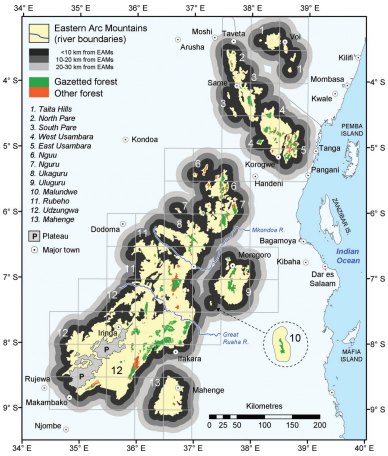
Valuing the Arc: Ecosystem Services in Tanzania

Linking science with stakeholders to sustain natural capital

In 2007 the Natural Capital Project (NatCap) began work in the Eastern Arc Mountains (EAM) of Tanzania with an international team of scientists and policy experts to analyze threatened ecosystem services and develop measures to conserve their value to people. As part of Valuing the Arc (VtA), a five-year research and policy program, NatCap helped improve knowledge of the Eastern Arc's regional ecosystem services, quantify their contribution to human well-being, and recommend solutions to sustain them. VtA's research collaborations have yielded considerable data on a globally significant ecoregion, introduced new GIS-based modules to value and protect its natural capital, and produced over 70 peer-reviewed articles in fields conducting ecosystem services research.



A global team of economists, carbon experts, and social scientists analyzed the critical ecosystem services in Tanzania's mountain forests.

VtA convened five UK-based universities, two Tanzanian universities, WWF-Tanzania and NatCap to share research methods and develop approaches that support Tanzanian policy makers in their resource management decisions.

EAM forests sustain rivers that supply water and hydroelectric power to over 3 million people, contain extensive natural reserves for carbon storage, and provide building materials, food and cash income for mountain communities. Decades of intensive and illegal logging, uncontrolled fires, and farmland conversion across the EAM have vastly depleted forest cover, threatened water supplies and fragmented natural habitats. Forests have survived across the Eastern Arc for 30 million years, but today nearly 70% of forest cover has been destroyed.

VtA scientists developed specialised GIS tools to model the ecosystem services of most importance to regional EAM stakeholders.

Analysts combined local field-based and remotely-sourced data to model the production of services, the flow from their points of origin, their use by people, and their estimated contribution to human well-being.

NatCap's work with VtA a pioneering effort to apply an ecosystem services approach to conservation in a developing country context. The methods of environmental assessment being advanced there will be applicable throughout Africa and in other biodiversity hotspots around the world.

Results

- **Produced the first ecosystem services maps** for the Eastern Arc Mountains and the watersheds that drain them. Maps produced with the NatCap's InVEST software suite and related GIS-based models will help steer planning decisions and secure investments in forest conservation and watershed management in Tanzania.

- **Convened high-level Project Advisory Committee**, composed of top government ministry representatives, NGOs, and donors. The committee was chaired by a member of Tanzania's Vice President's office and is charged with targeting ecosystem services research to guide government decision-makers.

- **Developed a research framework for evaluating ecosystem services** in a context with limited available data. VtA's approach has since been adopted and used for the UK National Ecosystem Assessment.

- **Forging new partnerships:** VtA is linking their results with WWF-Tanzania's green economy initiatives, in collaboration with UNEP Kenya and the African Development Bank in Mozambique.

- **Inspiring new projects:** VtA's work continues to provide guidance and data to assist Tanzania's implementation of the UN's REDD (Reduced Emissions from Deforestation and Degradation) scheme. Spin-off projects also include research on EAM ecosystem services and their impact on agriculture and livelihoods.

NATURAL CAPITAL PROJECT:
Eastern Arc Mountains,

Biodiversity
Scientists estimate 2,000 plant species are in the Eastern Arc Mountains (EAM) and surrounding forests. At least 550 of these are believed endemic to this region. The mountains are also home to nearly 100 endemic vertebrates.

Hydropower & Drinking Water
At least 50% of Tanzania's electricity comes from hydropower stations along rivers flowing from the EAM. These rivers also provide 10-25% of drinking water to Tanzanians, such as the 3 million residents of Dar es Salaam who rely on The Ruvu River for water.

Eco-Tourism
The EAM's rare and endangered wildlife draws an increasing number of tourists to its forests. Scientists with Valuing the Arc developed a model to measure the value of nature-based tourism to Tanzania's economy. Results indicate huge potential for revenues from nature-supported industries.

Non-timber Forest Products
The Eastern Arc forests are the major source of firewood, charcoal, building poles, wild vegetables, bushmeat, and medicinal plants for people living in the mountains. Hundreds of thousands of people rely on these products for energy, housing, and as much as one quarter of their household income.

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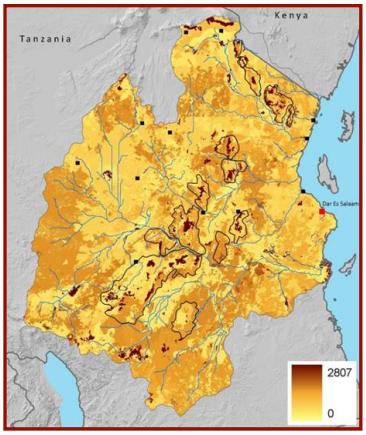
Valuing Critical Ecosystem Services: GIS-based Models

Over five years, Valuing the Arc refined scientific approaches to modeling the current and projected stocks, flows and values of ecological services. With the help of InVEST models and continued technical support from NatCap, VtA developed specialised tools to analyze the ecosystem services of most importance to regional EAM stakeholders. This resulted in the following sophisticated models:

- Hydrological Services
- Timber Services and Value
- Nature-Based Tourism Services
- Governance of Resources
- Carbon-related Services
- Non-Timber Forest Products
- Conservation Costs and Benefits
- Biodiversity Priorities, Existence Values

The models above combine all relevant and available spatial data for eastern Tanzania and have created the most comprehensive GIS dataset to date for this region. VtA has made their models and methods widely available to colleagues in universities, government and NGOs to promote further research.

Developing Practical Scenarios with Stakeholders



Map 1. Carbon storage in natural habitats of east Tanzania

The VtA research team developed quantitative, spatially explicit scenario maps that express the direction and magnitude of possible changes in land-cover across the Eastern Arc. Social scientists facilitated a participatory mapping process by conducting interviews, workshops and policy reviews where residents, government officials, industry leaders and NGOS offered input. This collaborative process yielded scenarios representative of realistic possible futures and policy contexts. Stakeholders helped rank the impacts of particular drivers of land-cover change and weigh the inputs needed for VtA's ecosystem service models. The group assessed where population growth is most likely to impact forest cover and how biofuel markets are likely to affect agricultural lands. VtA carbon models helped to identify regions eligible for payment under the UN REDD program and voluntary carbon projects.

Payment for Ecosystem Services (PES) in Tanzania

As a result of research from VtA partners, scientific resources have been developed for Payment for Ecosystem Services (PES) programs across the Eastern Arc region. VtA models provide a systematic basis of scoping and implementing PES programs, which compensate local residents for maintaining natural assets, such as forests, which provide vital public benefits.

VtA's work creates a foundation for scaling up market mechanisms to conserve ecosystem services in regions with limited data availability.

In 2005 CARE and WWF began work on a watershed PES scheme in the Uluguru Mountains, the major catchment to the Ruvu River. Conversion of forest to farmland has produced heavy sediment loading and turbidity of feeder streams to this main river, raising water treatment costs for downstream industries and utilities. The Uluguru EPWS (Equitable Payments for Watershed Services) project aims to improve the flow and quality of water, stabilize the productivity of farms, and support the livelihoods of mountain communities. Project leaders oversaw the project in its pilot phase - involving four communities and two downstream water users - from 2008 to 2012. In its proposed next phase, local stakeholders will own and monitor the project after the exit of foreign donors and managers and scale up the programme to include 50–75 communities across the Uluguru Mountains.