



CAN ECOLOGICAL MARKETS HELP DEVELOP A CONSERVATION ECONOMY IN PUERTO RICO?

KARST LANDSCAPE

Karst covers more than one third of Puerto Rico. Water interacting with limestone creates spectacular landforms, such as the haystack hills, caves, sinks, and blind valleys where streams disappear below ground. This rugged region holds the most extensive continuous forest left on the island. The karst region harbors rich biodiversity with more than 1,300 species of plants and animals including 30 federally listed species. The northern karst is a viable site for establishing a second wild population of the endangered Puerto Rican Parrot which is critical to its survival. Because of its complex hydrology, forests, wetlands, estuaries, aquifers, wildlife and people rely heavily on this karst. There are 3.8 million people living in Puerto Rico with a population density exceeding any U.S. state. The northern limestone supplies one-quarter of the island's public freshwater, mostly high quality ground water. The karst region also hosts economic activity including agriculture, mining and manufacturing. Electronic and pharmaceutical industries rely on high quality water from the north coast limestone aquifer. Despite these assets, this region is tending toward irreversible damage from development pressure, pollution and salinization of water. People and the environment may benefit from emerging ideas about creating markets for ecosystem services.



WHAT ARE ECOLOGICAL MARKETS?

Ecosystem services are the functions performed by ecosystems that lead to desirable outcomes for people such as air and water purification, drought and flood mitigation and climate stabilization. Markets exist only for some goods (e.g. wood from forests) while other environmental services are not valued in the marketplace (e.g. biodiversity, clean air). Those who supply ecosystem services are not always rewarded for all the benefits they provide to others, and those who reduce ecosystem services do not bear all the costs they impose. Creating markets for ecosystem services can help better reflect the true value of these services so they don't diminish to the point that they can no longer support people or these services will be very costly to restore.

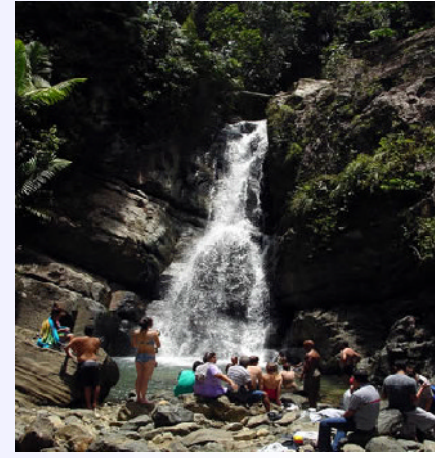
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CREATING MARKET INCENTIVES

Throughout its Spanish and American history, Puerto Rico has implemented a variety of economic incentives. A non-incorporated commonwealth of the United States, Puerto Rico operates under U.S. legal, monetary, security and tariff systems. After WWII Puerto Rico successfully engineered a transition from agriculture to industrial development by using tax breaks. This resulted in greater social and educational opportunities for its citizens.

Starting in 1996, the U.S. Congress phased out tax incentives. In response, the local government emphasized tourism and continues to provide business incentives such as a maximum 7% business income tax, research and development incentives and deductions for job training. The island's living standards are low by U.S. standards, with a per capita income only half that of Mississippi and unemployment of about 12%. The high-density population and unemployment rate adds to the need for integrated solutions that are environmentally, socially, and economically sound.

Markets for ecosystem services can generally be created when governments establish a new property right linked to an ecosystem service which can be exchanged or offset. For example, a property right has been established in some countries for carbon sequestered in forests. Use of this right is a proxy for climate stabilization services since the process of



sequestering carbon may mitigate greenhouse effects. Markets for ecosystem services can be divided into four categories:

Non-tradeable, No offset- Parties sell their right to undertake a certain activity, such as emitting pollutants or development. This right is transferred between parties only once. For example, landowners compete for conservation grants by maintaining native vegetation on their lands. Grants are awarded to those offering the most ecosystem services per dollar granted.

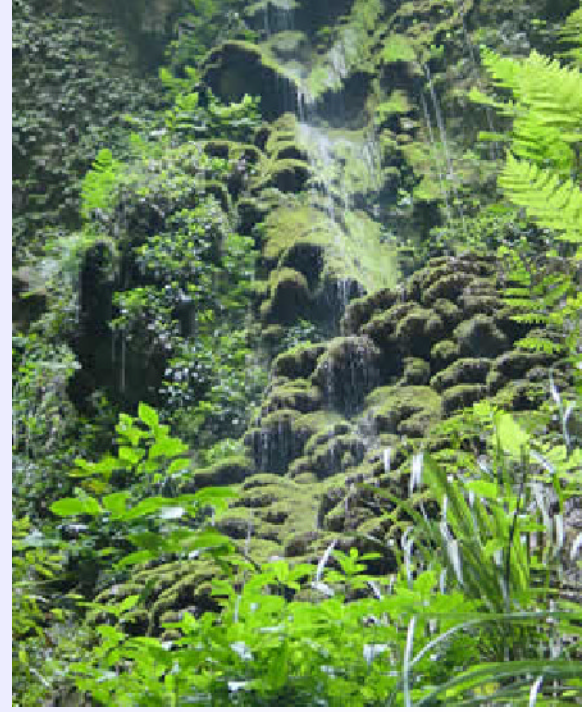
Non-tradeable, Offsets- A party can undertake an activity that reduces an ecosystem service only if it undertakes or purchases from another an activity that increases the service by at least the same amount.

Tradeable, No offset- An upper limit is set on a certain activities such as a pollution or land use. Parties who hold the limited right to undertake the activity may sell the right to another party.

Tradeable, Offset- A party can undertake an activity that reduces an ecosystem service if it pays another party for an activity that increases the service by at least the same amount. This right can be exchanged by an intermediary or broker before being offset.



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EXAMPLES FROM OTHER PLACES

Across various countries there are four general types of payment schemes: 1) public payments are made to private forest owners to maintain or enhance ecosystem services, 2) open trading under a regulatory cap or floor, 3) self-organized, voluntary payments, often with non-governmental entities, 4) ecolabeling of forest or farm products and services.

France- Perrier, the largest bottler of natural mineral water, pays upland farmers and forest owners for improved practices and reforestation of sensitive infiltration zones in order to maintain aquifer quality (non-tradeable, no offset).

Australia- Water tables and soil salinization is controlled by a pilot program where state forests earn transpiration credits. These are then sold to irrigators. Funds earned by the sale pay for reforestation projects on private and public lands. Auctions are held and private landowners compete for available grants (tradeable, offset).

Columbia- An eco-tax is levied on industrial water users for water flow and purity. This funds regular payments to municipalities and private landowners for improved management and expansion of forests (non-tradeable, no offset). Cooperatives can be formed to aggregate smaller landowners.

Costa Rica- Private hydroelectric companies and the government obtain cost effective water flow regularity and sediment reduction in reservoirs by paying upstream landowners to protect, increase or maintain forests. A non-governmental organization helps collect and manage the distribution of funds (non-tradeable, no offset).

United States- The city of New York determined that it was more cost effective to pay landowners to change their land management practices than to build a water filtration plant to maintain water quality. Also, several states are setting limits on the amount of pollution within a watershed. Pollution 'credits' are distributed to businesses and other sectors who may then trade them to meet overall pollution control objectives in the most efficient way (tradeable, no offset).

These examples focus on various methods to value services to ensure clean water and sustainable water withdrawal, similar to values provided by the Karst landscape in Puerto Rico. Some countries combine payment schemes involving clean water with complimentary payments for other services such as biodiversity and carbon sequestration. At the same time, landowners are often still able to conduct 'green' tourism, farming or forest activities.

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EL YUNQUE FOREST

In the last century, Puerto Rico's forest dominated landscape was rapidly converted to agriculture. Up until the 1940's forests only covered about 6% of the island. Industrialization actually accelerated forest recovery as people emigrated from rural to urban areas and coffee and sugarcane plantations were abandoned. By 1991, forest cover had increased to 42%. Secondary forests recover quickly in the tropical climate. However, as urbanization continues, forests adjacent to the Caribbean National Forest (CNF) boundary are being lost to shopping centers, tourism developments and subdivisions. The rate of forest conversion actually increases adjacent to the forest as relatively natural settings may be more attractive to homebuyers. In the rapidly growing municipality of Luquillo, which includes part of the CNF area, 80% of the land developed between 1988-1993 replaced the densest forest. Although the Caribbean National Forest is one of the smallest forests in the National Forest System, (28,000 acres or roughly 11,300 hectares), it is one of the most biologically diverse areas in the system and hosts the only wild Puerto Rican Parrot population. It also provides habitat for five other threatened or endangered species and over a hundred rare or endemic tree species.



The combined location of the mountain and forest provides the island with much of its rainfall. Moisture-laden air is carried by wind and forced to ascend over the mountains. The rise in elevation cools the air, causing condensation in the form of rain. More rain falls on the Luquillo mountains in the eastern part of the island than the western part, because the moisture-laden trade winds first rise on the eastern slopes. Land use intensification not only threatens this water source but also leads to increased soil erosion which can become both an economic and environmental problem. The LaPlata reservoir, which supplies water for 36% of San Juan has lost 30% of its storage capacity due to sediment accumulation.

In 1983 a special zoning ordinance was passed establishing a buffer around the Caribbean National Forest. Areas in the buffer were designated as agricultural and forest land to protect the ecological integrity of the rainforest. However almost 20% of the buffer was still lost to development pressures. In 2005, a new agreement was crafted and a new buffer zone around the forest is still in the planning process. Some critical areas within the buffer may be fully protected while other areas may allow limited development.

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EXAMPLES FROM OTHER PLACES

Brazil- Regulation requires landholders in Amazon forest areas to maintain 20-80% of their land in forest. Careful designation of comparable sites is required since landowners are allowed to offset or trade acres among themselves (tradeable, offset).

Costa Rica- Pharmaceutical companies have contracted for 'bioprospecting rights' in tropical forests. The federal government helps organize buyers and sell collection services (non-tradeable).

Chile- New commercial approaches such as conservation communities, ecotourism-based land protection projects and the eco-real estate projects are being developed to encourage the establishment of privately owned conservation areas while building on a growing consumer demand for housing and vacation in biodiverse and eco-friendly environments (non-tradeable, offset).

Australia- An approach under development is the creation of 'biodiversity credits' by legislation. A new property right is afforded to private landowners who conserve biodiversity values on their land. Landowners can sell the resulting credits to a common pool. The law also creates obligations for land developers and others to purchase the credits (tradeable, offset).

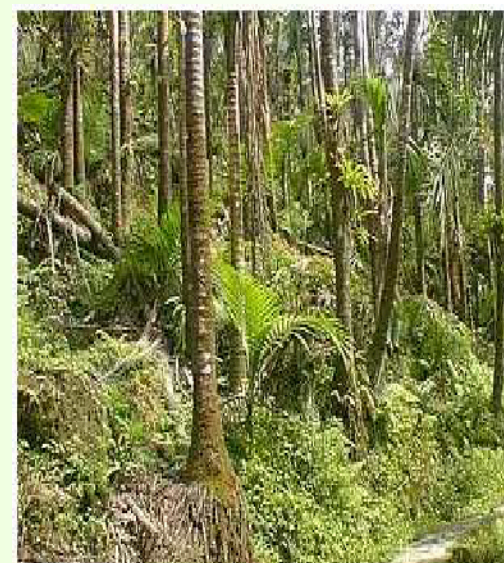
Biodiversity Conserving Business- Conservation values are informing consumer and investor decisions.

Ecolabelling certifies that products are produced in ways consistent with biodiversity conservation.

Certified organic agriculture was worth US\$21 billion worldwide in 2000. The Rainforest Alliance and Sustainable Agriculture Network certify coffee, bananas, oranges and other products grown in and around high-biodiversity value areas. Several food producers have formed a coalition seeking to source commodity supply from producers who are protecting biodiversity. Certification of "green tourism" is also being experimented with in some countries.

Certification requires an independent, credible entity.

Carbon Markets- The Kyoto protocol helped establish an international market for carbon trading. National cap-and-trade systems are also being established in Australia and other countries. In the US, the northeast states are forming a coalition to cap emissions and trade by 2009. Activities that sequester carbon in forests are rewarded. Individual companies like Amaco-BP have also voluntarily created a company-wide cap-and-trade systems. These examples of diversity, tourism, and carbon payments can also be combined with water payments in many places.



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POTENTIAL AND PITFALLS

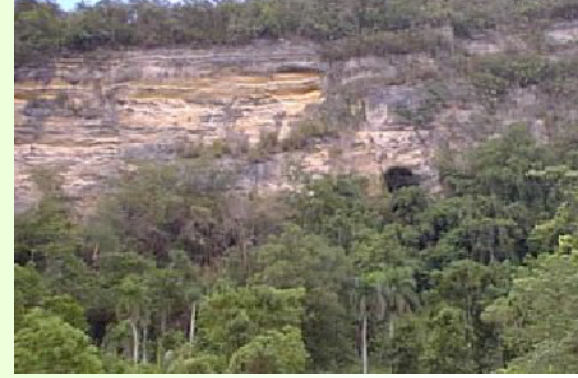
Markets for conservation alone are generally not sufficient in areas where there is a high opportunity costs for the land. However, modest payments, reliably paid over a number of years can serve as a catalyst and make conservation enterprises viable, justifying the restoration of degraded lands and enhancing the livelihood of people. Such markets can also lead to more efficient use of government funds across a broader landscape. Governments can concentrate land acquisition in the most sensitive areas while enhancing broader landscape goals with economic incentives. Markets can also help provide incentives that reduce the cost of enforcing land use laws. In many cases, participation is voluntary or developed within a more flexible regulatory framework which is appealing to private enterprise. There is also potentially a greater role for municipalities and communities in creating or participating in markets for conservation. When establishing market incentives, early dialog with businesses, communities, NGO's, landowners and the governments is essential to avoid potential social and environmental pitfalls. Careful planning can ensure that payments and revenues are distributed fairly and do not inadvertently disadvantage poorer people. Transaction costs need to be kept low by designing monitoring which is simple but effective at ensuring that payments result in predicted services. Possible unintended consequences also need to be carefully considered in design. For example, protection in one area can simply move impacts to another location which could be more sensitive ecologically. This can be avoided by taking a landscape approach. Market creation should be participatory, well considered and capable of being adapted during implementation.



There may be several opportunities to create market incentives for ecosystem services to enable solutions for Puerto Rico conservation issues while creating jobs and greater well-being. Puerto Rico has a history of utilizing various market incentives. In addition, it enjoys the local support of various scientific institutes and agencies, an existing commitment to planned development and potential for widespread partner interest.

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HOW ECOLOGICAL MARKETS CAN HELP DEVELOP A CONSERVATION ECONOMY IN PUERTO RICO

Both the Karst and El Yunque landscapes have tremendous potential for contributing to Puerto Rico's robust tourist economy. Both landscapes provide unique 'wilderness' and recreational experiences. Careful planning of the location and type of tourism in these landscapes, would provide not only a source of jobs and income, but could be intentionally designed to celebrate the continued provision of ecosystem services.

The tourism activities themselves would limit their footprint and drain on energy, biodiversity and water resources. This outcome could be ensured by local citizen-based planning at the municipal or island-wide scale, thus capitalizing on Puerto Rico's strengths in land use policy. This effort could further be enhanced by an eco-tourism certification program that would help ensure that Puerto Rico's tourism businesses remain competitive and maintain their market share within the region, as other tropical countries inevitably adopt similar certifications. This certification and validation program could be run by an independent non-profit or for-profit organization tying off of the values and ideas expressed by local citizens. Compatible agricultural land uses and agroforestry businesses in the Karst and El Yunque area could also be certified under existing national and international programs (e.g. fruit and shade grown coffee). In this way, a working ecosystem landscape could be maintained.

The greatest potential for protecting the Karst could be tapped by engaging local area industries that benefit most from clean water, in water conservation and pollution prevention efforts. A first step would be measuring and benchmarking the value of past and current benefits, and potential threats and costs (e.g. sedimentation, pollution and the need for filtration) for the pharmaceutical industry. Some pharmaceutical companies may also be interested in the added benefits of conserving the rich biodiversity of the karst area in order to retain access to the genetic material which is critical to their product discovery. A place to start is with companies that rank high on the EPA's pollution scorecard for Puerto Rico and companies that have active corporate environmental citizenship programs such as Bristol-Myers Squibb, Merck, Ortho-McNeil and Pfizer. Several of these companies are already part of the EPA's Performance Track program and one has a partnership with The Nature Conservancy to map biodiversity on the island. These industries benefit not only from the continued provision of ecosystem services, but also from meeting goals under their own environmental management systems and EPA programs. Local industries could team up with local government to design a ecosystem service payment system within the on-going water management plan for Puerto Rico that is compatible with the benefits from existing programs and rewards area companies.

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One option could provide for the establishment of a trust fund to pool a variety of payments or contributions over time while maintaining local control in how payments are best distributed to maintain ecosystem services in the karst landscape. NGO's or municipal organizations could organize individual landowners in cooperatives to more efficiently disperse funds and monitor achievements. The key is to involve various stakeholders in the design and execution of the payment system like the more successful examples from other countries. Local governments would provide the regulatory framework for the payment scheme (e.g. land use regulations, tax structures, caps, priority areas for protection) while the market helps ensure that goals and services are achieved in the most efficient way by allowing companies to trade or offset their environmental effects and contributions within the goals or limits. Local NGOs can best contribute funding, expertise, third-party monitoring and help lower delivery transaction costs.

Within the area surrounding the El Yunque, maintaining ecosystem service benefits can best be provided by an extension of the on-going efforts to update land-use policies within the buffer. What is most needed are additional market incentives for landowners that achieve and compliment land-use policies. Again, such incentives should be designed with the local stakeholders. One option would be to develop a cap-and-trade system for landowners depending on their proximity to El Yunque. Such a policy would allow a range of development of 10-80% on private lands depending on their proximity to the Caribbean National Forest and placement within certain ecological corridors or types. Landowners would be allowed to 'trade' their development rights to other landowners, provided such trades are made on a



per acre basis with lands of similar ecological value. Additional flexibility could be provided if a development offset is located within more valuable ecological types or corridors. In this way, limited development can still occur on the less valuable lands for retaining ecosystem benefits, while providing revenue for landowners who supply natural landscapes and ecosystem services. Additional economic incentives could also be provided for developers who minimize their paved footprint, erosion and drain on energy and water resources. The nature of the El Yunque buffer itself might be modified into a series of buffers that graduate from 10% development within the CNF boundary, to 80% in urban areas themselves. In this way, development within the urban areas would still contribute some ecosystem services (e.g. erosion control, open space) or may help offset development pressures in rural or forested areas. Land use policies would need to outline what specific land uses are consistent within undeveloped, natural landscapes. This way, landowners who are providing natural landscapes can simultaneously still engage in tourism, agroforestry or other income options. Those landowners that offset or achieve more protection on their lands than required may also be able to market any additional carbon they sequester as an offset in future national or international carbon markets.