Acta biol. Colomb (2016);**21(2)**:pag–pag
doi: http://dx.doi.org/10.15446/abc.v21n2.50920
Available online at: http://www.revistas.unal.edu.co/index.php/actabiol

DIVERSIDAD BIOCULTURAL: INNOVANDO EN INVESTIGACIÓN PARA LA CONSERVACIÓN

Biocultural Diversity: Innovating in Research For Conservation

Diversidade biocultural: inovação em pesquisa para conservação

Gabriel R. NEMOGÁ[1].

[1] Chair Department Graduate Committee, Master of Arts Indigenous Governance. The University of Winnipeg, Canadá.
Office: 3RC092 (Richardson College for the Environment)
University of Winnipeg
515 Portage Avenue
Winnipeg, Manitoba R3B 2E9
Canada

For correspondence. g.nemoga@uwinnipeg.ca

Received: 29th Mayo 2015, **Returned for revision**: 2nd August 2015, **Accepted**: 25th October 2015.
Associate Editor: Fagua Alvarez Florez.

Citation / Citar este artículo como: Nemogá GR. Diversidad biocultural: innovando en investigación para la conservación. Acta biol. Colomb. 2016;21(1) Supl:S311-319. doi:http://dx.doi.org/10.15446/abc.v21n1sup.50920

RESUMEN

La conservación de la biodiversidad puede avanzar en forma ética y más eficaz enfocando simultáneamente la erosión biológica y cultural. Esta idea se encuentra en los postulados funcionales y éticos iniciales de la biología de la conservación. Sin embargo la investigación para la conservación ha enfatizado los inventarios, la cuantificación y la georreferenciación de la diversidad biológica con miras a su utilización. Se le asigna poca relevancia al valor intrínseco de la biodiversidad ante lo cual se hacen llamados a explorar formas apropiadas de "vivir con" la biodiversidad. Esta reflexión responde a ese llamado. Introduce el enfoque biocultural como una perspectiva más comprehensiva para reconocer e investigar las complejas interrelaciones entre procesos ecológicos y dinámicas culturales. Para la investigación se resalta de este enfoque la necesidad de reconocer los derechos de los pueblos indígenas y comunidades locales, al igual que las cosmovisiones que le dan sentido a las prácticas y relaciones que las comunidades establecen con el ambiente. Se explora la base de datos GrupLac del período 1991- 2010 en cuanto al registro de investigaciones sobre biodiversidad que involucran conocimiento tradicional y comunidades. Dado el limitado reconocimiento a las contribuciones de las comunidades, se reseñan las principales barreras que encuentra la adopción del enfoque biocultural en investigación. Se proponen premisas éticas orientadas a transformar actitudes y prácticas en investigación que desconocen derechos ancestrales sobre el territorio y el conocimiento, obstaculizan el reconocimiento del valor intrínseco de la biodiversidad, y como resultado impiden garantizar su conservación en un territorio biodiverso, pluriétnico y multicultural.

Palabras clave: biodiversidad, Colombia, conocimiento tradicional, ética en investigación, poblaciones indígenas.

ABSTRACT

The conservation of biodiversity may be deemed ethical and more effective by focusing simultaneously on biological and cultural erosion. This idea was in the functional and ethical principles of the initial understanding in conservation biology. However, biological conservation research has emphasized inventories, quantification and georeferencing biodiversity with utilitarian purposes. Such research gives little importance to the intrinsic value of biodiversity provoking calls to explore appropriate ways of "living with" biodiversity. This paper responds to that call. The biocultural approach offers a more comprehensive view to recognize and investigate the complex interrelationships between ecological processes and cultural dynamics. For research, this approach highlights the need to recognize the rights of indigenous peoples and local communities, as well as the community worldviews that infuse meaning to community practices and relations with the environment. This paper explores biodiversity research data involving traditional knowledge and communities during the period 1991- 2010 in the GroupLac Database. Given the limited recognition to the contributions of communities, this paper outlines the main barriers that the adoption of the biocultural approach faces. The paper proposes ethical guidelines to transform research attitudes and practices that ignore ancestral rights over the territory and

traditional knowledge, hinder the recognition of the intrinsic value of biodiversity, and as a result, prevent conservation in a biodiverse, multi-ethnic and multicultural territory.

Keywords: biodiversity, Colombia, traditional knowledge, indigenous peoples, research ethics.

RESUMO

A conservação da biodiversidade pode ser ética e mais eficaz focando simultaneamente a erosão biológica e cultural. Essa ideia encontra-se nos postulados éticos e funcionais iniciais da biologia da conservação. Entretanto, a pesquisa tem enfatizado inventários de conservação, quantificação e georreferenciamento da diversidade biológica, com vista à sua utilização. Pouca relevância tem sido atribuida ao valor intrínseco da biodiversidade, pelo qual são necessárias chamadas para explorar formas adequadas de "viver com" a biodiversidade. Essa reflexão responde a esse apelo. Ela introduz a abordagem biocultural como uma forma mais abrangente para reconhecer e investigar as inter-relações complexas entre processos ecológicos e dinâmicas culturais. Deste enfoque, ressalta-se a necessidade de reconhecer os direitos dos povos indígenas e comunidades locais, bem como as cosmovisões que dão o sentido às práticas e relações que as comunidades estabelecem com o meio ambiente. Explora-se o banco de dados do GroupLac para o período entre 1991-2010 no que respeita ao registo de pesquisas em biodiversidade envolvendo conhecimentos tradicionais e comunidades. Devido ao limitado reconhecimento às contribuições das comunidades, são delineadas as

principais barreiras para a adoção da abordagem biocultural na pesquisa. São propostas premissas éticas orientadas à transformação das atitudes e práticas na pesquisa que desconhecem os direitos ancestrais sobre o território e o conhecimento, dificultando o reconhecimento do valor intrínseco da biodiversidade e como resultado, impedem garantir sua conservação em uma nação biodiversa, multi-étnica e multicultural.

Palavras-Chave: biodiversidade, Colombia, conhecimento tradicional, ética em pesquisa, povos Indígenas.

"Although scientists have been leading voices in describing the hazards we face, their fragmented acquisition of knowledge creates a mosaic of disconnected bits and pieces that does not provide an overarching context to guide our actions". (Suzuki, 2006).

INTRODUCTION

Turnhout *et al*. (2013) have established the need of advancing in research and promotion of alternative ways that support, preserve, modify or re-invent relationships between nature and society. This preoccupation confirms the need to recognize and revitalize the relationships among human local communities and nature as bases for the preservation of biodiversity. This reflection about biodiversity research in Colombia matches with the need to adopt a vision that recognizes the interactions between biological and cultural diversity in research projects and programs. Given the present limitations, a biocultural focus is proposed in its central elements. Information on the Scienti de Colciencias platform is immediately examined to confirm the participation of indigenous and local communities in research processes. It is then shown that this participation predominantly occurs within a focus that excludes the recognition of their knowledge systems and their land rights. At the end, ethic arguments are formulated to transform attitudes and perspectives on research from the proposed approach.

The predominance of a technological and economic approach

In the mid 1980's the emergence of conservation biology was supported as an area of research that could provide tools and principles for the preservation of biodiversity. For example, Soule (1985) included functional hypotheses based on evolution as a guide and scientific basis for actions leading to counteract the loss of biodiversity. Nevertheless, in a relevant manner, he proposed tenets of deep ecology (Leopold, 1966; Naess, 1973, Devall and Sessions, 1985), among which he included as axiological premise the intrinsic value of biodiversity, independent from its potential, instrumental or utilitarian value.

Deep ecology had postulated a substantial reorientation in ecological thinking pointing to the immanent and equivalent value of each of the manifestations of life (biocentric egalitarianism) and the interconnection between human beings and nature as part of the same and unique reality (holism metaphysical) (Keller, 2008). So every action that demeans, disturbs, or affects the integrity of nature, also affects humans because the human species is not conceived as a discrete component, separate from nature from the deep ecology approach.

The convergence of researchers with theoretical and applied disciplinary traditions, the establishment of the Society for Conservation Biology (SBC) in 1987, the remarkable growth of the membership of SBC in subsequent years, the regular publication of the scientific journal *Conservation Biology* and the emergence of centers of activity and periodicals associated within and outside North America (eg, *Conservation Biology in Practice, NeoCons and Pacific Conservation Biology*) record the growing dynamics that characterized the consolidation of conservation biology as a field of research from the 1980's (Meine et al., 2006). Conservation biology stands historically around scientific and philosophical concern for the preservation of life, aware of the impacts of economic development, which manifest for example, in the irreversible transformation of strategic ecosystems such as tropical forests and extinction of species not yet studied or inventoried. The fundamental consensus on preserving biodiversity prompted researchers from different trajectories to go beyond their disciplines in joint searches for interdisciplinary research to find answers to problems of conservation (Meine et al., 2006). In contrast with the previous ecology and conservation science, the consensus underlying conservation biology since the 1980's reveals a commitment to preserve all forms of life and a concern for the rupture of relations between the human species and the environment, which itself carries a substantial valorative or normative load. Meine et al. (2006), detail and analyze the events that contributed to conservation biology's consolidation of its own scientific niche in theoretical and applied research in the twenty years after insertion. They conclude by recording that its founders identified the

impoverishment of our ecological heritage and the rupture of life's evolutionary potential as indicators of the social and spiritual uprootedness of the human community.

Three decades after conservation biology's inclusion as a field of research, the balance presented by Turnhout et al. (2013) suggest that ethical principles have not been fully implemented. On the contrary, assumptions that emphasize a technological dimension have been imposed. Soule (1985) bet that conservation biology would help to combine science and technology to address environmental problems. In 1992, the Convention on Biological Diversity (CBD 2016) incorporated biotechnology as an input for achieving the objectives of conservation and sustainable use (Art. 16, paragraph 1). However, CBD also introduced an economic and utilitarian dimension that included within the definitions of genetic and biological diversity, its potential or real value.

This dimension has influenced the investigation to focus primarily on the inventory, quantifying and mapping of different ecosystems, species and existing genotypes with the purpose of utilizing them. Turnhout et al., (2013) note the prevalence of this trend in the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) and make a call to explore proper ways to "live with" biodiversity. This call is based on the intrinsic value of biodiversity and the need to recognize and reformulate the relationship between the human community and nature to ensure the conservation of biodiversity.

A more comprehensive approach in research

The biocultural framework offers a more comprehensive approach to understanding nd conducting research on the complex interrelationships between ecological processes and cultural dynamics. This approach comes from the study and characterization of landscapes that were originally considered pristine or natural but that were proven to be highly mediated by human intervention. Through recognizing and documenting the presence and active role of human groups, research has shown that the structure, processes and conservation of both rainforests and boreal forests are permeated by the actions of local and indigenous communities (Correa, 1990; Denevan, 1992; Gómez-

Pompa and Kaus, 1992; Heckenberger et al., 2003; Berkes and Davidson-Hunt, 2006). Works done by Posey (1982) and Posey (1985) showed that the Kayapó people create "forest islands" (apêtê) in savanna areas as a result of their farming and transplantation practices between ecological zones. The recognition of the Kayapó people's lifestyles and belief systems provided insight into how their productive and social practices lead to the conservation of biodiversity (Posey, 1985; Posey, 1997; Posey, 1999; Posey, 2002). Based on the study of 45 initiatives on the conservation of biological, cultural and linguistic diversity, Maffi (2010) proposed an understanding of bioculturality as the interrelationship of life in all its manifestations -biological, cultural and linguistic- which have co-evolved within complex adaptive socio-ecological systems.

Various research efforts on these interrelationships concur within the biocultural framework under other terms; for example, the concept of Traditional Ecological Knowledge, coined in the context of research with indigenous communities in North America (Johnson, 1992;. Gadgil et al, 1993; Berkes et al., 2000; Pierotti and Wildcat, 2000). This concept includes knowledge, beliefs and practices of indigenous peoples about their relationships with other living organisms and environmental components; this knowledge is transmitted from one generation to another and illustrates the adaptive capacity of those human populations to ecological changing conditions. The notion of Collective Biocultural Heritage has a similar meaning for practices and customs in programs and local conservation initiatives of Andean ecosystems (Swiderska., 2006 Swiderska et al, 2009; Ishizawa, 2010).These various approaches have as a common characteristic the respect and recognition of the worldviews typical of indigenous and local populations that interact with particular ecosystems. In indigenous conceptions humans are intrinsically intertwined with nature, and the practice of mutual relations of coexistence generates knowledge about plants, animals and other nature components locally (Pierotti, 2011). In contrast, the scientific paradigm establishes the distinction between the subject and object of knowledge as a premise to the process of knowing that demands the formulation of complex and specific models that are not mediated by subjective convictions (Bacon, 1901; Popper, 1980; Bachelard, 1987 ; Descartes,

2005;). The researcher must be able to distance himself/herself from the object, fragment it and separate it into parts in the process of seeking verifiable and universal truths.

Premises of biocultural approach to research

There is a growing consensus that biodiversity conservation can be more effective, ethical and fair if the actions focus on simultaneously counteracting biological and cultural erosion (Turner et al., 2000; Turner et al, 2008;. McShane et al ., 2011; Davidson-Hunt et al, 2012). This guidance requires that local knowledge associated with biodiversity is taken as a premise to increasing the adaptive capacity of human and non-human communities (Gavin et al., 2015). Gavin and others propose a series of principles for structuring programs and projects from biocultural conservation approaches.

Among those principles is the need to recognize and respect the right of indigenous peoples and local communities over their territories. It is recognized that the conservation of bio-cultural diversity is inseparable from other central concerns of indigenous peoples, such as the right to self-determination, autonomy, food sovereignty, environmental security, intergenerational transmission of knowledge and the strengthening of cultural identity.

Another principle indicates that knowledge about nature, practices and innovations for the use and management of biodiversity are guided by worldviews that uphold meaningful experiences of human communities with the environment. This principle means overcoming the dominance and exclusivity of scientific knowledge to define conservation priorities and actions so as not to omit or subordinate these systems of local and indigenous knowledge. The adoption of these principles is central to the transformation of research from a biocultural approach and its relevance is shown below. The underlying motivation is the search for viable partnerships and agreements in which different approaches can meet to create knowledge and practices that help to preserve biological and cultural diversity.

Relations between researchers, indigenous peoples and local communities

Despite the constitutional inclusion of ethnic and cultural diversity in several Latin American countries, the collective rights of indigenous communities are not fully assumed. For example, when talking about their collectively-owned land some researchers use the euphemism "territories with ethnic influence." In Colombia, such language captures the persistence of a colonial ideology that conceives as the basis of nationality a homogeneous population without Indians or blacks, overlooking: first, that the 1991 charter redefined the legal and political foundations of the nation and second, that the Colombian territory is mediated by different cultures of indigenous origin, African descent, peasant, Rom, raizal, palenquero who continually unfold interactions with its geography and diverse ecosystems. When Nieto (2000) refers to the researchers of the botanical expedition under La Colonia, he notes that their economic and social interests prevented them from committing to a fully democratic ideology, leading them to accept relations of racial, social and economic marginalization of indigenous and black populations. Although the Spanish empire was overcome, scientific practices, sheltered by criteria of objectivity and neutrality, seem to contribute to research on biodiversity perpetuating the conditions of racial, social and economic marginalization in which indigenous, black and local communities, who interact with biodiversity.

In practice, since Mutis, research on biodiversity participates in the appropriation of nature and local knowledge through translating it into languages and scientific formats for the development of products that do not directly benefit people and communities (Nieto, 2000). The utilitarian implementation of the research by the then Spanish empire, looking for new species, and by the current Colombian government, sponsoring the search of biochemical components for economic exploitation, is significantly maintained. Modern bioprospecting is directed to find materials of biological origin which can be transformed into profitable products in international markets, such as quinine in colonial times. While research may respond to other needs, a thorough

characterization of the interrelationships between researchers from different disciplines and indigenous and local communities has not been carried out.

These interrelationships have been, and continue to be, numerous and diverse. This is confirmed by a preliminary review of the Colciencias platform National System of Science and Technology (ScienTI) between September 2011 and January 2012, covering the period 1991- 2010. The review focuses on the GrupLAC data base (Latinoamerica data and Caribbean Group) of the Colombia ScienTI-platform. It records biodiversity research activities done by researchers and research groups affiliated with universities and research institutes in the country. Although the GrupLAC data base does not generally include institutions with national or international independent funding, and researchers and groups do not keep their reports updated, the records found are indicative of the research activity that is linked with biodiversity knowledge of indigenous and local afro-descendant communities.
In this sense 542 records associated with 232 research groups in the country in different areas of knowledge (agricultural sciences, life sciences, health sciences, exact and earth sciences, human sciences, applied social sciences, engineering, linguistics, letters and arts) were identified. 542 records correspond to research in which products or projects explicitly refer to the use of communities' knowledge, mention interaction with indigenous or black communities during research, or the research is described through using the prefix "ethno" (ethnobotanical, ethnobiological, ethnoecology, etc.). It is found that the greater occurrence of the interaction coincides with high biodiversity regions like Chocó and tropical rain forests in the Amazon, both characterized by high biodiversity and the presence of large indigenous and black population. The knowledge of indigenous and local communities referenced in the data corresponds to information about uses of biodiversity as food, medicine or commercial applications which are extracted as useful data, while discarding the worldviews and cultural contexts that give them full meaning.

Preliminary data highlights the need to document and qualitatively characterize the relationships that researchers establish with communities as a basis for promoting research practices and specific ways of establishing networks that contribute to the proper and respectful inclusion of knowledge associated with the biodiversity of local and indigenous peoples. So far, the multiple relationships and the uses of traditional knowledge have not led to an institutional, legal and ethical framework in which the research will contribute to effectively protecting the rights of communities.

Challenges for the adoption of a biocultural approach to research

Research is not a neutral term, and it makes indigenous peoples from around the world feel uneasy (Smith, 1999; Bagele, 2012). It is common for researchers from different disciplines to enter indigenous territories without observing community protocols and to end up carrying out research projects that do not take into account the interests and needs of communities. The biocultural approach would help to establish mutual trust to facilitate research and promote the conservation of biological and cultural diversity (Nemogá, 2013). However, the practical application of the biocultural approach to research found several barriers:

The institutional and legal framework

The institutional framework for biodiversity research discourages researchers from acquiring additional commitments in the complex political, social and cultural context. Working with communities and ensuring their adequate and effective participation implies greater time and resources that sponsoring agencies, institutions and colleagues describe as expensive and unnecessary. The omission of consultation and the lack of prior informed consent are shortcuts to a comprehensive ethic in research on biodiversity in indigenous territories.

Prior consultation with the involved communities is rarely observed during research on biodiversity and genetic resources. Records of contracts for access to genetic resources show that consultation processes are filled at a very low proportion compared to

research in genetic resources *in situ* that takes place in Colombian territory. First, not all research on genetic diversity *in situ* has processed a contract to access genetic resources. Second, from a total of 105 contracts for access to genetic resources granted up to September 2014, prior consultation was given to only 15 cases for conducting research in collective territories, of which nine are investigations carried out by the National University of Colombia (PLEBIO-Database, 2013).

Emphasis on inventories and measuring biodiversity

Since 1990, environmental and academic institutions, articulated under the idea of sustainable development, took on programs and projects focused on genotypes and species inventories of diverse ecosystems. Institutional research efforts emphasize the focus on biodiversity as natural capital. Development plans and bioprospecting initiatives focus on biological and genetic diversity as natural wealth to develop new food and health products, handicrafts, cosmetics, ecotourism, among others. More and more, research is aimed towards the incorporation of biological and genetic diversity as inputs for economic development. The diversity of life, whether it is plants, animals or microorganisms, is progressively taken as an object that after being inventoried and mapped, must be manipulated, fragmented and used in industrial applications. The Science, Technology and Innovation System and the National Planning Department adamantly promote biodiversity as a competitive advantage for the development of biotechnology (Pacheco et al, 2008;. CONPES, 2008, CONPES, 2011; Melgarejo, 2013).

Local communities as providers of data

Indigenous, black and local communities, who have lived on their territory for several generations and are continuously adapting to ecological changes and developing relationships with "other non-human persons", are treated as storehouses of useful data. The majority of research on biodiversity focuses on collecting data to be integrated with segmented and temporary observations of the scientific theoretical framework (Ferguson et al., 1998). In these practices, worldview, belief systems, ethical principles and teachings that accompany the indigenous ways of life are

discarded as useless without realizing that they are essential for the deployment of the diversity of life and knowledge production (Pino et al., 2003).

Omission in the System of Science, Technology and Innovation

The measuring system in the Scienti platform promotes the registration of individual researchers and excludes the reality of knowledge systems of indigenous peoples and local communities. Tools designed to recognize knowledge and innovation production and their measurement are governed by criteria and quantitative indicators of individual production. Records of communities as knower and producer of knowledge on species, ecological relationships, and uses of biodiversity and conservation practices turns out to be unfeasible in the Scienti platform. This exclusion corresponds to the invariable absence of programs at universities recognizing the knowledge systems of indigenous peoples. An exceptional case is the Faculty of Education at the University of Antioquia that introduced a degree in Pedagogy of Mother Earth and research projects involving indigenous participants as researchers (Lopez Sierra, 2007). At the same time, academic and government institutions reject or ignore opportunities for training in higher education that indigenous peoples have autonomously built, such as the Indigenous Intercultural University of the Cauca Regional Indigenous Council (UAIIN-CRIC) (Bolaños, 2009, Pancho et al ., 2012).

Ethical considerations for research

The biocultural approach provides a basis to support a research ethic guided by the premise of "living with biodiversity". In indigenous worldviews land, plants, animals, mountains and rivers are part of a whole to which humans are integrated. In different indigenous worldviews, for example, plants and animals form a single community with humans and are treated and respected as living and sentient beings (Sherry and Myers, 2002). As a whole, humans and non-humans are conceived as a result of the same and only source of life, Mother Earth. This relationship of identity and community that extends with nature can be found in different indigenous worldviews and supports a different ethic (Feit, 1973).

This distinctive ethics in indigenous worldviews involves showing love and respect for other members of the extended natural community in various ways: repaying and thanking actions towards the earth; welcoming celebrations and caring for new seeds; following the principle of not taking more than necessary; and performing ceremonies accompanied by the use of plants and animals. In the Anishinabe's way of life, for example, soil, plants, rocks, rivers and animals are members of the Ahishinabe family (Hallowel, 1960). Hallowel (1960) and Nadasdy (2011) talk about "other non-human people" to describe the understanding of the relationships with those other members of the Anishinabe community in Canada and Yukon in Alaska, respectively. This recognition and relationship with "other non-human people" has been present also in the Amazonian cultures (Reichel-Dolmatoff, 1971; Posey, 1985; Posey, 1997).

The biocultural approach is based on admitting that the action of knowing is not an exclusive attribute of brains trained in fragmented disciplines of Western science (Posey, 1999; Watson and Huntington, 2008). It assumes that science offers partial results, fragmented, but is not able to provide a comprehensive understanding of all, as noted in the preface to this reflection. Before reacting to explanations that do not match the western epistemological and ontological framework, attributing them to mysticism, atavism or Barbarism, the biocultural approach invites the researcher to understand why such explanations work in other cultural communities (Watson and Huntington, 2008).

In Colombia, the constitutional recognition of indigenous peoples as collective subject holders of fundamental rights is a seminal principle for a plural society, including the recognition and effective protection of biocultural diversity. The judgments of the Constitutional Court on the right to self-determination and cultural identity; the right to collective property, resources and traditional knowledge; and the right to participation agree with an approach to the conservation of biocultural diversity that assumes the complexity of interactions between human communities and biodiversity. The study and

adoption of the biocultural approach provides an entry for transforming attitudes and practices that reject ancestral rights. Also, it can contribute to the recognition of the intrinsic value of biodiversity to ensure their preservation in a multiethnic and multicultural nation. Embracing this approach also has the potential to positively influence the ethical training of new generations of researchers. In sum, the biocultural approach can nurture research agendas agreed upon by academia and indigenous and local communities under terms of respect, trust and mutual recognition, aimed at preserving and reaping the benefits of an exceptional biological and cultural diversity.

CONCLUSIONS

The call of Turnhout et al. (2013) on the need to advance research and development of alternative ways to support, modify or re-invent mutual relations between nature and society is relevant to research in bioculturally diverse countries. In response to this call it is appropriate to adopt the biocultural approach to research.

This approach is relevant because the biodiverse Colombian territory is mediated by different cultural formations of indigenous and African descent as well as peasant, rom, raizal, and palenquero that enrich their interactions with geography and diverse ecosystems. Several reviewed investigations have documented and reiterated the active role of human groups, showing that the structure and processes of biodiversity and its conservation are permeated by the actions of local and indigenous communities. These investigations are characterized by the acceptance and recognition of the indigenous and local populations' worldviews present in different ecosystems.

Contrary to the adoption of a biocultural approach, institutional research efforts emphasize the focus on biodiversity as natural capital and its industrial use. Gradually bioprospecting has been incorporated as a pillar of economic development in a government vision driven by Colciencias and the National Planning Department,

ignoring the relevance of the country's cultural diversity for research and conservation of biodiversity.

The explicit link of Afro-descendants, indigenous, and local communities within research processes on biodiversity in Colombia, demonstrated in the data base GroupLac for the 1991- 2010 period, has not propelled a transformation of relationships between researchers and communities. The biocultural approach is a way to build relationships of mutual trust and partnerships that facilitate research and promote the conservation of biological and cultural diversity. However, the adoption of the biocultural approach finds several limitations: the institutional and legal order, the emphasis on inventory and measurement of biodiversity, and the role assigned to communities as mere providers of research data.

In this context, respect for the collective rights of indigenous peoples and local communities, and the observation of community protocols typical of a biocultural approach in collective territories, offers an ethical path that is more efficient for biodiversity conservation. The study and application of the biocultural approach is offered as a framework for generating new relationships between researchers and communities that contribute to the preservation of biological and cultural diversity. Partnerships and alternative approaches would not be necessary if science could proclaim that present threats against life diversity and earth’s ecosystems are known and controlled, which would contradict what was warned by the founders of conservation biology in the mid 1980's.

THANKS

Students of post-graduate seminar Biocultural Diversity Conservation: Balancing Scientific and Indigenous Knowledge Practices, Winter 2015, University of Winnipeg, Canada, for inputs for reflection; organizer professors of the Public Lecture José Celestino Mutis :"Biology: Building Country 2015" session "Genetic Resources, Intellectual Property and Bioprospecting", Bogotá, National University of Colombia, who motivated me to advance this writing; to the academic peer reviewers and to Dali A. Rojas who supported the editing of the manuscript.

The English version was supported by University of Winnipeg funding and the work of Laura J. Nemogá and Natalie Bartmes, both students at this University.

References

Bacon F, Novum Organum. Devey J. Ed., Nueva York: P.F. Collier 1902. 333 p.

Bachelard G. La formación del Espíritu Científico. México: Editorial Siglo XXI; 2004. 306 p.

Bagele CH. Indigenous Research Methodologies. Los Angeles: SAGE Publications; 2012. 368 p.

Berkes F, Coldin J, Folke C. Rediscovery of Traditional Ecological Knowledge as Adaptive Management. Ecol Appl. 2000;10(5):1251-1262. Doi: 10.1890/1051-0761(2000)010[1251:ROTEKA]2.0.CO;2

Berkes F, Davidson-Hunt I. Biodiversity, Traditional Management Systems, and Cultural Landscapes: Examples from the Boreal Forest of Canada.Int Soc Sci J. 2006;58(187):35-47. Doi:10.1111/j.1468-2451.2006.00605.x

Berkes F. Sacred Ecology: Traditional Eecological Knowledge and Resource Management. New York: Routledge; 2008. 336 p.

Bolaños de Tattay G. Desde la Escuela y Hasta la Universidad: Educación Propia para un Buen y Mejor Gobierno. In: López LE, editor. Interculturalidad, Educación y Ciudadanía: Perspectivas Latinoamericanas. La Paz: Plural Editores; 2009. p. 355-376.

Consejo Nacional de Política Económica y Social (CONPES). Política Nacional de Competitividad y Productividad Conpes. Documento Conpes 3527. Bogotá: Departamento Nacional de Planeación; 2008. 83 p.

Consejo Nacional de Política Económica y Social (CONPES). Política para el Desarrollo Comercial de la Biotecnología a partir del Uso Sostenible de la Biodiversidad. Documento Conpes 3697. Bogotá: Departamento Nacional de Planeación; 2011. 36 p.

Convenio de Diversidad Biológica (CDB). Secretariat of the Convention on Biological Diversity. [Internet]. [Fecha de acceso 2016, Feb 4]. Available from https://www.cbd.int/convention

Correa F, editor. La Selva Humanizada. Ecología Alternativa en el Trópico Húmedo Colombiano. Bogotá: ICAN-Fondo FEN Colombia-Fondo Editorial CEREC; 1990. 255 p.

Denevan WM. The Pristine Myth: the Landscape of the Americas in 1492. Ann Assoc Am Geogr 1992;82(3):369-385.

Davidson-Hunt IJ, Turner KL, Te Pareake Mead A, Cabrera-Lopez J, Bolton R, Idrobo CJ, *et al*. Biocultural Design: A New Conceptual Framework for Sustainable Development in Rural Indigenous and Local Communities. SAPIENS [Internet]. 2012[Cited 2014, Abril 1];5(2):33-45. Available from: http://sapiens.revues.org/1382

Descartes R. Discurso del Método y Meditaciones Profundas. Madrid: Espasa Calpe; 2010. 97 p.

Devall B, Sessions G. Deep Ecology: Living as if Nature Mattered. Salt Lake City, Utah: G. M. Smith; 1985. 267 p.

Feit H. The Ethno-ecology of the Waswanipi Cree; or How Hunters Can Manage Their Resources. In: Cox B, editor. Cultural Ecology. Toronto: McClelland and Stewart; 1973. p. 115-125.
Ferguson Ma, Williamson Rg, Messier F. Inuit Knowledge Of Long-Term Changes In A Population Of Arctic Tundra Caribou. Arctic. 1998;51(3):201-219.
Gadgil M, Berkes F, Folke C. Indigenous Knowledge for Biodiversity Conservation. Ambio. 1993;22:151-156.
Gavin MC, Mccarter J, Mead A, Berkes F, Stepp JR, Peterson D, *et al*. Defining Biocultural Approaches to Conservation. Trends Ecol Evol. 2015;30(3):140-145. Doi:10.1016/j.tree.2014.12.005
Gómez-Pompa A, Kaus, A. Taming the Wilderness Myth. BioScience. 1992;42(4):271-279.
Grupo de Investigación Política y Legislación Sobre Biodiversidad, Recursos Genéticos y Conocimiento Tradicional (PLEBIO). Base de Datos ARG. Bogotá.; 2013.
Hallowel I. Ojibwa Ontology, Behavior and Worldview. In: Diamond S, editor. Culture and History: Essays in Honor of Paul Radin. New York: Columbia University Press; 1960. p. 19-52.
Heckenberger M, Kuikuro A, Kuikuro UT, Russell JC, Schmidt M, Fausto C. Amazonia 1492: Pristine Forest or Cultural Parkland?. Science. 2003;30(5640):1710-1714. Doi: 10.1126/science.1086112
Ishizawa J. Affirmation of Cultural Diversity – Learning with the Communities in the Central Andes. In: Tauli-Corpus V, Enkiwe-Abayao L, De Chavez R, editors. Towards an Alternative Development Paradigm: Indigenous People's Self-Determined Development. Baguio City: Tebtebba Foundation; 2010. p. 205-247.
Intergovernmental Platform On Biodiversity & Ecosystems Services [Internet]. 2015 [Cited 2015 Feb 9]. Available from: http://www.ipbes.net/
Johnson M. Lore: Capturing Traditional Environmental Knowledge. Ottawa: IDRC; 1992. 190 p.
Keller D. Deep Ecology. In Callicot J, Frodeman R, editors. Encyclopedia of Environmental Ethics and Philosophy. Volumen 1. Farmington Hills, MI: Thomson Gale; 2009. p. 206-211.
Leopold A. A Sand County Almanac. Oxford: Oxford University Press; 1966. 269 p.
López G, Sierra Z. Presentación. Educación y Pedagogía. 2007;19(49):9-18. Fecha de acceso: 09 Feb. 2016. Disponible en: http://aprendeenlinea.udea.edu.co/revistas/index.php/revistaeyp/article/view/6629/6072
Maffi L, Woodley E. Biocultural Diversity Conservation: A Global Sourcebook. London: Earthscan; 2010. 224 p.
Meine C, Soule M, Noss R. A Mission-driven Discipline: the Growth of Conservation Biology. Conservation Biol. 2006;20(3):631–651. Doi: 10.1111/j.1523-1739.2006.00449.x
Melgarejo ML. Bioprospecting as a possible development mechanism for Colombia. Acta biol Colomb. 2013;18(1):19-30. Fecha de acceso: 09 Feb. 2016. Disponible en: <http://www.revistas.unal.edu.co/index.php/actabiol/article/view/33444/40205>.

Mcshane TO, Hirsch PD, Tran CT, Songorwa AN, Kinzig A, Monteferri B, *et al*. Hard Choices: Making Trade-offs Between Biodiversity Conservation and Human Well-being. Biol Conserv. 2011;144(3):966-972. Doi: 10.1016/j.biocon.2010.04.038
Nadasdy P. "We Don't Harvest Animals; We Kill Them": Agricultural Metaphors and the Politics of Wildlife Management in the Yukon. In: Goldman M, Nasdady P, Turner MD, editors. Knowing Nature: Conversations at the Intersection of Political Ecology and Science. Chicago: University of Chicago Press; 2011. 145 p.
Naess A. The Shallow and the Deep, Long-range Ecology Movement. A Summary. Inquiry, 1973;16(1):95-100.
Nemogá G. Investigación Genética y Políticas sobre Biodiversidad: Escenarios para el Reconocimiento de la Diversidad Étnica y Cultural. Bogotá: Ibáñez Editores; 2013. 144 p.
Nieto M. Remedios para el Imperio: Historia Natural y la Apropiación del Nuevo Mundo. Bogotá: Instituto Colombiano de Antropología e Historia; 2000. 280 p.
Pancho A, Bolaños de Tattay G, Manios S, Chavaco A, Viluche J, Sisco M, *et al*.. Educación Superior Indígena en Colombia: Una Apuesta de Futuro y Esperanza. 3ª Ed. Popayán: IESALC-UNESCO, PEBI-CRIC; 2012. 174 p.
Pacheco MD, Castellanos O, Carrizosa S, Jiménez C, Clavijo A, DEL Portillo P. La biotecnología, Motor de Desarrollo para la Colombia de 2015. Bogotá : Colciencias; 2008. 264 p.
Pierotti R, Wildcat R. Traditional Ecological Knowledge: The Third Alternative, (Commentary). Ecol Appl. 2000;10(5):1333-1340. Doi: 10.1890/1051-0761(2000)010[1333:TEKTTA]2.0.CO;2
Pierotti R. Indigenous Knowledge, Ecology and Evolutionary Biology. New York: Routledge; 2011. 198 p.
Pino W, Guerrero J, Castro A, Castro AA, Palacios J, Castro A. Extracción artisanal de colorants naturales, una alternativa de aprovechamiento de la diversidad biológica del Chocó, Colombia. Acta biol Colomb. 20011;8(2):95-98. Fecha de acceso: 09 Feb. 2016. Disponible en: Disponible en: <http://www.revistas.unal.edu.co/index.php/actabiol/article/view/26674/26963>
Popper K. La Lógica de la Investigación Científica. Madrid: Editorial Tecnos; 1980. 451 p.
Posey DA. Nomadic Agriculture of the Amazon. Garden:New York Botanical Garden Magazine) 1982. 6(1):18-24.
Posey DA. Indigenous Management of Tropical Forest Ecosystems: the Case of the Kayapó Indians of the Brazilian Amazon. Agroforestry Systems. 1985;3-2:139-158. Doi: 10.1007/BF00122640
Posey DA. The Kayapó: the Role of Intellectual Property in Resource Management in the Brazilian Amazon. In: Posey DA, Dutfield G, editors. Indigenous Peoples and Sustainability: Cases and Actions. Utrecht: IUCN and International Books; 1997. p. 240-254.
Posey DA. Introduction: Culture and Nature – The Inextricable Link. In: Posey DA, editor. Cultural and Spiritual Values of Biodiversity. London: United Nations Environmental Programme, Intermediate Technology Publications; 1999, p. 3-18.

Posey DA. Kayapó Ethnoecology and Culture. Plenderleith K, editor. London: Routledge; 2002. 255 p.
Reichel-Dolmatoff G. Amazonian Cosmos: The sexual and Religious Symbolism of the Tukano Indians. Chicago: University of Chicago Press; 1971. 290 p.
Sherry E, Myers H. Traditional Environmental Knowledge in PracticeSoc Nat Resour. 2002;15(4):345-358. Doi: 10.1080/089419202753570828.
Smith LT. Decolonizing Methodologies: Research and Indigenous Peoples. London: Zed Books Ltd; 1999. 208 p.
Soulé M.E. What is Conservation Biology?. BioScience. 1985;35:727-734.
Suzuki DA. Personal Foreword: The Value of Native Ecologies. In: Knudtson P, Suzuki D, editors. Wisdom of the Elders: Sacred Native Stories of Nature. New York: Bantam Books; 2006. xxvii-xliv.
Swiderska K. Banishing the Biopirates: a New Approach to Protecting Traditional Knowledge. Gatekeeper series / International Institute for Environment and Development, Sustainable Agriculture and Rural Livelihoods Programme. London: IIED; 2006. 129 p.
Swiderska K, Argumedo A, Song Y, Li J, Pant R, Herrera H, *et al*. Protecting Community Rights over Traditional Knowledge: Implications of Customary Laws and Practices. Key Findings and Recommendations 2005-2009. London: IIED; 2009. 21 p.
Turner N, Boelscher M, Ignace R. Traditional Ecological Knowledge and Wisdom of Aboriginal Peoples in British Columbia. Ecol Appl. 2000;10(5):1275-1287. Doi: 10.1890/1051-0761(2000)010[1275:TEKAWO]2.0.CO;2
Turnhout E, Waterton C, Neves K, Buizer M. Rethinking Biodiversity: from Goods and Services to "Living with". Conserv Lett. 2013;6:154-161. Doi: 10.1111/j.1755-263X.2012.00307.x
Watson A, Huntington O. They're here- I can feel them: the Epistemic Spaces of Indigenous and Western Knowledges.Soc Cult Geogr. 2008;9(3):257-281. Doi: 10.1080/14649360801990488