



An economic approach to biodiversity protection

Valuing Colombia's natural wealth to bring sustainable prosperity





An economic approach to biodiversity protection

Valuing Colombia's natural wealth to bring sustainable prosperity:

Colombia is the second most biodiverse country on the planet. Its biological wealth is essential, not only for the country's cultural heritage and the health of unique ecosystems, but also for human wellbeing, social equity and economic development. Generating economic value from healthy, biodiverse ecosystems and understanding how conservation objectives can promote economic growth is at the heart of the GROW Colombia project.

Our socio-economics researchers are highlighting how current choices will shape the future of Colombia. Comprehensive and careful valuation of this natural wealth is vital if it is to be properly accounted for in future policy decisions. Only through participatory approaches can the Colombian economy become sustainable, growing steadily according to ecological thresholds (in terms of climate, water, pollution, resource extraction etc) and deliver long-term social welfare advances for all Colombians.

As the planet's biodiversity is depleted and the climate disrupted, Colombia's natural assets will grow in value and bring economic opportunities and sustainable prosperity. The challenge is to conserve those natural assets now, before it is too late.

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Andean bear

Studying museum
collections to protect
the Andean bear





Andean bear

Studying museum collections to protect the Andean bear:

The Andean bear, the only extant species of bear in South America, is considered to be threatened with extinction as a consequence of human activities during the last few centuries. We aim to understand the consequences of the progressive decline in the number of individuals on the health of present-day Colombian Andean bears (Paddington's cousins). To help us, we are using genome sequencing to obtain information about the genomes of previous generations of Andean bears from museum specimens collected throughout the last 200 years.

Like a time machine, genomic data obtained from museum specimens allows us to assess the threats from genetic diseases associated with the loss of diversity as a population declines through time. This information can then be used to inform conservation strategies over the large territories required by such a large mammal species.

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Forages

New screening technologies
to accelerate forage breeding

Photo: Neil Palmer (CIAT)



Forages

New screening technologies to accelerate forage breeding:

We are taking advantage of the wide natural biodiversity of the tropical forage Guinea grass (*Megathyrus maximus*) to accelerate its breeding. For that, we are developing new methods to quickly screen relevant agronomic and environmental traits in natural varieties available in seed collections, such as CIAT's genebank which contains almost 600 different Guinea grass varieties. Our interest is identifying livestock pasture that produces highly nutritious biomass with more protein and less fibre, resulting in less greenhouse gas emissions to the atmosphere.

New screening technologies allow us to shorten breeding cycles and improve genetic gain in breeding programmes to respond to the growing demands of a changing climate. This project is allowing us to obtain highly productive climate-smart cultivars of forage pastures for sustainable intensification of livestock systems in the tropics. Eventually, intensification should reduce deforestation by limiting incentives for new pastures.

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COLOMBIA

Cacao

Exploring cacao's wild
relatives to improve
crop tolerance



Cacao

Exploring cacao's wild relatives to improve crop tolerance:

Cacao produces the main ingredient of chocolate. Cacao is a promising option to replace illicit crops in Colombia. However, producers face serious challenges due to the accumulation of high concentrations of cadmium absorbed from the soil in the cacao beans, as well as from pathogens. This project aims to identify genetic regions in cacao's wild relatives that are associated with pathogen resistance or cadmium accumulation, in order to better understand the genetics of pathogen resistance and cadmium absorption. We are also constructing a phylogenetic tree to understand the evolution of cacao.

This knowledge will facilitate the identification and breeding of pathogen resistant and low cadmium accumulating cacao varieties. This will improve the marketability of Colombian cacao beans and will contribute to making cacao a more profitable alternative for Colombian farmers.

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Sugarcane

Understanding the origin
of modern sugarcane to
inform breeding





Sugarcane

Understanding the origin of modern sugarcane to inform breeding:

Sugar is a global commodity and sugarcane produces around 80% of the world's sugar. In Colombia, it is a cash crop contributing to post-conflict economic growth. Through reducing inputs and impacts on local flora and fauna, as well as improving soil health, we can sustain production while increasing social, economic and environmental benefits - encouraging the green growth of the Colombian economy.

Modern commercial sugarcane varieties have been bred for high sugar content by combining different ancestral sugarcane species. Their genomes are consequently particularly complex and large compared with other crops. We have sequenced over 200 sugarcane varieties, including modern varieties from Colombia and other countries worldwide, as well as the ancestral sugarcane species. This is enabling us to compare sugarcane diversity and gain an insight into the implications of past breeding.

Our work on sugarcane genomics allows us to choose priorities for crop improvement, such as sustaining sucrose production in a changing climate.

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Soil microbiome

Microorganisms in healthy
and degraded soils



Soil microbiome

Microorganisms in healthy and degraded soils:

Soils contain diverse microorganisms that interact with each other and plants. Microorganisms mediate ecosystem functions, such as organic matter turnover and soil nutrient cycling, that are important for the right balance of ecosystems. We are developing molecular methods to accurately identify the whole biodiversity of microorganisms in the soil, as well as the functional capabilities of some key groups of bacteria. Our projects particularly aim at comparing microorganism biodiversity and roles in sugarcane plantations and Paramos plots with different agricultural uses. We will use the results as an indicator to assess the effect of different farming practices on soil health and fertility.

Soils sustain ecosystem processes and services important for the survival of most living organisms. Human activities and changes in the use of land result in alterations of nutrient cycles and soil fertility, often with negative socioeconomic impacts. Our project aims to develop molecular methods to understand at a large-scale the components of soil microbial communities and diversity, which are imperative to maintain plant biodiversity, soil health, and productivity.

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Sustainable cattle farming

Valuing the environmental
benefits of sustainable
cattle farming





Sustainable cattle farming

Valuing the environmental benefits of sustainable cattle farming:

Expansion of cattle ranching is a driver of deforestation and ecosystem degradation. Cattle farming is one of the main sources of greenhouse gas emissions in Colombia, but also a prominent and productive sector. In a silvopastoral cattle farm, shrubs and trees are planted in grazing pastures for livestock to eat. This has a range of potential benefits, including healthier soils, the well-being of animals, a rise in biodiversity and fewer greenhouse gas emissions.

Assigning an economic value to these benefits helps to make a stronger argument for adopting alternative farming practices that help to protect nature. We are calculating the economic value of these environmental benefits and including these figures in the assessment of the economic viability of the silvopastoral farming system. These environmental valuations can reveal the magnitude of the benefits we get from maintaining a healthy environment and therefore influence policy towards the adoption of more sustainable paths of development.

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Ecotourism

Preserving biodiversity
and empowering local
communities





Ecotourism

Preserving biodiversity and empowering local communities:

While threatened by human activities, charismatic species such as river dolphins, butterflies or wax palm parrots also offer an opportunity to develop the economy of the local communities that live in the same areas. Economic valuation tools can help to understand how new sustainable economic activities, like ecotourism, can contribute to preserving the protected areas while providing a sustainable income. Ecotourism activities are being analyzed jointly with ecological indicators to identify changes in ecosystem services. To assess these solutions, we are also developing engagement activities with smallholder farmers, local policy-makers and the ecotourism value chain.

Our results will help to implement or strengthen the management of protected areas and to establish ecotourism projects where it is most cost-effective. We will identify where ecotourism can distribute benefits among local communities, reduce poverty and increase communities' governance. Policy and decision makers will receive data-supported information to help designing incentives and regulations to promote sustainable growth.

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The future generation

Engaging young people
in science and the
natural world





The future generation

Engaging young people in science and the natural world:

Children have an in-built curiosity for the natural world and their experiences in early life shape who they become as adults and the things that they care about most. Working in partnership with local youth and educational organisations we are using a combination of art and science to create experiences and activities that will reveal, share, and celebrate the wonders and possibilities of Colombian biodiversity. We want to ensure that we pass on our knowledge and enthusiasm for science and the natural world from one generation to another.

Each generation creates a future for the next. We are keen to inspire a new generation of scientific explorers who are connected to the natural world and who want to build their careers dedicated to supporting its sustainable use and protection.

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Wildlife protection

Tackling wildlife
trafficking in Colombia





Wildlife protection

Tackling wildlife trafficking in Colombia:

Illegal trafficking of wildlife is the third most lucrative criminal activity in Colombia. A wide diversity of plant and animal species including birds, mammals, amphibians, fish and reptiles are sold illegally both within and outside of Colombia. Police and local authorities regularly intercept animals illegally being transported at airports and in transit. In addition to animal welfare concerns, this may threaten the conservation status of targeted species. However, the species identification and geographic origin of these individuals is not always known. Using DNA barcoding techniques, we can accurately and reliably identify what species captured individuals belong to.

We aim to assist authorities in identifying at the species level what animals are being trafficked. We anticipate that this will assist with catching and prosecuting wildlife traffickers. We want to track which species are particularly at threat from traffickers in order to prioritise conservation efforts.

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