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Contribution of subsistence farming and Local Ecological Practice to the mountain livelihoods in the Georgian Greater Caucasus

MASTER'S THESIS

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Declaration

I hereby declare that I have done this thesis entitled “Contribution of subsistence farming and Local Ecological Practice to the mountain livelihoods in the Georgian Greater Caucasus” independently, all texts in this thesis are original, and all the sources have been quoted and acknowledged by means of complete references and according to Citation rules of the FTA.

In Prague 15. 5. 2020

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Kristýna Sosnovcová

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Abstract

The present master thesis documented livelihood strategies of households living within the planned Aragvi Protected Landscape (APL) in Georgia, in connection to agricultural production and Local Ecological Practice (LEP). The data were collected in September 2018 and in July 2019. First visit brought general overview on the study site through combination of observations, transect walks and informal interviews. During the second phase, data on household characteristics, agricultural production and LEP on Wild Food Plants and mushrooms (WFPs) gathering were collected through questionnaires with 94 households in 17 villages in Pshavi, Ukanapshavi, Gudamaqari and Piraketa Khevsureti. The results showed that outmigration threatens the functioning of remaining social structures. Particularly economically active women were underrepresented in the APL. Subsistence farming including small-scale cattle herding remained dominant livelihood strategy. Even though 33 different cultivated crops were recorded, only 18% of the estimated total production, including 9 cultivated crops, were commercialised. Regarding animal products, out of 12 mentioned, 9 were regularly commercialised representing around 43% of the total production from the region. Results showed that remoteness and households' income dependent on farming relate to the larger volumes of animal production. Regarding LEP, 63% of households continued to collect Wild Food Plants and mushrooms (WFPs). We recorded current use of 41 folk-taxa of WFPs in four use categories. On average, 4 species were collected per household and the diversity of species did not differ across communities or altitudes. Relative Cultural Importance Indices highlighted multipurpose fruits and herbal species widespread across the region. WFPs were commercialised by 7% of interviewed households. Parents and grandparents appeared to be dominant LEP knowledge source. According to peoples' perception LEP has been declining. However, local communities mostly expect WFPs to be available and gathered in the future as much as today. Designation of the APL as protected area might create numerous opportunities to improve livelihoods of local communities and to promote LEP. Localized research on communities' perception of LEP as their potential livelihood strategy should be undertaken in order to support successful conservation efforts in mountains.

Key words: Aragvi Protected Landscape, sustainable livelihoods framework, pastoralism, Traditional Ecological Knowledge, Wild Food Plants, tourism.

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List of the abbreviations used in the thesis

APL	Aragvi Protected Landscape
USSR	Union of Soviet Socialistic Republics
FAO	Food and Agriculture Organisation of the United Nations
IUCN	International Union for the Conservation of Nature
GDP	Gross Domestic Product
PPP	Purchase power parity
GEL	Georgian lari
NTFPs	Non-Timber Forest Products
WFPs	Wild Food Plants
TEK	Traditional Ecological Knowledge
LEP	Local Ecological Practice
UV	Use value
LSU	Livestock unit
HHs	Households

1. Introduction

1.1. Mountain ecosystem services: a global overview of a fragile habitat

Mountains occupy over 24% (40 million km^2) of the terrestrial surface of the Earth (FAO 2011; El Solh 2018). Mountainous regions are exceptional in the diversity and number of ecosystem services directly provided to humans, both at high elevations and in lowlands (Kohler et al. 2010; Egan & Price 2017). In fact, they contribute to all 24 services defined by the Millennium Ecosystem Assessment (Harrison et al. 2010). Above all, mountains provide water to more than half of the global population through downstream water supply (Viviroli et al. 2007; Gracheva et al. 2012). High climatic and topographic diversity on a relatively small area create favourable conditions for biological, genetic and ecosystem diversity. It is estimated that half of the world's biodiversity occurs in mountains along with a large number of endemic species (Egan & Price 2017). In addition, the harsh and dynamic conditions demand great diversity of locally adapted crops and livestock which results in rich agro-biodiversity and abundant genetic resources (Kohler & Maselli 2012).

Yet, provision of these necessary services is threatened by climate change and anthropogenic pressure. It is estimated that many ecosystem services including water provision, water retention, or biodiversity will diminish, considering that mountains are among the habitats most sensitive to climate change (IPCC 2007; Wymann von Dach et al. 2018). The diversity of fauna and flora has been decreasing due to degradation of natural habitats mostly caused by human activities such as overgrazing, introduction of new varieties, intensification of agriculture, unregulated tourism and infrastructure (Batello et al. 2010; FAO 2011; Hock et al. 2019). Therefore, it is appropriate that protected areas have been the fastest growing land use category in mountains in the recent decades (Kohler et al. 2010).

1.2. Mountain populations and their complex livelihood realities

Mountains are home to around 10% of the global population (El Solh 2018; Hock et al. 2019). Despite unfavourable conditions, people have been living at high elevations for centuries and have developed complex livelihood strategies and food systems adjusted and tied to natural environment and ecosystem services (FAO 2019a). Isolated valleys gave rise to numerous cultural and ethno-linguistic groups enriching our cultural heritage (Egan & Price 2017). Within communities, the extensive knowledge of surrounding nature, processes and sustainable practices have accumulated and developed into Traditional Ecological Knowledge (TEK), with a great potential for climate change adaptation strategies (Kohler & Maselli

2012; Ingty 2017) and sustainable resources management (Berkes 1999). These communities are key actors in maintaining the mountain ecosystems and supporting the provision of ecosystem services (FAO 2011).

However, mountain communities are facing multiple challenges in securing sustainable livelihoods (Wymann von Dach et al. 2018). Land suitable for agriculture has always been limited. The FAO estimates that only 22% of the mountainous land is suitable for growing crops. It is expected that due to climate change, frequency and intensity of natural disasters such as landslides, storms and rockfalls will increase (Wymann von Dach et al. 2017). Remoteness and poor infrastructure restrain economic activities, access to markets and diversification of income. Therefore, a large number of these people is dependent on agriculture and still one third of them lives in food insecurity (Kohler & Maselli 2012; Wymann von Dach et al. 2018). Given the complex conditions of the mountain and rural regions, the FAO estimates that around 1 billion people rely on non-timber forest products (NTFPs) including wild edibles (Sacande & Parfondry 2018). This important provisioning ecosystem service and Local Ecological Practice (LEP) has until recently been neglected (Berkes 1999; Bharucha & Pretty 2010).

The reality of mountain communities is often underrepresented on the national and global political levels, and they are excluded from decision-making about the environment they live in (Mitrofanenko et al. 2015; Egan & Price 2017). While conservation of biodiversity has been recognised as a global concern, local communities remain overlooked and excluded from the stewardship of the natural resources (Kohler et al. 2010). Consequently, some mountainous regions experience depopulation caused by low fertility rates, lack of job opportunities and basic services, or due to natural disasters. In some regions this trend has serious consequences for the rest of the communities, for management of the landscape and land use (Batello et al. 2010; Gracheva et al. 2012; Kohler et al. 2017). Especially TEK, which has been proven to be an important part of the mountain livelihoods and for the management of ecosystem services (Berkes et al. 2000; Angelsen et al. 2014; Uprety et al. 2016), has been significantly declining due to outmigration in some regions (Ahmad & Pieroni 2016; Sõukand & Pieroni 2019).

1.3. Important questions in sustainable mountain development

In order to stabilize livelihoods of mountain people, they have to be included into the conservation of mountain ecosystems and development of social-ecological systems which they co-create (Sayer et al. 2013; Wymann von Dach et al. 2018). Local communities need to

be understood as key actors in protection and management of the landscape. Otherwise, top-down conservation efforts and exclusion of TEK result in conflicts over natural resources and it threaten their livelihoods (Nakhutsrishvili et al. 2009; Kohler et al. 2017). Among others, it requires recognition of TEK as complementary with scientific ecological knowledge (Berkes et al. 2000; Dudley 2008). This implicates integration of Traditional Ecological Knowledge into the management of natural resources and ensuring access to subsistence use of wild products by local communities (Rasul et al. 2012; Rasmussen et al. 2017; Wymann von Dach et al. 2018).

Thus, the following questions stand at the centre of sustainable mountain development: 1) what is the best way to involve local communities into management and protection of natural resources, and 2) how to improve and support their livelihoods which are becoming more insecure due to climate change (FAO 2011; Mitrofanenko et al. 2015). Along with accepting the fact that protected areas are not only "ecosystems" but also "social systems" (West et al. 2006; Rasul et al. 2012), the conservation efforts should be more inclusive to Traditional Ecological Knowledge and management practices. Therefore, it is important to identify 1) what the living knowledge and practice in different regions are, and 2) which role this knowledge can play in nature conservation and sustainable livelihood strategies (Nakhutsrishvili et al. 2009; Muccione et al. 2016).

The present research contributes to the current discussion with analyses of Local Ecological Practices and, livelihood strategies, as well as their implication for the sustainable development of a specific location of the planned Aragvi Protected Landscape (APL) in Caucasian Georgia.

2. Current issues in the Georgian Caucasus mountains

2.1. Georgia at a glance

Georgia is located in the central and western part of the Southern Caucasus. In the west, it is bounded by the Black Sea. In the northwest it borders the Russian Federation, to the east Azerbaijan, to the southeast Armenia and to the southwest Turkey. Its total area is 69,700 km^2 (FAO 2019b) or according to the Georgian records, 76,284 km^2 which include territorial waters of the Autonomous Republic of Abkhazia and Tskhinvali region (GEOSTAT 2019a). Despite its relatively small area, the country is very diverse in its climate, soils, vegetation cover, traditions and culture (Prince 2000; Bedoshvili 2008).

The terrain of Georgia is mostly mountainous and has three main landforms. In the northwest, the Greater Caucasus Mountain Range stands with the highest peak of the country, Mt. Skhara (5,068 m). To the south, the Lesser Caucasus Mountain System reaches up to 3,301 masl The two mountain systems are separated by an intermountain plain of an average width of 100 km (Akhalkatsi et al. 2010; GEOSTAT 2019a).

The Georgian climate varies from the humid subtropical zone at sea level to the permanent snow and glaciers on the mountain peaks. The different climate in Western and Eastern Georgia is reflected in vegetation cover. More humidity in Western Georgia creates favourable conditions for a forest cover right from sea level up to the subalpine zone (Bedoshvili 2008). In Eastern Georgia, areas below 600 m are covered with semi-deserts, dry grasslands and low-density forests. According to FAO (2019b), 12 different climatic zones and 49 types of soils can be found there.

Forest is a prevailing type of vegetation cover. It encompasses 3,112,000 ha, almost 40% of the country area. Above the forest climatic limit (1,800-2,300 masl) vegetation cover changes between sub-alpine herbaceous, forb and grass alpine meadows and subnival belt (Bedoshvili 2008). For the last twenty-five years, the area of forest land and permanent pastures and meadows remains almost the same. While high mountain meadows have been intensively used as pastures, middle mountain landscapes, due to their complex terrain present less favourable environment for economic activities (Salukvadze & Chaladze 2013). Thereby, 98% of forests and spots with pristine forests of high conservation value can be found on the steep slopes at middle elevations (GEOSTAT 2019a).

Nowadays, around 35% of the total area is classified as agricultural land. Georgia did not experience land abandonment after the USSR collapse as much as other Easter European

countries (Yin et al. 2018). However, there has been a decline in arable land and land under permanent crops to the benefit of "built up land" and "land not in use" which is presented in the Figure 1 as "other land" (FAOSTAT 2020). In 2017, agricultural land comprised 801,800 ha of arable land, 263,800 ha of permanent crops, 143,800 ha of permanent meadows and 1,796,600 ha of pastures. However, only 39% of arable land lies below 500 masl, 21% is located between 1,000-1,500 masl and 11% even above the altitude of 1,500 m. According to data from 2004, 95% of pastures and 45% of arable land was under state ownership (FAO 2019b; GEOSTAT 2019b; The World Bank 2019).

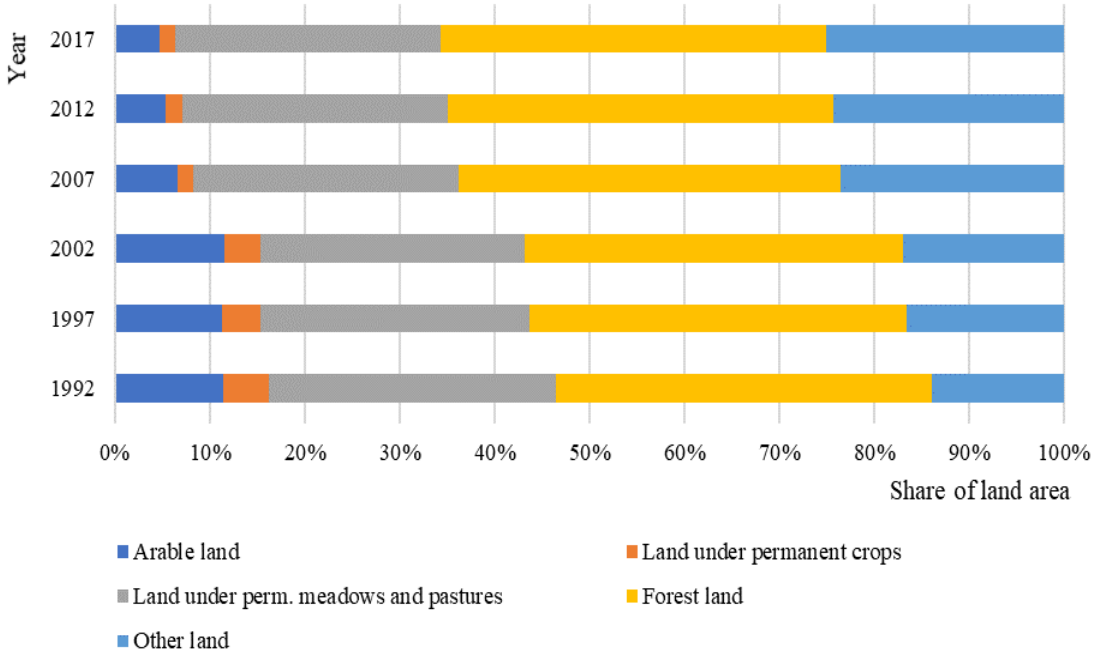

Figure 1. Area change of main land cover types in Georgia between 1992 and 2017, in five year intervals.

Due to the favourable climatic conditions, agriculture continues to be an important part of the country identity, cultural heritage, GDP and livelihood strategies. Agricultural activities and land use have been mostly determined by altitude, and characterised by temperature extremes, length of cropping season, excessive rain and soil erosion. Table 1 summarises elevation and related land use zones (GEOSTAT 2019a). Important annual crops ranked by annual harvest are potatoes, maise, vegetables (tomatoes, cucumbers), wheat, melons and hay. The main perennial crops are grapes, apples, citruses, peaches and nuts. Due to the land cover and climatic condition, livestock and animal production is an essential part of the Georgian agriculture. The most popular are cattle, sheep, pigs and poultry. In the last ten years, numbers of cattle and pigs have been shrinking while those of sheep and chickens expanded (GEOSTAT 2019b; FAOSTAT 2020). A traditional transhumance system across

the Caucasus slopes, regardless of borders, has stopped and is today limited to within-country shifting between high mountain summer meadows and semi-desert lowland winter steppes (Radvanyi & Muduyev 2007).

Table 1. Land use zones in Georgia determined by altitude.

Zone	Altitude masl	Agriculture activity
I. zone	< 250	mainly subtropical cultures in humid Western Georgia
II. zone	250-500	horticulture, viticulture, gardening and intensive cash crop production (mainly maise)
III. zone	500-1,000	cereal crops and other arable land, animal husbandry
IV. zone	1,000-1,500	grassland, few field activities
V. zone	1,500-2,000	grassland
VI. zone	> 2,000	no agriculture

Source: GEOSTAT 2019a

The territory of today's Georgia has been continuously inhabited since the early Stone Age. Population in 2019 totalled 3.7 million people. Settlements are concentrated mostly in the central lowland belt and on the coast. The average population density stabilised over the last years at 65.1 people per sq. km with a maximum of 2,322 people per sq. km living in the capital, Tbilisi, which is constantly growing. Minimal densities of 6.5 and 16.7 are respectively found in the Racha-Lechkhumi and Kvemo Svaneti region, and Mtskheta-Mtianeti region, both mountainous regions at the Russian border, of which the second encompasses the study site. Regarding the demographic situation, the country is facing two challenges. Firstly, the population is ageing. In 2019, 14.8% of inhabitants were over 65 years old. Secondly, up to a million people left the country between 1990 and 1996, which accounted for 20% of the overall population. Moreover, net migration stayed negative until 2004. Additionally to emigration, political conflicts resulted in 293,000 internally displaced people, mostly coming from the autonomous regions of South Ossetia and Abkhazia (Salukvadze & Meladze 2014; GEOSTAT 2019b; IDMC 2019).

Prevailing weak economy appears to be the main reason behind emigration. The GDP per capita in purchasing power parity (PPP) declined from almost 5,500 in 1990 to 1,600 USD in 1994. Currently, slowly growing GDP achieved 12,000 US per capita in PPP. Unemployment rate has decreased from 18.3% in 2008 to 11.6% in 2019 (The Bank Data, 2020). However, some experts argue that the unemployment level is around 30% (Salukvadze & Meladze 2014). In rural areas, a majority of the population practices subsistence farming and consider themselves self-employed (FAO 2019b). Average monthly income on household

level shows relatively small difference between 1,014 GEL in rural areas and 1,196 GEL in urban ones (GEOSTAT 2019b).

Until now, agriculture has played a very important role in the economy. Nowadays, almost 43% of the labour force works in agriculture representing about 7% of GDP (compared to 1992 when it rocketed to 52%). In terms of major food produce like meat, dairy products and cereals, the monetary import value is higher than that of exports (FAOSTAT 2020). In the last decade, the country experienced boom of the service sector induced primarily by tourism. Incidentally, 43% of the labour force works in services and 13% in industry. Industry accounts for a 20% share of GDP and services contributed 60% in 2018 (The World Bank 2019). Only recently, Georgian cultural and nature heritage has been re-discovered by international tourists (Tevzadze & Kikvidze 2016), but in this short period their number grew from 1.1 million in 2010 to 4.8 million in 2018, and the sector received broad governmental attention (UNWTO 2019).

2.2. Caucasus socio-ecological systems

The Caucasus is listed in two of the thirty-six "biodiversity hotspots" on Earth, and the flora of Georgia encompasses about 4,300 native species. Approximately, 21% of Georgian flora is endemic to the Caucasus and 300 species are strictly endemic to Georgia (Prince 2000; IUCN 2012). The tremendous biological diversity and wide range of ecosystems has been recognised by establishing 43 areas of nature protection according to IUCN guidelines which covers almost 9% of the country's total area (Slodowicz et al. 2018; The World Bank 2019). Since two-thirds of the country are mountainous with average elevation of 1,200 masl (Nakhutsrishvili et al. 2009), agriculture practices, cultures and societies have developed in relative isolation and show a strong adaptation to the extreme mountain conditions. Thereby, Georgian agriculture is characterised by a great diversity of landraces and endemic species of cultivated plants (Akhalkatsi et al. 2010; Batello et al. 2010). In addition, recent studies show prevailing rich Traditional Ecological Knowledge demonstrated by the abundance of wild plants and mushrooms used in remote and mountainous regions (Bussmann et al. 2016b, 2017b, 2018; Łuczaj et al. 2017).

2.3. Current threats to biological, agricultural and cultural diversity

According to Nakhutsrishvili et al. (2009), anthropogenic pressure became a serious threat to the Georgian mountain biodiversity. Degrading anthropogenic impacts emerged with agricultural intensification during the Soviet Union. Increases in the sheep and goat herds

caused overgrazing and soil erosion, especially on the high alpine meadows. Meanwhile, lowland broadleaf forests were intensively logged and converted into pastures and agricultural land (Salukvadze & Chaladze 2013). Although degradation of mountain ecosystems by overgrazing, infrastructure and intensification of agriculture may seem to benefit from the current depopulation, it has many shortcomings.

Mountain population has always been moving, voluntarily or due to enforced resettlement. Migration has been a part of the livelihood strategy that helped to cope with the limited resources or seasonality. It is preserved till today in forms of transhumance pastoralism (Ingty 2017; Hock et al. 2019). The Caucasian population was purposely resettled several times during the Tsarist regime and the consequent Soviet Union in order to control mountain peasants who were not in favour of collectivisation, to manipulate ethnic composition and to cultivate new land. During the soviet regime almost the entire population of Khevsureti was resettled and other regions such as Pshavi or Tusheti lost half of their inhabitants (Trier & Turashvili 2007). According to available studies, in several mountain regions population shrunk by 22-45% between 1989 and 2005 (Radvanyi & Muduyev 2007; Salukvadze & Meladze 2014). Although Kohler et al. (2017) demonstrated that the decrease correlates with altitude leading to a total abandonment in some villages.

The serious level of depopulation in the last decades became an important concern in the Georgian mountains (Radvanyi & Muduyev 2007; Nakhutsrishvili et al. 2009; Kohler et al. 2017). Depopulation has led to abandonment of settlements and social-ecological systems which had evolved with subsistence farming and traditional transhumance pastoralism (Gracheva et al. 2012). Consequent land-use and land-cover changes diminish provision of various ecosystem services such as aesthetic, recreational or productive (Theissen et al. 2019b). Until the 1990s, mountains functioned as the repository of ancient varieties of rye, wheat, barley, oat, common millet, legumes, vegetables, herbs, and spice plants because agriculture modernisation hesitated to transform steep slopes. However, recently the crop diversity has significantly decreased due to outmigration and erosion of the traditional farming practices (Akhalkatsi et al. 2010; Bussmann et al. 2014).

2.4. Population and livelihoods strategies in the Caucasus mountains

High outmigration from Georgian mountains has been driven by poor socioeconomic situations associated with low job opportunities, missing infrastructure and a lack of basic services (Kohler et al. 2017). The majority of the Georgian mountain population maintains its activities of subsistence farming and livestock grazing due to the absence of other income

sources (Gracheva et al. 2012). Political conflict with the neighbouring Russian Federation, currently latent, undermines the security of the border regions and the whole country (Salukvadze & Meladze 2014). However, cultural landscapes have been reviewed not only for their ecological value but also for their economic potential. Especially in relation to the growing importance of tourism in the Georgian economy (Gracheva et al. 2012). It has been documented that in regions already discovered by tourists, such as Kazbegi and Tusheti, peoples' livelihoods have been improved through new job opportunities, investment into infrastructure and international development cooperation programmes (Tevzadze & Kikvidze 2016; Applis 2019; Theissen et al. 2019a). Nevertheless, livelihood strategies are known to determine patterns of natural resource use and the economic relevance of different income sources (Cuni-Sanchez et al. 2019). This poses a question of how traditional socio-ecological systems can be preserved when people alter their livelihood strategy.

3. Literature Review of Local Ecological Practice

3.1. Concepts of Traditional Ecological Knowledge and Wild Food Plants

Only in the 1980s researchers and global institutions started to pay attention to traditional low-yielding crops and uncultivated wild products and their contribution to food security, nutrition and households' income mainly in rural and mountainous areas (Bharucha & Pretty 2010; Godfray et al. 2010; Menendez-Baceta et al. 2012; Rasmussen et al. 2017). So-called Non-Timber Forest Products (NTFPs) were defined as any materials or substances such as firewood, fibres, animals, fish, mushrooms, fruits, honey, herbs or insect "*obtained from forests that do not require the harvesting of trees*" (Leßmeister et al. 2018; Sacande & Parfondry 2018). Since then, it has been estimated that around 1 billion people rely on NTFPs. In 1990s institutions and scientists extended the range of focus from materials, products and substances to a more comprehensive study of why and how indigenous people and rural communities had managed the landscape (Berkes et al. 2000). Traditional Ecological Knowledge (TEK) emerged as a term to describe "*the knowledge held by indigenous cultures about their immediate environment and the culture (management) practices that built on that knowledge*" (Ford & Martinez 2000). Since then, interest in TEK has been growing with recognition of its positive impact on nature protection, conservation of biodiversity and rare species, ecological services and the huge potential for pharmaceutical industry (Mauro & Hardison 2000; Belcher & Kusters 2004; Hadjichambis et al. 2008; Bharucha & Pretty 2010).

However, TEK is not necessarily restricted to primarily forests. Products can be gathered in secondary forests, fallow agricultural fields, meadows, bushes and other basically open access spaces and have various uses (Belcher & Kusters 2004; Sardeshpande & Shackleton 2019). "Wild products" can be defined as any uncultivated plants, animals or mushrooms which are culturally important and locally available for gathering and hunting by local communities. (Powell et al. 2013). Wild plants may be related to processes associated with cultivation and landscape alteration driven by humans (Bharucha & Pretty 2010). Łuczaj et al. (2012) described that the term "wild" "*mostly includes native species growing in their natural habitat, but sometimes managed, as well as introduced species that have been naturalised*." The understanding of "wild" depends on local circumstances and history (Leonti et al. 2006; Çakir 2017). In contrast to NTFPs, Wild Food Plants or products (WFPs) concern with species collected as food, beverage, additives etc. which are not purposely cultivated but can be also found in homegardens.

3.2. Concept of Local Ecological Practice

Reyes-García et al. (2007) point out that TEK can be described on different levels from naming the local plants to knowing how to prepare a medicine from a plant. The majority of reviewed studies on TEK and WFPs from Eurasian mountains and neighbouring countries were focused on documenting total ethnobotanical knowledge and diversity of uses with local knowledgeable people (Hadjichambis et al. 2008; Łuczaj et al. 2013, 2017; Ari et al. 2015; Ahmad & Pieroni 2016; Hovsepyan et al. 2016; Bussmann et al. 2016b, 2017b). A few studies measured the actual usage in traditional cuisine and commercialisation (Leonti et al. 2006; Kang et al. 2013; Çakir 2017) and medicine (Hadjichambis et al. 2008; Bussmann et al. 2016a, 2018).

In contrast to the abundance of TEK centred research, there is a lack of studies on Local Ecological Practice (LEP) which Pieroni & Sõukand (2018) define as everyday practice of collecting and using wild species. They underline the fact that Traditional Ecological Knowledge can be passive. In other words, communities may preserve their knowledge while they have abandoned active application of the knowledge. While the knowledge can be important for conservation, it does not necessarily contribute to livelihood strategies. Ahmad and Pieroni (2016) describe that TEK depends on direct active involvement in the gathering of WFPs, and declines once people leave their original home for studies or work in urban areas. Similarly, Pieroni and Sõukand (2019) concluded that young generation might show high level of knowledge when staying with their families, but once they leave to urban areas, they lose opportunities and their relation to the practice and, consequently, the knowledge. Therefore, the knowledge will not be sustained without the practice.

3.2.1. Importance of wild food products in rural livelihoods and nutrition

Wild food has been celebrated for its nutritional and dietary benefits for rural communities (Powell et al. 2013; Hovsepyan et al. 2016). Bharucha and Pretty (2010) point out that in many cases, wild food does not contribute much to caloric intake as it functions as a source of vitamins, minerals and other micronutrients. Powell et al. (2013) demonstrated that in Tanzania, wild food contributed only 2% of energy in the sample population. Yet, it contributed 31% of vitamin A, 20% of vitamin C, and almost 20% of iron consumed. WFPs have shifted from nutrition food to fruits as snacks, herbs for teas and wild greens for salads (Łuczaj et al. 2012; Ahmad & Pieroni 2016; Pieroni & Sõukand 2018).

Many commonly collected wild plants or fruits are used for more than a single purpose. For example, Hadjichambis et al. (2008) documented that 31% of recorded wild food species in the Mediterranean region were also known and collected for their medicinal effect, which is confirmed by more studies (Leonti et al. 2006; Bharucha & Pretty 2010; Yeşil et al. 2019). Several authors (Pardo-de-Santayana et al. 2007; Łuczaj et al. 2012) point out that in history, wild food served as essential nutritional and safety net for survival of the poorest households during periods of droughts, unexpected yield loss, natural disasters or conflicts. NTFPs and WFPs can be gathered spontaneously and thus fill gaps caused by a sudden loss of yield or usual season shortage during winter or dry season (Rasmussen et al. 2017; Pieroni & Sõukand 2019).

Currently, NTFPs and WFPs contribute more to subsistence consumption of rural households than to income because their potential has not been utilised (Rasmussen et al. 2017). Hickey (2016) analysed that WFPs contribute 4.2% of the total household income in several tropical countries in Africa, Asia and Latin America. In Pakistan's mountains, only 7 recorded species, accounting for 14% of collected WFPs, were commercialised (Ahmad & Pieroni 2016). In Turkey, Yeşil et al. (2019) encountered 12 species (16%). In general, poorer families derive a higher income share from NTFPs and WFPs. Simultaneously, families with higher cash crop income tend to have a lower share derived from NTFPs or WFPs (Angelsen et al. 2014; Hickey et al. 2016).

3.2.2. Loss of Traditional Ecological Knowledge and practice

Most of authors agree that TEK has dramatically deteriorated around the world in the last century (Benz et al. 2000; Łuczaj et al. 2012; Tontisirin 2014; Hickey et al. 2016; Baykal & Atamov 2017; Hovsepyan et al. 2019). Loss of TEK is often associated with a change of opportunities and lifestyle, depopulation, urbanisation and education. An important factor in the preservation of the level of TEK is access to urban areas and modernisation (Çakir 2017). According to Kang et al. (2013) and Bussmann et al. (2017b), more remote communities hold superior TEK. Nevertheless, communities in Azerbaijan with good access to the city show a low diversity in WFPs use, while isolated communities show considerable differences in the level of the knowledge (Pieroni & Sõukand 2019). A comprehensive study in Europe affirms that people rather choose accessible commercial food because wild food gathering is more time consuming and requires more effort (Łuczaj et al. 2012). Especially, knowledge of medicinal species and their use has declined and is remembered only by elderly people.

Young people rather use commercial medicine because it is available, accessible and believed to be more effective (Ari et al. 2015; Baykal & Atamov 2017).

3.2.3. Traditional Ecological Knowledge in Georgia

Ethnobotanical studies in Georgia demonstrate a tremendous variety of locally used species. Bussmann and fellow colleagues from Institute of Botany of Ilia State University (Bussmann et al. 2014, 2016b, 2017b, 2018) inventoried traditional plant knowledge in several mountainous regions across Georgia. In 2013-2015, this study included the Khevsureti region, namely the villages of Barisakho, Roshka and Kobulo which are also part of our study site. According to their research published in 2017, 74 Khevsuretians and people of the neighbouring Tusheti region, named in total 317 useful species, of which 197 species were exclusively wild harvested, 73 were grown in gardens and 47 were harvested in both environments. The total number of species and diversity of uses was higher than in comparable studies done across other Georgian regions and most Eurasia. Recorded use categories comprise construction, cultural, food, fuel, medicinal, poison, utensils and tools, veterinary. Species of high Use Value (UV) tended to be common garden and orchard species such as *Solanum tuberosum* L., *Allium victorialis* L., *Rubus ideaeus* L. Authors underline this result with a long tradition of crop cultivation and with the centre of origin of some domesticated crops being located in Georgia. While for medicinal purposes, wild species were predominant, garden species were more common in the food category.

Another study on ethnobotanical knowledge in Georgia was conducted by Łuczaj et al. (2017). In March and June 2016, the research team visited the Imerety region in western Georgia and interviewed 41 knowledgeable informants about traditional use of wild greens. In total, they documented 53 species, with informants mentioning 10.4 species on average. Wild green vegetables are predominantly used in a traditional dish called *pkhali* – ფხალი. Use of all available plants indicates a strong adjustment of local people to difficult conditions, especially to long winters.

The above-mentioned studies focused on TEK and documented tremendous diversity use useful species and their uses. However, Kavtarishvili (2015) described that only 38% of households were involved in LEP in Tusheti protected areas, and similarly, Tevzadze & Kikvidze (2016) recorded a significant decline in households participation in Upper Adjara and Inner Upper Svaneti on the example of 16 wild food and medicinal species.

4. Aims of the Thesis

As the literature review suggests, households in the Georgian mountains are facing various challenges in sustaining their livelihoods, and at the same time they are key actors in the conservation of natural and cultural heritage, and traditional socio-ecological systems. Subsistence crop and husbandry farming have been an important part of these traditional systems and have been contributing to the current agricultural, cultural and biological diversity. Even though subsistence agriculture continues to be the dominant form of the mountainous farming systems of the Caucasus, agricultural practices have been altered impacting diversity, landscape and livelihoods. Besides diversity of cultivated crops, Georgian mountain people preserved extremely rich knowledge of local useful species. Although, importance of Local Ecological Practice for rural livelihoods and sustainable resources management has been recognised, it has been seriously declining.

Build on the aforementioned issues and the literature review, the main aim of the thesis was to document livelihood strategies of the Aragvi Protected Landscape households in connection to agricultural production and LEP. In order to meet this aim, we set four specific objectives:

1. Describe households' characteristics in the Aragvi Protected Landscape and gain understanding of their livelihood strategies.
2. Analyse relations between on one side households characteristics, involvement in agriculture and in LEP, and on the other side three selected factors affecting livelihoods: type of main income activity, accessibility to urban areas, and type of land tenure.
3. Document agricultural production in the APL regarding crop diversity, livestock herding and commercialisation of local produce.
4. Map LEP of wild food plants and mushrooms and investigate its contribution to the current and future livelihoods.

5. Methodology

5.1. Study site description

The study was conducted on the territory of the Aragvi Protected Landscape (APL) (Figure 2). The Government of Georgia designated the territory a protected landscape, but it has not been legitimised yet. The APL's name is derived from the river system flowing through the entire area and forming individual valleys (communities). From the North, the Khevsuretis Aragvi flows to the South through the Piraketa Khevsureti valley. The Pshavis Aragvi starts in the East in the Ukanapshavi valley, flows to the West and after a confluence with the Khevsuretis Aragvi, it continues south through the Pshavi valley. The third part of the study site is the Gudamaqari valley in the West formed by the Gudamaqris Aragvi (also called Shavi Aragvi). Both river branches join in the Zhinvali Reservoir which lies outside the study site in the South. The area of APL adjoins to already existing Pshav-Khevsureti National Park in northeast, Tusheti Protected Areas in the east and to a system of segments

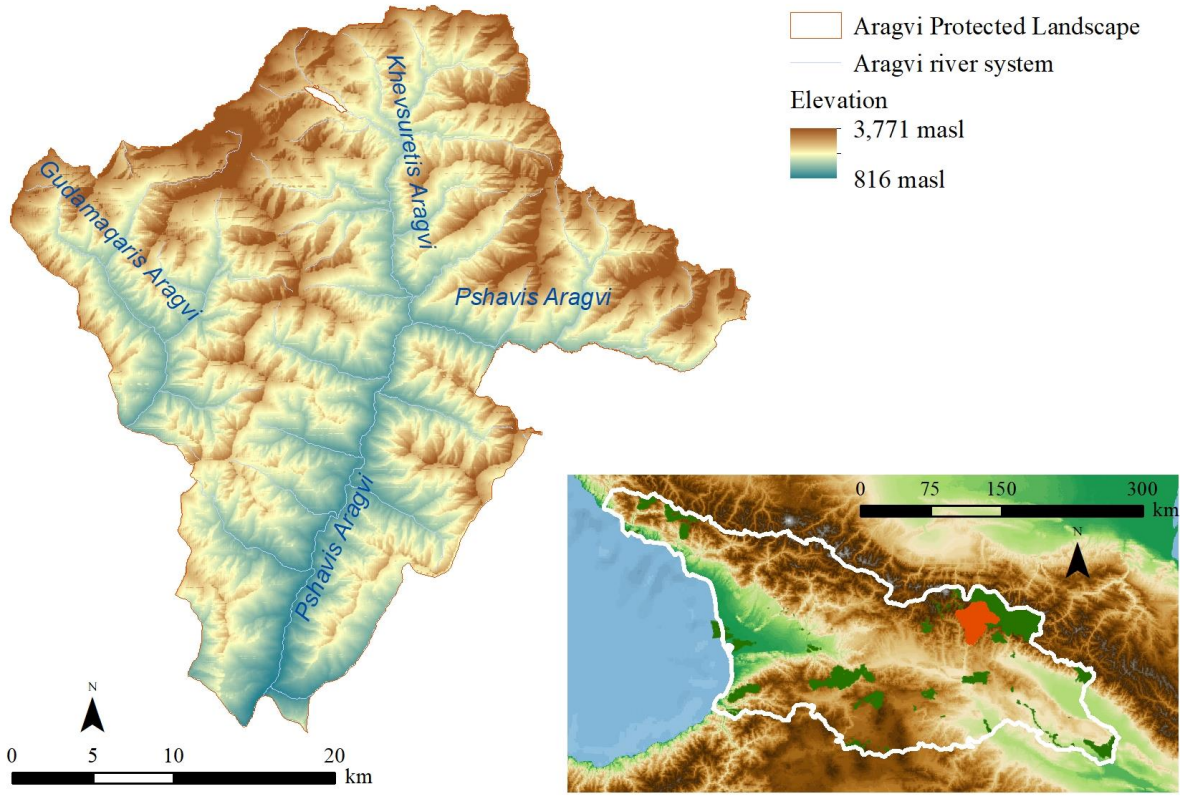

Figure 2 The planned Aragvi Protected Landscape topography and location.

Note: Location of the APL (red) within Georgia surrounded by Pshav-Khevsureti National Park, Tusheti Protected Areas and segments of National Park Kazbegi (dark green areas, bottom right). Elevation of the study site with parts of the Aragvi river system (left).

The area is characteristic with well-preserved landscape of the southern Caucasus, with scattered settlements and great diversity of natural habitats. Such diversity results from the vertical gradient ranging from approximately 850 masl in the Pshavis Aragvi valley to the altitudes of the Chaukhi massif peaks exceeding 3,700 masl. The vegetation involves a multitude of formations from oak-hornbeam forests in steep valleys of the foothills and beech forests to subalpine scrub and grazing land, alpine grassland, rocks and minor glaciers that are home to a large number of rare, threatened or Caucasus endemic flora and fauna species (Salukvadze & Chaladze 2013; Hošek 2018).

The area is administered by thw Mtskheta-Mtianeti Region and Dusheti municipality. The APL covers 4 communities (Figure 3), in Georgian *temi*[1]: Pshavi (*Magharoskaris temis*) with the centre in Magharoskari village, Ukanapshavi (centre Shuapkho), Piraketa Khevsureti (centre Barisakho) and Gudamaqari (centre Kitokhi). The Northern part of the Khevsureti historical region (Pirikita Khevsureti) has since 2014 been under protection as Pshav-Khevsureti National Park and thereby is not included in the APL (FAO 2015). Only the Southern part – Piraketa Khevsureti is part of the study site (names are very similar and may cause confusions).

Ethnographically, the area is very diverse. Pshavi and Khevsureti were culturally and spiritually important mountain regions in the past. Each valley is home to Kartvelian sub ethnic groups of Pshavians, Khevsurs and Gudamaqarians (Bussmann et al. 2017b). Nevertheless, the people share most of their cultural and social characteristics. They have common sanctuaries, common feasts and religious holidays, resembling material (including cuisine) and spiritual culture, and similar agricultural management practices. Like other Georgian mountain regions, inhabitants have been strongly connected to their original territories and to nature. Their relation can be noted by the number of religious monuments widespread in vicinity of villages, and by the continuous practice of spiritual and cultural rituals (Hošek 2018).

[1] a settlement within the former administrative division of the country

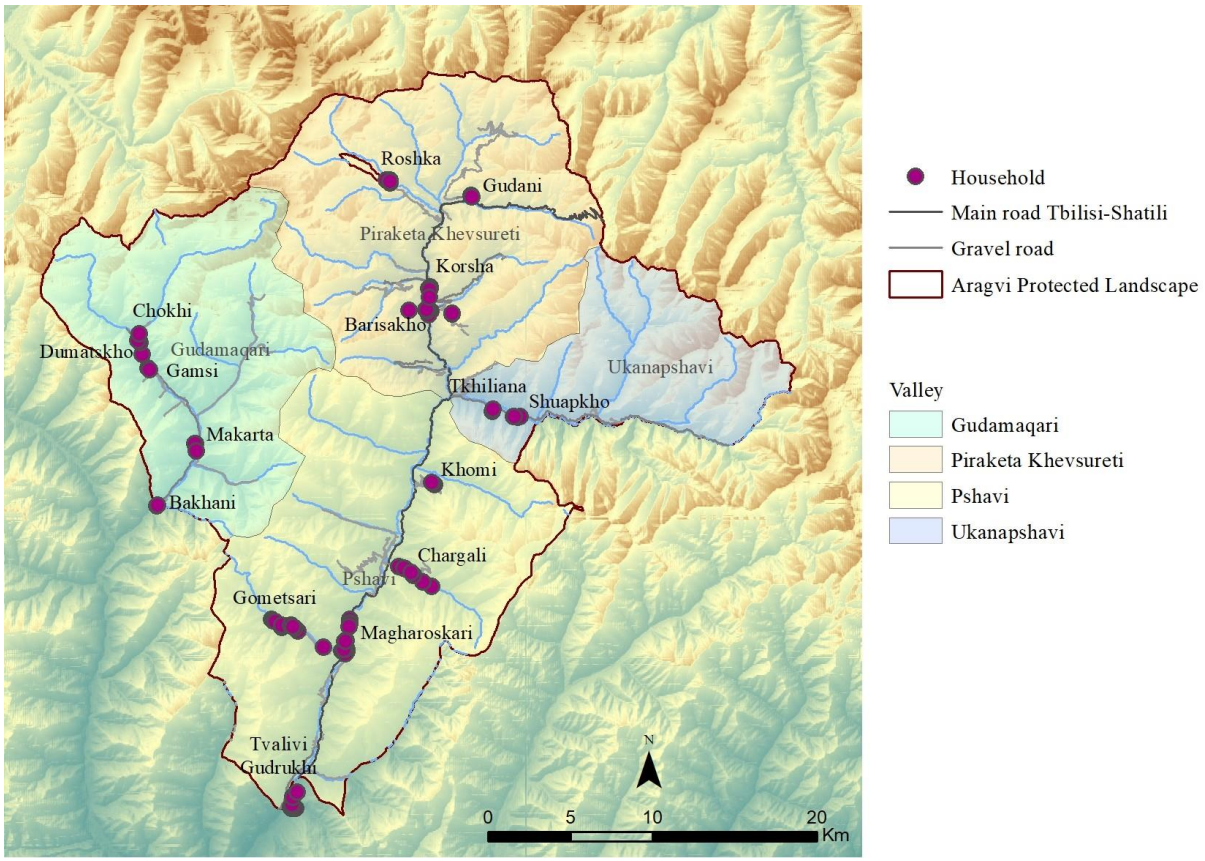

Figure 3. Four administrative units od APL and sample households' distribution.

Map source: sustainable-caucasus.unepgrid.ch

There is an ongoing trend of depopulation of villages, regardless of the efforts of the former and current governments such as provision of the public services or agricultural mechanization. According to the 2002 census, 90 villages existed in the study area with 2,299 inhabitants including Pirikita Khevsureti, which is not part of the APL. According to the same census, 154 inhabitants in 13 villages were registered in Ukanapshavi, while only six villages counted more than 10 people. Piraketa Khevsureti was home to 615 people, of which 215 lived in the central village of Barisakho and only 12 of the remaining 37 villages counted more than 10 inhabitants (5 villages registered only one inhabitant and 7 had none). The population in the Municipality of Dusheti declined over 36% to 26,000 inhabitants between 1995-2019. In 2002 the population was 29,200 (GEOSTAT 2003, 2018). Table 2 presents the population of selected villages and mean household members in APL. Visited villages and households' location are visualized in Figure 3.

Table 2. Population in the Aragvi Protected Landscape.

Community (valley/village)	Inhabitants (n=2,299)	Interviewed households (n=94)	Average household size
Pshavi	848	52	3.73 (±1.78)
Magharoskari	280	21	4.00 (±1.51)
Gometsari	135	10	4.70 (±2.33)
Chargali	100	9	3.22 (±1.03)
Tvalivi	80	8	3.00 (±1.58)
Khomi	26	3	2.67 (±1.70)
Gudrukhi	65	1	2.00 (±0.00)
Apsho	8	0	/
Khevsureti	615	25	4.44 (±2.48)
Barisakho	215	11	4.45 (±2.06)
Korsha	92	6	3.00 (±1.63)
Roshka	53	5	4.80 (±1.94)
Gudani	48	3	6.67 (±3.86)
Ukanapshavi	154	6	5.00 (±3.37)
Shuapkho	38	4	3.50 (±1.50)
Tkhiliana	43	2	8.00 (±4.00)
Matura	3	0	/
Gudamaqari	682	11	3.64 (±1.77)
Gamsi	55	2	5.50 (±1.50)
Bakhani	26	2	5.50 (±0.50)
Makarta	46	3	2.67 (±0.94)
Dumatskho	21	1	4.00 (±0.00)
Chokhi	17	3	2.00 (±0.82)

Source: GEOSTAT 2003, own collected data

Note: Inhabitants' data are from 2002. Number of respondents from each village and average household size are results from the data collection in 2019.

5.2. Theoretical framework

Given that this study aimed at exploring relations between diversified livelihood strategies and Local Ecological Practice, the applied approach combined elements of the sustainable livelihoods framework (DFID 1999; Ofoegbu et al. 2016) with quantitative ethnobotany research (Hoffman & Gallaher 2007) also adopted by Sher et al. (2010). The household was taken as the basic unit of analyses because of the expected share of capital (nature, human, physical) within the household. As same approach can be found for example in Pieroni and Sõukand (2018) and Negi et al. (2009).

In order to classify livelihood strategies, the activity choice approach was adopted (Sun et al. 2019) which influenced the design of used methods. As a result, households were divided into "farming" and "diversified" according to their main income generating activity. However, both groups of households embodied various livelihood strategies: wage-employment, self-employment, commercialised farming, commercialised herding, or non-labour.

It has been pointed out that socio-economic household characteristics influence preferences towards utilisation of plant species, especially wild species (Lawrence et al. 2005; Rasmussen et al. 2017) indicating the necessity for a more disaggregate analysis (Angelsen et al. 2014). Therefore, the factors of household remoteness and type of land tenure were implemented for separate analyses of relation between household characteristics and utilisation of cultivated and wild species.

The ethnobotany research design built on the Urbanisation and knowledge loss hypothesis (Gaoue et al. 2017) adapted to the context of the study site. Consequently, research incorporated households' perception of LEP in past and future. As Reyes-García et al. (2007) pointed out, ethnobotanical studies differ on how and what they measure. Present research focused on wild food plants and mushrooms (WFPs) according to the study on LEP by Pieroni and Sõukand (2018). Following up on the discussion on what "wild" means, Menendez-Baceta et al. (2012) argue that the term applies to plants and mushrooms that "grow without being cultivated", embracing non-cultivated species gathered on homegardens, fields and abandoned fruit trees.

5.3. Research design

To address the research questions, a feasibility visit was conducted in September 2018 and a fieldwork lasting four weeks in July 2019. The research combined various methods: questionnaires, informal interviews, transect walks and observations.

5.3.1. Procedures

During the feasibility visit, observations, transect walks and informal interviews with local people were applied. After receiving verbal consent from respondents, questionnaires were pre-tested on twenty-four respondents from three communities: Pshavi, Ukanapshavi and Gudamaquari. Amendment was afterwards incorporated in the questionnaire. In the first two valleys, a non-native interpreter accompanied the visit. In addition, the preliminary visit was used to establish contacts with people across the study site for the sake of the second research phase.

Following the procedure of Hovsepyen et al. (2019), the fieldwork in 2019 began with visits of vegetable open-air markets in Tbilisi (market at Didube bus station), Dusheti and Passanauri. The aim was to map commercialisation of agricultural produce from the study site along with its prices. Observations and informal interviews with venders were carried out.

The fieldwork proceeded with a formal visit to community representatives from the APL, neighbouring Pshav-Khevsureti National Park, the Dusheti municipality and representatives from the Czech Development Agency. The research and its objectives were briefly presented to the stakeholders, and thus gained informal approval. In the next steps, around fifteen informal interviews, focused on understanding of the livelihood strategies, were carried out with various stakeholders.

During the final stage of the fieldwork in 2019, questionnaires were collected from ninety-four households in seventeen villages. Villages were visited during the weekdays. In July and August many seasonal inhabitants like school children and people living abroad come for holidays. Depending on household members present, filling in the questionnaire was usually a collective work – one person writing down and the rest of the family advising. People were informed about the purpose of the study and background of the authors, and interviewed after giving an informed verbal consent. The Code of Ethics of the International Society of Ethnobiology was followed (International Society of Ethnobiology 2006). Most of the questionnaires were carried out in the participants' houses, or businesses (local shops). However, some people were approached on the street, in a shop or while visiting their

neighbours. Participants could decide either to fill out the questionnaire themselves, or let the interpreter read out and note their answers. Around half of the questionnaire was written down by the interpreters. The researcher was always present and checked the process thanks to a basic knowledge of Georgian.

5.3.2. Methods

Quantitative data were collected by a set of methods. Questionnaires were selected as a core method (Baykal & Atamov 2017; Bussmann et al. 2017b; Pieroni & Sõukand 2018), and complemented by semi-structured interviews (Kang et al. 2013; Ari et al. 2015; Sõukand & Pieroni 2019), transect walks (Hadjichambis et al. 2008) and direct observations (Hovsepyan et al. 2016).

The process started with observations and transect walks to gain the overall impression on the landscape, homegardens, husbandry and infrastructure. Since observation is not free from researcher biases, other objective methods should cross-check the findings (Dudney et al. 2015). Consequently, informal and semi-structured interviews were held with the key stakeholders. This method facilitates better understanding of underlying processes and values, yet it is also subject to researcher's bias (McIntosh & Morse 2015). Importantly, such information helps to interpret quantitative data (Lawrence et al. 2005). However, the quality of information obtained from interviews relies upon the level of trust, the character of the interviewer and intercultural competences (Gaoue et al. 2017).

Finally, questionnaires were used for their implicit advantage of time efficiency and attainable sample. Another strength of the method is that data are categorised and standardised, which simplifies their analyses and potential comparability. Also, Dudney et al. (2015) suggest that free response questionnaires avoid some of the researcher's bias and allow for more diversity. Form structure followed the research questions and variables identified to answer the questions. The form combined open-end questions, dichotomous questions and free-listing for the second and the third section, which is a common approach in the field (Reyes-García et al. 2007; Kang et al. 2013). Questionnaires were first written in English and then translated and adjusted by a local schoolteacher into the Georgian language and printed out in Georgian alphabet.

During the fieldwork, herbarium samples were not collected. On the one hand, it would not be feasible given the scope of the field trip and the fact that not all species were available in July. On the other, a comprehensive ethnobotanical research was recently

conducted in the study site by a team of ethnobotanists (Bussmann et al. 2016b, 2017b). Also, the research aimed at the living practice where folk names were an essential entry for the analyses. Thereby, we followed approaches used by Lawrence et al. (2005). Collected local vernacular names were referenced with the matching species in the studies from the region. Additionally, images of crops, plants, their environments and processes were recorded. When available, dried samples were collected and later identified together with images by a local botanist.

5.3.3. Sampling

Households were selected through purposive sampling in line with common practice (Benz et al. 2000; Bussmann et al. 2017b; Pieroni & Sõukand 2019). In the first step, from each of the four former administrative units a number of households was selected that is proportional to its total population. The reason for differentiation between communities was that other research comparing mountainous communities across Georgia encountered significant differences in number of livestock per households and husbandry practices, in dialect, local terminology and use of wild foods (Akhalkatsi et al. 2010; Bussmann et al. 2014, 2016b; Tevzadze & Kikvidze 2016). In the next step, villages which were uninhabited according to the 2002 census and according to informants approached during the feasibility visit, were excluded from the sampling. The remainder are listed in Table 2.

In the last step, households were selected using the snowball method (Kang et al. 2013; Łuczaj et al. 2013). Usually, first households were proposed by the interpreters who at the same time were familiar with the community. Other households were either proposed by respondents or found via systematic walks through the village, visiting houses and asking the inhabitants if they want to take part in the research.

5.4. Data

5.4.1. Data collection

Data collection in each village was initiated by transects walks focused on infrastructure and community services available. In this process, sizes of homegardens, appearance, crops, cropping system, husbandry and processing facilities around the houses were observed.

Informal interviews were carried out with different stakeholders: two schoolteachers, a manager of the regional open-air market, farmers, four guesthouse managers, a coordinator of a local development programme and a team of people working on the management plan for

the protected landscape. Interviews were held in English directly between the researcher and the interviewee and directly noted down.

After these general observations in the village, households were selected (see section 5.3) and interviewed by means of a questionnaire. The latter contained three sections with different types of questions. Firstly, people were asked about their households' characteristics and a few socio-economic data. The second part focused on agricultural produce of the household. It consisted of free listing of all the crops grown and all the animal products made. Respondents were asked to self-asses if agriculture was their main income generating activity and if they had registered their traditional land tenure. The third part was dedicated to WFPs. It started with the question whether they collected any wild products, followed by a free listing of all usually collected species, their parts, distance and for example processing. Dudney at al. (2015) noted that a plant's value might be underestimated if use categories are too broad. Therefore, there were no predefined categories.

The three sections were structured in a table to order questions in columns and values for each product in a row. In the first row, a model answer for each column was provided. Giving an example directly influences first entry of the respondents. Therefore, results cannot be used to analyse the importance of species according to their order in the list (Dudney et al. 2015). All variables, data types and categories are listed in Table 3.

Table 3. List of variables collected through questionnaires.

Variable	Unit	Data type	Categories
Household demographic profile			
Household members	Person	Continuous	
Age	Years	Categorical (ordinal)	1-86
Achieved education	/	Categorical (nominal)	Public school High school Specialised school University
Years of schooling	Years	Categorical (ordinal)	0-12
Gender	/	Categorical (nominal)	Male Female
Decision making members	/	Categorical (binominal)	Yes No
Seasonal migration patterns	/	Categorical (nominal)	Permanent Seasonal Temporal
Number of months approximately staying in the house	Months	Categorical (ordinal)	1-12

Table 3. Continues.

Variable	Unit	Data type	Categories
Household socio/economic information			
Economic status of household members 15 years and older	/	Categorical (nominal)	Employed Unemployed Self-employed Retired Parental leave Social support Student
Type of occupation	/	Categorical (nominal)	
Salary	Lari/month	Continuous	
Remittances or other financial contributions from relatives	/	Categorical (binominal)	Yes No
Farming as a main income generating activity	/	Categorical (binominal)	Yes No
Type of other income activities	/	Categorical (nominal)	
Agricultural production			
Land official ownership	/	Categorical (binominal)	Yes No
Agricultural produce	/	Categorical (nominal)	
Place of production	/	Categorical (nominal)	Vegetable garden Fruit garden Yard Meadow House
Amount produced per season per product	kg/litres/pieces per season	Continuous	
Agricultural marketing			
Product commercialisation	/	Categorical (binominal)	Yes No
Place of commercialisation	/	Categorical (nominal)	Neighbours Acquaintances At the house Markets Local shops Other
Average amount sold per season per household	kg/litres/pieces per season	Continuous	
Price per unit	Lari/unit	Continuous	
Livestock			
Animal	/	Categorical (nominal)	
Livestock number	Animal head	Continuous	
Wild Food Plant and Mushroom			
Practicing WFPs gathering	/	Categorical (binomina)	Yes No
Wild food product	/	Categorical (nominal)	
Part(s) collected	/	Categorical (nominal)	Flower Leaf Whole plant Fruit Fruiting body

Table 3. Continues.

	Variable	Unit	Data type	Categories
	Use of product	/	Categorical (nominal)	Medicinal Food Beverages Alcoholic beverages
	Volume collected per household per season	kg	Continuous	
	Estimated distance of collection of the product from the house	km	Continuous	
	Months of collection of the product	/	Categorical (ordinal)	April-October
WFP commercialisation				
	WFP marketing	/	Categorical (binominal)	Yes No
	Place of commercialisation	/	Categorical (nominal)	Neighbours Acquaintances At the house Markets Local shops Factory Other
	Volume sold per household per product per season	kg	Continuous	
	Price per unit per product	Lari/unit	Continuous	
Perception of LEP				
	Members practicing LEP	/	Categorical (nominal)	
	Source of knowledge about LEP	/	Categorical (nominal)	
	Does your household collect more/same/less than before (app. 10 years ago)?	/	Categorical (ordinal)	More Same Less
	Do you think there will be more or less of wild products to collect in the near future?	/	Categorical (ordinal)	More Same Less
	Do you think your household will collect more or less products in the near future?	/	Categorical (ordinal)	More Same Less

5.4.2. Data processing

Questionnaires were translated from Georgian into English by the author and, if necessary, one of the interpreters was consulted for the translation. Paper forms were transcribed into an Excel database. Responses from the second and third section of the questionnaire were standardised, following the recommendation of Reyes-García et al. (2007), into corresponding categories itemised in Table 3. Volumes of production were recorded in various local measurements units and recalculated according to own notes about the length of the milking season, vegetable season, volumes of different bags and with the use of an online calculator (https://www.aqua-calc.com/calculate/food-calories). The spelling of plant and

fungi names written in Georgian alphabet was transcribed into Latin alphabet following Bussmann et al. (2017b) and Ethnobotany of Caucasus (Bussmann 2017).

Data from households were divided in two groups according to the three factors: type of income, accessibility, and type of land tenure. Type of income and land tenure were self-assessed by informants in questionnaires. Data about accessibility was drawn from a household survey across APL conducted in spring 2018 for the purposes of the Czech Development Agency (Kubec 2018). In this study, settlements were given a score according to local communities' perception of the road quality and accessibility in winter. A score for frequency of the public transport was added along with altitude. Resulting division is in Table 4. In several studies from the mountains (Kang et al. 2013; Bussmann et al. 2017b), accessibility and vicinity to urban areas was observed to correlate with the level of TEK. Altitude was included into the selection of focused villages according to previous findings that local flora varies with increasing altitude and consequently TEK varies with plants in proximity (Pawera et al. 2016). Elevation score came from Table 1.

Table 4. Classification of the villages according to elevation and remoteness.

Cluster	Elevation	Village name	Number of households
Good access	820-1,420 masl	Bakhani, Barisakho, Chargali, Gamsi, Gudrukhi, Korsha, Makarta, Magharoskari, Tvalivi	63
Limited access	1,180-2,000 masl	Chokhi, Dumatskho, Gometsari, Gudani, Khomi, Roshka, Shuapkho, Tkhiliana,	31

Source: Kubec 2018, own collected data

5.4.3. Data Analyses

Data analysis was conducted in three steps. Initially, descriptive statistics were applied to investigate the household characteristics and communities' demographic situation. These were compared with national statistical data and literature findings from the country and region (Radvanyi & Muduyev 2007; Salukvadze & Meladze 2014; Kohler et al. 2017; GEOSTAT 2018, 2019b; Theissen et al. 2019b). Likewise, all listed crops, animal products and WFPs were described and evaluated according to the frequency of citation, volume of production/collection and marketing orientation (Bussmann et al. 2016a; Hauck et al. 2016). All operations were done in Excel.

The second step involved comparative analyses between socio-economic characteristics of the interviewed households. Households were divided into two independent

groups based on the self-assessed main income activity (farming, diverse), land ownership (traditional, official), or the accessibility level of the village (limited, good). Two groups of each input factor were then analysed for any significant difference in households' characteristics, agricultural production, and commercialisation as well as LEP. We used various statistical tests analogous to Ofoegbu et al. (2016) noted in results Tables 6 and 7, depending on the data distribution (most of the data were not normally distributed) and type of data (binominal, nominal, ordinal, continuous). SPSS software was used in this step.

In the third step, the importance of WFPs was examined through Relative Cultural Importance indices. These quantitative methods aim at transforming complex and multidimensional concepts of "importance" and "diversity" into comparable numerical values (Hoffman & Gallaher 2007). They stand in opposition to basic methods of frequency of citation or use report (Tardío & Pardo-de-Santayana 2008; Dudney et al. 2015; Zenderland et al. 2019). Quantitative indices were then interpreted using qualitative information gathered through other used research methods (Lawrence et al. 2005). The four quantitative indices were:

1) The Relative Frequency of Citation for a species (RFC_s) index calculates frequency of citation (FC) over the total number of informants (N) interviewed in the survey (Zenderland et al. 2019).

$$RFC_s = FC_s/N$$

2) The Relative Importance Index (RI_s) combines relative and maximum values of frequency and number of uses for each species (NU_s). (Tardío & Pardo-de-Santayana 2008). This index is not influenced by the number of respondents or consensus among uses. It may bias rankings towards species that are frequently used, but not necessarily valuable. (Dudney et al. 2015)

$$RI_s = (FC_s/FC_{max} + NU_s/NU_{max})/2$$

3) The Cultural Importance Index (CI_s) measures the spread and diversity of species' use. It is calculated as the summation of the number of informants reporting a plant-use (UR) in every use category (NC) mentioned for a species divided by the number of respondents (N) (Tardío & Pardo-de-Santayana 2008; Bussmann et al. 2017b).

$$CI_s = \sum_{u=u_1}^{uNC} \sum_{i=i_1}^{iN} UR_{ui}/N$$

4) Cultural Value Index (CV_s) highlights species with a high number of uses (NU_s) and high number of respondents (FC_s) (Hoffman & Gallaher 2007; Dudney et al. 2015).

$$CV_s=(NU_s/NC)*(FC_s/N)*CI_s$$

6. Results

6.1. Households characteristics

In the present study, 94 households from four valleys in the planned Aragvi Protected Landscape (APL) were interviewed. On average, a household consisted of four members with a minimum of one person and a maximum of twelve. The sample population counted 375 people, of which 253 stayed permanently in the area. Thus, 68% of the population lived in APL permanently, while 85% of households had at least one permanent member. Comparison of household characteristics in Table 5 shows only small differences between the four APL valleys. Up to 95% (89 households) practice subsistence farming, 81% (76 households) combined this with small livestock production consisting of 8 livestock heads per involved household in LSU. Less than half of the respondents commercialised their agricultural production. The results show that the more remote villages of Gudamaqari and Ukanapshavi tended to commercialise their agriculture more than villages on the Pshavi's main road and in the touristic villages of Piraketa Khevsureti. WFPs were gathered by 63% (59 households) but only 7% (7 households) mentioned selling WFPs. Gudamaqari stands out with higher unemployment and self-employment in agriculture of labour force than the other three communities, which have more access to job opportunities such as tourism.

The age structure of the sample population showed great discrepancies between both gender and age. There was a slight male bias of 52% over female despite the exactly opposite domination on the national level. The mean age for women was 39 and for men 36, which almost corresponds to the national average. While there were few children aged 0-4, the age group of 5-19 years had a high share on the sample population with 59% male bias. The highest difference was in the age class of 15-19 with 63% of men. A similar inconsistency in gender showed the economically important age class of 20-39 years, where women were underrepresented. This age group had an even smaller share of the female population than the group aged 40-59. The labour force, defined as the population between ages 15-64 (Kohler et al. 2017), accounted for 67% of the sample population, children under 15 years old for 18% and people over 64 years old for 15%. This result corresponds to the national age structure.

Table 5. Demographic and socio-economic characteristics of households per administrative units.

	Community			
	Pshavi	Ukanapshavi	Piraketa Khevsureti	Gudamaqari
Households	52	6	25	11
Permanent households*	49 (94%)	6 (100%)	19 (76%)	6 (55%)
Demographic household profile (Mean ± Std. Dev.)				
Average household size	3.73 (± 1.78)	5.00 (± 3.37)	4.44 (± 2.48)	3.64 (± 1.77)
Average household labour force	2.46 (± 1.49)	3.33 (± 1.75)	2.84 (± 2.27)	2.73 (± 1.74)
Agriculture Capacity (Households)				
Households practicing agriculture	49 (94%)	6 (100%)	23 (92%)	11 (100%)
Households with livestock	43 (83%)	5 (83%)	19 (76%)	9 (82%)
Households practicing commercial agriculture	19 (33%)	4 (67%)	11 (44%)	8 (73%)
Local ecological knowledge capacity (Households)				
Households involved in WFPs gathering	27 (52%)	4 (67%)	21 (84%)	7 (64%)
Households involved in WFPs commercialisation	5 (10%)	0 (0%)	2 (8%)	0 (0%)

* at least 1 permanent member lives in the household

The household economic situation revealed that the study site suffered from a high unemployment rate compared to other rural areas (5%) and to the Georgian average (12%). Only 36% of working age people in the sample population had regular employment with monetary income. The unemployment rate amounted to 22%. A higher share of unemployed labour force correlated with with limited access and with farming as the main income activity, as summarised in Figure 4. A same share of 22% represented self-employed people, mostly those involved in small-scale commercial farming or tourism. Consequently, most of self-employed households had their land under official tenure. Reflecting the age structure, high-school and university students accounted for 16%. However, they were encountered while supporting their family subsistence farming activities, particularly during the summer break.

Wage-employment in the region was concentrated in the most central villages along the main road and was highly dependent on public administration. For example, 24 recorded people were employed in one of the four community schools. In the case of Ukanapshavi and Gudamaqari, teachers and school staff outnumbered pupils. In the Piraketa Khevsureti valley, 14 men were employed at the border control. Other common professions were road service, marshrutka drivers, nurses, or police officers. Self-employment turned out to be an important livelihood strategy (Figure 4). Nevertheless, the service sector has yet to grow, and most self-

employed people work in agriculture. Respondents mostly declared being financially self-sufficient and no strong role of foreign or urban-to-rural remittances was found. Only eight households mentioned receiving outside financial support from their relatives.

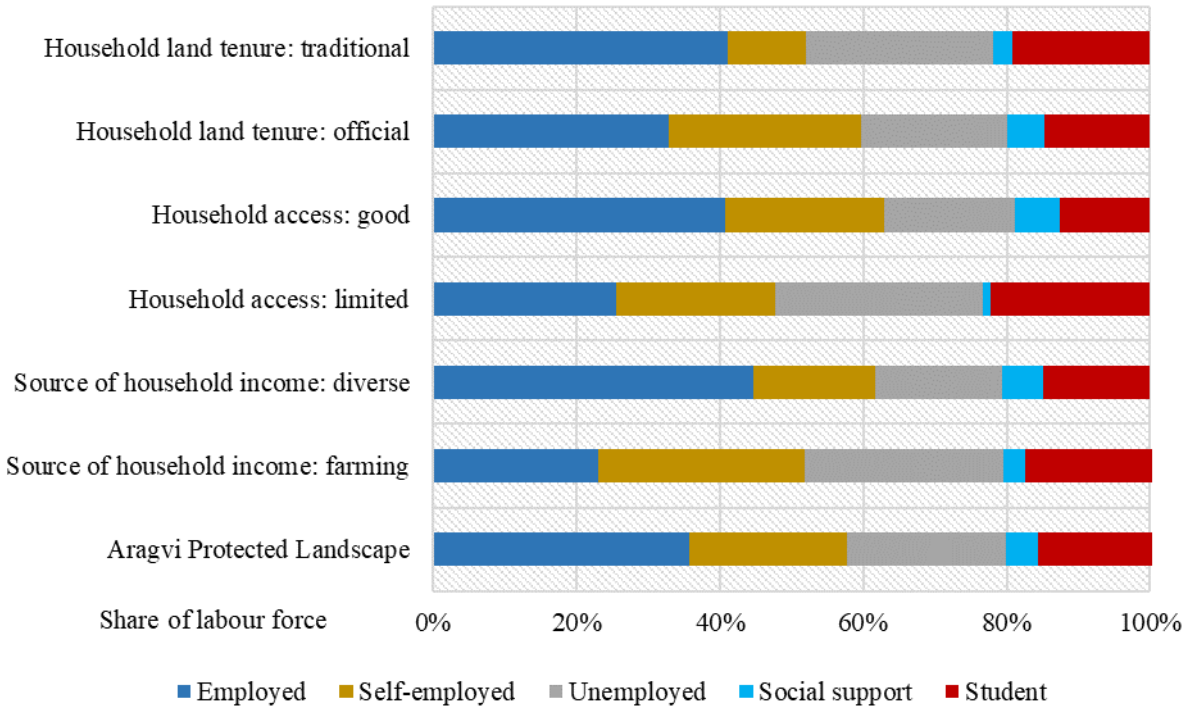

Figure 4. Distribution of livelihood strategies in the Aragvi Protected Landscape.

Note: Total households divided according to the three factors: main income generating activity, accessibility and type of household land tenure. Labour force is calculated as a sum of all household members aged 15-64 years. Social support status includes people receiving pension, parental support, and early pension.

6.2. Analyses of household characteristics, agriculture and LEP

A first analyses factor, the main income generating activity, did not have a significant relationship with any of the tested households' characteristics. Accessibility was significantly related to land tenure (Pearson Chi-Square, p=0.030, weak relation), i.e. communities with better road access and regular public transport had their land officially registered more often than communities in remote parts of the study site. Both accessibility and type of land tenure related to the household head's origin. Thereby, household heads were more likely to be born in APL when they lived in remote villages (Pearson Chi-Square, p=0.023, weak relation) or had a traditional land ownership (Fisher's Exact Test, p=0.038).

Analysing relations between the three household input factors and agricultural production variables revealed several strong connections which are summarised in Table 7. All households were almost equally involved in subsistence farming, but those fully

dependent on income from agriculture typically combined crops with livestock (Fisher's Exact Test, p=0.003). In parallel, they managed more animals than the diversified income group (on average 10 livestock units comparing to 3) (Mann-Whitney U test, p=0.007), and had a more diverse range of dairy products, meat, eggs and honey (Mann-Whitney U test, p=0.002). On average farming households produced 780 kg of crops and 543 kg of animal products while households with diverse income sources grew 530 kg and produced 315 kg of dairy products, meat and honey. Households with main income from farming activities were more often involved in produce commercialisation (Pearson Chi-Square, p=0.001, strong relation) and offered a higher number of produce on average (Mann-Whitney U test, p=0.001).

Similar relationships can be observed when analysing the impact of accessibility. While there was no connection with keeping livestock as such, remote households tended to keep more animals (Mann-Whitney U test, p=0.027) and consequently prepare more varied animal products (Mann-Whitney U test, p=0.033). On average, crop production per household was 630 kg, and was not influenced by accessibility. However, remote households contributed with 684 kg of animal products compared to 276 kg by families in more accessible villages.

The comparison of two groups of households with official or traditional land tenure expose opposite results. Households farming on traditionally owned land were less involved in livestock production (Fisher's Exact Test, p=0.037) but kept the same herd size as the other group. However, official land tenure strongly supports agricultural production (Mann-Whitney U test, p=0.000), crops (Mann-Whitney U test, p=0.003) and animal products (Mann-Whitney U test, p=0.026).

None of the household input factors had a strong relation to Local Ecological Practice. Households from all comparison groups were equally involved in WFPs and gathered a similar number of species. Commercialisation of WFPs was rarely mentioned and thereby the sample for most analyses was rather small.

Table 6. Demographic and socio-economic characteristics of households in the Aragvi Protected Landscape divided according to type of income, accessibility, or land tenure.

Variable	Unit of measure	Type of income			Accessibility			Land tenure		
		Farming (n=40)	Diverse (n=54)		Limited (n=31)	Good (n=63)		Traditional (n=26)	Official (n=68)	
		Mean (±Stand. Dev.)		p value, test	Mean (±Stand. Dev.)		p value, test	Mean (±Stand. Dev.)		p value, test
Household characteristics										
Household size	person	3.78 (±1.75)	4.15 (±2.44)	.730 [M]	4.48 (±2.84)	3.75 (±1.72)	.348 [M]	4.31 (±3.16)	3.87 (±1.66)	.864 [M]
Permanent HHs members	person	2.33 (±1.61)	2.93 (±2.29)	.286 [M]	2.52 (±2.49)	2.75 (±1.80)	.304 [M]	2.65 (±2.53)	2.68 (±1.84)	.745 [M]
Labour force	person 15-64 years	2.70 (±1.51)	2.61 (±1.94)	.600 [M]	2.90 (±1.99)	2.52 (±1.64)	.443 [M]	2.81 (±2.21)	2.59 (±1.57)	.925 [M]
Female labour force	women 15-64 years	1.20 (±0.79)	1.20 (±1.05)	.739 [M]	1.39 (±0.99)	1.11 (±0.92)	.198 [M]	1.19 (±1.10)	1.21 (±0.89)	.831 [M]
Dependency ratio	dependent members / labour force	0.62 (±0.98)	0.85 (±0.88)	.051 [M]	0.69 (±0.81)	0.78 (±0.98)	.758 [M]	0.69 (±0.77)	0.77 (±0.98)	.924 [M]
Decision makers	person	2.60 (±1.28)	2.93 (±1.69)	.485 [M]	3.19 (±1.70)	2.59 (±1.39)	.106 [M]	2.65 (±1.67)	2.84 (±1.46)	.362 [M]
Official land tenure	official=1, traditional=0	0.78	0.69	.336 [Ch]	0.58	0.79	.030 [Ch]	/	/	/
Accessibility	limited=1, good=0	0.40	0.28	.213 [Ch]	/	/	/	0.50	0.27	.030 [Ch]
Household head characteristics										
Age	years	59.80 (±10.25)	58.48 (±13.46)	.762 [M]	60.42 (±11.76)	58.37 (±12.38)	.447 [M]	57.46 (±15.38)	59.65 (±10.74)	.510 [T]
Education	years of schooling	9.98(±0.97)	10.06 (±1.62)	.123 [M]	9.71 (±1.81)	10.17 (±1.09)	.391 [M]	9.77 (±1.99)	10.12 (±1.06)	.977 [M]
Origin	born=1, otherwise=0	0.50	0.52	.859 [Ch]	0.68	0.43	.023 [Ch]	0.69	0.44	.038 [F]

[F] Fisher´s Exact Test
[Ch] Pearson Chi-Square
[M] Mann-Whitney U test
[T] Independent T-test

Table 7. Agricultural production and Local Ecological Practice of households in the Aragvi Protected Landscape divided according to type of income, accessibility, or land tenure.

Variable	Unit of measure	Type of income			Accessibility			Land tenure		
		Farming (n=40)	Diverse (n=54)		Limited (n=31)	Good (n=63)		Traditional (n=26)	Official (n=68)	
		Mean (±Stand. Dev.)		p value, test	Mean (±Stand. Dev.)		p value, test	Mean (±Stand. Dev.)		p value, test
Involved in agriculture	yes=1, no=0	1.00	0.91	.070 [F]	1.00	0.92	.167 [F]	0.89	0.97	.128 [F]
Involved in livestock production	yes=1, no=0	0.95	0.70	.003 [F]	0.87	0.78	.405 [F]	0.65	0.87	.037 [F]
Livestock heads	LSU	10.48 (±16.45)	3.68 (±5.41)	.007 [M]	10.96 (±17.03)	4.42 (±7.65)	.027 [M]	6.91 (±16.64)	6.45 (±9.69)	.080 [M]
Average agricultural produce	produce	9.28 (±3.07)	7.06 (±4.27)	.013 [M]	8.32 (±3.47)	7.84 (±4.18)	.654 [M]	5.73 (±3.65)	8.87 (±3.73)	.000 [M]
Crops	produce	6.23 (±2.86)	5.22 (±3.53)	.142 [M]	5.10 (±3.23)	5.92 (±3.30)	.257 [M]	4.12 (±3.06)	6.24 (±3.19)	.003 [M]
Animal products	product	3.05 (±2.14)	1.83 (±2.27)	.002 [M]	3.23 (±2.78)	1.92 (±1.88)	.033 [M]	1.62 (±2.10)	2.63 (±2.30)	.026 [M]
Involved in agriculture commercialisation	yes=1, no=0	0.65	0.32	.001 [Ch]	0.55	0.41	.214 [Ch]	0.35	0.50	.248 [F]
Average commercialised produce	produce	2.38 (±2.37)	0.87 (±1.48)	.001 [M]	2.03 (±2.24)	1.25 (±1.90)	.098 [M]	1.19 (±1.83)	1.63 (±2.12)	.262 [M]
Involved in WFPs gathering	yes=1, no=0	0.67	0.59	.414 [Ch]	0.65	0.62	.806 [Ch]	0.5	0.68	.113[Ch]
WFPs	species	4.80 (±4.38)	3.70 (±3.76)	.237 [M]	4.97 (±4.22)	3.78 (±3.94)	.206 [M]	3.15 (±3.80)	4.56 (±4.10)	.130 [M]
Involved in WFPs commercialisation	yes=1, no=0	0.10	0.06	.454 [F]	0.03	0.10	.419 [F]	0.00	0.10	.184 [F]

[F] Fisher´s Exact Test
[Ch] Pearson Chi-Square
[M] Mann-Whitney U test

6.3. Agricultural production and market orientation

Agricultural production in the region had mostly subsistence characteristics, i.e. meeting needs of the households' food demand. None of the households was specialised in a single cash crop or one crop class only (e.g. vegetables, fruits, or cereals). All households primarily produced to meet a part of their own food needs, and only secondly to generate income. Figure 5 demonstrates that most of the households combined livestock and crops. Respondents named 33 crops and 12 animal products, out of which 9 were dairy products. The rest were honey, eggs, and meat. All produce with details on frequency, volume and commercialisation are listed in Table 8 and Table 9. The most frequent crops were potatoes, beans, cucumbers, tomatoes, apples, and walnuts. According to the average harvest per household, potatoes and perennials (grapes, walnuts, apples, and plums) generated largest yields.

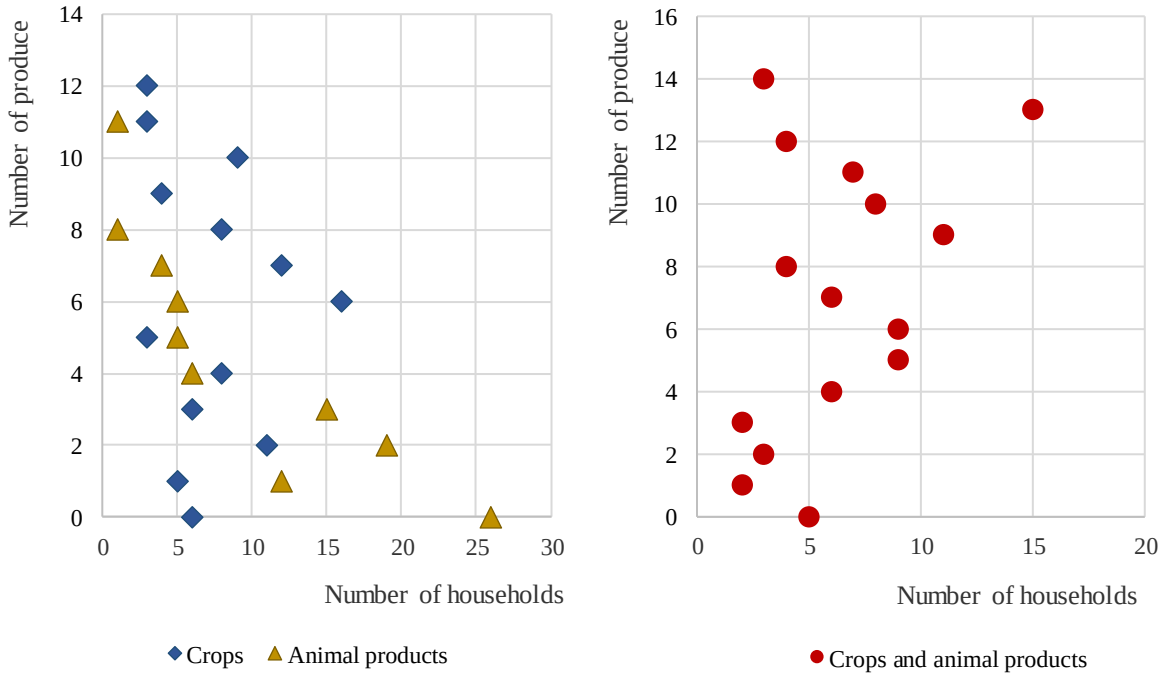

Figure 5. Abundance diagram of agricultural production in the Aragvi Protected Landscape.

Table 8. Crops and their marketing in the Aragvi Protected Landscape.

Crop class / English name	Households involved in growing (n, %)	Average harvest per household (kg)	Total harvest in the study site (kg)	Market orientation (n, %)	Average marketed amount (kg)	Price (GEL/ kg)
Cereals						
Corn	24 (26%)	86.38 (±134.71)	2,073.00	1 (1%)	500.00 (±99.91)	1.00
Vegetables and melons						
Onions	8 (9%)	13.81 (±14.53)	110.50	0	/	/
Garlic	9 (10%)	22.44 (±29.14)	202.00	0	/	/
Celery	1 (1%)	2.00 (±0.00)	2.00	0	/	/
Beetroot	13 (14%)	10.46 (±6.44)	136.00	0	/	/
Cabbage	17 (18%)	58.06 (±111.54)	987.00	0	/	/
Pepper	3 (3%)	14.17 (±11.61)	42.50	0	/	/
Cucumbers	54 (57%)	40.90 (±45.91)	2,208.50	1 (1%)	45.00 (±8.55)	9.25
Pumpkin	4 (4%)	55.00 (±55.45)	220.00	0	/	/
Zucchini	1 (1%)	20.00 (±0.00)	20.00	0	/	/
Carrot	10 (11%)	12.25 (±7.78)	122.50	0	/	/
Tomatoes	52 (55%)	59.56 (±83.32)	3,097.00	2 (2%)	200.00 (±38.46)	1.00
Eggplant	3 (3%)	43.33 (±40.07)	130.00	0	/	/
Herbs						
Dill	1 (1%)	2.00 (±0.00)	2.00	0	/	/
Estragon	1 (1%)	2.00 (±0.00)	2.00	0	/	/
Coriander	1 (1%)	4.00 (±0.00)	4.00	0	/	/
Basil	1 (1%)	3.00 (±0.00)	3.00	0	/	/
Parsley	1 (1%)	4.00 (±0.00)	4.00	0	/	/
Fruits						
Quince	3 (3%)	26.67 (±17.00)	80.00	0	/	/
Strawberries	2 (2%)	11.75 (±8.25)	23.50	0	/	/
Apples	42 (45%)	158.89 (±218.86)	6,673.50	1 (1%)	100.00 (±15.25)	3.00
Cherries	2 (2%)	17.50 (±2.50)	35.00	0	/	/
Tqemali plum	8 (9%)	65.00 (±37.42)	520.00	0	/	/
Alucha	2 (2%)	16.00 (±14.00)	32.00	0	/	/
Plums	20 (21%)	138.25 (±428.89)	2,765.00	0	/	/
Pears	24 (26%)	81.04 (±103.42)	1,945.00	1 (1%)	100.00 (±19.98)	1.00

Table 8. Continues.

Crop class / English name	Households involved in growing (n, %)	Average harvest per household (kg)	Total harvest in the study site (kg)	Market orientation (n, %)	Average marketed amount (kg)	Price (GEL/ kg)
Gooseberry	1 (1%)	3.00 (±0.00)	3.00	0	/	/
Raspberries	4 (4%)	10.88 (±5.90)	43.50	0	/	/
Grapes	5 (5%)	303.00 (±185.03)	1,515.00	0	/	/
Nuts						
Hazelnut	11 (12%)	35.45 (±31.80)	390.00	3 (3%)	50.00 (±28.05)	3.67
Walnuts	36 (38%)	167.92 (±121.16)	6,045.00	14 (15%)	172.86 (±126.01)	5.30
	walnuts (selling without shell)			4 (4%)	132.50 (±97.82)	17.50
Leguminous						
Beans	62 (66%)	28.78 (±32.50)	1,784.50	6 (6%)	51.67 (±20.91)	4.83
Root and tubers						
Potatoes	86 (91%)	318.62 (±269.86)	27,401.00	21 (22%)	260.95 (±150.39)	2.32
Other crops						
Tobacco	2 (2%)	2.50 (±0.50)	5.00	0	/	/

Table 9. Animal products and their marketing in the Aragvi Protected Landscape.

Product	HHs involved (n, %)	Average production per household (kg)	Total production in the study site (kg)	Market orientation (n, %)	Average marketed amount (kg)	Price (GEL/ kg)
Cheese	60 (64%)	416.52 (±672.1)	24,991.00	30 (32%)	357.00 (±326.80)	8.75
Curd	31 (33%)	44.97 (±40.64)	1,394.00	6 (6%)	25.50 (±14.88)	5.92
Honey	26 (28%)	125.77 (±151.62)	3,270.00	17 (18%)	120.59 (±128.83)	19.06
Butter	24 (26%)	78.75 (±82.27)	1,890.00	7 (7%)	106.25 (±95.57)	10.88
Purified butter	23 (24%)	80.78 (±116.08)	1,858.00	9 (10%)	109.17 (±96.97)	15.00
Eggs*	13 (14%)	877.69 (±716.68)*	11,410.00	1 (1%)	1,000.00 (±266.47)*	0.30
Yogurt	12 (13%)	82.08 (±58.56)	985.00	0 (0%)	/	/
Meat	11 (12%)	330.91 (±543.16)	3,640.00	8 (9%)	367.5 (±556.06)	10.31
Milk*	11 (12%)	938.18 (±853.58)*	10,320.00	4 (4%)	312.5 (±195.51)*	1.38
Mouldy cheese	5 (5%)	109.00 (±74.32)	545.00	4 (4%)	328.75 (±315.87)	13.50
Sour cream	4 (4%)	34.25 (±30.85)	137.00	0 (0%)	/	/
Cottage cheese	1 (1%)	7.00 (±0.00)	7.00	0 (0%)	/	/

Note: *Eggs were measured as pieces. Milk was estimated in litres.

Figure 6 summarises livestock numbers in the region and per households. More than half of the sample households kept chickens and cows while sheep, horses, beehives, or pigs were far less common. Likewise, hens and cows were the most numerous domesticated animals in the APL. Each household kept rather small numbers of animals: 14 hens, 11 beehives and 8 cows. Animals were primarily kept for household food needs and for cash generated by selling dairy products, meat, honey, and young cattle. On the other hand, sheep were kept only by two households in large herd sizes of 200 and 300 heads and represented their main income source. Horses were still used as a mean of transport and for ploughing across the mountains although their role is slowly changing.

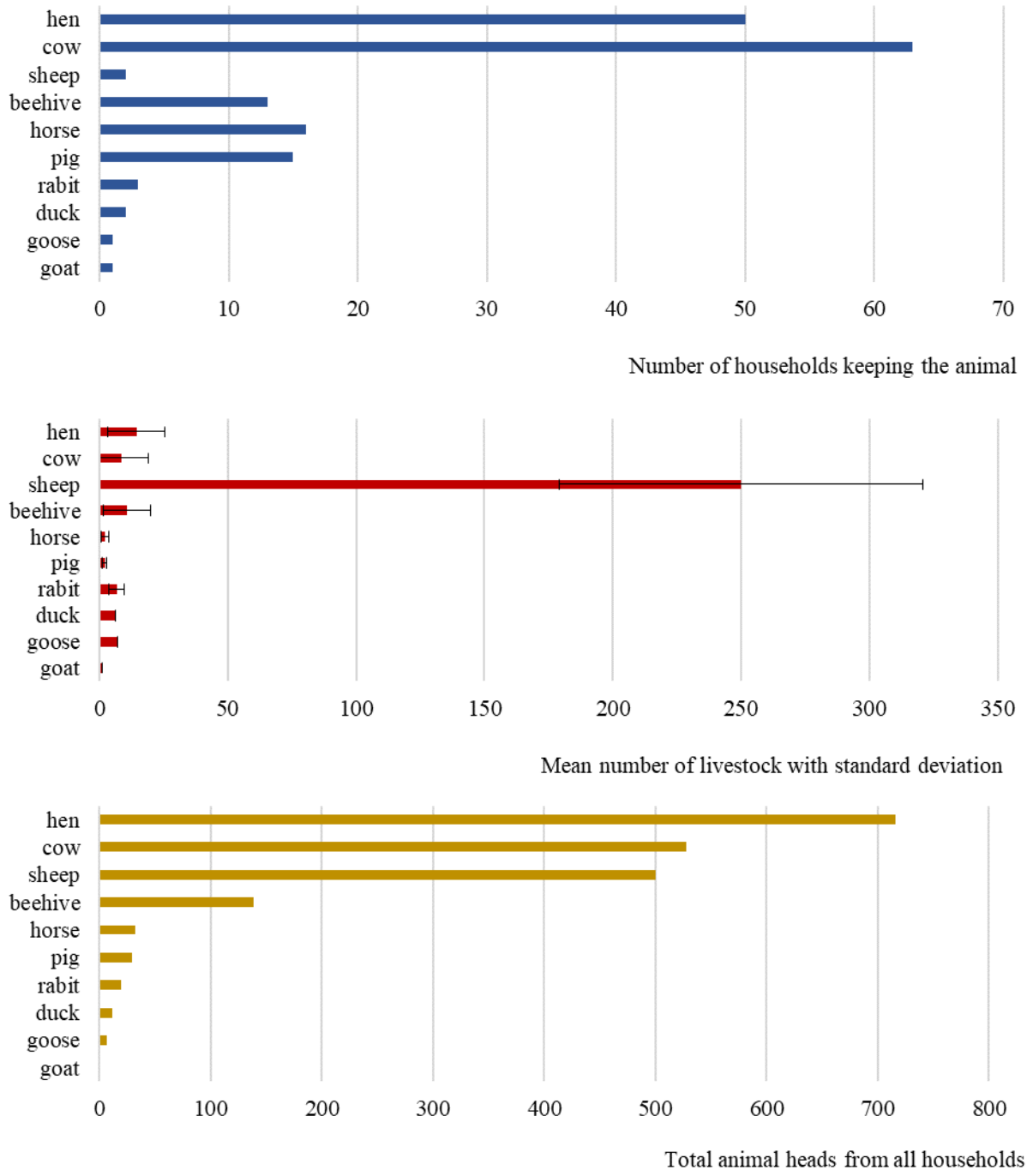

Figure 6. Livestock number in the sample households in the Aragvi Protected Landscape.

Commercialisation of farming produces in the region was quite limited. Regarding crops, only 18% of the estimated total production was sold on the market, while out of 33 different crops, 9 were market oriented. However, over half of the marketed harvest represented potatoes, followed by walnuts, corn, tomatoes, and a rather small volume of other crops. Crops were sold in fresh and raw form without further processing. Only a few exceptions of value adding were registered during the data collection. One example are walnuts. The market price of walnuts with shell was 4,5-8 GEL, and of those without shell 20-

25 GEL/kg. Animal products demonstrated a higher market orientation. Of 12 mentioned products, 9 were regularly commercialised representing around 43% of the total production from the region. Figure 7 demonstrates that animal products tended to have higher market price and thus represented a better income source. Indeed, dairy products are not raw but rather processed goods with added value.

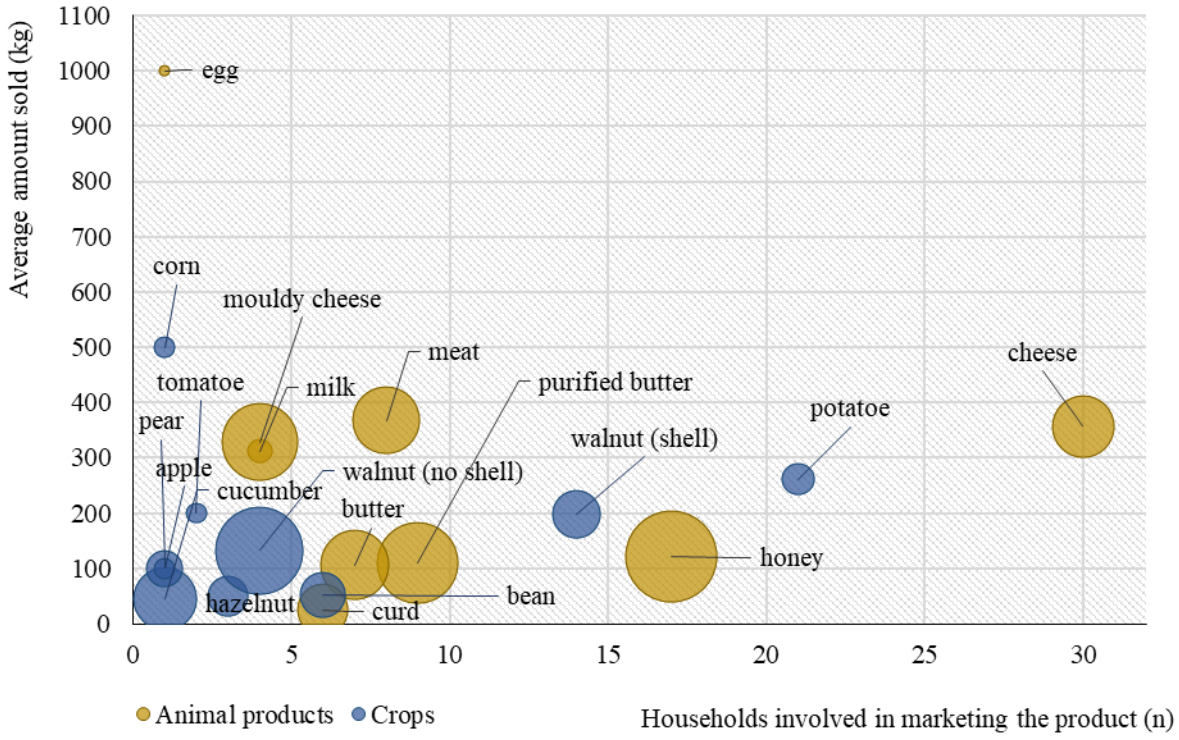

Figure 7. Agricultural produce commercialised by APL households and average volume sold per household.

Note: Size of a circle reflects the market price scaling from 0.3 (egg) to 19.1 (honey) GEL/kg.

Commercialisation mostly happened in local open-air markets. In the summer season they would usually take place on Sundays in Dusheti (region admin. Centre) or Passanauri (Tbilisi-Kazbegi main road). These markets have a good reputation for product quality, so they are visited by people from the lowlands and the capital. Several households sold their produces only to acquaintances in cities, at the local village shop or at their houses.

6.4. Local Ecological Practice of Wild Food Plants and mushrooms

The current use of 41 folk-taxa of wild food plants and mushrooms was recorded. All mentioned taxa are listed in Table 10. There are several folk-taxa which correspond to more than one species, or in one case, to a whole botanical kingdom. The Georgian name *kondari* is used for more than a dozen herbs. In the study region, Bussmann et al. (2017) identified only two species and one genus. *Carum caucasicum* is used a spice, while *Thymus* sp. and *Satureja*

laxiflora are used for tea. Thereby, *kondari* in our study represents two different folk-taxa. Mushrooms were mostly reported as *soko* which means mushroom. Only two times, informants specified what kind of mushroom they collect. Therefore, mushrooms are listed in the result Table 10 but not included in the recorded number of folk-taxa.

Two thirds of used folk-taxa were mentioned more than once. None of the species were recorded for all four use categories: food, medicinal, beverages and alcoholic beverages. Figure 8 illustrates that most of the species were used for a single category and only five were listed in three categories. The most represented use category was food closely followed by beverages which meant mostly herbal teas, fruit teas and fruit juices. The medicinal category was reported at half this frequency, but the total number of folk-taxa was higher than for the beverages. The highest number, 27 species, was named for the food category, followed by 21 medicinal, 18 for beverages and 2 for alcoholic beverages. This means that beverages species are more commonly known among people but are less diverse than medicinal plants.

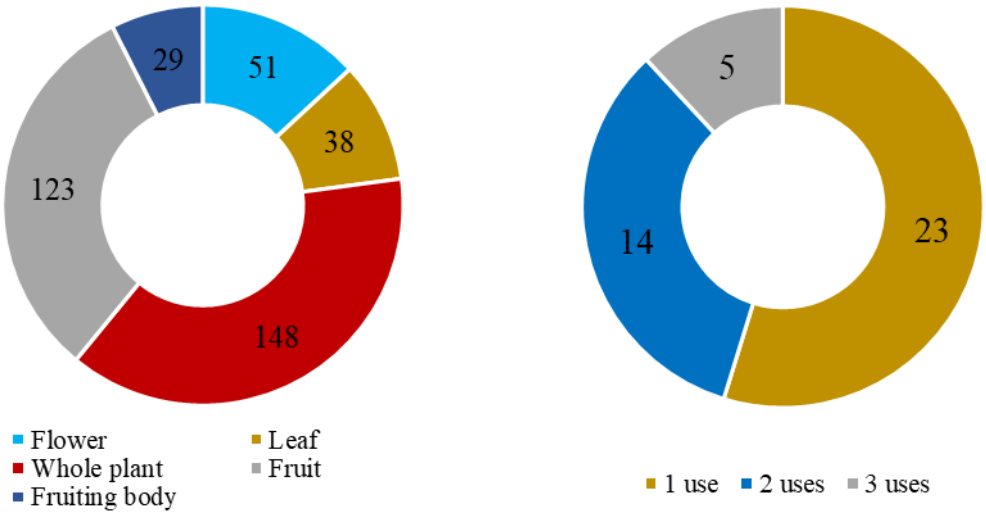

Figure 8. Parts of WFPs used and number of recorded uses per folk-taxa.

In the sample population, 63% (59 households) were involved in the WFPs gathering. On average, 4 species were regularly collected per household. In 59% of cases (35 families), more than one household member was involved. The most frequently mentioned household member practicing gathering was the mother (45 cases), followed by children (34) and father (34). Surprisingly, grandparents were specifically mentioned only a few times. However, the label “mother” and “father” depends on person/people filling in the questionnaire. Therefore, we can assume that grandparents were commonly involved in the gathering of species in a household’s vicinity because many species were mentioned to grow directly in “the yard”, in “the garden” or within 100 metres (Figure 9).

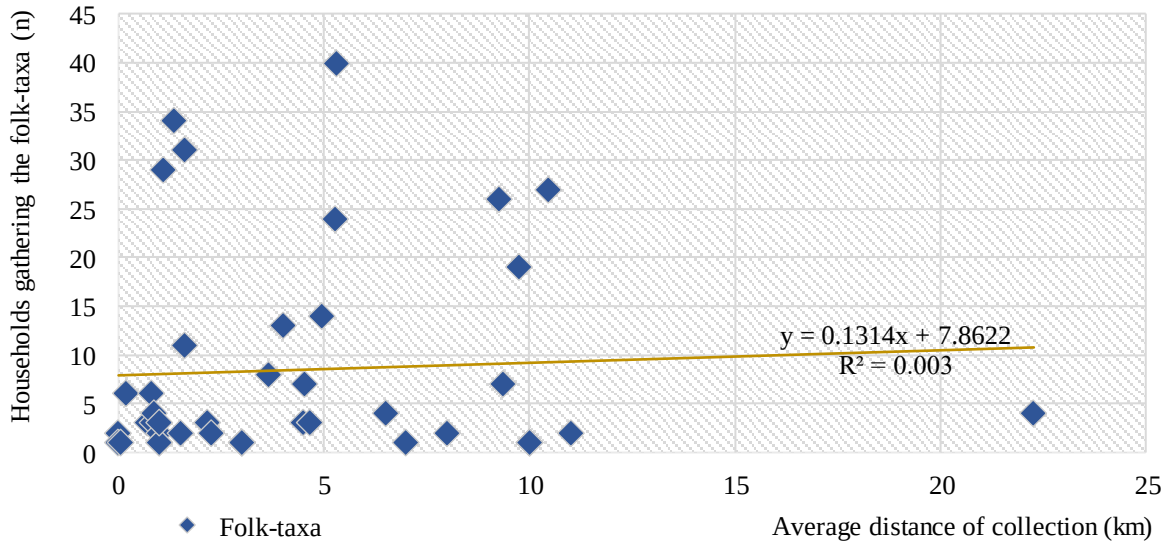

Figure 9. Abundance diagram of average species distance and households involved in its gathering.

Note: Linear function manifests almost constant trend with very poor coefficient of determination (R^2). It means that the data are scattered, and the trend does not help to predict the data.

All recorded folk-taxa were compared according to four Relative Cultural Importance Indices (Figure 10). Although each index highlights a different ethnobotanical value, results were consistent in ranking the most frequently cited species as the most valuable, too. Six species which stood out: American red raspberry (*Rubus idaeus* L.), Oregano *(Origanum vulgare* L.), European blueberry (*Vaccinium myrtillus* L.*)*, Mint (*Mentha* sp./*Nepeta mussinii* Spreng.), St. John's wort (*Hypericum perforatum* L.) and Yellow azalea *(Rhododendron caucasicum* Pall.).

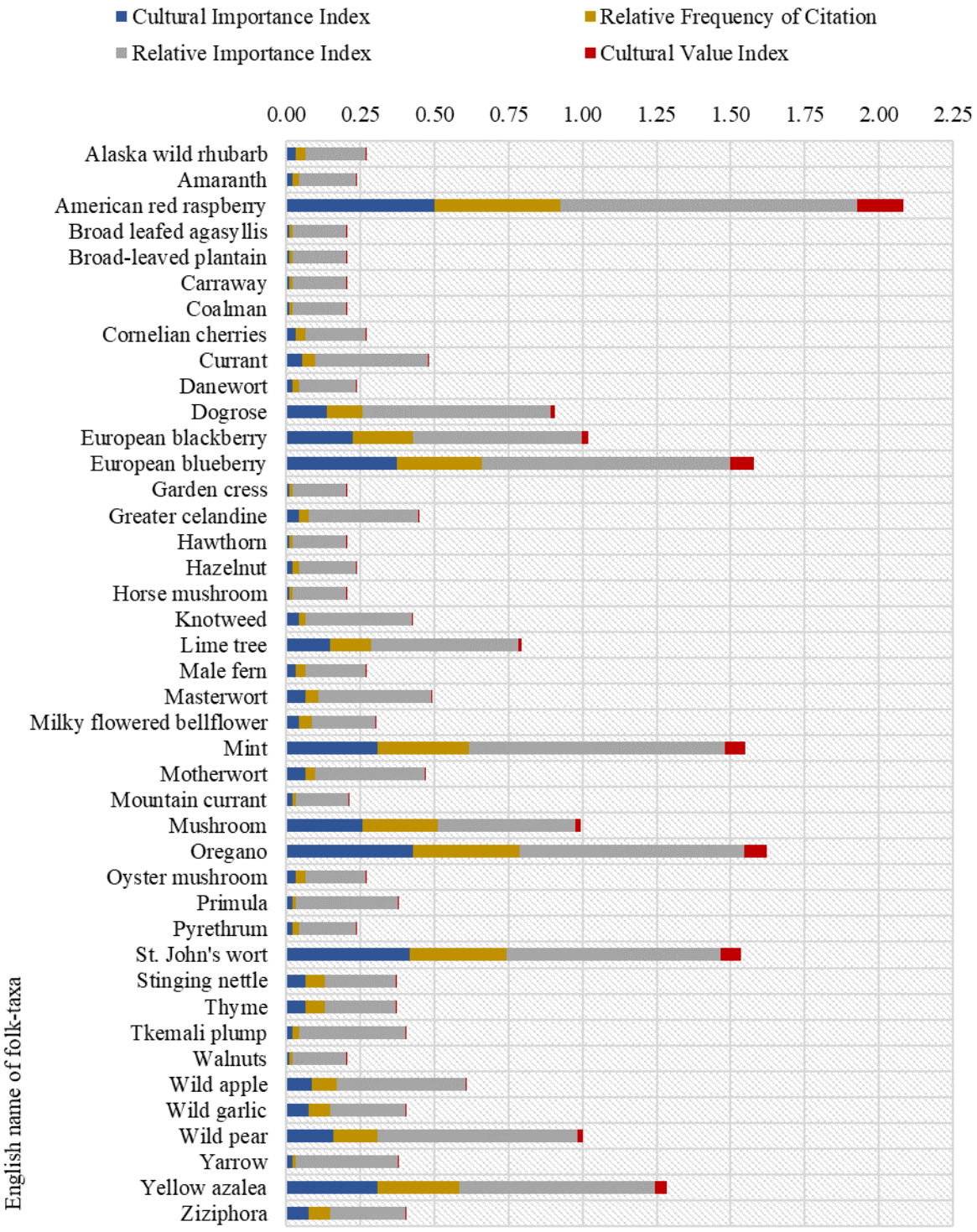

Figure 10. Evaluation of recorded WFPs using four Relative Cultural Importance Indices.

Local Ecological Practice was learned from elders, parents were mentioned 39 times (66%) and grandparents 11 times (19%). Relatives, neighbours, or other sources of knowledge were very scarce. The loss of LEP was reflected by local perceptions on amounts of WFPs commonly gathered by one's families. Most respondents believed that they used to gather

either more, or the same amount as nowadays (Figure 11). People were very optimistic about the future availability of WFPs in their environment. Only a few respondents mentioned that because of ecosystem degradation, there will be less WFPs growing. Although majority of people believed that their households would keep LEP or even practice more, still 36% thought that their household would reduce LEP. The reasons mentioned were lack of interest from younger generations, physical condition of elderly inhabitants or outmigration of productive members of the family.

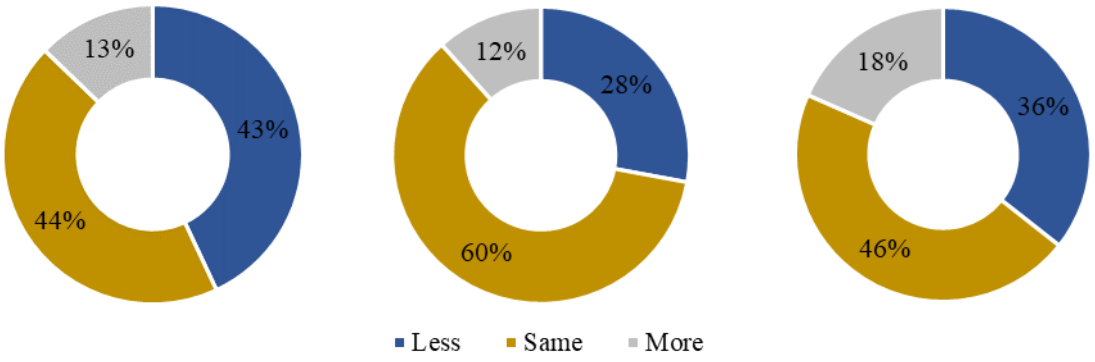

Figure 11. Households' perception on LEP

Note: Current household's practice comparing to 5-10 years ago (left), availability of WFPs in a near future (centre), and households' LEP in a near future (right).

Table 10. WFPs collected in the Aragvi Protected Landscape.

English name	Georgian folk-taxa transliteration	Households involved in collection (n, %)	Average volume collected per household (kg)	Total volume collected by households (kg)	Availability (% months mentioned by collectors)	Part(s) used	Use category	Distance to collection place (km)	Market orientation (household)	Type of consumption and processing method
Alaska wild rhubarb	Ts'ertkhala	3 (3%)	4.00 (±5.24)	12.00	May (33%), June (33%), July (33%)	whole plant	food	0.83 (±0.29)	0	cooked, *mkhalad*
Amaranth	Phkhali	2 (2%)	0.85 (±0.21)	1.70	May (50%), August (50%)	whole plant, leaf	food	0.01 (±0.01)	0	fresh, *mkhalad*
American red raspberry	Zholo	40 (43%)	14.92 (±38.07)	596.70	May (1%), June (6%), July (33%), August (57%), September (2%), October (3%)	fruit, leaf, whole plant	beverages, food, medicinal	5.30 (±6.04)	1	compote, jam, *muraba*, conservation, fresh, dried
Broad leafed agasyllis	Dutsi	1 (1%)	2.00 (±0.00)	2.00	July (100%)	whole plant	medicinal	0.05 (±0.00)	0	fresh
Broad-leaved plantain	Mravaldzarghva	1 (1%)	0.30 (±0.00)	0.30	July (100%)	whole plant	medicinal	1.0 (±0.00)	0	dried
Carraway	K'vliavi	1 (1%)	0.30 (±0.00)	0.30	August (100%)	fruit	food	1.0 (±0.00)	0	dried
Coalman	Shavchokha	1 (1%)	1.00 (±0.00)	1.00	October (100%)	fruiting body	food	10.0 (±0.00)	0	cooked
Cornelian cherries	Shindi	3 (3%)	7.33 (±4.62)	22.00	June (33%), October (67%)	fruit	food	4.67 (±4.62)	0	*muraba*, compote
Currant	Motskhari	4 (4%)	4.06 (±2.77)	16.25	July (13%), August (62%), October (25%)	fruit	food, medicinal	6.5 (±4.36)	0	*muraba*, jam, conservation

Table 10. Continues.

English name	Georgian folk-taxa transliteration	Households involved in collection (n, %)	Average volume collected per household (kg)	Total volume collected by households (kg)	Availability (% months mentioned by collectors)	Part(s) used	Use category	Distance to collection place (km)	Market orientation (household)	Type of consumption and processing method
Danewort	Ants'li	2 (2%)	5.63 (±6.19)	11.25	September (100%)	fruit	medicinal	1.00 (±0.00)	0	conservation
Dogrose	Ask'ili	11 (12%)	184.91 (±602.01)	2034.00	September (50%), October (50%)	fruit	medicinal, beverages, food,	1.63 (±2.83)	1	dried
European blackberry	Maqvali	19 (20%)	25.22 (±66.77)	479.00	July (23%), August (65%), September (12%)	fruit	beverages, food	9.75 (±11.33)	1	compote, *muraba*, juice, conservation, fresh
European blueberry	Motsvi	27 (29%)	7.19 (±3.97)	194.25	May (1%), June (4%), July (12%), August (73%), September (10%)	fruit, leaf, whole plant	food, medicinal, beverages	10.46 (±12.23)	1	compote, jam, *muraba*, conservation, fresh, dried
Garden cress	Ts'its'mati	1 (1%)	10.00 (±0.00)	10.00	July (100%)	whole plant	food	3.0 (±0.00)	0	fermentation
Greater celandine	Krist'esiskhla	3 (3%)	0.57 (±0.23)	1.70	April (33%), May (7%), June (7%), July (40%), August (7%), September (6%)	flower, leaf, whole plant	medicinal, beverages	1.00 (±1.00)	0	dried
Hawthorn	K'uneli	1 (1%)	3.00 (±0.00)	3.00	October (100%)	fruit	food	3.0 (±0.00)	0	conservation

Table 10. Continues.

English name	Georgian folk-taxa transliteration	Households involved in collection (n, %)	Average volume collected per household (kg)	Total volume collected by households (kg)	Availability (% months mentioned by collectors)	Part(s) used	Use category	Distance to collection place (km)	Market orientation (household)	Type of consumption and processing method
Hazelnut	Tkhili	2 (2%)	26.00 (±33.94)	52.00	July (25%), August (25%), October (50%)	fruit	food	1.51 (±2.11)	0	dried, fresh
Horse mushroom	Kama	1 (1%)	10.00 (±0.00)	10.00	September (100%)	fruiting body	food	3.0 (±0.00)	0	cooked
Knotweed	Matitela	2 (2%)	2.00 (±1.30)	4.00	May (10%), June (10%), July (60%), August (10%), September (10%)	whole plant	beverages, medicinal	11.00 (±9.00)	2	dried
Lime tree	Tsatskhvi	13 (14%)	1.02 (±1.78)	13.20	May (15%), June (31%), July (31%), August (54%)	flower, whole plant, leaf,	beverages, medicinal	4.01 (±6.65)	0	dried
Male fern	Chada	3 (3%)	0.50 (±0.10)	1.50	May (100%)	whole plant	food	2.17 (±1.26)	0	fresh, *mkhalad*, fermented
Masterwort	Uk'vdava	4 (4%)	1.15 (±1.45)	4.60	May (25%), July (25%), August (50%)	flower, whole plant	beverages, medicinal	22.25 (±19.67)	0	dried
Milky flowered bellflower	K'enk'esha	4 (4%)	5.48 (±5.26)	21.90	May (50%), July (50%)	whole plant	food	0.88 (±0.25)	0	*mkhalad*

Table 10. Continues.

English name	Georgian folk-taxa transliteration	Households involved in collection (n, %)	Average volume collected per household (kg)	Total volume collected by households (kg)	Availability (% months mentioned by collectors)	Part(s) used	Use category	Distance to collection place (km)	Market orientation (household)	Type of consumption and processing method
Mint	P'it'na	29 (31%)	4.64 (±15.58)	134.60	May (4%), June (31%), July (37%), August (23%), September (5%)	whole plant	food, medicinal, beverages	0.1 (±3.19)	2	dried
Motherwort	Shavbalakha	3 (3%)	0.43 (±0.23)	1.30	July (100%)	flower, whole plant	beverages, medicinal	0.7 (±1.13)	0	dried
Mountain currant	Khunts'i, Smarodina	1 (1%)	1.25 (±0.00)	1.25	July (100%)	Fruit, whole plant	Food, beverages	0.01 (±0.00)	0	*muraba*
Mushroom	Soko	23 (24%)	20.90 (±43.29)	479.00	April (9%), May (15%), June (35%), July (22%), August (14%), September (1%), October (4%)	fruiting body	food	5.07 (±5.33)	4	conservation, cooked, dried, fermentation
Oregano	Tavshava	34 (36%)	0.59 (±0.60)	20.10	May (7%), June (18%), July (48%), August (24%), September (4%)	flower, whole plant	beverages, medicinal	1.36 (±2.65)	1	conservation, dried
Oyster mushroom	K'almakha	3 (3%)	2.00 (±2.18)	6.00	June (16%), July (16%), August (16%), September (50%)	fruiting body	food	4.5 (±4.82)	0	cooked

Table 10. Continues.

English name	Georgian folk-taxa transliteration	Households involved in collection (n, %)	Average volume collected per household (kg)	Total volume collected by households (kg)	Availability (% months mentioned by collectors)	Part(s) used	Use category	Distance to collection place (km)	Market orientation (household)	Type of consumption and processing method
Primula	Phurisula	1 (1%)	500.00 (±0.00)	500.00	May (100%)	flower	beverages, medicinal	10.0 (±0.00)	1	dried
Pyrethrum	Gvirila	2 (2%)	0.30 (±0.14)	0.60	June (100%)	flower, whole plant	medicinal	8.00 (±9.90)	0	dried
St. John's wort	K'razana	31 (33%)	16.75 (±89.69)	519.10	May (13%), June (9%), July (65%), August (12%), September (1%)	flower, whole plant	medicinal, beverages	1.63 (±3.14)	2	dried
Stinging nettle	Ch'inch'ari	6 (6%)	1.30 (±1.85)	7.80	May (50%), June (25%), July (12.5%), August (12.5%)	whole plant, leaf	food	0.20 (±0.39)	0	cooked, *mkhalad*
Thyme	Kondari	6 (6%)	4.30 (±8.92)	25.80	June (8%), July (75%), August (17%)	flower, whole plant	beverages	0.82 (±1.02)	2	dried
Tkemali plump	T'q'emali	2 (2%)	2.50 (±0.00)	5.00	May (50%), September (50%)	fruit	food, medicinal	2.25 (±0.35)	0	conservation, dried
Walnuts	K'ak'ali	1 (1%)	40.00 (±0.00)	40.00	September (100%)	fruit	food	7.0 (±0.00)	0	fresh

Table 10. Continues.

English name	Georgian folk-taxa transliteration	Households involved in collection (n, %)	Average volume collected per household (kg)	Total volume collected by households (kg)	Availability (% months mentioned by collectors)	Part(s) used	Use category	Distance to collection place (km)	Market orientation (household)	Type of consumption and processing method
Wild apple	Mazhalo	8 (9%)	258.63 (±703.65)	2069.00	September (50%), October (50%)	fruit	food, alcoholic beverages, beverages	3.66 (±4.07)	1	compote, *muraba*, juice, conservation, fresh, distillation, dried
Wild garlic	Shibu	7 (7%)	5.27 (±3.71)	36.90	April (14%), May (36%), June (22%), July (28%)	fruit, whole plant	food	9.36 (±5.98)	0	fermentation
Wild pear	P'ant'a	14 (15%)	274.54 (±572.37)	3843.50	August (14%), September (50%), October (36%)	fruit, leaf, whole plant	food, alcoholic beverages	4.9 (±5.77)	2	compote, *muraba*, conservation, distillation, dried, jam,
Yarrow	Parsmanduk'i	2 (2%)	250.35 (±353.06)	500.00	July (100%)	flower	beverages, medicinal	6.00 (±5.65)	1	dried
Yellow azalea	Dek'a	26 (28%)	7.36 (±25.35)	191.40	May (32%), June (24%), July (24%), August (18%), September (2%)	flower, leaf, whole plant	medicinal, beverages	9.25 (±10.66)	2	dried
Ziziphora	Kondari	7 (7%)	0.46 (±0.28)	3.20	May (17%), June (3%), July (46%), August (31%), September (3%)	whole plant, leaf	food	0.54 (±6.62)	0	cooked

7. Discussion

7.1. Household characteristics in the Aragvi Protected Landscape

Many mountain areas around the world have been facing depopulation. Particularly in the post-Soviet countries, mountain dwellers have experienced forced resettlement several times during the last century (Trier & Turashvili 2007; Kohler et al. 2017). Region of the planned Aragvi Protected Landscape is a typical example of the migration pattern in the Georgian mountains. Majority of remote settlements, especially villages without a car access, have been completely abandoned already years ago. Households which remain in smaller villages, either live in poverty and thus do not have other option for living or are strongly tied to the place of their ancestors' origin. In both cases, households practice traditional subsistence farming and small-scale herding. Although, central villages with better accessibility lost part of their previous population, they are continuously inhabited and experience slow progress in the quality of living, infrastructure and job opportunities. A visible sight can be houses under reconstruction, of which part is meant to be accommodation for tourists. In general, population of the APL got centralized into bigger villages with improved livelihoods opportunities.

Several previous studies from Georgia demonstrated that many young and economically active people moved away from the mountains (Nakhutsrishvili et al. 2009; Salukvadze & Meladze 2014; Tevzadze & Kikvidze 2016; Theissen et al. 2019b). The present age structure proved that especially young and middle-aged women are missing in the APL. This process has also been documented in another scarcely populated Georgian region (Racha) (Kohler et al. 2017). This is probably related to the fact that culturally female jobs, such as administration, social services, vendors, are missing in the region even more than male work. Thus, women are forced to move out and are, possibly, more flexible to adapt to a different place. However, Das Gupta (2015) suggests that "missing girls" manifest birth sex selection in the South Caucasus which accelerated during uncertain 90s. Nevertheless, outmigration of economically active people from the APL continues due to the lack of paid jobs, insufficient income from farming, and hard living conditions with limited accessibility.

Depopulation and aging of the population further undermine development of the region (Nakhutsrishvili et al. 2009; Hauck et al. 2016; Kohler et al. 2017), since many

current jobs are connected to schools and public services provided by the state and dependent on inhabitants (Haerdle & Bontjer 2010). To stabilise the population and attract a young productive generation, creation of employment within the region is necessary. Designation of the APL as protected area in hand with improved land use planning promise numerous jobs across the region. It also open a door for various international nature conservation resources and, importantly, attract tourists (Wymann von Dach et al. 2018; Theissen et al. 2019a). It has been indicated in previous studies that tourism is currently the main opportunity to improve livelihoods of Georgian mountain people (Radvanyi & Muduyev 2007; Kavtarishvili 2015; Tevzadze & Kikvidze 2016; Applis 2019). However, single sector orientation arguably creates yet another dependency which may result in a sudden poverty in case of political instability, a conflict situation, or a global pandemic. Therefore, opportunities to diversify livelihood strategies are needed in the APL.

7.2. Subsistence farming as a livelihood strategy

Mixed farming systems continue to play an important role for livelihoods in the Aragvi Protected Landscape as demonstrated by the number of households involved in agriculture. It is still a dominant source of income for around 40% of them, while for the remaining majority, subsistence farming forms a source of non-cash products to supplement monetary income from other sources. This is especially true for the central and more accessible villages with more job opportunities in Pshavi, Ukanapshavi and on the main road in Piraketa Khevsureti. Animal production is far more market oriented than crops due to better market prices per unit and more suitable conditions. However, most of the production from the APL, as well as other Greater Caucasus regions of Georgia (Tevzadze & Kikvidze 2016; Applis 2019; Theissen et al. 2019b), is consumed locally or sold on the local markets. It restricts good earnings, since a majority of farmers sell their products at the same markets and many potential customers grow the same crops.

The subsistence form of farming remains a necessary livelihood strategy for Caucasian mountain people (Radvanyi & Muduyev 2007; Haerdle & Bontjer 2010; Tevzadze & Kikvidze 2016). However, agriculture in the mountains is characterised by low efficiency and limited access to the market which restrict commercialisation and generates relatively low profit (Salukvadze & Meladze 2014; Applis 2019; Theissen et

al. 2019b). Among the households of the APL who assess agriculture as their main income activity, only 65% commercialise their products. The remainder may not be farmers as a matter of choice but rather because they do not have other income sources. The profile of farming households without market-oriented production revealed that the majority of their labour force is unemployed or receive retirement pension. Even with one household member being employed or self-employed, earnings in rural areas are too low to offset the value of one's own food production (Hauck et al. 2016). Moreover, subsistence food production is a tradition. And a strategy of coping with political and economic insecurities in rural areas, such as a temporary job loss, or a conflict situation (Radvanyi & Muduyev 2007; Haerdle & Bontjer 2010; Theissen et al. 2019b).

Unemployed labour force triggers small-scale animal husbandry in APL. Farming households and those from remote parts of the region, where literally no other income sources exist, have more unemployed and self-employed members in the APL. Low monetary income causes a need for self-sufficiency, which together with free labour force and abundance of land triggers an increase in livestock production. This is demonstrated by average herd size, diversity of animal products and average quantity of products per household. A similar pattern has been described in the neighbouring Kazbegi region (Theissen et al. 2019b). Particularly in bigger villages on the main road, the spatial limitation and higher competition over communal pastures may be another motivation to reduce livestock numbers (Hauck et al. 2016). Competition over land in accessible villages is manifested by number of officially registered land. While traditional land tenure restricts crop production, it does not affect animal husbandry. This might be cause by the communal status of pastures and abundance of land and labour force in remote villages. It appears that types of land tenure play an important, yet not understood role in households' and communities' livelihoods, therefore we recommend including closer look on land property in the region for future studies.

Although income from agricultural production is an important source for majority of people in the APL and mountains of former soviet countries (Hauck et al. 2016; Tevzadze & Kikvidze 2016), wages, earnings from other activities and retirement pensions are a necessary source of cash. The difficulty to attain a decent household income is strengthened by a lack of small factories and textile, wool or food processing enterprises across the Greater Caucasus regions of Georgia (Radvanyi & Muduyev

2007). Additionally, basic infrastructure necessary for enterprises such as stable electricity and good road connection is not guaranteed. Therefore, local households have very limited opportunities to generate income through employment or self-employment. To create sustainable livelihoods, communities with the governmental and international support should develop diversified income sources including tourism services, educational spaces focusing on regional cultural heritage and nature services, and local community-based food processing and food marketing enterprises (Kohler et al. 2017).

7.3. Agricultural production: current situation and future perspectives

The present study confirms previous findings from Georgian mountains (Akhalkatsi et al. 2010; Bussmann et al. 2017b) that agro-diversity declined and mountains do not longer serve as repositories for ancient local varieties of cereals and fruits. The results show that in the APL crop diversity has been reduced to around twenty high yielding introduced species and partially replaced by more profitable cattle breeding. During this research, cereal fields with local landraces of rye, millet, or wheat were not encountered, echoing findings from the region by Bussmann et al. (2017b). On the contrary, traditional cultivated fields in plains and on slope terraces have been abandoned or turned into pastures, also described in other Georgian regions (Akhalkatsi et al. 2010; Theissen et al. 2019a). With the abandonment agriculture practices, traditional hay fields disappear due to the succession of shrubs and pioneer tree species (Gracheva et al. 2012; Kohler et al. 2017; Theissen et al. 2019b). This not only means a loss of valuable diverse habitats but also a reduced landscape accessibility and undermined potential for touristic trails. Erosion of agro-diversity and fields abandonment most probably correlates with changes of lifestyle and accessible commercial food. People prefer to grow easily processed vegetables and fruits rather than cereals. We suggest that land use and land cover changes would be an important insight on the impact of protected areas on the landscape in Georgia. Given the fact that data for example on peoples' perception "before" and "during" the establishment could be compared.

Crop production in the APL has been affected by the loss of market ties with Dagestan in 1990s and by modernisation of agriculture (Bussmann et al. 2017b). Recent selection of annual and perennial crops in the APL reflects the subsistence character of

agriculture. Therefore, farmers compete with the same products such as potatoes, beans, cucumbers, tomatoes, apples, or walnuts at the local markets. Due to less favourable terrain and lack of arable land, limited processing facilities and bad road condition, crop production in the mountains is disadvantage compared to the Eastern Georgian lowlands. Despite its low commercial potential, it plays an important role in the food self-sufficiency of local households and contributes to the diverse and valuable cultural landscape pattern (Akhalkatsi et al. 2010; Theissen et al. 2019b, 2019a).

Given the minor crop orientation in the APL, farming typically encompass livestock. Traditional transhumance pastoralism of the Greater Caucasus involving large sheep herds altered to stationary cattle husbandry managed by individual households (Haerdle & Bontjer 2010; Theissen et al. 2019a). The average household in APL owns 4-6 cows, around 8 hens and a horse or a pig, figures slightly higher than those from Kazbegi (Theissen et al. 2019b) and similar to those from Svaneti (Tevzadze & Kikvidze 2016; Applis 2019). Beside that cattle produce milk for dairy products which can be better commercialised, they are less attractive for common predators, namely wolves and bears. Cattle thus represents a more profitable and certain grazing animal. However, the abandonment of transhumance grazing, competition over communal pastures and missing pastures management has been causing soil erosion and degradation which increase the risk of landslides around settlements and degradation of rich ecosystems (Salukvadze & Chaladze 2013; Wymann von Dach et al. 2017; Theissen et al. 2019a).

Although among Caucasian farming households, animal and particularly dairy production became an important livelihood strategy (Haerdle & Bontjer 2010), full and thus sustainable production seems to be absent (Theissen et al. 2019a). There is potential to increase the amount of production, improve the quality of products and develop marketing (Applis 2019). Depopulated mountain regions offer an abundance of meadows and pastures on previously arable land. However, grazing would require better management involving photovoltaic pasture fences and herders to avoid erratic grazing (Salukvadze & Chaladze 2013). Increased quantities of animal production would require improved processing practices (Batello et al. 2010; Tevzadze & Kikvidze 2016). Current practice is to process milk, meat, and honey in unregulated conditions without hygiene standards. There are a few existing factories such as a milk processing factory

in Shuapkho, a herb drying plant in Barisakho, a trout farm and a mineral water factory near Magharoskari, but they provide only few employments and are mostly managed from outside the APL. Therefore, community-run enterprises could be the functional approach which would create inclusive economic opportunities for the whole community. In addition, communal storage facilities would enable farmer to keep products until higher market prices in winter. Nevertheless, this cannot happen without governmental investment into infrastructure such as stable electricity supply and year-round road access (Salukvadze & Chaladze 2013).

Marketing and supply chains for local products appear to be underdeveloped (Applis 2019; Theissen et al. 2019b). Besides personal acquaintances, most production is sold at the local markets during harvest season when prices are relatively low (Applis 2019). Products diversity is quite low, as a majority of households involved in diary production prepare only cheese. Curd, butter, purified butter, or yogurt are prepared by 15-40% of households. Although cheese is the third most common product in the region (after potatoes and beans), only one prevailing type is produced by most households. However, the regional specialty is *dambalkhacho*, a mouldy cheese produced from cow buttermilk cottage cheese which remains after churning butter. Despite being a regional non-material cultural heritage, only five households were encountered producing this cheese in a semi-subsistence and semi-commercial way. Improved product quality and diversity could increase marketing opportunities and therefore income.

7.4. Local Ecological Practice and future perspectives

Traditional knowledge of plant and fungi use in Khevsureti and Pshavi recently described in Bussmann et al. (2017b) has showed tremendous variety and richness in comparison to other European regions (Leonti et al. 2006; Hadjichambis et al. 2008; Ari et al. 2015; Sõukand & Pieroni 2019). This goes in hand with the overall botanical diversity in the Caucasus and the long isolation of mountain communities (Akhalkatsi et al. 2010; Bussmann et al. 2014). However, Local Ecological Practice as measured by regularly collected species is significantly lower than the recorded knowledge. According to our results, 63% of families in APL are involved in WFPs gathering. This figure is higher than for Upper Adjara and neighbouring Tusheti region, but lower than for Upper Svaneti (Kavtarishvili 2015; Tevzadze & Kikvidze 2016). We assume that the use of wild food plants and mushrooms in the APL is shaped mostly by socio-economic

situation of households, continuing farming lifestyle, tradition and abundance of useful plants in the proximity of settlements. However, profound research on communities' attitude towards LEP is needed in order to understand behavioural factors affecting LEP.

Although wild edible plants and mushrooms are still commonly gathered by people in APL, the diversity of collected species across the region is rather low. A total of 41 folk-taxa of wild edibles were encountered, which is very similar to results from Armenian mountains (Hovsepyan et al. 2019) and slightly lower than results from rural Ukraine (Pieroni & Sõukand 2018), rural Russia (Stryamets et al. 2015) and eastern Turkey (Çakir 2017). Among the recorded folk-taxa, around 25 species are common, while the rest were listed two times or less. Since other studies from the region, particularly from Georgia (Bussmann et al. 2017a, 2018; Łuczaj et al. 2017), Azerbaijan (Pieroni & Sõukand 2019; Sõukand & Pieroni 2019) and Turkey (Ari et al. 2015; Yeşil et al. 2019) were done with local knowledgeable elderly people and focused on the total ethnobotanical knowledge, results are not comparable.

LEP in the APL as in other European regions (Pardo-de-Santayana et al. 2007; Łuczaj et al. 2012; Pieroni & Sõukand 2018) and Asian countries (Ahmad & Pieroni 2016) shifted from nutritional food to teas, fruits and other snacks, or spices. In the APL, households regularly collect four species which are mostly fruits and herbs with food, medicinal or beverage uses. Similarly, the quantitative ethnobotanical analysis of recorded species highlights cultural importance of the most frequently collected species. It demonstrates that edible species associated with several uses are more popular, like other authors found out (Leonti et al. 2006; Yeşil et al. 2019), regardless of the distance people need to cross. Species gathered for medicinal purposes only, and prepared mostly as herbal teas or eaten raw, were far less mentioned and retained mostly by elderly people, as has been documented also in Upper Svaneti (Tevzadze & Kikvidze 2016). On the other hand, collection and processing of wild fruits is common for families with children as an important source of fresh fruits, sweets and vitamins (Tontisirin 2014) that are otherwise limited in rural mountain regions (Pardo-de-Santayana et al. 2007). In the APL, Yellow azalea *(Rhododendron caucasicum* Pall.) is a widespread medicinal and tea species (Bussmann et al. 2017b) despite the long distance to collection spots. Thereby, its popularity can be associated with local

tradition and assumed medicinal effect. No relation was shown between geographic isolation and household involvement in WFPs gathering as observed by Bussmann et al. (2017b) in Khevsureti and Tusheti. Also, the same species are most frequent for both remote and accessible communities. The reason might be a prevalence of the most important species across all examined elevations and habitats, relative isolation of all study communities and persistent shared tradition.

LEP and knowledge has been declining in various regions of Georgia (Kavtarishvili 2015; Tevzadze & Kikvidze 2016), and neighbouring countries (Çakir 2017; Hovsepyan et al. 2019; Sõukand & Pieroni 2019; Yeşil et al. 2019) since the last century. A majority of people in the APL perceive that LEP has declined or remained stable in the last decade mostly due to the lack of youth interest and of opportunities to collect the WFPs. As demonstrated by the difference between knowledge held by elderly people and LEP in Khevsureti and Pshavi, WFPs around Europe (Hadjichambis et al. 2008) are rather an addition to a diet and do not contribute much to households' nutritional needs nor monetary income. The loss of TEK and LEP in the region is often associated with depopulation (Theissen et al. 2019b), change of lifestyle (Pieroni & Sõukand 2019) and also communist propaganda (Tevzadze & Kikvidze 2016; Hovsepyan et al. 2019). Soviet modernisation projects ridiculed traditional medicinal plant knowledge and folk culture, and replaced it with officially approved sources (Łuczaj et al. 2012). This trend continues until today regarding medicinal plants, as younger generations prefer using commercial medicine because it is associated with better efficacy and it became available and accessible (Ari et al. 2015; Baykal & Atamov 2017).

The ethnobotanical knowledge is mostly preserved by elderly people and is not completely transmitted between generations (Pieroni & Sõukand 2019). When young people leave their original home for university studies or work in urban areas, the knowledge diminished even if they later return (Ahmad & Pieroni 2016; Pieroni & Sõukand 2019). However, people in the APL are optimistic about LEP and a majority believe that it will remain the same. People learned their current ecological practice mostly from their parents or family elders. Very scarcely, people mentioned anyone outside their own family. This is quite surprising since other studies from post-soviet countries also mentioned wider community including local authorities and official

sources, such as books and the internet (Pieroni & Sõukand 2018; Hovsepyan et al. 2019). However, even during the soviet era, Georgian mountains remained relatively resistant to modernisation propaganda, which leads to the conclusion that TEK sources were not altered. Given the current population situation and slow but constant economic development of the country, the knowledge will most likely fade away with local elderly if it is not conserved and economically valuated (Bussmann et al. 2017b).

TEK and LEP in the mountain regions has a potential to contribute to local livelihoods at a nutritional and monetary level (Benz et al. 2000; Ahmad & Pieroni 2016). Wild edibles have in comparison to many commonly cultivated plants a high share of vitamins and minerals and can significantly contribute to a healthy and balanced diet before the harvest season (Leonti et al. 2006; Hadjichambis et al. 2008). Therefore, people should be encouraged to continue practicing TEK also through market development with recognised regional products (Maikhuri et al. 2004; Applis 2019; Sõukand & Pieroni 2019). Commercialisation of WFPs does exist in the APL but it is restricted to a few households who sell medicinal and tea herbs to small-scale drying factories. Cooperative or community-based drying factories can function only when there is also a market chain. In addition, local people believe that LEP will remain in the future due to interest from tourists and people from cities appreciating fresh and organic wild products. In such a scenario, new local job opportunities for young people would grow and the knowledge would more probably be transferred from older to younger generations, and remain alive (Maikhuri et al. 2004). However, according to our knowledge, there are no studies from the country focused on market chains and commercialisation of WFPs.

Planned nature protection of the APL should consider including LEP into its management plan as well as designing mechanisms for sustainable wild plant and mushroom gathering as a cultural and ethnobotanical heritage (Pieroni et al. 2014; Theissen et al. 2019b). The APL landscapes encompass preserved and valuable broadleaf forests (Salukvadze & Chaladze 2013; Theissen et al. 2019b), but lack the aesthetic alpine sceneries of Khevsureti and Tusheti as well as touristic attractions, such as the Kazbegi summit and glacier. Therefore, recreational-educational programmes related to LEP can be a marketing strategy to attract “nature oriented” tourists (Nakhutsrishvili et al. 2009). Sustainable mountain development can be achieved by

creating socio-economic opportunities for local communities to take ownership of and to benefit from (Mitrofanenko et al. 2015; Kohler et al. 2017). Thereby, already existing LEP as an example of long interaction of people and nature and peoples' survivance has a great potential. We suggest that analysis of potential connection of nature protection and LEP could bring key information for the actual planning.

7.5. Limitations of the research

The present research was conducted according to the authors' best knowledge of scientific approaches in the field and feasibility under the given conditions. However, the study bears several limitations. Firstly, the research questions were determined rather broad, being limited spatially but encompassing wide range of socio-economic, anthropogenic, environmental and ethnobotanical objectives. As the multidisciplinary approach has its essential role in designing protected area management plans or in sustainable development of mountain communities, in the scope of the research it affects depth of the findings. For example, more methods to cross-check and correct data could improve the research credibility. The research questions were set up having two interests in mind: the first was to bring new insights into livelihoods and LEP of the mountain communities in the post-soviet country, and the second was to collect reliable data and perspectives of local communities for a need of the protected area planning process. In the future, we would recommend sticking to a single objective since having two might imply adopting quite different approaches.

Secondly, success of the questionnaire method depends on adequate pre-testing and good design of questions according to assumed possible answers. Although the questionnaires were pre-tested and adjusted, the author is aware that individual understanding of concepts such as "household", "household member", "main income activity" and "wild food plants and mushrooms" may vary. But the method does not create space for individual realities or opinions. Therefore, comparisons of various groups of households or comparison across regions may not fully represent reality. In order to overcome this drawback, examples were used for each question to explain what is meant. On the one hand this tool helped to specify questions, but on the other, it directed informants towards expected answers. Therefore, the researchers' bias free "free-listing" method in our data collection was manipulated (Dudney et al. 2015). For the future research, we would recommend allocating more time for the data collection

and complementing each questionnaire with an interview and demonstrations, for example measurement units, crops on the field, field size, a location on the map of a particular WFP etc.

Furthermore, while the ethnobotanical research question targeted the living practice among local communities, due to the lack of time and capacities, voucher specimens of listed species were not collected. Despite the available ethnobotanical collection from the area, the results cannot be interpreted at the level of species but only at the folk-taxa level. Therefore, species diversity and cultural importance may not reflect the actual situation. Moreover, use of some endemic species in a certain area as well as species' use determined by location might be unseen in the current data. Overall, it limits comparison with other studies from the country and the regions because they mostly use WFPs species and families. As well, detailed comparison with the future data from the region may be restricted.

Finally, as the production volumes were estimated by farmers and not empirically measured, the total production values are rather approximate. This drawback affects especially factor comparison between households, since one group may tend to under- or overestimate their harvest generating false statistically significant relation between the household's characteristic and the factor. Standardized measurement units such as kilograms or litres would most probably cause confusion and prevent respondents from any answer. Therefore, we would recommend doing empirical measurements for data correction and ask respondents to demonstrate possible samples.

8. Conclusions

Present master thesis contributed to other studies focused on changing farming systems in remote areas of transition economies. Generally, the Caucasus mountain range is highly valued for its biological, agricultural and cultural diversity and for extremely rich Traditional Ecological Knowledge. However, unique social-ecological systems in Georgian Caucasus mountains, which arose from centuries of human-nature interaction, have been threatened and to a certain extend altered. Similarly, Local Ecological Practice has been seriously declining due to depopulation and lifestyle changes. Despite growing interest in the potential role of LEP in enhancing the livelihoods of mountain communities, primarily data are limited. Therefore, the present study aimed to document livelihood strategies of households in the planned Aragvi Protected Landscape in Georgia, in connection to agricultural production and LEP.

The results showed that majority of remote settlements have been abandoned and that population is centralized in the accessible bigger villages. Outmigration of young and economically active population continues to undermine the functioning of remaining social structures as manifested on the example of teachers exceeding pupils in elementary schools. Particularly women were found to be missing in the APL. They represented 42% in 15-39 age group, which we explained by a combination of absence of culturally accepted female jobs and former preference of sons in the challenging mountainous conditions.

Furthermore, the research confirmed that subsistence farming, practiced by 95% of households, including small-scale cattle herding (81% of households) is a dominant livelihood strategy in the APL which is determined by limited income generating activities. Although, official land ownership appeared to be an important factor behind households' involvement and volume of agricultural production. Since we were unable to come with a clear explanation for this relation, we recommend including closer look on land property in the region for future studies. Even though we recorded 33 cultivated crops, only around 15 high yielding introduced species of vegetables and fruits were widespread and only 9 species were occasionally commercialised. We suggested that crop commercialisation has low potential due to less favourable conditions. Yet, it plays an important role in the food security of local households and contributes to the diverse and valuable cultural landscape pattern. On the contrary, 43% of the estimated animal

production from the region was documented to be market oriented and to generate better income. Results showed that households' remoteness and farming income dependency relate to larger volume of animal production. However, its full potential is not topped due to poor marketing of regional produce and underdeveloped supply chains.

The study found out that LEP, herein demonstrated on the Wild Food Plants and mushrooms gathering, has been slowly declining. Although, 63% of households continue with subsistence LEP, its purpose has shifted from nutritional and medicinal food to additives such as fruits and herbs for beverages. Moreover, the diversity of recorded species across the region and within households was low. From recorded 41 folk-taxa of plants and mushrooms, around 10 species were frequently gathered. Despite that 15 species were mentioned to be marketed, only 7% of households were involved and mostly trading low quantities. We assumed that LEP in the APL is tied to continuous farming livelihoods, tradition and abundance of useful plants in the vicinity. Similarly, 64% of households believed that they would continue with LEP in the same or wider manner. The results suggested that outmigration trend, current almost non-existent market orientation and availability of commercial foods would contribute to WFPs availability in the future, which corresponded to the households' perception.

To conclude, designation of the APL as protected area creates numerous opportunities to improve livelihoods of local communities and to protect valuable habitats. Conservation efforts in the APL, as well as in other Caucasian regions, should closely cooperate with local communities on creating spaces using the TEK and LEP for diversification of livelihood strategies and protection of local social-ecological systems. Localized research on creation of such spaces and on communities' perception of LEP as their potential livelihood strategy should be undertaken in order to support successful conservation efforts in mountains.

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Appendices

List of the Appendices:

Appendix 1: Questionnaire form in English.

Hello, my name is Kristýna and I study master programme of Sustainable Rural Development at the Czech University of Life Sciences in Prague, Czechia. Three years ago, I had a chance to spend 3 months in Tusheti and discover a bit of the Georgia. Since then, I am interested in the agriculture, culture and ethnography of the people living in Georgia, especially in the mountains. I would like to learn and understand more. Therefore, I have decided to locate my master thesis in Georgia. I had learned that there will be established a new Protected Landscape Aragvi. Before it happens and before different actors will come and change the area, I would like to learn about the livelihood of you - people in Pshavi, Khevsureti and Gudamaqari. My focus is on what you grow and what you collect in the forest, how do you process these products, how do you market your products and how this can bring more benefits for your households through sustainable tourism in the future. By filling in this questionnaire you help me to gather important information. My objective is not only to write the thesis but also to provide the results to the Aragvi administration and international experts coming to design the Protected Landscape Aragvi. I will keep anonymity of all respondents and share only general results from my research.

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1. What is the name of your village?
2. Who lives in this household?

Household member (mother, father, children)	Decision (YES/NO)	Main occupation and monthly salary/income (GEL)	Age	Gender (F/M)	Years of schooling/ achieved education	Daily committing to work (YES/NO)	Permanent/ Temporal or seasonal: months of stay	Since when living here
Example: father	yes	Police officer – 900 GEL	45	M	11 years / high school	Yes	Seasonal – 6 months	2015

3. Do you receive any financial support from relatives living in city, or abroad?

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1. Is agriculture your main income generating activity?

   1b. Do you have any off-farm activities? Which?

2. Do you produce any agricultural produce?

Product (nuts, vegetables, cheese, honey…)	Where (vegetables garden, yard, field…)	Have you registered the land? (YES/NO)	How much you produce? (kg)	Do you commercialise the products? (YES/NO)	Where/whom do you sell it?	How much do you sell? (kg)	For what price
Example: cheese	In the house	no	20 kg/month	Yes	Neighbours, market	15 kg/month	10 GEL/kg

3. Do you keep any animals? Which and how many. (Example: 3 cows, 2 horses,…)

4. Do you purchase other products? YES NO
   a. From where: Neighbours Market Relatives Supermarket Other:

1. Do you collect any products (herbs, mushrooms) from the wild around? YES NO

Name of the forest product (berries, herbs…)	Which part is collected? (whole, leaf…)	For which purpose? (medicinal, food, tea…)	How much per season?	How far from your house?	When do you collect it (month)?	How do you process it? (conservation, drying, cooked)	Do you sell it?	Where do you sell it?	How much do you sell?	What is price (GEL/kg)
Example: nettle	Whole plant	food	1 kg	2 km	May	drying	No	-	-	-

1. Who collects these products in your household (mother, father, grandparents, children…)?
2. Where or how did you learn to collect these products?
3. Do you collect more/same/less than before (app. 5 and 10 years ago)?

   MORE SAME LESS

4. Do you think in the near future there will be more/same/less of forest products to collect?

   MORE SAME LESS

5. Do you think your household will collect more/same/less products in the near future?

   MORE SAME LESS

Thank you very much.

Appendix 2: Relative Cultural Importance Indices of WFPs

English name	Latin name (Bussmann et al. 2016b; Bussmann 2017)	Cultural Importance Index	Relative Frequency of Citation	Relative Importance Index	Cultural Value Index
Alaska wild rhubarb	*Polygonum alpinum* All.	0.03	0.03	0.20	0.00025
Amaranth	*Amaranthus paniculatus* L./ *Atriplex hortensis* L./ *Beta vulgaris* L. ssp. *cicla* (L.) Moq.	0.02	0.02	0.19	0.00011
American red raspberry	*Rubus idaeus* L.	0.50	0.43	1.00	0.15957
Broad leafed agasyllis	*Agasyllis latifolia* (Bieb.) Boiss.	0.01	0.01	0.18	0.00003
Broad-leaved plantain	*Plantago major* L.	0.01	0.01	0.18	0.00003
Carraway	*Carum carvi* L.	0.01	0.01	0.18	0.00003
Coalman	*Tricholoma portentosum* (Fr.) Quél.	0.01	0.01	0.18	0.00003
Cornelian cherries	*Cornus mas* L.	0.03	0.03	0.20	0.00025
Currant	*Ribes* sp. *(alpinum, nigrum* L., *rubrum* L., *vulgare* Lam.*)*	0.05	0.04	0.38	0.00113
Danewort	*Sambucus ebulus* L.	0.02	0.02	0.19	0.00011
Dogrose	*Rosa* sp.	0.14	0.12	0.64	0.01214
European blackberry	*Rubus fruticosus* L.	0.22	0.20	0.57	0.02258
European blueberry	*Vaccinium myrtillus* L.	0.37	0.29	0.84	0.08021
Garden cress	*Lepidium sativum* L.	0.01	0.01	0.18	0.00003
Greater celandine	*Chelidonium majus* L.	0.04	0.03	0.37	0.00068
Hawthorn	*Crataegus* sp. *(pentagyna* Waldst.)	0.01	0.01	0.18	0.00003
Hazelnut	*Corylus avellana* L./ *pontica* K. Koch.	0.02	0.02	0.19	0.00011
Horse mushroom	*Agaricus arvensis* Schaeff.	0.01	0.01	0.18	0.00003
Knotweed	*Polygonum* sp./ *Bistorta officinalis* Delarbre	0.04	0.02	0.36	0.00045
Lime tree	*Tilia begoniifolia* Stev./ *caucasica* Rupr.	0.15	0.14	0.50	0.01030
Male fern	*Dryopteris filix-mas* (L.) Schott./ *Matteuccia struthiopteris* (L.) Todd.	0.03	0.03	0.20	0.00025
Masterwort	*Astrantia maxima* Pall.,	0.06	0.04	0.38	0.00136
Milky flowered bellflower	*Campanula lactiflora* Bieb.	0.04	0.04	0.22	0.00045
Mint	*Mentha* sp./ *Nepeta mussinii* Spreng.	0.31	0.31	0.86	0.07138
Motherwort	*Leonurus quinquelobatus* Gilib. var. *caucasicus* Krestovsk.	0.06	0.03	0.37	0.00102

Appendix 2: Continues.

English name	Latin name (Bussmann et al. 2016b; Bussmann 2017)	Cultural Importance Index	Relative Frequency of Citation	Relative Importance Index	Cultural Value Index
Mountain currant	*Ribes biebersteinii* Berl. ex DC	0.02	0.01	0.18	0.00006
Mushroom	/	0.26	0.26	0.47	0.01630
Oregano	*Origanum vulgare* L.	0.43	0.36	0.76	0.07696
Oyster mushroom	*Pleurotus ostreatus* (Jacq. ex Fr.) P. Kumm	0.03	0.03	0.20	0.00025
Primula	*Primula macrocalyx* Bunge/ *Primula woronowii* Losinsk.	0.02	0.01	0.35	0.00011
Pyrethrum	*Pyrethrum parthenifolium* Willd./ *Matricaria chamomilla* L.	0.02	0.02	0.19	0.00011
St. John's wort	*Hypericum perforatum* L.	0.41	0.33	0.72	0.06841
Stinging nettle	*Urtica dioica* L.	0.06	0.06	0.24	0.00102
Thyme	*Thymus* sp./*Satureja laxiflora*	0.06	0.06	0.24	0.00102
Tkemali plump	*Prunus divaricata* Ledeb.	0.02	0.02	0.36	0.00023
Walnuts	*Juglans regia* L.	0.01	0.01	0.18	0.00003
Wild apple	*Malus orientalis* Uglizk.	0.09	0.09	0.43	0.00362
Wild garlic	*Allium ursinum* L./ *Allium victorialis* L.	0.07	0.07	0.25	0.00139
Wild pear	*Pyrus caucasica* Fed.	0.16	0.15	0.68	0.01782
Yarrow	*Achillea millefolium* L./ *Achillea nobilis* L.	0.02	0.01	0.35	0.00011
Yellow azalea	*Rhododendron caucasicum* Pall.	0.31	0.28	0.66	0.04267
Ziziphora	*Ziziphora pushkinii* Adams.	0.07	0.07	0.25	0.00139