their credits. This glossary defines major terms as used in this discussion brief.

Aggregation – Combining multiple small projects into one large project.

Capturable Net Present Value – The portion of net present value from a project that is internalized in market prices and can therefore be captured by project developers. It does not include positive environmental externalities from ES projects.

Counterparty Breach – Breach of contract by a counterparty. In the case of bilateral option contracts, it comes when one party to the contract does not honor part of the commitment. For example, while an option to sell an ES credit for a certain minimum price in the future can reduce investment risk, if the party agreeing to the future purchase violates the arrangement, then the ES project investment could be stranded without a purchaser.

Crediting Calculators – Software tools that allow straightforward calculation of ES credits that will result from specific on-the-ground restoration/stewardship actions. Calculators allow for *ex ante* measurement of credits and reduce project risk for the developer.

Ecosystem Services (ES) – The benefits derived from ecological functions that support human welfare, but do not directly enter into production and consumption in the market economy.

Ecosystem Services Credits – A financial asset representing a claim on the ecosystem services produced by a project.

Ecosystem Services Projects (ES Projects) – Natural resource or land management projects that increase the flow of ecosystem services produced by a particular ecosystem.

Financial Assets - Assets that have no intrinsic value but rather represent claims on real assets and the income they produce. For example, a share of stock is a financial asset that represents a claim on a company, which may own land, buildings, equipment, and other real assets. Similarly, the intact ecosystems that provide services to society are real assets. Ecosystem services credits are a corresponding financial asset representing the flow of services from those real assets.

Monetized – Converted into money. In investing, monetizing assets through their sale to other investors is essential to allowing the investor to exit the investment and redeploy capital for other purposes.

Net Present Value (NPV) – A financial measure of the value of a potential investment calculated as the risk-adjusted sum of expected revenues and costs, discounted to the present.

Options – A type of derivative financial asset that is the right to buy or sell a financial asset at a specified future date for a specified price. For example, a stock option affords its holder the right but not the obligation to purchase a specific share of stock for a specific price (the strike price) anytime before a specific expiration date. If the strike price is less than the market value of the stock, then the holder of the option can exercise it to purchase the stock for below market value to realize an immediate profit.

Out year payoffs – Revenues from an ES project that occur only several years after initial project investment.

Private Investors – Investors whose primary motivation is to realize the maximum risk adjusted financial return on their investments. These investors will typically not be willing to sacrifice investment performance, even to support environmentally beneficial projects.

Regulatory Credits – Tradable credits generated by ecosystem services projects that meet regulatory agency rules and can therefore satisfy a regulatory mitigation obligation. These credits are highly valuable because regulation required their purchase and thereby stimulated demand.

Rural Sustainability – Understanding what financial methods are appropriate in the context of rural sustainability requires defining what we mean by the term. We define rural as those communities at least 10 miles by road from an urban community (of at least 50,000 people) and where dominant livelihoods which contribute to the local economy include manufacturing, government, services, and natural resource dependent industries such as forestry and agricultural production. Sustainability generally implies managing and using natural resources in ways that link current and long-term societal, economic and environmental vitality. We define sustainability as land use practices coupled with economic exchanges that maintain or enhance the natural resource base in ways that contribute to the local economy and that help maintain local community social systems and economic self determination. (Lurie and Hibbard, in prep. The New Natural Resource Economy: Elements of a Definition and Considerations for a Research Agenda.)

Secondary Market – A market in which financial assets are traded between investors after their initial sale by project developers. The stock market is a secondary market. The primary market for stock involves trades where privately held companies sell stock to investment banks in order to raise capital. Investment banks then recoup their investment by selling stock to other investors on the secondary market.

Socially Responsible Investors – Investors who seek both to a) realize acceptable risk adjusted financial return on their investments and b) support companies or projects engaged in activities consistent with their personal values. These investors may be willing to sacrifice investment performance to support environmentally beneficial projects.

Voluntary Credits - Tradable credits generated by ecosystem services projects that follow crediting protocols outside of any regulatory agency rules and which cannot satisfy a regulatory mitigation obligation. The value of these credits depends on whether demand will materialize absent regulatory requirements.