

BEYOND GREEN GOLD: MEGADIVERSE COUNTRIES AS PROVIDERS OF GENETIC RESOURCES AND DIGITAL SEQUENCE INFORMATION

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The Convention on Biological Diversity (CBD), which came into effect in 1993, has three main objectives: "The conservation of biological diversity; the sustainable use of its components; and the fair and equitable sharing of benefits arising from genetic resources". According to Article 1, these objectives may be achieved through, "appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding" (CBD).

As stated in Article 2 of the CBD, the definition of "technology" includes "biotechnology" which is defined as "any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use" (CBD). It is evident that this technology necessarily depends on genetic diversity, which is found in megadiverse countries such as Mexico.

In December of 2016, three important international meetings took place simultaneously in Cancun, Mexico: 1) the 13th meeting of the Conference of the Parties (COP) of the Convention of Biological Diversity (CBD); 2) the 8th COP of the Cartagena Protocol on the Biosecurity of Biotechnology, and; 3) the 2nd COP of the Nagoya Protocol (NP) on Access to Genetic Resources and Associated Traditional Knowledge. In all three of the meetings, emphasis was placed on "the very worrying shift towards a predominantly mercantile view of nature and the growing influence of the business sector at different levels of the organisation, in conferences, projects and activities of the Convention and its associated bodies. The participation of the business sector [in the CBD] through the Global Partnership for Business and Biodiversity is becoming increasingly important" (Betancourt, 2016).

In fact, it was during one of the meetings of the Conference of the Parties (COP) that the hosting delegation first began to promote the use of "integration of biodiversity" as a concept. This term quickly became mainstream in the COP and its official language, English, while in Spanish it began to be interpreted as the integration of biodiversity according to its exchange value, or in other words, its commercial potential.

Conversely, Mexico was the first of those countries that ratified the Nagoya Protocol to show to the world the way in which it might be implemented; it was applied to the maize species called *olotón*, a hugely important variety owing to its ability to "fix nitrogen" in the atmosphere. The Mexican Secretariat of Environment and Natural Resources (SEMARNAT) "welcomed the fact that in Mexico the

benefits established by the Nagoya Protocol were already being reflected, particularly with regards to the legal certainty needed for the use of genetic resources, by establishing measures to prevent their improper use" (SEMARNAT, 2018).

In these same meetings of the COP, it became evident that digital sequence information (DSI) was an increasingly important topic for attendees and sparking several debates on this particular approach to the storage of genetic information. So significant was it, that the 196 countries present at the meeting "agreed to investigate the ways in which digital sequence information might be used in new forms of biopiracy" (Böll, 2016).

DSI facilitates "digital biopiracy" because it allows for the downloading of genetic sequences of plants, microorganisms and seeds from the Internet, which can later be used to recreate physical DNA using methods taken from synthetic biology. This may be done without considering any potential benefit for the countries and communities from which the organisms originate, and in which this genetic information is based (Böll, 2016). DSI may include the following: sequences of nucleotides which form part of deoxyribonucleic acid (DNA), sequences of ribonucleic acid (RNA), amino acids which form proteins, chemical compounds derived from genetic information (metabolites) and even environmental information or information related to ecological interactions between sequences (epigenetics), as well as any other resulting information.

Today, there exist millions of DSI in public and private databases. These sequences can be used and modified for commercial purposes and patented, without following any of the basic principles established by the NP; in other words, their use does not necessarily imply any financial or non-financial benefits to the Parties, which provide those resources. They may not even require Prior Informed Consent (PIC) or Mutually Agreed Terms (MAT), much less the fair and equal sharing of the benefits that result from the use of genetic resources.

DSI are intrinsic to "physical" genetic resources and the two are therefore inseparable. Gaining access to DSI without following the main regulations of the NP encourages biopiracy and leads to unilateral economic benefits which miss the most important aim of the CBD; "the conservation and sustainable use of biological diversity". It is precisely for this reason, that it is important to recognize that DSI should be considered as valuable as any "physical" genetic resource.

Furthermore, the present low-cost of genetic sequencing and the free availability of DSI in databases are both factors that are contributing to a reduction in the need for "physical" access to genetic resources.

In Cancun, a very important agreement was reached: to request opinions with governments, civil society, indigenous and local communities so as to know their opinions on the theme of genetic resources as well as to establish ad hoc groups of technical experts to analyze these discussions (CBD, 2016). This agreement was envisaged as a starting point from which to begin analyzing the

implications of digital sequence information. It must be recognized that “the members of the CBD took an enormous step forward in addressing the controversial theme of digital biopiracy as a means of attending to the many legal gaps that exist in the Convention on Biological Diversity. Although its true to say that some Northern countries with powerful biotechnological industries (such as Canada) tried to have the theme of digital biopiracy removed from the discussion agenda, ultimately everyone agreed that the issue warranted deeper scrutiny and that this would be addressed as part of future meetings” (Böll, 2016).

It is crucial to recognise that open access to DSI has been fundamental to scientific research, which has resulted in studies that expand our knowledge of the many different aspects of genetic resources, both in evolutionary and taxonomic terms as well as in relation to diversity and conservation. Similarly, it has played a fundamental role in the development of medicines, and the diagnosis and molecular identification of organisms of biomedical interest, particularly in the field of public health, amongst others.

However, open access to this information has also been considered *res nullius*, a legal term translated as “nobody's thing”, which means that digital databases containing genetic information uploaded by researchers are freely available to companies and other parties who generate intellectual property rights over sequences with no regard for the existing ancestral work and knowledge that indigenous communities hold on that particular information.

The use of DSI implies great responsibility and its possible repercussions require ethical principles. Therefore, in order to fulfil the 3rd aim of the CBD, those researchers who upload sequences onto digital platforms must commit themselves to providing data that helps in the traceability of the aforementioned DSI. Finally, it must be said that open access does not mean unrestricted or unregulated access, because at least theoretically one could benefit from and make use of DSI obtained through unethical or bad practices.

As a megadiverse country, Mexico is an important provider of genetic resources and thus of many different kinds of DSI. It is acknowledged that biodiversity continues to be the inheritance of indigenous and local communities who, using the profound knowledge built up over centuries, and practices such as seed exchange and the sustainable management of nature, have managed to create and recreate biodiversity in line with their cosmologies which imply a positive and congruent relationship between communities and their environments. For this reason, it is clear that there is a need to promote of biocultural heritage (Toledo, 2008) as a strategic position, particularly for megadiverse countries, who are more likely to be providers of genetic resources and therefore, also, of DSI.

However, in past decades, successive neoliberal governments in Mexico (1982-2018) opened many of the nation's vital resources up to the transnational market, and amongst those were genetic resources. It is calculated that “since 1996, [the Mexican government] has authorized 4,238 permits for scientific collection” (Betancourt, 2016) and many of these authorizations have resulted in



"Maize, the sacred grain used in the rituals of indigenous agriculture", by Jack Zalium, is licensed under CC BY 2.0 (<https://creativecommons.org/licenses/by/2.0/deed.en>).

profiteering. Access was even provided to sensitive genetic resources such as those found in maize. Access to the genetic wealth of this particular cereal and the growing interest in its commercial potential was also demonstrated by a joint-visit made by Bill Gates and Mexico's richest man, Carlos Slim, to the International Centre for the Improvement of Maize and Wheat (CIMMYT) in Texcoco, State of Mexico. There they announced "the investment of 25 million dollars by the Bill & Melinda Gates Foundation and the Carlos Slim Foundation to CIMMYT, which, founded in 1943, had been an initiative of the Mexican government and the Rockefeller Foundation, in which the father of the Green Revolution, Normal Borlaug, had worked" (Nuel, 2013).

The current government, which was democratically elected in 2018, is determined to work for the poorest in society, to protect the sovereignty of the

resources that belong to the nation, and to ensure that indigenous communities are the true beneficiaries, thereby recognising their central role in the conservation of biodiversity. In this way, the government is working to include in local legislation and with great precision the guidelines set out by the NP, therefore reinforcing the vision that indigenous communities already have of their biocultural heritage. Regarding DSI, it is essential that criteria is specified to establish with clarity what the commitments and obligations of users of DSI databases should be so that they might be obliged to share the benefits and not avoid those measures indicated by the NP.

If regulation is often one step behind technology, then time is of the essence and the issue of access to DSI must be discussed and analysed in the 15th COP, through the lens of biculturalism. The challenge for all participating sectors is to face the issue head-on, and although it will not be easy, not to do so risks rendering the Nagoya Protocol meaningless.

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