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Commercialization of Biodiversity: The Regulation of Bioprospecting in Ecuador

Abstract

The creation of new markets to promote sustainable development is the central premise of today's environmental policy-making. In Ecuador, bioprospecting became regulated under Access and Benefit-Sharing measures. The idea is that the commercial use of biodiversity will trigger the bio-economy sector, ensure biodiversity conservation and support rural livelihoods. In this article, I take a critical perspective on "selling nature to save it" logic. I understand bioprospecting negotiations not only as a market in which user and provider bargain over the conditions of exchange, but also one in which actors involved negotiate "Nature".

Starting with an overview of the development of bioprospecting regulation in Ecuador, I present several case studies between 1980 and 2003. Despite the fact that bioprospecting developed from an open access regime to a highly regulated market, so far the commercialization of biodiversity has not yielded benefit-sharing on more equal grounds. Diverse concepts of "Nature" prevail among actors: The state declared biodiversity "*national patrimony*" and promotes the country's "*competitive advantage*" in bio-economy. Companies employ biodiversity as a "*resource*" in research and development and use it as a "*marketing tool*" to promote the companies' visions on sustainability. Traditional knowledge is seen as an integral part of community "*culture*", as a "*property*" which needs to be protected and as a "*benefit*" for community development. Finally, the focus is whether and how an alternative development model based on the concept *Buen Vivir* may give grounds to overcome exploitative resource acquisition patterns.

Keywords: Biodiversity, Ecuador, Biosprospecting, Nature, Resource, Knowledge

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Introduction

The creation of “new” markets to promote sustainable development has become the central premise of today's environmental policy-making. Richly biodiverse countries in particular have implemented restrictive policies for the commercial use of their “nature's wealth”. The process of bioprospecting, the “exploration of biodiversity for commercially valuable genetic and biochemical resources” (Reid et al. 3) is regulated under Access and Benefit-Sharing (ABS) policies.

Many varieties of different exploratory activities are summarized under the umbrella term bioprospecting. For example, pharmaceutical companies search for “new” active ingredients. Biotechnology companies search for “new” resistance genes to be integrated into “new” crops. Beside industrial applications, research agencies and universities may conduct bioprospecting for scientific purposes as well. [1] Plant material and associated attributes like genetic resources and traditional knowledge, to be employed in research and development (R&D), used to be freely available in databases, herbaria, botanical gardens and via field expeditions. At that time, biodiversity was considered the “common heritage of mankind” (ten Kate and Laird 8).

The idea to commercialize biodiversity started in the early 1990s in the context of the development of the “Convention on Biological Diversity” (CBD). The primarily objective of the CBD is to halt biodiversity loss on the global level by promoting its utilization on a sustainable basis (3). Since then the majority of richly biodiverse countries have implemented national policies on the restrictive use of biodiversity. The basic assumption is that by integrating the commercial value of biodiversity, sufficient means are generated to finance nature conservation and to support rural livelihoods. The basic principle is the assignment of the national sovereignty on biodiversity. As a result, a market is created in which user and provider negotiate over the conditions of exchange (Richerzhagen 94, 100).

Despite the fact that the promotion of a sustainable bio-economy has been taken up as a national approach in the majority of richly biodiverse countries, the commercialization of biodiversity has not fulfilled its proposed goals. In most attempts, economic approaches have been employed in order to analyze the functioning (and dys-functioning) of biodiversity markets (Richerzhagen; Gehl Sampath; Siebenhüner and Suplie). From a social science perspective, the “selling nature so save it” logic has been criticized based on the argument that it is critical to take into account societal, cultural and historical aspects in the context of bioprospecting (Dorsey; Brand and Vadrot).

I understand bioprospecting negotiations not only as a market in which user and provider bargain over the conditions of exchange, but also one in which actors involved negotiate “Nature”. Concepts of “Nature” serve as ideologies to facilitate and/or limit certain modes of action. There is a need to unmask the individual concepts of “Nature” of the different actors involved to draw attention to the underlying power asymmetries and hierarchies, prohibiting the allocation of benefits on more equal grounds.

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ISSN: 1867-1519

A variety of different actors is involved in bioprospecting activities, often with diverse (and potentially divergent) perspectives upon how to deal with ABS issues. This may include industrial actors, state representatives, local and indigenous communities as well as individual, traditional knowledge holders. Intermediate actors, e.g. non-governmental organizations (NGO) and scientific experts, may be involved as well (ten Kate and Laird 4-6).

In order to shed light into the development of bioprospecting regulation in Ecuador, I will first present an overview of ABS measures and how these have been implemented in Ecuador. I will present the underlying concepts of the commercialization of biodiversity from an economic perspective, followed by a critical assessment of the "selling nature to save it" logic from a social scientific perspective. I will also examine several Ecuadorian bioprospecting cases to give an overview of the prevailing concepts of "Nature" and how these relate to certain practices within a specific historical context. Finally, I shall discuss the findings by making reference to the concept of *Buen Vivir*.

The Emergence of Access and Benefit-Sharing Measures

Since the early 1990s, public attention on global environmental issues has risen. As a result, the CBD was implemented in 1992. This formed the basis for subsequent biodiversity-related policy-making. The primarily objective is to secure the "conservation of biological diversity" by promoting the "sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources" (CBD 3). The major principle of the CBD is the establishment of the state's sovereignty over its biodiversity. The assignment of property rights on biodiversity gave grounds to stress the "misappropriate" use of biodiversity and the "insufficient" recognition of resource holders. This is based on the argument that "local and indigenous communities have historically acted as keepers, or even developers, of biological diversity and, thus, should be 'compensated' by those who benefit from their care and labor" (Hamilton 1487).

Today ABS policies have been implemented in the majority of richly biodiverse countries to regulate the process of bioprospecting. Even when the exact requirements and procedures highly differ, the basic principle of ABS measures is the bargain over access to biodiversity between user and provider. Consequently, bioprospecting contracts are established. Access to genetic resources is granted in exchange for specific compensation measures. Compensation mechanisms include monetary payments, e.g. upfront payments, shares of revenues and royalties, and/or non-monetary benefits, e.g. technological transfer and capacity building (ten Kate and Laird 109).

The Development of Bioprospecting Regulation in Ecuador

Ecuador is often referred to as one of the "hottest" biodiversity hotspots worldwide (Bendix et al. 1). The country is characterized by a great diversity of landscapes and climates: the dry coastal

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plains “*La Costa*”, the Andean highlands “*La Sierra*” and the tropical Amazon forest “*La Amazonia*”. Regions are characterized by high level of endemic species diversity. Traditional knowledge about plants is widespread among local and indigenous communities. Thus, Ecuador is seen as a high potential area for bioprospecting activities in the search for new chemical compounds for commercial product development.

During colonial and post-colonial times, access to Ecuador's fauna and flora was unrestricted and today local biodiversity is found in botanical gardens, herbaria and databases worldwide. This exploitative practice remained basically unchallenged until the early 1990s, when public attention was drawn towards environmental issues (Mariaca). [2]

In Ecuador global environmentalism met with the emerging indigenous movement, promoting indigenous national, cultural and territorial rights against the colonial structure of the society (Altmann). [3] The establishment of sovereignty on indigenous territory was key in this development by promoting decentralized decision-making structures (Frank; Erazo).

Ecuador ratified the CBD in 1993. In 1996 a sub-regional frame for access to biodiversity was established under the Andean Pact Decision 391 (1996) “*Régimen común sobre acceso a los recursos genéticos*”. [4] National sovereignty over the development of biological and genetic heritage was implemented. The major objective was to strengthen the integration and scientific, technical and cultural cooperation of the Andean states on a sustainable basis. Specific attention was drawn to the *multi-ethnic* and *pluri-cultural* nature of the Andean states: ”It is necessary to recognize the historic contribution made by the native, Afro-American, and local communities to the biological diversity, its conservation and development and the sustained use of its components, as well as to the benefit generated by that contribution” (*Decisión 391* 1).

The competent national authority, the “*Ministerio del Ambiente del Ecuador*” (MAE), oversees access requirements to genetic resources. When access to traditional knowledge is sought, supplementary annex agreements need to be reached with local and indigenous communities. The principle of “*previo consultar”* became implemented, requiring the acknowledgment of traditional practices and procedures (Mariaca). [5]

At that time, provisions and procedures on ABS were rather loosely defined and dealt with on a case-by-case basis. This lead to a highly controversial debate on how best to govern bioprospecting negotiations. According to Ribadeneira Sarmiento (241) bioprospecting activities were under the “shadow of suspicion and doubt” to potentially qualify as “biopiracy” to the extent that it seemed there was no legitimate way to access genetic resources and associated knowledge. In contrast, proponents saw ABS as a national (or international) legal entity that could be presented to courts in order to get reparation or compensation for the country of origin. They argued that the biopiracy debate needed to be freed from fundamentalist beliefs and promoted an objective science-based approach.

In 2005, the “Ecuadorian Working Group on the Prevention of Biopiracy” (EWGPB) was set up to develop a coherent national approach on ABS. Several bioprospecting cases were analyzed to

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define legitimate access applications (Ribadeneira Sarmiento). However, it was not until 2011 that a detailed ABS policy was implemented in Ecuador, the "*Decreto Ejecutivo 905: Reglamento Nacional al Régimen Común sobre Acceso a Recursos Genéticos en Aplicación*" [hereafter Ecuadorian ABS Regulation] (Cabreara Medaglia et al.). The idea was to "erect sufficient regulatory infrastructure to protect these resources from continued exploitation" (Dorsey 141). Therefore, a broad definition on access to biodiversity was applied, defined as "acquirement and utilization of genetic resources conserved *ex-situ* or *in-situ*, and their derived products, including their intangible components, for research, bioprospecting, conservation, industrial or commercial applications" (*Decreto Ejecutivo 905* 7). [6] The Ecuadorian ABS Regulation makes explicit reference to the Ecuadorian Constitution (2008). Rights have been granted to nature, referred to as "*Pachamama*". Based on the concept of *Buen Vivir*, an alternative development model has been promoted based on managed scarcity instead of extractive development (Lewis 11). [7] Gudynas and Acosta define *Buen Vivir* as an "opportunity to build a different society sustained in the coexistence of human beings in their diversity and in harmony with nature, based on recognition of the diverse cultural values existing in each country and worldwide" (103). Since then, the promotion of the bio-economy has become part of the national strategy. The "*Plan Nacional para el Buen Vivir* 2009-2013" states that "the country's greatest comparative advantage is its biodiversity and, undoubtedly, the greatest competitive advantage it could have is to know how to utilize it properly, through conservation and by construction the country's own bio- and nanotechnology industries (...) Biodiversity is synonymous with life and therefore with information" (Plan National de Desarollo 2009-2013 56). However, whether and how the concept of *Buen vivir* may promote sustainable development within a market economy still needs to be determined.

Level	**Regulation (Year)**	**Principle**
inter-national	Convention on Biological Diversity (1992)	- sustainable use of biodiversity - fair and equitable benefit-sharing
regional	Andean Pact Decision 391 (1996)	- economic integration on a sustainable basis - multi-ethnic and pluri-cultural nature of the state
national	Ecuadorian ABS Regulation (2011)	- state-led approach on "Buen Vivir" - biodiversity as competitive advantage

Table 1: Bioprospecting Regulation in Ecuador

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In the following, I will present the underlying concepts of the commercialization of biodiversity from an economic perspective, followed by a critical assessment of the "selling nature to save it" logic from a social science perspective.

Commercialization of Biodiversity: An Economic Approach

The commodification of "Nature" is based on the concept of ecosystem services, defined as "benefits people obtain from ecosystems" (MEA 40). [8] Benefits obtained by a functioning natural environment either constitute market or non-market values. The idea is that only market values are reflected in environmental decision-making, while non-market values are neglected. The argument has been developed that the non-market value of biodiversity needs to be measured in order to be appropriately accounted for (Kontogianni et al. 1479). [9] By attributing value to "Nature" biodiversity is turned into a "commodity" to be traded in the biodiversity market.

ABS policies can be understood as a tool to create markets for biodiversity. Therefore, efficient institutions need to be set-up. The underlying economic concepts are mainly derived from "New Institutional Economics", based on the assumption is that sustainable development will be achieved by promoting the commercial use of biodiversity (Sukhdev et al. 3).

According to Richerzhagen the main principles of ABS are the sovereign right of states over their genetic resources (94), the internalization of the positive externalities of biodiversity conservation (83) and the bilateral contract between provider and user of genetic resources (98).
The promotion of the establishment of the sovereign right of states over their genetic resources is based on the assumption that under an open access regime the overexploitation of the resource is likely. Property rights are established to implement effective mechanisms to exclude others from using the resource. As a result, access to biodiversity is turned from a public good into a private good, which is associated with increased levels of excludability and rivalry. In order to provide efficient maintenance and investment incentives in resource conservation on the local level, property rights can be further assigned to private land owners or local communities (Swanson and Göschl; Boisvert and Caron).

The assignment of property rights is a precondition for capturing the positive externalities of biodiversity conservation. The existence of an externality is seen as a major cause of market failure, meaning that "existing markets do not efficiently allocate resources because their full costs or benefits are not reflected in the prices" (Richerzhagen 82). The positive externality of biodiversity conservation arises when efforts made on the local level create global benefits which remain uncompensated. This may lead to a reduced level of biodiversity conservation in favor of more destructive land use options (OECD).

ABS can be modeled as a bilateral contract between a richly biodiverse country granting access to genetic resource and a technologically rich countries, which provide compensation in form

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of monetary and non-monetary benefits (Lerch; Boisvert and Caron). This refers to the "Coase Theorem", understood as "given a suitable assignment of property rights, private bargaining between individuals can correct externality problems and lead to efficient outcomes" (Perman et al. 137/138). Conditions of exchange are based on a negotiation between provider and user. The bargain may result in exclusive user rights, e.g. license agreements and patents. The idea is that the bargain will end in a Pareto-optimal solution, meaning that the optimal allocation of biodiversity conservation is reached (Richerzhagen). These arguments can be summarized under the "selling nature to save it" logic (Mc Afee), proposing that biodiversity loss can be counteracted by implementing the "right" market incentives.

Social, Cultural and Historical Context of Bioprospecting Negotiations

From a social science perspective, a critical view is taken on the "selling nature to save it" logic. The commodification of "Nature" is understood in terms of "identifying and justifying new financial sources and markets for the protection of nature" (Brand and Vadrot 204).

In order to understand the societal relations to nature, it is necessary to take into account the normative, historical and political situation within which bioprospecting takes place: bioprospecting does not "happen "in the ever present now", devoid of a historical, political-economic context and legacies of past exploitation of the prospected materials in question" (Dorsey 138). In this perspective bioprospecting negotiations do not only represent a market in which user and provider bargain over the conditions of exchange, but also one in which actors negotiate about meaning attributed to "Nature" in its various forms.[10]

Brand and Vadrot studied the global dimension of the political economy of biodiversity by explicitly taking into account the notion of discursive power and hegemony. They argue that governance ineffectiveness rests in the contradictory dynamics of globalized capitalist economies and societies. This becomes visible in typical North-South relations: the providers are richly biodiverse developing countries in the South, while the users are located in technology-rich industrialized Northern countries. According to Wynberg and Laird, user countries "seek unimpeded access to genetic resources within a softer legal framework of corporate social responsibility and contractual agreements for benefit-sharing", while provider countries "are resentful of centuries of colonialism and the uncompensated export of genetic material and traditional knowledge and want to address these injustices and prevent further misappropriation" (24).

However, perspectives should not be assigned in a stereotypical way: state representatives, industrial actors, NGOs as well as local and indigenous communities may promote and/or oppose bioprospecting on various grounds. For example, communities are frequently presented as having worldviews alien to Western understanding only: "The notion of genes (...) understood as isolated and tradable commodities, derives from a modern technical development and does not exist in that manner in many traditional communities" (de Jonge 134). Instead, it is safe to assume that various

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concepts of “Nature” and related practices prevail among the various actors. Also, these differing concepts of “Nature” may serve as ideologies to facilitate and/or limit specific modes of action.

Bioprospecting Negotiation in Ecuador: Case Studies

In the following, five cases studies will be presented to give an overview of the development of bioprospecting in Ecuador. [11] The description of case studies is based on an analysis of publications on bioprospecting negotiations. This includes scientific publications, governmental statements, industry reports, activist and community announcements as well as newspaper articles. The case studies cover the time between 1980 and 2003. Please note that the choice of data cannot be considered as representative. Generalization cannot be made due to the limited number of studies considered. Publications may rather reflect political concerns on “unregulated” bioprospecting at a certain time rather than the actual extent of commercial applications on biodiversity. In general, information on bioprospecting is difficult to retrieve as conditions of exchange are often confidential.

Commercialization of *Ayahuasca* (*Banisteropsis caapi*)

Ayahuasca (*Banisteropsis caapi*) is part of a ritual performed in the *Shuar* community in the Ecuadorian Amazon. According to Marin Gutiérrez et al. *ayahuasca* is referred to as “*la soga que permite ir al lugar de los muertos*” [the robe that allows to go to the place of death] (1067). It contains psychoactive substances, which are used for consumption to create visions to access the mystical world. This tradition is seen as the foundation of system of values and identity of the *Shuar* people. Despite changing cultural and social customs, the plant's consumption remains vital to the present day. Even when today trade in its active ingredient is banned, the utilization of the plant's natural forms is not prohibited on the grounds of being an integral part of indigenous people's worldview.

Attempts to commercialize *ayahuasca* started in the early 1980s. Mr. Loren Miller, on behalf of the U.S.-based International Plant Medicine Corporation (IPMC) collected plants for potential commercial product development in the Ecuadorian Amazon. Mr. Miller lived about two years in *Cofan* and *Siona* communities. When he left, he took several plant samples to be analyzed in the company's laboratory. As no regulation on bioprospecting was in place at that time, Mr. Miller did not feel obliged to receive consent from communities or to inform the state. In 1986, a patent on uses upon the indigenous plant *ayahuasca* in order to develop a botanical medicine was filed at the U.S. patent office (Dorsey). However, whether and how this created tensions in indigenous communities at that time cannot be determined, as no publications are available.

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Bioprospecting activities need to be interpreted in their historical contexts. During the 1980 and 1990s, the national political system was characterized by instability and neoliberal politics promoted by the U.S. government. In the absence of state action taken to guarantee indigenous territorial rights, the emerging indigenous movement took up the issue. In 1996 the "*Coordinadora de Organizaciones Índígenas de la Cuenca Amazonica*" (COICA) wrote a resolution, labeling the patenting of a*yahuasca* as "an offense against all the Amazon indigenous people" (Dorsey 142/143). It was argued that the "stealing" of a sacred species, like a*yahuasca*, represents a lack of respect for cultural practices. These communities declared Mr. Miller a "*persona non-grata"*.

The Inter-American Foundation, a U.S.-based development organization, strongly offended the resolution by accusing the COICA of being a terrorist organization and proposed to cease financial support. In contrast, international NGOs supported the resolution. A great coalition of national and international NGOs was set up supporting the resolution, including lawyers, indigenous communities as well as environmental and human rights activists. With the involvement of the U.S.-based "*Centro International de Derecho Ambiental*" (CIEL) a large-scale legal patent challenge was initiated. The main argument was that the patent did not fulfill the requirement of novelty, as knowledge of the a*yahuasca* plant had long been documented. As a result, in 1999 the patent was revoked, three years prior to its termination (Dorsey).

Commercialization of *Sangre de Drago* (Dragon's Blood)

In the late 1980s the U.S.-based pharmaceutical company "Shaman Pharmaceuticals" initiated a cooperative research program to conduct field explorations in the Ecuadorian Amazon. The idea was to search for plants of potential pharmaceutical interest with direct assistance by local healers. Even when no bioprospecting regulation was in place yet, neither on the international nor on the national level, awareness was raised on acknowledging indigenous communities. Thus, prior to the field collection "Shaman Pharmaceuticals" set up a corporate bioprospecting policy. It was proposed that about 15 % of the expedition budget are to be allocated among communities. In 1990 a cooperation was set up between "Shaman Pharmaceuticals" and the "*Coordinadora de las Organizaciones Indígenas de la Cuenca Amazónica*" (COICA). The field work started in 1991 and plant specimens were collected by focusing on traditional medicines. About 30 kg of dry plant samples were exported and further laboratory analysis of potentially valuable chemical ingredients was conducted (Dorsey; Svarstad).

Soon the focus was lead upon the latex sap of a *Croton sp*., called s*angre de drago* (dragon's blood). The latex sap is traditionally used as a natural wound cover. Eventually, two anti-viral products were developed, *Provir* and *Virend.* As a result, several patents were filed at the U.S. patent office. Part of the cooperation was the establishment of plantations on communal land. "Shaman Pharmaceuticals" proposed to establish a "reciprocal" relationship with forest-dwelling peoples to harvest and supply resources on a sustainable basis.

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Despite the fact that individual community members expressed ambivalence to antagonistic reactions, the community leaders of 11 communities supported the companies' approach and signed "*cartas de compromio*". About 180 families were involved and set up plantations for the commercial production of s*angre de drago.* About 33,000 US$ were received as upfront payments. Despite the fact that agreements were reached, environmental NGO questioned the fairness of the "reciprocal" trade relationship. The international NGOs "Rural Advancement Foundation International" and "Cultural Survival Canada" stressed the limited benefits received by local communities and accused "Shaman Pharmaceuticals" of biopiracy. The national NGO "*Acción Ecológica*" also criticized the patenting of an indigenous plant (Svarstad).

However, in 1999 the negative approval of the U.S. Food and Drug Administration resulted into a serious setback for "Shaman Pharmaceuticals", which finally lead to bankruptcy. As a result, research on the compound terminated (Dorsey).

Bioprospecting Contract between the National Cancer Institute and FCAE

The *Awa* people live in the North-Western parts of Ecuador and in South-West Columbia. In Ecuador the *Awa* acquired legal recognition as citizens in 1988. The "*Federación de Centros Awa del Ecuador*" (FCAE) was formed. The FCAE administers land held a territory of about 1,000 km^2 under communal title. About 3000 people live widely dispersed in eight communities. Decision-making is made collectively at the "Community Assembly". The *Awa* territory is characterized by a high level of endemic biodiversity. Thus, the area is of priority interest for bioprospecting.

In 1993, the U.S.-based "National Cancer Institute" appointed the FCAE to study the local biodiversity on community territory. The major objective was to search for plants of potential pharmaceutical interest to treat cancer. A "letter of collection" was signed between the "National Cancer Institute" and the FCAE. The agreement was approved by the "*Ministerio de Relaciones Exteriores*" (Bravo).

The "New York Botanical Garden" was consulted as an intermediate actor to conduct the collection of plant samples. During a period of two years, six ethno-botanical inventories were carried out and about 1500 specimens were collected. Samples were subject of further phyto-chemical analysis.

Community involvement included the guiding of the expedition and the disclosure of traditional knowledge. Community members received payments of about 500-700 sucre/day (0.5 US$). Two traditional healers were employed at the "National Cancer Institute" to conduct sample identification. Furthermore, plantations were set up on community territory. Training was provided on primary processing methods (Bravo; Posey and Dutfiled). Whether or not findings resulted in commercial applications is undetermined as this information is confidential.

Despite the fact that agreement upon procedures was reached between users and providers, the environmental NGO "*Acción Ecológica*" raised criticism by making reference to the CBD. "*Acción*

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Ecológica" blamed the "National Cancer Institute" of biopiracy. Especially the patenting of indigenous knowledge was perceived as the continued extraction of resources by former "colonizers". As a result, the FCAE pro-actively developed a bioprospecting regulation on communal territory, the "*Realizaciónes de Estudios Cientificos en el Territorio de la Federación Awa*". Other communities, not being involved in contracting, stressed the exclusion of *Awa* communities from Columbia (Posey and Dutfield).

A Role Model for Participatory ABS Procedures – ProBenefit Project

In 2003 the German pharmaceutical company "Dr. Wilmar Schwabe Arzneimittel GmbH & Co. KG" (Schwabe) in cooperation with the NGO "Institute for Biodiversity–Networks" set up the ProBenefit Project to develop a role model for ABS procedures in Ecuador. The objective was to conduct ethno-botanical studies in cooperation with local and indigenous communities. The Nature Reserve "*Biosfera Gran Sumaco*", inhabited by *Kichwa* communities, was chosen as a potential research site due to its high level of biodiversity (PRO-BENEFIT).

A bioprospecting application was filed at the MAE. In 2005 a research permit to conduct an environmental inventory was granted. Cooperation with a national counterpart was initiated, the "*National Herbarium*" and the herbarium at the *"Pontifica Universidad Católica del Ecuador*". Several field visits were carried out. Plant material was documented and phyto-chemical analysis was conducted.

In order to access traditional knowledge on plants, the principle of "*previo consultar*" needs to be followed, requiring the acknowledgment of traditional practices and customs. Schwabe perceived the missing definition of exact requirements as a "legislative vacuum". Prior to the field entry Schwabe commissioned a juridical and an ethnological expertise to the University Göttingen, Germany (Stoll and Reynes-Knoche; Wörrle).

Several indigenous association were contacted, the "*Confederation de Nationalidades Indigenas del Ecuador*" (CONAIE), the "*Confederación de Nacionalidades Indígenas de la Amazonía Ecuatoriana*" (CONFENIAE) and the "*Federación de Organizaciones de la Nacionalidad Kichwa de Napo*" (FONAKIN). Only FONAKIN supported the idea and showed interest in Schwabe's activities.

In 2004, a workshop with *Kichwa* community representatives was conducted. A "*grupo de trabajo*" (working group) was set up. The basic idea promoted by Schwabe was that participants will develop a coherent position over which decision-making is made at the FONAKIN "General Assembly". However, in 2006, the General Assembly was held, but no decision was made. In the face of ongoing preparations in the context of the upcoming elections, indigenous community member argued that regional issues are of more relevance than bioprospecting activities conducted by foreign companies. Working group member argued that a more wide-reaching discussion based

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on a comprehensive information campaign is required. Eventually, Schwabe refused to make further investments (PRO-BENEFIT).

Global Ocean Sampling Expedition – Galapagos

The "Global Ocean Sampling Expedition", initiated in 2003 by the U.S.-based J. Craig Venter Institute (JCVI), aimed to analyze the genetics of the maritime microbiological diversity in order to understand their role in ecosystem processes. The expedition was presented as an adventure to the unknown, unexplored world: "a quest to unlock the secrets of the oceans by sampling, sequencing and analyzing the DNA of the microorganisms living in these waters. While this world is invisible to us, its importance is immeasurable" (JCVI).

Coastal seawater samples were mainly collected in international waters not subject to ABS requirements. In Ecuador, the Galapagos Islands were of primary interest. Marine as well as terrestrial fauna and flora, characterized by a high level of endemic species diversity, is protected under the "*Parque Nacional Galápagos*" (Suárez).

In order to conduct sampling activities in Galapagos the "Institute for Biological Energy Alternative" (IBEA), headed by J. Craig Venter, filed an application at MAE. During that time in Ecuador bioprospecting activities potentially qualifying as biopiracy were critically debated. The IBEA presented the project as a non-profit collaborative research activity of scientific purpose only: The IBEA announced to "collaborate on designated projects of mutual interest". The objective was "the study of microbiological diversity in the Galapagos using a 'whole environment' approach (…) to determine the complex interrelationship between groups of microorganisms that affect regional and global environmental processes (MoU 1/2).

A Memorandum of Understanding (MoU) was signed between IBEA and MAE. The IBEA would provide "advanced technology facilities for the study for genomic sequencing and informatics" through "pioneer methods" at "no cost for the Parque Nacional Galápagos" (1). In turn, Ecuador would receive a number of non-monetary benefits. This included the generation of a publicly available "microorganism inventory of inestimable value to Ecuador" (2) and technological training on sequencing methods. It was agreed upon that data should "be used exclusively for purposes of generating public information on sequencing. In addition, neither party shall pursue nor exercise intellectual property rights over the genomic data and results (…) since this information is part of the genetic patrimony of the state of Ecuador" (2/3). The attempt by any party to make commercial applications with the data generated was considered to be a "misuse [of] the samples in its custody". (4).

After state approval was granted, a research permit was issued by the "*Parque National Galápagos*". In order or ensure the sustainable utilization of biological resources, scientific expertise was conducted by the "*Estación Cientifica Charles Darwin*" and the University of Guayaquil. Reports

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pointed out the national interest in scientific, technological and technical capacity development measures.

The actual collection in Galapagos was carried out in February and March 2004. In order to ship the material to the U.S.-based laboratory for further analysis, an export permit was granted by the Ministry of Foreign Affairs. In 2005, the MAE requested to sign a contract in order to grant authorization for publication. Several scientific reports were published in 2004 and 2008. The genetic information was made available in Gen Bank and CAMERA in 2007 (Nemogá-Soto and Lizarazo).

The Regional Office for South of the International Union for Conservation of Nature (IUCN) criticized that, based on the argument that the "Global Ocean Sampling Expedition" is more about the generation of "knowledge" than promoting the "conservation" of biodiversity, no specific clause on potential monetary benefits was provided for. Actual or potential commercial uses of the resources, e.g. in the enzyme industry and biofuel sector, were not considered. Furthermore, IUCN criticizes that none of the scientific reports included an Ecuadorian co-author (Nemogá-Soto and Lizarazo).

Overview of Bioprospecting Cases in Ecuador

The bioprospecting cases studied in this paper cover the time between 1980 and 2003. With the implementation of the national sovereignty on its biological resources, the exploration of biodiversity in Ecuador developed from an open access regime into a highly regulated market. This resulted into several changes, e.g. actors involved, negotiation procedures, and benefits received. In the following, I will group bioprospecting cases along the lines of whether ABS measures were in place or not. Two cases were conducted prior to the implementation of the CBD (1992). One case was conducted just after its set-up. Two cases followed the principles laid down by the Andean Pact Decision 391 (1996).

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Unregulated Bioprospecting	
1986	resource: *ayahuasca*, traditionally used in ritual user: Mr. Miller (IPMC), provider: *Cofan* and *Siona* communities contract: no *previo consultar*, no benefit-sharing R&D: botanical medicine, patent challenge commercialization: none
1990	resource: collection of medicinal plants guided by traditional healers user: Shaman Pharmaceuticals, provider: COICA contract: cooperative research, *cartas de compromio* benefits: 15% of expedition budget, 33,000 US$ upfront payments R&D: antiviral products on *sangre de drago*, several patents filed commercialization: failed in clinical phase
1993	resource: collection of traditional medicine on communal land user: U.S. National Cancer Institute, provider: FCAE contract: letter of collection, plantations on communal land benefits: 500-700 sucre/day, training on processing methods R&D: pharmaceutical medicine, patent application unknown commercialization: unknown
Regulated Bioprospecting	
2003	resource: environmental inventory in *Biosfera Gran Sumaco* user: Schwabe, provider: MAE, *Kichwa* communities contract: research permit, negotiation of *previo consultar* failed benefits: cooperation with national research institutions R&D: analysis of phyto-chemical ingredients commercialization: none
2003	resource: genomic sequencing of marine microbiological diversity user: IBEA, provider: MAE contract: Memorandum of understanding benefits: publicly available microorganism inventory, training sequencing methods R&D: exclusive use of data for scientific purposes only

Table 2: Overview of Bioprospecting Cases in Ecuador

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Bioprospecting activities are mainly carried out in richly biodiverse areas, the Ecuadorian Amazon and tropical Andean region as well as on Galapagos islands. On the user side, it was mainly U.S.-based companies and research organizations that initiated bioprospecting activities in order to develop botanical and pharmaceutical medicines. However, new actors have entered the stage, e.g. European companies and non-profit organizations. Prior to the implementation of ABS measures mainly focused sample collections guided by traditional knowledge were conducted. When provider rights were strengthened, search strategies changed: broad scale environmental inventories were conducted without accessing related traditional knowledge. Furthermore, after access to terrestrial biodiversity became regulated, attention was drawn to microbiological marine resources not yet covered by ABS mechanisms.

Prior to the implementation of ABS measures, no state action was taken to oversee bioprospecting activities. In the case that access to traditional knowledge was sought, providers were not approached or agreements were negotiated on a voluntary basis only. Negotiating partners were mainly indigenous organizations, e.g. COICA, FONAKIN and FCAE. Even after the assignment of property rights on biodiversity, state action was not taken to institutionalize ABS requirements. Access to biodiversity is instead granted via a permit system already in place. In the case of "unregulated" bioprospecting, intermediate actors increasingly become involved to criticize "inappropriate" access conditions and/or to provide scientific expertise.

After accessing plant samples, the material was mainly exported to conduct phyto-chemical analyses of potentially valuable active ingredients. While this resulted in several patent applications at the U.S. patent office, none of the bioprospecting cases resulted in a commercial product. Only two products reached the clinical phase. In one case, bioprospecting was conducted by a non-profit organization proposing that sampling and analysis is only of scientific interest.

In the majority of cases, only limited benefits–if any at all–were received by resource providers. In two cases, monetary benefits were received by traditional healers guiding sample collection. In one case, community members received upfront payments to establish plantations on communal land. Under regulated bioprospecting conditions non-monetary benefits tend to become more relevant, e.g. cooperative research and technological capacity building.

Concepts of "Nature" in the Context of Bioprospecting Negotiations

In the following the diverse perspectives of the different actors involved in bioprospecting are presented. Specific attention is paid to the analysis of concepts of "Nature" and how these relate to certain practices within a specific historical context.

During the 1980s and 1990s, the Ecuadorian state was characterized by political instability and neoliberal U.S. politics. There was not yet any state action designed to secure biodiversity. There was not a concept of "Nature" available upon which non-exploitative resource acquisition could have been based. If at all, bioprospecting was treated as a "*foreign affair*". With the implementation of the

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Andean Pact Decision 391 (1996) the "*national sovereignty*" of states over natural resources was declared. However, only access to biological resources was internalized under the state. Access to traditional knowledge was left to indigenous communities. This situation changed when the concept of "*Buen Vivir*" was laid down in the Ecuadorian Constitution (2008), proposing an alternative development model based on "*harmony*" with nature. Since then the countries "*competitive advantage*" in bio-economy has been promoted.

From a user perspective, all bioprospecting cases studied in this paper must be regarded as a failure. Investments made, e.g. the negotiation of access agreements, plant collections and laboratory research, were not recovered. For the users of biodiversity the primary objective is to receive a reliable "*resource*" supply. Biodiversity is perceived as an "*input factor*" in R&D. Traditional knowledge can be employed as a "*device*" to improve success rates. In principle, companies do not feel responsible for biodiversity conservation and community development. However, after the implementation of ABS measures, the unconcerned user attitude to take samples, analyze them, patent their findings and commercialize them cannot be conducted anymore. In the face of being accused of biopiracy, companies are forced to take on "responsibility". A pro-active approach was taken to develop long-term trade relationships, e.g. corporate bioprospecting policies, principles for cooperative research and community involvement, were set up. In this case, bioprospecting is employed as a "*marketing tool*" to promote the companies image of sustainable business-making. However, non-profit activities, proposing to unlock the "*secrets*" of the yet unexplored world of biodiversity solely for the public interest, may instead mask that once research findings are available publicly, they can potentially be employed for commercial uses as well.

On the provider side, represented by local and indigenous communities, diverse concepts of "Nature" prevail: indigenous plants can be perceived as an integral part of the community "*culture*" and/or as "*property*". Communities should not be perceived as a uniform group. Instead, communities are often characterized by rivalries. In the case that agreements had been reached, other stakeholder may enter the stage and challenge such contracts. Since the early 1990s in Ecuador, the indigenous movement is actively involved in promoting national identities, territorial rights and decentralized decision-making structures. Positions taken on bioprospecting issues are not coherent: activities can be perceived as a "*loss of culture*", as a "*stealing of a sacred plant*" and /or as a "*benefit*" for community development. On the one hand, communities can challenge biopiracy in writing a resolution to the state and by collating with NGOs. On the other hand, communities can define their own procedures and pro-actively negotiate bioprospecting agreements.

Since the implementation of the CBD, environmental NGOs dominate the bioprospecting debate. In some cases, NGOs see biodiversity as a "*community good*" and stress the "misappropriate" use of traditional knowledge and the missing acknowledgment of local procedures. In other cases, NGOs perceive biodiversity and traditional knowledge as "*green gold*", the "*wealth*" of the country, as a "*key resource*" which needs to be employed to ensure sustainable development,

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to finance nature conservation and to support rural livelihoods. Actions taken range from providing scientific expertiseto facilitating ABS to blaming industrial actors of biopiracy, e.g. by implementing patent challenges. In the following, an overview of the concepts of "Nature" of the actors involved is provided. [13]

Actor	**Concepts of "Nature"**	**Practice**
State Perspective	- missing definition of biodiversity - biodiversity as "**foreign affair**" - biodiversity as "**national patrimony**" - biodiversity as "**competitive advantage**" - "**harmony**" with nature	- no action taken - national sovereignty on nature - promote bio-economy sector - create alternative development model
Company perspective	- indigenous plants as "**resource**" for production - biodiversity as "**input factor**" in R&D - traditional knowledge as "**device**" - traditional medicine as "**marketing tool**" - biodiversity as "**secret**" of unexplored world	- exploitative resource acquisition - patenting of indigenous plant uses - promote reliable resource supply - set up corporate policies -sustainable marketing strategies
Community perspective	- "**sacred**" species - traditional medicine is part of "**culture**" - biodiversity/traditional knowledge as "**property**" - biodiversity as community "**benefit**"	- declare bioprospecting as biopiracy - set up resolutions - coalition with NGOs - define own procedures
NGO Perspective	- biodiversity and traditional knowledge as "**green gold**", "**wealth**" of the country, "**key resource**" -biodiversity as "**community good**"	- promote sustainable development - patent challenge/public attention -provide scientific expertise

Table 3: Concepts of "Nature" of the Actors Involved and Related Practices

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Conclusion

The commercialization of biodiversity is the central premise of today's environmental policy-making. The basic idea is that by internalizing the commercial value of biodiversity, sustainable development will be achieved. In Ecuador ABS measures have been implemented under the Andean Pact Decision 391 (1996). State sovereignty over biodiversity, i.e. genetic resources and traditional knowledge, has been established. Since then, the process of bioprospecting has developed from an open access regime into a highly regulated market. Despite the fact that provider rights have been strengthened, exploitative trade patterns remain largely unchallenged. The development of commercial applications using indigenous plants has mainly failed, only limited benefits were received by resources providers, and thus, only limited incentives for biodiversity conservation are given. Even when new actors have entered the stage promoting search strategies based on more ethical considerations of fairness and equity, this has not translated into benefit-sharing on more equal grounds. Instead, companies tend to conduct random analyses of broad scale environmental inventories rather than engaging in a lengthy process to negotiate access to traditional knowledge with local and indigenous communities. Furthermore, attention has been drawn to microbiological marine resources not yet covered under ABS mechanisms. However, under regulated bioprospecting conditions, non-monetary benefits, e.g. cooperative research and technological capacity building, tend to become more relevant.

There is a need to unmask the conceptions of "Nature" used by the diverse actors involved to better understand the process of how ideas, assumptions and ideologies shape the actions taken. This allows us to draw attention to the underlying power asymmetries and hierarchies that prohibit the efficient allocation of benefits among the various actors.

The state declared the "*national sovereignty*" over biodiversity and promotes the countries "*competitive advantage*" in bio-economy. Companies employ biodiversity as a "*resource*" in R&D and use it as a "*marketing tool*" to promote the companies' vision on sustainability. Traditional knowledge is seen as an integral part of community "*culture*", as a "property" which needs to be protected and as a "*benefit*" for community development. NGOs see biodiversity as a "*community good*" which need to be protected from further exploitation and facilitate scientific expertise to promote the utilization of "*green gold*". Concepts of "Nature" cannot be assigned in a stereotypical way to either users or providers.

Despite the fact that alternative concepts of "Nature" prevail, the basic assumption of ABS that all actors involved share the Western perception of "Nature", declaring biodiversity as a tradable commodity, remains mainly unchallenged. However, whether the alternative development model of "*Buen Vivir*", based on indigenous worldviews, will provide means to overcome the exploitative resource acquisition pattern still remains unknown. Currently, there is a controversial debate on the possibility of establishing an alternative development model on the concept of *Buen Vivir*. The concept of "*Buen Vivir*" seems to incorporate elements of a solidarity economy, potentially

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allowing for empathy in participatory procedures on a broader scope. Vanhurst and Beling (56) highlight the model's potential for a cultural, social and political renewal based on the critique of European modernity to overcome the structural nature/culture division. However, action taken under the auspices of *Buen Vivir* may mask hierarchical trade pattern within a capitalist market economy.

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Endnotes

[1] Even when in the majority of bioprospecting regulations a strict division is made between scientific and commercial applications, these two are closely interrelated as scientific findings can be used for commercial purposes at a later stage.

[2] For example, in Ecuador environmental damages perpetrated by oil companies were stressed. One prominent case is the accusation of the oil company "Texacon" to be responsible for ground-water contamination in Amazonian Ecuador. In 2003, a lawsuit was filed in the United States (OilWatch).

[3] In 1984 the *Coordinadora de las Organizaciones Indígenas de la Cuenca Amazónica* (COICA) was formed, followed by the establishment of the national umbrella organization *Confederación de Nacionalidades Indígenas del Ecuador* (CONAIE) in 1986. Further regional organizations, e.g. *Federación de Organizaciones de la Nacionalidad Kichwa de Napo*" (FONAKIN) were formed. In 1996 the *Movimiento de Unidad Plurinacional Pachakutik – Nuevo País* was formed taking party in political elections. According to Andolina et al. under the indigenous movement "development and culture was reframed through neoliberal governmentalities, multiscalar networking, and social protest" (20).

[4] The Andean community is a subregional organization, including Bolivia, Colombia, Ecuador, Peru and Venezuela. Even when it was primarily established to promote regional economic integration, since the mid-1990s environmental and social aspects are increasingly covered as well (Marieka).

[5] Biodiversity is considered a commodity with two components: there is a differentiation between genetic resources, defined as "biological material that contains genetic information of value", and intangible components, defined as "all know-how, innovation or individual or collective practice, that is associated with the genetic resource" (Decisión 391 3/4).

[6] In the CBD a narrow definition of genetic resources is employed: "genetic materials (...) containing functional units of heredity" (CBD 3).

[7] For further discussion on how the concept of *Buen Vivir* relates to indigenous principles, e.g. the Quechua concept *sumak kawsay*, please refer to Vanhurst and Beling.

[8] Ecosystem services include provisioning services (e.g. food, water and timber), regulating services (e.g. climate regulation and water purification), and cultural services (e.g recreational, aesthetic and spiritual benefits). Furthermore, supporting services (e.g. nutrient cycle, pollination, and soil formation) are inked to all three levels (MEA).

[9] This has lead to a discussion whether the "value" of biodiversity is sufficient to finance its conservation (Simpson et al.; Rausser and Small).

[10] Societal relations to nature can be defined as "dynamical patterns of relations between humans, society and nature. They emerge from the culturally specific and historically variable forms and practices in which individuals, groups and cultures design and regulate their relations to Nature" (Becker et al. 76). According to Kropp the quotation mark highlights the discursive character of the term "Nature" (23). This allows one to question both every-day as well as scientific certainties.

[11] In the present study, only commercial applications of plants are covered. However, bioprospecting activities on human resources are still under-researched. For example, in the early 1990s the U.S.-based "Coriell Medical Institute" collected about 3,500 blood and tissue samples from 600 *Huaorani* people. The idea was that *Huaorani* people possess a specific genetic trait with immunity to certain diseases, e.g. hepatitis. Resources were used to develop DNA samples and cell lines, which were sold to the "Harvard University Medical School". Only recently has the missing PIC been stressed by community representative (Mole; Hogan).

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Suggested Citation:

Heeren, Anne. “Commercialization of Biodiversity: The Regulation of Bioprospecting in Ecuador.” Forum for interamerican research 9.2 (Sep. 2016): 93-117. Available at:<www.interamerica.

ISSN: 1867-1519