



Impact Assessment, Permitting, and Mitigation

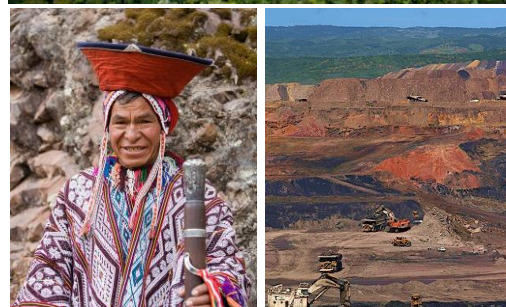
Integrating ecosystem services into real-world decisions

The Natural Capital Project (NatCap) is creating an approach to inform the permitting process for new development by incorporating quantified ecosystem services into environmental impact assessments and mitigation.

Policy makers, financial institutions and developers can use our method to measure environmental costs of proposed projects and compare alternatives, and to scope locations for offsetting losses of vital natural services.

Mapping and quantification of ecosystem services informs infrastructure plans by providing clear metrics of impact.

In Colombia, our scientists pioneered an approach to quantify impacts of expanding coal mines in terms of ecosystem service provision. NatCap is also developing a decision-support software tool for the Colombian Ministry of the Environment to aid its evaluation of permit requests and design of mitigation requirements. In Peru, we recently analyzed the natural capital losses from the proposed construction of a major road through the Amazon, identified the human communities most impacted, and suggested locations where protection or restoration activities could likely offset losses.



With our modeling tools, ecosystems service losses can be mapped in relation to population density and location within a *serviceshed*, the geographic area producing a specific service for a particular group of people. This spatial analysis aids awareness of social inequities that arise when critical services (e.g., clean drinking water) are restored unevenly.

Comprehensive accounting of environmental costs also helps minimize service losses that can accompany new infrastructure. With our approach, policy makers and planners can manage the goals of planned development – such as improved transport and communication, cheaper energy, and expanded employment opportunities – with its anticipated impacts to surrounding landscapes. In the absence of broad, spatially-explicit assessments of ecosystem impact, proposed projects can have unintended impacts on local populations by polluting air and waterways, limiting outdoor recreation, and threatening the material benefits of nature that sustain local livelihoods.



Applications

Our spatially-explicit approach to ecosystem service quantification supports policy makers, financial institutions, and developers to:

- **Plan development projects to minimize ecosystem service losses and reduce risk of unintended environmental consequences.**

- **Quantify impacts of development and mitigation activities on people**, enabling analysis of social equity concerns that arise from the uneven distribution of service losses.

- **Determine the potential to efficiently offset ecosystem service losses** or reach no net loss of ecosystem services with mitigation policy.

Nearly 200 countries require the completion of environmental impact assessment (EIA), and a third of those also require mitigation to offset environmental degradation.



Early Results

■ **Creating a decision-support tool to include ecosystem services in impact assessment and mitigation** for terrestrial and freshwater at a national scale in Colombia. The tool enables the Ministry of the Environment to apply our approach in licensing companies for mining, transportation, and other projects.

■ **Linking ecosystem impact and human well-being.** Our research approach can incorporate social equity concerns by mapping where ecosystem services are providing benefits to populations that differ in their access to resources (e.g., indigenous and urban communities).

■ **Expanding our approach:** TNC applied our method of assessing ecosystem service losses to compare the impacts and mitigation potential of power transmission lines proposed by ISA (Interconexión Eléctrica S.A.) in the Loreto Region of Peru.

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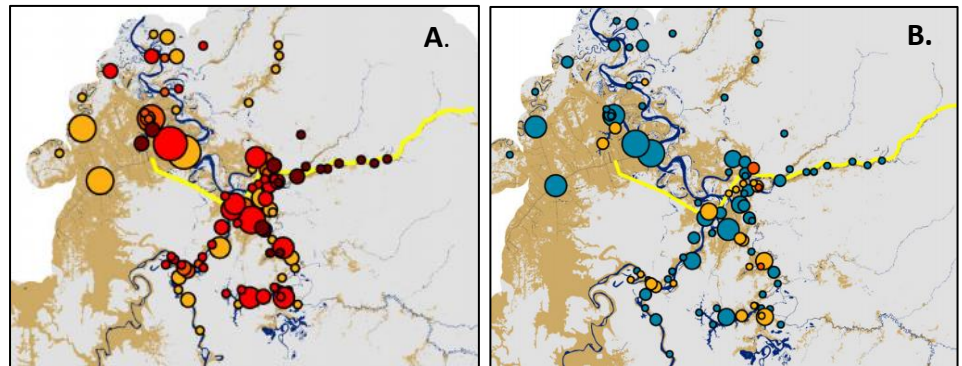
Coal Mining in Colombia

Federal regulation in Colombia requires new development projects to mitigate and compensate people for negative impacts to ecosystems and the environment. Working with the Colombian Ministry of Environment and The Nature Conservancy (TNC), NatCap evaluated the impacts of new and proposed coal mine permits on drinking water quality regulation services in the Cesar Department. Analyses suggested where mitigation was likely to offset the impacts of mine expansion, and where full mitigation is unlikely. Our initial analysis is being adapted into a general software tool to provide a standard approach to mitigating the impacts of development on ecosystem services.

Road Construction through the Peruvian Amazon

NatCap worked with TNC to determine how construction of the Pucallpa-Cruzeiro do Sul road from Peru to Brazil could impact ecosystem services for local communities in a biologically sensitive region of the Amazon.

Scientists applied NatCap's InVEST models to evaluate the potential for no net loss of four key ecosystem services – erosion control; water quality regulation for nitrogen and phosphorus; and carbon storage – that impact nearly 250,000 people in 107 cities and towns in the Ucayali Region of Peru.



Road and associated deforestation

A. Impacts without mitigation

B. Impacts with targeted mitigation

Anthropogenic areas (pastures, urban, roads, mines) are shown in brown. Waterways are blue.

Population size

- < 250
- 250 - 500
- 500 - 1,000
- 1,000 - 5,000
- 5,000 - 130,000

Loss of services

- Loss of 4 services
- Loss of 3 services
- Loss of 2 services
- Loss of 1 service
- No loss of services

Above, two maps compare the ecosystem losses of road construction and associated deforestation without mitigation (panel A) with a targeted mitigation approach (B) focused on the most effective places on the landscape to achieve natural capital gains. Our analysis explored scenarios of impact and mitigation to determine possible locations for reforestation and protection efforts, and to identify which communities will benefit most from these activities. Results suggest that while mitigation activities could potentially offset much of the ecosystem service losses associated with road construction, it is not possible to offset the impacts to all people and that indigenous communities are likely to bear a disproportionate burden of development.



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