Multi-scaled assessment of Ecosystem Services (ES) using diverse tools

Volcanica Central Talamanca Biological Corridor - Reventazon River, Costa Rica

Sarah Jones (s.jones@cgiar.org)
Fabrice DeClerck (f.declerck@cgiar.org)
Natalia Estrada-Carmona (n.e.carmona@cgiar.org)

Bioversity International | CGIAR | RESEARCH PROGRAM ON Water, Land and Ecosystems

Latin America

Note:
Active region implementing Integrated Landscape Approach as a strategy to increase the multi-functionality of agricultural landscapes for food production, livelihood improvement, and ecosystem conservation

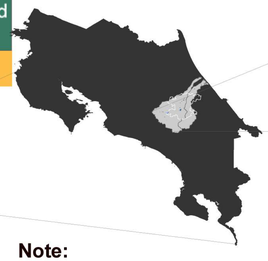
Challenges:
* Develop strategies to actively involve key stakeholders such as government and private sector

* Facilitate sufficient and sustainable sources of funding and support

* Decrease policies and laws that hinder integrated landscape management

Estrada-Carmona et al., 2014

Costa Rica



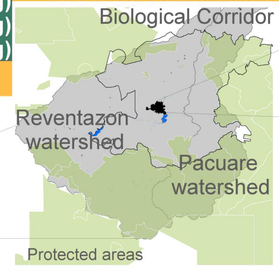
Note:
Costa Rica is leading the implementation of incentives to preserve natural ecosystems and its services

Challenges:
* Develop mechanisms or incentives that strengthen the governance of agricultural systems guaranteeing food production and healthy agricultural landscapes.

* Improve targetting strategies to implement incentives across scales.

Robalino & Pfaff, 2013; Fremier et al., 2013; Vignola et al., 2010

Volcanica Central Talamanca Biological Corridor



Note:
The upper-middle Reventazon watershed generates approximately 38% of the national energy, 25% of the consumed water in San José and 11% of the agricultural products for exportation (ProDUS, 2011). The biological corridor connects 11 protected areas and 2 indigenous reserves.

Challenges:
* Decrease erosion rates to levels that do not compromise food and hydropower production in the short and long term.

* Identify and estimate the effect of agriculture practices that facilitates connectivity.

CATIE's farm

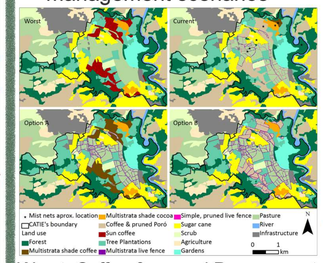
Note:
Large farm (~1,000ha) with the same land uses of the biological corridor. Long term bird monitoring efforts (www.gamma.catie.ac.cr/pma/en) offers a rich opportunigy to asseess land managment versus connectivity.

Challenges:
* Quantify the impact of land managmenet in connectivity.

* Find land management that are good for connectivity and attractive to farmers.

Example No. 1 Modeling habitat connectivity for six bird species under different farm management in CATIE's farm

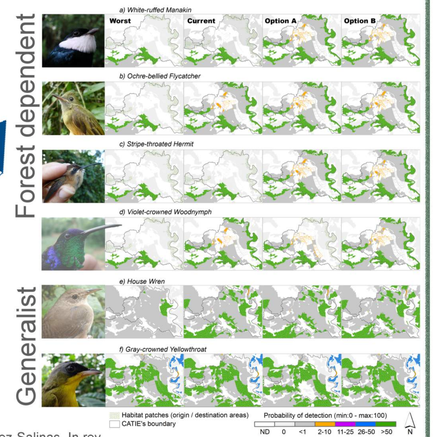
Input:
Land use map, indicator species, land use resistance, management scenarios



Worst: Coffee & pruned Poro converted to sun coffee
Current: Current land management
Option A: Coffee & pruned Poro converted to multistrata shade coffee. Multistrata live fences around all plots with pasture.
Option B: Multistrata live fence around all plots with pasture and coffee & pruned Poro

Circuitscape
(www.circuitscape.org)

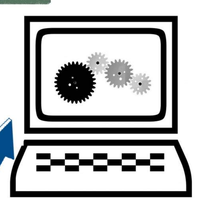
Output:
A map showing potential dispersal paths for each bird species and under each management scenario.



DeClerck, Estrada-Carmona, Garbach, and Martínez-Salinas. In rev.

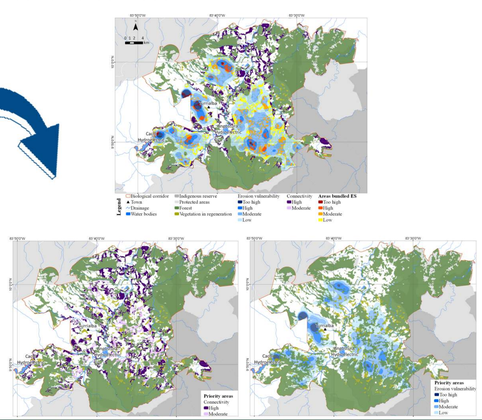
Example No. 2 Modeling two of the most important ecosystem services for the biological corridor: 1) soil erosion control and 2) habitat connectivity

Inputs:
Connectivity: bird species presence, bird habitat and bird ecology
Soil erosion: soil erodibility, cover management factor, land use, rainfall erosivity, digital elevation model, support practices, watersheds.



Nonpoint Source Pollution and Erosion Comparison Tool - NSPECT (www.http://nspect.codeplex.com)
Desktop Garp http://www.nhm.ku.edu/desktopgarp/)
Functional Connectivity Model - FunConn

Output:
Maps indicating priority areas for enhancing connectivity, reducing erosion vulnerability and bundled services.



Estrada-Carmona and DeClerck, 2012

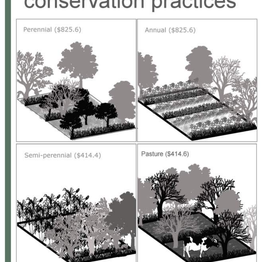
Example No. 3 Using the Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) and the Resources Investment Optimization System (RIOS) tools to identify cost-effective targetting strategies to provide the ES soil retention in the upper-middle Reventazon watershed.

Input:
InVEST (Sediment retention model): land use, digital elevation model, soil erodibility, rainfall erosivity, cover management factor and watershed.

RIOS (Erosion control): soil erosion control intervention options, implementation and maintenance cost, budget to implement activities, scenarios or targeting strategies.

natural capital PROJECT | InVEST integrated valuation of environmental services and tradeoffs | RIOS

Activities: Implement soil conservation practices



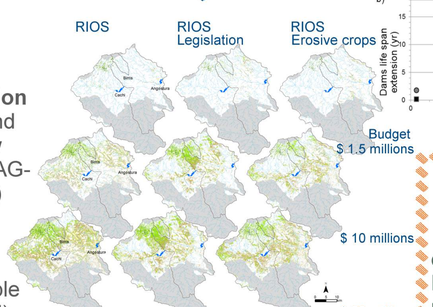
Scenarios or targetting strategies

RIOS

RIOS & Legislation (Reinforce the land use capability law (Act N° 23214-MAG-MIRENEM, 1994)

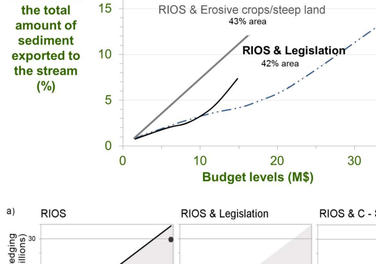
RIOS & Erosive crops on steep slopes (observable criteria in the field)

Output:
Clear picture of the best investment strategy

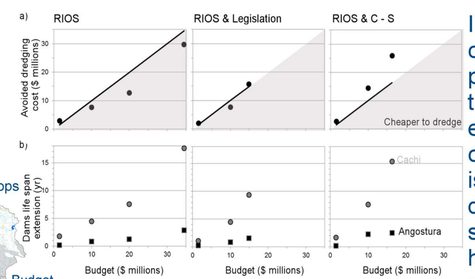


Estrada-Carmona, DeClerck and Fremier. In prep.

InVEST can help you to assess how changes in the ecosystems lead to change in **16 ES!**.



The largest amount of reduced sediment is accomplished when targeting conservation efforts on erosive crops on steep slopes.



Investing on conservation practices targeted on erosive crops on steep slopes is cheaper than dredging the soil that would have been eroded

Both tools were developed by the **Natural Capital Project** and are complementary.

InVEST determines the quantity or presence of an ecosystem service and its economic value; while RIOS identifies priority areas where changes on land management to protect or restore ecosystem services that are potentially more cost-effective.

References: DeClerck, F., Estrada-Carmona, N., Garbach, K., and Martínez-Salinas, A. In revision. Beyond Borders: managing farmscapes for connectivity increases conservation value for forest dependent birds. Ecological Applications; Estrada Carmona, N. and DeClerck F.A.J. 2012. Payment for ecosystem services for energy, biodiversity conservation, and poverty reduction in Costa Rica. In: Carter I. J., and DeClerck, F.A.J (Eds.), Integrating Ecology and Poverty Reduction (191-211, Vol. 2). New York: Springer; Estrada Carmona, N; DeClerck, F; Hart, A.; Harvey, C; and Milder, J. 2014. Integrated landscape management for agriculture, rural livelihoods, and ecosystem conservation: an assessment of experience from Latin America and the Caribbean. Landscape and Urban Planning, 129, 1–11. doi:10.1016/j.landurbplan.2014.05.001 [Open access]. Estrada-Carmona, N., DeClerck, F. and Fremier K. A. In preparation. Prevention is better than cure: implementing soil conservation practices may be cheaper than dredging; Fremier, A. K., DeClerck, F., Bosque-Pérez, N., Estrada-Carmona, N., Hill, R., Joyal, T., …Wulfhorst, J. D. (2013). Understanding Spatiotemporal Lags in Ecosystem Services to Improve Incentives. BioScience, 63(6), 472–482. doi:10.1525/bio.2013.63.6.9; Robalino, J., & Pfaff, A. (2013). Ecopayments and Deforestation in Costa Rica : A Nationwide Analysis of PSA ' s Initial Years. Land Economics, 89(3), 432–448; Vignola, R., Koellner, T., Scholz, R. W., & McDaniels, T. L. (2010). Decision-making by farmers regarding ecosystem services: Factors affecting soil conservation efforts in Costa Rica. Land Use Policy, 27(4), 1132–1142. doi:10.1016/j.landusepol.2010.03.003; ProDUS. (2011). Base teórica para la construcción de planes reguladores en la cuenca alta y media del Río Reventazón (No. Tomo II) (p. 312). San José, Costa Rica.