NatCap Annual Meeting & Training
March 26th at 5:30 PM
Herrin Courtyard

POSTER SESSION

1. Changes in the Delivery of Ecosystem Services in Galveston Bay, TX, under Different Sea-Level Rise Scenarios

Greg Guannel, Natural Capital Project

Galveston Bay is the 7th largest estuary in the United States, home to the 2nd largest port in the country by tonnage, and is a favorite destination for recreation. Furthermore, the bay's rich ecosystem hosts the most valuable fisheries resource in Texas. However, the region also suffers severely from the impacts of rapid sea level rise (SLR), particularly through displacement of marshland. As a result, the bay's coastal habitats are unlikely to deliver in the future all the benefits on which many Texans depend. In this presentation, we discuss how the delivery of ecosystem services in Galveston Bay will change under different SLR scenarios. Using outputs from the InVEST suite of models, we quantify how SLR will displace coastal habitats and change the delivery of coastal protection, storm water retention, fisheries habitat and population, carbon storage and sequestration, and recreation services. Such modeling outcomes will be useful to decision makers and stakeholders across the globe who need reliable methods to evaluate changes in ecosystem services delivery under different climate change scenarios.

2. Coastal habitats shield people and property from sea-level rise and storms

Gregg Verutes, Natural Capital Project

Extreme weather, sea-level rise and degraded coastal ecosystems are placing people and property at greater risk of damage from coastal hazards. The likelihood and magnitude of losses may be reduced by intact reefs and coastal vegetation, especially when those habitats fringe vulnerable communities and infrastructure. Using five sea-level-rise scenarios, we calculate a hazard index for every 1 km2 of the United States coastline. We use this index to identify the most vulnerable people and property, as indicated by being in the upper quartile of hazard for the nation's coastline. The number of people, poor families, elderly, and total value of residential property that are most exposed to hazards can be reduced by half if existing coastal habitats remain fully intact. Coastal habitats defend the greatest number of people and total property value in Florida, New York and California. Our analyses deliver the first national map of risk reduction owing to natural habitats and, in so doing, indicate where conservation and restoration of reefs and vegetation have the greatest potential to protect coastal communities.

3. Incorporating Natural Capital into Climate Adaptation Planning

Eric Hartge and Suzanne Langridge, Center for Ocean Solutions

Our team uses an interdisciplinary, boundary-spanning approach to collaborate with regional planners and leading science, engineering, and legal experts to provide natural capital information that coastal planners can incorporate in climate adaptation decisions. Our poster will represent a previous case study approach in water resource management and lead into our current work with county level land use management in north-central California.

4. Invest Chiloé: Communicating the Value of the Chiloé Archipelago's Natural and Cultural Heritage to Generate Alternative Development Scenarios

Alvaro Montaña and Tamara Elwell, Centro de Estudio y Conservación del Patrimonio Natural (CECPAN)

Our poster introduces Invest Chiloé, a pilot program that evaluates and maps coastal ecosystem services in order to spur policy changes at a local level.

5. Identifying Opportunities for Climate-compatible Tourism Development in Belize

Nadia Bood, World Wildlife Fund-Mesoamerican Reef

Climate change is affecting coastal ecosystems with severe implications for developing countries heavily reliant on their natural resources for economic growth. In Belize, coral reefs, mangroves, and beaches are the cornerstone of the tourism industry, while coastal communities rely on mangrove and reef-based fisheries for food security and income. Growth of the tourism industry is viewed as inherent to economic development in Belize, but is often accompanied by habitat degradation that directly threatens the resources upon which the industry depends. The challenge faced by decision-makers is how best to move forward with tourism development whilst maintaining healthy, functional ecosystems that support the tourism industry, sustain livelihoods and provide resilience to climate change. This project is helping to inform this process by assessing the vulnerability of Belize's tourism system to climate change, including the coastal ecosystems on which it depends, and assessing how current policies facilitate or hinder climate-compatible tourism development based on healthy coastal ecosystems. We are also exploring the policy reforms and adaptation strategies required to enhance ecosystem resilience to climate change and foster tourism development, at a local and national scale.

6. Ecosystem services provided by the coral reefs of the archipelago of Tinharé-Boipeba, Bahia, Brazil

Carla Elliff, Universidade Federal da Bahia

This study is the first evaluation of the ecosystem services provided by coral reefs in Brazil. The archipelago of Tinharé-Boipeba is located on the coast of Bahia and is under human pressures, especially due to the tourism industry and disorderly use of the coastline. Coral reefs in Brazil naturally have high endemic rates and very low biodiversity, which make them unique among other reef systems in the world. The present study had the objective of assessing the ecosystem services provided by this singular environment and sought to identify possible negative impacts that may be threatening these services.

7. Ecosystem Services: community based natural resource management on Indonesian coral reefs

Kelly Heber, MIT/WHOI

A comparative case study of two Indonesian regions recovering from heavy blast fishing in the 1990's. I look at the reasons that one village's reefs are making a comeback, and why another's are not. I examine local

governance structures and political economic institutions at the community level to explain the differences in reef resilience.

8. Participatory scenario development in four European coastal lagoons

Geoffrey Gooch, Centre for Water Law, Policy and Science

Lagoons is an EU-funded research project that looks at integrated coastal zone management in four European coastal lagoons; the Aveiro Lagoon in Portugal, the Mar Menor in Spain, the Vistula Lagoon between Poland and Kaliningrad (Russia) and the Tylygulskyi Lagoon in Ukraine. The project uses a combination of catchment modelling, lagoon modelling and socio-economic scenarios created through three participatory processes. These are a) focus groups used to identify the main driving forces, b) citizen juries used to examine the main issues with the help of experts and c) workshops used to create an ideal future scenario using examples from four alternative scenarios in each lagoon.

9. Sensitivity analysis of the InVEST sediment retention model in a Mediterranean river basin: global change and management implications

María Sánchez Canales, Universidad Politécnica de Madrid

Climate change and land-use change are major factors influencing sediment dynamics, and our ability to predict the impacts of these changes at the river basin scale is still limited. The risks posed by altered sediment dynamics are particularly evident in Mediterranean and other semiarid regions, which are among the most vulnerable areas to global change.

Model parameter uncertainty is one of the main challenges in linking global change and sediment dynamics, limiting our capacity to design effective mitigation measures at the basin scale. Sensitivity analyses can help identify which parameters have the greatest influence on model outcomes, and therefore improve model calibration and interpretation. We present here the sensitivity analysis of the InVEST sediment retention model performed in the Llobregat river basin (NE Iberian Peninsula) as an example of Mediterranean river basins.

Our analysis identified the physical model parameters as the most influential. Accordingly, small changes in variables such as the magnitude and frequency of extreme rainfall events could cause major changes in sediment dynamics, demonstrating their susceptibility to climate change in Mediterranean basins. Parameters more directly related to human activities, such as crop management practices, were also influential in the amount of exported sediment. The importance of these human-related parameters in the sediment export process suggests that mitigation measures have the potential to compensate, to a certain degree, the climate-change impacts on sediment dynamics.

10. Impacts of Land Use/Land Cover Change on Water Yields: A Review

Alex Martinez and Kjellen Belcher, Stanford University

The goal of our research was to review vegetation effects on water quantity, to better inform the Natural Capital Project's water yield model and identify knowledge gaps. A thorough understanding of water yield impacts is critical for developing water funds that effectively meet economic and ecological goals. Within an overarching review of the effects of land-use change on water yield, we chose to focus on a) how certain land-use changes (such as forest conversion to agriculture) impact water yield; and b) the temporal dynamics of how land change impacts water yield. We reviewed fifty studies on the impacts of land use/land cover (LULC). We found that converting forest to agriculture typically results in an increase in water yield in both tropical and temperate climates. With further inquiry into types of agriculture, we found that If the forest is converted to no-till agriculture or agroforestry the increase in water yield will be smaller than if the forest is simply converted to

conventional plowed agriculture. Following a LULC change, the long-term effect on water yield can be very different from initial water yield impacts. It can take anywhere from five years to over twenty-five years for an ecosystem's water yield to equilibrate, and vegetation management (such as maintaining deforestation or allowing regrowth) after vegetation removal seems to be the dominant factor controlling whether the initial change in water yield is sustained.

11. Terrestrial Habitat Risk Assessment in the Independence Creek Preserve In the Lower Pecos River Basin, TX

Valerie Solis, Texas State University

The InVEST Habitat Quality: Biodivesity model will be used to assess the impacts of invasive species, water wells, and oil/gas well on the Independence Creek Preserve habitat managed by The Nature Conservancy. Species of concern include endangered and threatened native avian and reptilian species in the area.

12. Distribution models of umbrella species applied as a spatial management tool in the Corredor Trinacional de Conservación (Conservation Corridor of three countries) in the limits of Colombia, Ecuador and Perú.

Diego A Zárrate-Charry, Oregon State University/World Wildlife Fund

Distribution models of umbrella species have been used as a shortcut to identify areas that need special protection, select conservation priorities, and create management tools in the absence of specific biodiversity information or other ecosystem functionality criteria (Simberloff 1998). We review presence information of nine vertebrate species that can be used as conservation targets in a conservation planning approach, in the Corredor Trinacional de Conservación (Conservation Corridor) at the limits of Colombia, Ecuador and Peru. With the information available we construct the extent of occurrence and the species distribution model of each of these species. The threats impacts within these defined polygons were analyzed using the habitat quality model incorporated in the InVEST Geographic Tool (Integrated Valuation of Environmental Services and Tradeoffs). We examined temporal scenarios of habitat quality loss within the umbrella species distribution models between the years 1990 and 2010, and evaluate the trends in habitat quality loss and the differences between the two distribution polygons constructed for each species.

This Corridor is a joint initiative between the three governments of the countries to preserve more than four million hectares in the Amazon.

The use of these scenarios can be used as a planning tool to (1) help the protected areas that are within the corridor (2) focus monitoring or management decisions, (3) improve the ecosystems' health where these umbrella species exist and (4) develop strategies to conserve an area of extreme biodiversity that extends across three countries.

13. Mapping Mediterranean Ecosystem Services and Trade-offs

Sallustio Lorenzo, University of Molise

Quantifying ecosystems services and balancing their trade-offs is critical to the long-term well-being of humans, biodiversity, and our shared environment. Trade-offs exist in ecosystem services and biodiversity, for example the maximization of carbon storage can potentially jeopardize biodiversity by encouraging the structural homogenization of forests that reduce overall diversity. In this study, ecosystem services and their trade-offs are considered in the context of Mediterranean forest management. Here, we investigate trade-offs in Italian landscapes by analyzing the relationship between scenarios that balance and analyze the interactions between carbon storage, timber production, and biodiversity at different spatial and temporal scales. We develop our approach within the framework of InVEST. Moreover, we offer our approach as a case study that may be

developed to optimize the delivery of ecosystem services and the conservation of biodiversity throughout the Mediterranean and globally.

14. Mapping multiple ecosystem services in central Veracruz, Mexico

Pierre Mokondoko, Instituto de Ecología AC

Our research seeks to provide information that will strengthen the PES programs active in the region, promote the inclusion of shade coffee plantations (comprising 40% of tree cover in the mountainous region of central Veracruz) in these programs, and improve InVEST models that allow us to identify and monitor priority areas in each watershed that provide multiple ecosystem services.

15. Framework for Valuing Ecosystem Services in the Delaware and Hudson Estuaries

Edward Carr and Yosef Shirazi, University of Delaware

This poster outlines the major issues affecting changes in ecosystem services in the Delaware and Hudson Estuaries in response to maintenance and deepening of navigational channels. We investigate the pathways by which various policy decisions can impact the provision of these services and suggest methods by which these changes can be economically quantified. We will investigate the applicability of the InVEST model to our area of study and anticipate it can be especially useful in quantifying changes in water quality, sediment retention, overlap analysis, carbon sequestration, and coastal protection.

16. Reality and constraints of a biological corridor in the central zone of Mexico

Antonio Villanueva, CIRAD (agricultural research for development), Paris Institute of Technology

The Central Valley (central area) in Mexico is a priority zone for the conservation of biodiversity. In this area, there are numerous Protected Natural Areas. The Central Valley landscape is under strong anthropogenic pressures: mining activities, agriculture expansion and urban sprawl of the large conurbations. The effects of these pressures are forest fragmentation and decreasing connectivity of the natural ecosystems.

We quantify the forest fragmentation of this area, using morphological indices derived from the 'landscape ecology' theories. Then, a model of percolation is applied for estimating the connectivity of these natural ecosystems and to delimitate the biological corridor. This research allows identification of the corridor of the Central Valley.

17. An ecosystem services approach to design equitable watershed investments and support spatial planning

Blal Adem Esmail, University of Trento

Urban water infrastructures (UWIs) constitute substantial collective assets that shape the spatial organization of cities, and directly contribute to the wellbeing of inhabitants. UWIs are essential for the flow of ecosystem services to urbanites, including water provisioning, and mediation of flows and wastes. Their spatial and functional configuration, which are typically laid out in spatial plans, play a key role in addressing two issues of policy relevance: (a) the spatial mismatch of ecosystem service production (e.g. the watershed) and benefit area (e.g. urban area), and (b) the equity in the access to benefits of different stakeholders.

In this study we develop a methodology to support spatial planning by designing watershed investments aimed at enhancing ecosystem services while promoting an equitable distribution of their benefits to people.

18. Ecosystem services of the Douro estuary (NW Iberian Peninsula)

Sandra Ramos, CIIMAR-Interdisciplinary Centre of Marine and Environmental Research

The poster attempts to give an overview of the main ecosystem services of Douro estuary, located in the northern Iberian Peninsula (E Atlantic). This study represents the first attempt to compile key economic data arising from the services provided by this estuary. The Douro estuary is a highly urbanized system, sheltering a major city of Portugal. This estuary suffers from several pressures derived from human activities that may comprise not only the ecosystem health, but also all the goods provided by the estuary.

19. Applying the Analytical Hierarchy Process to Small Dam Management: A Case Study of the Ames Mill Dam, Northfield, MN

Jesse Gourevitch, Carleton College

As hundreds of small dams across the United States exceed their functional life spans, decision-makers must confront the question of how to manage them. However, due to the multitude of stakeholders and the uncertainty of outcomes, decisions about managing these aging dams are highly complex. For decades, these dams have transformed their surrounding communities and ecosystems. In order to manage aging dams, it is necessary to recognize and predict the social and biophysical impacts of decisions. The Analytical Hierarchy Process (AHP) provides a framework for dividing the impacts and criteria of a complex decision into categories and weighing them against each other relative to an overall goal. We applied the AHP to the a case study of how to best manage the Ames Mill Dam, a small relic mill dam located on the Cannon River in Northfield, Minnesota. To implement the AHP, we determined the potential economic, social, hydrological, and ecological effects of two dam management options, dam retention and dam removal, by distributing surveys to Northfield businesses, conducting community focus groups, and running a hydraulic sediment transport model. We found that removing the dam would provide opportunities for economic growth and that local residents would support restoring the river to a more “natural” state. Based on model results, we predicted that increased downstream sediment deposition caused by removing the dam could have a negative short-term on freshwater mussel communities, but would likely increase connectivity between fish populations in the Cannon River. We conclude that the AHP’s comprehensive evaluation of decision criteria provides decision-makers with the analysis necessary to select a dam management option that will have an overall positive impact stakeholders and the river ecosystem.

20. Assessing the Effect of Land Cover on Native Bee Diversity in Eastern North Dakota

Russ Bryant, Humboldt State University

Native bees provide vital pollination services that are essential across agriculture and natural landscapes. To better estimate and model habitat quality for native bees, I modeled land cover on 4 common bee genera (Agapostemon, Bombus, Lasioglossum, and Melissodes spp.) using the InVEST Pollination model. My results expose that land cover is a potential indicator to accurately assess a given land cover’s effects on native bee populations.

21. Community Forests for an Resilient, Abundant Future

Dale Prest, Community Forests International

Community Forests International is an environmental start-up innovating new ways for communities to connect with the forests that surround them. Community Forests International has found success reforesting large areas of Pemba Island, Tanzania, by working with communities to rebuild their natural capital and increase their abundance of ecosystem services - soil formation, fuel wood, pollination, climate change adaptation, etc.. By restoring a region's natural capital a surplus is created that helps lift communities out of poverty, creating opportunity and the space for a culture of innovation to take hold within those same communities.

In Canada CFI has similarly built new ways to quantify and value forests, allowing for the restoration of severely degraded small woodlots. In so doing, natural capital is similarly accumulated in forests allowing for the creation of opportunity and further innovation.

It is through this process - restoration, increased natural capital and economic opportunity creating the space for innovation - that communities can best adapt to and thrive in an increasingly uncertain future.

Taking academic knowledge and tools and finding innovative ways to realize their potential to build natural capital, prepare and adapt to climate change and improve the lives of those most connected to our forests; Community Forests International is committed to a resilient and abundant future.

22. Social-ecological dynamics of ecosystem services in the Norrström Basin in Sweden (SEEN): a core regional case-study of PECS

Megan Meacham, Stockholm Resilience Centre

The SEEN project explores the dynamics and processes that contribute to the production of ecosystem services in the Norrström basin. The Norrström basin is the most densely populated region in Sweden and covers 22,650 square kilometers. Stockholm, Sweden is situated in the basin as well as agricultural, forest and wetland landscapes and two of Sweden's largest lakes.
In order to identify social, ecological and geographic drivers of ecosystem service change, the SEEN project will assess patterns of key ecosystem services within and across the municipalities of the Norrström basin. We will generate novel policy-and-practice relevant knowledge on ecosystem service governance in the region, and establish how historical and current governance arrangements affect the provision and deterioration of ecosystem services as well as access to these services in practice. The SEEN project will also include a regional Resilience Assessment of ecosystem services across the Norrström region through participatory engagement with relevant stakeholders. It is important that the results of the project are connected to an appropriate decision making context and facilitate the operationalization of the ecosystem service concept in the region.

23. Optimal control of restoration - the role of economic threshold

Adam Lampert, University of California, Davis

A variety of ecological systems around the world have been damaged in recent years, either by natural factors such as invasive species, storms and global change or by direct human activities such as overfishing and water pollution. Restoration of these systems to provide ecosystem services entails significant economic benefits. Thus, choosing how and when to restore in an optimal fashion is important, but has not been well studied. Here we examine a general model where population growth can be induced or accelerated by investing in active restoration. We show that the most cost-effective method to restore an ecosystem dictates investment until the population approaches an ‘economic restoration threshold’, a density above which the ecosystem should be left to recover naturally. Therefore, determining this threshold is a key general approach for guiding efficient restoration management.

24. A simplified model for the evaluation of air quality related public health damages

Christopher Tessum, University of Minnesota

The emission of non-greenhouse gas air pollutants is one of the largest sources of human health damages from many industrial activities. Owing to the complex and non-linear relationship between the release and ultimate impact of pollutant emissions, however, a rigorous assessment of the air quality impacts of human activities often requires the work of a team of dedicated experts with access to a supercomputer. Therefore, many environmental impact assessments do not include a rigorous analysis of air quality impacts. We present a

reduced-complexity air quality model that captures the aspects of air pollutant fate and transport most important for human exposure, but is simple enough to be operated by non-specialist researchers on a desktop computer.

25. People in Ecosystems/Watershed Integration: An Interactive Land-use Learning Tool

Carrie Chennault, Iowa State University

People in Ecosystems/Watershed Integration v2 (PE/WI) is an online game-based educational tool that teaches complex interactions between humans and ecosystems through simulation of land use and land-use outcomes in a fictitious agricultural watershed. PE/WI puts users in the driver's seat to creatively imagine alternative land-use configurations and experiment with agricultural and environmental trade-offs.

26. InVEST & RIOS: From Discrete to Continuous Modeling

Jorge Leon, The Nature Conservancy

Modifiying InVEST and RIOS core biophysical tables to accept continuous, non categorical, data inputs widely available worldwide, mainstreaming its use when data availability is factor for these or any other hydrological modeling software. Especially useful in developing countries of remote locations.

27. Resource Investment Optimization System: A powerful tool to design cost-effective watershed investments

Adrian Vogl, Natural Capital Project

RIOS provides a standardized, science-based approach to watershed management in contexts throughout the world. It combines biophysical, social, and economic data to help users identify the best locations for protection and restoration activities in order to maximize the ecological return on investment within the bounds of what is socially and politically feasible. It was developed with input from more than 11 water funds and watershed protection experts throughout Latin America and the world. This poster highlights the key features of RIOS and its history of development.

28. Designing conservation experiments: a new approach for water funds in data-scarce regions

Joanna Nelson, Natural Capital Project

An innovative approach is needed to implement science-based conservation in data-scarce regions, specifically for designing monitoring networks to evaluate conservation investments. We present a method to designate Impact (conservation activities) and Control catchments to evaluate changes in hydrological ecosystem services, for multiple objectives, using globally-available data. In the approach, we use biophysical data on soil, climate, topography and land use – in the absence of historical, hydrological records – to identify the most similar Control catchments to compare to Impact catchments. This science-based approach guides monitoring-network design in efforts to detect the potential effects of conservation activity against a backdrop of environmental variation and a changing climate. We use this method to present a) experimental design to identify both Impact and Control catchments and b) an implementation case of identifying controls for already-designated conservation sites. We then explore considerations to take into account when using this approach for data-scarce regions.

29. Prioritizing areas for conservation and restoration through RIOS: the Cali Waterfund case.

Lozano Juan Sebastián, The Nature Conservancy

Cali is the third most important city in Colombia. Although most of its water provision comes from the large Río Cauca, 30% still comes from medium-size acueducts located on the western andean mountains. The watersheds

providing this water face several problems such as illegal settlements, deforestation, extensive cattleranching and coal and limestone mining. We ran the RIOS prioritization tool for three objectives: erosion control, flood mitigation and baseflow. We also consider three scenarios of budget and then compared the changes on sediment export for the scenarios. Results showed that higher budgets lead to higher reductions on export, but the curve of budget vs benefit doesn't seem to stop growing, which means that higher investments need to be done in order to find the optimal benefit point.

30. RIOS effectiveness in Costa Rica´s Water Fund

Manuel Guerrero, FUNDECOR

The Water Fund is located in Costa Rica´s Great Metropolitan Area (GAM), this area contains four of the seven main head of provinces of the country: Alajuela (79,403 ha), Cartago (6,899 ha), Heredia (26,088 ha) and San José (51,606 ha), concentrating 57% of the country´s population and 75% of the national industry.

The project is concentrated in the Río Grande de Tárcoles watershed specifically in two sub-watersheds (Grande river basin and Virilla river basin) the total area is 163,996 ha, 72,272 ha (44%) corresponding to the Grande river basin and 91,724 ha (56%) corresponding to the Virilla river basin.

Biophysical data was collected from Government and Non-Governmental Organizations, Academia and Private Enterprises such as: the National Meteorological Institute (IMN), the National Service of Ground Water, Irrigation and Drainage (SENARA), the National System of Conservation Areas (SINAC), Heredia´s Public Service Enterprise (ESPH), Costa Rican Technological Institute (ITCR), the Ministry of Agriculture and Livestock (MAG) and FUNDECOR.

The Ecosystem Services selected to work with RIOS on this primer trial were consulted with the Water Fund Working Group and are as following: 1) Erosion Control for Drinking Water, 2) Erosion Control for Reservoir Maintenance, 3) Ground Water Recharge, 4) Baseflow. Also an expert’s consult was conducted to determinate specific activities that will contribute to increase these Ecosystem Services, but moreover it helped to obtain charts of Objective weights and Transition potential.