Green Health in Guatemala - How can we build mutual trust and partnerships for developing local medicines' evidence-base and potential?

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ABSTRACT

The implementation of access and benefit-sharing (ABS) protocols and especially the Nagoya Protocol has created new hurdles for collaborations around Indigenous Traditional Knowledge and international collaborations. Overall, these frameworks push for the development of novel collaborative North-South agendas in order to improve the fair distribution of benefits. The Green Health project (Guatemala) aims to implement a culturally pertinent and mutually accepted framework for sustainable use, access and benefit-sharing (ABS) of traditional medicinal plants. It involves developing a consensus among indigenous groups, government officials, industry, and academia. We describe steps undertaken to design and implement an intercultural transdisciplinary process that promotes trust building and advances herbal medicine research in a respectful and innovative way. This involves joint definition of goals and methods. The consortium co-researched Q'eqchi' Maya traditional medicine, collected voucher specimens of medicinal plants with traditional healers, identified their taxa, and later developed a literature-based evaluation identifying species for potential product development. No samples for further research and development are collected. By applying the emic-etic concept, the project was able to understand the main drivers of each stakeholder and the associated obstacles for reaching an ABS agreement. This results in the emergence of potential new drivers for developing evidence-based herbal medicine from the perspective of academia, policy and cooperation and grass-roots indigenous movements.

KEYWORDS: Guatemala, Access and Benefit Sharing, Q'eqchi', Transdisciplinary process, traditional medicine, ethnopharmacology

ABBREVIATIONS

ABS – Access and Benefit Sharing

CBD – Convention on Biological Diversity

CITES – Convention of International Trade in Endangered Species

CONAP - Consejo Nacional de Areas Protegidas

IPR - Intellectual Property Rights

TCM – Traditional Chinese Medicine

TD – Transdisciplinarity

TM – Traditional Medicine

INTRODUCTION

Recent years have seen a tremendous increase in research on some traditional medical systems, albeit the drivers have been different in each world region. This increase clearly results from the numerous pharmacological and phytochemical studies on traditional medicines, often based on an ongoing drive to investigate local and traditional knowledge systems (Heinrich and Jaeger, 2015). Globally, clinical and intervention studies remain rare and have had a limited impact in advancing knowledge on efficacy, while the safety and potential toxicity concerns about herbal medicines have remained a small but essential aspect of this field of research. In Asian countries, the main drive seems to be a push for recognising and 'validating' traditional practices using medicinal plants, fungi and other drugs, where the case of China is certainly the most impressive of these examples (Li et al., 2018). The medical classification of Traditional Chinese Medicine (TCM) is now included in the latest edition of the international classification of diseases (ICD-11; https://icd.who.int/en) as a supplementary chapter on traditional medicine conditions and specifically 'Ancient Chinese Medicine'. Another driver for herbal medicine research is based on the framework of bioeconomy or biotechnology, where local medical resources are seen as means to drive both the national or regional bio-economies, with a vision to support biotechnological capabilities on a sustainable basis, also resulting in strategies to overcome some of the challenges of environmental degradation (Valli et al., 2018). In contrast, in American countries with a strong indigenous representation an important drive to advance herbal medicine research, more recently, is linked to emancipatory processes of indigenous peoples and towards developing more sustainable and culturally pertinent models for healthcare delivery, under the concept of 'health sovereignty'. This drive to promote universal health coverage by promoting research on TM and integrating TM services into national health care delivery is also found on the World Health Organization's Traditional Medicine Strategy 2014-2023 (WHO, 2013). The Convention on Biological Diversity (CBD), and the Nagoya Protocol in particular, have generated yet another driver towards researching traditional peoples' knowledge on herbal medicine, pushing for the development of collaborative North-South agendas aiming at a fair distribution of benefits. Amidst this great complexity of interests coming together, the issue of how to build trustworthy research partnerships between diverse stakeholders becomes of great importance for truly advancing acceptable herbal medicine research. This article uses the case of the 'Green Health Project' in Guatemala to discuss what this path may look like. It is a project conducted by a consortium of partners under a UK's Darwin Initiative Grant to develop an ABS framework in Guatemala.

Understanding local medicinal systems in the context of a culture has a long tradition in (medical) anthropology and ethnobotany, including in Mesoamerica (e.g. Ortiz de Montellano 1990; Rubel et al., 1991; Berlin and Jara, 1993; Berlin and Berlin 1996). Debates have gone from cross-cultural comparison (Browner et al., 1998) towards critical views on the co-existence of plurimedical systems in conditions of inequity (Singer and Baer, 1995), and into discussions on the role of local (indigenous) systems of knowledge (epistemologies) using approaches, based on mutual respect (decolonial approaches) to address healthcare and development alternatives (Basile, 2018). Therefore, recent attempts to incorporate culture-specific epistemologies can actually benefit from a debate, which has been an important element in the context of the ethnobotany and ethnopharmacology of the Americas (e.g., Bourbonnais-Spear et al., 2007).

Traditionally, the emic-etic distinction has played a role in defining from which perspective a particular medical system is being described (Headland et al., 1990). An emic perspective on medicine offers a viewpoint from within a culture or society / group (i.e., focusing on perspectives of the subjects that are 'native' to a particular epistemology) (Pike 1954 and later editions). The etic distinction (often referred as the "outsider's approach") describes using explanatory models and interpretations from the perspective of an observer outside of the specific cultural group studied. Etic accounts usually refer to the perspective of a 'scientific' (academic) observer. An early example of combining an emic and an etic approach from the Americas is Ortiz de Montellano's work (1975) on 'Aztec empirical medicine', which specifically looked at treatment outcomes of diseases in the historic Aztec culture. Numerous later studies addressed this dichotomy of perspectives and contributed to an understanding of local medical traditions using elements from modern Western epistemologies to compare them, as for example when relating 'cultural syndromes' with specific aetiologies or identifying plant taxa used in traditional herbal medicines (Berlin and Jara, 1993; Menegoni, 1996).

In Guatemala, 'Raxnaq'il Nuk'aslemal: Maya Medicine in Guatemala' is an example of a purely emic account that is part of an indigenous revitalization movement. Published by the *Maya Council of Indigenous Healers by Birth* (CMMM, 2016), it presents concepts of health and well-being, the taxonomy of diseases as conceived in Maya medicine and ways to diagnose and treat diseases, among other topics, without attempting to find correlations to modern biomedicine. In contrast, the drive for enabling national or regional bio-economies based on the knowledge of specific local and indigenous medical systems would traditionally stem from an etic perspective. This development has been embedded in the implementation of the principles and specific requirements of the CBD (1992) and its subsequent treaties and protocols, including national and regional implementation procedures (Heinrich 2010; Heinrich et al., 2020). Within this framework, there remain serious concerns about a lack of mechanisms for equitable access and benefit sharing. The ambiguities of implementing these agreements have also impacted negatively on ethnobotanical and ethnopharmacological research in the Americas and elsewhere, because of unclear procedures that de-incentivise research. Yet we need to ask the question: "what new drivers could emerge if we broaden the application of the emic-etic dichotomy when building multi-stakeholder partnerships for advancing herbal medicine research?"

In many regions of the Americas, there is an increasing trend towards reaching 'health sovereignty'. Research approaches promoting traditional knowledge systems historically excluded from public health strategies are an integral part of this strategy (De Sousa Santos, 2010). Traditional systems give local phytomedicines an important role to increase cultural pertinence and access to healthcare delivery (Rocha-Buelvas, 2017). This movement, stemming from the 'Epistemologies of the South' (De Sousa Santos, 2011), advocates for promoting a diverse 'ecology of knowledge systems' that places holders of traditional knowledge at the forefront of applied research endeavours (Basile, 2018; Laurell 2010). This approach means going beyond mere participatory orientations in research and instead into deeper equal partnerships breaking away from reproducing the historical inequities of the *status quo*, and discussing the deeper aspects of trust-building (Christopher et al., 2008; Berger-Gonzalez et al., 2016a). In this context, many indigenous universities in the Americas have emerged (Manriquez and Gareiz, 2014; Pérez, 2019). These institutions embrace an emancipatory philosophy and challenge methodologies that, in their view, contribute to a systematic destruction of any indigenous knowledge base (epistemicide; Bennet, 2015). Although this might seem as a purely political position, it is in fact affecting the integration of academic partnerships worldwide and causing a reflexive process from academia in Europe and elsewhere in the global North (Carbonnier and Kontinen, 2015; Kontinen and Nguyahambi 2020). In this process, all institutions pursuing any form of research across hemispheres, cultures, societal stakeholders or knowledge systems, have been invited to reconceptualise partnerships that better reflect the potential for understanding sustainability amidst complex settings (Seidl et al., 2013).

Transdisciplinarity (TD) has emerged as an approach to research that transcends disciplinary (academic) boundaries but that, nonetheless, is able to incorporate state-of-the-art interdisciplinary approaches. Many studies have summarized the state-of-the-art in transdisciplinarity (Lawrence and Després, 2004; Wickson et al., 2006; Bergmann and Schramm, 2008; Hirsch Hadorn et al., 2008; Klein, 2008; Frodeman et al, 2010; Jahn et al. 2012). These latter studies recognize that different members of society hold particular epistemologies, which comprise diverse knowledge systems that need to be equally taken into account. TD recognizes the co-existence of a myriad of perspectives on shared societal concerns, with different degrees of awareness among them. According to Pohl and Hirsch Hadorn (2007:20), "there is a need for transdisciplinary research when knowledge about a societally relevant problem field is uncertain, when the concrete nature of problems is disputed, and when there is a great deal at stake for those concerned by problems and involved in dealing with them. Transdisciplinary research deals with problem fields in such a way that it can: a) grasp the complexity of problems, b) take into account the diversity of societal and scientific perceptions of problems, c) link abstract and case specific knowledge, and d) constitute knowledge and practices that promote what is perceived to be the common good.” We see here an acknowledgement for uncertainty and a recognition that the collaborative process will not be static but rather subjected to constant change. This is perhaps one of the most important characteristics of the transdisciplinary approach in the Green Health project.

In TD, mutual learning among participants is a key concept referring to the process of “exchange, generation and integration of existing or newly developing knowledge in different parts of science and society” (Scholz, 2011:8). Many authors agree that symmetry in the acquisition of new knowledge among all stakeholders (not just scientists) is a key component and a goal of TD (Miller et al., 2008; Pohl, 2008; Aeberhard and Rist, 2009). This idea of a mutual learning process derives a notion of equality that requires active steps to go beyond lip service. The practice of equity in a TD process is often challenged by power asymmetries between the participating actors (Nowotny et.al. 2001). Understanding power relations among all participants is a prerequisite directly affecting the outcomes from a mutual learning process (Möbjork 2010). In multicultural contexts, the issue of power needs to be understood also as the degree of agency of each group within the partnership to represent their interests and voice concerns based on their own epistemology. The reflexive question to start with becomes: ‘how many distinctive emic constructs are represented here?’ This enables partners to understand the centrality of exchanging and reinterpreting evidence presented to them. In this process, one cultural group often reassigns significance over another’s emic constructs (thus creating an etic interpretation). This can sometimes lead to misrepresenting a given culture’s knowledge system, or to overlook their associated values and preferences, potentially leading to a conflict. In multicultural settings, with diverse systems of knowledge (pluri-epistemic), transdisciplinary collaboration requires all participants to bring forth their emic explanatory models about the issue at hand and present them to each other, creating in the process many etic interpretations (for example, traditional healers reinterpreting a biomedical doctor’s explanations about a zoonotic disease, and vice versa). The challenge is to facilitate a process for dialogue where multiple emics of *self-representation* and etics of *otherness-representation* can find a common ground for mutual learning, reducing ethnocentric behaviour that may lead to bias in research, and aiming instead towards co-creation of new knowledge to address the target problem (Berger-Gonzalez et al., 2016a).

Trust-building is one of the most important elements determining a successful partnership in complex contexts. We propose that a carefully designed intercultural transdisciplinary process can promote avenues for building trust and advance research on useful plants and, specifically, herbal medicines in a respectful and innovative way. We present evidence of how this process aids in building agency for under-represented groups and the associated perils, as well as discuss the emergence of potential new drivers for developing evidence-based herbal medicine from the perspective of academia, policy, cooperation and grass-roots indigenous movements.

BACKGROUND

Central America and Guatemala

Central America has a population growth rate of >2% per year with high levels of poverty, unsustainable exploitation of natural resources, soil erosion and one of the world's highest rates of deforestation. From 2001 to 2019, Guatemala lost 1.48 Mha of forest, equivalent to a 19% loss since 2000 (Global Forest Watch 2020), resulting in forest fragmentation, biodiversity loss, malnutrition and poor socioeconomic access to natural capital (Torres, 2020).

Guatemala is one of the mega-diverse countries that together host 70% of Earth's terrestrial biodiversity (FAO, 2018). Its contrasting topographic variations produce a complex variety of climatic conditions and ecosystems accounting for its broad diversity (Byers and Lopez Selva, 2016). Categorized into 14 ecoregions by the WWF in 2001, this complexity contributes to making Guatemala the Central American country having the highest number of endemic species (Olson et al., 2001), with a long-standing/ancient traditional knowledge related to them.

Holding a medium human development index (0.663) (PNUD, 2020), Guatemala is characterized by great inequalities within society. There are 21 indigenous groups representing around half of the country's population (UNHCR, 2013; CIA, 2019). About 79% of these people live in conditions of poverty and 40% suffer extreme poverty (CIA, 2019). Traditional ways of life remain important, including a strong reliance on local natural resources for daily lives. Within this context, it is clear how the conservation of Guatemala's biodiversity assumes great social and political significance for the country. Guatemala's main source of income and employment is agriculture, with a growing cattle sector expanding in the lowlands of subtropical rainforest (MAGA, 2016). Exacerbated migration to the United States contributed to remittances accounting for 14.6% of Guatemala's gross internal product in 2020, according to Guatemala's National Bank reports. The political instability and widespread corruption create a generalized sense of mistrust towards authorities, even those in place to promote and drive conservation.

The Green Health project's main study area is located in the Petén lowlands, a vast territory of 35,854 km², where biodiversity loss is rapidly increasing due to urbanization, oil palm (*Elaeis guineensis* Jacq.)

plantations, and cattle farms (Torres, 2020). Culturally, the area is diverse owing to historical human immigration from other parts of the country. Indigenous Maya peoples, mostly Q'eqchi', Itza' and Mopan, account for up to one third of the population, living mostly in rural areas. With some of the largest Mayan cities from pre-Hispanic times, the Petén is a popular tourist destination. Cultural heritage of many indigenous groups in the region, such as the Mopan and the Itza' can be traced to the pre-Hispanic period. The many land-use pressures have put many species at risk due to habitat loss and degradation, with a consequent negative impact on livelihoods of vulnerable populations. In the municipality of Poptun, where the Q'eqchi' Council of Elders that co-leads this research project is located, over half of the population has poor access to official healthcare services and relies mainly on traditional Maya practitioners using herbal medicines (Hitziger et al., 2017).

<u>Regulating collaborative biological research – The International framework</u>

Due to the challenges related to the conservation of species and the problems associated with international trade, the regulation of and access to biological resources and associated knowledge has been increasingly institutionalized through several internationally agreed frameworks. For example, the Convention of International Trade in Endangered Species (CITES) was adopted to ensure that international trade is non-detrimental to the survival of traded species. Sustainable use and fair and equitable sharing of benefits arising out of the utilization of genetic resources are key objectives of the CBD. Its supplementary Nagoya Protocol (NP) regulates access to genetic resources, and the sharing of benefits arising from research and development of these resources and associated traditional knowledge. Both CITES and NP operate on the basis of permit systems that are binding on their Parties. Similar objectives are also pursued in less prominent agreements, such as the International Treaty on Plant Genetic Resources for Food and Agriculture, hosted under the auspices of the United Nations Food and Agriculture Organization (FAO). CBD´s non-binding Addis Ababa principles complement these regulations to provide a framework for sustainable use of biodiversity at national level. They emphasize, in particular, participative and adaptive decision making and management that involves local communities. Additional non-binding guidance also exists in other fora, such as the code of ethics proposed by the International Society of Ethnobiology. These frameworks are, therefore, key to ethnobotanical/pharmacological collaborations that aim at scientific research or product development from biological resources and associated traditional knowledge.

Some previous ethnobotanical/pharmacological research consortia aimed to overcome specific negative ecological, socio-cultural and economic consequences of research into biological resources and their associated traditional knowledge. Examples are the international cooperative biodiversity group (ICBG), a large-scale, participative bioprospecting consortium established jointly with Mayan people in Mexico (Berlin and Berlin 2004), and the MACOCC (Maya and contemporary conceptions of cancer) project, aimed at advancing innovative transdisciplinary approaches of North-South research on traditional medicinal knowledge in Guatemala (Hitziger et al., 2016; Berger-Gonzalez et al., 2016a). However, the nature of such consortia implies that they need to bridge not only different disciplines but, more importantly, they can only be successful if aligning interests and facilitating successful collaboration among local communities, researchers, and (mostly international) pharmaceutic industries. Implementing such consortia within the frameworks adopted by national and international regulators may pose additional challenges.

The ICBG Maya in Chiapas, México (1999-2000), which predates the Nagoya Protocol, was a short lived international collaborative programme funded by various US government agencies. It started with the key aim to 'return cultural as well as economic benefits in the form of books, videos, and community gardens' to indigenous peoples of Chiapas (Berlin et al., 1999). In the end it failed within the complex political and social framework in Chiapas and México just a few years after a major conflict linked to the North American Free Trade Agreement, which came into force on 01/01/1994. On the same day an uprising started in Chiapas. There can be no doubt that the project was both well-intended and was based on aims to achieve mutually agreed terms for using biological resources and for benefit sharing, as well as conserving biodiversity. However, the project came under serious criticism which resulted in the project's termination in 2000. ,

The implementation of access and benefit sharing instruments was then stipulated much more explicitly in the Nagoya protocol but remains problematic (Heinrich et al., 2020). Therefore, the Green Health Project is, to our knowledge, the first intercultural ethnopharmacological North-South consortium that brings together local communities, researchers, and pharmaceutical industry in Guatemala and beyond.

<u>The Green Health Project Partnership</u>

Funded by the UK's Dept. of Environment, Food and Rural Affairs, through the Darwin Initiative Fund, the Green Health Project was developed as a transdisciplinary collaboration among partners from academia, industry, government and an indigenous council. It is based on previous collaborations that have nurtured a relationship built on mutual trust and respect.

Two universities lead the academic aspects of this project: a research group at the UCL School of Pharmacy in London, and the Unit of Medical Anthropology of the Center for Health Studies at Universidad del Valle de Guatemala (UVG). Representing industry, Indigena Biodiversity Ltd. is an important partner bridging the know-how of commercialization efforts centred around ABS. The Council for Protected Areas (CONAP - Consejo Nacional de Areas Protegidas), represents the

Guatemala government in all matters concerning biodiversity use, as it is the appointed national focal point for the CBD.

At the centre of this partnership stands the Association of Councils of Maya Spiritual Guides *Releb'aal Saq'e'* (ACGERS), a group representing *Ajq'ij, Ajilonel* and *Comadronas* (spiritual guides, herbalists and midwives) from more than 40 different Q'eqchi' towns in Petén, las Verapaces, and Izabal. The ACGERS Council's mission is to document, revitalize and teach to new generations the values of Maya spirituality, medical practice, traditional music and overall cultural heritage. Since 2010, they have been part of three other transdisciplinary process studying traditional approaches to cancer, zoonotic diseases and models of healthcare delivery (Berger-Gonzalez, et al., 2016b, Hitziger et al., 2016; Berger-Gonzalez et al., 2020;), which have enhanced linkages of mutual trust between the Council and the academic partners of the Green Health Project. Due to a complex history of navigating interactions between indigenous groups and the government, two other partners from multilateral cooperation agencies within the UN system (an expert on conservation of medicinal plant species and an ABS expert) joined the partnership to aid in the process.

PROJECT AIMS

The project aims to implement a culturally pertinent and mutually accepted framework for sustainable use, access and benefit-sharing (ABS) of medicinal plants, based on natural capital and traditional knowledge in Guatemala, involving a consensus among relevant stakeholders. Specifically, the project is designed to build a framework for a policy on biodiversity and ABS, developed through a transdisciplinary dialogue among indigenous groups, government, academia and industry. Such an intercultural dialogue aims to help break down barriers and misunderstandings that have opposed the ratification of the Nagoya Protocol, as we will describe later, and serve as a basis for future research collaboration on traditional medical Maya knowledge, sustainable use of biodiversity, intellectual property recognition and other forms of benefit sharing.

Implementing an ABS mechanism is linked to ongoing empirical research on traditional medicine and intercultural health in order to understand the embedding of traditional knowledge in its use of a rich ecosystem. Therefore, this project also contributes to understanding the traditional medicine practices of the Q'eqchi' of the Petén.

THE FRAMEWORK FOR COLLABORATION: ETIC AND EMIC VIEWS

Regulatory framework on biodiversity research and development in Guatemala

Specialised knowledge of, and international access to, priced biological resources have always been sensitive political concerns. Famous examples were the global dissemination of silk moths [*Bombyx mori* (L.)] and mulberry trees on which the moths feed (*Morus alba* (L.)), as well as many tropical spices and other species that were important political drivers throughout the age of colonialism. Large scale commercial use has frequently resulted in the unsustainable exploitation of harvested species (ecological dimension), allegations of unfair appropriation and exploitation of specialised knowledge (sociocultural dimension), and economical exploitation of local communities (economic dimension). Based on the long history of exploitation of land, people, and the region, there is a complicated situation in Guatemala from the point of view of legislation around ABS.

In 1995, Guatemala ratified the Convention on Biological Diversity and, in 2014, ratified the Nagoya Protocol, through legislative decrees 5-1995 and 6-2014, respectively. The ABS National Focal Point for Guatemala is CONAP, which also acts as the Competent National Authority. In Guatemala, there is no legislation defining access to traditional knowledge associated with genetic resources. In 2016 - 2018, CONAP instituted a process towards developing a new law and policies for access to Guatemala’s genetic resources, including derivatives, and for the associated traditional knowledge. Part of this process included 26 “Regional Dialogue” sessions, held across the country to understand the concerns of indigenous and other local communities.

The proposed law would have its own institutional framework through the creation of a state entity, with functional, budgetary and regulatory independence, which would enable generation of financial and functional self-sustainability. The law was to be implemented through a National Policy for Genetic Resources and Biocultural Heritage that would consider the valuation, conservation, protection, sustainable use and exploitation of genetic resources used by indigenous peoples and local communities. This policy was to include a *sui generis* mechanism called the “Biocultural Heritage of Indigenous Peoples and Local Communities” for providing access to resources.

However, in 2016, before the NP could be implemented through a new law and policy, the consultation process was temporarily suspended. The suspension came after the process was challenged in the courts as unconstitutional by an indigenous congressman. This challenge was based on a recommendation of the Gran Consejo de Autoridades Ancestrales de los Pueblos Indígenas de Guatemala (GCAAG—The Grand Council of Ancestral Authorities of the Indigenous Peoples of Guatemala) and indigenous members of the REDSAG (Network for Food and Nutritional Security), supported by a number of local non-government organisations. There were concerns expressed about inadequacies in the process with respect to indigenous peoples. The rationale for the suspension by the court was that the NP had been approved too quickly and with insufficient attention to the constitutional requirement that all issues affecting indigenous peoples should follow a careful consultation process. As a result, there will have to be further consultations before a policy or law affecting indigenous peoples' knowledge can be successfully implemented. To this date, Guatemala still lacks any policy or laws to regulate intellectual property rights (IPR) regarding traditional knowledge (Risoli, 2019).

Guatemala has been attempting to move forward with an ABS protocol but currently any applications for the use or export of Guatemalan genetic resources are considered only on a case-by-case basis. The first (of only two) applications of the Nagoya Protocol in Guatemala occurred in 2018, and both are for internal (within Guatemala) academic use. One permission was granted for a non-commercial study of gene flow in mahogany (*Swietenia macrophylla*) populations in the Maya Biosphere Reserve of Petén (van Zonneveld et al., 2018).

The current implementation of the international biodiversity regulation was recently assessed (Heinrich et al., 2020). As noted, Guatemala has no legislation regulating ABS and the regulatory core weaknesses that we identified include:

- There is a general uncertainty for foreign entities interested in accessing and potentially developing local resources, pushing potential involvement abroad to countries, such as Panama, with easier routes to access, due to the temporary suspension of implementing the Nagoya Protocol from 2016 to 2021.
- No framework is in place to support the evaluation of who owns traditional knowledge and genetic resources.
- No policy or law exists to regulate intellectual property rights regarding traditional knowledge and limitations.

Importantly, IPR is an alien concept to many indigenous groups, proving difficult to negotiate, and not necessarily designed to protect traditional knowledge often considered to belong to a *social corpus* rather than individuals or small tangible groups. While there is interest in commercial applications from potential users of genetic resources, the lack of clarity about ABS laws and policy in this regard has hampered any advance, as outlined below.

An emic view on Access and Conservation

Traditional healers remain embedded in a plurimedical system that puts them in conditions of inequity, where no formal public policy recognizes the importance of their services in providing healthcare (Hoyler, 2018). A limited program within the Ministry of Health is supposed to promote traditional and alternative medicine including herbal medicines, but it has not had any impact at either the policy or the technical levels. The ostracism inflicted on Maya healers through historical exclusion and racism (Chary et al., 2018), topped with religious intolerance equating healers to witches (as shown in the 2020 murder of traditional healer Domingo Choc Che – see Abbot, 2020) is in stark contrast with the ACGERS Council's recognition of traditional healers' as " walking natural pharmacies". The ACGERS Council see healers as having an intrinsic role as guardians of the forests, charged by their nawales (spiritual energy guides) to care for plants and animals. One of the main interests of the ACGERS Council is the protection of the forest and a desire to learn how to secure access to important medicinal plants.

The pressure on forests in Petén is increasing due to an accelerated change in land-use patterns brought by cattle ranching, cultivation of monocrops and other activities (Torres, 2020), resulting in less availability for medicinal plants in their natural habitat. Because of this, healers have been forced to collect plants in areas that are increasingly threatened. These areas include populated centers (market and trade centers), family gardens, cornfields or general agricultural plots, along the roads and even between pasture lands.

OUR APPROACH AND METHODS DEVELOPED FOR THE GREEN HEALTH PROJECT

On a national policy level in Guatemala, it is essential to secure a constructive dialogue between key stakeholders. These groups have historically clashed on issues relating to the use and protection of traditional knowledge, as well as on the equitable use of resources and for ABS. Based on prior successful experiences, we used a TD methodology to foster participatory processes on an equal footing of a highly reflexive nature (Figure 1). This approach facilitates collaboration and mutual learning across knowledge systems and societal boundaries.

Figure 1 here

1) <u>Preparing a reflexive field</u>

The preparatory phase included a mapping of relevant stakeholders, while also researching historical, structural, sociocultural, economic, and other relevant conditions acting as potential behavioural drivers. Analytic lenses from intersectional analyses helped reveal gender issues affecting equal participation by men and women, while an analysis of power differentials across other societal divides became the starting point to develop tools needed to bring forth a horizontal multilateral exchange. For example, the TD process requires all stakeholders to participate in co-defining the interests and objectives to be reached by the project, as well as to agree on the activities and the methods. We therefore used analytical tools in a backward planning exercise to check our assumptions and identify where there are conditions generating gaps between the goal and observed reality (as shown in Figure 2). For each negative condition, specific tools were developed by the team to apply within the TD process as modulators of change.

Figure 2 here

The Green Health consortia followed traditional Maya protocols, as requested by the Elders of the ACGERS Council, to determine the degree of research and participation to be allowed. These included traditional sacred fire ceremonies and spiritual consultations with Ancestors and Guides of the Council. Reciprocally, Q'eqchi' participants underwent training in protocol concepts from modern western science to help set a base for mutual understanding and respect.

2) Developing an intercultural transdisciplinary workshop

An important phase in the project was the first transdisciplinary meeting, where stakeholders came together formally to build a partnership._To address interlingual differences, we included on-site simultaneous translation of Spanish, English, and Q'eqchi'. For easing intra- and inter-lingual complexity, we developed a glossary of terms of key concepts and values of each main epistemology present in the consortium (i.e., traditional respect titles of Maya elders, important values in the Q'eqchi' community, or science concepts such as 'objectivity' or 'reliability').

In meetings of previous TD-projects, there was criticism that the academic partners controlled the agenda, since the meetings almost solely focused on research approaches. In this project we encouraged all interest groups (representatives from the government, midwives, Maya Ajilonel (healers), European researchers, Guatemalan researchers, and community leaders), to prepare summary presentations of their groups' history related to herbal medicine approaches and the focus, values and preferences that they brought to the project. Emic interpretations were discussed to help participants understand the multiplicity of epistemic (knowledge) systems in the room, and to build tolerance. Perhaps one of the most important aspects in this phase was employing pertinent methodologies to enter into de discussion of each groups' interest and their inclusion or exclusion within the project. We employed three components of individual work, smaller interest groups, and plenary discussions, to facilitate equal representation among stakeholders, and particularly of women, who tend to be ignored in Maya indigenous societies when participating in public fora. The use of flashcards (aided by pictures and support from students) allowed participation of illiterate Elders and guaranteed that everyone had the same chance of presenting their ideas. An open dialogue lasted over 6 hours and allowed the plenary to choose which interests should be kept, which ones should be forwarded to other forums, and which ones had to be left out. This exercise was key for transparency and trust building because once preferences are out and agreements are reached, there is less room for false expectations to remain. Table 1 presents a summary of the overarching aims / interests presented by each partner in the consortium.

Note: The UN partners that accompanied this consortium were also interested in providing accurate advice on the NP, CBD and CITES where needed as the project evolved, to ensure clarity.

To facilitate the sharing of responsibilities and resources, a steering-board with representatives from the key societal actors and institutions needed to affect change, was created. This has been operational since the start of the project in 2019 and includes indigenous leaders (> 30%) and women (>30%). This board leads negotiations of participants from wider institutional sectors including academia, industry and local and international regulatory bodies. Importantly, financial resources are shared by all partners and all resources flowing to the Council are discussed openly in the TD workshops.

As part of the initial TD workshop, intercultural rules for engagement were discussed and recorded for future reference. All stakeholders then engaged in defining an Action Plan for the first year of the project, where for each objective (defined from the discussion on joint interests) there are activities defined, indicators created, and responsible partners assigned. This is the basis for the continued monitoring of the project in order to measure advances, identify problems and needs to adapt on a timely manner.

Ethical approvals

Due to the transdisciplinary nature of this project, there were two ethical assessments. The first followed Maya ritual protocols (consuetudinary procedures) through and included a detailed revision of the proposal by Elders of the ACGERS Council. This was accompanied by a ceremonial process led by traditional Ajq'ijab' (Spiritual Guides). Permission to co-lead the research was granted on June 2019 and is recorded in the Councils' *Libro de Actas* (Folio No. 05-2019). Secondly, this project was reviewed by the Institutional Review Board of the *Universidad del Valle de Guatemala* (Protocol rev.13-04-20); a change request due to Covid19 delays was resubmitted and is pending final approval (March 2021). No plant material has been or will be exported from Guatemala as a part of this project.

Joint Implementation of Methods

Knowledge co-production requires the buy-in of all participants from the start of the project and joint design of the principal elements of the tools used in the research. A rich interdisciplinary discussion between social scientists, biologists, ethnobotanists and a medical practitioner opened up to include all actors in defining the following activities.

Understanding Q'eqchi' phytotherapy

To understand the role of local biodiversity in traditional healthcare practice, the Mayan Councils of Elders selected 16 *Ajilonel* or herbalists to participate in research to document their own medical practices. Activities chosen by our team included:

- Correlating biomedical epidemiology with 'cultural epidemiology' records: In most American countries, there is no data on what consultations healers do and what the outcomes are. Our team developed a tool similar to the epidemiology records kept in public health services, training Ajilonel to record all consultations that they provided to indigenous patients over a period of 6 months. This database contains a description of emic categories of cultural syndromes, traditional diagnostic methods, general treatment approach and specific mentioning of herbal medicines. It also includes a large initial inventory of local plants used in treatments. These data served as the basis for transect walks with the Ajilonel to collect specimens in the forest.
- In-depth reconstruction of medical cases: Representatives of biomedicine and Maya medicine jointly diagnose a patient, discuss the case with each other and the patient, and offer treatment, explaining to each other the logic for the selected treatment and follow up. This thorough documentation of Maya medicine in specific ailments enables a better understanding of the approach's limits and opportunities, facilitation the design of intercultural healthcare modes, and quantifying preferences for specific herbal medicines. Ethnographic tools, including participatory observation, open and structured interviews and focus groups, used to document Maya medicine and understand the embeddedness of plant use. Species used were later collected also using transect walks with healers. Plants collected were curated and since April 2020 are being identified at the herbarium of UVG.

Experiential exchanges between project partners continued during this phase as a mechanism to reach consensus towards the implementation mechanisms for ABS. This includes reflexive dialogues in a multi-epistemological setting addressing differing knowledge systems, values, and institutional organization styles. For this reason, patients and plants can be considered 'boundary mechanisms' (Kertcher and Coslor, 2020), tangibly bridging mutual learning opportunities across societal divides through becoming the focus of common interest.

3) Ethnobotanical methods

Transects consisted of walks at places where traditional healers collect their plants. These included forests, orchards, near the healers' houses, urban areas, along roads, forest patches, mountain forests, or areas near paddocks. The search included listed and non-listed medicinal plants that the traditional healers recognized. During the process, two community researchers from the council of Maya Elders were trained in sample collecting of plants, including the process of curation and note-taking. Collection of plants was carried out from November 2019 to October 2020. For each plant collected, a semi-structured interview took place to document its role in Maya medicine. Each plant was collected with a duplicate, when possible, coded and photographed. The ethnographic and ethnobotanical information documented was transcribed to a digital database for later analysis.

We conducted 32 transect walks in 15 different communities' areas. Two hundred fifty three samples were collected, from which 123 are from eight healers in the Petén areas of Cantutú, Ixobel, Santa Cruz, Concomá, Jolobob, La Florida, Sehamay, and Chimay within the Poptún and San Luis municipalities. We collected 66 plants from three healers in Izabal at Los Zapotillos, San José Pacayal, and Chunacté within Livingston municipality; and 64 from four healers of the Alta Verapaz' villages of San Juan el Paraíso, San Fernando, and San Agustín, within the Chahal municipality.

OUTCOMES AND DISCUSSION

Areas where healers from the ACGERS Council collected medicinal plants for this project were in forest patches or forest edges, surrounded by non-forest areas that have been used for agriculture and pastures (Figure 3). The white and gray areas show degraded landscapes where cattle and farming practices have destroyed primary forests, leaving behind second growth. It is evident that Maya healers face tremendous difficulties to continue harvesting forest products for ensuing their traditional medical practices, owing to substantial forest loss.

Figure 3 here

The impact of negative effects on forests, such as pressure towards the use of forests by different physical-social activities, occurs up to a distance of 3 km from the main activity, deforesting from 22% to 51% of the forest's original area (Vergara and Gayoso, 2004). Applied in a reverse fashion, Elder's proposals to recuperate degraded land through regenerating (planting) a buffer of 1 km around the collection areas, would result in there being enough forest patches converging to create a possible 'corridor' of medicinal plants and other local species. Traditional healers from the ACGERS Council are primarily worried about securing access to critical resources used in the medical care they provide in their towns. The Council's interest may represent an opportunity for the creation of conservation corridors. In recent meetings the ACGERS Council's has expressed its eagerness to continue this TD partnership as a mechanism to find avenues to guarantee continued access of medicinal plant species in the forest or via assisted reproduction (for which partnerships with academic institutions are seen as important). From an emic perspective, ABS should help in improving access to key natural resources for future generations of Q'eqchi' Ajilonel, and not so much on the immediate monetization of plant knowledge. This follows the traditional Maya way to understand collective benefits for the well-being of generations to come, over economic gains for only the present generation of healers.

<u>The industrial experience focusing on biodiversity in Guatemala</u>

In order to understand the current challenges in the context of commercial uses, it is essential to understand the recent history of developing high-value products from Guatemalan resources. The project partnership includes Indigena Biodiversity Limited, a UK-based company, established to operate under the legal and ethical principles of the CBD and NP. The company's objective is to provide research access to valuable genetic resources from biodiversity-rich countries and manage equitable sharing of any commercial benefits arising from its utilization with provider countries.

Indigena began operations in 2014, shortly after the introduction of the NP and chose Guatemala as its first potential provider country. A local manager and a local lawyer were recruited. Early on, there were local misperceptions and a culture of opposition to intellectual property on plant varieties, which spilled over to a suspicion of any foreign entity wishing to export plants. Initially, there were conflicting reports on whether there were even any CBD/NP regulations in place.

During 2014, contact was made with the Guatemala National Focal Point at CONAP. Although Guatemala had ratified both CBD and the NP, no ABS regulation was in place (see above). Prompted by Indigena's enquiries, CONAP initiated a project to formulate the requirements for access. The first suggestion, in 2015, was that Indigena should establish a company registered in Guatemala. Indigena countered that such a requirement would in fact deter foreign access, which is one of the principles of the CBD. In 2015, Indigena wanted to export plant material for research purposes with no plans for direct commercial uses of products, which was made clear to CONAP's working group. It was acknowledged that the access regulations in Guatemala were being developed through the practical input that the company was providing.

Under revised rules, the local company requirement was dropped and instead, two forms were required:

1. Request for a research licence

2. Request for collection

In addition, a list of further requirements was listed, including the preparation of a detailed research plan, to be approved by a university in Guatemala.

In 2016, Indigena put together a consortium to carry out research on a plant species endemic to Guatemala, in particular for *Ageratina ligustrina* (DC.) R.M.King & H.Rob. (syn.: *Eupatorium semialatum* Benth.), which is used locally for treating malaria. The research partners in the UK planned to modify the constituents of the natural product to attempt to improve the antimalarial activity, providing a more effective treatment in Guatemala, plus financial benefits, if a new medical substance could be developed and marketed.

The plan was presented at a meeting at CONAP, chaired by the director of the newly established Biodiversity Technical Office of CONAP, who was very helpful and offered to facilitate the required endorsement from the University of San Carlos. If approved, this species would be the first plant to be object of a permit under the new ABS regulations in Guatemala. Unfortunately, San Carlos did not wish to approve the plan and instead, in 2017, Indigena approached Universidad del Valle de Guatemala, who were interested in entering into a partnership.

However, in 2017, there was an increasing and significant local opposition to bioprospecting in Guatemala and late in 2017, the legal challenge of the ratification of the NP effectively halted any access applications, including Indigena's.

These regulatory challenges were known prior to the start of our project and overcoming certain legislative obstacles was part of the overarching goal. Unfortunately, in 2020, CONAP, released a directive requiring, in all cases, that 50% of the "rights and benefits" need to go to a Guatemalan entity (CONAP 2020). From Indigena's perspective (and likely of any industrial partner), this created a major hurdle for the collaboration and is currently seriously jeopardising the project's desired outcome. Any industrial partner, as the provider of structural and financial investment, could not accept such terms, especially the sharing of patent rights (which is another requirement in the policy). This 'event' links back to the current complicated situation. In the specific case of this project, Indigena is not prepared to sign an ABS agreement (with mutually agreed terms - MAT) under the proposed terms when there is no way for a company to develop business relations while abiding by the law; therefore, the collaboration remains in a cul-de-sac. More generally, despite Indigena's efforts to protect local traditional knowledge and genetic resources, while attempting to provide satisfactory benefits and revenues, the history of exploitation has sadly resulted in a legal situation that will undoubtedly discourage research and commercial investment in Guatemala. Interestingly despite having been working alongside CONAP, only recently has there been clarity about the exact restrictions posed by the regulations in place. This exemplifies how complicated the regulatory situation currently is.

As a result, therefore, this part of the project has not been able to progress to a workable solution in Guatemala. Nevertheless, a great deal has been achieved through the TD process. For example, an outline ABS framework has been proposed, to inform future dialogue on possible regulations that could attract industrial involvement. In addition, a possible future positive outcome has been specifically set out in terms of a selection of species with a potential to provide research leads. A model ABS agreement is available for an exemplary commercial project. The law needs to change and the future is unclear, but we have provided a clear positive vision of what the future could look like.

Defining a framework for benefits

A core element of our approach is a review and assessment of the current framework for using Guatemalan biodiversity for further research and development, to contribute to a better evidence-base for current practices and for generating opportunities in the context of developing new medicines, supplements and/or cosmetics. Discussions with indigenous counterparts and national institutions responsible for biodiversity protection have been conducted and continue to explore potential monetary and non-monetary benefits on which to focus, from the possible implementation of the CBD and Nagoya Protocol in Guatemala, enabling an assessment of the biodiversity's future potential impact on Mayan communities. This includes a focus on recuperating endangered medicinal plants, and protect and use the local biodiversity. None of this is – at this stage- feasible, since the core of this project is on establishing a basis for future development of ABS mechanisms.

In spite of this, developing the *know-how* on how to build a trustful relationship upon which to develop such a desired ABS mechanism, has been a major contribution of this project. All documentation from participatory research provides input into the transdisciplinary process and guides the discussions to assess all relevant data. Consequently, stakeholders have co-developed tools to assess the correct mechanisms to: 1) formally recognize indigenous traditional knowledge concerning medicinal plants, 2) identify appropriate mechanisms for protection of intellectual property if desired, and 3) define concrete mechanisms for benefit sharing. The intercultural transdisciplinary process in itself is part of the academic endeavour to systematize the mechanisms fostering dialogue and negotiations towards consensus of policy, from which specific tools (manuals or technical guides being developed) will facilitate future replicability.

Medicinal Plant Research - Outcomes from local uses to global potential

Of the 253 samples collected, until March 2021, 150 specimens were identified (including species reported more than once by different healers), belonging to 48 families and 77 genera. On average, a healer takes up to an hour to collect around nine plants (9 plants/1.2 hours), depending on their location. For some plants it took up to four hours to collect a single specimen. Evidently, access to the plants varies greatly depending on their preferred habitat and current distribution (see above). From all collected plants, 28% were collected in and near the healer's house, 66% in forests, near paddocks, or forest patches, 4% came from interdepartmental transfer upon request from the healers, and 2% were obtained on a local market. According to the frequency of use, at least 51 medicinal plants are frequently used by the healers throughout the three departments. At least 59% of the plants used have no contraindications or toxicity (based on the healers' assessment).

Literature review of a selection of species

We conducted a literature review for each plant species identified by the UVG herbarium team by assessing previous ethnobotanical records, pharmacological and toxicological published data. These reviews meant to inform the assessment of the current economic potential of target species including potential for exclusivity provided by intellectual property and possible commercially viable uses of products from these target species. The aim of this part of the project is twofold. On the one hand, it helps to understand the existing knowledge about a species' pharmacology and toxicology which can be used locally. On the other hand, it provides a basis for understanding larger scale uses of these resources outside of their region of origin, an aim defined in etic terms and as such one not directly transparent in the local context.

The medicinal flora of the Neotropis and specifically of the lowlands of México, Guatemala and Belize is not well known, but some species have already been assessed in considerable detail (Geck et al., 2020). In this project, no samples for pharmacological and phytochemical research were collected. Instead, it includes a literature-based assessment of the existing evidence on a species' pharmacological effects and toxicological risks. In a first analysis, we assessed the distribution of the species in order to understand whether the species is restricted or not.

Assessing the evidence base and potential of selected species

Among the specimens collected, 58 species have been assessed so far (i.e. the ones reported until 01.02.2021). For each species, a literature review was performed to inform the selection of species of relevance for potential 'utilization', as defined by the CBD, but no assessment was made of the plants as commodity products. As a first step, very widely or globally known, generally non-native species, were separated from those in essence restricted to the Neotropics. A more restricted distribution would provide products, which will result in local opportunities for ABS. However, this research also provides an opportunity for assessing the potential of other species (for example, by identifying very widely used plants, which may have research potential).

We excluded, in the first instance widely known, used and well-researched taxa such as *Aloe vera* (L.) Burm.f. *Salvia rosmarinus* Spenn. (better known as *Rosmarinus officinalis* L.), or *Theobroma cacao* L. (Geck et al., 2020). For such well-known species, a large body of evidence including pharmacological and toxicological data are available. Therefore, there is very little scope for new lines of research resulting in new products with benefits for the region.

Secondly, species that are not native to Guatemala or Central America were also excluded, including widespread and globally used species. They have become accessible/imported in the Neotropics and are an integral part of the local practice mostly as food or medicine. Examples include *Kalanchoe pinnata* (Lam.) Pers., native to Madagascar and *S. rosmarinus*, native to the Mediterranean region.

We excluded additional species if they were either endangered or well-known for being toxic. This is the case for *Aristolochia tonduzii* O.C. Schmid, as the entire genus *Aristolochia* is of major toxicological concern, due to the presence of aristolochic acid derivatives (Michl et al., 2014)

These three criteria led to the exclusion of 17 species from the initial list (Figure 4, selection stages A + B + C). In the following steps, we looked at the different levels of pharmacological evidence and the reports of traditional uses for the remaining 41 species.

Figure 4 here

Previously some species characteristic of the Flora Neotropica have been investigated extensively for their potential medicinal properties. For example, *Neurolaena lobata* (L.) Cass. is the subject of numerous publications supporting its *in vitro* antiprotozoal (including antiplasmodial) and cytotoxic activity (Berger et al., 2001), in vivo wound healing properties (Nayak et al., 2014) linked to its sesquiterpene lactones', and anti-inflammatory activity (François et al., 1996; Walshe-Roussel et al., 2013). Similarly, *Guazuma ulmifolia* Lam. has been studied in considerable detail in relation to its potential antibacterial, antihypertensive, and antidiabetic properties (Alonso-Castro et al., 2008; Magos et al., 2008).

Other species have been reported as traditional medicines but no evidence related to their pharmacology and chemistry is available. For example, *Lygodium heterodoxum* Kunze, has previously only been reported as used by Q'eqchi' for medicinal purposes (Walsh-Roussel, 2014) and *Odontonema callistachyum* (Cham. & Schltdl.) Kuntze, is mentioned in relation to the traditional medicine of some indigenous people of Mexico, specifically the Mazatecs in Oaxaca, (Giovannini and Heinrich, 2009) and the Popoluca (Leonti et al., 2001).

Interestingly, some species have been reported as Q'eqchi' traditional medicine previously but for a different use, compared to the uses mentioned by the healers involved in our project. For example, *Gurania makoyana* Cogn. was reported by Walsh-Roussell (2014) as used by Q'eqchi for immunomodulatory purposes, while in Petén the species is used to reduce fever and treat haemorrhage.

Other species have not been previously reported for their medicinal uses and have only been investigated botanically, such as *Heliconia aurantiaca* Ghiesbr. In this case, there are a considerable number of reports (>50 published papers) but these are limited to botanical descriptions and location or biodiversity and environmental importance (Iremonger et al., 1995; Castro-Luna et al., 2011; Collins, 2015; Gomez-Dominguez et al., 2015).

Finally, some species are almost unknown, including *Philodendron hoffmannii* Schott. and *Stenospermation robustum* Engl. (both Araceae), with minimal published records (less than 10 found), and limited to their existence as reported by the botanists who named them (Hilje, 2007), or reported on local floras (e.g., Flora of Panama, Standley, 1944), or their specific location as part of local biodiversity investigations (Kohlmann et al., 2010; Valdez-Porón, 2012).

The list was shared with the industrial partner, who, taking into account the academic and patent literature available, removed 10 species for which prior extensive studies meant that an exclusive position was unlikely to be achievable. For example, *Piper peltatum* has been well researched and its main constituents are known, so that there is little possibility to find a patentable outcome from a research program. That left a preliminary list of 31 species.

The industrial partner then carried out a further study of the information available to assess the commercial potential of the remaining species. From that list, 12 species were first removed because they exhibited too many activities; such a variety of properties would make it unlikely to be able to develop a product treat a specific human disease or condition, without other side-effects. Secondly, a further 15 species were excluded because the reported activities would be unlikely to translate into a high value commercial application.

That analysis led to a shortlist of four species with a potential for further research and development. As an example, *Phalaris canariensis* L. is traditionally used for "blood in urine"/prostate treatment, which is certainly a condition that could have a commercial potential. Kchaou et al. (2015) describe anti-acetylcholinesterase activity for the species. As other anticholinergics are used as treatments for benign prostate, this finding could explain the traditional use of this species. Furthermore, anticholinergics have also been proposed for treating Alzheimer's disease, which would be a very commercially attractive target.

P. canariensis was not, however, among our two selected species because it is well known globally as canary seed, although not explored in terms of medical potential. Secondly, the desired activities are already suggested in the literature. Nevertheless, the individual metabolites responsible for the activity are not known; and identification of those molecules, or chemical modifications thereof, could provide valuable research targets for a commercial product.

Core obstacles and opportunities

The project has resulted in a unique collaborative perspective, has enabled a mutual understanding of what is possible for developing high value products from indigenous traditional knowledge on local biodiversity, and has built a basis of trust among very different stakeholders. The TD process has developed a pathway for consensus building, mutual understanding and learning, but core challenges remain to move ahead due to constraints in the CONAP current policy framework.

There is still a need to develop an ABS mechanism agreed on by all parties. A way forward could be to open a discussion with CONAP for a decision to lobby its way into amending article 26 of *Acuerdo Gubernativo No. 759-90* directly, possibly by adding a clause (f) for projects operating under the NP, providing for a more reasonable and attractive sharing of patent rights and benefits. This, however, would need the re-ratification of the NP by Congress, which can only happen after a detailed consulting with indigenous peoples. Although this seems like a lengthy process, we propose the use of an intercultural transdisciplinary framework, like the one employed in our Green Health project, for this purpose.

In the context of the Green Health project, the most realistic way forward would be a joint effort of CONAP, indigenous communities and industry to amend the *Acuerdo Gubernativo No. 759-90*, also giving better opportunities to the indigenous representatives to negotiate access and benefits. Based on this case, the project could keep working to produce a long term plan for changing the law and show what that scenario could look like. This will also develop into an example of scientific collaboration with ABS mechanisms.

CONAP's efforts in conservation constitute a mitigation strategy against deforestation, but it has a zero tolerance policy on formally using protected areas in any way, further preventing healers from accessing medicinal plants in healthy forests. This is why on the last TD workshop held in December 2020, members of the ACGERS Council formally requested CONAP to create a mechanism by which traditional healers could be given a formal ID allowing them to go into National Parks and protected areas to harvest traditional medicinal plants in a sustainable fashion. This idea is being pondered by both sides but it won't be operational within a legal framework of CONAP any time soon. On the other hand, Guatemala's K'atun 2032 National Development Plan considers the restoration of 1.2 million hectares of forest with an assessment of opportunities for landscape restoration in Guatemala. However, State policies still favour capitalist agro-export development, including promotion of industrial logging, extensive cultivation of monocultured crops, and cattle farms. Factors, such as increasing land concentration, soil depletion, biodiversity loss and inadequate access to markets, healthcare and food, threaten small land holders' health and nutritional welfare (Márquez and Schwartz, 2008). As traditional healers try to cope with landscape-level changes, the suitable areas for plant collection continue to shrink, forcing them to generate agreements with landowners to avoid legal consequences for trespassing.

The emic view of the Q'eqchi' Ajilonel on protecting access to genetic resources through the creation of conservation corridors, and their desire for ongoing research to understand the characteristics of each species for determining assisted reproduction and safety use, is a key element that needs to be addressed in any further discussions on ABS in the region. Rather than adopting only the principles of an etic perspective on developing ABS mechanisms following the guidelines of foreign experiences, incorporating emic concepts of 'value' regarding increased access to genetic resources can tilt the balance towards promoting the needed policy change. For future successful partnerships, this interest of local indigenous epistemologies could be the starting point to move the needed ABS policy framework forward, while at the same time advancing collaboration on researching herbal medicines and contributing to conservation of biodiversity in Guatemala.

Conclusion

At first sight the most obvious outcome from the etic perspective of an industry partner is a list of prioritized species of interest for future pharmaceutic evaluation. Importantly, the concept of developing local resources is shared widely also within the community participants. While in this paper, only interim outcomes can be reported, at the end of the project these list of priority species can be the basis for new collaborations, which actually focus on the research and development of target species that may also include emic Q'eqchi' Maya categories of 'valuable' plants.

Our project has achieved a platform for developing a trustful collaboration of different stakeholders, who, at the same time, share a common interest in biodiversity and their sustainable use. This was done through developing an inter-institutional culture of open dialogues at equal footing by promoting the inclusion of all relevant perspectives. Applying a multidirectional emic-etic reflexive exercise when assessing desired project outcomes enhances the mutual understanding of different drivers and potential approaches and provides a better chance to build long lasting partnerships for advancing the needs and interests of all stakeholders. Such a process enables an intercultural and international dialogue within a transdisciplinary process. Overall, our Green Health project has demonstrated that for any successful future collaborations between diverse stakeholders interested in research and development of herbal medicines and derived uses, it is necessary to invest the time and resources in developing a reflexive and respectful participatory process that builds mutual trust. Most importantly, however, future stakeholders, for example, from industry need to seriously incorporate the desired benefits from the emic views of indigenous communities.

Without overcoming the regulatory problems, our project, however, remains theoretical in its efforts to develop an actual ABS contract between industry and indigenous peoples in Guatemala. In a wider context, the project also highlights that the national implementation of the NP and associated international agreements will impact not only on a country's global competitiveness, but also directly on what opportunities exist for local stakeholders, including the indigenous groups. The implementation of the NP differs among Central American countries, and this has resulted in some countries developing their bioeconomies faster than others. Overall, while we have proof that incorporating emic drivers and views make potential ABS agreements more socially robust, these need to meet at the middle with etic views of scientifically robust, clear, legal frameworks that reduce uncertainty for all stakeholders involved.

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Table 1: Overarching aims and interested as presented by the indigenous, governmental, industrial and academic partners.

Interests of academic Partners	To advance knowledge on ethnopharmacology and ethnobotany of the Q'eqchi Generate a basic evidence-base for advancing herbal medicine research. Case study for safety use of most used plants. To increase the repository of medicinal spp. at the UVG herbarium. To develop a case study for ABS understanding role of science partners. To develop intercultural transdisciplinary methods for building N-S partnerships
Interests of the Indigenous Council	To increase information on the plants used by the Ajilonel, particularly their safety and ability to be reproduced outside of the forest. To develop a plant nursery and seed repository of medicinal plant species. To create an agreement with local government officials for the creation of a protected area. To discuss potential income generation strategies with foreign partners, for the development of the Council's families.
Interests of CONAP (Government partner)	To develop the first case study on how to create an ABS format for negotiating agreements between indigenous peoples and a foreign institution. To develop tools and manuals for the replicability of the experience with other indigenous groups. To generate evidence for CONAP's use on further advancing the negotiation of regulatory frameworks.
Interests of industry partner	To gain access to information on indigenous plant use for evaluating potential commercial uses. To develop the first ABS agreement with an indigenous group and a partner from industry, as a step to advance clear policy and regulatory frameworks.

Figure legends:

Figure 1. Architecture of transdisciplinary design of the Green Health Project, depicting four project phases in order to reach the desired goal.

Figure 2. Flow diagram of the backward planning process to identify assumptions in multicultural settings, detect participation gaps, and develop modulators of change to facilitate the original desired goal, a key element of the TD process. (based on Berger-Gonzalez et al., 2020)

Figure 3. Dynamics of forest coverage, non-forest lands, and points for plant collection by traditional healers. The color version of this map is available at https://discovery.ucl.ac.uk/.

Figure 4: Flow diagram showing the selection of species that are of potential commercial interest based on the literature review.

Figure 1

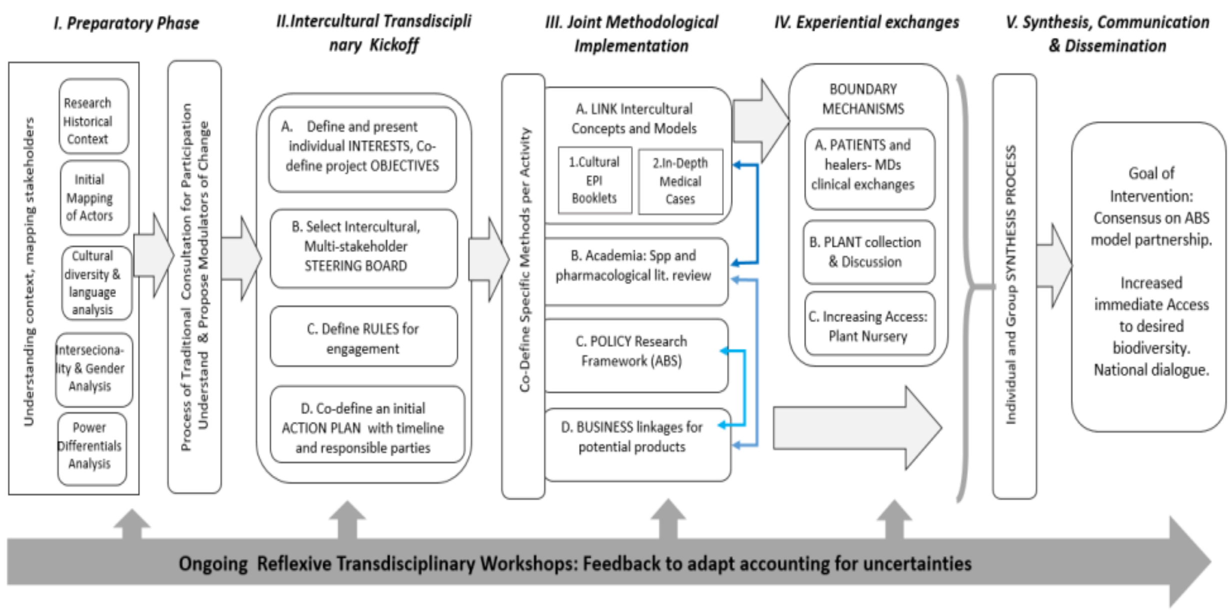

I. Preparatory Phase
II.Intercultural Transdisciplinary Kickoff
III. Joint Methodological Implementation
IV. Experiential exchanges
V. Synthesis, Communication & Dissemination
Understanding context, mapping stakeholders
Research Historical Context
Initial Mapping of Actors
Cultural diversity & language analysis
Intersecionality & Gender Analysis
Power Differentials Analysis
Process of Traditional Consultation for Participation
Understand & Propose Modulators of Change
A. Define and present individual INTERESTS, Co-define project OBJECTIVES
B. Select Intercultural, Multi-stakeholder STEERING BOARD
C. Define RULES for engagement
D. Co-define an initial ACTION PLAN with timeline and responsible parties
Co-Define Specific Methods per Activity
A. LINK Intercultural Concepts and Models
1.Cultural EPI Booklets
2.In-Depth Medical Cases
B. Academia: Spp and pharmacological lit. review
C. POLICY Research Framework (ABS)
D. BUSINESS linkages for potential products
BOUNDARY MECHANISMS
A. PATIENTS and healers- MDs clinical exchanges
B. PLANT collection & Discussion
C. Increasing Access: Plant Nursery
Individual and Group SYNTHESIS PROCESS
Goal of Intervention: Consensus on ABS model partnership.
Increased immediate Access to desired biodiversity. National dialogue.
Ongoing Reflexive Transdisciplinary Workshops: Feedback to adapt accounting for uncertainties

Figure 2

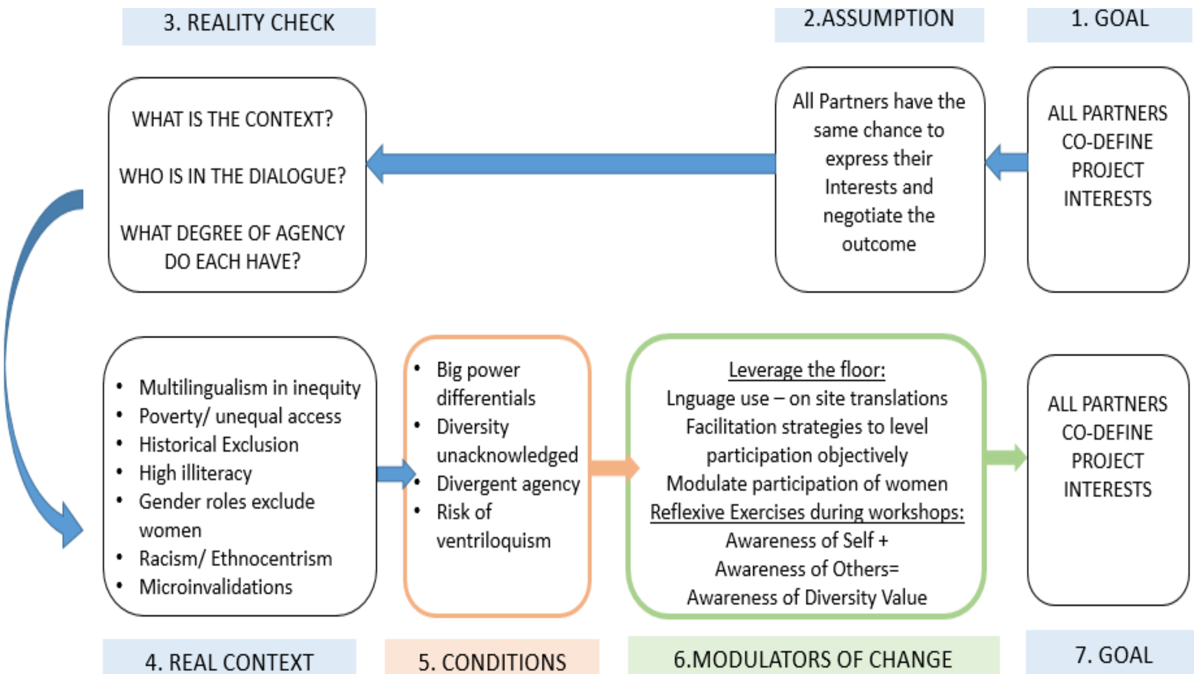
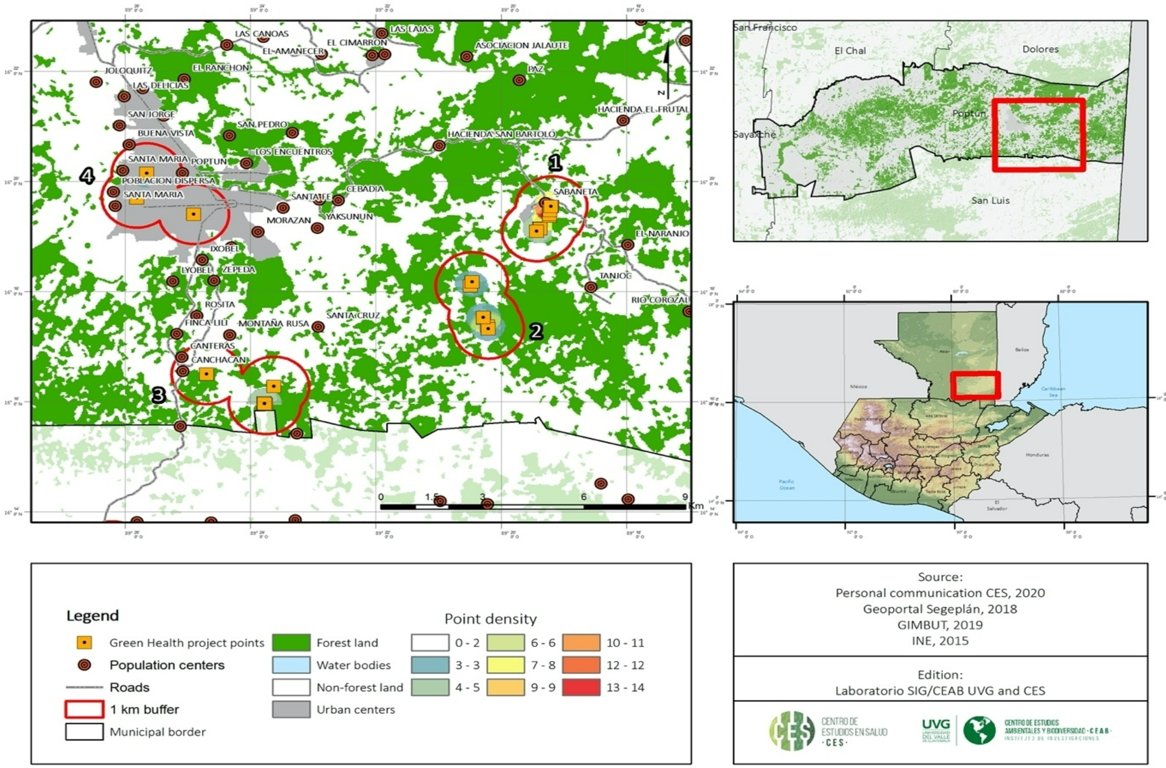

3. REALITY CHECK
2.ASSUMPTION
1. GOAL
WHAT IS THE CONTEXT?
WHO IS IN THE DIALOGUE?
WHAT DEGREE OF AGENCY DO EACH HAVE?
All Partners have the same chance to express their Interests and negotiate the outcome
ALL PARTNERS CO-DEFINE PROJECT INTERESTS
Multilingualism in inequity
Poverty/ unequal access
Historical Exclusion
High illiteracy
Gender roles exclude women
Racism/ Ethnocentrism
Microinvalidations
Big power differentials
Diversity unacknowledged
Divergent agency
Risk of ventriloquism
Leverage the floor:
Lnguage use – on site translations
Facilitation strategies to level participation objectively
Modulate participation of women
Reflexive Exercises during workshops:
Awareness of Self +
Awareness of Others=
Awareness of Diversity Value
ALL PARTNERS CO-DEFINE PROJECT INTERESTS
4. REAL CONTEXT
5. CONDITIONS
6.MODULATORS OF CHANGE
7. GOAL

Figure 3


LAS CANOAS
LAS LAJAS
EL CIMARRON
EL AMANECER
ASOCIACION JALAUTE
EL RANCHON
JOLOQUITZ
LAS DELICIAS
PAZ
SAN JORGE
HACIENDA EL FRUTAL
SAN PEDRO
BUENA VISTA
HACIENDA SAN BARTOLO
LOS ENCUENTROS
SANTA MARIA
POBLACION DISPERSA
POPTUN
SANTA MARIA
SANTA FE
CEBADIA
SABANETA
MORAZAN
YAKSUNUN
EL NARANJO
IXOBEL
LYOBEL
ZEPEDA
TANJOC
RIO COROZAL
ROSITA
FINCA ULI
MONTAÑA RUSA
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1
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El Chal
Dolores
Poptun
Sayaxche
San Luis
Legend
Green Health project points
Population centers
Roads
1 km buffer
Municipal border
Forest land
Water bodies
Non-forest land
Urban centers
Point density
0 - 2
3 - 3
4 - 5
6 - 6
7 - 8
9 - 9
10 - 11
12 - 12
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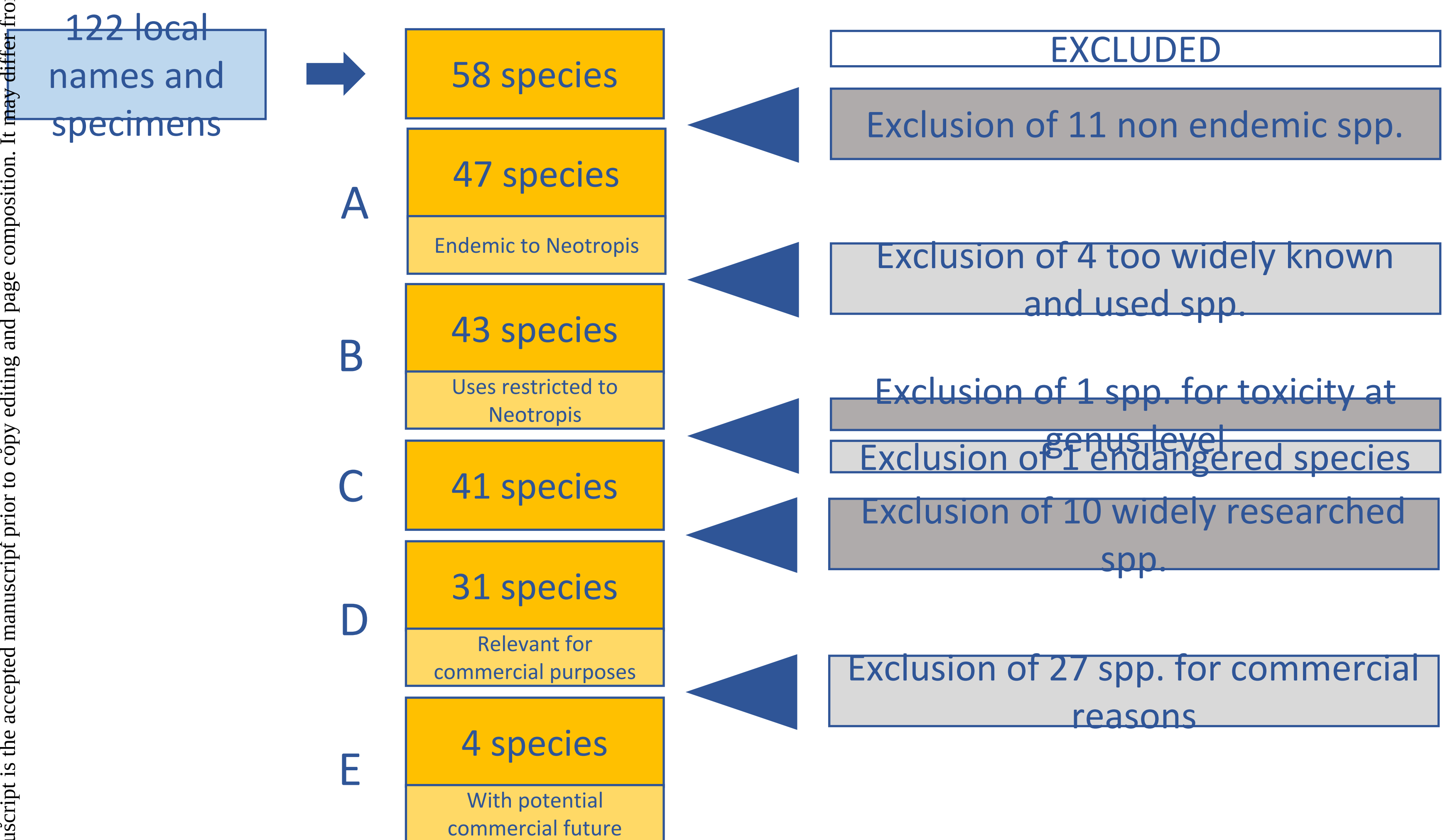
Source:
Personal communication CES, 2020
Geoportal Segeplán, 2018
GIMBUT, 2019
INE, 2015
Edition:
Laboratorio SIG/CEAB UVG and CES


122 local names and specimens
58 species
A
47 species
Endemic to Neotropis
B
43 species
Uses restricted to Neotropis
C
41 species
D
31 species
Relevant for commercial purposes
E
4 species
With potential commercial future
EXCLUDED
Exclusion of 11 non endemic spp.
Exclusion of 4 too widely known and used spp.
Exclusion of 1 spp. for toxicity at genus level
Exclusion of 1 endangered species
Exclusion of 10 widely researched spp.
Exclusion of 27 spp. for commercial reasons