InVEST | Integrated Valuation of Ecosystem Services and Tradeoffs

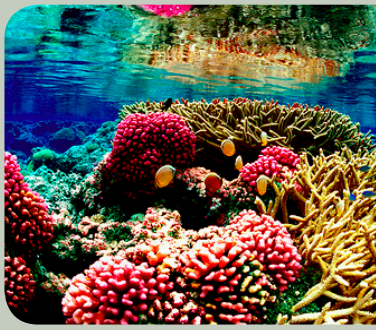
natural capital PROJECT

A Powerful Tool to Map and Value Ecosystem Services

InVEST is a suite of modeling tools that map, measure and value the goods and services that sustain human life.

Nature supports human health, livelihoods and economies in countless ways: ecosystems store carbon to slow climate change, purify and regulate water supplies, and provide foods, medicines and opportunities for spiritual cultural experiences. Despite their value, ecosystem services are not normally included in resource decisions, often because practical, credible information about them is lacking or inaccessible.

InVEST is free and open source. Its modular toolset enables users to quantify, visualize and compare the delivery of ecosystem services under different scenarios of land, water, and marine uses. Model outputs can describe natural resources in terms of their biophyiscal supply, the service they provide humans, or their projected value.



Who Should Use InVEST?

Governments, companies, non-profits, and multilateral development institutions that manage natural resources employ InVEST to evaluate the impact of their decisions on the environment and on human well-being, and to inform planning efforts.

Using InVEST, decision makers can assess the tradeoffs associated with alternative policy options and identify areas where investment in ecosystem services can enhance human development and conservation of terrestrial, freshwater, and marine ecosystems. InVEST can help inform policy and program designs, such as land use and marine spatial plans, strategic environmental assessments, payment for ecosystem services, climate adaptation strategies, and mitigation and offsets.

What are ecosystem services?

Ecosystems yield a flow of services that are vital to humanity, including the production of goods (e.g. food), life support processes (e.g. water purification), life-fulfilling conditions (e.g. beauty and recreational opportunities), and the conservation of options (e.g. genetic diversity for future use). Despite their importance, ecosystem services are poorly understood, scarcely monitored, and, in many cases, undergoing rapid degradation and depletion. InVEST empowers users to account for ecosystem services in their decisions and preserve their benefits to human well-being.

How InVEST Can Help

InVEST is most effectively used within a decision-making process that begins by identifying different management options. Decision makers develop future scenarios to show, for example, alternative areas where marine protected areas might be established, where agricultural land might be converted to residential development, or where climate change is expected to affect precipitation and temperature patterns.

Combining these future scenarios with basic biophysical and economic input data, InVEST can estimate how the current distribution and value of relevant services are likely to change under alternative futures. The spatial resolution of analyses is defined by the user's interests and the quality of the input data; users can address questions at the local, regional or global scales.

InVEST results easily can be shared with stakeholders and policy makers to inform upcoming decisions. InVEST is used most effectively as an iterative process; users may choose to create new scenarios based on model results and improve data sources until suitable solutions are identified.

Questions InVEST Can Answer

? How will a new coastal management plan affect seafood harvest, renewable energy production, and protection from storms?

? Where would reforestation achieve the greatest climate regulation, water quality, and biodiversity benefits?

? Which agricultural or forest management practices would increase food security while minimizing impacts on biodiversity, clean water, erosion, and climate?

Getting Started

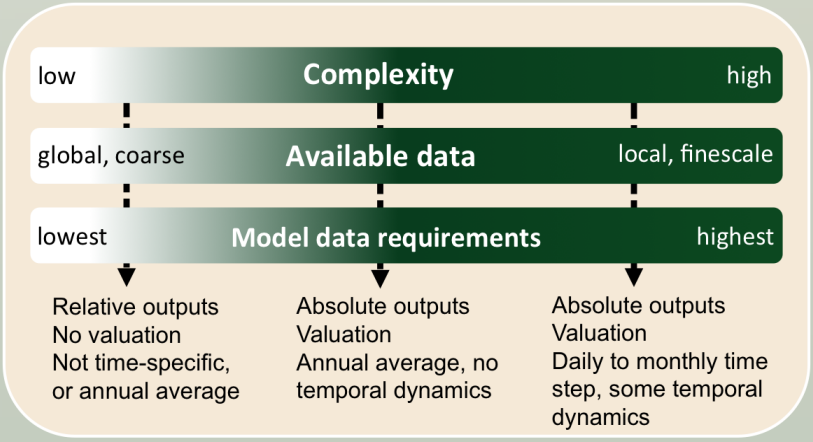
To run InVEST, you can use ESRI's ArcGIS or other GIS software such as QGIS. Sample data and some global datasets are included in InVEST 2.0 and higher. The InVEST User's Guide is a comprehensive resource for technical and general users of InVEST models and results. Download InVEST at naturalcapitalproject.org/download.html. By Summer 2013, InVEST will run on multiple online and offline platforms including ArcGIS, direct from the web, and IDRISI.

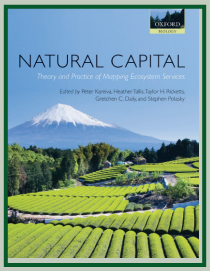
HOW IT WORKS

InVEST models are based on production functions that calculate the potential of ecosystems to provide human benefits under different ecological conditions. Biophysical information is combined with information about the location and activities of people to determine the flow and value of ecosystem services. Our approach identifies where ecosystem services are provided and where they are delivered. InVEST provides information about:

supply – the potential for nature to provide benefits
service – the benefits that are delivered to people
value – the economic and social implications of these benefits

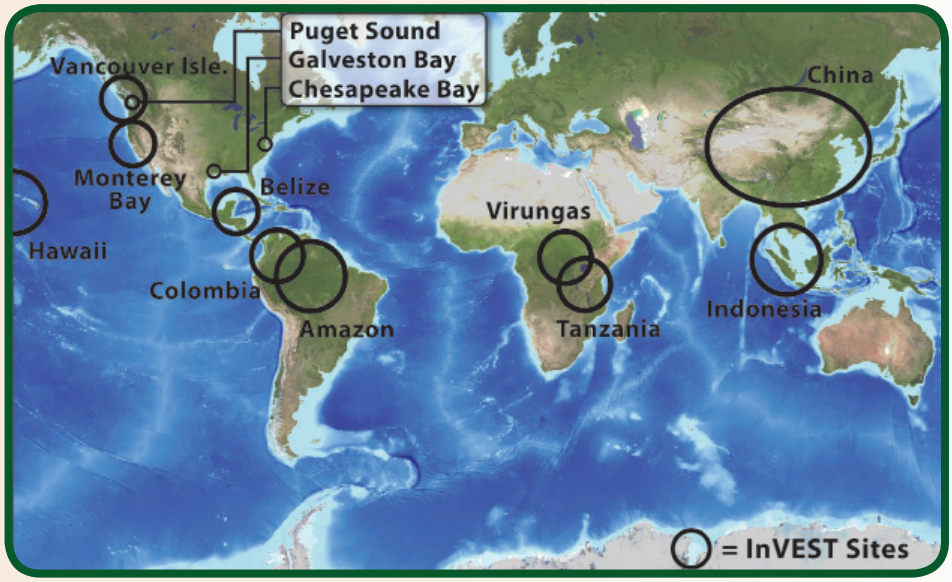
InVEST models are spatially explicit, using maps as information sources and producing maps and summary metrics as outputs. InVEST is flexible, offering a tiered approach to modeling.





Natural Capital: Theory and Practice of Mapping Ecosystem Services (Oxford University Press, 2011) describes the theory and mathematical models that underpin InVEST. Find more publications using InVEST: naturalcapitalproject.org/publications.html.

Site Examples



SUMATRA, INDONESIA

In October 2008, the ten provincial governors of Sumatra made a historic commitment to protect remaining forests and critical ecosystems of Sumatra. Local land-use planning is critical for achieving this. InVEST was used to compare the impacts on ecosystem services and biodiversity of a more conservation-friendly 'Ecosystem Vision' land-use plan with the impacts of a 'Business as Usual' plan. InVEST produced estimates of change in good tiger habitat, carbon storage and sequestration, annual water yield, erosion control, and water purification under these alternative scenarios. The results are helping to locate the best areas for forest restoration, payments for carbon and watershed services, by the Millenium Challenge Corporation and others, and best management practices for forestry and plantations.

COLOMBIA

Where natural ecosystems provide clean water to users downstream, investing in conservation provides biodiversity protection, and purifies and regulates waters upon which communities and businesses depend. One way to invest in these benefits is through water funds: long-term trust funds that involve a public-private partnership between water users, to support activities that maintain or improve water services. In the East Cauca Valley Water Fund in Colombia, InVEST results were combined with stakeholder information to direct conservation investments to areas with the highest potential for reducing sedimentation and maintaining water yield. InVEST also was used to estimate returns from alternative fund investment portfolios. Over $500,000 has been invested in areas identified by the Natural Capital Project, and we are working with The Nature Conservancy in a new continent-wide initiative to expand this approach in developing over 30 new water funds across Latin America.

VANCOUVER ISLAND, CANADA

Vancouver Island's shoreline is home to thousands of species, and to local communities that rely on these resources for sustenance and livelihood. Yet, in recent years signs of stress have appeared: salmon populations have declined dramatically and various stakeholder groups have disagreed over the future of development. West Coast Aquatic, a co-management body for aquatic resources, is using InVEST to create marine spatial plans for Barkley and Clayoquot Sounds. InVEST estimates of fisheries, aquaculture, wave energy generation, and coastal protection are providing a platform for stakeholder discussions and negotiations around tradeoffs to create plans that are agreed upon by governments, First Nations, coastal communities, and private entities.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InVEST Models

Lands and waters:

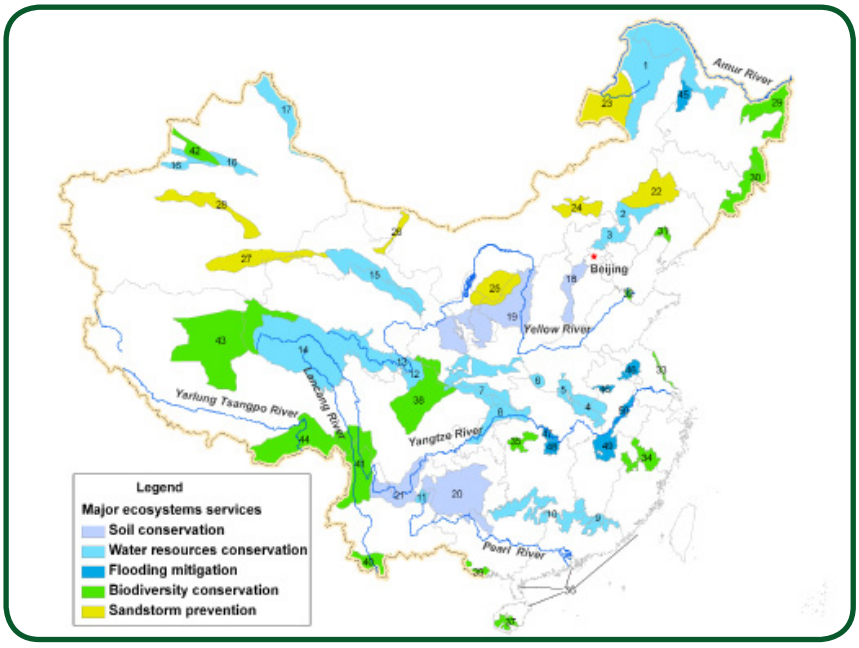
Biodiversity
Carbon storage & sequestration
Hydropower production
Water purification (nutrient & sediment)
Erosion control
Managed timber production
Crop pollination

Oceans and coasts:

Habitat risk assessment
Coastal protection
Finfish aquaculture
Aesthetic quality
Fisheries
Marine recreation
Offshore Wind Energy
Wave Energy

Coming Soon:

Flood mitigation
Agriculture production
Foraged products
Marine Carbon
Shellfish aquaculture
Marine water quality
Recreation
Scenario-generator tool
Monthly water yield



Ecosystem Function Conservation Areas

China's leaders recognize that they must balance growth with conservation to secure resources and promote sustained national well-being. InVEST is being used to zone Ecosystem Function Conservation Areas (EFCAs), an ambitious national zoning scheme that specifies areas for restricted development based on the high levels of ecosystem servcies they provide. EFCAs will span nearly 25% of China's land area, and are designed to reduce soil loss and improve water retention, mitigate desertification, and protect biodiversity.

InVEST models are being in these areas used to quantify service provision and impacts on human well-being under zoning scenarios intended to target conservation and development for the highest benefit.

InVEST was also used for China's first National Ecosystem Service Assessment over 2000-2010, spanning a wide range of ecosystems and geographic scales. These massive initiatives yield immense opportunities to integrate conservation and human development, and achieve better outcomes for both.

Download InVEST at:

naturalcapitalproject.org/download.html

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A joint venture among:

INSTITUTE ON THE ENVIRONMENT
UNIVERSITY OF MINNESOTA Driven to Discover℠
WWF
The Nature Conservancy Protecting nature. Preserving life.
Stanford WOODS INSTITUTE for the ENVIRONMENT

The Natural Capital Project

The Natural Capital Project aims to align economic forces with conservation. We are an innovative partnership between Stanford University, The Nature Conservancy, World Wildlife Fund, and the University of Minnesota working together to value nature's benefits to society. We develop tools that make it easy to incorporate natural capital into decisions, apply these tools in select places around the world, and engage leaders to transform decision making by taking up this approach.

Contact us: invest@naturalcapitalproject.org