Utilization of Medicinal Plants under the Influence of Modern Medicine in Villages near a Secondary City in the Central Peruvian Amazon: An Integrative Approach

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ABSTRACT

Medicinal plants have been expected to contribute to healthcare improvement, poverty alleviation and biological biodiversity. The plants help conserving natural environment where they are distributed by way of valuing traditional and local knowledge, complementing people's healthcare in the areas and social strata whose access to healthcare services based on modern medicine is limited, and improving livelihood due to potential market values of the plants. They have been studied in various disciplines such as Ethnobotany that has documented medicinal plants as traditional knowledge systems of natural resources, Medical Anthropology that has examined them in order to seek factors pertaining to their utilization or medical pluralism, and, Forest Sociology that has identified them as a part of non-timber forest products. This study questions the previous studies based on the following assumptions: 1) People in remote forested areas depend on medicinal plants for their healthcare, 2) Indigenous people use medicinal plants more than non-indigenous people, and 3) People living away from urbanized areas use more medicinal plants than those who live close to them, and proposes the importance of an integrated approach. As a new attempt, the study added healthcare services as a competitive product to clarify the relation among the three purposes of medicinal plant utilization: healthcare, livelihood improvement, and biodiversity management, and verified their factors by examining the above assumptions.

Selecting Contamana as a secondary city of the Amazon area in Peru, a mega-biological diverse country, the study conducted face-to-face interviews based on a structured questionnaire among 127 households in four villages - two indigenous and two mestizo - along the Ucayali River. Based on the quantitative data obtained from the interviews, the study determined medicinal plant utilization and analyzed i) Ethnicity, ii) Distance from the city, and iii) Relations with healthcare services, and how these three influence each other.

Among the households interviewed, only 5 to 15% in each village did not use medicinal plants, while approximately 20% of households used them every day. The plants frequently used were concentrated on two species, although 64 species were used altogether. Among the top 10 most frequently used medicinal plants, only 3 originated from the forest, while the remaining 7 were cultivated. Overall, the frequency of processed medicinal plant purchase and sale was low. The linkage between medicinal plants and the forest implied in the assumption 1 was not supported due to the low utilization of plants originated from the forest. Medicinal plant extraction would not be a tool for biodiversity management.

The indigenous households used medicinal plants more frequently than mestizos'; yet, the number of species and parts the former used were less than the latter. The species commonly used by the both groups represented 41% of the total; yet, only 39% were used in the mestizo households, indicating they knew more species of medicinal plants. The mestizo households purchased more processed medicinal plant remedies than the indigenous'. Medicinal plants were actually used for healthcare, yet the transition to healthcare services, accompanied with health insurance was occurring and the tendency was clearer in the indigenous group. More indigenous respondents felt no problems without medicinal plants due to the availability of healthcare services. The linkage between medicinal plants and the indigenous group implied in assumption 2 was not supported either, because the indigenous households did not necessarily utilize medicinal plants more than the mestizo households.

The proximity to the city increased the frequency of healthcare service use and decreased that of medicinal plant use. However, the households closer to the city used more species and parts of medicinal plants than those in the remote village. Regardless of the higher frequency of healthcare service uses by the households in the village near the city, they purchased processed medicinal plant remedies more than those in the remote village. The assumption 3 related to access to the city was not supported in the study site.

The study, starting from the necessity of an integrative approach, and including the analysis of the level of urbanization and healthcare seeking behaviors, verified how urbanization encompassing health service prevalence and acculturation affects medicinal plant utilization. In the study area, medicinal plants and healthcare services co-existed though the dependency of healthcare services was observed in both villages, closer and farther to the city. A possible explanation as to why the conventional medicinal plant use was not yet replaced by healthcare services was that the plants they used were easy to obtain and even planted. However, the availability of healthcare services led respondents to perceive no problems without medicinal plants, even in the remote village. This study evidenced the importance to consider competitive products, which may define natural resource utilization in livelihood improvement and biodiversity management. The prevalence of healthcare services, which is affected by the level of urbanization influences the utilization of medicinal plants at least indirectly, if not directly. The study also found that the linkage between medicinal plants, forests and traditional knowledge system that was commonly understood in the global community was not necessarily present, and suggested that demographic traits of medicinal plant users indicated by the previous studies were not the prescribed factors.

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ACRONYMS AND ABBREVIATIONS

CBD	Convention on Biological Diversity
CENSI	Centro Nacional de Salud Intercultural
EsSalud	El Seguro Social de Salud
FAO	The Food and Agriculture Organization of the United Nations
GSPC	Global Strategy for Plant Conservation
IUCN	International Union for Conservation of Nature
MDGs	The Millennium Development Goals
MINSA	Ministerio de Salud
NTFP	Not-timber forest product
SDGs	The Sustainable Development Goals
SIS	Seguro Integral de Salud
UN	The United Nations
UNCED	The United Nations Conference on Environment and Development
UNFCCC	The United Nations Framework Convention on Climate Change
WHO	World Health Organization
WWF	World Wildlife Fund for Nature

TERMINOLOGY

Healthcare service	Healthcare services and products offered by public and private sectors including healthcare facilities and medicinal drugs.
Healthcare facility	Hospitals and health posts.
Health post	Health clinics established by the regional health administration in Peru
Medicinal drug	Pharmaceutical products used to diagnose, cure, treat, or prevent disease based on modern medicine.
Medicinal plant	Plants used for the physical, psychological, mental, and spiritual health, regardless a plant actually has a potent property or not.
Non-timber forest product	Products based on forest resources other than timber.
Secondary city	Cities ranked as the second in population size and administrative functions in a given region.

CHAPTER 1

INTRODUCTION: THE IMPORTANCE OF MEDICINAL PLANTS

1.1 Introduction

The purpose of this thesis is to attempt to verify the factors emerging from an integrative approach to medicinal plant utilization study, which I propose here, through fieldwork in the central Peruvian Amazon. Medicinal plants have been and are used for various purposes and are globally expected to serve for mitigating global issues such as health, poverty, and biodiversity. Due to the extensive utilization and the high expectation of medicinal plants, different divisions of global communities and academic disciplines have dealt with them separately. This thesis points out a few missing links in the view towards current medicinal plant utilization studies and propounds an integrative approach towards the study.

In the history and elsewhere across cultures on the Earth, plants have supported our lives by providing food, medicine, clothes, and materials for shelters. People have utilized the plants, which had been “the medicine” in every culture before the advent of modern medicine. Since the industrial revolution, our technologies have replaced plants to new alternatives; yet, they do not necessarily enable to do so for everything. Today, most medicinal drugs are chemically synthesized; however, 25% of material medica is still derived from plants (Farnsworth et al., 1985; Robinson & Zhang, 2011). Medicinal plants are still the important source of healthcare and medicaments especially in developing countries.

The potential of and expectation to medicinal plants are highly regarded globally. A World Bank report (Lambert, 2006) states that medicinal plants and the knowledge of plants possessed by traditional healers can mitigate the dilemmas among health, economy and environment caused by rapid globalization. One of the articles in the magazines published by the Convention of Biological Diversity also states that medicinal plants are uniquely positioned to link biodiversity, health and sustainable development (Urrea, 2010) because biodiversity of medicinal plants supports primary healthcare in developing countries and the appropriate extraction of the plants can play a key role in conservation and provide an important path for sustainable development for the local people.

The introduction of an integrative approach to studies on medicinal plant utilization, considering healthcare and livelihood needs and potential biodiversity management, sheds light upon the further understanding of the dynamic and fragile status of plants, a type of natural resources, as a vehicle for healthcare, livelihood improvement, and biodiversity management. Although there may be other values and functions of medicinal plants in each local life, an integrative approach based on the currently known elements provides a foundation for further investigations. This thesis explores how medicinal plants currently play a role in the Peruvian Amazon, which has been repeatedly swamped by the repercussions of global economy, and thus, environmental threads, taking issues in health, livelihood, and biodiversity into account.

1.2 Global Expectation on Medicinal Plants

1.2.1 Medicinal plants as a supplement for the healthcare system

Medicinal plants can be defined as plants used for health and well-being purposes, such as to improve physical, psychological, mental, and spiritual health, to comfort lives, or to ease mal conditions of them. There are various forms of intake, such as a tea, a cold drink, decoction, maceration with alcohol, suction, bathing, and others. Human beings have utilized an enormous variety of plant species for these purposes since time immemorial. It was only since the nineteenth century that chemical properties were isolated from plants and some have been proven to be potent. Although so many efficacious properties of plants have been found so far, there is not sufficient effort to examine the efficacy of all plants used by humans. In this study, medicinal plants include all plants used for the aforementioned purposes, regardless of the plant actually having a potent property.

“Health for All” is one of the most important world-wide social goals that World Health Organization (WHO) and its member countries unanimously decided in 1977. It aimed at an ambitious achievement that by the year 2000 all the people in the world would attain a level of health that would enable them to have the capability to work productively and to lead an active social life. In 1978, the Alma Ata declaration at the International Conference on Primary Healthcare identified that primary healthcare is the key to achieve health for all by the year 2000 and beyond and set forth that health is “not merely the absence of disease or infirmity, is a fundamental human right” (WHO, 1978). The declaration called for each government to take responsibility for the health of their people and provide adequate health and social measures. Additionally, the conference at Alma Ata invited the member countries to include traditional medicine in their primary healthcare system in order to supplement the insufficient

penetration of modern medicine, especially in remote or marginalized areas in developing countries. It was a remarkable event as traditional medicine was recognized as a part of the healthcare system for the first time (Green, 1988; Kayne, 2010). Since then, trying to achieve the goal, the international community and donor organizations have initiated interventions and each country have been making efforts to adopt the international policy.

In the course of various interventions, another declaration was made at Chang Mai in 1988 at the International Consultation on Conservation of Medicinal Plants held by WHO, the International Union for Conservation of Nature (IUCN) and the World Wildlife Found (WWF). The declaration formally recognized "medicinal plants are essential in the primary healthcare" (Akerele et al., 1991) and assured conserving medicinal plants (van Seters, 1997; Kathe, 2006). Having the focus of primary healthcare, the declaration states "saving lives by saving plants" (WHO, 1993). It resulted in the "Guidelines on the Conservation of Medicinal Plants" published in 1993, which influenced 'Traditional Medicine Strategy 2002- 2005' by WHO (Kathe, 2006). In 2008, WHO held the congress for the first time solely on traditional medicine at Beijing. The Beijing Declaration recognized the role of traditional medicine, including medicinal plants, in the improvement of public health as one of the resources of primary healthcare services (WHO, 2008). Traditional medicine, comprising a wide variety of therapies and practices with a great variety across counties and regions, may provide more affordable and accessible solutions than modern medicine and play an important role to meet the demand for primary healthcare in developing countries.

In 2005, after having failed to achieve 'Health for All by 2000', all member countries of WHO committed to provide 'universal health coverage' (WHO, 2013). Universal health coverage, as a descendant of the "Health for All" movement, would provide accesses to health services to all individuals and communities and protect them from the financial risks of paying for health services. In 2013, WHO updated its strategy of traditional medicine, in which one of the objectives was 'to promote universal health coverage by integrating traditional and complementary medicine service into healthcare service delivery and self-healthcare (WHO, 2013). In 2015, this became one of the essential parts of the Sustainable Development Goals of the United Nation (SDGs), Goal 3"Ensure healthy lives and promote well-being for all at all ages," to achieve by 2030 and was considered as indispensable to achieve Goal 1"End poverty in all its forms everywhere (UN, 2017; WB, 2017a)".

These declarations and decisions at the international level for more than several decades have promoted to strengthen healthcare programs based on modern medicine, and at

the same time, they have recognized the importance of traditional medicine, which utilizes plants in their major part, and tried to utilize them to achieve their goal. WHO estimated that, for primary healthcare, approximately 80% of the world population relies mainly on traditional medicines (Farnsworth et al., 1985; WHO, 2002). The international expectation on the role of medicinal plants continues to be high, as a dedicated division of WHO has continuously set strategies and supported member countries' initiatives to organize and manage systems of traditional medicine (WHO 2002, 2013b, 2013c). Two simple questions arise. What is the progress on prevailing modern medicine in marginalized areas such as remote rural forest areas in developing countries, after the long term efforts of the international agency and its member countries? If modern medicine is provided widely, do people living in such areas still use traditional medicine including medicinal plants?

1.2.3 Medicinal plants as a tool for biodiversity management

In 1992, one hundred and fifty government leaders signed the Convention on Biological Diversity (CBD) at The United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil. The convention aims at the conservation of biological diversity, sustainable use of its components, and the fair and equitable sharing of benefits arising from genetic resources. Since UNCED, biological diversity (biodiversity) is one of the most globally concerned social and environmental issues, along with Framework Convention on Climate Change, namely UNFCC. In Article 6, the convention states each party to "develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity" (UN, 1992). In 1999, CBD, sloganizing "no plants, no life", launched Global Strategy for Plant Conservation (GSPC), which emphasizes the importance of plants and the ecosystem services they provide for all life on earth, and aims at preventing plant biodiversity loss (Sharrock, 2012). In 2002, CBD issued Gran Canaria Declaration calling for GSPC and set the target to slow down the pace of plant extinction throughout the world by 2010. In the 16 targets of GSPC, medicinal plants are included as to identify species to prioritize for conservation and to regulate for international trade, and to source sustainably.

There has been an increasing recognition and appreciation of indigenous or traditional knowledge (hereafter, 'indigenous knowledge') to contribute to conservation of biodiversity (Gadgil et al., 1993; Berkes et al., 2000; Mauro & Hardison, 2000; Sheil & Lawrence, 2004; Drew, 2005; Fraser et al., 2006). Indigenous knowledge is defined as "a cumulative body of knowledge and beliefs handed down through generations by cultural transmission about the relationship of living beings (including human), with one another and with their environments" (Gadgil et al., 1993). This knowledge is useful to biodiversity management because indigenous

people have led their lives by highly depending on natural resources and their knowledge with long term careful observations was cumulated and transmitted from generation to generation. The notion of indigenous knowledge for biodiversity conservation gained attention when CBD included Article 8(j), which stated that each party should "respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity" (UN, 1992). Thereafter, the notion of utilization of indigenous knowledge became one of the norms for biodiversity management.

Conservation and sustainable use of biodiversity were not the only reasons for which attention was paid to indigenous knowledge and practices. More importantly, CBD recognized that the property right of such knowledge and practices and pursued ensuring fair and equitable sharing of benefits rising from genetic resources, and thus, biodiversity. Accompanied with facilitation of the access to genetic resources based on appropriate rule set by owner countries, the sharing issue is one of the three aims of CBD. Uses and knowledge of genetic resources had been compiled and sometimes imbedded into local and indigenous peoples, who are often marginalized and live in remote areas in developing nations. The aforementioned Article 8(j) is very important in this context and after a long debate, Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization was adapted in October, 2010. The protocol "sets out core obligations for its contracting parties to take measures in relation to access to genetic resources, benefit-sharing and compliance" (CBD, 2011).

Medicinal plant uses and knowledge highly owed to local and indigenous people are also expected to contribute to biodiversity management. Hamilton (2004) pointed out that the importance of medicinal plants for people itself leads to sustainably using and conserving the plants, which would be an important basis for the conservation of natural habitats and ecological services. Today, there are growing concerns regarding biodiversity loss of medicinal plant species, of which 8% are under threat worldwide (Schippmann, 2002). With many other factors such as less rainfall, deforestation, land use change, monoculture, and others (Ramakrishnappa, 2002; Shanley & Luz, 2003), the loss is also contributed by non-sustainable harvesting to meet the demand of the regional and international market (Schippmann, et al., 2002). Thus, conserving medicinal plants themselves must contribute to biodiversity conservation. Food and Agricultural Organization (FAO) published "Medicinal plants for forest conservation and healthcare" and called for the awareness of medicinal plants as a forest resource and their sustainable harvesting (Bodeker et al., 1997). Although indigenous people do not always use

medicinal plants sustainably (Kala, 2005; van Andel & Havinga, 2008), restoring of the knowledge and use of plants would be part of an important strategy of biodiversity conservation (Almeida et al., 2006). However, some questions are brought here. Whether indigenous people currently utilize medicinal plants more than non-indigenous people? Whether medicinal plants can be expected to be a tool for biodiversity conservation?

1.2.4 Medicinal plants as a mean of livelihood improvement

Medicinal plant conservation is part of biodiversity conservation; then, there must be a potential for the plants to help livelihoods. In 1990s, the link between biodiversity conservation and poverty alleviation received an increasing attention in the international communities. Recognizing poverty eradication is the first priority of developing countries CBD included this in its target as "to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on earth" (CBD 2002). Furthermore the Millennium Development Goals (MDGs) added and incorporated the reduction of biodiversity loss into its set of targets in 2005. The rationale of the link between the two is supported by a general expectation that conservation should benefit humans' well-being and livelihoods (Turner et al., 2012) and increasing evidence that biodiversity and poverty geographically coincide (Hernandez-Morcillo et al., 2010). Although divergent opinions on the biodiversity-poverty link have raised and multiple relationships between the two have been recognized, a number of documents reported some biodiversity conservation actions as mechanisms for poverty reduction (CBD, 2010).

One of the mechanisms for poverty reduction in relation to biodiversity management is non-timber forest products (NTFPs), which include medicinal plants. NTFP can be defined as all products from forests other than timber (Belcher, 2003), although there is no unified definition (Ahenkan & Boon, 2011). NTFP was brought to attention by the landmark study of Peters, Gentry, and Mendelsohn (1989), which calculated commercial values of NTFPs that were compatible to timber, indicating income opportunities in a less ecologically destructive manner than timber harvesting. Since then, NTFP was seen as the great hope for poverty alleviation and sustainable forest management in the rural areas in forests and became one of the popular themes of forest and local livelihood studies. In 2007, IUCN held an international conference on "the role of NTFPs in Poverty Alleviation and Biodiversity Conservation" and confirmed that "NTFPs can play a critical role in providing both food and income for the poorest households", but "the potential impact of NTFPs collection on biodiversity" was of concern (Warner et al., 2008). In many case studies presented in the conference, medicinal plants are included as a type of NTFPs.

The benefit of NTFPs may be brought from the global market. The world exported value of medicinal plants and their derived and related products were conservatively estimated for US$33 billion, global exported value of medicinal plants were for US$ 3.6 billion and an annual growth rate of the trade between 2001 to 2014 was 2.4% in volume and 9.2% in export value (Vasisht et al., 2016). As the demand for medicinal plants globally increases, medicinal plants can be a profitable product once medicinal or functional components are found. There is mounting evidence that the commercialization of medicinal plants supports local livelihood in countries across Asia, Africa and Central America continents (Hersch-Martínez, 1995; Rawal, 1995; Shanley & Luz, 2003; Williams et al. 2000; Vodouhe et al., 2008). In Indonesia, medicinal plants help earn income through the market niche (Torri, 2012). Therefore, medicinal plants can be an income source as well as help livelihood by being used as an inexpensive healthcare. This is expected as a NTFP due to the growing global demands; however, to what extend medicinal plants contribute to improving livelihood of people in remote and forest areas is another question.

1.3 Studies related to Medicinal Plant Utilization

1.3.1 Studies of medicinal plant utilization for healthcare purposes

The pioneer of collecting medicinal plant information at least in the Western world must be Dioscorides, a Greek physician in the first century, who compiled voluminous 'De Materia Medica', the harbinger of the pharmacopeias (De Vos, 2010; Staub et al., 2016). Yet, the abundant information of medicinal plants in developing countries that we currently have highly owes the western expansionism in the 18th century. AT the end of the 19th century, 'ethnobotany' was coined by John William Harshberger, an American botanist, and developed as an academic discipline through various works of anthropologists and ethnologist (Cotton, 1997). Ethnobotany is the study of plant use by humans, especially traditional uses by indigenous peoples. Its scope is not only in medicine, but also in food, colorants, fibers, fertilizer, poisons, and building materials among many others. Up to date, it is the ethnobotanical studies that have inventoried an enormous amount of plant information including usage, practice, efficacy and specimen in regions throughout the world. 'Ethnopharmacology' also seeks indigenous uses of medicine from natural resources, such as, but not limited to, plants, animals and bacteria. Although it is intended to be an interdisciplinary study, intersecting medical ethnography and the biology of therapeutic action, thus biological and social sciences, the studies have slanted to focus on phytochemical and pharmacologic properties (Etkin &

Elisabetsky, 2005). Medical anthropology is a sub-discipline of anthropology and studies "causes and consequences of sickness in human beings" in given cultural contexts (Waldsten & Adams, 2006). Although it covers a wide range of issues related to health and well-being with social, cultural and biological influences, its scope often tends to be only in selected communities with detailed observation and descriptions (Etkins, 1993).

Previous studies in and around these disciplines have provided extensive insights how people uses medicinal plants. However, various contradicted results have been reported. Some studies found that medicinal plants are still used for medical purposes, and thus, as an important practice for primary healthcare in some developing countries (Estomba et al., 2006; Kitula, 2007; Lozada et al., 2006). For example, Valadeau et al. (2010) reported extensive use of medicinal plants, including uses other than medical purpose, by one of Amazonian ethnic groups in Peru. Other studies observed that people increasingly use modern medicine in other areas in developing countries (Caniago & Siebert, 1998; Case et al., 2005). Vandebroek et al. (2004) reported that even within a remote Amazonian area in Bolivia, the proximity to a healthcare facility attended by a doctor influences more people to use medicinal drugs, yet the distance to the facility has a strong negative correlation to the use medicinal drugs.

Factors of medicinal plant utilization and knowledge have been extensively studied. Although the factors, such as age, gender, occupation, education and location of plant habitation, were reported, they also provided contradictory results. For example, while ages are often correlated with more use and knowledge of medicinal plants (Case et al., 2005; Quinlan & Quinlan, 2007; Teklehaymanot, 2009; Silva el al., 2011), the influence of gender varies across studies. The gender who has more use and knowledge of medicinal plants than the other gender can be male (Case et al., 2005; Teklehaymanot, 2009) or female (Voeks, 2007; Silva el al., 2011), yet, there can be no difference between the two (Vandebroek et al., 2004; Lozada et al., 2006; Merétika et al., 2010). Factors of declining medicinal plant utilization, which are always associated with knowledge loss, are modernization (Benz et al., 2000; Voeks, 2007; Quinlan & Quinlan, 2007; Srithi et al., 2009), urbanization (Case et al., 2005; Monteiro et al., 2006; Merétika et al., 2010) and the presence of healthcare service (Caniago & Siebert, 1998; Vandebroek et al., 2004; Merétika et al., 2010). Social and cultural values attached to a medicine type can affect the choice of healthcare modality (Janes, 1999; Wayland, 2004) and their knowledge of medicinal plants (Dahlberg & Trygger, 2009).

Studies in the disciplines related to ethnobotany, pharmacology, and medical anthropology at least provided useful information that might influence people's utilization of

medicinal plants and contribute to decreasing the utilization of medicinal plants. They indicate the complexity of causes and phenomena of medicinal plant utilization showing conflict results on the utilization. However, the scope of these disciplines is only on the utilization of medicinal plants for healthcare purposes, but not for other purposes: livelihood improvement and biodiversity management.

1.3.2 Studies related to medicinal plants utilization for biodiversity management and livelihood improvement

As mentioned earlier, 8% of medicinal plants in the world are threatened (Schippmann et al., 2002). Although climate change and environmental degradation definitely affect the extinction and decrease in medicinal plant species and population, over-harvesting for commercial purposes is also one of the concerns (Olsen, 2005; Schippmann et al., 2006, Chowdhury & Koike, 2010). Some of the efforts in the academia are to prioritize medicinal plants for conservation based on use value, rarity, mode of extraction, and others (Dhar et al., 2000; Kala et al., 2004). Other efforts were to identify whether medicinal plants used are extracted from the wild forest or cultivated. If plants are cultivated for commercial purposes, such species as well as wild and forest biodiversity in areas where they may be extracted are not damaged (Schippmann et al., 2006, Wiersum et al., 2006; Aguilar-Støen & Moe, 2007). However, in the report by Aguilar-Støen and Moe (2007), only 3.3% of medicinal plants found in studies in eight countries were cultivated species. If this is the case for other areas, medicinal plants should be cautiously extracted, and that will be one way to manage biodiversity. It is also possible that if medicinal plants are valuable to that livelihood improvement for local people, they would be motivated to extract plants sustainably (Barirega et al., 2012).

Medicinal plants can contribute to livelihood improvement either through trading or consuming within households which would save spending on substitute products. While various studies on medicinal plant commercialization in developing countries across the continents are found (Hersch-Martinez, 1995; Williams et al., 2000; Olsen, 2005; van Andel & Havinga, 2008; Vodouhe, et al., 2008), the studies such as by Hersch-Martinez, (1995) and Vodouhe, et al., (2008) reported that the primary collectors do not receive a good share of profit. Bussmann and Sharon (2009) in their study in a norther Peruvian city reported low profit margin of medicinal plant commercialization not only for collectors but also for traders. Most studies referred in the previous section look at medicinal plant utilization based on household consumptions, yet, they do not necessarily look at them as livelihood improvement. Studies on benefits of medicinal plant utilization as livelihood improvement other than healthcare can be found in the aforementioned NTFP studies.

Values of NTFP or natural products can be determined as direct (commercial) and use (consumption) values (Godoy et al., 2000; Shackleton et al., 2002; Twine et al., 2003; Shackleton & Shackleton 2004; Belcher et al., 2005). In the study in a South African rural village, only less than 30% of plant products were traded and more than 70% were consumed within household (High & Schakleton, 2000). In this case, forest products may not contribute much to improve cash income, but, may serve as a saving expenditure. The mounting researches did not necessary prove the hope that NTFPs would improve people's livelihoods, for example, whether NTFP would effectively improve livelihood depends on product, landscape, location, land use system (Wiersum, 1997, 2004; Ros-Tonen & Wiersum, 2003; Chilalo & Wiersum, 2011) or the type of relationship between people and forest (Wiersum, 1997; Byron & Arnold, 1999). NTFPs may increase inequity in communities (Kusters et al., 2006) or only function as safety-nets of livelihood (Shackleton & Shackleton, 2004). Since the factors and levels of people's dependency on forests are not fully understood, whether NTFP help secure livelihood is not yet known (Lawrence et al., 2005). Byron and Arnold (1999) pointed out that many of the NTFP studies documented only some aspects of the relationship between people and forest products and proposed the importance of closely looking at the changing nature of such relationship. Demand, use, and supply of forest products change over time in economic, cultural, and political contexts (Byron & Arnold, 1999; Arnold & Perez, 2001).

CBD addressed that the reduction of biodiversity loss contributes to poverty alleviation. NTFP as one of the mechanisms to tackle poverty alleviation with biodiversity management have been continuously introduced in many international aid projects in rural forest areas in various developing countries (Marshall et al. 2006; Warner et al., 2008). However, the studies of NTFP and medicinal plants suggest that to find out whether or not NTFP improves livelihood in ecological manners, it must consider not just how people use the products but also the contextual background of a target NTFP.

1.3.3 New insights on the previous studies

The previous studies on NTFP revealed that the usefulness of NTFP is controversial because it is highly conditional as shown in the previous subsection. What is less emphasized in the NTFP study is the consideration of NTFP as a type of products. It means that NTFP is highly affected by the demand and supply mechanism and whether NTFPs bring benefits depends on a given market condition including its competitive products. This view point is common sense in the commercial sector, yet rare in academic studies in NTFP. In case of medicinal plants, the existence of modern medicine possibly affects the commercial potential

as well as household consumption of medicinal plants. Additionally, this may affect if plants should be cultivated or harvested from forests. Without including the competitive information, the potential of NTFP as well as the impact on biodiversity cannot be fully accessed. Here, the importance of including the aspect of market conditions appears to examine the contribution of medicinal plants to livelihood improvement.

Medicinal plant utilization studies around Ethnobotany, Ethnopharmacology, and Medical Anthropology have pointed out the factors for decline in medicinal plant utilization, such as modernization, urbanization and the presence of healthcare services. While modernization and urbanization, in general, highly affect market conditions, so does the presence of healthcare services in the context of the study. The availability of a variety of healthcare services would provide people an opportunity to choose healthcare methods. Then, healthcare choice is another aspect to be included to determine medicinal plant utilization for healthcare purpose as well as livelihood improvement.

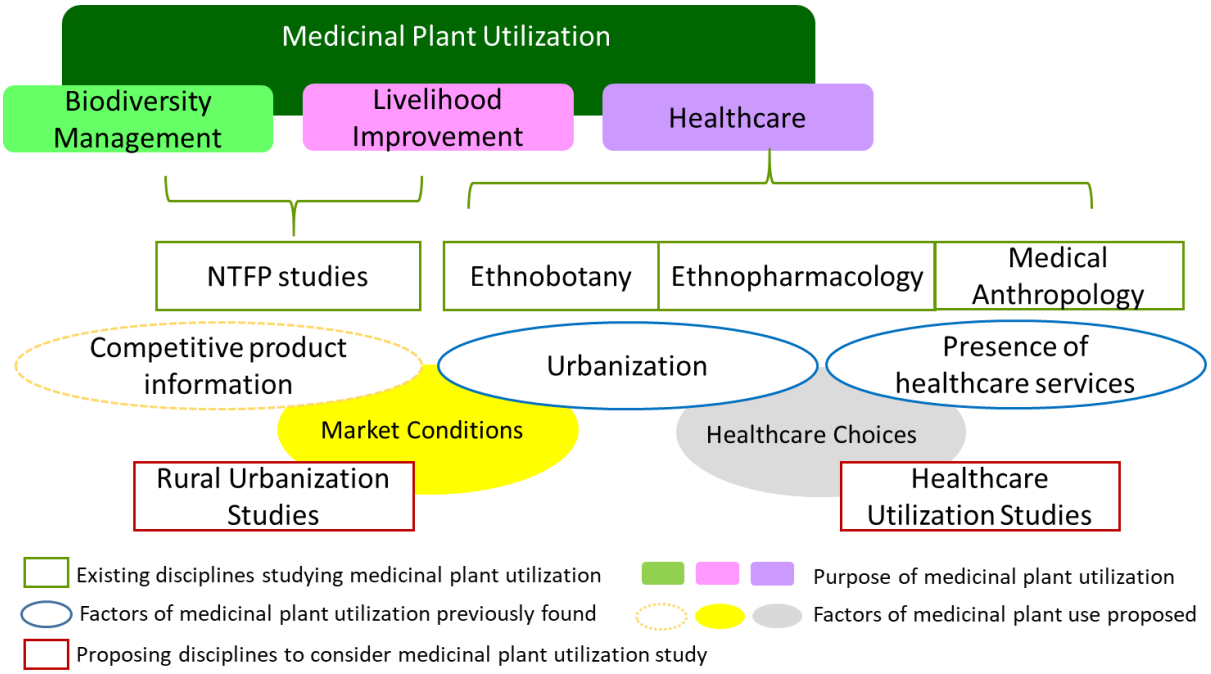

Figure 1.1 Factors and academic studies which bring insights to study on medicinal plant utilization.

I would like to bring wisdom from completely different disciplines that do not necessarily study on medicinal plant utilization (Figure 1.1). As for market conditions including urbanization issues, there is a discipline study on urbanization, but, that particularly focuses on rural areas in developing countries, which here I call rural urbanization studies. As for

healthcare choices, I would like to call for the disciplines that study healthcare utilization. The insights from these disciplines, which will be explained in the next section, would expand and deepen the understanding of medicinal plant utilization for different purposes: healthcare, livelihood improvement, and biodiversity management.

1.4 Disciplines which Contribute to the Medicinal Plant Utilization Study

1.4.1 Rural urbanization

It was the theory of Thomas Malthus proposed in 1873 that predicted exponential population growth leading ultimately to famine due to arithmetic increase of food supply and that prefaced the notion of the population and environment interaction (Moran, 2010). Later, the theory of Boserup (1965) argued that the population density triggers agricultural intensification towards land scarcity as an alternative to Malthus' theory. However, there has not been a unified consensus on the interaction between population and environment. The debates imply that population can be an underlying cause of deforestation (Geist & Lambin, 2002; Perez, 2006). The discourse of population and deforestation nexus directly reflects on the theme of my study as population directly relates to the demand for forest resources, the potential supply of medicinal plants. Carr et al. (2005) reported the key discussions about population and deforestation linkage and highlighted people's movement within forest areas to seek frontier, remote demand for forest resources from urban areas, and place-based uniqueness as key heuristic in population and deforestation relation among others. The implication from this discourse for my study is that the location (place) and the population agglomeration would affect demand and supply of medicinal plants because size of population or urbanization is also one of the important factors of decrease in use and knowledge of medicinal plants (Merétika et al., 2010).

While the majority of urbanization studies in developing countries focus on the population agglomeration in the primary or secondary cities, fewer researchers have given attention to the important functions of intermediate cities or smaller cities and towns (Rondinelli, 1983; Bolay & Rabinovich 2004; Berdegué & Proctor, 2014). The argument, which opposes and expands the central place model of Johann Heinrich von Thünen, was that the critical functions of intermediate and smaller cities or towns in economic activities connecting rather smaller villages and interfacing to larger cities, and their networking are the keys to understand their livelihoods and the potential pathway to development; the concept was rather derived from the central place theory proposed by Walter Christaller in 1933 and August Losch in 1940

(Rondinelli, 1983). Berdegué and Proctor (2014) stated that rural urbanization is different from that of the primary and secondary cities economically, with diversified employment, demographically, with multiple placed in living, and culturally, with rapid change by easier access to communication systems. Padoch et al. (2008) found the unique patterns of the consumption and knowledge patterns during the course of rural-urban migration in Amazon. At the same time, urban and rural differences was blurring in rural transformation (Berdegué & Proctor, 2014). Bolay and Rabinovich (2004) stated that the focus only on the rapid agglomeration of the primary or secondary cities overshadow other strata of agglomeration. Therefore, it is worth to closely look at the level of population agglomeration in the area of study even in remote rural region in the developing countries. The place and population agglomeration in the rural forest area would be an important factor of local people's livelihoods, and thus, would lead to medicinal plant utilization.

1.4.2 Studies related to healthcare utilization

Studies related to healthcare utilization can be found in medical anthropology, socio-medical research, and psychology. From the large collection of observation and empirical studies, a variety of theories have been proposed. The health belief model is a well-established theoretical approach, which was first developed by the US Department of Public Health Service in 1950s to make people adopt the disease prevention program (Janz & Becker, 1984). The model constructs with perceived susceptibility, perceived severity, perceived benefits, cues-to-action, and self-efficacy and can be used for the understanding of people's response to diseases. The 'pathway model' was first proposed by Edward A. Suchman in 1965, followed by Horacio Fabrega Jr. in 1972 (MacKian, et al., 2004), and Christman (1977) described the process of illness behaviors, the stages of information processing during illness, and the procedural steps to make decision for solving a health problem. These approaches of the process, although their focus varies, recognize the socio-cultural context and influences, such as social influences on referral, socio-cultural features for health-related decision making, and cultural context of health beliefs and practices. Some studies focus on the cognitive and psychological approach in the course of healthcare utilization, such as attachment theory that was first developed by John Bowlby in 1973 (Ciechanowski et al., 2002), social cognition model proposed by Mark Conner and Paul Norman in 1995 (Conner & Norman, 2005), and perceived-ill health (Ahmed et al., 2000).

In 1968, Andersen developed the healthcare utilization model, determining factors that lead to the use of healthcare services and further modified it with his colleagues several times. Andersen's health service utilization model originally classified factors as 'predisposing factor

(demographics, social structure, and health beliefs)', 'enabling characteristics (personal, family, and community resource)' and 'need (perceived and evaluated),' which lead to the use of health services (Andersen, 1995). In the model phase 3, the factors are modified as 'primary determinants of health behavior (population characteristics, healthcare system, external environment)' and 'health behavior (personal health practices and use of health services),' which results in 'health outcomes (perceived health status, evaluated health status, and consumer satisfaction)' (Andersen, 1995). Although the sets of factors of Andersen's models which are widely used in healthcare research are comprehensive, MacKian, Bedri, and Lovel (2004) pointed out that the models only focus on individual decision-making process and neglect "the impact of the social network on the decision-making process" (p. 138). Kroeger (1983) stated that the interaction of factors are more complex in developing countries than developed countries and elucidated factors of healthcare utilization found in the literature: age, gender, household size, status in household, interaction with the social network, ethnic group, religion, education socio-economic status, and occupation among others.

MacKian (2003) and MacKian et al. (2004) argued that decisions made for healthcare utilization especially in developing countries are far more complex and cannot be understood just from the broad range of factors or interpretations. The decision making are constructed through the interaction of people under social systems and constraints and cultural norms. Interestingly, studies related to healthcare seeking behavior based on modern medicine in the Peruvian Amazon focus on the remoteness (Nawaz et al., 2001; Brierley et al., 2014) and socioeconomic status (Kristiansson et al., 2009), but do not refer cultural influences although they are aware of their use of self-care and traditional medicine. What healthcare utilization literature suggests to my study is that the choice of healthcare methods between medicinal plants and healthcare services based on modern medicine must be understood in the wider context of economic, social and cultural background.

1.5 A Need for Integrating Medicinal Plant Utilization Studies

1.5.1 Assumptions

In the previous sections, the importance of medicinal plants is explained based on the activities and decisions made by the global communities for the last several decades. The importance of medicinal plants has been well understood globally. However, whether the decisions made by the international organizations and the actions followed by the member countries reflect the needs and situations of the locals is unknown, especially after a few decades

from the original decisions and strategies that are continuously succeeded in the present. Previous studies related medicinal plant utilization provided rather contradicting results or conditional outcomes in many different aspects. Moreover, additional factors and disciplines are proposed to further understand medicinal plants especially encompassing three different purposes: healthcare, livelihood improvement and biodiversity management.

The following three assumptions are brought from the long term discourses and actions of global communities relating to medicinal plants and the insights from academic studies:

Assumption 1. People in remote forested areas depend on medicinal plants for their healthcare.
Assumption 2. Indigenous people use medicinal plants more than non-indigenous people.
Assumption 3. People living away from urbanized areas use more medicinal plants than those who live close to them,

Assumption 1 is brought partially from a phrase by Farnsworth et al. (1985) and modified by many other documents that "The World Health Organization estimated that 80% of the population of developing countries rely on traditional medicines, mostly plant drugs, for their primary healthcare needs" (Bodeker et al., 1997, Preface). A series of studies in NTFP and medicinal plants that was discussed in the previous sections, although there are various conflicting results, contribute to hold the assumption. Assumption 2 is brought from the fact that medicinal plants have been used in almost all types of traditional medicine which was defined as "It is the sum total of the knowledge, skill, and practices abased on the theories, beliefs, and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness" (p.15) by WHO (2013c). Bodeker (1997) in his article in the aforementioned FAO work stated that "medicinal plants form the basis of traditional or indigenous health system" (p. 1). Rural urbanization and healthcare utilization studies bring up Assumption 3 to the study. The rural urbanization studies pointed out unique and different phenomena and functions of small towns in rural area in developing countries as well as the transformation and transition of during the course of urbanization, which may blur the differences between urban and rural. The healthcare utilization studies pointed out the influence of social interaction and cultural norms. All of these affect medicinal plant utilization. Moreover, it can be assumed that their utilization would change over time through the influence of transition and transformation.

In the last three decades, economic environment has changed globally and drastically.

Some countries including Peru, the research area of the study, developed economically, which may have changed rural economy, and thus, the population and would have strongly promoted the provision of modern medicine. While at the same time, the expansion of global economy may demand for commercialization of a certain medicinal plants. Moreover, the development and prevalence of communication technologies, namely, mobile communication system and the Internet have drastically impact on the rural and forest areas in the last decade or so. These changes all affect demand, supply and use of natural and forest resources and products including medicinal plants. WHO set out the "health for all" strategy four decades ago both to support modern and traditional medicine. While still millions of people must reply on traditional medicine in certain areas, yet, whether all people in rural areas in developing countries continuously use them is unknown. Therefore, the thesis challenges the three assumptions if they reflect reality seeking any other factors to determine utilization of medicinal plants for healthcare, livelihood improvement, and biodiversity management and any relations among factors and the three purposes.

1.5.2 An integrative approach

I propose an integrative approach based on multidisciplinary studies on medicinal plant utilization in order to answer the research questions through verifying the assumptions, which, in turn, would verify the factors emerging in the integrative approach.

The previous section of literature review related to medicinal plant utilization not only showed conflicting results but also revealed that the studies in each discipline are unaware of the impact on medicinal plant utilization in the broader context. The insights from the studies in rural urbanization and healthcare utilization, which not necessarily focus on medicinal plant utilization implies the complexity of local situation in the remote areas in developing countries and of decision making process of healthcare utilization, yet suggests the inclusion of locational concerns and social and cultural aspects into the study. The multidisciplinary study including such discipline is not only to explain the new factors of medicinal plant utilization for three different purposes, but also to make us to see a dynamic relationship among those purposes.

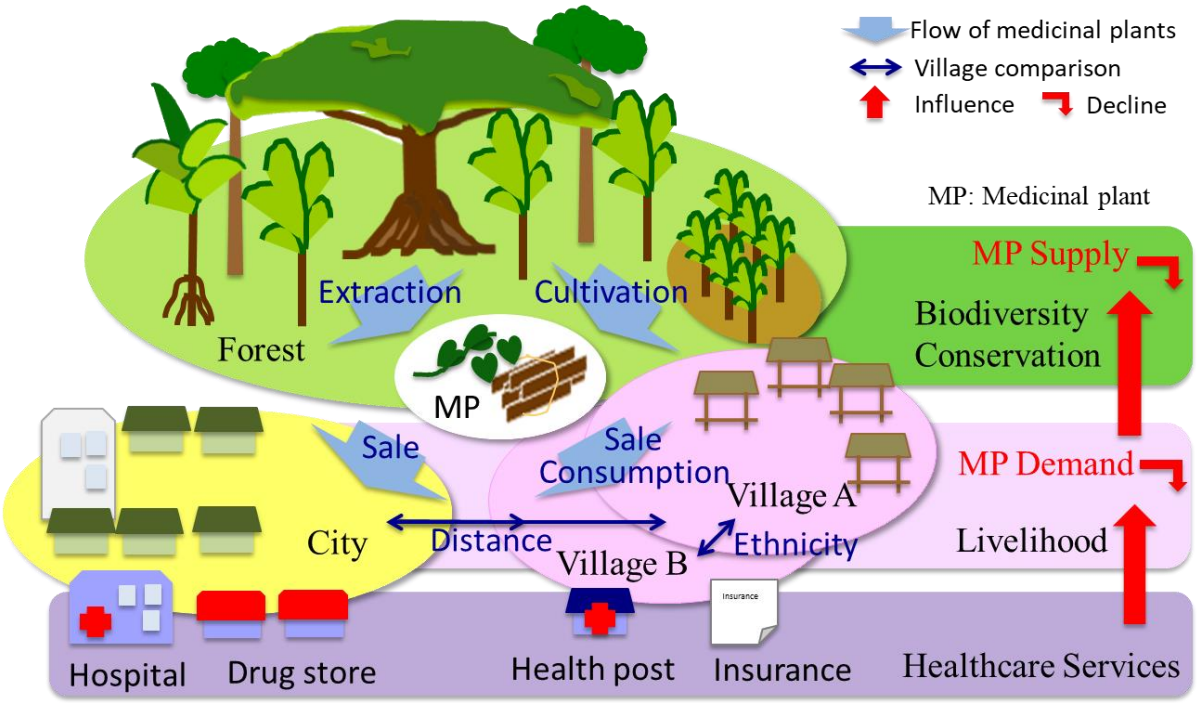

Figure 1.2 An integrative approach based on multidisciplinary studies on medicinal plant utilization.

The dynamic relationships among three different purposes of medicinal plant utilization are clearly shown in Figure 1.2. Medicinal plants may be extracted from forest or cultivated near houses for healthcare and commercial purposes. Extraction or cultivation is directly related to the biodiversity and conservation issue. Medicinal plants in turn may be sold to the market in cities and/or villages or consumed internally in households. As the literature suggested possible unique patterns of consumption in rural urbanized area, the location of the setting as well as the distance to a city center should be considered. Villagers' behaviors towards purchasing or consumptions may differ in the location, the distance from an urban area. Cultural influences and networking which would influence healthcare utilization behavior, are also considered. These directly influence the potential of medicinal plants for their healthcare and livelihood improvement. The competitive products of medicinal plants are all types of healthcare services offered both by public or private sectors. The availability of such healthcare services would affect people's healthcare choices, and thus, the demand for medicinal plants, which will affect medicinal plant supply. The supply side is related to biodiversity issue.

The integrative approach based on multidisciplinary study on medicinal plant utilization reveals the interrelation among the three different purposes of medicinal plant utilization and indicates that without understanding the utilization for other purposes, medicinal

plant utilization would not be understood.

1.5.3 Rationale for and benefits of an integrative approach based on multidisciplinary studies of medicinal plant utilization

High expectation triggered enormous actions and studies regarding medicinal plants from different fields have been enforced for the last four decades throughout the world. However, in contrast to the great volume of academic works in various disciplines, medicinal plant studies integrating different aspects have been relatively limited. Conflict results of whether NTFP improve livelihood in the previous studies may have had emerged from the lack of other influential points of view. The studies indicate that the usefulness of NTFP for livelihood is highly conditional, meaning product and situation dependence. The condition especially related to demand, supply and use of a product changes over time (Byron & Arnold, 1999; Arnold & Perez, 2001). Studies in ethnobotany, ethnopharmacology, and medical anthropology reported that the decline in medicinal plant utilization is due to the modernization, urbanization, and presence of modern medicine. These results indicate social changes of surrounding environment of medicinal plant. The studies in different disciplines provide an expanding insight of medicinal plant utilization.

What I would like to emphasize here is that we must take a closer look at the background of competitive products or substitution of a target NTFP, in this case medicinal plants, if we pursue whether or not the plants support livelihoods, which can be related to healthcare or biodiversity management. A certain NTFP may not be affected by its substitution, for example, food product might provide a unique taste or nutrition. However, in the case of medicinal plants, the provision of healthcare services based on modern medicine is one of the significant governmental strategies and of global goals and missions. Healthcare utilization studies suggest that the choice of healthcare methods is highly influenced by culture and socio-cultural references. If more people use modern medicine, less people will use medicinal plants, and then, the knowledge will be lost eventually. Obviously, if people do not use medicinal plants, medicinal plants would not be expected for healthcare support or the burden on natural environment would be reduced. Yet, as a NTFP, and thus, a product, it cannot be profitable or effectively work as a tool for biodiversity management. Therefore, the NTFP approach complemented with findings from other disciplines would depict a more precise picture regarding medicinal plant utilization covering healthcare, livelihood, and biodiversity all together.

In the 21st century, an integrative approach towards medicinal plant utilization is

desired more than ever. One of the reasons stems from the global economic environment and economic development of each country. Not only economic conditions, yet societal and cultural environments have been changed since the initial recognition of the importance of plants in modern healthcare system. Another reason emerges from the addition of new values and expectation, such as livelihood improvement and biodiversity management, of medicinal plants since around UNCED in 1992. Furthermore, while the studies of NTFP have been rather toned down in the last decades, introducing and developing NTFP became the common approach for livelihood improvement in the environmental projects, such as REDD+ (Reducing emissions from deforestation and forest degradation) that was developed by parties to the United Nations Framework Convention on Climate Change (UNFCCC). If the market and competitive product conditions were not considered, the benefits from NTFP developed may not last long. International interventions as well as academic studies are often segregated; they only see the value of, and influences to medicinal plants within a limited perspective. However, different values of the plants may interact with each other and influences to the conditions, which determine actions to utilize them.

There are several benefits of this study. First, by providing a framework for an integrative approach to medicinal plant utilization study, the thesis fills some gaps among different studies areas. Second, an integrative approach to ethno-oriented and NTFP studies adding rural urbanization and healthcare utilization studies provide a broader views to medicinal plant utilizations and recognize dynamics of medicinal plant utilization in a macro and a local circumstances and changes. Finally, the theoretical-based integrative approach paves a way to expand the scope of further studies.

1.6 Chapter Outline

The following Chapter 2 will describe the geography and population distribution of the Peruvian Amazon and the related to laws and policies in Peru in order to understand the background of the field to study on medicinal plant utilization and to provide the rationale for the study field selection. Chapter 3 will set objectives, explain methodology of the study, describe the details of the study site, and data collection and analysis. Chapter 4, 5, and 6 will present the results of the field study and their analysis and discussion. Chapter 4 will dedicate the pursuing of medicinal plant utilization for healthcare, livelihood improvement, and biodiversity management to assess Assumption 1. It provides an overall picture of medicinal plants utilization in the study sites. Chapter 5 will focus on the influence of ethnic differences

on medicinal plant and healthcare services, and the impact of the latter on the former addressing Assumption 2. Chapter 6 will focus on the influence of the distance to an urbanized town (city) and to healthcare services on medicinal plant utilization and healthcare services, and the impact of the latter on the former addressing Assumption 3. Finally, Chapter 7 will summariz the study, explore the implications of the study and conclude the thesis.

CHAPTER 2

MEDICINAL PLANTS AND THE PERUVIAN AMAZON

2.1 Rationale for a Medicinal Plant Utilization Study in the Peruvian Amazon

The Peruvian Amazon provides an ideal setting to examine medicinal plant utilization with questions raised in the previous chapter. One of the aspects is that there are abundant medicinal plants in the Peruvian Amazon evidenced through extensive ethnobotanical researches (Lacaze & Alexiades 1995; Mejia & Rengifo 1995; Communeros, 2007). These ethnobotanical works have not only determined the use and practice of medicinal plants, but also helped to identify and appreciate medicinal plants used in studies that followed them. However, 44% of plant species in the country (de Queiroz, et al., 2014), as well as the forest itself being threatened is another aspect to be addressed in the present study. Peru's annual deforestation rate has been as low as 0.16% between 2000 and 2011, yet, a decrease in biodiversity and degradation of the forest have been indicated. The cause of threats include overexploitation, illegal and informal gold mining, construction of dams and roads, linkage with urban markets and mass production (de Queiroz, et al., 2014).

Another aspect is the increasing disparities in income and healthcare provision between urban and rural areas, especially in the Amazonian region (INEI 2009). Peru is now categorized as an upper middle country by the World Bank and has US$ 5,950 GNI per capita income in 2016 (WB, 2017b). Its average GDP growth rate from 2007 to 2011 was 6.9 percent, although it is predicted to be 4.0 percent for 2017 (WB, 2017b). However, as the country's economic situation improves, the disparities between the rich and the poor, and urban and rural populations have widened (INEI, 2009). The Gini coefficient of Peru is 44.1 percent (WB, 2017b). Seventy-seven ethnic groups are identified in Peru, using 66 different languages falling in 16 linguistic families, spreading all over the country, yet concentrated in the Andean and Amazonian regions. This chapter particularly focuses on the relatively recent transition in forest, biodiversity, and health policies, which provide the background information of the present study, so that it supports the rationale to select the Peruvian Amazon to conduct medicinal plant utilization study.

2.2 The Peruvian Amazon and Medicinal Plants

2.2.1 La Amazonia

La Amazonia is host to billions of lives on the earth. The river flows from the western side of the South American continent to the Atlantic Ocean for more than 6,600 km and discharges approximately 20 percent of the total world's river water into the sea. It holds the largest contiguous tropical rain forest in the world. The basin, spanning a land area of 799 million ha along more than 1,100 tributaries, covers 20 percent of the world's forest area (FAO, 2011) and is called the lung of the earth. In the forest, not only are at least 10 percent of world's known species housed, but also 177 billion tons, accounting for 27 percent of the world carbon stock, are stored (FAO, 2011).

The Amazon basin comprises portions of eight countries: Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname, and Venezuela, of which three countries contribute more than 90 percent of the area: Brazil (67%), Peru (12%), and Bolivia (12%). The immense biological diversity of the basin contributes to five countries: Brazil, Colombia, Ecuador, Peru, and Venezuela to be selected for one of 17 megadiverse countries. The basin is also home to more than 300 million people, including groups of indigenous people having a diverse array of cultures and languages. The people dwelling in the basin, though 70 percent of which live in cities (FAO, 2011), depend on the forest for their living and have been known to use most of the plant resources, including for medicinal purposes (Bennett, 1992; Phillips & Gentry, 1993a, 1993b; Jovel et al., 1996; Milliken & Albert, 1996, 1997; Flores & Ashton, 2000; Campos & Ehringhaus, 2003; Vandebroek et al., 2004; Lawrence et al., 2005; Reyes-Garcia et al, 2006; Thomas et al., 2009, Valadeau et al., 2010, Reyes-Garcia et al, 2013).

2.2.2 The Peruvian Amazon

In the Peruvian territory, the Amazon rain forest comprises 68 million ha, 93 percent of its forest area of 73 million ha and 53% percent of its total land of 128 million ha (FAO, 2015). The Peruvian Amazon, although its area is less than one-fifth of the Brazilian one, is uniquely characterized by the headwaters of the Amazon River running through high lands from the Andean mountain range to the low land. One of the major water sources of the Amazon basin is the snow melting from the mountains. It is the center where the Amazon meets the Andes, which, as a whole, has the highest biodiversity on the earth (Hemming, 2008). The forest spreading on the eastern foothills of the Andean mountains is called "*selva alta*" in Spanish

(highland jungle). Located between around 1,000 and 3,800 m above sea level with cool and low temperature and heavy rain, *selva alta* is home to a gigantic variety of flora and fauna.

The forest spreading at the elevation between 80 and 1,000 m with an average temperature of around 26 centigrade and annual precipitation ranging from 1600 to 2800 mm is called "*selva baja* (lowland jungle)" or "*La Amazonia*". Many smaller upper tributaries of the Amazon River gradually merge to fewer main tributaries, in which water level changes by 5 to 8 m between the dry and rainy seasons. Massive nutritious sediments are washed from the mountains and deposited along the river edges or create sandbars, which are quickly colonized by pioneer plants and later invaded by various species. The process gradually forms the dense Amazon forest (Lathrap, 1970). *Selva baja*, located on the eastern side of the country, the other side of the Andes from Lima, the capital facing the Pacific Ocean, comprises five administrative departments from north to south: Loreto, Amazonas, San Martin, Ucayali, and Madre de Dios.

A little less than three million people live in the five Amazonian administrative departments, accounting for approximately 10 percent of 32 million, the total population of Peru (INEI, 2016). According to the census in 2007 (INEI, 2010), the average population density is 4.6/Km^2, though varying from 1.3/km^2 (San Martin) to 14.2/Km^2 (Madre de Dios) among the Amazonian departments. The urbanization rate with in these departments is 64% on average ranging from 44% (Amazonas) to 75% (Ucayali) (INEI, 2010). In 2016, *Instituto Nacional de Estadística e Infomática* (the National Institute of Statistics and Information) reported that 0.33 million Amazonian indigenous people dispersedly live in eleven different departments, representing approximately 1.2 percent of the total population. It is currently recognized that they comprise 64 indigenous groups (Valqui et al., 2015). The rest of the people living in the Amazonian forest are called Mestizo, descendants of the Amerindian and Iberian peoples.

2.2.3 Medicinal plants in the Peruvian Amazon

Needless to remind, the Amazon is the reservoir of medicinal plants as their profuse references are easily found in the reports from the age of great exploration and current scientific researches. After Columbus' discovery of the new world, many European countries hastily dispatched explorers and botanists to the new world because finding useful flora as well as fauna was the basis of economy back in that time (Schiebinger, 2004). The first information about Amazonian medicinal plants to Europe was brought by one of the early reports of exploration of Central and South America by Peter Martyr of Angleria published in 1534, and a plant, now called *Sangre de grado* (*Croton lechleri*) was the first Peruvian plant that appeared

in the report by the naturalist and explorer Bernabé Cobo in 1600 (Rengifo, 2007). It was a frenetic era of plant discovery and transportation, yet the action continued to the later ages even to the current time.

In 1948, the United Nations Educational, Scientific and Cultural Organization (UNESCO) sponsored an expedition to investigate medicinal plants in the Peruvian Amazon (Rengifo, 2007). Today, thanks to the works of ethnobotanists, a lot of information about medicinal plants is available (Lacaze & Alexiades, 1995; Mejia & Rengifo, 1995). However, we must remember that it is not Europeans or researchers who discovered medicinal plants, but the people, indigenous and mestizo, who had lived in the Amazonian forest (Communeros, 2007). The latter found the usefulness of plants and have maintained the usages as part of their culture. More than 1,000 species of medicinal plants are used in the Peruvian Amazon as the database of *Instituto de Investigacoines de la Amazonia Peruana*, a research institute dedicated to the Amazon region under the Ministry of Environment listed 1,028 species based on 18 years of their work (IIAP, 2010).

2.3 The Peruvian Law and Regulations

2.3.1 Land and forest policy

The lives of the people living in the Peruvian Amazon located on the other side of the Andean mountain range from the capital and the most populated areas on the coast have been drastically stirred by the economic and political transitions. Over a long period of time, there has been a flow of people to the Amazon from elsewhere in the country by a clear intention of the government policy at least partially, if not entirely. People who live in the Peruvian Amazon consist of not only indigenous people, but mestizos and those who migrated from other areas of the country. The inflow of people to the Amazon region from the other areas in the country resulting in the interaction of different cultural backgrounds may have influenced the use of forest resources and medicinal plants. The forest laws have also directed the inflow of industries and people that may have affected the use of forest and medicinal plants.

Since the independence of the country in 1821, people who were attracted to the production of trading products such as rubber, wood and oil have migrated to the Amazon region (Limachi et al., 2006). In the late 19th century around the time of rubber boom, populations in the Departments of Loreto and Amazonas increased by 93 and 117 percent, respectively. Even after the rubber boom, the flow of people to the Amazon has continued,

though the volume never matched that of the rubber time.

The agricultural reform laws in 1964 (Law 15037) and in 1969 (Law 17716) resulted in redistributing about a half of the total farmlands of the country to approximately 33 percent of the rural farming households mainly under various organized co-operatives (Barker, 1980, Saleth, 1991). Aiming to increase agricultural productivity and focus on neglected farmers' livelihoods mainly in *Sierra*, the Andean mountain region, and funded by the United States, the reform projects made visible qualitative changes in the agricultural sector and obsoleted *hacienda*, the old landownership system. However, it did not solve the problems of the landless (Saleth, 1991); so, many landless farmers ended up moving to *Selva*, the Amazon forest region. In May 1975, the forest and wild fauna law was passed and allowed long-term enhanced timber production, which resulted in fostering large timber corporations and increasing encroachment to lands of indigenous peoples (Smith, et al., 2006).

During and after the agrarian reform in the 1960s, the government's promotion of economic activities in Amazon through creating a tax free zone for fifteen years (Law 15600) in 1965 and financial incentives (Law 23407) in 1988 and tax exemption (Law 27037) in 1990 for industries in the region increased labor opportunities, and then migration to the region (Limachi et al., 2006). In the 1980s when the country's economy collapsed under the presidency of Belaúnde, the rise of a terrorist group '*Sendero Luminoso* (Shining Path)' from the Andean region further washed people away to the Amazon region (Perz et al., 2005, Limachi et al., 2006). In the early 1990s, the country's economy finally stabilized with the Fujimori presidency adopting a neo-liberal strategy: enhancing market mechanism, privatizing enterprises, and promoting foreign investments. The 1995 law of private investment in the development of economic activities in the lands of national territory and peasant and native communities (Land Law: Law 26505) allowed all land to be sold in order to promote economic activities. It meant that all land, including the forest, was theoretically available to sell. Further, in 1996, the government established the commission for the promotion of private concession for developing infrastructure as well as oil, mining and forestry.

In 2000, the law of forest and wild fauna (Law 27308) was renewed and set out expansion of timber production mainly through concession. Although the law incorporates sustainable forest management, biodiversity conservation and livelihood improvement, the practices did not reflect the law (Sear & Pinedo-Vasquez, 2011). Peru's illegal logging has been notorious, involving officers and people and infringing indigenous territories and protected areas (EIA, 2009, 2012). In 2011, the government had to renew the law as a requirement for its

free trade agreement with the United States. The new law of forest and wild fauna (Law 29763) intended to strengthen governance, participatory forest management, equity and social inclusion, prior and informed consultation, the ecosystem approach and others.

Peru's deforestation rate was as slow as 0.1% between 1990 and 2000 and 0.2% between 2000 and 2010 (FAO, 2011). However, considering population flow to the Amazon region, uncontrolled illegal logging, the government policy for mining, gas and oil concession, and the construction of highways across the continent are the concerns for speeding up deforestation. All these threaten not only the forest coverage, but also the biodiversity in the Peruvian Amazon.

2.3.2 Laws and strategies of biodiversity and medicinal plant use

Selected as one of the mega biodiversity countries, Peru has the highest number of butterfly species numbering about 4,200 and the second largest bird species with 1,816 after Colombia. The country represents 10% of the world's total fish and plant species of which, 5,000 species of the plants are used for both food and medicinal purposes (MINAM, 2009). However, Peru's forest, like many other tropical rain forests in the world, is not exempt from threats. Since Peru's ratification of CBD, the Peruvian government has set the framework for biodiversity management including sustainable use of medicinal plants. It also highly recognizes the value of indigenous knowledge related to sustainable biodiversity management. This indicates that medicinal plant utilization may be used as a tool of sustainable biodiversity management.

Peru ratified CBD on December 29, 1993 and issued a framework law on the Conservation and Sustainable Use of Biological Diversity (Law 26839) on July 8, 1997. The law regulates the conservation and sustainable use of biological diversity, sets out the goal and objectives in executing CBD and requires a national strategy and action plants for maintaining biological diversity. It also recognizes the value of traditional knowledge and practices of indigenous peoples for the conservation and sustainable use of biological diversity and includes the principle of the fair and equitable sharing of benefits, which arise from their knowledge and the use of biological diversity (CBD, 1997, 2017).

A specific legislation for sustainable medicinal plant use was enforced under the law of sustainable use of medicinal plants (Law 27300) in July 2000, in which commercialization and industrialization of medicinal plants by indigenous peoples and peasants are also regulated based on the framework of the existent legislation and the international conventions ratified by

the government. In July 2002, Law of Protecting Regime for the Collective Knowledge of Indigenous Peoples derived from Biological Resources (Law 27811) and in April 2004, Law of the Protection of Access to Peruvian Biological Diversity and Collective Knowledge of Indigenous People (Law 28216) were issued. With these laws, Peru seeks to protect indigenous peoples from unfair use and access to traditional knowledge without their informed consent and a secure, equitable sharing of products arising from indigenous knowledge and practices, and thus prevent biopiracy (Clark, et al., 2004). In 2008, the Ministry of Environment was established to enhance environmental sustainability through conservation, protection and restoration of ecosystems and natural resources and took the responsibility of planning and executing all matters related to natural environment.

The first National Biodiversity Strategy was completed in 2001 and resulted in generating various environmental management tools, such as regional biodiversity strategies and the strengthened national legal framework among several others (de Queiroz et al., 2014). In 2002, Peru issued the Organic Law of Regional Governments (Law 27867), which enhances decentralization of administrative functions from the central government to the regions. Peru has ensured decentralized regional governance of biodiversity to focus on social inclusion, such as indigenous peoples and gender. Subsequently, several regional governments also developed their own biodiversity strategies (de Queiroz et al., 2014). The second National Biodiversity Strategy, drafted in 2010 and adopted in 2014, further emphasized "re-valuing traditional knowledge associated with the biodiversity of indigenous peoples" and "strengthening cooperation and the participation of all actors in biodiversity governance" as part of strategic objectives to 2021 (CBD, 2017). Peru's national biodiversity strategy is seen as one of most comprehensive ones in terms of stakeholders' involvement using participatory approaches (IDLO, 2017).

2.3.3 Health policy and healthcare system

The health sector of the Peruvian government, although some health indicators show improvement, has been facing the issues of disparities between rural and urban areas. This is partly the reason why the Peruvian Amazon is the target of the study. If the public health services are not fully provided in the rural areas, medicinal plants can be expected to complement their insufficiency.

In the beginning of the 1980s, accompanied by the economic collapse in the country, the health indicators and healthcare system were devastated. The most urbanized country having the sixth per capita income among 11 countries in Latin America had the second highest

infant mortality rate (Zschock, 1988). Two-thirds of infant deaths were concentrated among the poor accounting for 40% of the poorest households (Cotlear, 2000). There were large disparities between urban and rural areas in terms of health conditions, healthcare facilities, and number of doctors (Zschock, 1988, Ewing, 2010). The health expenditure of the country in 1980 only accounted for about 3% of GDP, the lowest rate in the region and further dropped during the economic recession from 1980 to 1984 (Zschock, 1988). Having been helped by international donors, the Ministry of Health (MINSA) intended to provide primary healthcare for all Peruvian people following the WHO strategy. However, the policy to move away from the conventional hospital centered service and to provide primary healthcare failed because the objection from medical staff working in hospitals and deteriorated medical facilities and supplies could not provide adequate medical services (Zschock, 1988).

From the 1980s to the 1990s, international institutions intensively intervened with structural adjustment programs in Peru's economic recovery; the healthcare intervention was one of the foci of international banks and bi-lateral development aid agencies as "good health increases the economic productivity of individuals and the economic growth rate of countries, thus investing in health is one means of accelerating development (WB, 1993). Thanks to the growing interventions, the country's healthcare sector recovered and health indicators showed improvement in the 1990s. However, the disparities between the urban and the rural and the rich and the poor in healthcare infrastructure rather widened because the reform essentially aimed at economic development and not so much at human development, and the primary healthcare strategy of WHO was not the priority (Ewing, 2010). Since early as the 1930s, the government offered various occupation-based social security health insurances to urban workers, professionals, and civil servants which were integrated into EsSalud in 1999. Those who work informally or were self-employed, such as farmers or fishers, or were unemployed, could not access to these insurances. Most people who lived in in the Andes and Amazons fell into this category. During the health sector reform in the 1990s, private sector health providers were introduced to compete with the public social security health system that resulted in increasing accessibility to better healthcare service mainly for urban population.

The general health law (Law 26842) issued on July 20, 1997 set a series of regulations regarding health-related actions and states that every person has the right to free access to health benefits and to choose their social insurance systems. In 2002, the Peruvian government introduced Integral Health Insurance (*Seguro Integral de Salud*: SIS) giving the priority to the poorer sections of the population, ushered in by the rise of human rights and development focus in the United Nations. The SIS subscribers who are under certain categories do not need to pay

for health services in appointed health facilities. SIS gradually expanded its coverages in rural and poor areas (Francke, 2013), though the healthcare system remains to be financed inadequately (Cotlear, 2006), and the disparities between the rural and the urban and the poor and the non-poor in health and healthcare provisions still exist. As for the cultural health concerns of ethnic groups, in 1991, MINSA established a division, the National Center for Intercultural Health (*Centro Nacional de Salud Intercultural*: CENSI), whose objectives are to propose policies, strategies, and standards in culture-based symptoms and syndromes, which are not in the scope of modern medicine, and to promote research to integrate traditional, complementary and alternative medicine into conventional medicine (CENSI, 2017). CENSI also compiles the information on medicinal plants and manages an herbarium and botanical garden. However, the budget for this division is meager and collecting cultural health information through medical staff dispatched to remote health posts does not make much progress due to their workload with formal medical treatment (Director of Traditional Medicine in CENSI, personal conversation, February 25, 2014).

Along with the economic boom in the 2000s, Peru paved the way to the universal health coverage and approved a universal coverage framework Law (Law 29344) in 2009. Since the 1980s to 2014, the health indicators improved; the life expectancy at birth increased from 60.0 to 74.5 and the infant mortality rate at birth per 1,000 decreased from 82.6 to 13.6 (WB, 2017a). In 2014, regardless of high economic growth in the first decade of this century, the health expenditure remained as low as 5.5% of GDP, and the disparities between rural and urban remained wide (PAHO, 2012).

2.4 Significance of a Medicinal Plant Utilization Study in the Peruvian Amazon

Today, the lung of the earth is facing rapid economic, social and ecological changes due to the continual expansion of the global economy. The biological and cultural diversity is staggering, including the use and knowledge of medicinal plants. The Peruvian Amazon is no exception. While environmental changes, such as deforestation, may affect medicinal plant habitats, local economic development and global economic expansion might influence the usage of medicinal plants in multiple ways. On the one hand, medicinal plants may become globally demanded once their medical and functional properties are found, economic development may change cultural and social lives, including the use of medicinal plants, of people living in Amazon on the other. Peru has experienced rapid economic growth since the first decade of the 21st century. However, the country's economic growth does not necessarily

benefit people in the Peruvian Amazon. The people living in the Peruvian Amazon are situated in the middle of the influence of economic growth and insufficiency to receive its benefit and national health policy on modern medicine and accessibility to the forest resources for traditional use of medicinal plants. That is the rationale for conducting field studies in the Peruvian Amazon.

CHAPTER 3

OBJECTIVES, METHODOLOGY, AND FIELD INFORMATION

3.1 Objectives and Research Framework

Taking the degree of urbanization and cultural influence into account, this thesis examines if medicinal plants are still effectively used as expected at the global level and if their utilization leads to adverse effects on biodiversity in the surrounding forest. I intent to reanalyze the international expectations of medicinal plants by determining different reality through updated information of the field in the Peruvian Amazon. Determining perceptions and actions of people who live in a remote forest area under the rapid economic and social changes, about their utilization of medicinal plants, I hope, would provide an insight for better policies and international recognition toward medicinal plant utilization as well as people living in such areas.

The objectives of the study are as follows:

1. To determine utilization of medicinal plants for health, livelihood and biodiversity management in a secondary city of the Peruvian Amazon
2. To assess the influence of ethnicity and distance to the city on medicinal plant utilization in health, livelihood, and biodiversity
3. To assess the influence of healthcare services on medicinal plant utilization.

This study has selected a secondary city in the Peruvian Amazon as the base for the field study, as it focuses on the situation of the second strata of population agglomeration, as shown in Chapter 1. In the Peruvian Amazon, large cities such as Iquitos and Pucallpa have many healthcare services based on modern medicine, such as hospitals, clinics, and pharmacies, and are located a little away from forests. Unlike, secondary cities have smaller population agglomeration, are located near forests, have few healthcare services, and serve as a commercial center for surrounding villages. The surrounding villages often located within forests are placed in ambivalent conditions to choosing healthcare methods and developing commercial products associated with remoteness under the pervading influence of economic development and national policies to implement health services based on the modern medicine (Toda et al., 2016).

The research framework was developed through literature review as shown in Chapter 1 and the research objectives shown in the previous section were set based on this framework. For a research field, first the Peruvian Amazon was selected as it provides an ideal condition to pursue this study shown in Chapter 2 and, then, a secondary city in the Peruvian Amazon was selected based on studies of rural urbanization in order to explore its expected unique conditions and roles in relation to the surrounding villages. The data was collected from four villages near the secondary city shown in the following section, through face-to-face interviews to households based on a structured questionnaire. The data was analyzed by statistical testing and interpreted qualitatively through the literature.

3.2 Field Information

3.2.1 Site Selection

The site for field study was selected based on rural urbanization studies; in this case it was a secondary city in the Peruvian Amazon. Secondary cities were suitable for the study because of the proximity to forests and the degree of urbanization, thus, that of amenity that the cities might have.

The city of Contamana located in the central Peruvian Amazon was selected as the secondary city as it is remote enough to provide the suitable conditions for the study. The city is located between the two largest cities in the Peruvian Amazon: Iquitos and Pucallpa, along the Ucayali River (Figure 3.1) - the main upper tributary of the Amazon River. Iquitos is the department capital of Loreto with population of approximately 440,000 and Pucallpa is the department capital of Ucayali with population of approximately 200,000. Both the cities face the Ucayali River and are highly urbanized with several healthcare facilities and many drug stores. The author observed that people living near Iquitos depended on modern medicine and forests were not necessarily in proximity.

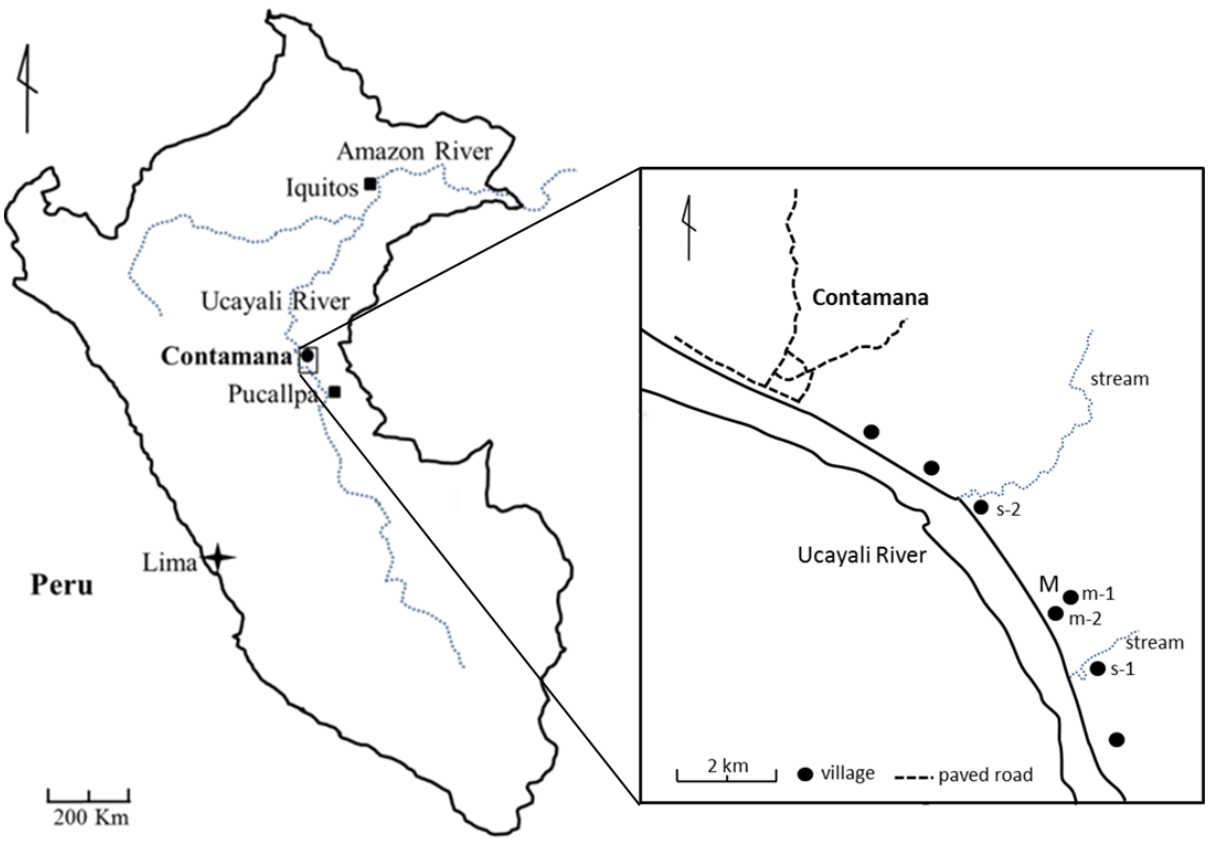

Figure 3.1 Study Site.

The city of Contamana is surrounded by forests, which are a part of the richest biodiversity in the world (Gentry, 1988; Pyhälä et al., 2006). They are a tropical moist forest and also a flooded alluvial forest, which have grown on a flat or depressed land adjacent to the course of a large river, formed by recent accumulation of materials and has drainage problems. (Kometter, 2004). The typical dominant species found in a flooded alluvial forest include Aguaje (*Mauritia* spp.), Caimitillo (*Pouteria* sp.), Machimango (*Eschweilera* spp.), Shimbillo (*Inga* spp.) among others. However, its vegetation type comprises of agricultural intervention, cultivated grasses, secondary forest in different stages of growth and primary forest. Law 29763 zoned forests in this area as Permanent Production Forest (Kometter, 2004), which is one of the four forest zonings defined by the law and designated for use of forest resources including timber and non-timber products.

Figure 3.2 The city of Contamana: From the sky (top left), The municipal building of Contamana (top right), A market by the river (bottom left), and A street along the city plaza (bottom right).

Contamana is the capital of Ucayali province, the southern frontier of Loreto department and adjacent to Ucayali department with a population of over 20,000. Its distance from Iquitos is 440km (840 km by river) and 134km from Pucallpa (285km by river). There is no road access to Contamana from these cities but flights with small planes fly daily from Pucallpa and once a week from Iquitos. Inside the city, paved roads are spread across several blocks from the city center and few extend to hilly areas and the airport. The paved road to a hot spring located 29 km from the city, which is the single source of tourism for Contamana, did not complete until 2014. Motorcycles and three wheelers, called *moto-carro* are the most common modes of transportation, but not automobiles. There are many shops in the city, but three major markets are located a few blocks from the city center at the river side (Figure 3.2). Contamana serves as the important regional commercial center, where agricultural products and fish are delivered by people living in nearby or remote villages requiring 5 or 6-hour boat travel to reach the city, which are to earn money. Agriculture and fishery are the main livelihood of people in surrounding villages. The Ucayali River provides the sole mean of transportation connecting the villages located away from the city along the river. Regional governmental offices, a hospital, many drug stores, accommodation facilities, and schools including a college are also present in the city.

3.2.2 Field study site

The field study was conducted in two indigenous *Shipibo* communities, namely s-1 and s-2 in the summer of 2014 and 2013 respectively and two mestizo hamlets, namely m-1 and m-2 in the winter of 2014. Mestizo are the descendants of Amerindian and Iberian people, and the *Shipibo* are the dominant indigenous ethnic group in the central Peruvian Amazon, dispersed mainly in Peru along the Ucayali River and partially living in Bolivian and Brazilian territory. *Shipibo* is well known for its unique geometric patterns used for pottery, houses, and cloths died using mud and for Ayahuasca shamanism, which uses variety of medicinal plants to cure illness (Tournon et al., 2014) including Ayahuasca, a plant which provides a hallucinatory effect. The two indigenous communities are officially registered and titled as a native community defined by Law 22175 and given the right to use its territory. The hamlet called *caserío* is the smallest population center defined in Law 27795 of Demarcation and Territorial Organization, which does not have territorial limit or border (Table 3.1). In the study, both native community and hamlet are called "village" (Figure 3.3).

Figure 3.3 Villages: s-1 (top left), s-2 (top right), m-1 (bottom left), m-2 (bottom right).

Table 3.1 Village profile

Category of population center	Village	Established	Area (ha)	Population	Number of household
Communidades Nativas tituladas (Law 22175)	s-1	1974	1,230	380	39
	s-2	1974	1,155	860	132
Casario (Law 27795)	m-1	-	no territorial limit	225	47
	m-2	-		184	34

The four villages are located at the south of Contamana along the Ucayali River (Figure 3.2). Village s-1 is located further south from Contamana 18 km away, which takes about 50 minutes to reach by boat. Village s-2 is located close to the city, 9 km away, which takes about 25 minutes to reach by boat. Village m-1 and m-2 are located between the two indigenous villages, yet closer to Village s-1, around 13 km away from the city and takes around 40 minutes to reach by boat. Village m-1 and m-2 share a port at the river and are adjacent to each other; though m-2 is located at the lower land along the river and m-1 is located at the high land above m-2 (Table 3.2).

Table 3.2 Village infrastructure and distance to healthcare services

Village	s-1	m-1	m-2	s-2
Distance to				
hospital	18 km	13 km	13 km	9 km
clinic	9 km	4 km	4 km	0 km
pharmacy	18 km	13 km	13 km	9 km
Electricity	Yes	No	No	Yes
Water	Yes	Yes	No	No

These villages have been selected because they are not too small to conduct interviews in. Moreover, the distance to the city and the accessibility to healthcare facility of s-1 and s-2, the two largest *Shipibo* villages, which are closest to the city on the south side along the Ucayali River, allowed me to compare the influence of the proximity to the city, and the close proximity of s-1 to m-1 and m-2 allowed me to compare the influence of ethnicity as a better combination than any other villages.

The livelihoods of *Shipibo* and mestizo are very similar (Figure 3.4). Swidden-fallow agriculture (Figure 3.5) after two to four years of using a field cultivating cassava, maize, plantain, and rice, the field is to be used as forest garden (de Jong, 1996) and a new swidden

field is to be made by clearing and burning a primary or secondary forest, sparing valuable species such as palms and other trees for timber (Urruh, 1988). They also constantly fish to consume or sell and hunt in the forest in a minimum extent. A few work as carpenters to help construct houses in their village. Some temporarily work in the oil concession site nearby, though only once in a while. Several people living in Village s-2 have work in the city. All villages in this area do not have paved passes or roads; though Village s-2 is an exception, which recently completed paving its main pass from the port to inside the village in the following year of my survey. Automobiles and motorcycles are not used in the villages. Boat is the only mode of transportation to access the city and most of the nearby villages. A hospital and few pharmacies that the villagers visit, are located only in the city, though there is a health post staffed by a nurse and a technician in Village s-2. The health post is responsible for taking care of people living in 10 villages located in the south of Contamana including all the villages I conducted the interviews in (Table 3.2).

Figure 3.4 Village life: Working in a farming lot (top left), Rice farming in the dry season by the river (top right), Grilling fish in the morning (bottom left), A house in Village s-2 (bottom right).

Figure 3.5 Swidden-fallow agriculture: Secondary forest (top left), Burnt forest (top right), and Farming lot (bottom left and right).

During the interview period, 39 households were present in Village s-1, which is located at a tributary of the Ucayali River, a 5 minute-walk from a port on the River. The village has electricity and a water distribution system, which functions for limited hours in a day. The river water is often used for cooking and bathing. No healthcare facility is provided in the village, but, some medicinal drugs are stocked in the village. Residents need to go to the health post located in Village s-2 or a hospital in the city for any medical treatment. The village has a kindergarten and a primary school. In Village s-2, which faces the Ucayali River, yet extended further inland, there were 132 households. A filtered water distribution system using the river water was in place but did not function during the interview period. So, people did not have any other choice except to use water from a communal well or river water. Electricity was available for limited hours a day. There was a kindergarten, a primary and secondary school in Village s-2. In Village m-1 and m-2, located next to each other, only 26 households were residing during the interview period. People living in Village m-1 on the upper land could use water distribution for several hours in a day. There was no water distribution in Village m-2, so the residents used water either from a communal well, a stream, or the river. There was an elementary school in

each village, but only one secondary school in Village m-2, located between the two mestizo villages. Most children go to this secondary school, but some go to the secondary school in Village s-2 (Figure .3.6 and 3.7).

Figure 3.6 Village infrastructure: Villages with electricity (top and bottom left), Children taking water from a stream (top right), A well in a village (bottom left), A water pomp taking water from the river (bottom right).

Figure 3.7 Healthcare facilities and a medicinal plants shop: Hospital (top left), Medicinal plants sold in Contamana (top right), Health post in Village s-2 (bottom left), and Medicinal drugs in the health post (bottom right).

3.3 Data Collection and Analysis

3.3.1 Data collection

The data was collected through the field study in the four villages near the secondary city by conducting face-to-face interviews with a structured questionnaire by the author in Spanish. The field study was approved by the ethics committee of the Graduate School of Life and Environment of Sciences of University of Tsukuba.

For every field interview, the data collection began by obtaining permission from the head of each village. The interview of each household was held after obtaining the signed consent forms informing interviewees about verbal and written explanation of the study. The interview was conducted along structured questionnaire, which included questions about utilization of medicinal plants, such as frequency, purposes, type of plants, location of the plants extracted, purchase and sales, perceptions towards medicinal plants and about modern medicine utilization, such as frequency of healthcare facility visit, purpose, purchase of medicinal drugs,

and health insurance subscription. Socio-economic information was also obtained from each household (Appendix 3.1 and 3.2).

In Village s-1, m-1, and m-2, household inventory interview was intended although a few households were unavailable in Village m-1 and m-2. Either the household head or wives in all the 39 households in Village s-1, 25 out of 26 households of Village m-1, and 21 out of 26 households of Village m-2 were interviewed. In Village s-2, 50 households out of 132 were selected through random sampling by lot. Only 42 household heads were available for the interview. Table 3.3 shows demographic information of each village. In addition to the household interview, informal interview of the director of the hospital in Contamana and nurses in the health post in Village s-2 were conducted, and the market in the city was observed to obtain the background information of the area related to medicinal plants.

Table 3.3 Respondents' profile in each village

Village	s-1	s-2	m-1	m-2
Number of households in village	39	132	26	26
Number of respondents	39	42	25	21
Number of male/female	21/18	42/0	10/15	12/9
Average age (years old)	38.1	46.6	37.0	41.0
Average age (years old) male/female	38.7/37.4	-	40.5/34.6	48.3/31.3
Average year of education	6.5	9.5	5.7	5.2
Average year of education male/female	7.5/5.3	-	7.2/4.7	5.0/5.4
Average income in sol (number of data collected)	4,012 (34)	6,268 (30)	9,823 (24)	7,187 (21)

3.3.2 Data analysis

The data collected was analyzed through simple statistical testing using statistical software, namely IBM SPSS 24 and R version 3.4 and interpreted qualitatively based on the literature. The medicinal plant utilization was assessed based on the responses to the questions regarding frequency of use, plant species and frequency of purchase of medicinal plant products. Respondents answered with local plant names, though for reference purposes, scientific names were added based on the references provided by Mejia and Rengifo (1995) and IIAP (2010). The impact of medicinal plant utilization was assessed, on livelihood through the sales activities of medicinal plants and on biodiversity through the type, place of extraction, and frequency of the plant use. The utilization of healthcare services was assessed based on the frequency of healthcare facility visit, its purpose, medicinal drug purchases, and health insurance subscription. Based on these assessments as well as the responses regarding the perception related questions, the influence of healthcare services on medicinal plant utilization with the

differences in ethnicity and the distance to the city were analyzed. The relation between explanation and dependent variables and corresponding assumptions and objectives are shown in Figure 3.8.

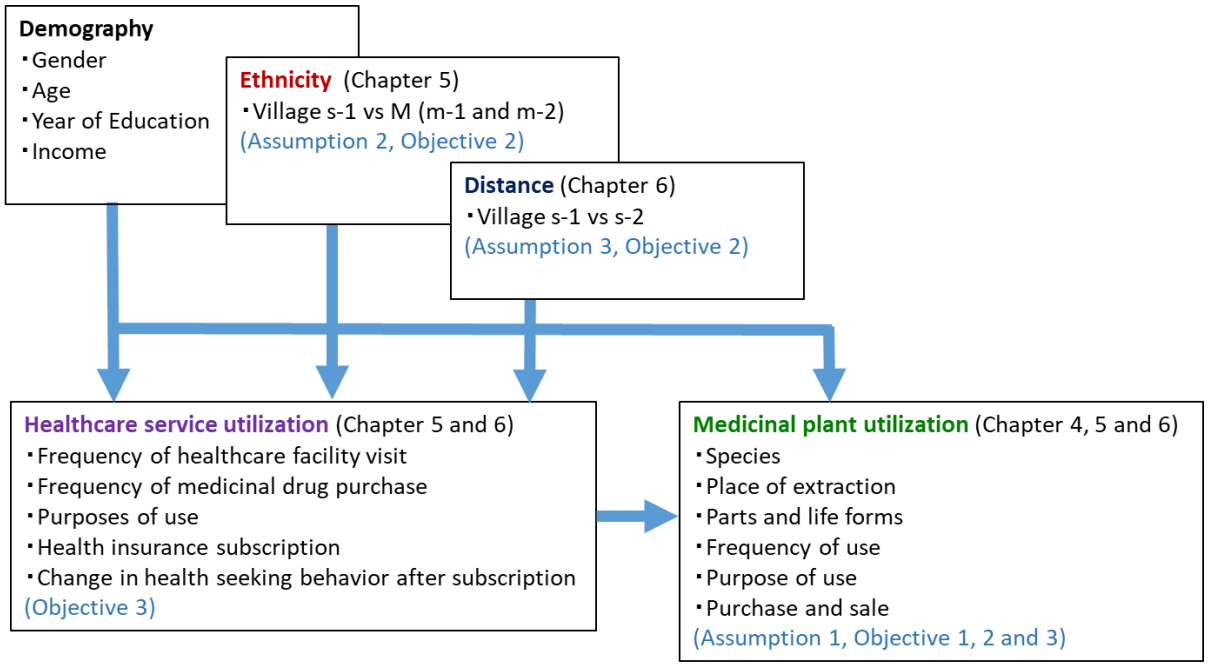

Figure 3.8 Explanatory and independent variables and their corresponding assumptions and objectives.

In order to determine the ethnic differences in behaviors towards utilization of medicinal plants and healthcare services, the data of Village s-1, and combined data of Village m-1 and m-2 were compared. Village m-1 and m-2 had the same distance to the city and shared a port. Although Village s-1, an indigenous village, is located 5 km further south away from the city, this distance makes the shortest proximity between a mestizo and indigenous village among any other combination. Although the sample size in Village m-1 and m-2 was rather small in comparison to Village s-1, all the households resided during the filed study were interviewed except for one in Village m-1. Prior to combining the data of Village m-1 and m-2, the demographic attributes were tested, using chi-square test for the ratio of gender and Mann-Whitney U test for differences in distribution of the age, the year of education, and the income distribution (Appendix 3.3). As the distribution of all attributes was not significantly different between Village m-1 and m-2, the two villages were collectively treated as a mestizo village M having 46 household respondents and compared with Village s-1 with 39 household respondents.

The differences of medicinal plant utilization in the distance to the city and the

accessibility to a health post were assessed using the data of two indigenous villages: Village s-1 and s-2. Village s-2 is located 9 km from the city along the river, half of the distance from Village s-1. There are several other different conditions between the two villages as described earlier in this chapter. The population size was much larger, and the data were collected from randomly selected households in Village s-2. The education level was much higher with 9.5 average years of education of respondents in Village s-2 compared to 6.5 years in Village s-1. Several respondents were teachers in Village s-2 whereas respondents in Village s-1 were mostly farmers. These were uncontrolled attributes, which may be associated to villages near a city. The average age of the respondents were 46.6 years in Village s-2 and 38.1 years in Village s-1. The respondents in Village s-2 were all males, while those in Village s-1 were males and females. Having these conditions, medicinal plant utilization of households in Village s-1 and s-2 were compared.

3.3.3 Demographic distributions among respondents in each village

Taking into account demographic traits as potential factors for medicinal plant utilization as shown in Chapter 1, the demographic distribution was tested among villages. The gender distribution of respondents was tested among Village s-1, m-1, and m-2 because in Village s-2, only household heads, all males, were the respondents. The distribution did not appear to be significantly different among the three villages (χ^2 (2, 85) = 1.648, p = .439). The age distribution of respondents among four villages was significantly different (H (3, 127) = 10.095, p = .018). However, when Village s-2, which had the highest average age, was excluded, the age distribution among Village s-1, m-1, and m-2 was not significant (H (2, 85) = .486, p =.784). The average age of Village s-2 was 46.6 years old, whereas that of Village s-1 was 38.1 years, m-1, 37.0 years, and m-2, 41.0 years. Likewise, while overall distribution of the year of education among four villages was also significantly different (H (3, 127) = 23.469, p = .000), the distribution of the year of education among three villages excluding Village s-2, which had outstandingly high average year of education, was not significantly different (H (2, 85) = 3.511, p =.173). As shown in the previous section, the average education year of respondents in Village s-2 was much higher with 9.5 years than 6.5, 5.7, and 5.2 years in Village s-1, m-1, and m-2 respectively. The data of income distribution which was not precisely collected from all respondents, was also tested. The income distribution of four villages was not significantly different (H (3, 109) = 7.602, p = .055).

The differences in demographic distribution of age and year of education in Village s-2 lead to two possible interpretations: the influence of 1) all male respondents and 2) the location of the village near the city including the population size of Village s-2. As the field

interviews mainly collected information regarding household behaviors, not individual ones, the basic assumption was that the information would not be influenced by the respondents' demographic attributes. However, the results of the differences in distribution of demographic attributes among villages was taken into consideration for interpretation where necessarily.

3.3.4 Testing spurious relationship among demographic traits

Spurious relationship among demographic traits: gender, age, year of education, and income in each village were tested (Table 3.4 and Appendix 3.4). Age and the year of education was correlated in Village s-1, s-2 and m-2, but not in Village m1. The mean of gender and age in Village m-2 and the mean of gender and income in Village s-1 were significant. The year of education and income in Village s-2 was significantly correlated. These spurious relationships were taken into account for interpreting the data.

Table 3.4 Significant level of spurious relationship among demographic data in each village

		Village			
Demographic data	Statistic testing	s-1	s-2	m-1	m-2
Gender x Age	Mann-Whitney (m-1 = t-test)	*ns*	-	*ns*	*s*
Gender x Year of education	Mann-Whitney	*ns*	-	*ns*	*ns*
Gender x Income	Mann-Whitney	*s*	-	*ns*	*ns*
Age x Year of education	Pearson correlation	*s*	*s*	*ns*	*s*
Age x Income	Pearson correlation	*ns*	*ns*	*ns*	*ns*
Year of Education x Income	Pearson correlation	*ns*	*s*	*ns*	*ns*

s = significant, ns = not significant

CHAPTER 4

RESULTS: MEDICINAL PLANT UTILIZATION

4.1 Most Frequently Used Plants

Most frequently used plants for household's healthcare were assessed based on the data obtained through the top five most frequently used medicinal plants for the last one year answered by each respondent. Not all respondents provided five plants because many of them pointed out less than four plants, or few just did not remember the name of plants they used.

The total count of plant mentioned by respondents from all four villages was 463 spreading across 82 different species. In breakdown, households cited 147 counts in Village s-1, 160 in Village s-2, 83 in Village m-1, and 73 in Village m-2. The average number of medicinal plants cited per respondent was 3.6 in the total and slightly higher in Village s-1 and s-2 with 3.8 counts than 3.3 in Village m-1 and 3.5 in Village m-s. The number of species cited and the average number per respondent was 0.65 in total, 1.2 in Village s-2, m-1, and m-2, but 1.0 in Village s-1. The number of medicinal plants cited only once in each village were 28 species out of 82 representing 35.4% in total, 21 out of 39, 53.8% in Village s-1, 28 out of 51, 54.9% in Village s-2, 20 out of 31, 64.5% in Village m-1, and 21 out of 26, 80.8% in Village m-2. Its average per respondent was higher in the mestizo villages, especially in Village m-2 (Table 4.1).

Table 4.1 Count of medicinal plants cited and number of species

The count of medicinal plants cited and number of species	Village (n = respondents)			
	s-1 (n=39)	s-2 (n=42)	m-1 (n=25)	m-2 (n=21)
Total counts of plant mentioned in each village	147	160	83	73
The average number of plant per respondent	3.8	3.8	3.3	3.5
The number of species mentioned in each village	39	51	31	26
The average number of plant species per respondent	1.0	1.2	1.2	1.2
The number of species cited only once in each village	21	28	20	21
Percentage of species cited once of total species	53.8%	54.9%	64.5%	80.8%
The average number of plant species cited once per respondent	0.5	0.7	0.8	1.0

Among the all counts, the plant cited most frequently was Piñón Colorado (*Jatropha*

gossypifolia), a shrub with 81 counts representing 17.5% of the total count. The second most frequently used plant was Malva (*Malachra alceifolia*), an herb, with 65 counts or 14.0%, followed by Ajo Sacha (*Mansoa alliacea*), a shrub, with 21 or 4.5%, and Chuchuhuasi (*Maytenus macrocarpa*), a tree and Sangre de grado (*Croton lechileri*), both with 19 counts or 4.1%. The top two plants represents 31.5%, top five, 44.5%, and top 10, 57.9%. (Table 4.2). Among the top 10 most cited plants, those extracted from forest are only Chuchuhuasi, which root and bark were used, and Uña de Gato (*Uncaria tomentosa*), a liana, with 12 counts 2.6%, which bark were used. Sangra de grado, which resin was used, and Ubos (*Spondias mombin*), which bark was used can be found in forests, yet, people plant them near their houses for their use. Other 6 plants within the top ten are either a shrub or herb and planted or just found near houses.

Table 4.2 Top ten species of the top five most frequently used medicinal plants by each respondent in Village s-1, s-2, m-1, and m-2 (n=461*)

Local name	Scientific name (reference purpose only)	Life form	Habitat	Wild/Planted /Cultivated	Part used	Count	%
Piñón colorado	*Jatropha gossypifolia*	S	NH	cultivated	Rs/L	81	17.5
Malva	*Malachra alceifolia*	H	NH	cultivated	L	65	14.0
Ajo sacha	*Mansoa alliacea*	V	NH	cultivated	L	21	4.5
Chuchuhuasi	*Maytenus macrocarpa*	T	F	wild	Rt/B	19	4.1
Sanger de grado	*Croton lechileri*	T	NH/F	planted/wild	Rs	19	4.1
Mucra	*Petiveria alliacea*	H	NH	wild	leaf	15	3.2
Piñón blanco	*Jathropa curcas*	S	NH	cultivated	L/Rs	15	3.2
Uña de gato	*Uncaria tomentosa*	V	F	wild	B	12	2.6
Ubos	*Spondias mombin*	T	NH/F	planted/wild	B	11	2.4
Yahuar piripiri	*Eleutherine bulbosa*	H	NH	wild/cultivated	L/Rt	10	2.2
Top ten sub-total						268	57.8
Others						195	42.2
Total						463	100

*Some respondents did not list up five plants. Life form: H=herb, S=shurb, T=tree, V=vine. Part used: B=bark, L=leaf, Rs=resin, Rt=root. Habitat: F=forest, NH=near house.

The total count of frequently used plant in each village was 147 in s-1, 160 in s-2, 83 in m-1, and 73 in m-2. The top two most frequently use plants were Piñón Colorado and Malva across the four villages, although Malva took the first place in Village m-1 receiving 4 points more than Piñón Colorado. In each village, the share of the top two frequently used plants was much higher in Village s-1 representing 41.4% than other villages: 26.3% in Village s-2, 28.9% in Village m-1, and 26.0% in Village m-2. Although eight plants comprise the top three most frequently used medicinal plant across four villages, medicinal plant utilization was highly slanted to the top two plants in each village (Table 4.3). The top five and ten plants took 57.8% and 72.8% in Village s-1, 45.0% and 60.0% in Village s-2, and 55.4% and 71.1% in Village m-1, yet, only 38.4% and 54.8% in Village m-2.

Table 4.3 Top three most frequently used medicinal plants in Villages s-1, s-2, m-1, and m-2

	Village							
	s-1 (n=147)		s-2 (n=160)		m-1（n=83)		m-2 (n=73)	
Local name	Rank	%	Rank	%	Rank	%	Rank	%
Piñón colorado	1	22.4	1	17.5	2	12.0	1	13.7
Malva	2	19	2	8.8	1	16.9	2	12.3
Top two of the total		41.4		26.3		28.9		26.0
Chuchuhuasi	-		3	8.1	-		3	4.1
Ajo sacha	-		-		-		3	4.1
Sanger de grado	3	6.8	-		-		-	
Piñón blanco	-		-		-		3	4.1
Chiricsanango	-		-		-		3	4.1
Mucura	-		-		2	12.0	-	
Top five of the total		57.8		45.0		55.4		38.4
Top ten of the total		72.8		60.6		71.1		54.8

Figure 4.1 Frequently used medicinal plants: Piñon Colorado (top left), Malva (top right), Ajo sacha (bottom left), and Cat's claw (bottom right).

4.2 Utilization of Plant Parts and Life Forms

4.2.1 Plant parts and life forms used

Plant parts used were asked for assessing possible damage or unsustainable extraction caused by utilization. The total count was 514, of which leaf represents 57.4%; resin, 15.4%; bark, 13.2%; root, 6.6%; fruit, 4.3%; and others, 3.1% (Table 4.4). Leaves were the most used part across villages. Although in Village s-1, m-1, and m-2 leaves were used more than 60%, in Village s-2, they were used less than 40%, but used more barks (21.4%) and roots (19.7%). The use of barks and roots were 4.4% each in Village s-1, 12.9% and 2.2% in Village m-1, and 12.2% and 6.8% in Village m-2, respectively. The use of parts was significantly different among villages ($\chi 2$ (15, 514) = 56.387, p = .000) (Figure 4.1). The differences across demographic attributes were tested. Overall, gender, age, and year of education significantly influenced plant parts used (Appendix 4.1). However, if data from Village s-2 were excluded, only gender significantly influenced the plant parts across Village s-1, m-1, and m-2 (χ^2 (5, 327) = 18.406 p = .002).

Table 4.4 Plant parts utilized by life form

Plant	Plant type (life form)											
	Total		Tree		Vine		Shrub		Herb		Unknown	
Part	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Leaf	295	57.4	6	1.2	18	3.5	113	22.0	149	29.0	9	1.8
Resin	79	15.4	39	7.6	2	0.4	37	7.2	1	0.2	0	0.0
Bark	68	13.2	38	7.4	21	4.1	3	0.6	2	0.4	4	0.8
Root	34	6.6	12	2.3	1	0.2	6	1.2	13	2.5	2	0.4
Fruit	22	4.3	16	3.1	0	0.0	2	0.4	2	0.4	2	0.4
Others	16	3.1	9	1.8	1	0.2	2	0.4	4	0.8	0	0.0
Total	514	100.0	120	23.3	43	8.4	163	31.7	171	33.3	17	3.3

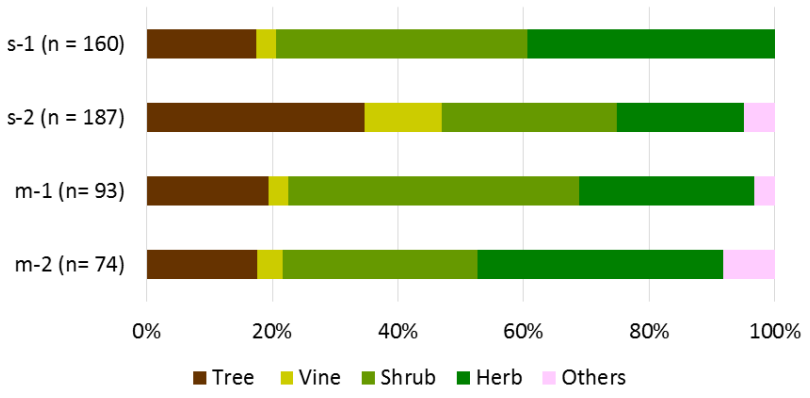

Figure 4.2 Plant parts used by households in each village.

Schippmann et al. (2002) state that "species most susceptible to over-harvest are habitat specific, slow growing and destructively harvested for their bark, roots, or the whole plant (p8)." The present study, then, the life form of plants which root or bark were used was determined. There was no case of using whole plant in the interview. Table 4.4 shows the plant parts utilized based on plant life form. Twelve out of 34 root counts were derived from trees representing 2.3% of the total. For these, 4 species are utilized; Chuchuhuasi with 9 counts, and Icoja (*Unonopsis floribunda*), Huasai (*Euterpe oleracea*) and Ubos with 1. Only Ubos can be planted and the others are extracted from forests. Nine out of 12 roots from tree were used by respondents in Village s-2; Village s-1 had only 1 count, m-1, 2; and m-2, 0. The roots of 3 shrub species were also utilized having 6 counts representing 1.2%. Among three, Chiric sanango (*Brunfelsia grandiflora*) had 4 counts from Village s-1, s-2, and m-2, other two species were cited only one each. Chiric sanango can be found in forests, yet a sub species can be cultivated. Roots of herbs also had 13 counts from Village s-1, s-2, and m-2 again, representing 2.3% of the total. For these, 5 species are utilized; Yahuar piri-piri (*Eleutherine bulbosa*) and Ginger (*Curcuma longa*) with 5 counts each, and two other species were Carrot and Maca with 1 count each from Village m-2, and Renqauilla (*Clusaa rosea*) from Village s-2. The root of vine, Ajo sacha, was also cited only once from Village s-1.

Thirty eight out of 68 bark counts were derived from tree representing 7.4% of the total. Among 11 species utilized for these, Chuchuhuasi with 16 counts was used most, yet mostly by Village s-2 with 11 counts. Ubos with 7 counts were the second most used species followed by Icoja, 4, and Cedro (*Cedrela sp.*). Other 7 species were cited only once, of which were from Village s-2. Again, only Ubos can be cultivated and other are found in forest. Twenty two bark counts were derived from vine species. Uña de Gato (*Uncaria tomentosa or Uncaria guianensis*) cited most with 11 counts, followed by Ayahuasca (*Banisteriopsis caapi*) with 5 counts and Ajo sacha with 4 counts. Two others were cited only once. Uña de Gato is found in forests. Two shrub species and 1 parasite herb species were cited only once or twice for utilizing their bark.

The life forms of medicinal plants used by each village are shown in Figure 4.2. In Village s-1, trees were used 17.5% of the total; vines, 3.1%; shrubs, 40.0%; and herbs, 39.4%. In Village s-2, 34.8%, 12.3%, 27.8%, 20.3%, respectively, and others were 4.8%. In Village m-1, they were used 19.45, 3.2%, 46.2%, 28.0%, and 3.2%, respectively; and in Village m-2, 17.6%, 4.1%, 31.1%, 39.2%, and 8.1% respectively. The life forms of medicinal plants used among villages were significantly different ($\chi 2$ (12, 515) = 58.487, p = .000). Overall, gender and year of education significantly influenced in plant life forms used (Appendix 4.1); however,

across three villages: Village s-1, m-1, and m-2, again only gender made significantly different (χ^2 (4, 327) = 12.719 p = .013).

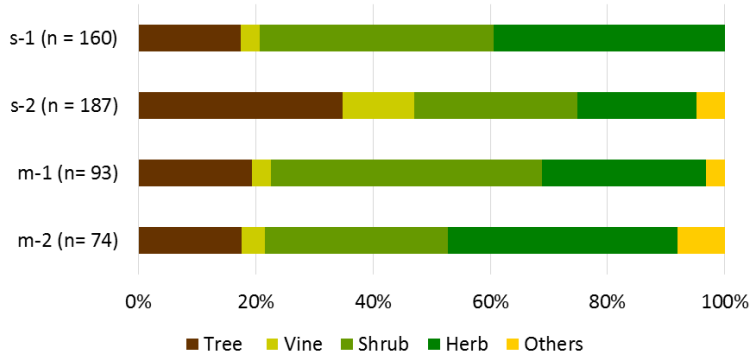

Figure 4.3 Life forms of medicinal plants used by households in each village.

4.2.2 Number of persons used plants and parts, which may cause damages on forests

The number of households used the potential destructive plant parts was assessed. The potential destructive plant parts were defined here as roots and barks of trees, vines, and shrubs, found in forests although use of these parts do not necessarily and directly damage plants. Among 127 total households, 50 representing 39.4% mentioned that they used potential destructive plant parts. However, it is the households in Village s-2 who used potential destructive plant parts most as 29 households representing 69.0% of the total responded households used such parts. In other three villages, 20.5% in Village s-1, 28.0% in Village m-1, and 28.6% of Village m-s used them. This reflects more use of bark and roots in Village s-2 shown in the previous section.

Table 4.5 Households which use potentially destructive plant parts and life forms

	Village	s-1 (n = 39)	s-2 (n = 42)	m-1 (n = 25)	m-2 (n=21)
Number of potentail destructive users* by plant part	Tree Root	1	9	1	0
	Tree Bark	3	18	4	6
	Vine Root	0	0	0	0
	Vine Bark	3	11	2	0
	Shrub Root	1	1	0	1
	Shrub Bark	0	2	3	0
Number of potential destructive users*		8	29	7	6
Percentage of potential destructive users*		20.5	69.0	28.0	28.6
Number of potential destructive users* male/female		6/2	29/-	5/2	3/3

*potential destructive users: those who ued roots and bark of trees, vines, or shrubs

4.3 Frequency and Purpose of Medicinal Plant Use

4.3.1 Demographic influences

First of all, the gender differences in frequency of medicinal plant utilization for healthcare purposes among Village s-1, am-1, and m-2, then all four villages were tested, especially because the respondents in Village s-2 were all male. The result shows no significant in the three villages together (U (85) = 860.000 p = .705) or all villages together (U (126) = 1706.000 p = .763). None of the other demographic attributes including age, year of education, and income, were significantly correlated with the frequency of medicinal plant use in all four villages (Appendix 4.2). Thus, hereafter, the analyses in this section treat all respondents equally without considering differences in demographic attributes.

4.3.2 Frequency of medicinal plant use

The frequency of medicinal plant utilization was defined based on five most frequently used plants of each respondent for his/herself and family, which were not purchased or sold, for the last one year. For the sake of analysis, medicinal plant users were categorized into four as Daily Users as those who used medicinal plant daily, Weekly Users used once a week or more but not daily, Monthly Users used once a month or more but less than once a week, and Infrequent Users used less than once a month. The percentages of medicinal plant frequency in order of Daily Users, Weekly Users, Monthly Users, Infrequent Users, and Non Users are 20.5%, 43.6%, 17.9%, 5.1%, and 12.8% in Village s-1; 23.8%, 14.3%, 50.05, 7.1%, and 4.8% in Village s-2; 24.0%, 16.0%, 24.05, 20.0%, and 16.0% in Village m-1; and 19.0%, 23.8%, 33.3%, 14.3%, and 9.5% in Village m-2, respectively (Figure 4.4). If Daily Users and Weekly Users are assumed to be frequent users, the breakdown for Village s-1 is 64.1% and 38.1% for Village s-2, 40.0% for Village m-2, and 42.9% for Village m-2 (Figure 4.3). Overall, medicinal plant use among four villages is significantly different (H (3, 126) = 8.285 p = .04). When Village s-1, whose Frequent Users were much more as over 60% than that of the other villages around 40%, was excluded, there were no significant in the frequency of medicinal plant use among the other village s-2, m-1, and m-2.

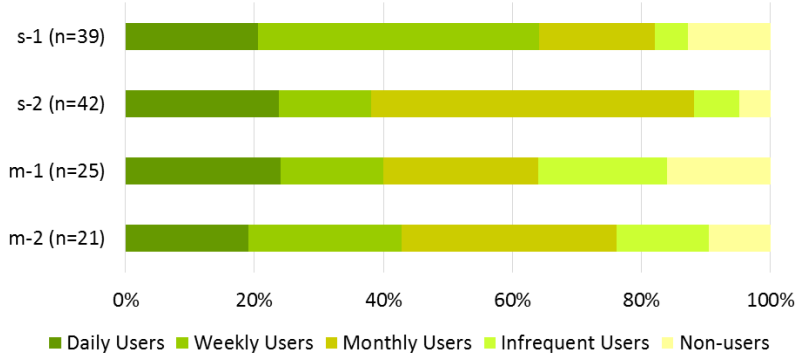

Figure 4.4 Frequency of household medicinal plant use by households in each village.

4.3.3 Purpose of medicinal plant use

The purpose of medicinal plant use was asked based on the top five most frequently used medicinal plants. Medicinal plants were used for various purposes and some plants were mixed for a specific purpose. The usage lists were not complete and do not quantitatively and precisely represent these purposes, yet they show some tendency of their medicinal plant use. The total of 84 symptoms and purposes were mentioned across four villages. However, as they were based on the respondents' perception, some of them were overlapped and others may have indicated same symptoms or purpose. Moreover, some of them were for gaining luck or removing evil spirits. Therefore, analyzing them statistically does not lead to an appropriate interpretation. Instead, just listing up them would help to grasp respondents' general behaviors towards using medicinal plants while comparing to that of healthcare services based on modern medicine. The top ten cited purposes of four villages were fever, wounds, headache, diarrhea, cold, cough, stomach problems, rheumatism, joint, and bleeding. Other than the top ten in total, households in Village s-1 cited for general pain, health, parasite, and vomitus; in Village s-2, for kidney; in Village m-1, for bronchitis, kidney, refresh drink, and inflammation; and in Village m-2, for abdominal area and high blood pressure within their top ten list.

4.4 Commercial Medicinal Plant Products

Medicinal plants are mainly purchased or sold in the form of tincture, which are made of alcohol in which barks or roots of plant were soaked. The frequency of medicinal plant purchased and sold was asked to identify demand and supply of commercialized medicinal plants.

Forty five households representing 35.4% of the total respondents from four villages purchased medicinal plant tincture in the last one year. In breakdown, 9 out of 39 representing 23.1% of the total households in Village s-1 purchased them; 15 out of 42, 35.7% in Village s-2; 10 out of 25, 40.0% in Village m-1; and 11 out of 21, 52.4% in Village m-2 purchased them (Table 4.6). However, frequent users purchasing tinctures once a month or more were only 8 all together and the rest purchased only once or few times a year. They mostly purchased them in the market in Contamana.

In terms of the sales of medicinal plants, only 14 households representing 8.7% of the total respondents across the four villages sold tincture or medicinal plants. There was only one household in Village s-2 who sold medicinal plant tincture as its main livelihood. The rest of the sellers were engaged in other livelihoods, mainly agriculture, but few were teachers in Village s-2. In Village m-1, no one sold medicinal plants during the period questioned. In Village s-1, 2 sellers out of 4 sold tinctures because they were ordered to make specific ones for indigenous ceremonies by an outsider for tourism purposes. Three of them earned from medicinal plants more than 50% of the total income in the last year. Another earned less than 10% from medicinal plant in the total annual income. In Village m-2, 2 sellers out of 3 regularly sold medicinal plants; one of them, who earned 16% of their annual income from medicinal plants go to Pucallpa to sell them. Two others earned 7.6% and 0.7% of their annual income from medicinal plants. In Village s-2, 2 sellers out of 7 were a teacher and 1 was a student, besides 1 medicinal plant vendor and 3 farmers mentioned above. An interesting aspect in Village s-2 was that the average education years of sellers was 11.6 years which were higher than the respondents' average age in the village, whereas sellers' average education years were lower than that of respondents in Village s-1 and m-2.

Table 4.6 Frequency of medicinal plant purchase and sale by households in each village

	Village			
Number of respondents	s-1 (n=39)	s-2 (n=42)	m-1 (n=25)	m-2 (n=21)
Tincture purchasers	9	15	10	11
Plant and tincture sellers	4	7	0	3

4.5 Discussion

4.5.1 Medicinal plant for healthcare purposes

It has been estimated that about 80% of people in developing countries rely on

traditional medicine, of which a major part is herbal medicine (Farnsworth et al., 1991). The rich literature, especially in ethnobotanical studies, has proved it. Likewise, the majority of households in the villages studied used medicinal plants for healthcare purposes. As Figure 4.3 indicates, about 40% to over 60% of households in each village rely on medicinal plants for their healthcare as Daily and Weekly Users. Households also hold quite a lot of knowledge of medicinal plants citing 3.6 counts in average out of 5 maximum counts and use them for quite variety of purposes. However, Table 4.3 indicates a tendency of decline in medicinal plant knowledge with limited way of medicinal plant use concentrated into the top two species representing from 26% to over 40% in each village and the top five took over 38% to more than 57%. The purposes of medicinal plant use were also concentrated on several symptoms, such as fever, wounds, headache, diarrhea, cold, cough, and stomach problems. Households have knowledge, yet they do not practice it as much as they can share it among households.

The utilization in the study accords with the rich literature of medicinal plant knowledge loss. The previous studies show that the factors of knowledge loss of medicinal plants are the presence of healthcare service (Caniago & Siebert, 1998; Vandebroek & Balick, 2012), modernization, globalization and urbanization (Benz et al., 2000; Voeks & Leony, 2004; Case et al., 2005; Voeks, 2007; Quinlan & Quinlan, 2007; Srithi et al., 2009; Merétika et al., 2010). While the present study shows that households living in the most remote village s-1 more frequently used medicinal plants, the differences in overall use of medicinal plant for healthcare purposes among villages are not so clear. A possible explanation is that the access to the medicinal plants through cultivating and finding near houses or in forests were not much different among the villages. It can be also assumed that the households in the target villages are in the middle of transition from using traditional or folk medicine for their healthcare to alternatives. The influence of healthcare services on medicinal plant utilization will be assessed in the following two chapters.

4.5.2 Medicinal plants for livelihood support

Hamilton (2004) states that medicinal plants are a significantly potential source of income for rural people in the developing countries. However, in the study site, the commercial potential could not be highly expected or exploited; not a source of income for many people. The medicinal plant venders in the markets of Contamana were not fully examined in the study, yet, only a few venders were observed. In the villages studied, only 11.0% of households sold medicinal plants remedies or plants themselves. Yet, among them, only one households made medicinal plant sales as their main livelihood. For all others, medicinal plant sales were their side business. Existing of only few sellers suggest that there are not much opportunities to sell

plants, indicating not much demand for plants or plant-based remedies. Medicinal plants were not sold to the national or global markets, although people use Uña de Gato, (*Uncaria tomentosa* and *Uncaria guianensis*) which is a globally demanded plant..

Households in the four villages did purchase medicinal plant remedies in the city of Contamana mostly, or within the villages, yet, in a very limited way. Overall, more than two third of households purchased remedies, yet, only 8 households purchased them frequently. Others purchased them only once or a few times a year. The results reveal that not many people spend money to obtain medicinal plants and lead to an assumption that they do not need to spend money due to the availability of medicinal plants nearby. One of the interpretation of the situation is that medicinal plant markets have not been developed in and around the secondary city, which condition can be different from larger cities where medicinal plants are highly demanded, and many venders are seen in the markets (Galy et al., 2000; Shanley & Luz 2003; Lima et al., 2016). In the study area, medicinal plants supported livelihood as an income only for few people, but as potential expense saving for at least more than a half of people.

It is well understood that one of the key factors for NTFPs to be effective to people's livelihood is the access to the market (Ros-Tonen and Wiersum 2003; Dercon & Hoddinott, 2005; Pyhälä et al., 2006). Moreover, the access to the forest resources is also an important factor (Pyhälä et al., 2006; Timko et al., 2010). Thomas et al. (2009) reported that the plants that are accessible are perceived to be useful. The access to markets and resources is important to develop NTFPs while considering as a supply side. However, as a demand side, the accessibility to resources may prevent from developing the market. In the secondary city, potential buyers of medicinal plants have access to nature or forests, where medicinal plants can be found or cultivated. The proximity to and availability of medicinal plants may likely prevent from spending money on them, indicating the market of medicinal plants is not developed. Among the respondents, only one household occasionally goes to Pucallpa, the second largest city in the Peruvian Amazon, to sell medicinal plants. None of the other households in the target villages was engaged in selling plants to larger markets on a national or global scale. This is an issue of the accessibility to larger markets, as a study in Ethiopia shows that rural households do not have direct links to larger cities or markets (Dercon & Hoddinott, 2005).

The area of the study has the richest biodiversity in the world (Gentry, 1988; Pyhälä et al., 2006) and has a lot of potential that there are medicinal plants which could be subject to a national or global demand. Once medicinal plants are demanded nationally and globally, it

would bring benefits to the local livelihood, but may cause overharvesting (Schippmann et al., 2002; Hamilton, 2004; Kala, 2005; Kathe, 2006). Uña de Gato is one of few medicinal plants globally famous and in demand in the Peruvian Amazon. Because the plant is mostly extracted from forests, overharvesting would be an issue once the global demand soars. While the species are not under threatened and cultivation is possible (de Jong et al., 1999), Bussmann et al. (2007) reported unsustainability of the plant and a lack of the species expressed by collectors at medicinal plant markets in the cities of the northern coast of Peru.

4.5.3 Medicinal plants for biodiversity management

Conservation, namely forest biodiversity management, is another global expectation for medicinal plants (Hamilton, 2004). However, medicinal plants were used neither for healthcare nor commercial purposes from forest resources in the villages studied. The households did not use many plants either from the wild forest or potentially destructive parts of plants. Table 4.2 shows that only limited amount of plants used were the forest-origin. Except for several types of plants, most medicinal plants used are found near houses or on the paths to their farmland or forest or planted near houses. This accords with the study of Merétika et al. (2010) in fishing communities in southern Brazil where people most frequently use plants, which are easily found in areas of easy access without significant impact on environment due to low utilization of forest resources. None of the frequently used medicinal plants identified in this study are listed in IUCN Red List (IUCN, 2015). Section 4.3 shows that the utilization of medicinal plants by households in the target villages damages little or not at all the forests or forest biodiversity, if any. Leaves, which are not considered as a destructive part to use, are the most frequently used parts of the plants. This coincides with the ethnobotanical literature, though in some cases, roots and barks are also used in higher percentage or species than the present study (Srithi, et al., 2009; Chowdhury & Koike, 2010; Lima et al., 2016). Trees, roots, and barks, which may damage plants in forests were used in a limited way. In addition, the few trees whose bark was utilized were cultivated, were not wild (Table 4.2). Among the top ten medicinal plants used, seven species were cultivated or can be planted near houses. Six species were wild plants, of which a half can be also planted. Four species can be found in forest, of which two can be also planted. Not many plants used for healthcare were from forest.

Interestingly, even though there were no gender differences in the frequency of medicinal plant use, the parts and life forms of plant used differed by gender. In the literature, gender differences appear in various ways. Several studies in Brazil (Voeks & Leony, 2004; Voeks, 2007; Silva et al., 2011) and a study in Dominica (Quinlan & Quinlan, 2007) found that

female have more medicinal plant knowledge than male. Yet, studies in Brazil (Merétika et al., 2010) and Argentina (Lozada et al., 2006) reported no gender differences in medicinal plant knowledge. Studies in other regions reported that males have more medicinal plant knowledge than females in Papua New Guinea (Case et al., 2005), Niger (Ayantunde et al., 2008), and Ethiopia (Teklehaymanot, 2009). Other studies found that types of forests in which males and females extract medicinal plants were different in Indonesia (Caniago & Siebert, 1998), or the roles of medicinal plant practice differ in gender in Dominica (Quinlan & Quinlan, 2007). In case of the present study, while the gender differences in use of plant parts and life forms are commonly expected, the important point here is the frequency of medicinal plant use. Even though males tend to use more potentially destructive parts and life forms, less frequent use would not damage the biodiversity.

In terms of protecting forest or forest biodiversity, less use of forest resources or not destructive parts are desirable. However, at the same time, as a tool for biodiversity management, medicinal plant utilization cannot be expected. While this accords with the results of a study on indigenous people in Bolivian Amazonia reporting they do not necessarily highly utilize medicinal plants in forests (Vandebroek, et al. 2004) and a study on people in a rural area in Matto Grosso in the Brazil reporting their continuous use of medicinal plants, yet, restricted to cultivated and exotic species (Amorozo, 2004), the result disagrees with some studies in Amazonia showing people's active use of forest medicinal plants (Phillips & Gentry, 1993a, 1993b; Milliken & Albert 1996, 1997; Shanley & Luz 2003; Valadeau et al., 2010).

In the present study, while utilization of medicinal plants would not cause damaging forests or its biodiversity, medicinal plants offer little opportunity to support the livelihood of households in the target villages. The one of the assumptions of the study is "People in remote forest areas often use medicinal plants." However, the results of the study only partially, but not strongly, support this assumption. They do use medicinal plants, yet not so much, and do not utilize forest resources to do so. The utilization of medicinal plant use was even declining.

As shown in Table 4.1, the average number of plant counts cited was higher in two indigenous villages than two mestizo villages; and the number of species cited only once was slightly over 50. % in two indigenous villages, yet two mestizo villages was higher percentage with 64.5% in Village m-1 and 80.8% in Village m-2. The differences between ethnicity will be examined in Chapter 5. The average number of species cited was 1.2 except for Village s-1 with 1.0. The different attribute of Village s-1 from other villages is the distance to the city. This will be also assessed in Chapter 6.

In brief, the households in the study still held a variety of medicinal plant knowledge as a whole, yet intensively utilized the limited number of plant species. Varying across the villages, about a half of households relied on medicinal plants, which are used for a variety of symptoms. However, they did not frequently use wild plants, not as much as the conservation needs to be considered. Medicinal plants were sold and purchased in the areas yet can support livelihood only for a limited number of people. The demand for expending on medicinal plants were very limited. Overall, medicinal plants were not necessarily or intensively utilized for healthcare purposes and livelihood improvement in the study site. Therefore, Assumption 1 “People in remote forested areas depend on medicinal plants for their healthcare,” was only partially supported. The minimum use of forest resources indicated that the extraction of medicinal plants cannot be expected as a tool for biodiversity management.

CHAPTER 5

RESILTS: INFLUENCE OF ETHNICITY AND HEALTHCARE SERVICES

5.1 Utilization of Medicinal Plants

5.1.1 Most frequently used medicinal plants

The households in Village s-1 cited 147 counts of medicinal plant and those in Village M did 156. Most cited medicinal plant was Malva and Piñón Colorado took the second place in both villages. Although the plants taking from the third to fifth place were different in each village, the top five represents 57.8% of the total count in Village s-1 and 45.5% in Village M (Table 5.1). While the average count of medicinal plants cited was higher in Village s-1 (3.8) than M (3.4), the average number of species cited was higher in Village M (1.1) than s-1 (1.0). The number of species mentioned only once was 21 representing 53.8% of the total number of species mentioned in Village s-1, and 27, 52.9% in Village M (Table 5.2).

Table 5.1 Top five most frequently used medicinal plants in village s-1 and M

			Village s-1 (n=147)			Village M (n=156)		
Local name	Life form	Part used	Rank	Count	%	Rank	Count	%
Malva	H	leaf	2	28	19.0	1	23	14.7
Piñón colorado	S	leaf/resin	1	33	22.4	2	20	12.8
Mucura	H	leaf	>5			3	12	7.7
Ajo sacha	V	leaf	>5			4	9	5.8
Coca	S	leaf	>5			5	7	4.5
Sangre de grado	T	resin	3	10	6.8	>5		
Piñón blanco	S	leaf/resin	4	7	4.8	>5		
Piripiri	H	leaf	4	7	4.8	>5		
Top five sub total				85	57.8%		71	45.5
Others				62	42.2%		85	54.5
Total				147	100.0		156	100.0

Table 5.2 Number of medicinal plants and species cited by households in Village s-1 and M

Village	s-1	M
Total counts of plant mentioned in each village	147	156
・The average count of plant per respondent	3.8	3.4
The number of species mentioned in each village	39	51
・The average number of plant species per respondent	1.0	1.1
The number of species cited only once in each village	21	27
・Percentage of species cited once of total species	53.8%	52.9%
・The average number of plant species cited once per respondent	0.5	0.6

The species which were used by households of both villages and by only one of the two and their life forms were identified. Between Village s-1 and M, the total number of species mentioned was 64 among which 26 species were mentioned by households of both villages. While the number of species mentioned only by those in Village s-1 was just a half of the number of species mentioned also by those in Village M, the numbers of species mentioned only by those in Village M and in both villages were almost equal (Figure 5.1).

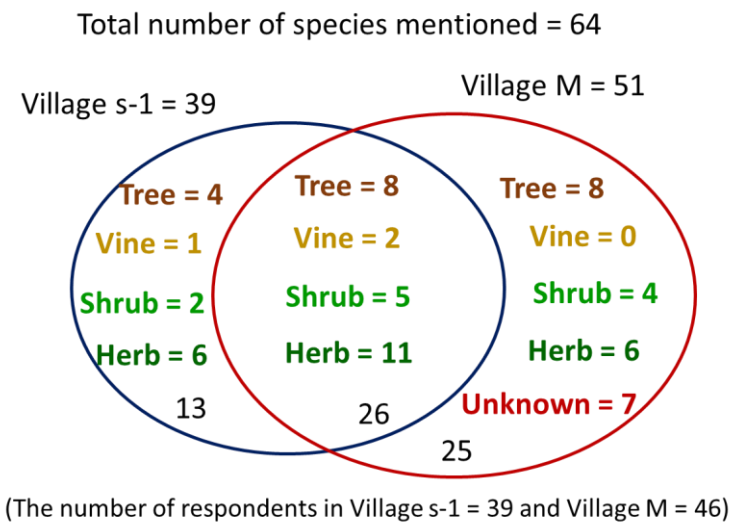

Figure 5.1 Number of species mentioned with their life form by households in Village s-1 and M.

5.1.2 Life forms and parts of medicinal plant used

The plant form of medicinal plants used by the two villages is shown in Figure 5.2. Although the percentages of parts they used look not so much different, except for households in Village M more used vines than those in Village s-1, the difference was statistically significant (p = .004551; FET). The difference in the use of plant parts between the two villages was not significant (p = .1149; FET). The households in both villages used leaf more than 60%.

Households in Village s-1 used slightly more resin and those in Village M used more bark than those in the other village (Figure 5.3).

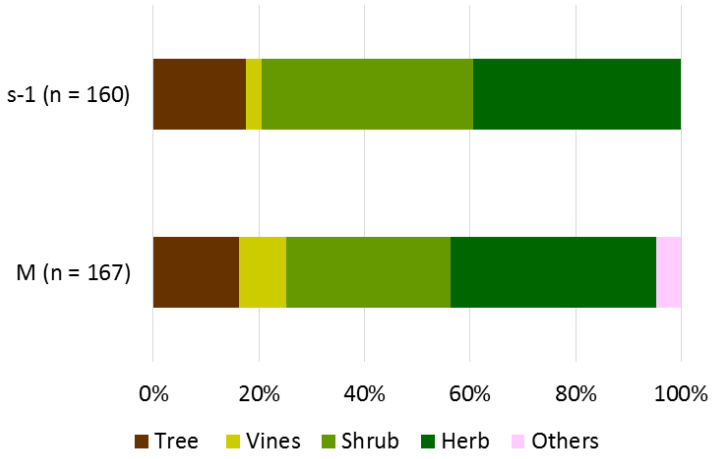

Figure 5.2 Life form of medicinal plants used by households in Village s-1 and M.

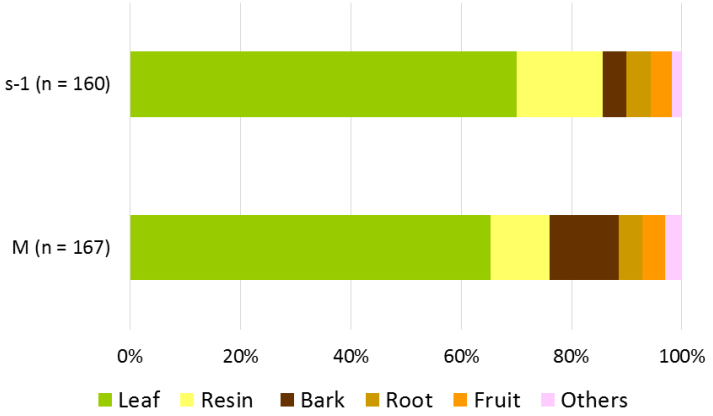

Figure 5.3 Plant parts used by households in Village s-1 and M.

As shown in Table 4.5, the number of households used plant parts which may be destructive, bark and roots of trees and shrubs, was 8 representing 20.5% of the total respondents in Village s-1 and 13 or 28.3% in Village M. The difference reflects that those in Village M use barks more than those in Village s-1. Any other uses were not so much different. The numbers of plant parts used by each village were assessed as Figure 5.4. The total number of medicinal plant parts mentioned was 79, and 45 in Village s-1 and 60 in Village M. The number of plant parts uniquely mentioned by the households in Village s-1 was just a half of the number of plant parts mentioned by both; the numbers of plant parts mentioned only by those in Village M were much more than those mentioned by both (Figure 5.4).

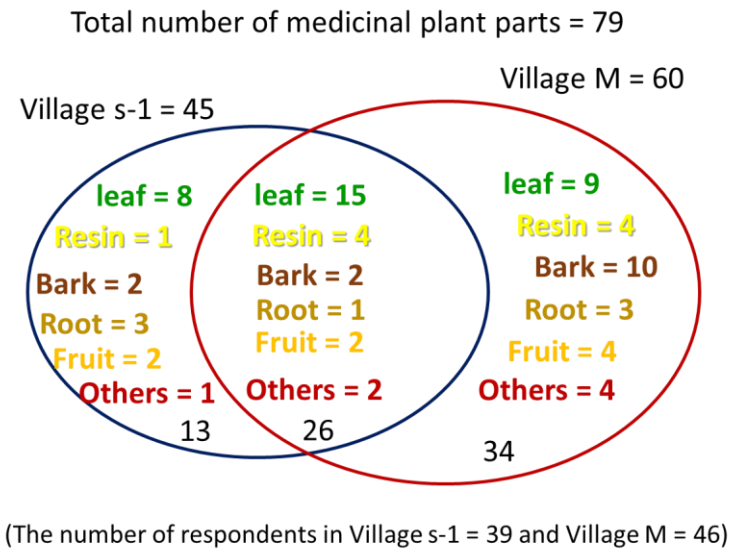

Figure 5.4 Number of plant parts mentioned by households in Village s-1 and M.

5.1.3 Frequency of medicinal plant use for healthcare and livelihood

As for the frequency of medicinal plant uses, households who used medicinal plant once a month or more were 82% in Village s-1 and 70% in Village M. Those who used medicinal plant once a week or more were more than 60% in Village s-1 and slightly over 40% in Village M. Figure 5.5 shows more households used medicinal plants more frequently in Village s-1, then, the difference of the frequency between the two villages was significant (U (85) = 612.00, p =.012).

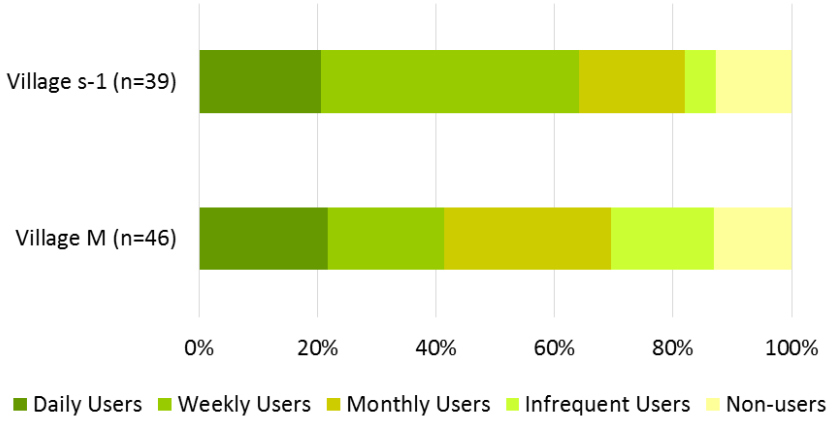

Figure 5.5 Frequency of medicinal plant use by households in Village s-1 and M.

The households which purchased medicinal plant remedies in the last one year prior to the field interview were 9 in Village s-1 and 21 in Village M. However, the frequency of their purchase was once or twice a year in both villages except for three in Village s-1, who purchased

three times in the year and four in Village M, who purchased monthly due to having chronical symptoms. As for sellers of medicinal plants, four sold in Village s-1, of which two did so due to the order from a foreigner who conducted ceremonial tourism the first time in the village, and three in Village M, of which two were a regular seller.

5.2 Influence of Healthcare Service Use on Medicinal Plant Utilization

5.2.1 Utilization of healthcare facilities

The households were asked the frequency of visit to the healthcare facilities including either or both the health post located in Village s-2 and a hospital located in the city for themselves and their family during the previous one year. In order to easily grasp the frequency of healthcare facility visit, the frequency was categorized as Monthly Visitors for those of once a month or more; Occasional Visitors for once three months or more and less than once a month; and Rare Visitors for less than once three months.

In Village s-1, Monthly Visitors were 8 or 20.5% of the total respondents, Occasional Visitors were 5 or 12.8%, and Rare Visitors were 23 or 59.0% (Figure 5.6). Those who did not visit at all were 3 or 7.7%. In Village M, Monthly Visitors were 13 or 28.3% of the total respondents, Occasional Visitors were 11 or 23.9%, and Rare Visitors were 20 or 43.5%. Those who did not visit at all were 2 or 4.3%. Although more households visited the facilities less frequently in Village s-1 than M, the difference was not significant (U (85) = 834.0, p = .573).

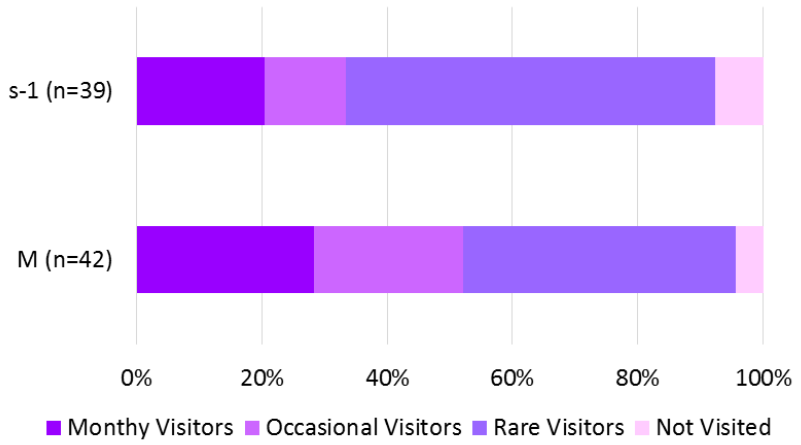

Figure 5.6 Frequency of healthcare facility visit by households in Village s-1 and M.

5.2.2 Utilization of medicinal drug

Households were asked about medicinal drug purchase for themselves and family members in the city during a year prior to the interview conducted. The frequency of medicinal drug purchase in the city and the purposes for the respondents and their family in the last one year were asked to determine the general behavior toward medicinal drug purchase. Those who purchased medicinal drugs were categorized as Weekly Purchasers who did so once a week or more, Monthly Purchasers who did so once a month or more but less than once a week, and Occasional Purchasers who did so more than once three months but less than once a month, and Rare Purchasers who did so less than once three months.

In Village s-1, Weekly Purchasers were 2 or 5.4% of the total, Monthly Purchasers were 0, Occasional Purchasers were 12 or 32.4%, and Rare Purchasers were 7 or 18.9%. Seven households or 18.9% of the total did not purchase medicinal drugs at all. In Village M, Weekly Purchasers were 3 or 7.0% of the total, Monthly Purchasers were 2 or 4.7%, Occasional Purchasers were 15 or 34.9%, and Rare Purchasers were 23 or 53.5%. Three households or 7.0% of the total did not purchase medicinal drugs at all. Overall, about a half of households were Rare Purchasers, purchasing drugs less than once three month in both villages (Figure 5.7). Their purchasing behaviors were not significantly different (U (85) = 847.5, p = .657).

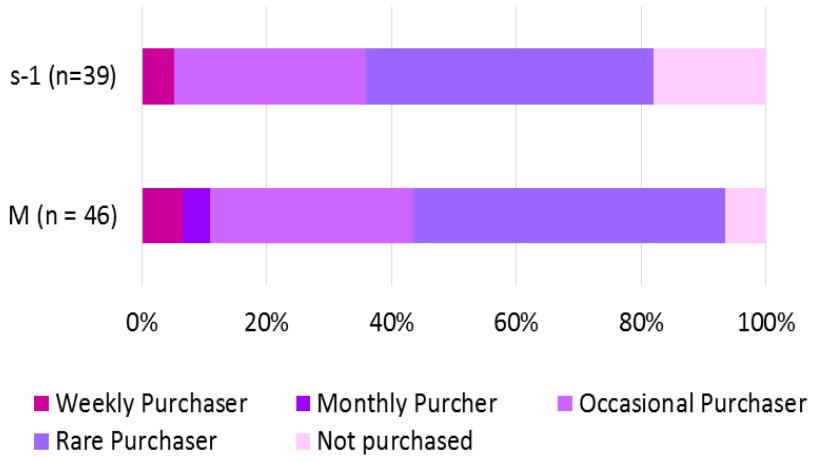

Figure 5.7 Frequency of medicinal drug purchase by households in Village s-1 and M.

5.2.3 Purposes and influence of healthcare service uses on medicinal plant utilization

The purposes of these two healthcare service use are very similar. Although the purposes of healthcare facility visit were not provided precisely, the top two purposes and symptoms as the reason for the healthcare facility visit were fever followed by headache in both villages. They were followed by diarrhea and stomach problem in Village s-1 and diarrhea and

other mal condition in Village M. Other symptoms for a reason to healthcare facility visit include cough, vomit, backache, digestive problems, and cholera.

The purposes of medicinal drug purchases were provided as respondents' personal perspective. The top reason for medicinal drug purchase were headache and fever in Village s-1 followed by diarrhea, then, for joints. Seven mentioned that they purchased due to no medicinal drugs in the health post. In Village M, the top purpose was headache followed by fever, bronchitis, cough, stomach/digestion, infection. The prices of medicinal drugs spent varied from 0.1 to 50 soles (s/.), equivalent to US$ 0.03 to 15.3, per time as medicinal drugs can be purchased by a tablet. The average spending per time was S/ 11.35 in Village s-1 and S/ 7.2 in Village M.

The frequencies of healthcare facility visit and medicinal drug purchase were significantly correlated within each village (Village s-1: R^2 (39) = .412, p = .009; Village M: R^2 (46) = .651, p = .000). However, the frequencies of these healthcare service use were not significantly correlated or inversely correlated with the frequency of medicinal plant utilization in both villages (Table 5.3).

Table 5.3 Correlation between use of medicinal plants and healthcare services in Village s-1 and M

Village	Correlation between medicinal plant use and healthcare facility visit	Correlation between medicinal plant use and medicinal drug purchase
s-1	R^2 (39) = .045, p = .784	R^2 (39) = -.081, p = .623
M	R^2 (46) = -.08, p = .958	R^2 (46) = .032, p = .833

5.2.4 Influence of health insurance on uses of healthcare services and medicinal plants

The households were asked regarding health insurance subscription. The health insurance the respondents held in Village s-1 and M was Seguro Integral Salud (SIS), which is designated to poorer population. If the criteria are met, people can subscribe SIS free and are given free visits to and medicinal drugs in designated facilities. In both villages, two third of respondents held health insurance; the subscribers and non-subscribers were 26 and 13 in Village s-1 and 30 and 16 in Village M (Table 5.4).

Table 5.4 Number of health insurance subscribers and non-subscribers in Village s-1 and M

	Village	
	s-1	M
Number of health insurance subscribers	26	30
Number of non-subscribers	13	16
Percentage of insurance subscribers	66.7%	65.2%

The health insurance subscription seemed to influence the frequency of healthcare facility visits. In Village s-1, Monthly Visitors to healthcare facilities were 7 or 26.9% of 26 SIS subscribers whereas 1 or 7.7% of 13 non-subscribers; Occasional Visitors were 2 or 7.7% and 3 or 23.1%; Rare Visitors were 16 or 61.5% and 7 or 53.8%; and Non-Visitors were 1 or 3.8% and 2 or 15.4%, respectively (Figure 5.8). In Village M, Monthly Visitors were 12 or 40.0% of 30 subscribers whereas 1 or 6.3% of 16 non-subscribers; Occasional Visitors were 7 or 23.3% and 4 or 25.0%; Rare Visitors were 10 or 33.3% and 10 or 62.5%; and Non-visitors were 1 or 3.3% and 1 or 6.3%, respectively (Figure 5.9). However, the differences were not significant in both villages (Village s-1: U (39) = 132.5, p = .281; Village M: U (46) = 177.5, p = .148).

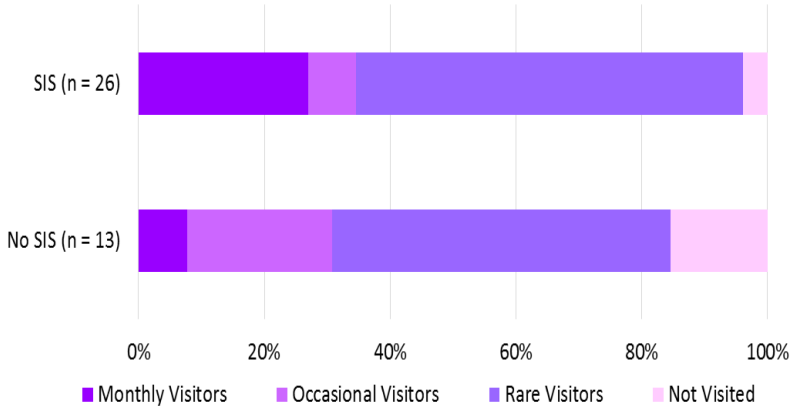

Figure 5.8 Frequency of healthcare facility visit by health insurance (SIS) subscribers and non-subscribers in Village s-1.

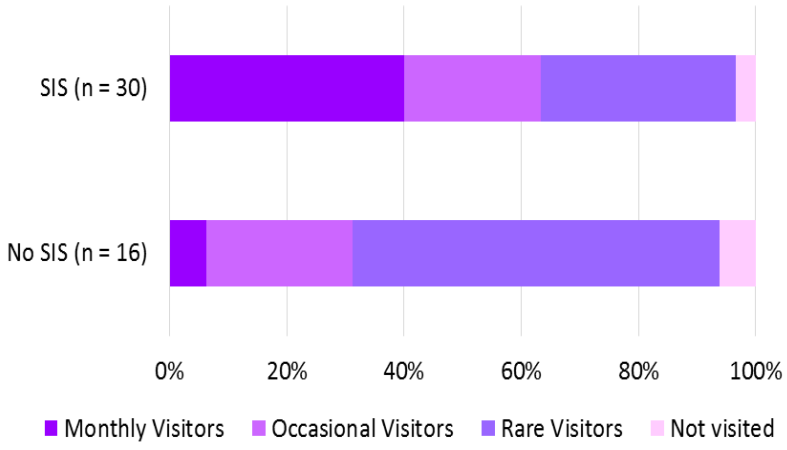

Figure 5.9 Frequency of healthcare facility visit by health insurance (SIS) subscribers and non-subscribers in Village M.

The influence of health insurance subscription on the frequency of medicinal drug purchase seemed to be different between the two villages. In Village s-1, Weekly Purchasers of medicinal drug were 1 or 3.8% of 26 SIS subscribers whereas were also 1 but 7.7% of 13 non-subscribers; Monthly Purchasers were 0 among both subscribers and non-subscribers; Occasional Purchasers were 9 or 34.6% and 3 or 23.1%; Rare Purchasers were 13 or 38.5% and 5 or 38.5%; and Non-Purchasers were 3 or 11.5% and 4 or 30.8%, respectively (Figure 5.10). In Village M, Weekly Purchasers were 2 or 6.7% of 30 SIS subscribers and 1 or 6.3% of 16 non-subscribers; Monthly Purchasers were 1 or 3.3% and 1 or 6.3%; Occasional Purchasers were 9 or 30.0% and 6 or 3.8%; Rare Purchasers were 15 or 50.0% and 8 or 50.0%, and Non-Purchasers were 3 or 10.0% and 0, respectively (Figure 5.11). However, the differences were not significant in both villages (Village s-1: U (39) = 148.000, p = .546; Village M: U (46) = 194.000, p = .284).

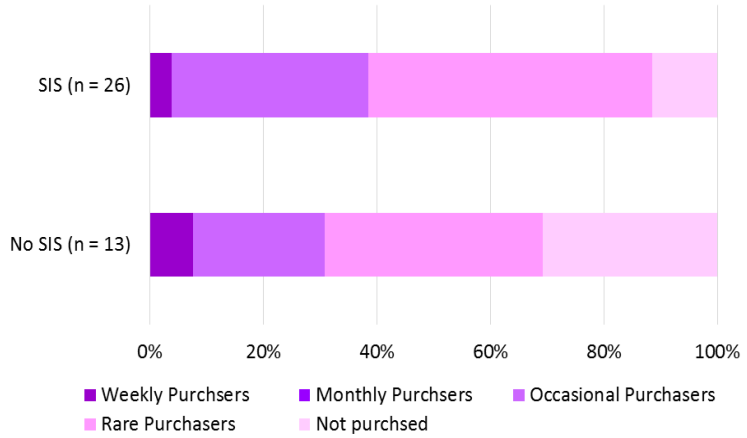

Figure 5.10 Frequency of medicinal drug purchase by health insurance (SIS) subscribers and non-subscribers in Village s-1.

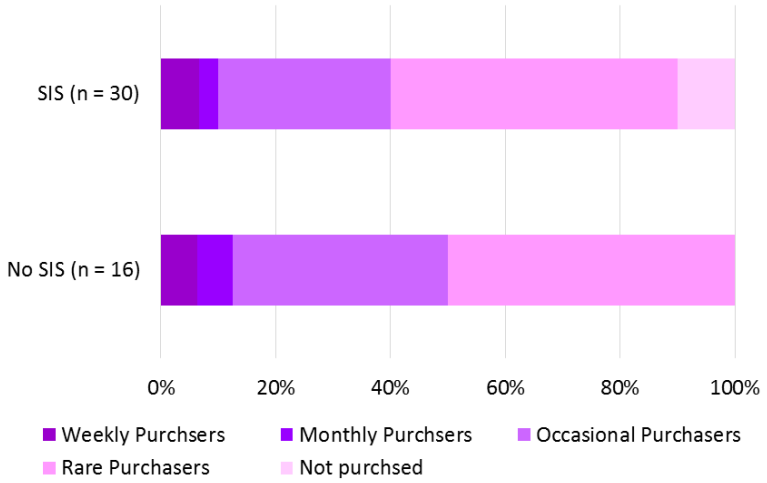

Figure 5.11 Frequency of medicinal drug purchase by health insurance (SIS) subscribers and non-subscribers in Village M.

Similarly, the influences of health insurance subscription on medicinal plant use were assessed. In Village s-1, Daily Users of medicinal plants were 5 or 19.2% of 26 SIS subscribers and 3 or 23.1% of 13 non-subscribers; Weekly Users were 12 or 46.2% and 5 or 38.5%; Monthly Users were 6 or 23.1% and 1 or 7.7%; Infrequent Users were 2 or 7.7% and 0; and Non-Users were 1 or 3.8% and 4 or 30.8%, respectively. In Village M, Daily Users of medicinal plants were 7 or 23.3% of 30 SIS subscribers and 3 or 18.8% of 16 non-subscribers; Weekly Users were 7 or 23.3% and 2 or 12.5 % Monthly Users were 8 or 26.7% and 5 or 31.2%; Infrequent Users were 5 or 16.7% and 3 or 18.8%; and Non-Users were 3 or 10.0% and 3 or 18.8%, respectively. However, the differences between SIS subscribers and non-subscribers were not significant (Village s-1: U (39) = 157.5, p = .735; Village M: U (46) = 204.5, p = .407).

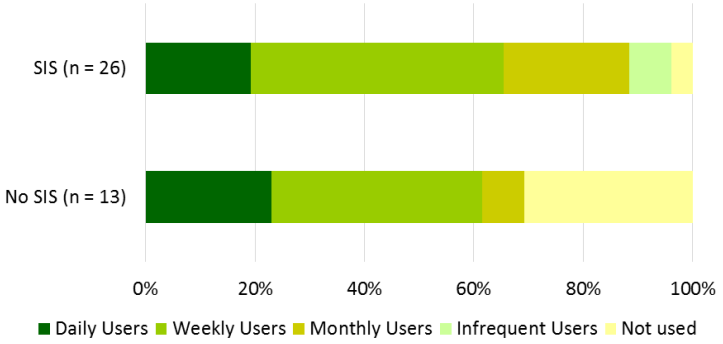

Figure 5.12 Frequency of medicinal plant use by health insurance subscribers and non-subscribers in Village s-1.

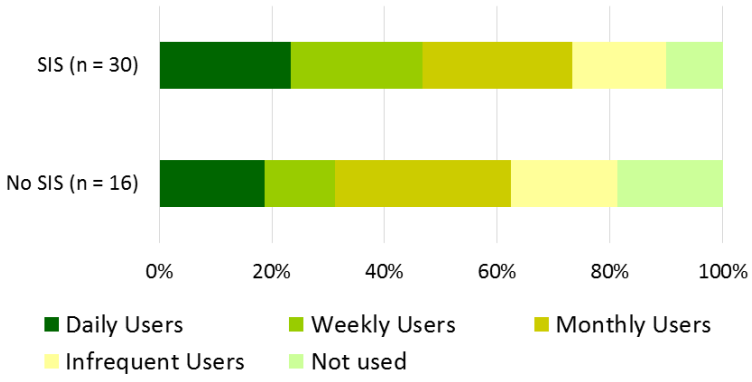

Figure 5.13 Frequency of medicinal plant use by health insurance subscribers and non-subscribers in Village M.

5.2.5 Behavioral changes after health insurance subscription

Changes in healthcare seeking behaviors after the health insurance subscription were assessed. Firstly, changes in frequency of healthcare facility visit were analyzed (Figure 5.14). In Village s-1, among 26 health insurance subscribers, 18 respondents representing 69.2% of the total subscribers visited healthcare facility more frequently than before subscribing to health insurance; 5, 19.2% had no change; 2, 7.7% had less; and 1 gave no answer. Fifteen respondents visited the healthcare facility more due to insurance subscriptions. In Village M, among 30 health insurance subscribers, 11 respondents representing 36.7% of the total subscribers visited healthcare facility more frequently than before subscription; 16 or 53.3% had not change; 2 or 6.7% had less ; and 1 gave no answer. The difference between villages was significant (p = .02335; FET). More households in Village s-1 visited more frequently than Village M after insurance subscription. Among those who visits more frequently than before, 15 out of 18 in Village s-1 and 6 out of 11 responded that it was because of the insurance subscription.

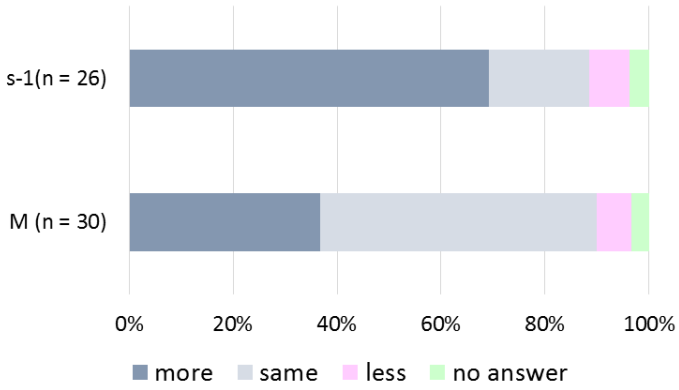

Figure 5.14 Change in frequency of healthcare facility visit after the health insurance subscription in Village s-1 and M.

Second, change in frequency of purchasing medicinal drugs was analyzed (Figure

5.15). In Village s-1, among 26 health insurance subscribers, 9 respondents representing 34.6% of the total subscribers purchased medicinal drug more frequently than before subscription; 1, 3.8% had no change; 14, 53.8% had less; and 2 did not purchase. In Village M, among 30 health insurance subscribers, 6 respondents representing 20.0% of the total subscribers purchased medicinal drug more frequently than before subscription; 7 or 23.3% had not change; 14 or 46.7% had less, and 3 did not purchase. However, the difference between villages was not significant at 95% level, yet significant at 90% level (p = .0901; FET). More households in Village s-1 purchased more frequently and less frequently than Village M. Among those who purchased medicinal drug less frequently than before, 9 out of 14 in Village s-1 and 10 out of 14 in Village M responded it was due to the health insurance subscription. In Village s-1, 3 and 1 out of 9 who purchased more frequently responded that it was because the health post recommended and there was no drugs in the health post. In both villages, 1 respondent each who purchased more frequently than before because they held the healthcare insurance.

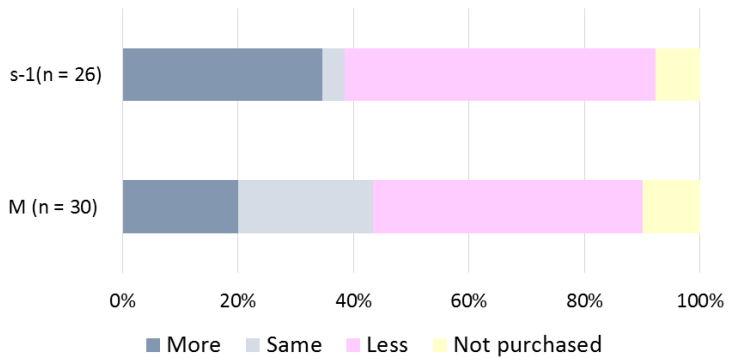

Figure 5.15 Change in frequency of medicinal drug purchase after the health insurance subscription in Village s-1 and M.

Lastly, change in medicinal plant use after insurance subscription was analyzed (Figure 5.13). Among 26 health insurance subscribers in Village s-1, 6 representing 23.1% used medicinal plant more than previously after health insurance subscription; 3 or 11.5% had no change; 14 or 53.8% used less, and 3 did not answer. In Village M, among 30 health insurance subscribers, 7 representing 23.3% used medicinal plant more than previously after the subscription; 13 or 43.3% had no change; 6 or 20.0% used less; 3 or 10.0% did not use; and 1 did not give an answer. The difference was significant at 99% level (χ^2 (2, 49) = 9.378 p = .009). Among those who used medicinal plants less frequently than before, 8 out of 14 in Village s-1 responded that it was because they held the health insurance. In village M, no one made the insurance subscription as the reason for the change of the frequency of medicinal plant use.

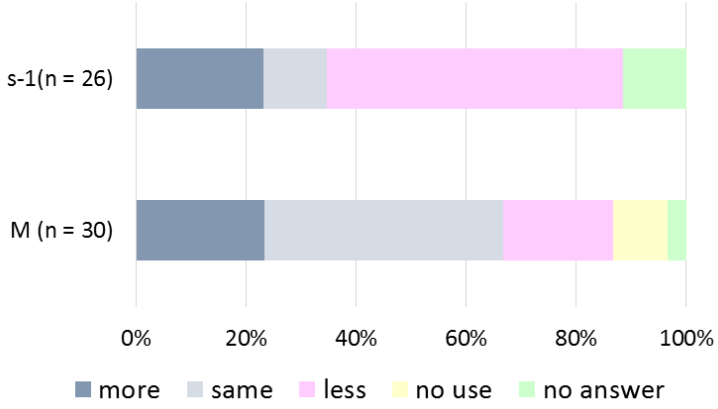

Figure 5.16 Change in frequency of medicinal plant use after the health insurance subscription in Village s-1 and M.

5.2.6 Perception towards Medicinal Plant Use

The questions regarding their belief in the efficacy of medicinal plants over medicinal drugs, willingness to learn medicinal plant knowledge, and the importance of medicinal plant availability were asked to all respondents to determine perception towards medicinal plants.

The respondents who believed medicinal plant efficacy over medicinal drugs were 59.0% in Village s-1 and 50.0% in Village M. Those who believed the efficacy of medicinal drugs over medicinal plants were 28.2% in Village s-1 and 26.1% in Village M (Figure 5.17). The distribution of different perceptions between the two villages were very similar, not significantly different (p = .6063; FET).

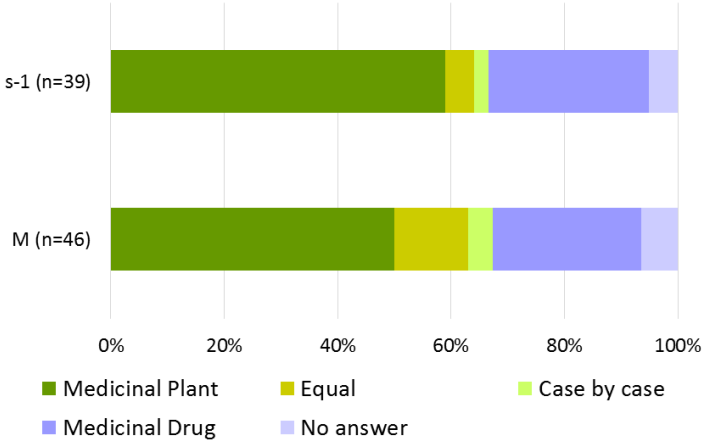

Figure 5.17 Perception of medicinal plant's efficacy over medicinal drugs in Village s-1 and M.

The respondents who felt a need for learning medicinal plant knowledge were 84.6% in Village s-1 and 93.5% in Village M (Figure 5.18). Those who answered that it is a problem

if medicinal plants are not available to use were 53.8% in Village s-1 and 45.7% in Village M (Figure 5.19). Among those who answered no problem without medicinal plants, 12 out of 18 respondents in Village s-1 and 3 out of 24 in Village M mentioned that it was because the availability of insurance subscription, medicinal drugs and healthcare facility.

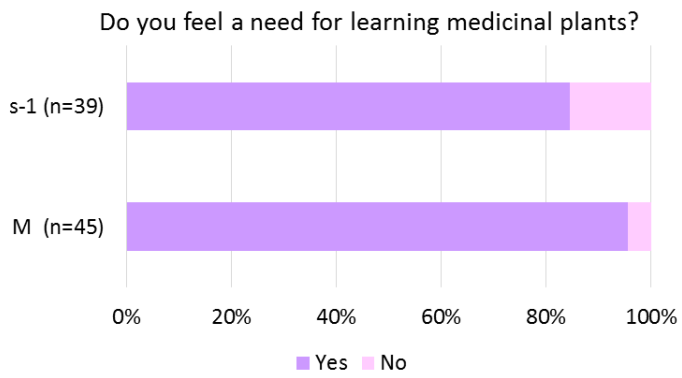

Figure 5.18 Perception towards a need for learning medicinal plant knowledge in Village s-1 and M.

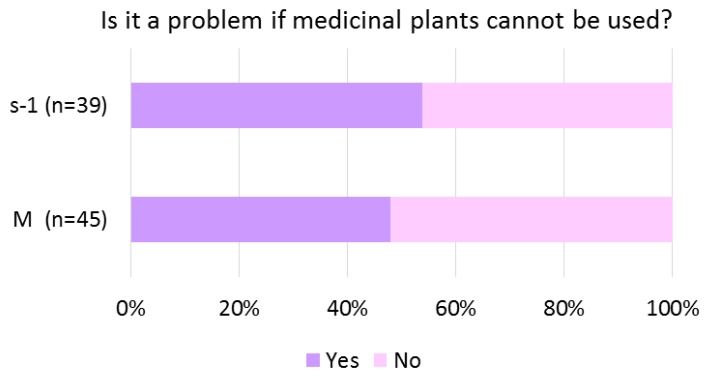

Figure 5.19 Perception towards feeling a problem without medicinal plants in Village s-1 and M.

5.3 Discussion

5.3.1 Influence of ethnicity on medicinal plant utilization

The study assumes that indigenous people use medicinal plants more than non-indigenous people. A common understanding is that indigenous people hold more ecological knowledge including medicinal plants as much as intellectual property rights of indigenous people became the global issue (CBD, 1997, 2011). In fact, *Shipibo* did historically utilize medicinal plants (Tournon et al., 2014) as mentioned earlier. Unlike such notion, Campos and

Ehringhaus (2003) found in their study of palm use between indigenous and folk communities in the western Amazon that acquisition and loss of knowledge and practice interplay and the boundary of knowledge of two communities becomes unclear. The results of the present study agree with this. The species of medicinal plant used were very similar among the households in two villages. While the households in Village s-1 used medicinal plants more frequently than Village M, they used slightly less number of species overall and more concentrated to use the top two species than Village M. Those in Village M, on the other hand, rather use a bit more variety of species and plant parts than those in Village s-1, thus may use a bit more parts which may be destructive. The sales and purchase activities of medicinal plants were also not so different between the two villages. The results show that the differences in the use of medicinal plant between the two ethnic groups are not clear. The assumption 2 "Indigenous people use medicinal plants more than non-indigenous people" was not supported in the present study.

5.3.2 Influence of healthcare services on medicinal plant utilization

Utilization of healthcare services including healthcare facility visit and medicinal drug purchase between the households of the two villages was not so much different. Although more households in Village M visited healthcare facilities more frequently and spent more on medicinal drugs in the city than those in Village s-1 and more households in Village s-1 did not spend at all on medicinal drugs than those in Village M, their differences were not statistically significant. Overall frequencies of healthcare facility visits and purchase of medicinal drugs were strongly correlated in both villages. This suggests that households in these villages have a certain attitude towards utilization of healthcare services based on modern medicine. Caniago and Siebert (1998) in their study in Kalimantan, Indonesia, found that even though all villagers in the study were familiar with medicinal plants, most mentioned that they preferred modern medicine. Does this suggest that once healthcare services based on modern medicine were provided, a tendency to rely on modern medicine emerged? However, the fact that the frequency of healthcare service use did not affect that of medicinal plants in the present study, disagrees with the majority of previous studies indicating that the presence of healthcare services is a cause of the loss of medicinal plant uses and knowledge (Caniago & Siebert, 1998; Benz et al., 2000; Case et al., 2005; Estomba, et al., 2006; Monteiro et al., 2006, Teklehayamanot, 2009; Merétika et al., 2010; Vandebroek & Balick, 2012).

5.3.3 Influence of health insurance

The rate of health insurance subscription is lower than 80.0%, the average of Loreto Department (Cetrángolo et al., 2013). The subscription rate of health insurance in Village s-1 and M were about two third of the total. Although the insurance subscribers and non-subscribers

did not show different frequencies of use of healthcare services or medicinal plants, the health insurance subscription changed healthcare seeking behaviors after the subscription. It also revealed different healthcare seeking behavior between the two ethnic groups. Around 70% of the subscribers in Village s-1 visited the facilities more frequently than before subscription, yet, less than 40% of the subscribers in Village M did so. In Village M, over 50% of the subscribers did not change their frequency of healthcare facility visits. More than a half the respondents in Village s-1 purchased medicinal drugs less frequently than before subscriptions but over 30 % of respondents purchased them more frequently. However, in Village M, although about 46% of respondents purchased medicinal drugs less frequently than before insurance subscription, 20% of respondents did purchase more frequently and another 20% or so did not change the frequency due to insurance. An explanation for this is, as mentioned earlier, that the subscribers are given medicinal drugs free of charge in the designated healthcare facilities, but they are often out of stock or medical attendance recommends them to purchase medicinal drugs from drug stores. The insurance subscription lessened the frequency of medicinal plant use in Village s-1, but not much in Village M. The impact of the health insurance subscription was much stronger in Village s-1.

5.3.4 Perception towards medicinal plants and healthcare services

As for the efficacy of medicinal plants versus medicinal drug, while more respondents in Village s-1 (59.0%) than those in Village M (50.0%) believed in medicinal plants efficacy over medicinal drugs, more respondents in Village s-1 (28.2%) than those in Village M (26.1%) believed medicinal drugs' efficacy over medicinal plants. In village M, more respondents thought that the efficacy was equal or depended on case by case. Brierley et al. (2014) in their study of indigenous communities located remotely in the northern Loreto Department reported that 30.2% of the total respondents believed that traditional medicine is better than modern medicine, 45.8% believed them to be equal, and 24.0% found traditional medicine worse than modern medicine, even though 38.5% had never seen a medical doctor due to the access and cost. Although the rate of the belief in medicinal plants in the present study is slightly higher than the previous study, about a half of the respondents in both villages felt there is no problem without medicinal plants regardless of inconvenient access to healthcare facilities and pharmacies. Even if accessibility to healthcare facilities is limited and there is trust in medicinal plants, it indicates that a certain reliance on modern medicine is present. One of the causes of replacing medicinal plants with modern medicines is modernization or acculturation, even if the access is limited (Benz et al., 2000; Case et al., 2005; Merétika et al., 2010). Culture is one of the factors of healthcare seeking behavior (MacKian et al., 2004; Shaikh & Hatcher, 2005; Grundy & Annear, 2010). As Campos and Ehringhaus (2003) suggested, acculturalization and

assimilation have been occurring not only in the use of plants, but of healthcare services as well. Such acculturalization and assimilation are partially occurring due to the implementation of health care insurance by the government.

5.3.5 Health seeking behaviors influenced by culture and many others

MacKian (2003) states that the behaviors towards health and healthcare seeking cannot be explained just by simple processes, so-called path way models, or causal relationships defined by factors, such as Andersen models. These theories on health or healthcare seeking behaviors do not provide full picture of how people make a decision for their behaviors. One's health seeking behaviors behavior can be influenced by "a mixture of demographic, social, emotional and cognitive factors, perceived symptoms, and access to care and personality" (MacKian, 2003, p. 7). MacPhail and Campbell (2001) emphasize that individual knowledge, attitudes, and behaviors are negotiated or constructed in the societal, normative and cultural contexts. Gold and Clapp (2011) found in the study of high land Peru that the choice of healthcare modalities can be influenced by how they support one's identity. Reflective communities proposed by Lash (2000) suggest that communities reflect the way of thinking, making decision, or behavior, and such acts are not just a result of information or knowledge processing. MacKian et al. (2004) state that "underlying, unspoken, unconscious feelings and assumptions" (p. 141) need to be understood as they support cognitive process of people. What these developments of social science theories suggest to the present study is that health seeking behaviors cannot be determined just by elucidating factors or information. What would happen in an individual setting is only known by examining not only possibly influential factors, but by seeking interaction among people, norms, perceptions, social and cultural conditions and networks, identities, emotions, and others.

Interestingly, when the data of Village M was broken down into that of Village m-1 and m-2, frequencies of healthcare facility visit and medicinal drug purchase were significantly different. While over 40% of households in Village m-1 were Monthly Visitors for healthcare facilities, less than 10% of households were Monthly Visitors in Village m-2. While only 4.0% of households in Village m-1 were Monthly Purchasers of medicinal drugs, in Village m-2 19.0% purchased medicinal drugs monthly. As these two villages are located at almost the same distance to the city and healthcare facilities, the proximity is not the reason for these differences neither are the income or health insurance subscription. One of the differences between Village m-1 and m-2 in the data is the rate of the insurance subscription. While 76.0% of respondents in Village m-1 subscribed to health insurance, only 52.4% did in Village m-2. Statistical test did not show the influence of health insurance subscription on healthcare facility visit and

medicinal drug purchase in Village m-2, such health seeking behavior may be related to the rate of insurance subscription. Previous studies provide a direction to the possible explanations for it. Amorozo (2004), in her study of a rural area in Brazil, found that a patient uses all therapeutic options available, but would not feel at ease about the effectiveness of options, and stated the attitude "mirrors in fact their present sociocultural situation" (p.151). Wayland (2004), in her study at a peri-urban community in Brazil, stated that the choice of healthcare would be the matter that "(n)ot only are medicines 'good to heal with', they are also 'good to think with' " (p 2417). These studies suggest that healthcare seeking behaviors of people living in medical pluralism are far more complex.

In short, although the indigenous households in Village s-1 used medicinal plants more frequently than mestizo households, their use of plant species were more limited than the latter. While the pattern of plant form and parts used were very similar between the two ethnic groups, the mestizo households used more variety. Frequency of healthcare service use was not significantly different between the two as the majority of households used them, yet not so frequent, though mestizo households used only slight more frequently. The frequency of medicinal plants was not correlated to that of healthcare services in both villages. In both villages, about two third of respondents subscribed to health insurance, but it did not significantly influence the frequency of their use of medicinal plants and healthcare services. However, the households in Village s-1 were more strongly affected by health insurance subscription than the other group changing their healthcare seeking behaviors after the subscription. Even though more respondents in Village s-1 than that in Village M believed in the efficacy of medicinal plants over medicinal drugs, many respondents felt no problems about not having medicinal plants due to the availability of healthcare services. The assumption 2 "Indigenous people use medicinal plants more than non-indigenous people" were not necessarily supported in this study, and the influence of healthcare service availability on medicinal plant utilization cannot be denied.

CHAPTER 6

RESULTS: THE INFLUENCE OF DISTANCE TO THE CITY AND HEALTHCARE SERVICES

6.1 The Influence of the Distance to the City on Utilization of Medicinal Plants and Healthcare Services

6.1.1 Most frequently used medicinal plants

As shown in Table 4.1, the average count of medicinal plants mentioned per household in Village s-1 and s-2 was the same and 3.8 counts, yet, the average number of plant species mentioned was 1.0 in Village s-1 and 1.2 in Village s-2; and the average number of species cited only once was 0.5 and 0.7, respectively. Among 147 in Village s-1 and 160 in Village s-2, the top two most counted species were Piñon colorado and Malva. However, the percentage share of the top two were 41.4% in Village s-1 and 26.3% in Village s-2 (Table 4.2).

The species which were used by households of both villages and by only one of the two and their life forms were identified. Between Village s-1 and s-2, the total number of species mentioned was 66 among which 24 species were mentioned by households of both villages. The number of species mentioned only by those in Village s-1 was 15 and the numbers of species mentioned only by those in Village s-2 was 27 (Figure 6.1). The total number of medicinal plant mentioned was 91, and 45 in Village s-1 and 7s in Village s-2. The number of plant parts uniquely mentioned by the households in Village s-1 was 19 and uniquely mentioned by those in Village s-2 was 72. Twenty six plant parts were mentioned by the both villages (Figure 6.2).

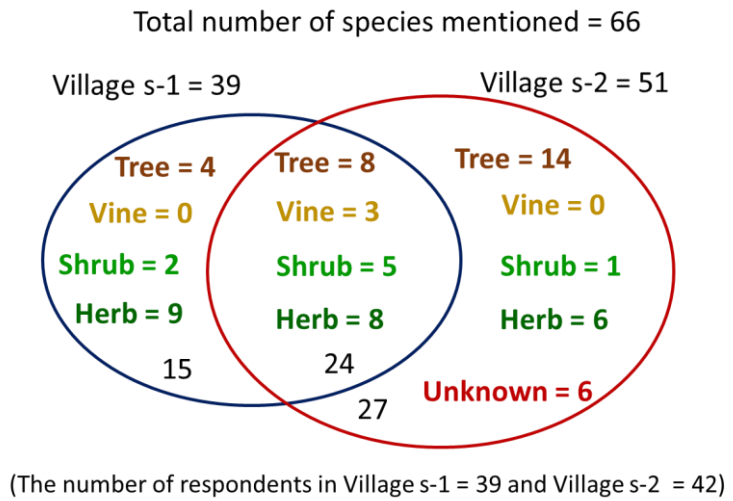

Figure 6.1 Number of species mentioned with their life form by households in Village s-1 and s-2.

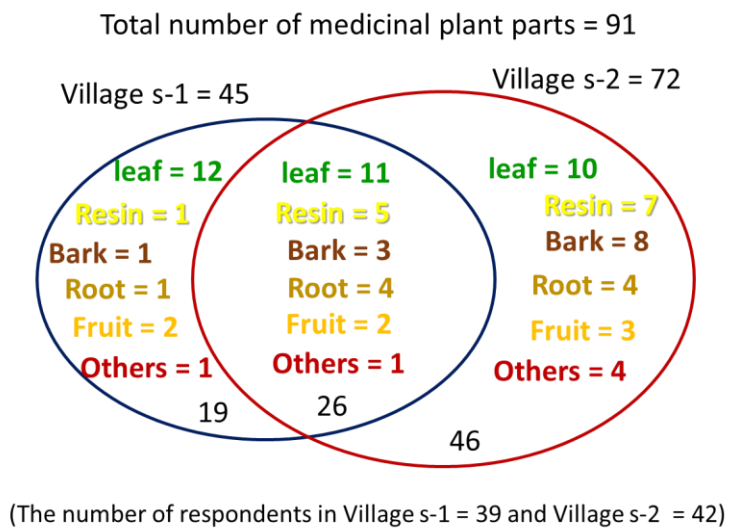

Figure 6.2 Number of plant parts mentioned by households in Village s-1 and s-2.

6.1.2 Utilization of life forms and plant parts

The most obvious and significant differences in medicinal plant uses between Village s-1 and s-2 appeared in life forms (χ^2 (4, 347) = 40.868, p = .000) and parts (χ^2 (5, 347) = 40.192, p = .000) of plants they used. While trees were used 17.5% of the total count in Village s-1, were 34.8% in Village s-2. Vines were 39.4% and 12.3; shrubs, 27.8% and 40.0%; herbs, 20.3% and 3.1%; and others, 4.8% and 0.0%, in respective villages (Figure 6.3). The parts of medicinal plants they used were much more different (Figure 6.4). Seventy percent of the total count of medicinal plants used by Village s-1 was leaves, yet, 39.6% in Village s-2. While barks and roots were used 4.4% each by the households in Village s-1, 21.4% and 10.7% respectively

were used in Village s-2. The high rate of barks and roots used in the total counts of Village s-2 reflected the number of households who used those potentially destructive parts (Table 4.5). While 61.9% of households used those parts of trees, vines, and shrubs in Village s-2, 20.5% of those did in Village s-1.

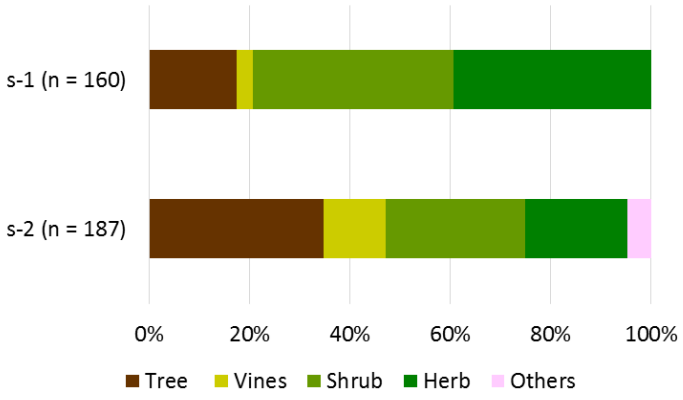

Figure 6.3 Life form of medicinal plants used by households in Village s-1 and s-2.

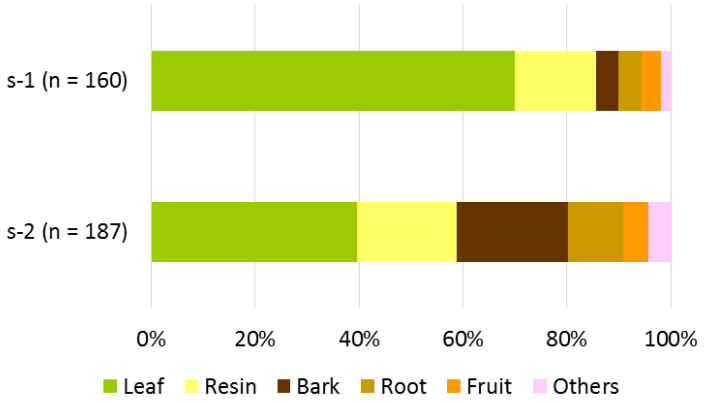

Figure 6.4 Plant parts of medicinal plants used by households in Village s-1 and s-2.

The influence of demographic attributes on life forms and parts of medicinal plant used were tested by Kruskal-Wallis test. While the life forms of medicinal plant used were not significantly different by age (H (4) = 5.484 p = .240) or years of education (H (4) = 8.590 p = .072), the parts of plants used were significantly different both by age (H (5) = 18.568 p = .002) and years of education (H (5) = 22.497 p = .000). As all respondents in Village s-2 were male, obviously gender made significant differences in parts used (χ^2 (5, 347) = 26.067, p = .000) and life forms of plants used (χ^2 (4, 347) = 19.347, p = .001). As the large differences could be influenced by gender, the data from male in Village s-1 and Village s-2 were compared

(Figure 6.5 and Figure 6.6). The differences of life form and plant parts used were still significant (life form:χ^2 (4, 276) = 21.349, p = .000: parts:χ^2 (5, 276) = 17.439, p = .004).

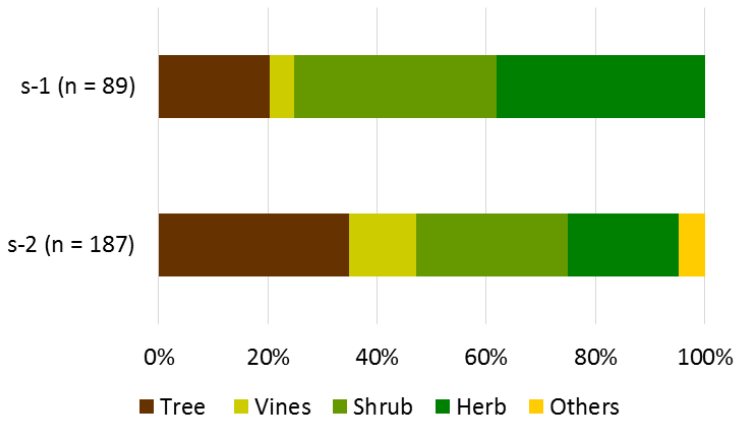

Figure 6.5 Life form of medicinal plants used by male respondents in Village s-1 and s-2.

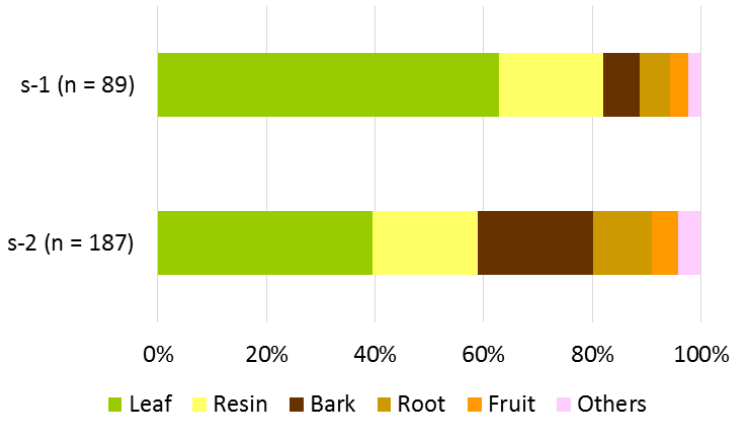

Figure 6.6 Plant parts of medicinal plants used by male respondents in Village s-1 and s-2.

6.1.3 Frequency of medicinal plant use for healthcare and livelihood

While Daily Users of medicinal plants took 20.5% of the total in Village s-1 and 23.8% in Village s-2, Weekly Users were 43.6% and 14.3 5, respectively (Figure 6.7). Overall, the frequency of medicinal plant use between the two villages was significantly different (U (80) = 589.000, p = .043). Households in Village s-1 more frequently used medicinal plants. However, when only male data from Village s-1 was compared (Figure 6.8), the frequency of medicinal plant use between the two villages was not significantly different (U (62) = 372.500, p = .386).

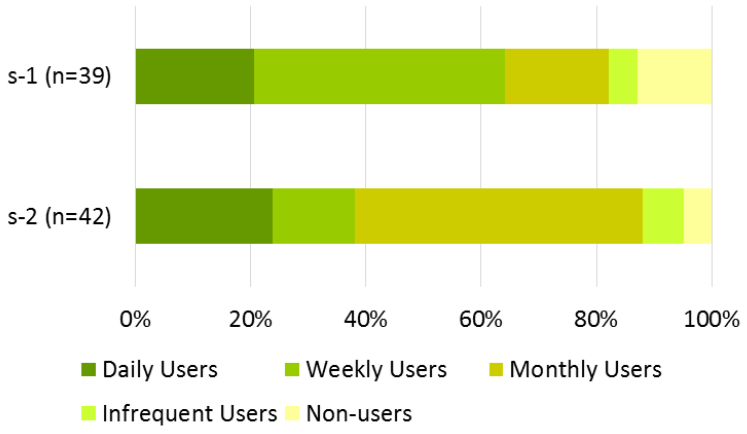

Figure 6.7 Frequency of medicinal plant use by households in Village s-1 and s-2.

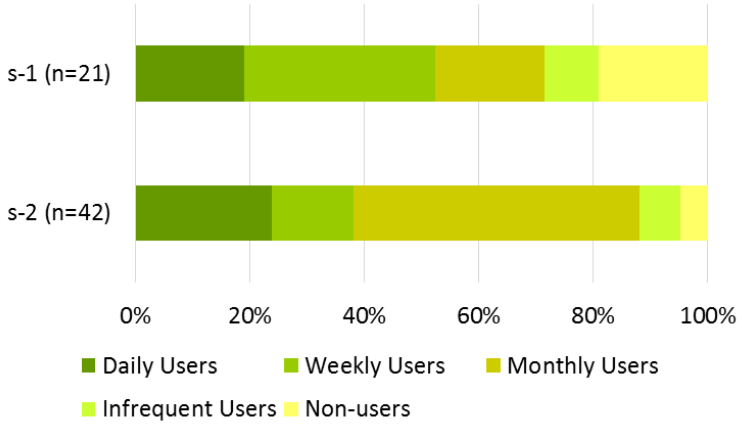

Figure 6.8 Frequency of medicinal plant use by male respondents in Village s-1 and s-2.

More households in Village s-2 engaged in purchasing and selling medicinal plant remedies (Table 6.1). It is easy to assume that the reason is that Village s-2 is located in proximity to the city. However, one of the remarks is that the average year of education of sellers, 12.3 years old is higher than the already higher average year of education in Village s-2, 9.5 years old than that of other villages. In Village s-1, the average year of education of sellers was 3.5 years old, which is lower than their village average of 6.5 years old (Table 6.2). The high average year of the education is partially the reflection of the occupation of some of the sellers in Village s-2, namely teaching profession, but, those who engaged in agriculture or medicinal plant selling as a main livelihood, have also higher years of education than those in Village s-1.

Table 6.1 Frequency of medicinal plant purchase and sale by households in Village s-1 and s-2

	Village			
	s-1 (n=39)		s-2 (n=42)	
	Number	%	Number	%
Tincture purchasers	9	23.1	15	35.7
Plant and tincture sellers	4	10.3	7	16.7

Table 6.2 Profile of medicinal plant sellers in Village s-1 and s-2

Village	Gender	Age	Year of education	Occumpation
s-1	Female	27	0	Farmer
	Male	49	8	Farmer
	Male	50	3	Farmer
	Male	64	3	Farmer
Average		47.5	3.5	
s-2	Male	68	6	
	Male	43	16	Medicinal plant seller
	Male	41	14	Teacher
	Male	44	9	Farmer
	Male	26	16	Student
	Male	55	9	Farmer
	Male	49	16	Teacher
Average		46.6	12.3	

Although the parts and life forms of medicinal plants used were supposed for household consumption, but not for sale, any relations between the parts and life forms which may be destructive and sales activities were checked. Among 4 medicinal plant sellers in Village s-1, only 1 used potential destructive parts, and among 7 sellers in Village s-2, 5 used such parts, yet other 2 did not.

6.2 Influence of Healthcare Service Use on Medicinal Plant Utilization

6.2.1 Utilization of healthcare facilities

Households were asked the frequency of visit to the healthcare facilities including either or both the health post located in Village s-2 and a hospital located in the city for themselves and their family during the one year prior to the interview. The frequency of the visit was again categorized as Monthly, Occasional, and Rare Visitors as the previous chapter.

Monthly Visitors were 8 representing 20.5% the total households in Village s-1 and 33 representing 78.6% of the total respondents in Village s-2, Occasional Visitors were 5 or 12.8% and 2 or 4.8%, Rare Visitors were 23 or 59.0% and 5 or 11.9%, and Non-visitors were 3 or 7.7% and 1 or 2.4%, respectively (Figure 6.9). A respondent did not answer in Village s-2. It is so obvious that more households in Village s-2 more frequently visited healthcare facilities, and the difference was significant (U (79) = 305.5, p = .000).

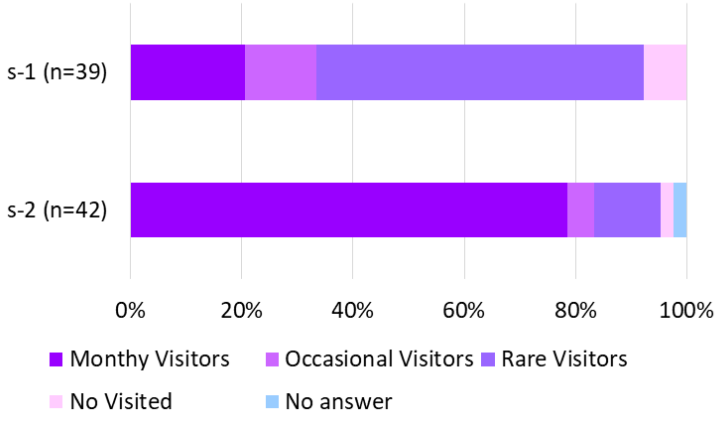

Figure 6.9 Frequency of healthcare facility visit by households in Village s-1 and s-2.

The influences of demographic attributes including gender, age, education year, and income on the frequency of healthcare facility visit within each village were tested. Among all attributes in both villages, only gender in Village s-1 was significantly different (U (39) = 101.500, p = .012). Since the respondents in Village s-2 were all male, the data from male in Village s-1 and that of Village s-2 were compared (Figure 6.10). Interestingly, the difference was further widened and was strongly significant (U (61) = 96.000, p = .000).

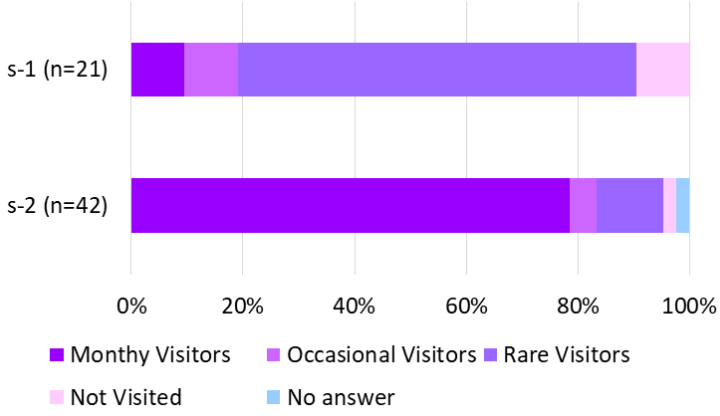

Figure 6.10 Frequency of healthcare facility visit by male respondents in Village s-1 and s-2.

6.2.2 Utilization of medicinal drugs

Households were asked about medicinal drug purchase for themselves and family members in the city during a year prior to the interview conducted. The frequency of medicinal drug purchase was answered by times per year by households in Village s-1 and those in Village s-2 answered their purchases by the category of Monthly, once a month or more but less than once a week; Occasional, more than once three months but less than once a month; and Rare, less than once three months. Monthly Purchasers were 2 representing 5.1% of 39 total households in Village s-1 and 17 representing 40.5% of 42 total respondents in Village s-2; Occasional Purchasers were 30 or 76.9% and 22 or 52.3%; and those who did not purchase were 7 or 17.9% and 3 or 7.1%, respectively (Figure 6.11). Their purchasing behaviors were significantly different (χ^2 (2, 80) = 14.582, p = .000).

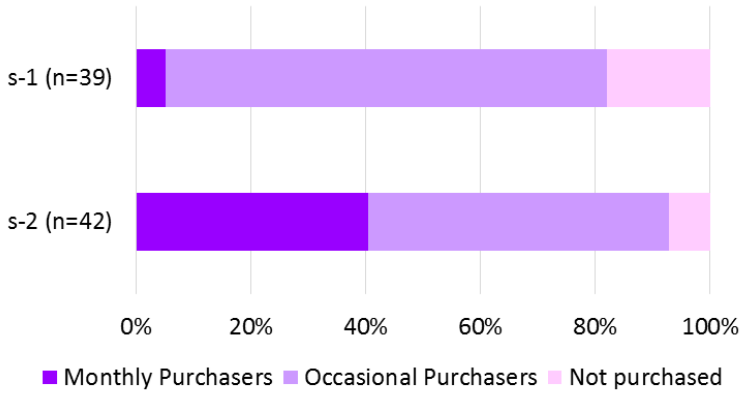

Figure 6.11 Frequency of medicinal drug purchase by households in Village s-1 and s-2.

Since the respondents in Village s-2 were all male, the data from male in Village s-1 and that of Village s-2 were compared (Figure 6.12). Interestingly, the difference was further widened and was strongly significant (U (62) = 150.000, p = .000). The influences of demographic attributes besides gender: age, education year, and income, on the frequency of medicinal drug purchase within each village were also tested. In Village s-1, age and year of education were correlated with the frequency (age: r (39) = .336, p = .036; year of education: r (39) = -.325, p = .043). In Village s-2, income was correlated with the frequency (rs (29) = .406, p = .029).

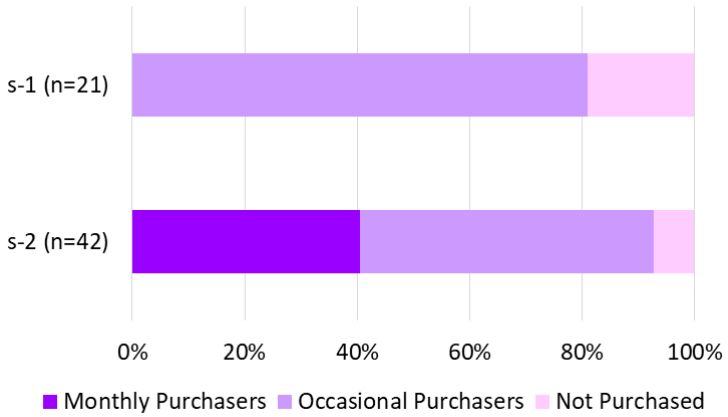

Figure 6.12 Frequency of medicinal drug purchase by male respondents in Village s-1 and s-2.

6.2.3 Influence of healthcare service uses on medicinal plant utilization

Between Village s-1 and s2, the results of the correlation among the frequencies of healthcare facility visit, medicinal drug purchase and medicinal plant use were same. For Village s-2, Spearman's rank correlation coefficient was used because the data for the frequency of medicinal drug purchase in Village s-2 were categorical. For other combinations, Pearson's correlation coefficient was used. As in the case of Village s-1 mentioned in the previous chapter, the frequencies of healthcare facility visit and medicinal drug purchase were significantly correlated within the village (rs (39) = .582, p = .000). However, the frequencies of medicinal plant use and that of healthcare facility visit and of medicinal drug purchase were not correlated (Figure 6.3).

Table 6.3 Correlation between use of medicinal plants and healthcare services by households in Village s-1 and s-2

Village	Correlation between medicinal plant use and healthcare facility visit	Correlation between medicinal plant use and medicinal drug purchase
s-1	R^2 (39) = .045, p = .784	R^2 (39) = -.081, p = .623
s-2	rs (39) = .082, p =.618	rs (41) = .086, p =.592

6.3.4 Health insurance subscription

The households in Village s-2 as well were asked regarding health insurance subscription. Forty-one representing 97.6% of 42 respondents subscribed health insurance in Village s-2 (Table 6.4). This is much higher than the average rate in the Loreto department. Among them, the majority of subscribers held Seguro Integral Salud (SIS), which is designated to poorer population and 4 subscribers held EsSalud, which is for employees of enterprises or public sectors as their occupation was a teacher. Those who held EsSalud visit the hospital in

Contamana rather than the health post in their village. The behaviors related to healthcare subscription were not compared between these two villages due to the high rate of healthcare subscription in Village s-2.

Table 6.4 Number of health insurance subscribers and non-subscribers in Village s-1 and s-2

	Village	
	s-1	s-2
Number of health insurance subscribers	26	41
Number of non-subscribers	13	1
Percentage of insurance subscribers	66.7%	97.6%

6.4 Discussion

6.4.1 Influence of the distance to the city and healthcare services on utilization of medicinal plants for healthcare and healthcare services

Previous studies repeatedly report that urbanization and the access to modern medicine are two of the causes for the decrease in medicinal plant use and knowledge (Benz et al., 2000; Case et al., 2005; Monteiro et al., 2006, Merétika et al., 2010), that brought Assumption 3, "People living away from urbanized areas use more medicinal plants than those who live close to them," to the study. However, overall, the assumption was not necessarily supported by the results of the study. Although the frequency of medicinal plant use among male respondents in both villages was not significantly different, those in Village s-2 used a greater variety of species and parts. The households in Village s-2 also used more variety of plant life forms and their parts than those in Village s-1. A possible explanation for the discrepancy to the assumption is that it does not necessarily consider the level of urbanization and the differences in the access to the resources, or what resources they use. If households in a village do not have access to healthcare services at all, they would definitely use more medicinal plants than those who have an access. In the study site, the households in the village furthest to the city did have an access to healthcare services. Another explanation that the households in the village located near the city used a greater variety of medicinal plants is that the plants they mainly used were cultivated or found near their houses, and they also had an access to forests. These explanations indicate that it is important for medicinal plant utilization to consider the level of urbanization and the conditions of the location of villages even though they are located in a relatively remote area.

Previous studies also report that the physical distance to a health post is one of the

factors that define the access to healthcare services (Peters et al., 2008; Savedoff, 2009). The results of the present study clearly accord with the literature, showing that the frequency of healthcare facility visit and medicinal drug purchase in Village s-2 were significantly different from Village s-1. On the one hand, the majority of households in both villages visited healthcare facilities and purchased medicinal drugs at the pharmacies in the city of Contamana in a year prior to the interviews. On the other hand, in Village s-2, there were much more households who were Monthly Users for both healthcare services, but, in Village s-1, more than 50% and 70% of the households visited healthcare facility and purchased medicinal drugs, respectively, less than at the monthly basis.

Although it is safe to say that the proximity to the city or healthcare services affected the use of healthcare services, its influence on medicinal plant use is still not clear. Vandebroek et al. (2004) found that Andean healers in Bolivia who had more and easier access to modern services and healthcare facilities have more medicinal plant knowledge than those living in the isolated vegetation rich environment. There are also large markets of medicinal plants in large cities in the Amazon (Galy et al., 2000; Shanley & Luz, 2003; Lima et al., 2016) despite the easier access to modern medicine. In the other context, demand for medicinal plants is increasing in coastal cities in Peru (Bussmann & Sharon, 2009). Vandebroek and Balick (2012) report that migrated Dominicans in New York City show more medicinal plant knowledge than those in their homeland, the Dominican Republic. Another study by Giovannini, et al. (2011) shows that positive association between uses or knowledge of medicinal plants and pharmaceuticals. These evidences that contradict the popular notion about loss of medicinal plant knowledge by urbanization or the access to modern medicine support the results that the exposure to healthcare services does not necessarily reduce the use of medicinal plants. However, considering such a popular notion, further question can be raised if Village s-1 has already lost a certain level of knowledge of medicinal plants at the same level as Village s-2 that is close to the city, but Village s-2 regained some knowledge due to the proximity to the city that may demand more medicinal plants. Vandebroek et al. (2004), in the study of the indigenous communities in the Bolivian Andes and Amazon, found that the proximity to other communities leads to less dependence on medicinal plant use. Although Village s-1 is furthest from the city among the villages studied, there are several indigenous villages in proximity. It is quite possible that Village s-1 have already become less depended on medicinal plant use.

6.4.2 Influence of the distance to the city on health insurance subscription

The outstanding difference in households of Village s-2 from that of Village s-1 is the high rate of healthcare insurance subscription (97.6%) of the former. All the respondents except

one were insured. This can be interpreted as one of the characteristics of the proximity to an urbanized town, the city. The higher frequencies of healthcare facility visit and medicinal drug purchase by the households in Village s-2 than Village s-1 are assumed to be so due to the proximity to the health care services, yet, it is possibly further facilitated by the health insurance subscription. If the high rate of healthcare insurance subscription is most likely associated with the proximity to the city, it could be predicted that the households in Village s-2 would more and more utilize healthcare services, while those in Village s-1 would less utilize them.

As matter of fact, the higher rate of Rare Visitors to healthcare facilities in Village s-1 even than Village M which are located slightly closer to the city and healthcare facilities as shown in Chapter 5, was perhaps strongly influenced by the distance to the healthcare services as well as the health insurance holding. In Village s-1, the rate of not purchasing medicinal drugs was the highest (17.9%) than Village s-2 (7.1%) as well as Village M (7.0%) shown in Chapter 5. Interestingly, however, in Village s-1, the result shows households' tendency to increase healthcare facility visit and decrease the use of medicinal plants after the health insurance subscription. However, the distance to the healthcare facilities and pharmacies would not change. If households in Village s-1 use medicinal plants for the first aid, their quickly losing medicinal plant use and knowledge may affect their home and preventive care. It is possible that households in remote areas remain with a disadvantage in caring their health without having alternatives.

6.4.3 Medicinal plant parts used

The use of parts of plants in households had a significant difference between Village s-1 and s-2. Although the results could not confirm that the distance to the city is the reason, they left an interesting insight and assumption to how they use the medicinal plants. The parts, which were barks and roots that more households in Village s-2 used require more time to prepare, turning them into a tincture, than leaves that 70% of households in Village s-1 used. The differences in parts used were significantly influenced by gender, age, and years of education. As shown in Table 4.6, the users who used potentially destructive parts and life forms of plants have a higher average age both in Village s-1 and s-2 than the total average; and have a higher average year of education in Village s-1 than the total average, and the same average year to the respondents' average in Village s-2. The results agree with rich evidence that elders hold more medicinal plant knowledge (Caniago & Siebert, 1998; Voeks & Leony, 2004; Estomba et al., 2006; Quinlan & Quinlan, 2007; Silva, et al., 2011). However they disagree with the reports that education is negatively associated with plant knowledge (Voeks & Leony, 2004; Quinlan & Quinlan, 2007; Giovannini, et al., 2011). Why households in Village s-1 use

plant parts that can be prepared easily? Considering the significant difference in healthcare facility visits between households in Village s-1 and s-2, it can be assumed that it is because those in Villages s-1 do not often visit healthcare facilities and they use medicinal plants as the first aid. Further investigation would be required to confirm this assumption.

6.4.4 Markets

Dercon and Hoddinott (2005) report from their study in Ethiopian villages that the proximity to a market center influences commercial activity. More people were engaged in sales of medicinal plants in Village s-2 than s-1. Although all sellers except for one in Village s-2 had another main livelihood, the differences between Village s-2 and s-1 were most likely due to the proximity to the city. Besides the proximity to the market, their age and years of education seem to influence sales of medicinal plants. In Village s-2, the average age of the seller was also higher than their total average. However, the average year of education in Village s-1 did not influence sales of the plants. Only one seller out of four has a higher education of 8 years. As two sellers happened to be asked to sell remedies for an episodic business ran by a foreigner, it is reasonable to think that the households in Village s-1 do not necessarily actively sell medicinal plants. The distance to markets in the city of Contamana form Village s-1 is much far than that in Village s-2, and the demand for medicinal plants are not necessarily high because perhaps people living in the city also have access to the plants.

In sum, while it is obvious that the proximity to the city and healthcare services affected the higher frequency of healthcare services, it does not necessarily reduce the use of medicinal plants. In the case of Village s-2, the closest village to the city, rather used more variety of species, life forms, and parts of plants. The Assumption 3, “People living away from urbanized areas use more medicinal plants than those who live close to them,” was not necessarily supported by the study. Although most sellers of medicinal plants in Village s-2 had their main livelihood other than medicinal plant sales, the fact that more households sold the plants was possibly a result of the proximity to the city, the high subscription rate of health insurance, and the much longer years of education.

CHAPTER 7

SUMMARY AND CONCLUSION

7.1 Summary

7.1.1 Issues

The recognition of medicinal plants has not only been in the area of healthcare as traditional medicine and supplement to modern medicine, but also in livelihood improvement or poverty alleviation and biodiversity conservation as a tool for management. In the area of healthcare, the global communities centering around WHO recognized the importance and functions of medicinal plants as part of the primary healthcare, which is one of the central goals of the agency, guided member countries to identify them, develop policies and implement action plans, and integrate them into the healthcare system where possible or necessary three decades ago. Developing countries were not an exception, and rather needed it more as their people tended to rely on traditional medicine, which utilizes medicinal plants majorly, and the budget for healthcare provision based on modern medicine may not have been sufficient. They followed this path in addition to pursuing the "health for all" vision, mainly evaluated by indicators related to modern medicine, which was declared about four decades ago. The basic and common understanding of the global communities is based on the estimation that 80% of people in the world or in developing countries rely on traditional medicine for their primary healthcare (Farnsworth et al., 1985; Robinson & Zhang, 2011). By the time WHO set the first traditional medicine strategy in 2002, many developing countries enforced certain types of actions pertaining to funding or setting up regulations on traditional medicine (Ong et al., 2005). The strategy was updated in 2014, confirming the objectives previously set: To develop policy to integrate traditional medicine with national healthcare systems as appropriate, promote the safety, efficacy and quality, increase the availability and affordability, and promote rational use (WHO, 2002, 2013c). The issue here is how these global and country efforts contribute to healthcare among local people living in remote areas in developing countries, with the parallel development of healthcare provisions based on modern medicine, after drastic changes in the economic and informational environment of the era of globalization.

In the last 25 years, another significant change had been observed across the global

communities in the area of environmental issues, namely, loss of biodiversity and climate change. Since UNCED in 1992, the global communities found out the linkage between biodiversity loss and poverty in the biodiversity rich areas in developing countries, and set their priority as poverty alleviation for biodiversity conservation (CBD, 2010). The notion of NTFP in the 1990s was singled out as a mechanism to improve local livelihood in such regions in a less destructive manner to preserve forest biodiversity. NTFP was expected to be a solution to improve livelihood, and its sustainable extraction could prove to be a tool to managing biodiversity. Local indigenous people, especially, have traditionally managed forests and are expected to extract NTFP in a sustainable manner. Many NTFP studies were conducted and development of NTFP in rural areas of developing countries became one of the most popular environmental projects receiving international aid. Medicinal plants as a type of NTFP have been also the object of these studies and projects. At a very early stage, the studies found out that NTFP may not be biodiversity friendly or effective to improve livelihood as it is highly conditional. However, since NTFPs have the potential to currency, although not much, developing NTFPs have today become one of the first choices while considering livelihood improvement in programs such as REDD+. Even after the long-term debate on ineffectiveness of NTFP in academia, it is being developed in such projects. Another issue is that most studies and programs, perhaps, did not necessarily have a long-term view toward NTFP, not taking into account the market dynamics and sustainability of demand and supply, which are the basic considerations when any business product is developed.

7.1.2 Questions and assumptions

Medicinal plants are expected to support the health of people living in marginalized areas. They are also considered to have the potential to improve livelihood, and used as a tool for biodiversity management. However, if medicinal plants are utilized for healthcare purposes, the provision of healthcare services based on modern medicine must be taken into account. Although promoting traditional medicine is a global as well as national strategy, the universal health coverage is one of the essential parts of Sustainable Development Goals of the United Nation to be achieved by 2030 (UN, 2017). How do the global and national efforts from these directions affect the utilization of medicinal plants? This is one of the questions of this thesis attempts to answer.

Whether medicinal plants can support livelihood depends on demand and supply of the locality. The demand, in this case, is how much people use medicinal plants to take care of their health. As just mentioned, it can be influenced by healthcare services, yet even before that, population matters. The supply, on the other hand, can be determined by the accessibility to

medicinal plants in forests or other types of natural environments. How the dynamics of demand and supply functions with population agglomeration in rural and forest areas, or rural urbanization is another question.

Medical pluralism has been accepted as a notion and phenomenon in reality (Rubel, 1978). In the 21st century, it is still true everywhere, especially in marginalized areas (Gold & Clapp, 2011, Brierley et al., 2014). Yet, how people choose healthcare modalities can be very complex, especially in developing countries. The access and cost can be important aspects, yet the impact of socio-cultural networks cannot be underestimated (MacKian et al., 2014). Social networks are also influenced by the locality including population agglomeration and migration through which people and culture interact. Medicinal plant utilization also be examined considering health seeking behaviors, which could be influenced by locality and socio-cultural influence including ethnicity. How these aspects influence medicinal plant utilization is yet another question that needs to be ansered. Raising these questions, the study assumed the following:

1. People in remote forested areas depend on medicinal plants for their healthcare.
2. Indigenous people use medicinal plants more than non-indigenous people.
3. People living away from urbanized areas use more medicinal plants than those who live close to them.

7.1.3 An integrative approach proposed

Medicinal plant utilization can be affected by at least all aspects mentioned in the previous section. However, various disciplines regarding medicinal plant utilization do not consider other aspects outside their own disciplines. This thesis integrated the insights and wisdom from multiple disciplines related to medicinal plant utilization shown in Figure 1.1 and tried to determine the usefulness of medicinal plants for global issues in health, livelihood improvement and biodiversity management.

The study proposed an integrative approach based on multidisciplinary studies on medicinal plant utilization as shown in Figure 1.2. The figure clarifies the relationship and interaction among the three purposes of medicinal plant utilization: Healthcare services, which may influence the demand for medicinal plants as a product and a healthcare method, and the demand may influence forest resource use, and biodiversity.

The secondary city in the Peruvian Amazon was selected to be the study site. The

Peruvian Amazon is abundant in biodiversity, having rich medicinal plant species traditionally utilized by indigenous people. Yet, the forest and biodiversity is under threats due to population flows, logging, mining, infrastructure construction, and climate changes. Although the country's economy grew in the first decade of the 21st century, it created further disparities in health and economy between urban and rural areas. The primary cities in the Peruvian Amazon consist of populations over 200,000 and forests is no longer in proximity. Multiple hospitals and pharmacies are available. Therefore, the study selected the secondary city of Contamana, whose population size is only over 20,000 and is surrounded by forests in proximity. Based on the relationship within the context of the Peruvian Amazon, the objectives of the study are the following.

1. To determine utilization of medicinal plants for health, livelihood improvement and biodiversity management in a secondary city of the Peruvian Amazon
2. To assess the influence of ethnicity and distance to the city on medicinal plant utilization in healthcare, livelihood improvement, and biodiversity management
3. To assess the influence of healthcare services on medicinal plant utilization.

The field interviews were based on a structured questionnaire that took into account 127 households belonging to four villages (two mestizo and two indigenous villages) near Contamana. The interviews were conducted in the years 2013 and 2014. The data was analyzed through statistical testing, using IBM SPSS 24.0 and R version 3.4, and interpreted based on the literature.

7.2 Findings

7.2.1 Utilization of medicinal plants in the secondary city in the Peruvian Amazon,

The findings do not necessarily support the global expectation of medicinal plants to mitigate the global issues, such as health, livelihood, and biodiversity management. The assumption 1, which states that people in remote forested areas depend on medicinal plants for their healthcare, was only partially supported. The fact that the study did not strongly support the assumption suggests there is potential needs in looking at other factors such as the level of urbanization, thus, taking into account the conditions of the location, thereby employing an integrative approach.

The majority of households in the villages studied used medicinal plants for healthcare

purposes. About a half of them routinely used them, indicating reliance on medicinal plants for their healthcare. However, even though individual households possessed medicinal plant knowledge, they used medicinal plants in a very limited way in terms of various types of plants and their purposes. This is one of the indications of knowledge loss or decline in the use of medicinal plants, as many previous studies pointed out (eg. Quinlan and Quinlan, 2007), and the results suggest a possible relation to the level of urbanization.

Medicinal plants cannot be expected to support livelihoods for many as a commercial product. At least, households in the villages did not use medicinal plant products by purchasing. Considering only few people sold medicinal plants, the demand in the city of Contamana seemed to be very limited. Medicinal plants cannot be expected to be used as a tool for biodiversity management in the study area because the majority of medicinal plants used were not of forest-origin or from the wild, but cultivated or found everywhere near houses. The study area was aligned with the tendency of using plants, which were found in nearby houses (Merétika, 2010) and using leaves which have been reported as not destructive, although other studies show the opposite results. A certain number of households and males tended to use rather potential damaging parts of plants, yet the frequency of their use was not so much. Considering the low commercial utilization of plants, medicinal plant extraction in the area would not be destructive or contribute to biodiversity loss or forest degradation at this moment, thereby, not serving as a tool for biodiversity management. The results also suggest the importance of considering the conditions of the locality.

7.2.2 The influence of healthcare services on medicinal plant utilization with ethnicity and the distance

Healthcare services as a whole contributed to reduce medicinal plant utilization at the study site. The majority of households in the villages used the following healthcare services: Healthcare facilities and medicinal drugs purchased at pharmacies in the city. The frequency of their uses was strongly correlated. Although the frequency of utilization of healthcare services did not reduce the frequency of medicinal plant use, health insurance subscription, another healthcare service, did influence healthcare seeking behaviors, including medicinal plant utilization. Health insurance works as a driver for accessing healthcare facilities and reducing utilization of medicinal plants. The study confirmed the results of the previous studies, which reportd that the presence of healthcare services is one of factors leading to a knowledge loss of medicinal plants (Caniago & Siebert, 1998; Vandebroek & Balick, 2012).

The subscription rate of health insurance in the study site was lower than the

department average in three villages out of four. Although the frequencies of utilization of healthcare services and medicinal plants were not significantly different between insurance subscribers and non-subscribers, the behaviors after health insurance subscription showed significant differences. Especially, more households in the indigenous village furthest to the city visited healthcare facilities more frequently and used medicinal plants less frequently than before subscription and mestizo households. This is a clear indication of the influence of a healthcare services on medicinal plant utilization.

The influence of healthcare services on medicinal plants not only provides evidence that Peru's health policy towards universal health coverage (Fancke, 2013) is effectively working, but also shows a tendency of reliance on healthcare services in the study site. The universal access to healthcare services is a government policy and medicinal plants are expected to support and complement this, especially in remote and rural areas. However, medicinal plants are not necessarily able to play such a role.

The assumption 2, which states that indigenous people use medicinal plants more than non-indigenous people, was not strongly supported by the present study. The households in the indigenous village used medicinal plants more frequently than those in mestizo villages, yet, the average number of plant species mentioned by households in the indigenous village was even less than those of mestizo. The significant difference between the indigenous and mestizo villages was in the behaviors after health insurance subscription. The household insurance subscribers were more affected as they demonstrated increased healthcare facility visits and decreased medicinal plant use. The results highlight the fact that indigenous households are losing knowledge. Acculturation and assimilation are occurring and differences in use and knowledge of medicinal plants between indigenous and mestizo households are blurring as a previous study (Campos & Ehringhaus, 2003) reported.

The assumption 3, which states that people living away from urbanized areas use more medicinal plants than those who live close to them, was not supported by the study, as the households in the village nearest to the city did utilize more variety of medicinal plants, in a more time-consuming way than those residing in villages located away from the city. The results disagree with some previous studies that reported that the remoteness tends to hold more medicinal plant knowledge (Benz et al., 2000; Reyes-García et al., 2013). The discrepancy may have risen because the assumption 3 does not necessarily consider the level of urbanization of the area and its influences, such as the condition of the access to healthcare services or natural resources. The results of this study show that a greater variety of species and parts were used

by households in the village near the city, although the frequency of medicinal plants used by the households in the village further to the city was higher. On the one hand, with increasing proximity to the city healthcare services strongly and definitely affected the use of healthcare services, but on the other hand, it did not reduce the use of medicinal plants because those living away from the urbanized areas still had access to healthcare services and those living closer to the urbanized areas had equal access to the medicinal plants by way of cultivation and finding them near houses or even in forests.

7.2.3 Integrative findings

The influence of healthcare services in reducing medicinal plant utilization also diminishes the value of medicinal plants utilization for livelihood improvement and biodiversity management. The location near the secondary city contributes less demand for purchasing medicinal plants due to the ease of finding and cultivating plants near houses, which reduces the opportunities to use medicinal plants for livelihood improvement. In the study, the proximity to the city seemed to facilitate the sale of medicinal plants, yet the availability of medicinal plants close by prevented a rise in demand. In the area surrounding the secondary city, the market of medicinal plants was not developed unlike the larger cities in the Peruvian Amazon. Remoteness, in comparison to such larger cities, prevents its penetrating into larger market, so the products cannot be fully commercialized.

In the study site, the proximity to the city did reduce medicinal plant utilization in terms of frequency, but not which regard to the number of species, life forms and parts of plants used. The possible explanation for this is that, opposing to the popular notion, a few studies reported that the exposure to healthcare services does not necessarily reduce the use of medicinal plants (Lima et al., 2016; Giovannini, et al., 2011). More households in the village closest to the city being engaged in selling medicinal plants is likely due to the proximity to the market as well as the awareness of dwellers near cities about health and traditional medicine. High insurance subscription rate and a high average with respect to the years of education are the attributes of dwellers near cities. This can be interpreted as a process of urbanization, thus the transition to urbanized behaviors. Unlike many previous studies, which sought to discover the cause of knowledge loss of medicinal plant use, further studies can focus on what help in retaining the use of medicinal plants despite the influence of urbanization and the presence of healthcare services.

The households in the village furthest from the city used medicinal plants which are much easily prepared. Considering the difficult access to and less use of healthcare services, it

can be easily assumed that the households in the furthest village from the city use medicinal plants as first aid. Households in villages closest to the city, which regularly utilize healthcare services, use medicinal plants as a secondary or complementary source aiding healthcare services, so that they are able to place more emphasis on the utilization of medicinal plants. If this is the case, the discrepancy due to distance would be widened even in such a small local area. In this case, households living in remote area were highly influenced by the health service provision than others, thus, losing medicinal plant knowledge. Yet, the distance cannot be altered and the market and healthcare services are far away. Their opportunities to utilize medicinal plants decrease, losing a first aid alternative to take care of their health.

7.3 Implications

7.3.1 The importance of the integrative approach based on multidisciplinary studies

This thesis confirmed that medicinal plants, which are globally recognized in their different aspects, need to be understood from multiple aspects. Academic studies, in accordance with their tradition, tend to focus on an object of study from a restricted view point only. While detail examination from a view point is necessary and would bring profound insight and discovery, multiple view points to the object should be also taken into account. An academic discipline is a filter. An object never appears in its essence by looking through a filter. Although it is impossible to remove all filters or look through all filters, the effort to look through the most relevant filters are required to obtain a more realistic view of the object. Objects such as medicinal plants, whose values accrued over the course of the world transition, especially need to be examined in a multi-disciplinary manner. Moreover, an object which is strongly influenced by one's decision making, such as health seeking behaviors, cannot be explained by a simple causal relation. In the case of the present study, social networks may have influenced the choice of healthcare modalities. Although this study did not fully explore social networks and interaction, such elements could be considered in the future.

The study confirmed the need for multidisciplinary studies on medicinal plant utilization, especially, relating to NTFP development. Figure 7.1 shows factors within the dynamic relationship of medicinal plants utilization in this study. The red arrows are the influence of factors confirmed in previous studies, and the blue arrows are the influence of factors confirmed in the study.

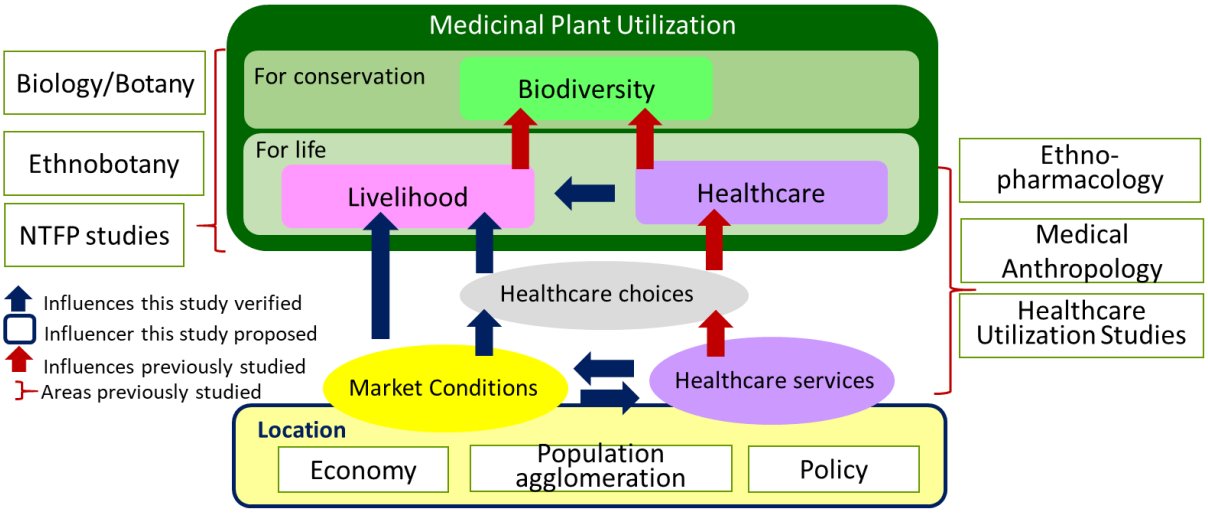

Figure 7.1 Revised integration of academic disciplines for a medicinal plant utilization study.

Figure 7.1 suggests that NTFP studies take into consideration not only target product and conservation, but also locational conditions including market and competitive products which are affected by population size, possibly economy, and policies related to the products. Healthcare utilization studies incorporate various socio-cultural aspects, but also need to consider how policy implementation and related market conditions, such as commercial availability of medicinal drugs, affect healthcare services. All these aspects influence how medicinal plants are utilized for healthcare services, thus, livelihood, and in turn, used as a tool for biodiversity conservation.

7.3.2 Competitive product information

The present thesis verified that the demand and supply and competitive products need to take into consideration when a NTFP or a natural based product, if not from forests, is developed. A product may bring in currency, yet whether it can sustainably support livelihood, depends on the market condition. The current study focused on a competitive product, in this case healthcare services, and rural urbanization and geographical location with regard to population agglomeration, in this case, a secondary city. The latter is important not only because of the size of potential demand by population, but also due to people's accessibility to the natural resources which may reduce the demand for commercial products. The study confirmed that the presence of substitute products affect the use of forest resources. This is the essential point of NTFP development. It is no exaggeration to say that the usefulness and successful of NTFP for biodiversity and livelihood issues depends on the existence of the competitive products. Another point related to the demand is healthcare seeking behaviors, which can be affected by the locality, the demand, and socio-cultural background. Healthcare is not just a

commodity, but the basis of life. In such cases, the process of decision-making is more complex. When it comes to NTFP, that is directly related to the life, to be developed, people's decision-making process influenced by socio-cultural interaction also needs to be considered. Otherwise, the benefit of a developed NTFP does not last long.

To have focused on not only healthcare facility visits and medicinal drug purchase, but also the health insurance subscription considering its influence on the utilization of medicinal plants is the uniqueness and novelty of the present study. As the universal health coverage utilizing the health insurance is one of the foci of Peru's health policy towards poorer population, the investigation of the impact of the insurance subscription on overall healthcare seeking behaviors as well as the utilization of medicinal plants and other traditional medicine will be required. The study would mark the beginning of a new approach of examining medicinal plant utilization.

7.3.3 Globalization and locality

The study shows that the common and stereo typed understanding of medicinal plant utilization or healthcare seeking behaviors is not necessarily the case for remote forest villages in the Peruvian Amazon. The policies and efforts of the global communities are not necessarily universally applicable. The results revealed some gaps between the common notions and the local realities. In the second half of the 20th century, the world has been united and tackled global issues such as poverty, environment, disparities, and others. Telecommunication technologies strengthen the globalization of economy and the union of global communities. What has been determined at the level of global communities have swayed the direction of member countries including developing countries and their localities. Tremendous amount of academic studies have been conducted to feed the decision making of global communities. The efforts to minimize the gaps between the macro level view point based on such academic studies and local situations must make the efforts effective and productive. The thesis propounds the multidisciplinary or holistic approach and local field work is one such effort.

7.4 Conclusion

7.4.1 Contribution

The integrative approach contribute to not only showing the importance of competitive products and complex relations of demand and supply of NTFP, but also providing a way to examine and understand conflicting results of previous studies on NTFP as well as medicinal

plants utilization. Although the study focused only on medicinal plants, the aspects of urbanizing rural area and notion of people's choice can apply to any type of natural products to be developed in remote rural and forest areas.

The study contributes to have reaffirmed the gap between the local situation and the macro level conceptions and policies, and reiterates the importance of continuous field studies. Large scale research and generalization is one of the main functions of social science studies and necessary for policy making. However, it is apparent that the generalization does not necessarily reflect the reality. On the one hand, the efforts to understand local situations and posing challenges to previous findings must be continued, on the other hand, a variation of policy implementation based on local needs should be considered even if the cost might increase. After all, it will bring better results than implementing policies, which would not meet the ends for most needed ones.

An integrative approach is one of few ways to understand reality. Theoretically, it is impossible to have a complete holistic viewpoints. However, the study confirmed additional understanding obtained from an integrative view based on multiple aspects. It is important especially when projects have the effect of affecting the life of people. I hope the thesis contributes to such an effort.

7.4.2 Limitations

One of the limitations of the study is that the field work was conducted over a small scale. The results obtained from the study reflect only the local situation of the study site and they cannot be generalized. Further field studies in nearby villages are desirable to find out the area's medicinal plant utilization practice. Another limitation is that the study did not include the other strata of population agglomeration. To obtain a better picture of medicinal plant utilization practices in the villages near the secondary cities in the Peruvian Amazon, it is better to compare them among the other strata of population agglomeration, such as the primary cities and the tertiary cities (smaller towns).

Although the study proposed the integrative approach based on multidisciplinary studies, it could not sufficiently encompass the other viewpoints possibly included in the medicinal plant utilization study. Continuous efforts and consideration to include possible viewpoints will deepen the understanding of medicinal plant utilization. This will apply to any social science study, especially field studies.

7.4.3 Final Remark

Four decades ago, the global communities realized that medicinal plants were required to reach all people for the purpose of healthcare. It is still true today for many people who sparsely live in remotely expanded areas. And there are the people, who are unintentionally forced to lose the way of taking care for their health due to the policies related to healthcare service provisions based on modern medicine, which almost reach them, yet leave them with adverse outcomes. They are the people living in villages a bit far from a secondary city in the Peruvian Amazon.

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APPENDIX

Appendix 3.1 Structured questionnaire 2013 (format has been modified)

Medicinal Plants Survey _____ community

Date:_____ **Interviewer:**_____ #___

1. Household

Relation to HH	Name	Age	Final education	Ethnic	Birth place	Since when live here?	Occupation	Income
H.Holder M/F	location:							
Wife M/F	location:							
M/F	location:							
M/F	location:							
M/F	location:							

①Agriculture ②Fishery (Pesca) ③Forestry ④Live stock (ganaderea) ⑤NTFP sales ⑥MP sales
⑦Transportation (transporte) ⑧Craft (Arte, Oficico) ⑨Tourism ⑩Others

2. Land area /Tenure

Land use	Area (ha)	owned rent	Distance f house Time/Distance	Origin	Year of transaction
Housing lot[m×m]			T D	□ herencia □ compra □ alquiler?	
Forest			T D	□ Inheritance □ Purchase □ Rent?	
Field			T D	□ Inheritance □ Purchase □ Rent?	
Field			T D	□ Inheritance □ Purchase □ Rent?	

3. Property

Item	Quantity	Purchaser	Item	Quantity	Purchser	Item	Quantity	Purchsor
Motor-cycle			Motocar			Fridge		

Car			TV			Washer		
Cellphone			Audio					

4. Visit to the village

How often? : _____ Purpose : _____ Means of transportation : □Walk □Motor Cycle □Motocar □Car **Time:**_____

5. Medicinal Plants : Do you use medicinal plants? □Yes □No For Last 1 year (from _____to_____)

How often? _____/week, mo Total # of sp. Use _____	#_____ of use MP/ 3 sympotms (fever, cough, diarria)	Basic Use: _____ Advance Use: _____

for fever	**for cough:**	**for diarria**	**for Trauma**	**for Skin**
For Infecciones respiratorias agudas	**For** Malignant stomach tumor	**for** Enfermedades isquemicas del Corazon	**for** Septicemia	**for** Intestinal infectious diseases
for parásito	**for** frio	**for** gripe	**for** Dolor cavesa	**for** Dolor hueso

Top five frequently used MP

Nname	**Purpose**	**Parts**	**Method**	**Place**	**When?**	**Freq**	**Qty**	**Prep**	**Freq**
	□refresco □banar □illness		□extract □cult □given □buy	□forest □near □garden ____Km	□rainy □dry □always	/wk /mon	/time		**/wk** **/mon**
Other use									
Nname	**Purpose**	**Parts**	**Method**	**Place**	**When?**	**Freq**	**Qty**	**Prep**	**Freq**
	□refresco □banar □illness		□extract □cult □given □buy	□forest □near □garden ____Km	□rainy □dry □always	/wk /mon	/time		**/wk** **/mon**
Other use									
Nname	**Purpose**	**Parts**	**Method**	**Place**	**When?**	**Freq**	**Qty**	**Prep**	**Freq**
	□refresco □banar □illness		□extract □cult □given □buy	□forest □near □garden ____Km	□rainy □dry □always	/wk /mon	/time		**/wk** **/mon**

Other use									
Nname	**Purpose**	**Parts**	**Method**	**Place**	**When?**	**Freq**	**Qty**	**Prep**	**Freq**
	☐refresco ☐banar ☐illness		☐extract ☐cult ☐given ☐buy	☐forest ☐near ☐garden ____Km	☐rainy ☐dry ☐always	/wk /mon	/time		**/wk** **/mon**
Other use									
Nname	**Purpose**	**Parts**	**Method**	**Place**	**When?**	**Freq**	**Qty**	**Prep**	**Freq**
	☐refresco ☐banar ☐illness		☐extract ☐cult ☐given ☐buy	☐forest ☐near ☐garden ____Km	☐rainy ☐dry ☐always	/wk /mon	/time		**/wk** **/mon**
Other use									
Nname	**Purpose**	**Parts**	**Method**	**Place**	**When?**	**Freq**	**Qty**	**Prep**	**Freq**
	☐refresco ☐banar ☐illness		☐extract ☐cult ☐given ☐buy	☐forest ☐near ☐garden ____Km	☐rainy ☐dry ☐always	/wk /mon	/time		**/wk** **/mon**
Other use									

Parte: ①ojas ②brote de la hoja ③flora ④brote de la flor ⑤florescencia ⑥Fruta ⑦semilla ⑧raíz ⑨corteza ⑩látex ⑪otros Método de preparación : ①té ②refresco ③jugo ④secocción ⑤tintura ⑥aceite macerado ⑦fomentación/cataplasma ⑧crema ⑨polvo ⑩bañar ⑪aroma ⑫inhalar ⑬otros Sintoma:①Infecciones respiratorias agudas ②Malignant stomach tumor ③Enfermedades isquemicas del Corazon ④Septicemia ⑤Intestinal infectious diseases ⑥fiebre ⑦tos ⑧diarrea ⑨trauma ⑩piel ⑪parásito ⑫dolor ⑬frio

6. Do you use prepared herbal medicine? ☐Yes ☐No

Name	**Whom**	**Purpose**	**Prep**	**Freq to use**	**How much?**	**Frequency/mon**

7. Other medicinal plants questions

Do you use more medicinal plants than 1 year ago? 10 years ago? Or Less?

1yr ago ☐less ☐same ☐more / 10yr ago ☐less ☐same ☐more Why?
Do you think it will be better off if you can use medicinal plants more?
Do you think the medicinal plants effective, comparing with medical drugs?
Who did you learn the knowledge and usage of medicinal plants?
Are you satisfied by using MP？ ☐Yes ☐No： ☐ Would you like to utilize medicinal plants more. ☐ Would you like to learn more about medicinal plants.

8. Do you sell medicinal plants? ☐Yes ☐No

How often? ___/week, mo, yr			Total /kg - roll /wk-mon Total /kg - roll /well			Get cash upon sales? ☐yes no: how to get paid?		
How much MP sales/income? sol______ ____%/total income			# MP sp availability Forest		Need to go more distance than past?		# MP sp availability near House	
Plant name	**Parts**	**Method**	**Place**	**When**	**Frq Qty**	**Sell to**	**Frq Qty**	**Income**
Disponibilidad Distancea		☐extracción ☐cultivo ☐compra	☐forest ☐near ☐garden _____Km	☐rainy ☐dry ☐always	/wk /mon /kg /rol		/wk /mon /kg /roll	/kg/roll Income/mon
Plant name	**Parts**	**Method**	**Place**	**When**	**Frq Qty**	**Sell to**	**Frq Qty**	**Income**
Disponibilidad Distancea		☐extracción ☐cultivo ☐compra	☐forest ☐near ☐garden _____Km	☐rainy ☐dry ☐always	/wk /mon /kg /rol		/wk /mon /kg /roll	/kg/roll Income/mon
Plant name	**Parts**	**Method**	**Place**	**When**	**Frq Qty**	**Sell to**	**Frq Qty**	**Income**
Disponibilidad Distancea		☐extracción ☐cultivo ☐compra	☐forest ☐near ☐garden _____Km	☐rainy ☐dry ☐always	/wk /mon /kg /rol		/wk /mon /kg /roll	/kg/roll Income/mon

9. Do you know anyone to sell medicinal plants? Or prepared herbal medicine?

Seller /crandero/naturalist/shaman name & addess ☐seller ☐crandero / naturalist / shaman

10. Do you go to the Puesto de Salud? □**Yes** □**No**

When?		**Frequency**	/	**Transportation**		**Distance**	**Km** **hr.**

Can you visit HP? #_____ of use MP/HP visitWhen do you use?	Transportation to get there：□walk □motercycle □car □other _____
Do you usually wait at HP? □yes □no: Wait for □5min □15min □30 min □45min □1hr □2 hrs □more	
How many drugs do you usually receive? None. 1. 2. 3. 4. 5. What kind of medical drug do you receive? Name of drugs_____	
Are there sufficient medical drug in the puesto? □yes □no: how often do you NOT receive drugs? 1. 2. 3. 4. 5.	
Have you been recommended or prescribed medicinal plants by medical staff? □no □yes: by whom? □Dr. □Nurse □Tecnica □Other _____	
Do you purchase or have you purchased medical drugs at the permacy? □no □yes What was purchased?_____ How much did you pay?_____	
Which do you think is more effective, medical drugs or medicinal plant? □medical drugs □medicinal plants why?_____	
Comparing to the past, do you go to the puesto de salud more often? □more □less Before_____/_____ Present_____/_____	
Did your health improve? □no □yes	
What do you think about the service of the puesto de salud? □good □standard □no good □satisfied □standard □not satisfied Expectation_____	
Have you been to others (doctor/shaman/crandero/etc.) when you feel sick? □never □yes who?_____ frequency?_____	
What do you think about the medicinal plants use? □wish to use more □no need to use Expectation_____	

Appendix 3.2 Structured questionnaire 2014 (format has been modified)

Assessing the contribution of medicinal plants to health and livelihoods in the Peruvian Amazon

Respondent:_____ Sample No:_____ Ref No. : _____

Date:_____/□/2014_ Interviewer: Miki Interpreter: _____

1. Family

1.1 Household members

Relation	Name	Sex	Age	Edu	Ethno	Years lived	Moved from/when	Reason for left*	Main occupation
Husband									
Wife									
Child 1									
Child 2									
Child 3									

*: 1: education, 2: job, 3: spontaneous transmigration, 4: Marriage, 5: Others

1.2 Working experience outside the village (for family members)

Name	Relation	Year (Period)	Place	Activity

2. Agriculture

2.1 Land tenure and management (Jan 2013 – Dec 2013)

Plot and category	Location (name, distance, min by)	Area	Rented/Owned	Since when
Rice				
Cassava				
Platano				
Maize				

2.2 Cropping pattern (Jan 2013 – Dec 2013)

Crop	2013											
	1	2	3	4	5	6	7	8	9	10	11	12
Rice												
Cassava												
Platano												
Maize												

2.3 Crop harvest and sale (Jan 2013 – Dec 2013)

Crop	Total harvest amount	Sales		
		Amount	Price per unit	Place of sale
Rice				
Cassave				
Platano				
Maize				

2.4 Fishery etc and sale (Jan 2013- Dec 2013)

fish	Total amount of catch	Sales		
		Amount	Price per unit	Place of sale
fish				

2.5 Approximate self-sufficiency rate of major items in the sense of amount

Rice ( )% Cassava ( )% Platano ( )% Maize( )% Vegetable ( )%

Chicken( )% Other meat( )% Egg ( )% Fish ( )%

3. Other income raising activities by the household members (Jan 2013 – Dec 2013)

Name	Work	Location	Duration	Income/unit	Total Income
	Craft				
	MP				

4. Insurance

4.1 Do you have insurance? □yes (SIS / EsSalud / Other) □No (why?)

5. Medicinal Plants Use

5.1 Did you USE/ PREPARE medicinal plants in the last one year? **□Yes □No**

5.2 Where to extract (get) and how to use for what and for whom? Top Five

Name	Part	Place*	Distance	availability	Freq.	Purpose**	method	whom

***purchase /extraction place/ given by x** ****clarify if it is for health or curing disease**

5.3 Do you use more medicinal plants since Insurance? □more □same □Less Why?

Do you use more medicinal plants than 10 years? □more □same □Less Why?

5.4 Did you PURCHASE medicinal plants in the last one year? □Yes □No

5.5 What kind of plants or remedies do you PURCHSE? Top Five each type (fresh/dry/remedy)

Plant name	Type*	part	Place	price	Freq	purpose	method	F whom
	f / d / r							
	f / d / r							
	f / d / r							
	f / d / r							
	f / d / r							

5.6 Do you purchase more medicinal plants since Insurance? □more □same □Less Why?

Do you purchase more medicinal plants than 10 years? □more □same □Less Why?

5.7 Which one is more effective medicinal plants or medical drugs? ( ) for order of effectiveness

symptom	medical treatment	why?	Method
fever	( )MP, ( )Drug (HP), ( )Drug (Pha)		
caugh	( )MP, ( )Drug (HP), ( )Drug (Pha)		
diarrhea	( )MP, ( )Drug (HP), ( )Drug (Pha)		
vomitting	( )MP, ( )Drug (HP), ( )Drug (Pha)		

abdominal pain	( )MP, ( )Drug (HP), ( )Drug (Pha)		
rhinorrhea	( )MP, ( )Drug (HP), ( )Drug (Pha)		
arthralgia	( )MP, ( )Drug (HP), ( )Drug (Pha)		
chest pain	( )MP, ( )Drug (HP), ( )Drug (Pha)		
dyspnea	( )MP, ( )Drug (HP), ( )Drug (Pha)		
sore throat	( )MP, ( )Drug (HP), ( )Drug (Pha)		
headache	( )MP, ( )Drug (HP), ( )Drug (Pha)		
bleeding	( )MP, ( )Drug (HP), ( )Drug (Pha)		
wounds	( )MP, ( )Drug (HP), ( )Drug (Pha)		
convulsion	( )MP, ( )Drug (HP), ( )Drug (Pha)		
unconsciousness	( )MP, ( )Drug (HP), ( )Drug (Pha)		
unstability	( )MP, ( )Drug (HP), ( )Drug (Pha)		

5.8 Whom did you learn how to use medicinal plants from? ( )

5.9 Do you need to learn more about how to use medicinal plants? □ yes □ no

5.10 Is it a problem if you cannot use medicinal plants? □ yes □ no

5.11 Please name if you know anyone who sell medicinal plants in this village?

Name of seller	What do they sell?	Do you purchse?	price?	purpose

6. Medical Service

6.1 Did you go to medical facilities in the last one year?

type	frequency	F whom	purpose	Waiting time (min)	Drug insufficiency
Clinic					
Center					
Other( )					

6.2 Do you use more medical service since Insurance? □more □same □Less Why? ( )

Do you use more medical plants than 10 years? □more □same □Less Why? ( )

6.3 Have medicinal plants been recommended to use by medical staff? □yes (who) □no

6.4 How do you rate the service of medical facilities?

Clinic: □good □standard □poor why?/ □very satisfied □OK □not satisfied why?

Center: □good □standard □poor why?/ □very satisfied □OK □not satisfied why?

6.5 How is your health compared to 10 years ago? □better □same □worse ( )

6.6 Did you PURCHASE medical drugs in pharmacy in the last one year? □**yes** □**no**

Where	frequency	What purchased	price	purpose

6.7 Do you purchase more medical drugs since Insurance? □more □same □Less Why? ( )

Do you purchase more medical drugs than 10 years? □more □same □Less Why? ( )

6.8 Did you go to other type of doctors (shaman/crandero/others) for health/disease consultation?

□no □yes : who? ( ) purpose ( ) frequency ( ) Reason ( )

7. Properties

7.1 House property, housing size and materials

type	Size	Wall (#)	Wall (m)	Roof**	floor
land	( )m x ( )m				
House 1	( )m x ( )m		□wood □bamboo	□thatch □metal	□soil □wood
House 2	( )m x ( )m		□wood □bamboo	□thatch □metal	□soil □wood
Kitchen	( )m x ( )m		□wood □bamboo	□thatch □metal	□soil □wood
other	( )m x ( )m		□wood □bamboo	□thatch □metal	□soil □wood

7.2 Energy sources in the kitchen

□firewood : □purchase ( ) □collect ( ) □Propane gas

Appendix 3.3 Statistical test results of differences in distribution of demographic attributes between Village m-1 and m-2

	Differences between Village m-1 and m-2	Significance
Gender	$\chi 2$ (1, 46) = 1.344, p = .246	*n.s.*
Age	U (46) = 233.500, p = .522	*n.s.*
Year of education	U (46) = 239.000, p = .582	*n.s.*
Income	U (45) = 186.000, p = .133	*n.s.*

Appendix 3.4 Statistical testing results of spurious relationships

Demographic data	Village	Statistical testing result	Significant
Gender x Age	s-1	t (37) = .285, p = .777	*ns*
	m-1	t (23) = 1.106, p = .280	*ns*
	m-2	U (21) = 15.000, p = .006	*s*
Gender x Year of education	s-1	U (39) = 134.000, p = .114	*ns*
	m-1	U (25) = 44.500, p = .077	*ns*
	m-2	U (21) = 45.500, p = .513	*ns*
Gender x Income	s-1	U (34) = 71.000, p = .013	*s*
	m-1	U (24) = 66.000, p = .815	*ns*
	m-2	U (21) = 44.000, p = .477	*ns*
Age x Year of education	s-1	r (39) = -.564, p = .000	*s*
	s-2	r (42) = -.669, p = .000	*s*
	m-1	r (25) = -.137, p = .512	*ns*
	m-2	r (21) = -.454, p = .039	*s*
Age x Income	s-1	r (34) = .222, p = .207	*ns*
	s-2	r (30) = -.169, p = .373	*ns*
	m-1	r (24) = -.196, p = .358	*ns*
	m-2	r (21) = .200, p = .385	*ns*
Year of Education x Income	s-1	r (34) = -.071, p = .689	*ns*
	s-2	r (30) = .423, p = .020	*s*
	m-1	r (24) = -.310, p = .140	*ns*
	m-2	r (21) = -.066, p = .776	*ns*

Appendix 4.1 Differences in plant part and plant life form used by demographic attributes: gender, age, and year of education across all four villages and three villages excluding Village s-1

Demographic Attributes	Plant parts	Plant life forms	Significance level
Gender	χ^2 (5, 514) = 40.976, p = .000	χ^2 (4, 514) = 33.380, p = .000	p < .01
Age	H (5, 514) = 18.736, p = .002	H (4, 514) = 6.045, p = .196	*n.s*
Year of education	H (5, 514) = 28.761, p = .000	H (4, 514) = 17.47, p = .002	p < .01
Gender	χ^2 (5, 327) = 18.406, p = .002	χ^2 (5, 327) = 18.406, p = .013	p < .05
Age	H (5, 327) = 3.834, p = .573	H (5, 327) = 3.834, p = .209	*n.s*
Year of education	H (5, 327) = 6.956, p = .224	H (5, 327) = 6.956, p = .368	*n.s*

Appendix 4.2 Differences in medicinal plant use by gender, age, year of education, and income

	Frequency of medicinal plant use	Significance
Gender	U (126) = 1706.000, p = .763	*n.s*
Age	r (126) = .004, p = .964	*n.s*
Year of Education	r (126) = .000, p = .999	*n.s*
Income	r (109) = - .14, p = .885	*n.s*