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Review

How are legal matters related to the access of traditional knowledge being considered in the scope of ethnobotany publications in Brazil?

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ABSTRACT

Legal measures, such as the use of free or prior and informed consent, return of research results to communities (which can be understood as "sharing of benefits," according to Brazilian legislation), and research authorization by governmental bodies, are mentioned and regulated in various documents, either governmental or specific, within the area of ethnobiology. This study aims to explore how these matters are considered in the scope of published ethnobotany articles in Brazil, as well as whether the creation of the Provisional Measure 2.186-16/2001 has contributed to the national advance of these matters. The methodology comprised a literature review of articles focusing on medicinal and food plant resources in the prominent Brazilian journals which publish ethnobotany studies. From 137 articles analyzed, 8 mentioned the return of research results to the community; 21 explicitly cited the use of free or prior and informed consent; and 13 mentioned the authorization of governmental bodies. We expect that the present study will contribute to the debate regarding the necessity of reformulation of the current system, which would guarantee a more effective rapport between the government, researchers, local communities, and society and contribute to the development of ethnobotany in Brazil.

Keywords: Brazil, Council of Genetic Heritage Management (CGEN), literature review, Provisional Measure, traditional knowledge

Introduction

The use of genetic resources and associated traditional knowledge has been conducted for a long time in an asymmetric manner. Historically, many natural resources have been appropriated by developed countries without proper access request from, prior consent of, or benefit-sharing with countries and communities, which originally provided and detained such resources (MMA 2013). This reality was justified by the ease of facilitated access to genetic resources before the Convention of Biological Diversity (CBD) (Cunha 1999; MMA 2005; Andrade *et al*. 2013; Ferreira & Sampaio 2013). In addition, within the realm of science, during the pre-CBD phase, interactions between researchers and the use of biodiversity was not regulated by specific norms regarding access to resources and associated traditional knowledge as well as potential political, economic, and social implications resulting from some studies (Albuquerque *et al*. 2013). In contrast, intellectual property and patents have been regulated by international mechanisms, which are not often compatible with the free circulation of local knowledge (Cunha 1999).

During the 1980s, the first international regulatory body for the access of phytogenetic resources was created: The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) was adopted during the 22nd Food and Agriculture (FAO) conference in 1983 and signed by 133 countries (Santilli 2009). According to Cunha (1999), strong resistance to the generalized privatization of resources (the principle of free access without restrictions) during the 1970s and beginning of 1980s was the reason for instituting such a regulatory body.

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The United Nations Conference on Environment and Development/Earth Summit in Rio de Janeiro, in 1992, approved the CBD text signed by 157 countries, including Brazil (Santilli 2009), and projected changes in the manner biodiversity would be used and explored (MMA 2005; Andrade *et al*. 2013). The CBD recognized the sovereignty of the signatory countries over their biological resources (MMA 2000; Ferreira & Sampaio 2013), and established that the authority to govern access to genetic resources belongs to national governments under national legislation (MMA 2000; Santilli 2009). Moreover, it was decreed that researchers have a duty of sharing the benefits of their research, and acknowledged that local and indigenous communities have rights over their knowledge (MMA 2013) and therefore researches should always respect an established prior consent process (Santilli 2009; Bernardocki 2013).

Among CBD participant countries, Brazil was one of the first megadiverse countries that attempted to implement the convention objectives and to adopt an internal regimen for protecting and controlling the access of genetic resources and associated traditional knowledge, through the draft bill 306/1995 (Santilli 2013; Ferreira & Sampaio 2013). Three years later, in 1998, two other bills, including Brazilian genetic assets under the Union's authority were presented (MMA 2005). In the early 2000s, after a series of accusations of biopiracy involving a Brazilian association and a pharmaceutical company (Ferreira & Sampaio 2013), the federal government released the Provisional Measure (PM) 2.052 on June 29, 2000 (Andrade *et al*. 2013). This bill was modified and reedited as the PM 2.186-16 on August 23, 2001; it is still in force today, and establishes norms for regulating access to genetic resources and associated traditional knowledge in Brazil (MMA 2005).

The PM 2.186-16/2001 also created the Council of Genetic Heritage Management (CGEN). This council is responsible for deliberating processes related to access to genetic assets for bioprospecting and technological development, access to associated traditional knowledge for any objective, and accreditation of depositary institutions (MMA 2005). Ethnobiologists who already followed the Code of Ethics from the International Society of Ethnoecology, which was drafted in 1988 through the Declaration of Belém, now had to prove their ethical integrity and validate their work before conducting any research activities (Albuquerque *et al*. 2013). In addition to creating the PM 2.186-16/2001 and the CGEN, it is important to emphasize that during 2001, the International Treaty on Plant Genetic Resources for Food and Agriculture was expanded to focus on conservation and sustainable use of plant genetic resources, agriculture, and the fair and equitable sharing of benefits, thus guaranteeing the rights of farmers to agrobiodiversity (Santilli 2009).

The use and application of prior and informed consent, benefit-sharing with involved communities, and project authorization by governmental bodies are legal measures guided and shared not only by the CBD norms, PM 2.186-16/2001, and CGEN but also by the Brazilian Society of Ethnobiology and Ethnoecology. In addition, prior informed consent is also required by the Health National Council's resolution 196/1996. Moreover, there is extensive literature published in Brazil and other countries highlighting the importance of abiding by these legal measures. In Brazil, for example, prior and informed consent is regarded as a fundamental aspect in the methodology of scientific activities (Albuquerque & Hanazaki 2006; Albuquerque *et al*. 2010a); others emphasize the importance of returning results to communities and the sharing of benefits (Patzlaff & Peixoto 2009; Albuquerque *et al*. 2010b).

In this article, we consider that access authorization is regarded as authorization granted through the process of submitting projects, which involves providing access to genetic resources and associated traditional knowledge to governmental bodies designated by the PM 2.186-16/2001 and later norms related to this PM, such as CGEN, Brazilian Institute for the Environment and Natural Resources (IBAMA), Indian National Foundation (FUNAI), National Council for Scientific and Technological Development (CNPq), National Historic and Artistic Heritage Institute (IPHAN), and Research Ethics Committees of the Universities, which could vary depending on the theme and objectives of the research (MMA 2005; Ferreira & Sampaio 2013). It is important to emphasize that our focus is on the traditional knowledge associated with genetic resources and not on the authorizations required in the context of bioprospecting and technological development. In addition, according to the National Health Council's Resolution 196/1996, all research directly or indirectly involving humans is subject to the approval of Ethics Committees (Albuquerque *et al*. 2010a).

Free or prior and informed consent is understood here as a mandatory document to be attached to the research project and sent to the appropriate regulatory institutions as a prerequisite for obtaining the authorization for research activities (MMA 2005). This document must include information regarding the main steps of the research, such as the objective, methods, and techniques to be employed, as well as other information important to clarify and anticipate questions from the participants (Albuquerque *et al*. 2010a). In addition, the document must address identity protection for participants in the processes of collecting data and publication (Albuquerque *et al*. 2010a).

With regard to returning information to the people or sharing the results with the groups or communities studied, it is important to highlight that this measure can be a dynamic process that can also be seen as more applied activities, achieved by returning information in a systematic manner, in the forms of field guides and talks, among others (Patzlaff & Peixoto 2009; Albuquerque *et al.* 2010b) or actions developed to contribute to local development, considering their problems, demands, and collective interests (Albuquerque *et al*. 2010b). Moreover, returning and sharing information can involve participatory research and

educational approaches that may require a wide approach toward acknowledging traditional knowledge and culture.

Although there have been historical and political milestones and increased research on this theme (Bridges 2004; MMA 2005; Albuquerque & Hanazaki 2006; Patzlaff & Peixoto 2009; Albuquerque *et al.* 2010b), some authors have expressed concerns regarding ethical conduct and practices by certain researchers in ethnobiology, an interdisciplinary field that originated between biological and human sciences.

In the context of how research has been conducted and the issue of compliance with legal norms, this study aims to analyze how the results of ethnobotany research are shared with communities and how prior and informed consent and authorization of governmental bodies have been considered in articles published in the prominent Brazilian ethnobotany journals, through a bibliographic review. In addition, we aim to discuss how the creation of the PM 2.186-16/2001 has contributed to advance and improve the maturity of the considerations regarding these issues in Brazil. Our objective is to foster reflection and debate regarding the interaction among research, government, and societal spheres in relation to legal aspects and involving access to genetic resources and associated traditional knowledge.

Material and methods

We conducted a literature review for ethnobotany articles published in Brazilian journals: *Acta Amazônica, Acta Botanica Brasilica*, *Anais da Academia Brasileira de Ciências*, *Boletim do Museu Paraense Emílio Goeldi (Boletim de Ciências Naturais/ Ciências Humanas)*, *Ethnobiology and Conservation*, *Biotemas*, *Revista Brasileira de Biociências, Revista Brasileira de Farmacognosia*, *Revista Brasileira de Plantas Medicinais*, and *Rodriguésia.* These journals were selected based on analysis of the prominent ethnobotany studies published in journals in Brazil (Liporacci 2014). Articles were accessed according to their availability on journal websites, from their first volumes to the latest publication until 2012. Selected articles necessarily included local knowledge and food and/or medicinal species use. It is important to highlight that studies under an ethnobotanical/ethnopharmacological interface as well as those performed on open markets were also considered in this review.

Due to various ways by which authors treated research themes, it was necessary to develop a set of criteria for their classification. Returning or sharing data and results with communities was classified under three categories: *accomplished*, *suggested*, and *not mentioned*. An *accomplished* return of information to communities was when authors described what was performed and how it contributed to local communities; a *suggested* return was when authors suggested some type of measure; and return *not mentioned* when authors did not mention in any way the accomplishment, pretension, or suggestion of a return of data and results to the communities. Prior and informed consent was also divided into three categories: *explicit consent*, *implicit consent*, and *consent not mentioned*. The first refers to whenever articles made a clear statement of how prior and informed consent was guaranteed; the second refers to articles that did not make a clear statement about the use of prior and informed consent; and the last did not mention prior and informed consent at all. As for authorization by governmental bodies, we analyzed whether this process was mentioned, regardless of studied groups and possible exceptions within present legislation.

Additionally, we analyzed norms used by selected journals to investigate whether they mentioned publishing requirements related to the studied ethical and legal matters. Finally, a temporal analysis was performed to verify whether the creation of the PM 2.186-16/2001 has contributed to an increase in legal and ethical considerations by authors within the selected articles.

Results

A total of 137 articles were compiled from 1977 to 2012. The majority of the articles were from *Acta Botanica Brasilica* and *Revista Brasileira de Plantas Medicinais* (Tab. 1).

From all the analyzed articles, 53.28% did not mention any pretention to return data to communities, whereas 40.88% suggested some type of activity and only 5.84% mentioned accomplished actions of returning data to communities (Tab. 2).

Prior and informed consent was not mentioned in 72.99% of the articles. In 11.68% of articles, it is not clear whether this was employed, and in only 15.33% did authors mention the use of prior and informed consent (Tab. 2).

Only 13 articles mentioned research authorization by regulating governmental bodies. Of these, six had authorization from the Ethics Committee of the involved institution, three mentioned only an authorization by the CGEN, two mentioned authorization by the CGEN and Ethics Committee, and one article mentioned authorization by a different regulating body such as IBAMA through the Biodiversity System of Authorization and Information. Moreover, some authors presented numerous authorization processes, highlighting the diversity of ways in which legal aspects can be mentioned in articles.

With regard to the analysis of legal and ethical norms by the scientific journals studied, we did not find any requirements concerning the return of results to the communities. As for prior and informed consent, only the *Ethnobiology and Conservation* journal mentioned that authors must indicate consent from local informants. In terms of authorization by governmental bodies, there were requirements in four journals: *Revista Brasileira de Farmacognosia*, *Acta Amazônica*, *Anais da Academia Brasileira de Ciências*, and *Ethnobiology and Conservation*. Within *Acta Amazônica* guidelines, there is a specific item concerning legal and ethical aspects, which clarifies the organs that are suitable

Table 1. Articles selected for the literature review, classified according to decade.

1970-1979 (1 ARTICLE)	1980-1989 (2 ARTICLES)	1990-1999 (1 ARTICLE)
Anderson 1977	Miller *et al.* 1989; Grandi *et al.* 1989	Rodrigues 1998
2000-2009 (86 ARTICLES)		
Castellucci *et al.* 2000; Costa-Neto & Oliveira 2000; Dorigoni *et al.* 2001; Garlet & Irgang 2001; Marodin & Baptista 2001; Parente & Rosa 2001; Albuquerque & Andrade 2002; Amorozo 2002; Ghedini *et al.* 2002; Marodin & Baptista, 2002; Pinheiro 2002; Ritter *et al.* 2002; Silva & Andrade 2002; Barbosa & Pinto 2003; Nunes *et al.* 2003; Verde *et al.* 2003; Fonseca-Kruel & Peixoto 2004; Macedo & Ferreira 2004; Medeiros *et al.* 2004a; Medeiros *et al.* 2004b; Rocha *et al.* 2004; Soares *et al.* 2004; Albuquerque *et al.* 2005; Alvino *et al.* 2005; Bueno *et al.* 2005; Macedo & Ferreira 2005; Martins *et al.* 2005; Martins & Oliveira 2005; Morais *et al.* 2005; Pasa *et al.* 2005; Pereira *et al.* 2005a; Pereira *et al.* 2005b; Rocha & Silva 2005; Silva & Albuquerque 2005; Silva & Andrade 2005; Andrade *et al.* 2006; Azevedo & Silva 2006; Borba & Macedo 2006; Botrel *et al.* 2006; Christo *et al.* 2006; Falcão *et al.* 2006; Ferraz *et al.* 2006; Franco & Barros 2006; Freitas & Fernandes 2006; Hanazaki *et al.* 2006; Pilla *et al.* 2006; Pinto *et al.* 2006; Rodrigues & Guedes 2006; Roman & Santos 2006; Silva *et al.* 2006a; Silva *et al.* 2006b; Souza & Felfili 2006; Vendruscolo & Mentz 2006; Zeni & Bósio 2006; Florentino *et al.* 2007; Maioli-Azevedo & Fonseca-Kruel 2007; Marinho *et al.* 2007; Negrelle & Fornazzali, 2007; Negrelle *et al.* 2007; Ribeiro *et al.* 2007; Rodrigues & Carvalho 2007; Souza 2007; Vieira *et al.* 2007; Yuyama *et al.* 2007; Calábria *et al.* 2008; Cunha-Lima *et al.* 2008; Melo *et al.* 2008; Miranda & Hanazaki, 2008; Rufino *et al.* 2008; Santos *et al.* 2008; Silva & Proença 2008; Baldauf *et al.* 2009; Borges & Peixoto 2009; Castro *et al.* 2009; Eichemberg *et al.* 2009; Fonseca-Kruel *et al.* 2009; Jesus *et al.* 2009; Lanini *et al.* 2009; Leitão *et al.* 2009; Marchese *et al.* 2009; Oliveira & Trovão 2009; Pilla & Amorozo 2009; Pires *et al.* 2009; Santos *et al.* 2009; Scoles 2009; Ustulin *et al.* 2009.		
2010-2012 (47 ARTICLES)		
Albertasse *et al.* 2010; Almeida & Bandeira 2010; Althaus-Ottman *et al.* 2010; Barroso & Hanazaki 2010; Carneiro *et al.* 2010; Carniello *et al.* 2010; Christo *et al.* 2010; Costa & Mitja 2010; Giraldi & Hanazaki 2010; Merétika *et al.* 2010; Oliveira *et al.* 2010a; Oliveira *et al.* 2010b; Oliveira *et al.* 2010c; Roque *et al.* 2010; Silva *et al.* 2010; Silva & Freire 2010; Zuchiwschi *et al.* 2010; Brito & Senna-Valle 2011; Costa & Mayworm 2011; Cunha & Bortoloto 2011; Gandolfo & Hanazaki 2011; Lima *et al.* 2011; Marinho *et al.* 2011; Oliveira *et al.* 2011; Mattos *et al.* 2012; Miranda & Hanazaki *et al.* 2011; Siviero *et al.* 2011; Silva *et al.* 2011; Aguiar & Barros 2012; Araújo & Amorozo 2012; Brito & Senna-Valle 2012; Castro *et al.* 2012; Chaves & Barros 2012; Cunha-Lima *et al.* 2012; Espinosa *et al.* 2012; Freitas *et al.* 2012; Gomes & Bandeira 2012; González-Perez *et al.* 2012; Lima *et al.* 2012; Lucena *et al.* 2012; Nunes *et al.* 2012; Oliveira & Menini-Neto 2012; Paulino *et al.* 2012; Poderoso *et al.* 2012; Rosa *et al.* 2012; Santos & Coelho-Ferreira 2012; Siviero *et al.* 2012.		

Table 2. Number of articles per journal for the categories of returning/sharing results and prior and informed consent.

JOURNALS	RETURN OF RESEARCH RESULTS TO THE COMMUNITIES			PRIOR AND INFORMED CONSENT			Total Selected Articles by journal
	Accomplished	Suggested	Not mentioned	Implicit	Explicit	Not mentioned	
Revista Brasileira de Plantas Medicinais	2 (5%)	19 (47.5%)	19 (47.5%)	3 (7.5%)	4 (10%)	33 (82.5%)	40
Revista Brasileira de Farmacognosia	0	3 (14.29%)	18 (85.71%)	2 (9.52%)	4 (19.05%)	15 (71.43%)	21
Acta Botanica Brasilica	4 (8.51%)	22 (46.81%)	21 (44.68%)	10 (21.28%)	9 (19.15%)	28 (59.57%)	47
Rodriguesia	1 (16.67%)	2 (33.33%)	3 (50%)	1 (16.67%)	1 (16.67%)	4 (66.66%)	6
Acta Amazônica	0	3 (27.27%)	8 (72.72%)	0	0	11 (100%)	11
Revista Brasileira de Biociências	0	2 (40%)	3 (60%)	0	1 (20%)	4 (80%)	5
Anais da Academia Brasileira de Ciências	1 (100%)	0	0	0	0	1 (100%)	1
Biotemas	0	2 (66.67%)	1 (33.33%)	0	1 (33.33%)	2 (66.67%)	3
Revista Museu Goeldi	0	2 (100%)	0	0	0	2 (100%)	2
Ethnobiology and Conservation	0	1 (100%)	0	0	1 (100%)	0	1
TOTAL	**8 (5.84%)**	**56 (40.88%)**	**73 (53.28%)**	**16 (11.68%)**	**21 (15.33%)**	**100 (72.99%)**	**137**

for research authorization, and there is a requirement for a protocol number and approval date. *Revista Brasileira de Farmacognosia* requires only authorization by the Ethics Committee from the institution from which the research originates. *Anais da Academia Brasileira de Ciências* and *Ethnobiology and Conservation* require authors to mention the Ethics Committee approval within the Material and Methods section. Among the aforementioned four journals, only *Ethnobiology and Conservation* clearly mentions that a lack of legal procedures may result in a rejection of manuscripts by reviewers.

Temporal and historical analyses highlight the presence of two distinct periods (Fig. 1): the first, between 1977 and 2000 (referring to the date of the oldest selected article to the year of the enactment of PM 2.186-16/2001), and the second, between 2001 and 2012 (referring to the year of the

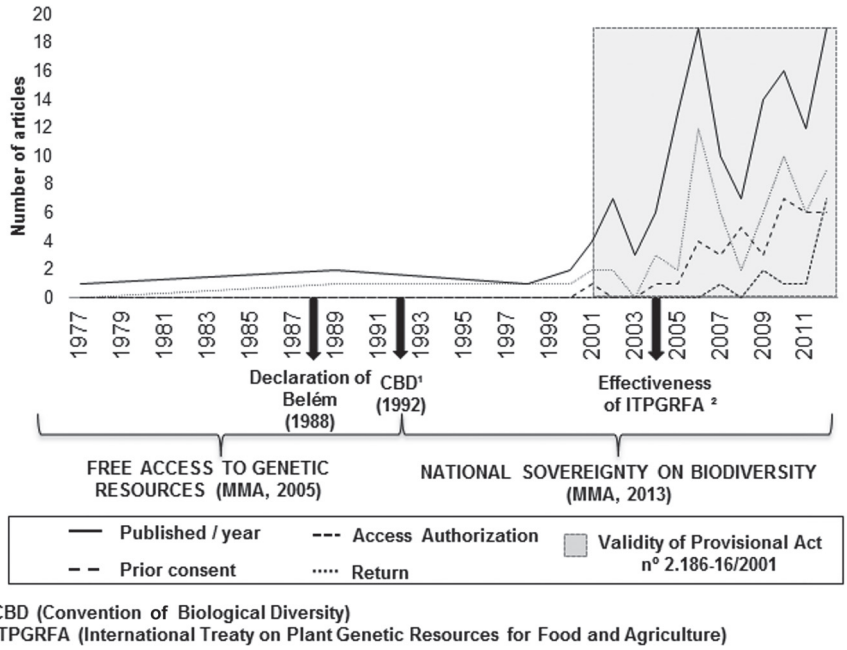

Figure 1. Temporal analysis of the considerations of legal issues in ethnobotanical articles regarding knowledge and use of medicinal and food plants between 1977 and 2012.

enactment of PM 2.186-16/2001 to the last year used for selecting articles for this study). It is important to note that within the first period (1977–2000), there are few mentions of legal matters and a few publications (six articles). In the next period (2001–2012), there is an increase in mentions of legal aspects and in the number of publications (131 articles).

Discussion

A considerable number of researchers are apparently not complying with legal obligations regarding the access to genetic heritage and associated traditional knowledge (Tab. 1). However, we emphasize that we are dealing with the limitations of analyzing only the written structure of articles: many authors may have accomplished and complied with legal requirements, but they have not mentioned them in the article for several reasons. Therefore, it is important that this theme is not oversimplified or treated as a judgment but is considered in the diversity of situations in which ethnobotanical research is performed.

We have observed that even when we add the number of articles that explicitly mention actions of returning results to the number of articles that only suggest the actions, the amount does not reach half of the total selected articles (46.72%). Thus, some authors discuss and comment on legal matters within ethnobotanical publications (Bridges 2004; Albuquerque & Hanazaki 2006; Albuquerque *et al*. 2010a; Pérez-Ojeda del Arco *et al*. 2011). Bridges (2004) mention that authors need to dedicate a part of their articles to legal obligations, thereby sharing ideas about how to collaborate with local communities. The author also suggests a change on the side of reviewers and editors that would promote the acknowledgement of such measures. Albuquerque *et al*. (2010b) also state that this type of information would provide ideas about well-developed experiences in different geographical and cultural contexts. Albuquerque & Hanazaki (2006) have noted the essential role of considering the ethical implications of research in the scope of discussions on access to associated traditional knowledge.

One can expect several impediments to developing and accomplishing the return or sharing of research results with communities. From an investigation of studies from different parts of the world, Pérez-Ojeda del Arco *et al*. (2011) elucidated the main difficulties in the process of returning results, such as limited funds and reduced time for research as determinant factors. Nevertheless, according to the same authors, these difficulties are distributed in a distinct manner, depending on countries, based on access to funding as well as the experience of researchers, because accomplished researchers receive greater recognition and funding (Pérez-Ojeda del Arco *et al*. 2011). According to Albuquerque *et al.* (2010b), a concern with research interlocutors is sometimes a novel aspect for some researchers because they may lack an academic background that would guarantee the focus on ethical obligations within the studied subjects. They recommend a consolidation of wider academic education in ethnobotany that would consider ethical and philosophical principles related to benefit-sharing and allow questioning that would help researchers to critically think regarding the compliance with legal tools related to these matters (Albuquerque *et al*. 2013).

It is necessary to consider that there are diverse ways of returning and sharing academic research results (Albuquerque *et al*. 2010b), which will vary according to the area of knowledge and type of research and according to local characteristics of and established agreements with studied communities (Patzlaff & Peixoto 2009). Moreover, Patzlaff & Peixoto (2009) state that the process of returning results is dynamic and that the researcher will have to adapt and adjust to it according to the observations and necessities of the community.

It is assumed that assimilation time, understanding, and choice of the most appropriate type of research results to return does not correspond to the time of a graduate program, such as a masters degree. The idea of including considerations regarding these issues in articles for publication is an interesting measure to stimulate and widen the visibility of such matters and to foster future developments in returning results and benefit sharing to the communities.

Results concerning the use of prior and informed consent may also seem to be alarming because 72.99% of articles lack any mention of its employment. However, as stated before, it is not possible to analyze the ethical conduct of researchers only through these data. On the other hand, there are factors that contribute to the situation mentioned above. Bureaucracy and tardiness in the processing and analysis of projects within institutional bodies may encourage some researchers to opt for obtaining prior verbal consent, which can have the same objectives of written consent, but does not require signatures and a printed official document. Depending on the context of the local communities, requiring a signature for an official document can generate discomfort, refusals, or even legal implications for the communities, such as in the case of people living within Protected Areas of full-protection status (Peroni *et al*. 2007).

It is possible to associate the use of prior and informed consent with authorizations by governmental bodies because consent documents are prerequisites for the authorization of research work (MMA 2005). However, we noted that two authors have cited a CGEN authorization and also the use of prior and informed consent. This may reveal different understandings among researchers in the manner to present such information in the articles. There is certainly asymmetry regarding these procedures between the researchers towards research subjects and efforts towards bureaucratic processes.

Apart from bureaucratic and political problems regarding the implementation of prior and informed consent, it is possible that some researchers are simply unaware of such matters. This lack of awareness may be due to the accelerated growth in field since the 2000s, revealing a new generation of researchers in ethnobiology including those uninformed regarding legal procedures involving their research. However, according to McClatchey (2006), Brazilians have easy access to a wide array of literature, including those of international distribution, which would not justify the lack of basic procedures and standardized methodologies in their research.

The reduced number of articles mentioning submissions and authorizations of research by governmental bodies such as CGEN is possibly connected to the required bureaucracy in the processing and analysis of projects. Platiau & Varella (2004) assert that Brazil has created an inefficient and bureaucratic structure for managing requests of access through the PM 2.186-16/2001, and Albuquerque *et al.* (2010a) argue that the various problems should be solved, so that research in this field is not jeopardized. Such incompatibility between regulatory bodies and research reality in Brazil has also been discussed by Peroni *et al.* (2007), who emphasize that graduate students have been encountering many impediments for reconciling their time for developing research and academic obligations to the legal requirements of such bodies.

In the face of issues involving these measures, it is important to note that since 2003, proposals for change of this legal framework have been under discussion (Ferreira & Sampaio 2013). The public consultation carried out during 2008 at the time of debates regarding substituting the PM 2.186-16/2001 by a draft bill, which would withdraw the need for authorizations and approvals for research, serves as an example (Albuquerque *et al*. 2010a). As a response to numerous manifestations and criticism to PM 2.186-16/2001 and CGEN, some governmental initiatives have been recently underway to facilitate a more agile process, with accreditation by IBAMA, CNPq, and IPHAN for expedited authorizations (Andrade *et al*. 2013). Notably, the degree of dissatisfaction and anxiety in relation to barriers posed by the government since the PM has been enacted. More than 10 years have passed and until now, the PM 2.186-16/2001 was not yet completely assessed by politicians, representing a setback to contributions for knowledge, conservation, and sustainable development for national megabiodiversity (Andrade *et al.* 2013). However, increasing the discussion regarding this theme can certainly contribute with the development of more adequate legal frameworks for the Brazilian reality.

There is some flexibility in relation to the requirements for describing legal matters within journals because these descriptions are not consistently a main prerequisite for acceptance and publication of manuscripts. Therefore, the lack of precision in specific guidelines related to legal and ethical matters may represent a contributing factor in authors failing to mention these aspects in the articles submitted, even though they might have had proper authorizations from competent bodies. In addition, scientific journals have opted for objectivity in published articles that could potentially discourage descriptions of legal and ethical procedures. However, editorials of some international journals such as the *Journal of Ethnopharmacology* (Verpoorte *et al*. 2006) and *Economic Botany* (Moerman 2005) reflect the trend of increasing rigor for accepting ethnobotanical and ethnopharmacological research in light of these matters,

pointing to specific criteria that require inclusion of specific methodological information, such as legal issues involving local communities (Albuquerque *et al*. 2010a).

As for the temporal analysis of selected scientific production, we noticed that until 2000, the number of publications, both the general ethnobotanical research and mentioning legal or ethical matters, were relatively small. These findings reflect the fact that some of these publications are pre-CBD and that, until then, there was no incisive direction on increasing the control of access to genetic resources and associated traditional knowledge. From the analyzed period of 2001–2012, we observed an increase both in number of publications (Oliveira *et al*. 2009) and in the number of mentions of legal measures, which could be explained by the PM 2.186-16/2001, the creation of CGEN, and the influence of the ITPGRFA, which improved visibility and posed a more rigorous enforcement in relation to compliance with legal matters and acknowledgement of local communities and rights of farmer. Moreover, the current concern with conservation of biodiversity and social/cultural diversity, ethics, protection, and acknowledgement of the rights of local communities, has been regarded with great importance worldwide. According to Hunn (2007), this period also characterizes a recent phase in the field of ethnobiology, which emphasizes the rights of indigenous peoples for the control of their own traditional knowledge and also contributes to the commoditization of such knowledge when the access and control of knowledge begin to be linked to commercial regulatory measures, such as patent laws (Cunha 1999; Alexiades 2003). In addition, during this period, different Brazilian and international authors emphasize the importance of discussing and revealing legal measures within publications in the area (Shanley & Laird 2002; Bridges 2004; Albuquerque & Hanazaki 2006; Patzlaff & Peixoto 2009; Albuquerque *et al*. 2010a; Pérez-Ojeda del Arco *et al*. 2011).

Conclusions

It is important to highlight that the intention of the present study was to contribute to critical reflections in relation to legal obligations outlined between the researcher and subjects. In addition, this study contributes in the context of access to traditional knowledge associated with biodiversity. In this context, it is essential to consider the distinct approaches among researchers in legal matters in the scope of published articles, indicating the influences of legal milestones and providing an opportunity for discussions about how the governmental, science, and societal spheres are integrated. This analysis clearly shows that such interactions need improvement from all actors involved.

Current legislation defines governmental bodies as responsible for evaluative activities related to accessing associated traditional knowledge; however, this is still far from the research reality in Brazil. Bureaucracy that involves obtaining authorization acts as a limiting factor for research instead of contributing to the advance of such studies. In addition, because of a lack of research planning for obtaining authorizations as well as lack of experience of these matters of a few researchers, scientific actors are becoming distant from the processes of building more comprehensive and socially sound policies. Furthermore, norms from the prominent Brazilian journals, which are open for ethnobotanical research, do not include specific guidelines around legal matters in research, particularly for research in ethnobiology, in majority of the cases. The positive side is that this lack of guidelines allows certain flexibility for authors in the fields of ethnobiology and ethnobotany. However, the importance of legal matters as fundamental elements in researching methodological procedures cannot be reinforced.

Temporal analysis and mentions of legal matters suggests that the creation of the PM 2.186-16/2001 has had significant impact in raising awareness regarding compliance with legal obligations, resulting in an increased number of mentions within articles. However, the criticism of societies toward the PM text over time (Andrade *et al*. 2013) and the period of research inertia between the first enactment of the PM in 2000 and beginning of CGEN activities in April 2002 (Azevedo 2005) as well as all the challenges discussed above have led to major delays in the implementation of scientific and technological developments and advances expected in natural resources in Brazil (Andrade *et al*. 2013). Based on these facts, there is a notable and immediate need for a reformulation of the entire system to attend specifically and in time to demands from all parts and most importantly to prioritize respect and compliance with legal and ethical measures by both science and society.

We should recognize that although there is an evident need for establishing regulations related to access to associated traditional knowledge and biodiversity and for creating norms with certain flexibility, the processes will not always function in a homogenous manner for heterogeneous cases (Peroni *et al*. 2007). Solutions must be considered in a manner that legislation could fit the diverse nuances that comprise science because we live in one of the most bioculturally diverse countries in the world, which offers endless possibilities for research. It is necessary that science should mutually attend to every local community, society, and academic community (Albuquerque *et al*. 2010a). For this, it is essential that spheres of government, science, and society work together. Above all, it is fundamental to highlight the importance of understanding legal matters from an ethical and moral perspective as a researcher and not only as legal obligations because there is a demand for professionals engaged with scientific ethics and concerned with safeguarding knowledge and rights for local communities in Brazil. Finally, in the 10 years since the PM enactment and almost two decades since the CBD, one question remains: "do these measures actually function to protect the rights of communities over their traditional knowledge?"

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