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SUSTAINABLE WILDLIFE MANAGEMENT AND LEGAL COMMERCIAL USE OF BUSHMEAT IN COLOMBIA: THE RESOURCE REMAINS AT THE CROSS ROAD

Note by the Executive Secretary

1. The Executive Secretary hereby provides, for the information of participants in the twentieth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA), a report on sustainable wildlife management and the legal commercial use of bushmeat in Colombia. The report explores the opportunities for legal commercial hunting by rural communities and highlights current bottlenecks in Colombia. Recommendations also emanate from a workshop held in Leticia, Amazonas from 5 to 9 October 2015 on operationalizing the legal framework for the commercial and sustainable use of bushmeat by rural communities.

2. The document is circulated in the form and language in which it was received by the Secretariat.

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Sustainable wildlife management and legal commercial use of bushmeat in Colombia: the resource remains at the cross road

N. VAN VLIET[a], J. GOMEZ[b], M.P. QUICENO-MESA[b], J.F. ESCOBAR[b], G. ANDRADE[c], L. A. VANEGAS[b] and R. NASI[a]

[a]*Center for International Forestry Research (CIFOR), Jalan CIFOR, Situ Gede, Sindang Barang, Bogor 16680, Indonesia.*
[b]*Fundación Science International, Calle 28 N° 13 A -24. oficina 308, Bogotá, Colombia.*
[c]*Instituto de Investigaciones Alexander von Humboldt, calle 28A # 15-09, Bogotá, Colombia.*

Email: vanvlietnathalie@yahoo.com, juanitagomez@fundsi.org, mariapaulaquiceno@fundsi.org, joseescobar@fundsi.org, gandrade@humboldt.org.co, r.nasi@cgiar.org

SUMMARY

Most countries in the Amazon have no clear policy frameworks to provide a legal path for sustainable wildlife management (SWM), including the commercial use of bushmeat. In Colombia, despite efforts to provide more local autonomy in the management of natural resources and the openness towards the sustainable use of wildlife since the 1970s, there are still a number of legal and technical impediments that need to be addressed. In this research, we first compiled evidence of the current illegal trade of bushmeat to justify the need to clarify legal frameworks regulating the activity. Then, we explore the opportunities for legal commercial hunting by rural communities and highlight current bottlenecks. Finally, we report on lessons learnt from past initiatives of sustainable bushmeat use in the country. In our conclusion, we provide some practical recommendations to promote the sustainable use of wildlife, clarify the definition of commercial use for subsistence purposes and legalize sustainable local bushmeat trade by rural communities.

Keywords: rural communities, legal commercial hunting, bushmeat trade, Colombian wildlife policies, regulatory bottlenecks

La gestion durable de la faune et le commerce légal de gibier en Colombie à la croisée des Chemins

N. VAN VLIET, J. GOMEZ, M.P. QUICENO-MESA, J.F. ESCOBAR, G. ANDRADE, L.A. VANEGAS et R. NASI

La plupart des pays du bassin Amazonien ne disposent pas de cadres politiques clairs qui proposent un chemin légal pour l'utilisation durable de la faune sauvage, y compris pour le commerce de gibier. En Colombie, bien que le cadre légal ait évolué depuis les années 1970 vers une meilleure autonomie locale pour l'utilisation des ressources naturelles, il subsiste encore une série de barrières légales et techniques pour l'utilisation de la faune. Dans cet article, nous présentons l'évidence de l'existence de chaines de commercialisation illégales de viande de brousse pour justifier la nécessité d'éclaircir le cadre juridique qui régule cette activité. Ensuite, nous explorons les opportunités qu'offre le cadre réglementaire actuel pour le commerce légal de gibier par les communautés locales et soulignons les goulots d'étranglement qui subsistent. Puis nous présentons les leçons tirées de quelques initiatives d'utilisation durable développées antérieurement dans le pays. En conclusion, nous présentons certaines recommendations pratiques pour promouvoir l'utilisation durable de la faune sauvage, clarifier les définitions de chasse commerciale et chasse de subsistence et légaliser l'utilisation durable du gibier par les communautés locales, y compris pour un commerce local.

Manejo sostenible de fauna y comercio legal de carne de monte en Colombia en la encrucijada

N. VAN VLIET, J. GOMEZ, M.P. QUICENO-MESA, J.F. ESCOBAR, G. ANDRADE, L.A. VANEGAS y R. NASI

La mayoría de países en la cuenca amazónica no cuentan con marcos de políticas públicas claros que proporcionen un camino legal al uso sostenible de la fauna silvestre, incluyendo el comercio de la carne. En Colombia, a pesar de la evolución normativa desde la década de 1970 tendiente a garantizar una mayor autonomía local en el uso de los recursos naturales, siguen existiendo una serie de impedimentos legales y técnicos para el uso de la fauna. En el presente artículo, presentaremos en primer lugar evidencia de la presencia actual de cadenas de comercio ilegal de carne de monte con el fin de justificar la necesidad de aclarar los marcos jurídicos que regulan la actividad. En segundo lugar exploraremos las oportunidades que provee la legislación para la caza comercial legal por parte de las comunidades rurales y señalaremos los cuellos de botella normativos. Posteriormente, presentaremos las lecciones aprendidas sobre algunas iniciativas de uso sostenible de carne de monte desarrolladas anteriormente en el país. En la conclusión, presentaremos algunas recomendaciones prácticas para promover el uso sostenible de la fauna silvestre; clarificar la definición de cacería con fines comerciales y de subsistencia; y para legalizar en las comunidades rurales, el comercio local y sostenible de la carne de monte.

INTRODUCTION

In tropical forest communities, the use of wildlife both for consumption, gift or sale is still deeply embedded in traditional lifestyles. Bushmeat trade is part of local economies, contributes to local livelihoods and plays a major role in maintaining food security and diet diversity (Nasi *et al*. 2008). However, rural communities often find themselves trapped between strict conservation measures that exclude them from traditional resource use and the modern world consumerism that weakens local values and drives unsustainable use of natural resources and wildlife in particular. Cultural transformations generated by socio-economic changes induced by globalization as well as the standardization of consumption habits, have profoundly changed traditional forms of bushmeat use (Baptiste *et al.* 2002, van Vliet *et al*., 2014). At the same time, in many tropical countries, national wildlife regulatory frameworks have evolved towards fortress conservation, an approach that seeks to preserve wildlife and their habitat through forceful exclusion of local people who have traditionally relied on the environment for their livelihoods (Brockington *et al*. 2006). More recently, some policies have evolved towards social conservation models, which advocate various forms of sustainable use and privilege conservation-oriented development and welfare-oriented goals such as poverty alleviation and social justice (Miller *et al*. 2011). For example, since 1991, approximately 63.1 million ha of new sustainable-use reserves were created in Brazilian Amazonia, to ensure both the usufruct access rights of local communities to natural resources and the persistence of all species and ecological processes (Peres, 2011). However, despite these initiatives towards sustainable use models, public environmental policies have most often resulted in the widespread criminalization of bushmeat hunting and trade, which instead of leading to reduced impacts on the environment, have fueled underground and illegal wildlife trade chains, no longer under control by governmental authorities (Nasi *et al*., 2008).

Within this context, the concept of sustainable wildlife management (SWM)[1] has been given little legal recognition particularly in the Neotropics. The rationale behind SWM is that, in view of its economic, ecological and social value, wildlife is an important renewable and not substitutable resource, which, if sustainably managed, can contribute to food security, income and to poverty alleviation while safeguarding ecosystem services. The concept was widely promoted in the 1990's in the Amazon by Ojasti, 1998 in his chapter entitled "Wildlife of Amazonas State: a resource at the cross-roads" as an innovative way to solve both conservation and livelihood aspirations. However, most countries in the Amazon still have no clear national policy frameworks that provide a legal path for SWM, including the commercial use of bushmeat. This represents an obvious bottleneck for up-scaling small scale/short term SWM pilot projects into national policies supported with clear strategies (Nasi *et al*. 2008).

In the meantime, international conventions are increasingly supportive of a transition towards more flexible legal frameworks that allow for SWM. The Convention on Biological Diversity adopted in COP 11 (2012) the recommendations of the Bushmeat liaison group in which governments are invited to evaluate and monitor the use of bushmeat in their countries and revise their national policies and regulatory frameworks in order to allow the sustainable legal use of bushmeat taking into account the rights of local and indigenous communities (http://www.cbd.int/doc/decisions/cop-11/cop-11-dec-25-en.pdf). Similarly, CITES adopted a resolution (16.6) (http://www.cites.org/res/16/16-06.php) where it explicitly recognizes that the implementation of CITES will be better achieved with the support of rural communities and where it acknowledges the need for national governments to evaluate the impacts of CITES lists on the livelihoods of local communities and to create opportunities that provide sustainable incomes that enhance conservation and sustainable use. In March 2015, an international group of experts, convened by international organizations (IUCN, TRAFFIC, IIED), formulated clear recommendations to recognize and enhance the role of local communities in wildlife conservation by promoting the sustainable use of some species to generate benefits (including income) to local communities whose livelihood depends on local wildlife.

In Colombia, environmental policies have traditionally been based on strict protectionist objectives. However, since the new Constitution of 1991, the later have been pressured to evolve towards a more flexible framework for sustainable use, by public claims of indigenous and minority groups over their territory and resources[2]. Current regulatory frameworks, which are a heritage of a long history of changes since the creation of the Division of Natural Resources of the Ministry of Agriculture in the 1950s, still offer unclear opportunities for sustainable use and bushmeat trade by rural community members. Under the current legal framework, hunting for subsistence, defined by Decree 2811 of 1974, is allowed for non-protected species and outside protected areas, for the sole purpose of providing food to the hunters and their families. All inhabitants may hunt without permit for subsistence purposes in the national territory, provided there is no prohibition issued by regional environmental authorities for the species to be hunted. Under the current definition of subsistence, hunters that trade bushmeat under any form, to cover for other subsistence needs such as housing, health, education or other food items, are considered illegal commercial hunters (unless a complex set of requirements is met, as described further in this document).

In this study, our objective is to highlight the need to clarify and operationalize the current legal framework by identifying the opportunities and bottlenecks for the sustainable

[1] Sustainable Wildlife Management (SWM) is the careful management of socially or economically important wildlife species, to sustain their populations and habitat over time.

[2] Political Constitution of Colombia, articles 329 and 330.

use of bushmeat and legal commercial hunting by rural communities in Colombia. First, we compiled evidence of the current illegal trade of bushmeat in Colombia to justify the need to explicitly address the issue clarify legal frameworks regulating the activity. Second, we describe the evolution of environmental institutions in Colombia and the changes of wildlife regulations since the 1950s to understand how these have shaped current regulations for the sustainable wildlife use and bushmeat trade. We also explore the opportunities for legal commercial hunting by rural communities and point out current bottlenecks. Third, we describe past initiatives of sustainable bushmeat use in Colombia and analyze their successes and failures to capitalize lessons learnt. Our conclusion provides some practical recommendations to clarify and operationalize the opportunities provided by the current legal framework.

COMMERCIAL HUNTING IN COLOMBIA: A REALITY BEYOND THE PROHIBITION

While bushmeat subsistence use is legal in Colombia, bushmeat trade without permit is illegal. The illegality of the trade has pushed it to hidden channels and made it invisible from formal institutions (van Vliet *et al*. 2014). The lack of clarity in national laws and the loopholes in current regulations have resulted in ambiguous interpretations by stakeholders, which have adapted their behavior to minimize fines and confiscations. Hunters have developed strategies to avoid police controls and to keep the market clandestine (transportation of merchandise in the early morning, bushmeat hidden in fridges under chicken meat, communication through cellphones, among others) (van Vliet *et al*. 2014). In spite of the existence of several sanctions, including imprisonment, commercial hunting is common in rural communities in all ecoregions of Colombia. However, available data is fragmented and insufficient to generate an overall understanding of the trade in terms of species, quantities, users in the market chain, impacts on wildlife and communities. Most available studies have highlighted the importance of wildlife harvest in diverse regions of Colombia (see Vargas-Tovar 2012, for a review), but only very recent research has been able to quantify the trade. Quiceno *et al*. (2014) suggest that 43% of the catch from hunters in Puerto Nariño (Amazon region in the border with Peru) is used for commercial purposes. The most representative taxa traded are mammals (60% of reports), birds (26%) and reptiles (14%). Their main incentive for hunting is subsistence, being either a direct source of food or a means to obtain money to buy food and beverages (chicken, beef, fish, beans, rice, sugar, bread, manioc, salt, coffee, onion, oil, spaghetti, beer) and basic products (soap, detergent, school supplies, clothing, pots, buckets, dishes), as well as hunting supplies (gasoline, cigarettes, matches, cartridges, batteries, lanterns, motorbike or bike parts). Ortega (2014) showed that between 31% and 53% of the offtake is sold by indigenous communities (Coayare, La Ceiba and Yuri) in Inírida (Amazonas on the border with Venezuela). Casas (2007) suggested that commercial hunting in three communities of Boyacá (Andes region) is relatively insignificant in terms of biomass, but species like squirrels, rodents and birds are sometimes sold to meet short-falls in agricultural production. Quiceno *et al*. (in press) evidenced the existence of bushmeat trade in urban areas in different biogeographic regions of Colombia[3] and reported a total of 144 sale points in 7 medium-sized towns (Leticia, Inírida, Fundación, Aracataca, Circasia, Yopal and Quibdó), comprising restaurants, market places and butcher shops. Bushmeat trade is generally local (traded in the village or in the closest town) and long distance trade routes within the country or to other countries are inexistent (except potentially the case of capybara meat exported illegally towards Venezuela). The most traded species reported in all regions are *Cuniculus paca* (Spotted Paca), *Dasyprocta punctate* (Picure), *Hydrochoerus hydrochaeris* (Capybara), *Pecari tajacu* (Collared Peccary), *Dasypus novemcinctus* (Nine-banded Armadillo), *Cabassous centralis* (Northern Naked-tailed Armadillo) and *Dasypus kappleri* (Greater Long-Nosed Armadillo). In the market of Leticia, for example, about 400 kg of bushmeat were sold in 20 days monitored in 2013 (van Vliet *et al*. 2014). Data from confiscations registered by the *Departamtento Administrativo de Seguridad* (DAS, Administrative Department of security in english) reported 31 147 kg of bushmeat confiscated between 1998 and 2004 (Mancera *et al*. 2008). The *Dirección de Impuestos y Aduanas Nacionales* (DIAN, Direction of taxes and customs in english) confiscated about 12 621 kg of capybara meat (*Hydrochoerus hydrochaeris*) from 2004 to 2006 (Mancera *et al*. 2008). According to Mancera *et al*. (2008), these numbers significantly under-estimate the amounts traded and the numbers provided by seizures are speculative without any robust support.

WILDLIFE INSTITUTIONS AND REGULATIONS IN COLOMBIA: A HISTORICAL PERSPECTIVE

Institutional historical framework in Colombia

The starting point of legal developments concerning the use of natural resources in Colombia was the creation of the Division of Natural Resources of the Ministry of Agriculture in 1952 (Rodríguez 1998). The later was motivated by the need to supervise the extractive use of natural resources in an economy dominated by the extractive use of timber, rubber and pelts. Parallel to the creation of the Division of Natural resources at the national level (between 1954 and 1968), the *Corporaciones Autónomas Nacionales* (CAR, Autonomous Regional Corporation in English) were also created, with functions of local environmental planning and development

[3] Andean, Pacific, Caribbean, Orinoco and Amazon Region.

(Rodríguez 2009). There are currently 26 CARs in Colombia covering the whole national territory.

In 1968, the National Institute for the Development of Natural Renewable Resources (INDERENA, for its initials in Spanish) was founded as the first attempt to manage the biological resources of the nation through a national independent institution (Rodríguez 1998). The overlapping jurisdictions of national and regional authorities ended up in a conflict of rules, creating confusion on the legitimacy of one or the other body. INDERENA was to rule at national level and CARs (Autonomous Regional Corporations) at the regional level, particularly for a number of environmental issues, such as the expedition of licenses and travel permits for wildlife transportation. In regions where no CAR had jurisdiction, the rules of INDERENA were applied. In 1974, the Code of Natural Resources and Environmental Protection reduced existing conflict of rules. Indeed, it set a uniform regulatory structure in a single and coherent normative body and it was the basis for subsequent regulatory developments (Ucros 2008).

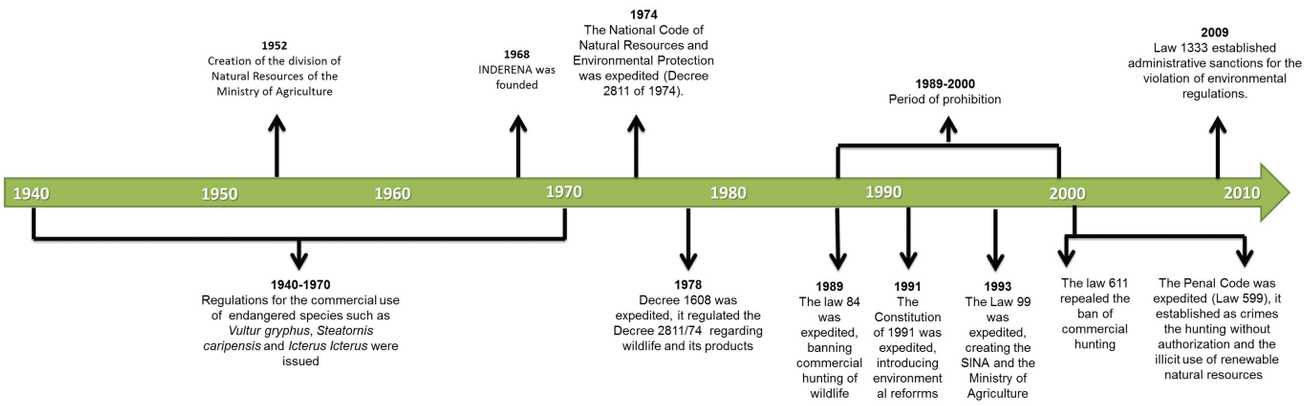
Another crucial moment in the environmental history of Colombia was the promulgation of the current Political Constitution, in 1991. The Constitution enshrined more than 30 articles on environmental matters. Among those, the preservation of natural resources became a duty for the citizens and the state, the right to have a healthy environment was established as a collective right, the planning of the management and use of natural resources for sustainable development was established as a State obligation. Furthermore, the Constitution of 1991 changed the institutional organization of the Republic and established the territorial autonomy principle. The Constitution expressly recognized that the Colombian State is organized as a unitary republic, but at the same time it guarantees the autonomy of local authorities. In environmental matters, the new Constitution gave local entities (governors, mayors, Autonomous Regional Corporations, Indigenous Reserves, among others) autonomy to regulate the use and preservation of natural resources on their own jurisdiction. Within the framework of the Constitution of 1991 the law 99 of 1993 was promulgated, creating the Ministry of Environment and the Environmental National System[4] (SINA). The SINA and the new Constitution intended to reinforce the decentralized management of natural resources; however the regulatory framework did not provide the necessary instruments to ensure a local and autonomous management, as we will show further in this document.

The Ministry has been reformed twice as a result of political changes introduced by new governments. In 2002 it was merged with the Ministry of Housing[5] and in 2011 was separated again from this institution, taking the current name of Ministry of Environment and Sustainable Development. Decree 3570 of 2011, restructured the Ministry dividing the functions among its offices, directions, and committees. The development of policies for wildlife sustainability was introduced as a function of the Direction of Forests, Biodiversity and Ecosystem services.

Historical evolution of the legislation on sustainable wildlife management and bushmeat trade

Between the years 1940 and 1970, the regulation of commercial hunting existed only for endangered species, such as *Vultur gryphus* (condor), *Steatornis caripensis* (oil bird) and *Icterus Icterus* (troupial) (Baptiste *et al*. 2002). In 1974, with the issuance of the National Code of Natural Resources and Environmental Protection (Decree 2811 of 1974), the guiding principles of environmental policy were established. Concerning wildlife, the normative base for subsequent regulation in hunting was settled. Hunting was divided into different types according to its purposes: subsistence, commercial,

FIGURE 1 *Timeline of wildlife institutions and regulations*



[4] It is composed by national and regional institutions (such as CARs, research institutions, a Unit of Natural National Parks, etc.) and it is led by the Ministry of Environment.

[5] From 2002 to 2011 the Ministry operated as the Ministry of Environment, Housing and Territorial Development.

recreational/sporting, scientific, population control and for ex-situ reproduction. In 1978, Decree 1608 was issued, regulating the Code of Natural Resources regarding wildlife and its products; it established the competency of the administrative entities (INDERENA and CARs) to issue the permits for commercial hunting and set harvesting quotas upon submission of studies by the applicant and upon approval by the national government. In 1989, Law 84 banned commercial hunting of wildlife. However, in 2000, Law 611 repealed the ban established by the Law 84. Thus, the legislation opened again the way for legal commercial hunting. Commercial hunting is currently regulated by Decree 4688 from 2005. For the purpose of commercial hunting, the interested stakeholder must prepare and submit a number of documents for the obtainment of a commercial permit issued by the regional authority of the jurisdiction were hunting will take place. Decree 2041 from 2014 states that an environmental assessment study (EIS) is needed for the obtainment of a commercial permit.

Despite the opportunities opened, public policies in commercial hunting have been focused in the establishment of sanctions, instead of the regulation of the activity based on sustainable use principles. In 2000, the Penal Code (Law 599, article 336 and 328) establishes as crimes hunting without authorization or in breach on existing rule and the illicit use of renewable natural resources (including imprisonment sanctions). In 2009, Law 1333, established administrative sanctions (fines, seizures, community work, among others) for the violation of environmental regulations.

LEGAL BOTTLENECKS FOR THE SUSTAINABLE USE OF WILDLIFE AND BUSHMEAT TRADE: THE OPPORTUNITIES REMAIN IN THE PIPELINE

While commercial hunting by rural communities can be legal in Colombia, it is, in practice, impossible to obtain a commercial permit for the following reasons:

As described by Moreno and Negrete (2012), while hunting for commercial purposes is legal under a license expedited by CARS, Decree 4688 of 2005 introduced a new bottleneck establishing that CARs can only provide licenses if the Ministry of Environment has previously set the list of species that may be harvested species and the global harvesting quota of each species. However, to date, the Ministry has not expedited resolutions in those terms and does not count with methodologies to determine the species for use and their global quota. According to Decree 3570 of 2011, the Direction of Forests, Biodiversity and Ecosystem Services from the Ministry of Environment is entitled to develop those guidelines. This situation leads the CARs to refuse the issuing of commercial hunting licenses in their jurisdiction and this is therefore a clear example where the principle of territorial autonomy described by the Constitution is contradicted by current decrees.

Besides, it is also very difficult for local hunters to fulfill all the requirements for obtaining a license without proper technical support. In order to obtain a license the hunter (or the hunter's group) must present an Environmental Impact Study (EIS) that includes a Management Plan, a Prior Consultation to the community (if applicable)[6] and other required documents (certifications, filled out forms, among others)[7]. The Terms of Reference for the Environmental Impact Study for commercial hunting, requests rigorous technical studies and therefore a significant investment that most rural communities can not afford (see table 1). Among the contents of the EIS, the Terms of Reference (MAVDT 2006) include a characterization of the area of direct influence and an estimation of the *"natural population of the species that will be affected by commercial hunting, including a preliminary stock assessment performed before harvesting. Furthermore, it includes a permanent population assessment to evaluate the structure and population dynamics and ecological impacts that may result from use."* Moreover, Decree 4688 of 2005 establishes that CARs assign annual quotas for the authorized species based on monitoring results to be submitted by the hunter (or group of hunters) three months before handling their request for a legal commercial hunting permit. However, nor the CARs nor the Ministry of Environment have developed the formal criteria and methodologies to monitor hunted species and to estimate the available stocks. The lack of formal guidelines leaves room either for very subjective appreciations of the documents submitted to the CAR's or to straight rejections to avoid legal complications. Article 17 from Decree 4688 (2005) also stipulates that if studies about the species are already available from environmental authorities (and/or research institutes linked to the Ministry of Environment and/or other entities of technical and scientific support of the SINA), these may be considered in the EIS. As described by Moreno and Negrete (2012), this rule could constitute a clear opportunity for local hunters, as they would not need to conduct additional studies if data is already available. However, studies on hunted populations are fragmentary and the information often comes from independent researchers who do not belong or support the SINA.

Moreover, bushmeat traded for commercial purposes, likewise any other meat from domestic origin, is subject to sanitary regulations. However those regulations are not fully developed yet for wildlife. Decree 2270 of 2012 establishes the competency of ICA (Colombian Agricultural and Livestock Institute from Ministry of Agriculture) to establish the sanitary requirements for native wildlife species whose commercial hunting has been authorized by the competent environmental authority. It also establishes the competence of the Ministry of Health and Social Protection to issue the

[6] Indigenous Reserves territories or Collective territories.
[7] Decree 2041/2014.

TABLE 1 *Terms of Reference for the EIS of commercial hunting (Ministry of Environment, Housing and Territorial Development, 2006)*

1. Generalities • Introduction • Background • Objectives and scope of the activity • Methodology (team)	**2. Description of the activity** • Location • Project characteristics • Commercial hunting, technical, socio-economical and financial viability. • Related activities: storage, processing and / or transformation, processing plant, commercialization, dismantling and overview of the organization
3. Characterization of the area of influence of the project • Areas of influence: Direct and Indirect • Abiotic Environment: geology, geomorphology, soils, hydrology, water quality, water use, atmosphere and landscape • Middle biotic: terrestrial ecosystems (flora and fauna), aquatic ecosystems • Socioeconomic environment: guidelines for participation, demographic dimension, economic dimension, cultural dimensión • Environmental zoning	**4. Demand, use, development and / or affectation of natural resources** • Construction Materials • Superficial waters • Underground water • Atmospheric emissions • Discharges of water • Forest harvesting • Handling and disposal of solid waste
5. Environmental evaluation • Identification and assessment of impacts • Scenario without commercial hunting and related activities • Scenario with commercial hunting and related activities	**6. Environmental Management Project Zoning** • Exclusion areas • Areas of intervention with restrictions • Intervention areas
7. Environmental Management Plan (EMP) • Abiotic environment management • Biotic environment management • Socioecomomic environment management • Compensation	**8. Monitoring Plan** • Monitoring the abiotic environment: residual and receiving stream water; Groundwater; Atmospheric emissions, air quality and noise; Soil; and systems management, treatment and disposal of solid waste • Monitoring the biotic environment • Monitoring the socioeconomic environment
9. Contingency Plan • Risk analysis • Contingency Plan	**10. Annexes** • Glossary • Photographic record • Primary information • Bibliography • Plans

regulations declaring the meat of this species suitable for human consumption as well as to establish the respective conditions in which it can be traded. In this regard, in 2015, resolution 705 was issued by ICA, establishing the sanitary requirements for commercial hunting of wildlife species authorized by the environmental authority. However, the resolution only describes the requirements for the registration of the activity and the report for zoonotic diseases: the conditions for the handling of bushmeat and its processing are still to be defined by the Ministry of Health and Social Protection. So far, there are no regulations from the Ministry of Health and Social Protection in this regard and therefore bushmeat cannot be legally commercialized for human consumption. However, the project for a Resolution for Capybara has already been developed but not yet expedited at the time of the publication of this manuscript.

LESSONS LEARNT FROM PAST INITIATIVES FOR THE SUSTAINABLE COMMERCIAL USE OF BUSHMEAT IN COLOMBIA

In Colombia there have been few initiatives to promote sustainable wildlife management and legal bushmeat trade by rural communities as an alternative to traffic and unsustainable illegal trade (Baptiste *et al*. 2002). In the last 20 years, we only found three pilot cases involving sea turtles in the Caribbean, hicotea turtles and iguanas in Mompóx and capybaras in the savannas of the Orinoco.

The sustainable use of capybara is not a recent initiative in Latin America (see Bolkovic and Ramadori, 2006 for examples in Argentina). In Colombia, since the Agreement 039 of 1985 and Resolution 017 of 1987 INDERENA designed a program of capybara breeding under an intensive system with

a maximum catch of 1 000 individuals from the wild as breeding stock to be reproduced in enclosures. The adult population was managed under a semi-extensive management system of up to 15 000 individuals in open cycle with improved habitat conditions (Aldana *et al*. 2007). Casanare farmer organizations grouped into 5 associations who legally marketed capybaras mainly to Venezuela. According to records from the regional environmental authority (Corporinoquia), between 1998 and 1999 nearly 660 012 capybaras were sold legally (Polanco 2000). However, in 2000, the illegal export of 100 000 kg of dried capybara meat corresponding to more than 10 000 animals killed in Casanare was reported. This ecological scandal led the Ministry to request the closure of the management program run by Corporinoquía and the suspension of the commercial use permits (Aldana *et al*. 2007). An ecological and population assessment study was mandated by the Ministry to identify the threat of hunting and the criteria and indicators to reopen the National Programme for Conservation and Sustainable Use of capybara in Colombia (Aldana *et al*. 2007 and López-Arévalo *et al.* 2014). Scientists considered that capybara populations in Casanare could continue to be harvested based on local population status, however, to-date the programme continues to await permission to re-open, given the lack of sanitary regulations for the legal trade of capybara meat. The failure of this case study is related to several reasons: 1. The national and regional authorities did not work in coordination and solidarity with one another; 2. Scientific experts and decision makers did not work in consensus: decision makers consistently considered that despite the biological and ecological data available, knowledge was not sufficient enough to make decisions and the precautionary principle was adopted; 3. The Ministry of Environment, the Ministry of health and social protection and the Ministry of Agriculture did not collaborate to develop the necessary regulations for bushmeat hunting, processing and trade.

Another interesting example of sustainable use of bushmeat in Colombia is that of turtles and iguana. Sea turtles in the Guajira region are traditionally captured, consumed and marketed by the indigenous Wayuu fishermen who catch three main species for consumption and trade: green turtles (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*) and possibly leatherback turtle (*Dermochelys coriacea*). The annual harvest volume was estimated to about 1 252 individuals from green turtle and hawksbill generating additional revenue along the trade chain of nearly US $272 765,95 (Hernández 2004, IAvH 2002). The hicoteas turtles (*Trachemys callirostris*) and green iguanas (*Iguana iguana*) are resources that have been traditionally used by fishermen in wetland Complexes Rivers Sinu and San Jorge (Baptiste *et al.* 2002). Trade and consumption of hicoteas was estimated at more than 960 000 hicotea turtles (Corpoica 1999) and 450 000 iguanas in the region (Orjuela and Bacca 1998). In both la Guajira and Mompox, the strategy of environmental authorities was historically based on a command and control strategy. However, in 2000, the Ministry of Environment and the Humboldt Institute proposed to develop a co-management system where a gradual reduction of the quota was negociated by environmental authorities and alternative productive projects were put in place to offset the economic loss. However, the regional environmental authority did not sufficiently engage with the scientific and field components of the project and preferred to take precautionary decisions to the use of the resource (Vieira *et al.* 2006). The system proposed by scientific institutions, CAR and local communities was not adopted by the Ministry considering that the precautionary principle should prevail given the uncertainty in the estimation of harvested populations. A quota system based on the average annual extraction rate was considered risky. In the case of sea turtles, given their status in CITES categories and the fact that these are migratory species; their use was also forbidden (Hernández 2004). In this example, the main lesson learnt is that local knowledge and local participation were crucial in generating the necessary knowledge on key biological and ecological characteristics of the species in question and in understanding the harvesting system. The participatory process and the active engagement of the users allowed a change in the relationship between the environmental authorities and local communities towards a trustful collaboration. This relationship ended when the project remained in status-quo.

CONCLUSIONS AND RECOMMENDATIONS

The existence of commercial hunting despite the actual prohibition shows that current wildlife laws fail to control the trade and rather lead to the inability of local and national institutions to monitor the underground trade chains. Given the widespread existence of bushmeat commerce in all ecoregions of Colombia, the scale of the trade (generally local), as well as the nutritional and cultural importance of bushmeat (Vargas-Tovar 2012), it becomes necessary to clarify the legal frameworks and decide at the crossroads, whether to ban or to clear the way for legal sustainable use and trade. As suggested by Mancera *et al*. (2008), efficient control of illegal wildlife trafficking might be a more expensive and less feasible strategy than the regulation of the activity on a legal market. However, there is a clear need to discuss the definitions of subsistence and commercial use in Colombia. In current regulatory frameworks, all trade is illegal, blurring the difference between the subsistence hunter who sells some of his harvest and the highly capitalized and large scale commercial hunter. Current texts are well adapted to the second type of commercial use. However, the sale by subsistence hunters of their harvest is a very different kind of 'commercial hunting', and needs to be treated differently by regulatory authorities.

In the following conclusions we provide some practical recommendations on the way forward for the sustainable use and trade of bushmeat by rural communities hunting for subsistence in Colombia.

First, a better cooperation and articulation between the different institutions is crucial to solve current bottlenecks in bushmeat use regulations. The lack of coordination between the national and regional levels of decision-makers on environmental issues, as well as the lack of inter-sectorial cooperation between the Ministry of Environment, the Ministry of

Agriculture and the Ministry of health, are the major problems for convert the sustainable commercial use of wildlife into a legal reality in Colombia (Rodríguez 2009). This inter-sectorial coordination would also contribute to a better integration of conservation and food security policies in the country.

Second, sustainable hunting in Colombia is impeded by the technical complexity of setting quotas based on the uncertainty concerning population densities. The Ministry of Environment is mandated to set the list of species that can be hunted and the global harvesting quotas. The CAR's are to define regional quotas according to national quotas and the hunters need to provide information on stocks to define their sustainable harvest. However, setting quotas under uncertainty is a complex task. Fryxell *et al*. (2010) suggest that it is unwise to neglect dynamic patterns of change in both harvest effort and quotas in assessing long- term strategies for sustainable resource use. Information on species abundance is indeed one key parameter used in achieving the quantification of sustainable harvest quotas (Garel *et al*. 2010, Rutberg and Naugle 2008). Unfortunately, most approaches for quantifying population densities are characterized by low accuracy and low precision (Garel *et al*. 2010, Nuno *et al*. 2013, Weinbaum *et al*. 2013). Both unreliable abundance estimates and neglected population responses lead to incorrect or incomplete information (Hagen *et al*. 2014). However, instead of suggesting the precautionary principle as it was the case in aborted examples from Colombia, many scientists and practitioners around the world have developed measures to reduce uncertainty or to take uncertainty into account by adaptive management (Keith *et al*. 2011). The adaptive management model adopted elsewhere could be a source of inspiration for the management of wildlife and bushmeat use in Colombia. As suggested by Keith *et al*. (2011): "*Successful adaptive management requires willingness to embrace uncertainty*". The key elements of adaptive management include explicit definition of management goals, development of plausible alternative management strategies to achieve those goals, implementation of two or more strategies in a comparative experimental framework to spread risks of management failure and improve understanding of system responses to management, monitoring to evaluate the relative merits and limitations of alternate strategies, and iterative modification of management strategies to improve management outcomes (Lindenmayer and Burgman 2005). An important quality of the adaptive approach is that it deals with uncertainty through a structured improvement of relevant knowledge, while seeking to minimize risks associated with ongoing management, which inevitably arises from imperfect information about system response. In practice, the management strategy evaluation (MSE) approach can be used to identify best scenarios and provide recommendations under uncertainty (Bunnefeld *et al*., 2011). In addition, some practical lessons could be learnt from the fisheries (see Getz and Berg 1989).

Third, practical guidelines for the operationalization of sustainable wildlife management and legal bushmeat trade by rural communities need to be developed to allow the implementation of sustainable use initiatives in practice. These guiding documents should include: 1. Methodologies for sustainable wildlife use under an adaptive management framework to guide the definition of global and regional quotas; 2. The development of sanitary regulations for those hunted species. 3. Guidelines to produce the EIS for commercial hunting, including the guidelines for the estimation of stocks and the design of a monitoring system within an adaptive management framework.

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