Policy Briefing: Developing a research cyberinfrastructure in Colombia

August 2018

By C3Biodiversidad, Colombian Cyberinfrastructure Consortium for Biodiversity.

Summary

In June 2018 an international group of 40 scientists came together in Bogotá to explore the needs and challenges of research infrastructure for Colombia's life science community. The workshop was facilitated by the UK Government-funded international collaboration project, known as GROW Colombia, which seeks to build capacity in bioscience and biodiversity conservation.

The workshop investigated resource requirements, in terms of hardware, software, human capital and funding, but crucially, it also explored the ethics and principles for building, accessing, processing and sharing Colombia's cyberinfrastructure.

The delegates unanimously called for a national strategy for research data to drive scientific excellence and to facilitate the translation of research into evidence-based policy making. They also pledged to form the Consorcio Colombiano de Ciberinfraestructura para la Biodiversidad - Colombian Cyberinfrastructure Consortium for Biodiversity known as "C3Biodiversidad" and tasked themselves with publishing a technical White Paper and driving forward a series of follow-up actions to cultivate Colombia's scientific proficiency.

The C3Biodiversidad agreed the principles of sustainability, security, collaboration, interoperability, and equitable and democratic access as the essential drivers in the development of Colombia's cyberinfrastructure.

Background

The C3Biodiversidad and its technical White Paper have emanated at a formative time for Colombia's science sector following the peace agreement. Earlier this year President Duque announced the establishment of the Ministry for Science, Technology and Innovation. The President's vision understands that science and innovation are prerequisite for economic growth and social development.

As one of the 17 "megadiverse" countries according to United Nations Environment Programme (UNEP), Colombia has Caribbean and Pacific coastlines, as well as a variety of unparalleled mountain, jungle and savanna ecosystems. Its biological wealth combined with a bourgeoning academic sector gives Colombia the potential in the future to lead the region in global bioscience research. The integrity and capacity of its research cyberinfrastructure is therefore an imperative component of Colombia's development.

The C3Biodiversidad workshop was delivered by GROW Colombia, a four-year international collaboration funded by the UK Government to build Colombia's capacity in bioscience and biodiversity conservation. Led by Professor Federica Di Palma, the Director of Science at the Earlham Institute in the UK, the project aims to achieve biodiversity conservation by promoting innovative technologies, developing excellent research capabilities, building multidisciplinary partnerships, and fostering best practise in knowledge exchange, with the longer-term goals to stimulate sustainable economic growth and inclusive social development in Colombia.

GROW Colombia partners

GROW Colombia Collaborators

AGROSAVIA
Corporación colombiana de investigación agropecuaria

Instituto amazónico de investigaciones científicas SINCHI

Universidad del Rosario

IIAP
Instituto de Investigaciones Ambientales del Pacífico
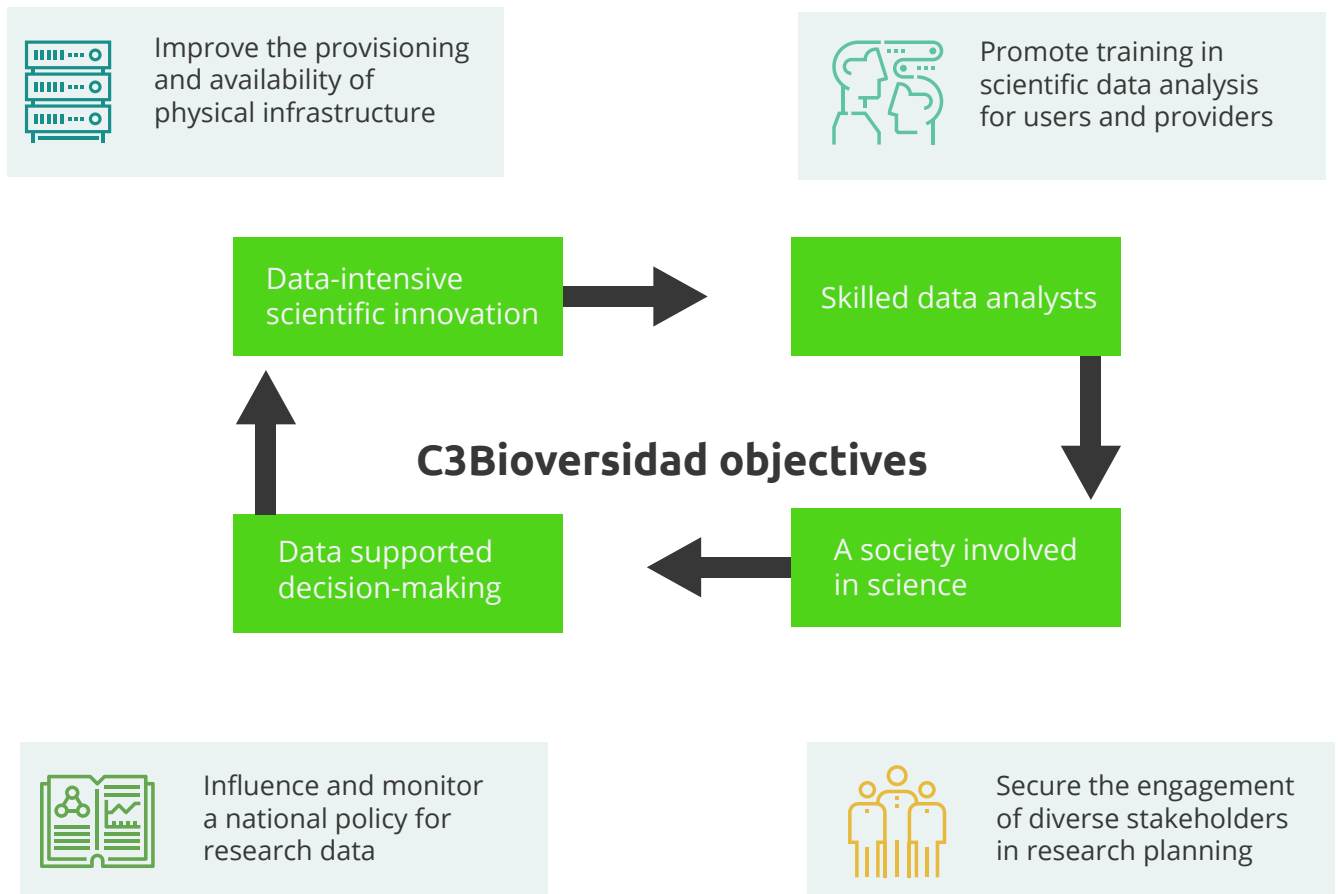
Addressing the challenges

The recent cessation of conflict in parts of rural Colombia have resulted in those areas becoming available for exploration to advance ecological and biological discovery. To date, the national catalogue of Colombian biodiversity (SiB) includes 62,829 species of animals and plants, 9,153 of them endemic, representing around 10% of all known species on Earth.

To develop the most effective strategies to conserve these species and their ecosystems, it is necessary to discover more about them and this involves bringing the data and analysis into the digital world.

What are the cyberinfrastructure needs?

Robust and progressive research cyberinfrastructure is imperative to enable Colombia's data-driven scientific discovery. This includes innovative resources, such as computational hardware and software systems, as well as advanced human capability.

- Limited physical infrastructure is the main challenge Colombia currently faces, particularly in terms of capacity and connectivity between institutions. These are mostly the result of short-term funding, under-resourced suppliers and a lack of strategic planning. As result, key academic and industrial institutions are not able to meet the ongoing costs of provision which inevitably exacerbate the risks and dependencies.

- Developing computational resources that can adapt to the rapidly changing digital world is essential. Coordinated digital infrastructure can avoid duplication of data, facilitate remote collaboration, and increase knowledge exchange.

- Emigration of skilled personnel and limited opportunities for technical training of new personnel are also risks. Colombia has a strong academic sector through which cyberinfrastructure skills training can be coordinated and delivered. The biannual bioinformatics national conference has a key role to play in driving the training agenda. Better communication between training providers is needed as well as more opportunities for internships/visits to promote knowledge exchange.

- A national network of trainers with coordinated training activities and records would strengthen skills provision within Colombia and increase engagement with international initiatives such as GOBLET (Global Organisation for Bioinformatics Learning, Education and Training). Pre-requisites for the success of these initiatives is the continued take-up among academic institutions and sufficient ongoing public funding.

- Improve the provisioning and availability of physical infrastructure.

- Grow training in scientific data analysis for users and providers.

- Design a national policy for research data.

- Develop a scheme to engage diverse stakeholders in research projects and funding planning.

Improve the provisioning and availability of physical infrastructure

Promote training in scientific data analysis for users and providers

Data-intensive scientific innovation → Skilled data analysts

C3Bioversidad objectives

Data supported decision-making ← A society involved in science

Influence and monitor a national policy for research data

Secure the engagement of diverse stakeholders in research planning

A National strategy for cyberinfrastructure

The C3Biodiversidad recommended implementing a national policy for research data. To establish and monitor such a policy and a subsequently delivery strategy, an advisory committee of experts and relevant stakeholders could be convened. They could agree the evolving needs for access, curation, retention, traceability, quality, interoperability and availability of the research data as well as the monitoring and enforcement mechanisms of this policy.

A national policy should:

a)   regulate the access, processing and sharing of data, particularly biodiversity data, in a standardised way;
b)   facilitate data-supported decision-making, as well as scientific excellence;
c)   achieve open access to publicly funded research, including both generated data and research publications;
d)   incentivise and evaluate researchers' collaboration and data sharing activity.

Ethical priorities of cyberinfrastructure

The integrity of the research cyberinfrastructure and its take-up among certain communities is critical to achieving resource conservation and progressive social development. For Colombia's research cyberinfrastructure to support the discovery and ongoing learning about Colombian biodiversity – including agricultural diversity – it must be driven by those communities that need it most. The value of local knowledge, grassroots experience and community understanding should never be underestimated in collating and understanding the data.

Designed appropriately, and founded on the principles of democracy, open access and sustainability, cyberinfrastructure can provide effective platforms for farmers, community leaders and scientists alike to evolve the data and share the learning. In this way, research cyberinfrastructure can help to shape the tools and decisions that lead to better practices and policies for biodiversity to thrive alongside progressive human activity, particularly in terms of land use and agriculture.

Next steps

- The C3Biodiversidad aims to develop a federated, sustainable and cooperative cyberinfrastructure to cultivate Colombia's science, based on the following priorities:
- Improve the provision and availability of physical infrastructure (including in-field innovative technologies as well as High Performance Computing);
- Grow training in scientific data analysis for users and providers;
- Implement a national policy for research data;
- Develop a scheme to engage diverse stakeholders in research projects and strategic funding proposals.

The UK's Royal Academy of Engineering is funding follow up workshops and training events in Colombia in 2019 and 2020 to progress the C3Biodiversidad's 7-point plan to develop Colombia's research cyberinfrastructure:

1.) A roadmap should identify the needs and available resources in Colombia via surveys of diverse stakeholders.
2.) A formal advisory committee should be convened with representation from key institutions. It should agree its own governance and deploy online collaborations tools.
3.) RENATA (or an equivalent institution) should coordinate high-speed connectivity between research institutions. This could involve private Internet Service Providers (ISPs) if needed.
4.) Computational resources from research institutions should be progressively shared to a common platform (e.g. virtual machines, storage etc).
5.) A social recognition and reward scheme by the Colombian Science Council could encourage stakeholder engagement and catalyse take-up.
6.) Research institutions offering academic internships/visits and training opportunities should be better coordinated.
7.) There should be a robust, ring-fenced funding source for the development and ongoing facilitation of Colombia's research cyberinfrastructure.