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Biocultural Diversity in Europe – A Literature Review of Selected Projects

Masterarbeit

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Content

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1. Introduction

It was in the 1990s, when researchers became aware that not only biological diversity, but also cultural and linguistic diversity are being lost at dramatic rates and that the ongoing worldwide loss of biodiversity is paralleled by and seems to be interrelated with the extinction crisis affecting cultural and linguistic diversity (Posey, 1999; Maffi, 2001; Harmon, 2002; Maffi, 2005). All three diversities turned out to be threatened by some of the same forces and drivers of change (Maffi, 2005). The interlinkage of biological and cultural diversity was probably first expressed in the Declaration of Belém by the International Society of Ethnobiology, which affirmed the existence of an “inextricable link” between the two diversities (ISE, 1988).

The newly emerged field of biocultural diversity can be defined as the sum of the diversity of life in all its manifestations. It comprises biological, cultural, and linguistic diversity, which are interrelated (and likely coevolved) within a complex socio- ecological adaptive system (Maffi and Woodley, 2010). The term “biocultural diversity” is actually the short form for “biocultural, cultural and linguistic diversity”. Language plays an important role in communicating and transmitting traditional knowledge and practices. As it is mediating between humans and their environment, it can be seen as third pillar of the biocultural diversity concept (Maffi, 2007).

The inextricable link of biological and cultural diversity and the observation that both of them are threatened by similar factors suggest the development of inter- and transdisciplinary approaches for conserving the diversities. In many areas not only biological diversity is under pressure, but also aspects of cultural and linguistic diversity (such as traditional ecological knowledge, minority languages, traditional agricultural systems,...). In such cases, it will not be sufficient to only conserve biological diversity. Instead, an interdisciplinary biocultural conservation approach and measures that are affecting all different threatened diversities should be developed and implemented.

Traditionally, research in the field of biocultural diversity focuses on tropic regions, as the three core areas of biocultural diversity can be found there. These bioculturally most diverse regions are the Amazonas Basin, Central Africa, and Indomalaysia/Melanesia (Loh and Harmon, 2005). However, even though other regions might not rank among the top diverse countries they can still be remarkably bioculturally diverse. Pieroni (2000) and González-Tejero et al. (2008) point out that also regions in Europe (such as the Mediterranean Basin) require further research in order to prevent diversity loss.

Because of this “unbalance” of biocultural research and conservation projects the idea came up to investigate the current state of research and biocultural conservation in Europe. The thesis was carried out as part of the MAB-project “Monitoring of Biocultural Diversity in the Biosphere Reserve ‘Großes Walsertal’”. One of the aims of the project is to document the diversity of locally gathered plant species, traditional crops, and the different local uses and habits related to these elements of biodiversity. Supporting local initiatives, dissemination of the results of the project, and inserting best practices of related international research will help creating awareness of the close link of biodiversity and local culture and support biodiversity conservation efforts in the biosphere reserve (Vogl et al., 2010).

This thesis first gives some background information about the concept of biocultural diversity and its components. The methods section describes how the research was conducted. Chapter 4 presents European projects that deal with and conserve biocultural diversity. These projects are then analysed in order to extract the information, provide best practices for future conservation projects, and answer the research questions.

1.1. Research questions

- Which projects are dealing with and conserving biocultural diversity in Europe?
- Which aspects of biocultural diversity are linked in the projects? Do European projects tend to focus on different aspects than the projects of Maffi and Woodley (2010)?
- Do the definitions of biocultural diversity of the European projects differ from those found in the literature (e.g. Maffi and Woodley, 2010)?
- In which projects is a monitoring/evaluation planned? What does it look like?
- Are European drivers of biocultural diversity loss similar to those identified by Maffi and Woodley (2010)?
- Do the projects offer any conservation strategies or solutions to cope with the encountered challenges and issues?

1.2. Objectives

The aims of this thesis are:

- To provide an overview of the concept of biocultural diversity and its current state of research,
- To identify European projects, which are dealing with biocultural diversity
- To identify European drivers of change that affect biocultural diversity negatively, and
- To extract recommendations and conservation strategies from the European projects.

2. The Concept of Biocultural Diversity – State of Research

During the last two decades, the new field of biocultural diversity emerged and forced the interdisciplinary research of biological, cultural and linguistic diversity and their interconnection. The reason for this development was the growing awareness that not only biological, but also cultural and linguistic diversity are being lost at increasing rate and that similar drivers could be identified as reasons for this dramatic loss (Maffi, 2005).

This chapter gives an overview of the concept of biocultural diversity and its current state of research. Before talking about biocultural diversity in detail, its components (biological, cultural and linguistic diversity) will be reviewed. Not only is it important to understand what these components are and how they are defined, but also how they can be measured and what threats they are exposed to.

2.1. Biological diversity

The Convention on Biological Diversity (CBD) defines biological diversity as follows:

"'Biological diversity' means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems" (CBD, 2006).

Biodiversity therefore includes diversity of life at different levels: at the genetic level between individuals of a population, the diversity of species, and the diversity of ecosystems and habitats. It further includes the different abundances of genes, individuals and habitats, their distributions and interactions. It also encompasses humans and its cultural diversity in all its forms (UNEP, 2007).

2.1.1. Measurement of Biological Diversity

Whittaker (1972) identified five different types of biodiversity. Alpha diversity is the biodiversity of a sampled area and is approximately measured as the number of species (species richness) in that area. Beta diversity is the differentiation of communities along habitat gradients (such as elevation or moisture conditions). The fewer species can be found in two habitats, the bigger is their beta diversity. The total or gamma diversity of a landscape consists of all the different alpha diversities of its communities and the beta diversity among them. Whittaker (1977) defines the delta diversity as the change of species between geographic areas or along climatic gradients. It is similar to beta diversity but bigger in scale. The epsilon diversity is the total species richness observed in a region or in the total number of gamma-scale landscapes sampled.

There are many different approaches and indices for summarising and analysing trends in alpha diversity. Probably the easiest way to describe the biodiversity is to count the number of species in a defined area (species richness). Other "traditional" indices are Shannon's and Simpson's index. As they are easy to calculate and understand, they are frequently used. Another group of indices are species intactness indices which can be divided into species intactness indices based on occurrence and species intactness indices based on abundance. They measure overall biodiversity intactness by summarising either the individual species intactness or the average intactness of a group of species. Occurrence indices (such as Nielsen occurrence index or Buckland geometric occurrence index) measure species intactness by comparing the proportion of sites where a species was detected between a reference and an observed dataset. The reference dataset can vary depending on the research goals: it can be the beginning or end of a time series, a desired final state or empirically measured reference conditions. Abundance indices (such as Nielsen abundance index or Buckland geometric abundance index) measure intactness by comparing the

population size of a species between a reference and an observed dataset. Multivariate community intactness indices monitor biodiversity intactness at the community level through multivariate approaches. They do not lose information on the community structure by averaging the occurrence or abundance indices of individual species. Instead they compare the deviation of an observed and a reference community structure (Lamb et al., 2009).

In 1992, the UN Conference on Environment and Development (also known as the Earth Summit) in Rio de Janeiro took place. One of the key agreements was the Convention on Biological Diversity (CBD) which has three main goals: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits from the use of genetic resources (CBD, 2009). In April 2002 all of the 193 parties of the CBD committed themselves to achieve the 2010 Biodiversity Target, which is a significant reduction of the current rate of biodiversity loss at the national, regional, and global level. For the assessment of the progress towards the 2010 Biodiversity Target, a list of global indicators for biodiversity was agreed on (CBD, 2010). According to 2010 Biodiversity Indicators Partnership (2008), the indicators are divided into seven focal areas:

- Status and trends of the components of biodiversity
- Sustainable use
- Threats to biodiversity
- Ecosystem integrity and ecosystem goods and services
- Status of traditional knowledge, innovations and practices
- Status of access and benefit sharing
- Status of resource transfers

For the different focal areas a total of 17 headline indicators and 29 indicators have been established. As global biodiversity is difficult to assess, various indicators are used that do not necessarily measure biodiversity directly but act as a barometer of biodiversity conservation and sustainable development. Examples of such indicators are “coverage of protected areas” or “global wild bird indicator”. The full set of indicators can be found on the homepage of the 2010 Biodiversity Indicators Partnership (2010 BIP, 2008).

2.1.2. Why Conserving Biological Diversity?

“Ecological diversity is essential for long-term planetary survival. All living organisms, plants, animals, bacteria and humans survive and prosper through a network of complex and delicate relationships. Damaging one of the elements in the ecosystem will result in unforeseen consequences for the whole of the system” (Baker, 2001).

During the last decades, the awareness has grown that humans are not external to and separate from nature, but are affected by the changes in ecosystems, populations of species and genetic changes. Even though biodiversities benefits towards humanity are not always that obvious, it is nevertheless essential and plays a fundamental role in maintaining and enhancing human’s well-being (UNEP, 2007).

According to the Millennium Environmental Assessment (MA), biological diversity has a positive effect on key ecosystem processes in terrestrial ecosystems, such as biomass production, nutrient and water cycling, and soil formation and retention. Depending on composition, relative abundance, functional and taxonomic diversity, ecosystem services are being supported (MA, 2005). Increasing loss of biological diversity is not only diminishing these key processes, but also the ecosystem’s resilience, meaning its tolerance towards disturbances and recovery rate after disturbing events (MA, 2005; Pretty et al., 2008).

There are many ways in which biodiversity and ecosystem services are beneficial and necessary for human's well-being. Without biological diversity, agriculture would not be possible, as humans would not have had the genetic pool from which to draw and domesticate crops. Furthermore, wild relatives of domesticated crops provide genetic variability which may be used for overcoming pests and pathogens. Wild plants are also very important; especially in rural communities they are often used for nutritious purposes (MA, 2005).

Biological diversity contributes directly and indirectly to livelihood security. Mangrove forests and coral reefs for instance are spots of high biodiversity and are very good buffers against floods and storms. Reduction of these natural buffers does not only reduce local biological diversity but also puts humans in nearby areas at risk. MA (2005) found out that rural communities tend to maintain ecosystem diversity and variability (such as diversity of species, food, and landscapes) in order to have more options and solutions available in case of emergency. Land degradation and habitat loss reduce livelihood security and make the region more vulnerable in case of extreme events (MA, 2005; UNEP, 2007).

Human health also benefits greatly from biodiversity. According to MA (2005), evidence is accumulating that greater wildlife diversity may decrease the spread of wildlife pathogens to humans (e.g. Lyme disease). In the huge pool of wild plants, many can be found that contribute to human health. Numerous ethnobotanical studies have proven that wild plants can be used for medical purpose (MA, 2005). Reducing this diversity would lower the pool from which we can draw (Bernard, 1992).

Biodiversity and energy are also closely linked. In developing countries more than half of the energy used is provided by wood fuel, making forests a very important energy source (MA, 2005). However, also fossil fuels are the result of ecosystem and biological diversity services in the past (UNEP, 2007).

The Economics of Ecosystem and Biodiversity study (2010) tries to calculate the monetary values of ecosystem and biodiversity services. Especially for decision- and policymakers it is useful to demonstrate theses values in economic terms. It is done by calculating the costs and benefits of conserving ecosystems and biodiversity. Forests for example are valuable sinks for CO_2. Halving deforestation rates by 2030 would reduce global greenhouse gas emissions and consequently reduce damages from climate change by more than US$ 3.7 trillion. Bee keeping also has a huge monetary benefit. It is estimated that in Switzerland an agricultural production worth more than US$ 213 million per year is generated by the pollinating insects (TEEB, 2010). In Pakistan, the degradation of mangrove forests causes losses of US$ 20 million in the fishing industry, US$ 500,000 in forestry and US$ 1.5 million in feed and pasture losses (UNEP, 2007).

Independent from its benefits and services to people, biodiversity also has an intrinsic value. Biological diversity and ecosystem services are far too complex to be understood, which is why the precautionary principle should be applied. Just because people cannot see any direct benefit, it does not mean that there is none. Biodiversity has evolved over the last 3.8 billion years. It would be disrespectful to keep dealing with biological diversity this carelessly instead of conserving it for future generations (UNEP, 2007).

2.1.3. Threats

There is evidence of so-far five major extinction events that caused dramatic loss of biodiversity. The current and sixth extinction is mainly due to human activities. The Global Environment Outlook (GEO) identifies population growth and patterns of consumption, which lead to increased demand for ecosystem services and energy, as most important drivers that are causing biodiversity loss. These drivers put pressures on ecosystems and biodiversity and have direct impacts on them (UNEP, 2007).

UNEP (2007) identifies the following major pressures that affect biodiversity and ecosystem services:

- Habitat conversion
- Invasive alien species
- Overexploitation
- Climate change
- Pollution

Habitat conversion is one of the serious threats affecting ecosystems and its biodiversity. Between 1990 and 2005 the global forest area was reduced by 8.9 million hectares per year, which is equivalent to an annual loss of 0.22 percent. Between the years 2000 and 2005 the forest area loss is estimated at -7.3 million hectares per year, which is -200 km^2 of forests per day. These forests are mostly transformed into less diverse farmland or used for infrastructure, both of which are decreasing local biodiversity significantly (FAO, 2006). Biological diversity is also being reduced, if economically unattractive agricultural areas are not managed any more. Many extensively managed agricultural areas developed a rich and diverse flora and fauna which adapted to humans disturbances. Because of the lack of agricultural management, especially in industrialized countries, these economically unattractive but highly diverse areas are slowly turning to forests again (Altieri, 1999; Mander et al. 1999; Hole et al., 2005; Schmitzberger et al., 2005).

Especially on islands and in fresh water habitats, invasive alien species have been a major cause of extinction. In many cases, native species cannot cope with sudden changes in competition and predation and are therefore dominated by invasive species (MA, 2005). Loss of traditionally available resources, loss of potential useful species, losses in food production and increased costs for agriculture, forestry, fisheries, and human health are only some of the possible negative impacts on ecosystem services and human well-being (UNEP, 2007).

Overexploitation often leads to a decrease of populations and extinctions, thus reducing biological diversity (UNEP, 2007). Marine fish and invertebrates, trees, and animals hunted for meat are the most overexploited groups of species. Often not only the species themselves but also their habitats and ecosystems are degraded and destroyed. As a consequence, resource availability and income earning potential are decreased (MA, 2005, UNEP, 2007).

Climate change is also a major pressure affecting biodiversity and ecosystems. Especially in warmer regions, significant impacts on species distributions, population sizes, and increased pest frequency have already been measured. Presumably, climate change intensifies the already ongoing loss of biological diversity by decreasing the water availability in semiarid and arid regions and by increasing the frequency of extreme events (such as floods and droughts). Furthermore, vector- and waterborne diseases (such as malaria and cholera) are expected to increase in many regions and agricultural productivity in the tropics and sub-tropics, and fish production are projected to decrease for almost any amount of warming (MA, 2005).

Especially in inland water and coastal habitats, pollution has severe impacts on biodiversity. The increased discharge of nutrients (such as nitrogen and phosphorous) causes intensive eutrophication and high levels of nitrate in drinking water (MA, 2005). Eutrophication often leads to an increase of algae blooms, which have negative effects on biodiversity, fisheries, and aquaculture (UNEP, 2007). Especially pollution from point sources such as mining and other industry has devastating effects on the biota of inland waters in many parts of the world (MA, 2005).

The general trend of biodiversity is a widespread, radical decline. The major driving forces of these dramatic losses are human actions and have impacts on all the different levels of biological diversity (Harmon, 2002). In order to reduce the current rate of extinctions, destructive and devastating actions have to be minimised. A first step into this direction is the 2010 Biodiversity Target, which aims at reducing the biodiversity loss at the global, regional and national level (2010 BIP, 2008).

2.2. Cultural diversity

The UNESCO defines culture as "*the set of distinctive spiritual, material, intellectual and emotional features of society or a social group, that encompasses, in addition to art and literature, lifestyles, ways of living together, value systems, traditions and beliefs*" (UNESCO, 2001).

"'Cultural diversity' refers to the manifold ways in which the cultures of groups and societies find expression. These expressions are passed on within and among groups and societies. Cultural diversity is made manifest not only through the varied ways in which the cultural heritage of humanity is expressed, augmented and transmitted through the variety of cultural expressions, but also through diverse modes of artistic creation, production, dissemination, distribution and enjoyment, whatever the means and technologies used" (UNESCO, 2005).

Cultural diversity therefore comprises the entire differences of world's cultures, including all the various behaviours, ideas and artefacts, created by the whole of humankind, no matter where they live (Harmon, 2002). The different cultures are also closely linked to their local environment. Cultural knowledge and practices often demonstrate strategies for the sustainable use and management of biodiversity. The global cultural diversity can be seen as a response to the various environmental conditions and ecosystems on earth, which all have to be dealt with in different ways (UNEP, 2007; Zent, 2009).

2.2.1. Measurement of Cultural Diversity

Harmon (2002) identifies some indicators of cultural diversity, which can be used to monitor its development (Table 1). These indicators are divided into three groups: subsistence and livelihood, creative activities, and group identification.

Subsistence and livelihood indicators of cultural diversity contain food production techniques and strategies such as crop selection and animal breeding, diets, environmental knowledge, languages, medicine and medical practices, and different forms of recreation. Creative activities such as architecture, dress and personal adornment, literature, performing and visual arts, and music can also be used as indicators. The third class includes group identification indicators: ethnicity, religion, secular affiliation and social organisation (Harmon, 2002).

Even though all of these indicators can be used to measure and show trends of cultural diversity, some of them turned out to be more useful and easier to use than others. Artistic indicators for example are harder to analyse, as they cannot be compared easily. In many

Table 1: Indicators of cultural diversity (Source: Harmon, 2002).

Subsistence and Livelihood	**Creative Activities**	**Group Identification**
Crop selection, animal breeding and husbandry techniques, land management strategies	Architecture	Ethnicity
Diet	Dress and personal adornment	Religion
Environmental knowledge	Literature	Secular affiliations
Language	Music	Social organization and kinship systems
Medicine and medical practices	Performing arts	
Recreation	Storytelling and oral history	
	Visual arts	

cases the amount of available data will be the limiting factor. Only for a few indicators rathercomplete and consistent databases exist, which can be used for analyses. In order to draw general conclusions about cultural diversity, it is helpful to use those indicators with the potential for universal applicability (Harmon, 2002).

According to Harmon (2002), the most detailed data on ethnicity can be found in the World Christian Encyclopedia. Its data has been made available online at the World Christian Database and contains not only information on religious aspects, but also secular data on population, health, education, and communication. Amongst others, it holds information on over 13,000 ethnolinguistic people groups, 5,000 cities, 3,000 provinces, and 239 countries. (World Christian Database, 2004). At the level of “ethnolinguistic families” the data from the period 1900 to 1980 suggests an increase in ethnolinguistic diversity. The five most populous ethnolinguistic families (Chinese, North Indian, Germanic, Slav, and Latin) dropped from 68 % of the world’s people to 55 %, implicating that smaller ethnolinguistic families grew faster than the bigger ones. However, total ethnolinguistic diversity decreased during that period because of the extinction of tribal cultures (Harmon, 2002).

Religious adherence is also a cultural indicator for which rough global data is available. At the moment, some 10,000 active religions exist, out of which Christianity, Islam, Hinduism, Buddhism, and Judaism have the most followers. The percentage of world’s people belonging to those “world religions” increased from 68 % in the year 1900 to 72 % in the year 2000. Chinese folk religions and tribal religions were the categories of religions that declined the most during this period. Two other trends are very interesting: on the one hand, the number of people that became secularised grew enormously (from almost 0 in the year 1900 to about 15 % in the year 2000), and on the other hand, a huge number of new religions developed. In the United States and Canada more than 1,600 active churches are listed, many of which have formed in the 20th century (Harmon, 2002).

Out of the few cultural diversity indicators that are universal applicable and for which sufficient analysable data exists, language use or linguistic diversity is by far the best indicator. Even though it is not equivalent to culture, it still can be used to depict cultural differences and changes. According to Harmon (2002), of all the indicators of cultural diversity, linguistic diversity offers the best chance of making a comprehensive and comprehensible division of the world’s peoples into constituent groups based on a single aspect of culture. Positive about linguistic diversity is the fact that languages cover every aspect of human lives and that they are easy to monitor. Religious or ethnic affiliations are much harder to survey and quantify (Harmon, 2002).

2.2.2. Why conserving Cultural Diversity?

UNESCO's Universal Declaration on Cultural Diversity (UNESCO, 2001) states that "*cultural diversity is as necessary for humankind as biodiversity is for nature*". It is a source of exchange, innovation, and creativity and should therefore be preserved for the benefit of present and future generations (UNESCO, 2001). Cultural diversity is a reservoir of creativity and potential solutions to future social and environmental problems. It would be ignorant to think that politically dominant cultures can deal with future challenges without the help of others (Harmon, 2002). Based on their local living conditions and environment, each society has developed its individual cultural knowledge and practices which contributed to sustainable management strategies. These strategies, practices and knowledge are an enormously valuable heritage that must be preserved, enhanced, and passed on to future generations (UNESCO, 2001; UNEP, 2007).

Similar to the idea of cultural diversity being a reservoir of creativity is the fact that it is important for future research. A lot of knowledge is hidden in the components of cultural diversity and has not been extracted yet. Languages for example can give us information about the relation of a society with its environment. But how can this relation be studied, if the language becomes extinct (Harmon, 2002)?

Another reason for conserving cultural diversity is "social justice". According to the UNESCO Universal Declaration on Cultural Diversity (UNESCO, 2001), cultural rights are an integral part of human rights. Therefore, all persons should have the right to express themselves in the language of their choice and conduct their own cultural practices (UNESCO, 2001). Consequently, subjugation of other cultures against their will is violating these cultural and human rights (UNESCO, 2001; Harmon, 2002).

Cultural diversity also has direct and indirect economic benefits. It provides an income for people who work in this field (such as artists or researchers) and avoids costs for society by offering novel solutions to social problems, which otherwise would need money to cope with (Harmon, 2002).

2.2.3. Threats

Similarly to biodiversity, the general trend in cultural diversity is a rapid decline (Posey, 1999; Maffi, 2001; Harmon, 2002; Maffi, 2005). The reason for this reduction of cultural diversity can be found in different direct and indirect drivers of change:

Indirect drivers or threats do not have impacts on cultural diversity itself, but they rather affect biodiversity. New commercial resource use, extended commodification of natural resources, and pollution of water ecosystems, increase both habitat and species loss. As a consequence, cultural identity, cultural knowledge, and livelihoods are lost, thus reducing cultural diversity (Pretty et al., 2009).

Direct drivers affect primarily cultural diversity. The continuing globalisation of food systems for instance is slowly changing traditional diets and is responsible for the loss of these diets and the related knowledge of famine foods. Similarly, the modernisation of the healthcare system caused an erosion of traditional medical plant knowledge, as there is less need to use this traditional knowledge and practices. The spread of formal education and the expansion of dominant belief systems are also reducing cultural diversity. In many cases, traditional environmental knowledge and minority languages are not taught in school and passed on to younger generations, making it difficult to transmit this knowledge and keep this heritage alive. Reduced communication with elder generations is additionally intensifying this effect (Pretty et al., 2009).

Disconnection from nature is also a driver which can cause loss of cultural diversity. Rural-urban migration and urbanisation are often connected with erosion of rural cultures. After the migration to cities, traditional environmental knowledge is often not needed anymore and

lost. This loss of knowledge is often accompanied by a loss of identity and changes in social organisation (Pretty et al., 2009).

Assimilation is also a major threat to cultural diversity. Because of the expansion of transport, communication, and trading networks, individuality and diversity is bit by bit lost. In “modern” societies traditional practices and knowledge are more and more forgotten, leading to the loss of cultural values and worldviews. Cultural erosion also occurs as a consequence of the increased access to and interaction with other cultures. In many cases this interaction causes cultural hybridisation and assimilation into the more dominant culture (Pretty et al., 2009).

2.3. Linguistic diversity

Linguistic diversity can be split up into three different levels or hierarchies of diversity. *Language diversity* or *language richness* is the number of different languages that are found in a given geographical area. *Phylogenetic diversity* is the number of different lineages of languages found in an area. It encompasses variation “above” the level of languages such as phylogenetic language families. The more closely related languages are found in an area, the higher is the language diversity, but not necessarily the phylogenetic diversity. The differences among structures within a language, such as morphology, word order, and phonology, are called *structural diversity* (Nettle, 1999; Harmon, 2010). Structural diversity is potentially independent of both the language diversity and the phylogenetic diversity. Some languages of the same family may differ on certain parameters, such as word order, whereas languages of completely different families may converge (Nettle, 1999).

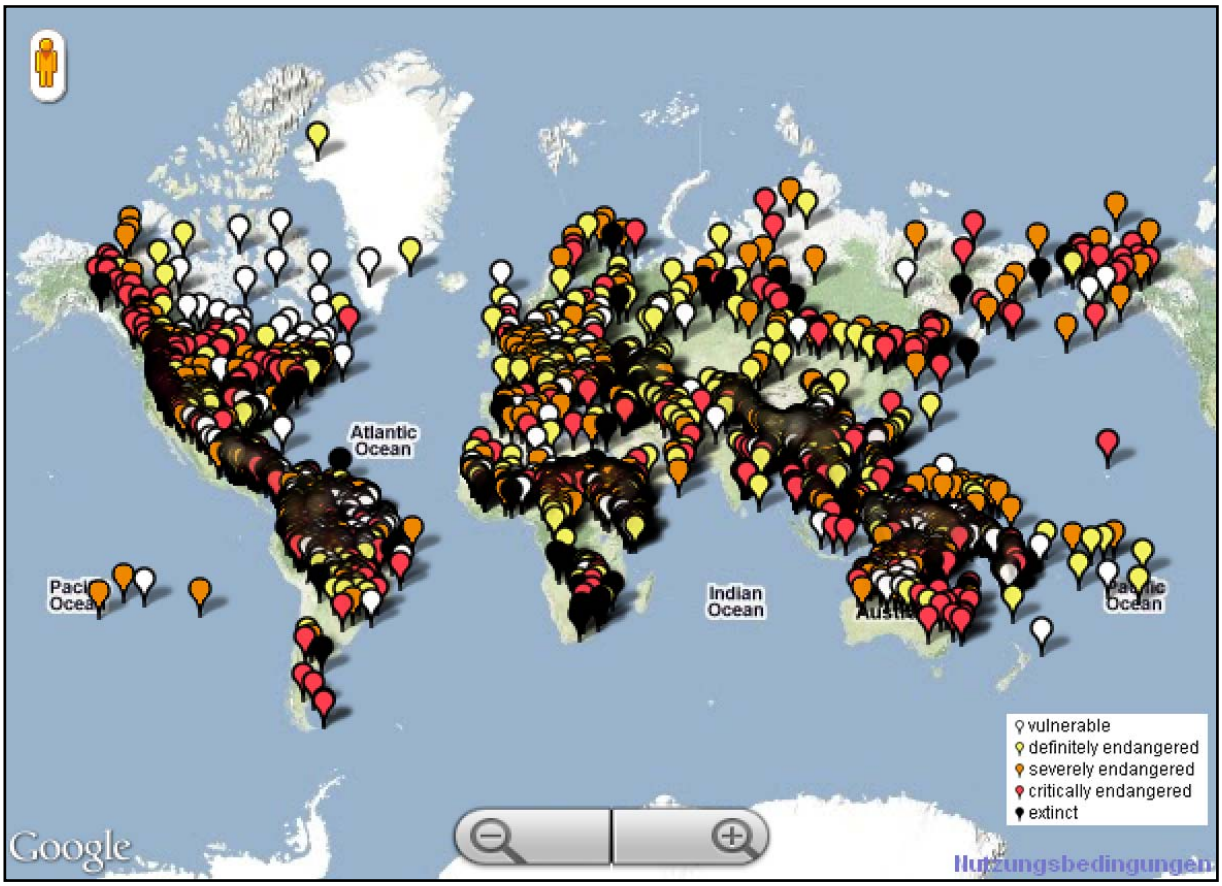

Figure 1: UNESCO Atlas of the World's Languages in Danger. Source: UNESCO, 2011.

Languages and species have many similarities. As already mentioned in chapter *2.1 Biological diversity,* biodiversity also consists of three different hierarchies of diversity. These levels of biological diversity have corresponding levels of linguistic diversity. At the smallest scale, genetic diversity in biology and structural diversity linguistics are analogous hierarchies of diversity. Similarly, species diversity and language diversity, and ecosystem diversity and phylogenetic diversity are correspondent hierarchies. Another similarity between species and languages is that many countries with high numbers of endemic species also have high numbers of endemic languages. 16 out of the 25 countries with the highest number of endemic higher vertebrate species (such as mammals, reptiles, amphibians) are among the top 25 endemic languages countries (Harmon, 2002).

The *Ethnologue* is an encyclopaedic reference work cataloguing all of the world's 6,909 known living languages. According to the *Ethnologue*'s genetic classification (Lewis, 2009), there are 116 different language families. The major six language families account for nearly 65% of the total amount of languages and 85% of the world's population. There are 389 (or nearly 6%) languages which have more than one million speaker. All together, these languages account for 94% of the world's population, which means that the remaining 94% of languages are spoken by only 6% of the world's people (Lewis, 2009). In fact, the median language size is only 5,000 speakers, whereas the average language size is 900,000. This discrepancy indicates that there are many small languages and only few languages with high numbers of native speakers (Harmon, 2002). Out of the *Ethnologue*'s 6,909 listed languages, 473 are classified as nearly extinct, which means that "only a few elderly speakers are still living" (Lewis, 2002). UNESCO Atlas of the World's Languages in Danger (Figure 1) provides detailed information about endangered languages and plots them on a world map (UNESCO, 2011). Harmon (2002) states, that 52-60% of the world's languages are spoken by no more than 10,000 people. As pressures on small languages will only increase, it is very likely that many of those languages will no longer be spoken as mother tongue, or at least will become irreversibly moribund during this century. In his opinion, roughly 2,800 - 3,200 languages (43 - 49%) of all living languages will become extinct during this century (Harmon, 2002).

2.3.1. Measurement of Linguistic Diversity

Harmon and Loh (2010) created the Index of Linguistic Diversity (ILD), which they believe to be "*the first-ever quantitative index of trends in linguistic diversity based on time-series data on numbers of mother-tongue speakers*". The database contains information of nine editions of *Ethnologue* and five other compendia of speaker numbers and allows assessing trends in linguistic diversity by comparing changes in the relative distribution of mother-tongue speakers against a reference state in 1970. The ILD measures how far the languages in a geographic area deviate from a hypothetical situation in which each language is neither increasing nor decreasing its share of the total population in this area. This is done by measuring the changes in the number of mother-tongue speaker over the period from the years 1970 to 2005. The year 1970 was chosen, because this was the first time when sufficient data was available to calculate the index. The index value is set equal to 1 in the baseline year, and depending on the average changes of all the languages in the sample, the index is either decreasing or increasing. If the average is decreasing, it means that a few larger languages are becoming more dominant and smaller languages are decreasing their shares. If the average is increasing, more people are shifting away from dominant languages to minority languages. The trendline of the index is tracking this trend over the period (Figure 2), but does not predict future changes (Harmon and Loh, 2010).

From the years 1970 to 1988, the ILD declines from 1.00 to 0.95. After the year 1988, it is decreasing at a higher rate and until 2005 the index went down to 0.80. The small lines above and below the trendline are the boundaries of the 95% confident interval. The decline of 20% of the ILD Global during the years from 1970 to 2005 does not mean that language

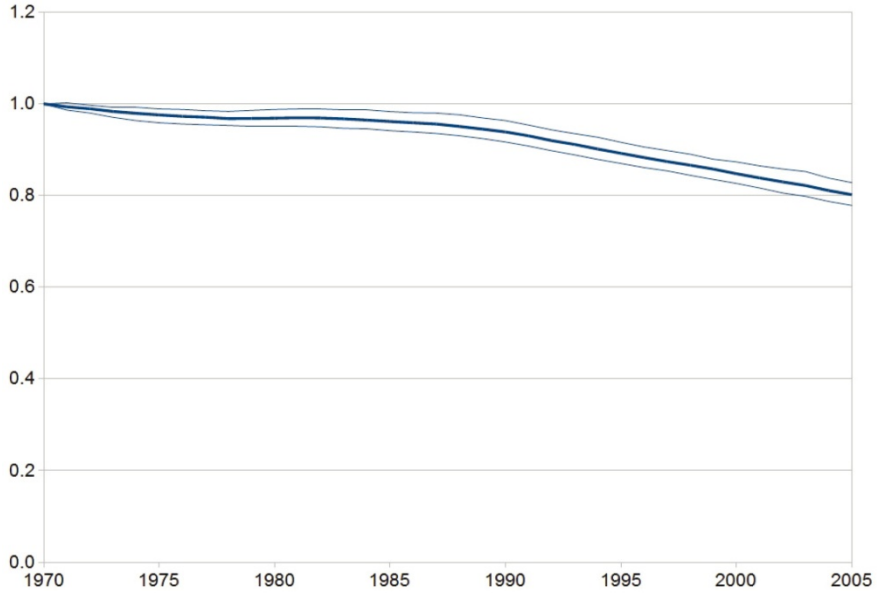

Figure 2: Index of Linguistic Diversity Global, 1970 – 2005. Source: Harmon and Loh, 2010.

diversity itself decreased by 20%, but their average share of the world's population went down. In other words, there has been a massive shift from smaller languages to bigger ones, making smaller languages even more vulnerable and endangered (Harmon and Loh, 2010).

Harmon and Loh (2010) also calculated the ILD of indigenous languages for the regions Eurasia, Africa, Pacific (including Australia and Papua New Guinea), and Americas (Figure 3). Out of the four different regions, Eurasia is the only one whose ILD shows an overall increase during the period from the years 1970 to 2005. Until 1981, it increased to 1.10, then flattened and declined to 1.07 in 2005. Similarly to ILD Eurasia Indigenous, ILD Africa Indigenous increased to 1.07 between 1970 and 1985, meaning that there was a shift towards smaller languages. However, after 1985 the ILD started to decline and went down to 0.83 until 2005. The pacific region shows the second steepest decrease in linguistic diversity. The index fell steadily to 0.70 during the period of 35 years. ILD Americas Indigenous declined even more. Between 1970 and 2005 the index decreased by 64% (Harmon and Loh, 2010).

However, one must keep in mind that the starting point (the year 1970) was chosen because this was the first time when there was enough data available to calculate indices. This does not necessarily mean that in 1970 the linguistic diversity was at its maximum state. Furthermore, the decline of ILD Americas Indigenous by 64% in the period 1970 – 2005 does not indicate that absolute linguistic diversity in that region is lower than in the others. It means that dominant languages increased their relative number of mother-tongue speakers but does not give any information about language richness. It is well plausible that the Americas were more linguistically diverse in 1970 compared with other regions (such as Europe), in which the majority of linguistic diversity was lost before 1970 (Harmon and Loh, 2010).

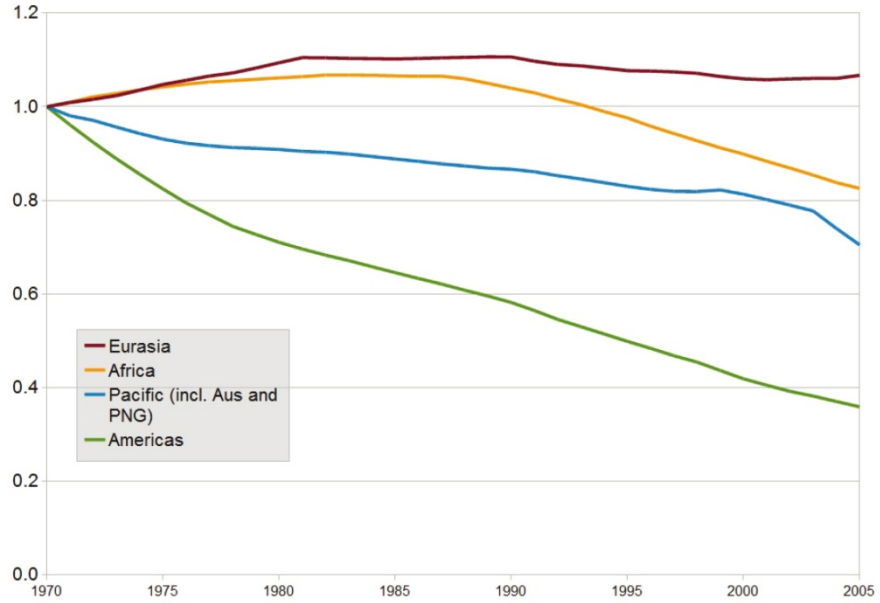

Figure 3: Index of Linguistic Diversity for the regions Eurasia, Africa, Pacific, and Americas for indigenous languages (1970 - 2005). Source: Harmon and Loh, 2010.

2.3.2. Why conserving Linguistic Diversity?

"In the same way that a healthy planet requires biological diversity, a healthy cultural world requires linguistic diversity. Yet, language is also an elaborate phenomenon tied to real people and cultures. Language loss threatens a fundamental human right – that of expression of the life and life ways of a people.

Each language relates ideas that can be expressed in that language and no other. Thus, when an indigenous community is no longer allowed to pray, sing, or tell stories in its language, it is denied a fundamental human right. Unfortunately, linguistic rights have been seriously abused for hundreds of years by banning specific languages and indirectly by assaulting language-support structures such as land, economies, and religions.

... Languages today are the next frontier in setting the country [indeed the world] into moral and environmental symmetry" (Meya, 2006).

According to Meya (2006), linguistic diversity must be preserved, as every human has the right to express himself in his own language. Consequently, dictating languages and cultural traditions against someone's will, as happened in colonial times, is violating this fundamental human right.

In addition to this ethical and social reason, languages are essential for humanity itself. Bernard (1992) states that "*any reduction of linguistic diversity diminishes the adaptive strength of our species because it lowers the pool of knowledge from which we can draw*" (Bernhard, 1922). In his opinion, languages are far too valuable to let them become extinct, because once they are lost, they cannot be revived.

Another good reason for conserving linguistic diversity is its interrelatedness with cultural and biological diversity. If we want to preserve cultural and biological diversity, it is inevitable to preserve languages as well. Languages embody the cultural wisdom of world's different societies (UNESCO, 2003). They play an important role in communicating and transmitting cultural values, traditional knowledge and practices (Maffi, 2007), which is why losing a language often means losing an entire culture (Maffi et al., 1999). With death of a language, also the traditional ecological knowledge about relationships between plants and animals is being lost (Nabhan, 2001). This knowledge is acquired through frequent interaction with the

local environment and passed on orally to the next generation. It often incorporates sustainable resource use strategies and has helped to protect and maintain natural environments (Posey, 1999; Pretty et al., 2008).

Skutnabb-Kangas (2002) also identifies economic arguments for preserving linguistic diversity. In our society knowledge, ideas and information are getting more and more important. Language richness and plurilingualism can help accessing different sources of knowledge and creativity and can therefore encourage innovations (Skutnabb-Kangas, 2002).

2.3.3. Threats

In our history, the main waves of colonial and imperial expansion were an important driver of cultural and linguistic change. Whenever a society was being dominated by another one, assimilation into the dominant culture and language occurred. This was done on the one hand by imposing the dominant language in schools, the media, and other public affairs and on the other hand by prohibition and denigration of the local languages. Together with the local languages, also the embodied customs, traditions, and beliefs vanished and got lost (Maffi, 1998).

Nowadays, globalisation is a major driver of change and cause of language loss. Along with the expansion of transport, communication, and trading networks comes a pressure, which acts on small societies, cultures and languages. Even though globalisation is facilitating communication with peoples of different origin and – as Maffi (1998) calls it – "*humanity will be freed of the burden laid upon it by the 'curse of Babel': the multiplicity of languages*", it must not occur at the expense of linguistic diversity. Learning of other languages should not lead to the loss of one's own language. Indigenous and minority groups should not be pressured to abandon their mother tongue for the sake of the dominant language (Maffi, 1998). This is why it is important to teach the children's mother tongue in school. Not teaching a child's mother tongue in school inevitably leads to erosion of traditional knowledge, as the child will not be able to learn the language fully. Skutnabb-Kangas et al. (2003) call it "*subtractive language learning*": the dominant language is learned at the cost of the mother tongue. Instead, the mother tongue should be learned first, and knowledge in dominant languages can be added later, at no cost to the mother tongues. This "additive language learning" leads to bilingualism or multilingualism and additionally helps maintaining the mother tongue (Skutnabb-Kangas et al., 2003).

2.4. Biocultural diversity

Having discussed the components of biocultural diversity, this chapter focuses on the concept of biocultural diversity itself.

In the 1990s, researchers became aware, that the world's biological, cultural, and linguistic diversities are being lost at dramatic rates and that some of the same forces are the causes for this decline (Maffi, 2005). The attention was drawn to linguistic and cultural diversity, whose extinction crisis had gone unnoticed, but obviously paralleled the loss of biological diversity (Posey, 1999; Maffi, 2001; Harmon, 2002). The field of biocultural diversity formed out of the awareness that the three diversities are linked and that a transdisciplinary approach is needed in order to conserve the different manifestations of the diversity of life (Maffi, 2005). Or as Pretty et al. (2008) put it, *"...any hope for saving biological diversity, or even recreating lost environments through restoration ecology, is predicated on a concomitant effort to appreciate, protect, and respect cultural diversity*".

Maffi and Woodley (2010) define biocultural diversity as follows:

"Biocultural diversity comprises the diversity of life in all of its manifestations: biological, cultural, and linguistic, which are interrelated (and likely coevolved) within a complex socio-ecological adaptive system" (Maffi and Woodley, 2010).

According to Loh and Harmon*, "biocultural diversity may be thought of as the sum total of the world's differences, no matter what their origin. It includes biological diversity at all its levels, from genes to populations to species to ecosystems; cultural diversity in all its manifestations (including linguistic diversity), ranging from individual ideas to entire cultures; and, importantly, the interactions among all of these" (Loh and Harmon, 2005).*

The label "biocultural diversity" is actually the short form for "biocultural, cultural and linguistic diversity". Language plays an important role in communicating and transmitting cultural values, traditional knowledge and practices, and mediates therefore interactions between humans and their environment. Consequently, it can be seen as the third pillar of the biocultural concept (Maffi, 2007).

The definition of biocultural diversity makes clear that diversity of life also incorporates the diversity of human cultures and languages. It is not restricted to biological diversity (such as plant and animal species, habitats, and ecosystems) but also includes humanity and its achievements. These diversities must not be seen as separate from each other. On the contrary, they are interwoven and dependent on each other. Another key element of the definition is the co-evolution of biological, cultural, and linguistic diversity. This means that they did not form overnight, but they developed over time through mutual adaptation between humans and the local environment (Maffi and Woodley, 2010).

The interlinkage of biological and cultural diversity was expressed in the Declaration of Belém by the International Society of Ethnobiology, which affirmed the existence of an "inextricable link" between the two diversities (ISE, 1988). Earlier research in the field of biocultural diversity focused on the parallels and correlations between biodiversity and linguistic diversity (Maffi, 2005).

Harmon (1996) identified significant overlaps between areas of high linguistic diversity and biodiversity on global scale. He found that 10 out of the top 12 countries with the highest numbers of biodiversity are among the top 25 most linguistically diverse countries. These both biologically and linguistically megadiverse countries can be found in Central and South America, Central Africa, South and Southeast Asia and the Pacific. According to Harmon (1996) there are a number of factors that affect the development of both biological and linguistic diversity. These are the presence of extensive land masses with a variety of terrains, climates, and ecosystems, island territories (especially with internal geophysical barriers), and tropical climates (Harmon, 1996).

Nettle (1999) tries to explain the distribution of linguistic diversity and subsumes the factors that are influencing this distribution under the concept of ecological risk. His findings suggest that higher rainfall and longer growing seasons correlate positively with linguistic diversity. The reason for this pattern is that in areas with lower ecological risk, humans do not have to group that much and build larger networks in order to mitigate the ecological risk. Accordingly, people can be more self-sufficient which results in a higher number of smaller-scale ethnolinguistic groups and total linguistic diversity (Nettle, 1999).

Stepp et al. (2004) used a Geographical Information System (GIS) to identify and map possible shared patterns in the spatial distribution of biological and cultural diversity (Figure 4). Plant diversity and language richness tend to be higher in tropical regions. These findings are similar to those of Harmon (1996) and Nettle (1999). According to Stepp et al. (2004), there is a correlation between low population densities and high biocultural diversity. Especially in the South Asian/Pacific region and the Himalayas this trend is noticeable. The reason for this correlation may be that increasing population density leads to linguistic homogenisation and ecosystem erosion (Stepp et al., 2004).

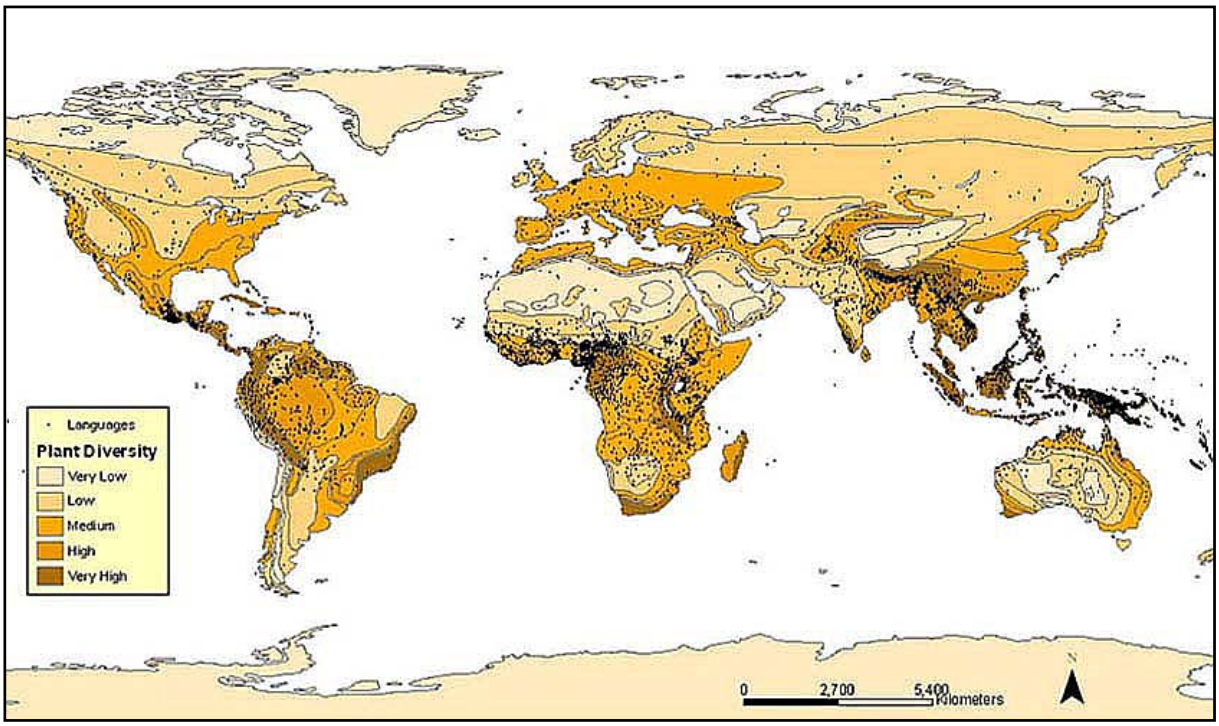

Figure 4: Plant diversity and language distribution. Source: Stepp et al., 2004.

Many other researchers identified similar geographic and climatic factors that most likely support high biological and cultural diversity. Some of these factors are low latitude, high rainfall, higher temperature, coastlines, and mountains (for more information see: Maffi, 2007, p. 270). The modes of subsistence and ease of access is also influencing the biocultural diversity in a given area. This idea is similar to Nettle's (1999) concept of ecological risk. Ease of access to abundant resources is leading to higher numbers of smaller-scale societies and a diversification of languages. Large-scale economies however tend to decrease both linguistic and biological diversity. Interestingly, there is a significant overlap between threatened ecosystems and threatened languages, suggesting that some of the same factors have negative impacts on both biodiversity and cultural diversity (Skutnabb-Kangas et al., 2003).

Even though the distributional overlaps between biological and cultural diversity show clear patterns at the global level, there is still further research needed on the local level. Often the globally identified correlations between biological and cultural diversity become weaker or even disappear when looking at smaller regions. Regional studies are needed to indentify correlations and mutual influences at the local level and may provide useful knowledge for conservation of biocultural diversity (Stepp et al., 2004; Maffi, 2007).

2.4.1. Measurement of Biocultural Diversity

The Index of Biocultural Diversity (IBCD) (Harmon and Loh, 2004; Loh and Harmon, 2005) is a first attempt to create a global measure of biocultural diversity by means of a country-level index. The IBCD uses a combination of five indicators to establish rankings for 238 countries and territories. The number of languages, religions, and ethnic groups within a country is used as a proxy for its cultural diversity. Biodiversity is measured by the number of bird and mammal species and the number of plant species (Loh and Harmon, 2005).

The IBCD consists of three parts: a biocultural diversity richness component (BCD-RICH), an area component (BCD-AREA), and a population component (BCP-POP) (Loh and Harmon, 2005):

- BCD-RICH uses unadjusted counts of the five indicators. It is most straightforward measure of a country's "raw" biocultural diversity.
- BCD-AREA accounts for the fact that large countries tend to have higher overall biological and cultural diversity. This component therefore measures a country's biocultural diversity relative to its area.
- BCD-POP adjusts the indicator for a country's human population and therefore measures biocultural diversity relative to a country's population size

By combining the results of the components BCD-RICH, BCD-AREA, and BCD-POP, the authors were able to identify three "core areas" of global biocultural diversity (Figure 5), where the countries tend to have an exceptional high IBCD. To these core areas belong the Amazon Basin, Central Africa, and Indomalaysia/Melanesia. Papua New Guinea, Indonesia, Cameroon, and Colombia turned out to be the world's most bioculturally diverse countries. In all three component rankings of the index, they were among the top 10 diverse countries (Loh and Harmon, 2005).

Loh and Harmon's (2005) findings have a big similarity with the result of Stepp et al.'s (2004) calculation. Again, tropical regions in Southern and Central America, Central Africa, and South Asia/Pacific have been identified as most bioculturally diverse regions. The authors point out that the IBCD could be used by policy-makers and donor organisations as a framework for guiding strategic investments in biocultural diversity conservation (Loh and Harmon, 2005). One should however keep in mind that even tough other regions might not rank among the top diverse countries they can still be remarkably bioculturally diverse. Pieroni (2000) and González-Tejero et al. (2008) point out that also regions in Europe require further research in order to prevent diversity loss. Especially the Mediterranean Basin faces problems like alteration of the physical and biological environment and depopulation in rural areas, which are threatening its biocultural diversity (González-Tejero et al., 2008). Therefore, systematic explorations of traditional ecological knowledge (preferably in geographically or historically isolated areas) are needed in this area (Pieroni, 2000).

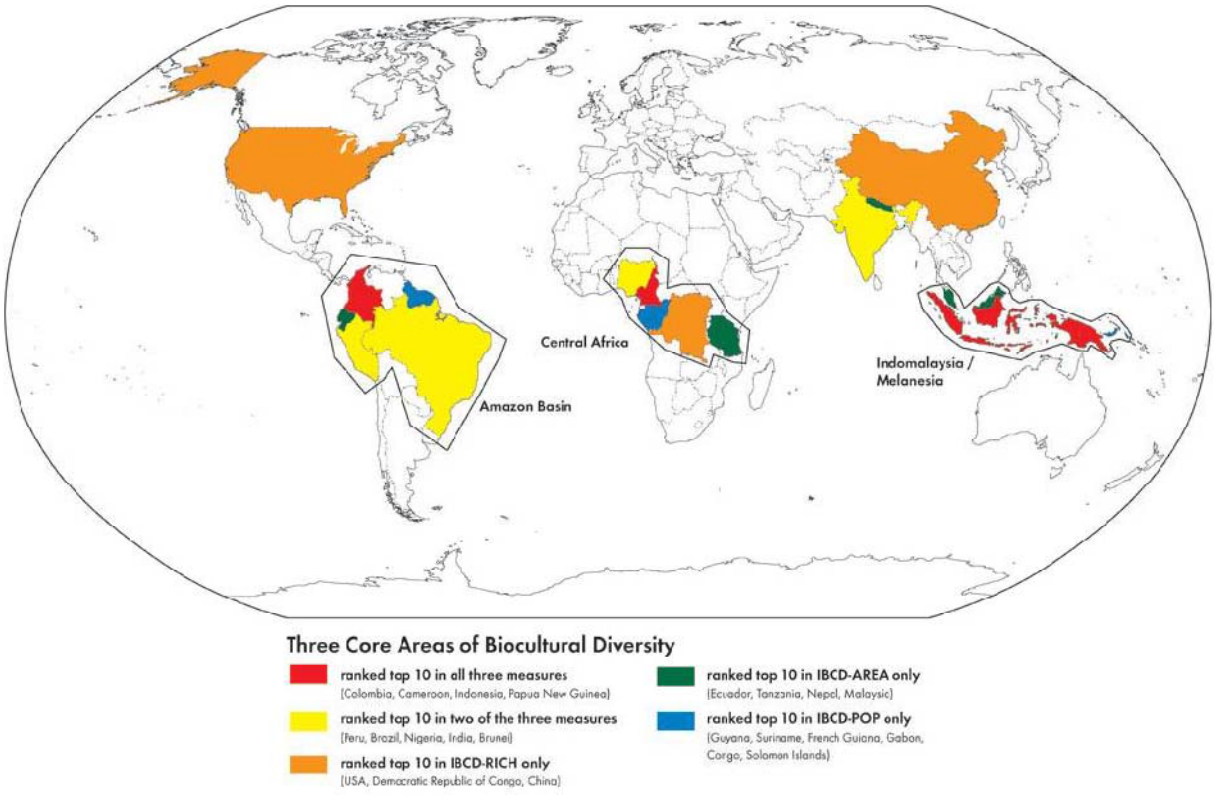

Figure 5: Three core areas of biocultural diversity. Source: Loh and Harmon, 2005.

2.4.2. Why conserving Biocultural Diversity?

As biocultural diversity comprises the total differences of life on our planet, it is obvious that we have to manage these different diversities (biocultural diversity as a sum of biological, cultural, and linguistic diversity) in a sustainable and responsible way. In the previous chapters (2.1.2, 2.2.2, 2.3.2) we have already identified different reasons for conserving biological, cultural, and linguistic diversity. Of course, these reasons also apply to biocultural diversity.

Out of the many reasons the idea of “keeping options alive” (Maffi, 1998) is probably the best argument for conserving biocultural diversity. The interactions between biological and cultural diversity are far too complex to be understood totally. There will always be aspects of this relationship which are not known and cause uncertainty. And because of this uncertainty and our ignorance of the consequences, we should apply the caution principle and make our decisions as conservative as possible and preserve as much diversity as we can. It is hard to express species or languages and their use for humanity in monetary terms. Ironically economic benefits are among the most important things in our society, which makes it hard to justify conservation efforts for species that do not necessarily provide monetary benefits for humans. However, just because we do not know of any benefits at the moment, it does not mean that there are none. It might as well be possible that the beneficial uses of species have not been investigated so far. Again, it is wise to keep as many options and potential solutions alive as possible in order to prevent or solve future challenges. Similarly, Bernard (1992) suggests maintaining the “pool of knowledge” from which we can draw.

Apart from the benefits for humans, biocultural diversity should be preserved for its intrinsic value. During the last 3.8 billion years of the world’s history of approximately 5 billion years, biodiversity has evolved (UNEP, 2007). For the last thousands of years a co-evolution between biological and cultural diversity took place. The species and languages which we encounter today are the results of these evolutionary processes. Even if there is not an anthropocentric benefit apparent, it would be irresponsible not to conserve biocultural

diversity and set this enormously valuable heritage at risk. Harmon (2002) states that "*the continued decrease of biocultural diversity would staunch the historical flow of being itself, the evolutionary processes through which the vitality of all life has come down to us through the ages*".

2.4.3. Threats

Over the past decade, a significant decrease in biological, cultural, and linguistic diversity has been observed (Maffi, 2005). Many of the threats have a variety of impacts affecting ecosystems and habitats, the people that live in these areas, and the languages they speak. Rarely, these drivers or threats are affecting only one of the three diversities (Skutnabb-Kangas, 2003; Maffi, 2005).

Large-scale conversion of land use and unsustainable exploitation of natural resources through agrobusiness, cattle ranching, logging, mining, oil drilling, creation of large dams, urban development, and road construction are only some of the forces threatening biocultural diversity. Possible consequences for biodiversity are loss of habitat and species, degradation of ecosystems, and habitat destruction. The outcomes for cultural and linguistic diversity may be erosion of cultural identity and loss of livelihoods, traditional diets, and traditional ecological knowledge (Skutnabb-Kangas, 2003; Pretty et al., 2009).

Changes in socio-economic and political systems (such as urbanization and rural-urban migration, and globalization) affect local societies and consequently also their surrounding environment. They often lead to biodiversity and habitat loss, linguistic and cultural shifts, and growing disconnection from nature. Erosion and loss of traditional ecological knowledge is a common consequence, which may result in adoption of not locally developed and thus not well adapted and sustainable strategies of using resources and the environment (Skutnabb-Kangas, 2003; Cocks, 2006; Pretty et al., 2009).

3. Methods

The literature search was carried out in three steps: first, searches on the topics literature review and meta-analysis were conducted. The second part consisted of gathering relevant publications on the concept of biocultural diversity in general. In the third and final step, publications and projects on biocultural diversity in Europe were searched.

3.1. Step 1: Literature Review and Meta-Analysis

Literature reviews are types of research articles that objectively report the current knowledge on a topic. They are based on previously published research and provide the reader with a comprehensive overview (Day, 1998; Green et al., 2006). Green et al. (2006) identify three basic types of literature reviews:

- Narrative reviews
- Qualitative systematic reviews
- Quantitative systematic reviews (meta-analyses)

Narrative (unsystematic) literature reviews can serve different purposes: editorials synthesise information about a particular topic for the reader and usually focus on few selected papers; commentaries intend to provoke dialog among the readers by critically questioning the examined articles; narrative overviews are comprehensive narrative syntheses of previously published information. Often they are useful educational articles, as they condense a lot of information about a topic and present a broad perspective (Green et al., 2006).

A systematic review identifies and evaluates multiple studies on a topic using clearly defined methodology (Neely et al., 2010). The basis is a focused research question and an extensive literature search. Detailed and explicit methods are designed to determine whether publications are included or not (Green et al., 2006; Borenstein et al., 2009; Neely et al., 2010). In a qualitative systematic review, each article is reviewed in a systematic and consistent way. The papers are screened for information that serve the purpose of the review and help answering the research question. Evidence tables are created and data is extracted to highlight the differences and similarities between the research projects. The results and outcomes of different papers are combined and compared in order to gain new knowledge from them (Green et al., 2006).

Quantitative systematic reviews (meta-analyses) statistically combine the results of all reviewed studies to generate new information. Comparable to qualitative systematic reviews, it also employs a detailed methodology, but it has the major advantage of pooling the data of the different studies. This allows for statistical analyses of larger sets of data which may lead to new findings (Lipsey and Wilson, 2001; Green et al., 2006, Borenstein et al., 2009; Neely et al., 2010). Especially in clinical research meta-analyses are a powerful analytical tool, as the growing number of individual studies requires secondary analyses that integrate the original findings (Glass, 1976; Green et al., 2006).

The main part of the literature search for step 1 of this thesis was carried out using the online databases Scopus, ScienceDirect, and SpringerLink. The objective was to find publications that deal with the topics “literature review”, “meta-analysis”, and “literature search” in general. Most retrieved results were actual meta-analyses of studies and therefore not suitable for the purpose of this thesis. The references of some of the publications led to further articles dealing with these topics. The publications on literature reviews and meta-analysis helped to get a better understanding of how to conduct a literature search (Brettle and Gambling, 2003; Timmins and McCabe, 2005) and the steps involved in writing a literature review (Green et al., 2006; Neely et al., 2010).

This thesis uses a qualitative systematic approach to summarise and analyse projects of biocultural diversity in Europe. Unlike clinical studies, in which quantitative data is collected that can be processed and analysed statistically, it is not beneficial to analyse qualitative data that has been extracted from methodically heterogeneous projects in such way. Still, the projects are screened in an objective way to gather the relevant information. The extracted information from the various projects will then be combined and compared.

3.2. Step 2: The Concept of Biocultural Diversity

In step 2, general information about the concept of biocultural diversity was gathered in order to provide a comprehensive introduction into the topic and the current state of biocultural research. The following sources were used for the literature search:

- Online databases: Scopus, ScienceDirect, SpringerLink
- Hand searches of the references of retrieved literature
- Homepages and publications recommended by experts in the field of biocultural diversity
- University libraries (University for Applied Life Sciences, University Vienna)
- Homepages and publications found with web search engine “Google”
- Related links found on various retrieved homepages
- Specific journals: Journal of Ethnobiology and Ethnomedicine, Journal of Ethno-Pharmacology

Online databases were the first source that was used for finding relevant publications on biocultural diversity in general. Different keywords, combinations of keywords, and search engine commands were used to maximise the number of found articles while minimising the number of redundant and unsuitable ones (Appendix II). The publications had to fulfil at least one criterion in order to be included in step 2:

- Main topic is biological diversity, cultural diversity, linguistic diversity, or biocultural diversity
- Provide general information (e.g. definitions) about one of the diversities
- Provide information about the measurement of one of the diversities (e.g. indicators)
- Provide information about the benefits of one of the diversities
- Provide information about the threats affecting one of the diversities

As in step 1, the references of publications sometimes led to further literature that was worth being included. Recommendations by colleagues and other experts in the field of biocultural diversity also provided useful articles. Similarly, the homepage of the international non-profit organisation Terralingua (http://www.terralingua.org) turned out to be an invaluable source of information and publications on the topic of biocultural diversity. Its related links and publication database cover wide areas of this field and offer latest information on biocultural diversity research. Specific scientific journals (Journal of Ethnobiology and Ethnomedicine, Journal of Ethno-Pharmacology) were searched in detail, as their main field of research is closely related to biocultural diversity.

3.3. Step 3: Biocultural Diversity Projects in Europe

Step 3 consisted of searching publications and projects on biocultural diversity in Europe. The literature search was carried out in a similar way as in step 2. Again, the literature search started with the use of online databases and specific journals, which led to first publications and projects of biocultural diversity research in Europe. In their reference sections, further useful literature could be found. The web search engine "Google" was mainly used to search for homepages of various non-governmental organizations, university institutes, governmental institutions, and projects involved in biocultural diversity research. Some homepages and publications were recommended to me by experts working in this field. Other valuable sources for the literature search were found in related links section which most homepages provided.

Even though the literature search revealed a large amount of publications, most of them were excluded because they did not serve the purpose of this thesis. The following criteria had to be met by the projects in order to be included:

- Project area in Europe
- Project focuses on biocultural diversity (covers at least two of the three aspects of biocultural diversity)
- Practical conservation efforts
- Published literature on the project is available

As this thesis examines biocultural diversity research and conservation efforts in Europe, the European context was prerequisite for the projects in order to be included in this research. In fact, most publications and projects had their area of work outside of Europe (Central and South America, South Asia, Pacific Region,...) and had therefore to be excluded.

The focus on biocultural diversity was another very important criterion. Maffi and Woodley (2010) see biocultural diversity as *"...diversity of life in all of its manifestations: biological, cultural, and linguistic..."*. Maffi (2007) states that biocultural diversity is the short form for "biological, cultural, and linguistic diversity". Similarly to these definitions, the interdisciplinary aspect of biocultural projects played an important role. In order to be included in this thesis, a project had to focus on at least two of the three different diversities and provide integrated conservation efforts. Numerous projects were found, whose research focus was either biological diversity, cultural diversity, or linguistic diversity. However, only a very limited amount of projects tried to bridge the gap between these disciplines and diversities.

This was the reason why all but one ethnobotanical projects were excluded. Especially in the Mediterranean region a lot of ethnobotanical research is being conducted (see Journal of Ethnobiology and Ethnomedicine and http://www.andreapieroni.eu/ for publications on this field of research). In most studies traditional knowledge of food plants, medical plants, and ethnoveterinary plants is investigated and documented. It is true that this traditional knowledge makes use of biological diversity. The knowledge itself has been developed by generations of humans, which makes it a part of cultural diversity. It could therefore be argumented that ethnobotanical research belongs to biocultural diversity, as both biological and cultural diversity are the main research focus. In my view however this is not appropriate. In most cases, ethnobotanical research is not directly involved in conserving biodiversity. Reviving traditions and tradtitional environmental knowledge does in fact also maintain biological diversity, but the cultural aspect (traditional knowledge) is always top priority in this field of research. In my opinion, ethnobotany focuses rather on cultural diversity only than on biological and cultural diversity, which is the reason why all but one ethnobotanical projects were not included in this thesis.

Practical approaches was another criterion, which the projects had to fulfil. One of the objectives of this thesis is to compare biocultural diversity projects and extract best practices

from them. Therefore, the studies and projects would ideally be trying to maintain and conserve any two of the three diversities (biological, cultural, and linguistic diversity) in an interdisciplinary way. Research projects that were investigating and highlighting single aspects of biocultural diversity without beeing part of a transdisciplinary conservation project could not be taken into account for this thesis.

Availablility of published literature about the projects and their outcomes was also an important criterion that had to be met. Without published information and data a biocultural project could not be used for further analysis. While all of the anaylsed project fulfiled this precondition, it can be assumed that there are numerous further european biocultural projects, which provide none or only limited published literature. It must be noted that in this step the internet was the main source for the literature search. Therefore, the internet presence of a project was very important, in order to be included in this thesis.

The European biocultural diversity projects that had fulfiled the criteria were reviewed in a systematic and consistent way. Prior to the reviewing process, all of the published literature on the projects was gathered. During the reviewing process, the following research questions were answered and information extracted from the literature:

- General information about the projects (Which stakeholders are involved? Why has the project been set up? What are the findings/outcomes of the project?)
- Which linkages are made in the projects? Which are the main focuses of research of the projects (e.g. local knowledge, biodiversity conservation, resource use,...)?
- Does the published project literature provide a definition for the concept of biocultural diversity?
- Do the projects develop a monitoring/evaluation system?
- What is the reason for biocultural diversity loss in the projects?
- Do the projects offer conservation strategies and approaches to counter the loss of diversity?

Analytical tables were created to give a quick overview of the different projects and summarise their main research questions, challenges, and outputs (Appendix I). Additionally, further tables on linkages made by the projects, monitoring and evaluation plans, drivers of biocultural diversity loss, and recommendations and conservation strategies were established to answer the research questions.

4. Projects

The project search revealed a total of ten different European biocultural projects that were used for further analysis. The projects are:

- RUBIA (Mediterranean Region)
- Jungfrau-Aletsch-Bietschhorn World Heritage Site (Switzerland)
- Environmental Co-operatives VEL and VANLA (The Netherlands)
- Globally Important Agricultural Heritage Systems (Italy, Slovakia, Romania, Russia, The Netherlands)
- Local knowledge of medical plant uses and traditional crops and their local varieties in Eastern Tyrol (Austria)
- Revitalisation of Sami Languages (Norway)

RUBIA is the only project, which actually does not cover the minimum of two aspects of biocultural diversity. Though documenting traditional knowledge related to plant uses (cultural aspect), it does not deal with or conserve biological and linguistic aspects of diversity. It does in fact evaluate traditional neglected crops and their economic feasibility, which might sustain local agro-biodiversity, but this clearly is not the main goal of RUBIA project. Nevertheless, this project was included in the analysis representatively for other ethnobotanical projects that do research on and document cultural diversity. Additionally, its transdisciplinary and multinational project design makes it a good showcase.

The Jungfrau-Aletsch-Bietschhorn World Heritage Site has been selected because of its integrated conservation approach. During the project, a management plan has been developed for the World Heritage site, which contains measures for nature and habitat, economy and culture, and organisation and communication. Using a participatory process, it was ensured that the project would be widely accepted.

The environmental co-operatives VEL and VANLA are a good example for endogenous development and self-governance and its potential for conserving biological and cultural aspects of diversity. By ensuring ongoing land use, not only the agricultural system, but also the landscape is preserved.

The Globally Important Agricultural Heritage Systems (GIAHS) project is a Food and Agriculture Organization of the United Nations (FAO) initiative supported by Global Environment Facility (GEF) (FAO, 2011a). In Europe, five different agricultural systems have been identified and nominated as candidate systems for the full scale project. The five European GIAHS are separate projects, which are focusing on preserving traditional land use systems (cultural aspect) and their associated landscapes (biological aspect). Similarly to RUBIA project, the GIAHS “Traditional Reindeer Herding in the Arctic Region (Siberia – Russia)” has only one main entry point. Its goal is the conservation of traditional reindeer herding and revitalisation of this agricultural system. It does not however take measures in conserving biological or linguistic diversity. Still it has been included in the project list as it can be seen as a part of the overall GIAHS project, which is definitely trying to conserve biocultural diversity.

The project Local knowledge of medical plant uses and traditional crops and their local varieties in Eastern Tyrol consists of two parts: Part 1 focuses on knowledge of medical plant uses in traditional animal healthcare (cultural diversity). Part 2 aims at documenting and preserving information about traditional crops and local varieties and the species itself (biological diversity).

Revitalisation of Sami Languages in Norway is the only project used for the analysis, which is conserving linguistic diversity. It bridges the gap between language and culture and aims at sustaining these two pillars of biocultural diversity.

In their appearance, the ten identified biocultural projects are very heterogeneous. While “Revitalisation of Sami Languages in Norway” is a governmental action plan, the project “Jungfrau-Aletsch-Bietschhorn World Heritage Site” is the process of creating and implementing a management plan. Despite being heterogeneous, all projects have the same aim: conserving biocultural diversity in its various forms.

4.1. RUBIA (Mediterranean Region)

RUBIA (Circum-Mediterranean ethno botanical and ethnographic heritage in traditional technologies, tools and uses of wild and neglected cultivated plants for food, medicine, textiles, dyeing and handicrafts) is a project that was undertaken from the years 2003 to 2005 and financed by the European Commission (González-Tejero et al., 2008). It is a research consortium which consisted of eight universities and research centres in Holland, Italy, Spain, Greece, Cyprus, Morocco, Egypt, and Algeria and recorded ethnobotanical field data in twelve different areas in the Mediterranean, including the ethnobotany of Turkish migrants in Cologne, the Russlanddeutschen of Southern Germany, and a study of a community in the Northern Albanian Alps (for detailed info see: Pieroni et al., 2005a; Pieroni et al., 2005b; Della et al., 2006; Pieroni et al., 2006; González-Tejero et al., 2008; Hadjichambis et al., 2008).

The general aim of the project was to compare traditional plant usages in the circum-Mediterranean region, and among Mediterranean migrants in Central Europe (Pieroni et al., 2006). The Mediterranean is a region with many different cultures that have been using and shaping their surrounding environments in various ways and developing their specific and individual traditional environmental knowledge. This knowledge represents a rich heritage both for the exploration and utilisation of new resources (e.g. food, drugs,...) as well as for constituting an irreplaceable part of the traditional culture of the Mediterranean peoples. RUBIA has been the first project in the Mediterranean region with researchers working simultaneously in different countries with the same methodology (González-Tejero et al., 2008). This allows for comparing the gathered information and analysing it in a cross-cultural way (Pieroni et al., 2005b).

The projects objectives of the RUBIA project were (RUBIA, 2011):

- To create an ethnographic knowledge data base of the traditional plant uses of the Mediterranean region
- To develop a data base (also visual) of all tools, objects and technologies used in these practices
- Analysing the socio-cultural relations and the context where this traditional knowledge (TK) has been found (e.g., significance of gender, age, kinship, and ethnicity in TK and TK transmission related to plants, strategies for conservation and re-evaluation of bio-cultural heritage)
- Evaluating data gathered in the different selected areas by using modern statistical methods for ethnobiological analysis and comparing with other botanical, ethnobotanical and anthropological databases
- Evaluating some selected traditional neglected crops for their current agronomic feasibility (cultivation of these species in arid and semi-arid areas)
- Evaluating traditional technologies for their perspectives in terms of the small-scale eco-sustainable production of a few phytotherapeuticals

- Disseminating the TK recorded in booklets for local distribution (particularly among the populations studied) as well as in one general Ethnographic Atlas of Useful Plants of the Mediterranean
- Contributing to modern ethnographical museology by developing special sections both in a couple of local Botanical gardens and Anthropological Museums (illustrating plants, folk tools and technologies related)

As a main output of the RUBIA project a centralised database has been created, which contains all the information gathered in the field (Pieroni et al., 2006; Gonzáles-Tejero et al., 2008; Hadjichambis et al., 2008). The database is located in MAICH (Mediterranean Agronomic Institute of Chania, Greece), but it is not yet accessible to readers. For a total of 985 plant species of traditional use, out of which 406 species are employed medicinally, the following information was stored in the database (Gonzáles-Tejero et al., 2008):

- Taxonomic information (genus, species, sub-species, etc.); herbarium index and specimen number; collector and identifier; vernacular names; interviewer and interviewee.
- Perceived abundance; country, area, and village; occurrence; habitat and abundance according to IUCN.
- Medicine: organism; disorder; preparations; common name of disorder; disorder description; administration method and dosage frequency; toxicity.
- Collected in; traded in; utilized in; cultivation method; collection method; storage method and preparation technique

The data collection was carried out using participant observation and unstructured and semi-structured interviews. During the interviews, tape recordings and – whenever possible – video cameras were used. The processes involving plants were documented photographically. The recorded material was used to produce a DVD and a RUBIA atlas, which were intended rather for broader public audiences and for policymakers than for the scientific community (Pieroni et al., 2006). The information which was gathered during the project was also disseminated via texts and brochures and in some study areas through special sections in local botanical gardens and anthropological museums (Gonzáles-Tejero et al., 2008).

Several authors stress the need for further research on the topics of traditional and medical plant uses, traditional animal healthcare, wild edible plants, and traditional phytotherapy of migrants (Pieroni et al., 2005a; Pieroni et al., 2005b; Della et al., 2006; Pieroni et al., 2006; González-Tejero et al., 2008).

Della et al. (2006), Pieroni et al. (2006), and Hadjichambis et al. (2008) recommend the further documentation, preservation, and distribution of traditional knowledge in the Mediterranean region. "*The habit of using wild food plants is still alive, but is 'ageing'. The recording and preserving of this knowledge is pressing and fundamental. The scientific inventory should gain value within the local communities, and traditional ecological knowledge should be infused to future generations"* (Hadjichambis et al., 2008). Della et al. (2006) conclude that "…*the transmission of folk uses of plants decreased in the last generations and surely in urban areas the knowledge is very much delimited*". Therefore, the preservation of traditional knowledge related to plants is essential, in order to make this extremely valuable cultural heritage available for future generations (Della et al., 2006). The transfer of ecological knowledge to the next generation requires novel curricula in schools and universities. It also needs changes in the agenda of many local policy-makers and cultural stakeholders (Hadjichambis et al., 2008).

4.2. Jungfrau-Aletsch-Bietschhorn World Heritage Site (Switzerland)

The Jungfrau-Aletsch-Bietschhorn World Heritage Site (WHS) covers an area of 824 km^2 in the Swiss Alps. In 2001, the World Heritage Committee declared the Jungfrau-Aletsch-Bietschhorn region a World Heritage Site, as it fulfilled three of the four selection criteria (Managementzentrum JAB, 2008; Wiesmann et al., 2005; Wallner et al., 2008):

1. The Jungfrau-Aletsch-Bietschhorn covers the most glaciated part of the Alps and incorporates the Great Aletsch Glacier, the largest and longest glacier in western Eurasia. It is thus of significant scientific interest in the context of glacial history and ongoing processes, particularly in relation to climate change.
2. A range of alpine and sub-alpine habitats harbour a great diversity of wildlife and plant colonisation in the wake of retreating glaciers provides an excellent example of plant succession.
3. The impressive landscape of the region has played an important role in European literature, art, mountaineering and alpine tourism. The aesthetics of the area have attracted an international clientele and it is recognised globally as one of the most spectacular mountain regions to visit.

In the four years prior to the nomination in 2001, broad campaigns involving strong personalities, and a formal democratic decision-making process at the level of communes, helped to turn the regional population's initial scepticism towards the establishment of a WHS into acceptance and enthusiasm (Wiesmann et al., 2005). During this preparation process, visual representations (images) in the local press were largely idealized and showed idyllic natural environment. Verbal representations (e.g. articles, letter's to the editor,…) were dominated by concerns towards the region's economic development, but also expressed potential economic benefits of the WHS. Even though visual and verbal representations differed, their combination may still have contributed to the support the establishment of Jungfrau-Aletsch-Bietschhorn WHS (Liechti and Müller, 2010).

Another evaluation of newspaper articles published in the local press between 1997 and 2003 revealed that the high level of acceptance was based on very diverse and conflicting expectations rather than on common goals and strategies. It showed the local people's different expectations towards the WHS: some wanted the conservations efforts to be increased, while others expected immediate economic benefits because of the World Heritage label (Wiesmann et al., 2005). In interviews, people mentioned that regional economic development (e.g. more tourism) and restrictions in land-use were the main effects as a result of the biosphere reserve (Wallner et al., 2007).

For each World Heritage Site the World Heritage Committee requires a management plan (Wallner and Wiesmann, 2009). In the case of Jungfrau-Aletsch WHS a multi-stakeholder participatory process was launched by the WHS Management Centre in order to negotiate and prioritise overall goals, specific objectives, necessary measures and concrete projects for the region (Wallner and Wiesmann, 2009; Wallner et al., 2010). The participants of the participatory process were either directly invited by the WHS Management Centre, or by calls placed in the regional newspapers (Wallner et al., 2010). 256 participants, representing various stakeholder groups (e.g. farmers, nature conservationists, representatives of the tourist sector,…) were actively involved in the process and separated into two different groups: one group focusing on agriculture, forestry, tourism, and trade and the other group dealing with questions of education, sensitisation, and natural and cultural values. These two groups met three times in total, with a core group meeting and synthesising the results of each main round (Wallner and Wiesmann, 2009; Aerni, 2005).

As an outcome of the participatory process, the overall goals of the WHS were refined in 69 objectives and 226 related measures. For each objective, the need for action and the relevant organisations and actors were identified. The objectives and measures were

prioritised by the participants, and grouped into 21 thematic fields of action, which themselves belong to three different areas of action: (1) Nature and Habitat; (2) Economy and Culture; (3) JAB-Organisation and -Communication (Jungfrau-Aletsch-Bietschhorn World Heritage Association, 2005).

During the multi-stakeholder participatory process, various issues have been encountered. It was remarked by the authors that it is difficult to equally involve all stakeholder groups in the discussion process. Groups of people that feel less concerned by the topic, as well as people who are not well linked or organised in social networks tend not to participate. One interviewee stated that more farmers should have participated rather than only representatives of farmer's organisations (Aerni, 2005; Wallner et al., 2010). Often the outcomes of such participatory processes are questioned by people who did not participate even though they had been invited to do so (Wallner et al., 2007; Wallner et al., 2010).

A basic conflict between the local inhabitants' views of sustainable regional development and outsiders' visions of protection has been revealed during the participation process. Especially nature conservation groups had many participants, which were not local inhabitants. This created tension during the discussions as the two conflicting positions of pristine nature and wilderness and regional development met (Wiesmann et al., 2005, Wallner and Wiesmann, 2009; Wallner et al., 2010).

The authors also mentioned that some conflicts came up, even though they could not be negotiated because of existing legal norms. For example the high level of protection of the natural landscape was seen as a restriction in land-use and prevention of regional development. However, this framework of existing legal norms in the region of the Swiss Alps Jungfrau-Aletsch WHS represents a kind of 'non-negotiable' feature in the participatory process (Wallner et al., 2008; Wallner and Wiesmann, 2009).

In participatory processes there is always some sort of power play involved, as every stakeholder group tries to put its concerns forth. This power play has been partly reduced by an open selection of participants but it still became apparent during the discussion process. As already mentioned above, it cannot be guaranteed to involve all stakeholder groups to the same extend. This causes some groups to act stronger and more confident. The same is true for the conflict insiders versus outsiders (Wallner and Wiesmann, 2009; Wallner, 2010; Wallner et al., 2010). Power play is therefore another key issue in management of protected areas (Wallner et al., 2007).

A very important result of the participatory process was the mutual learning of the participants and stakeholder groups. Mutual learning became apparent at three different levels: Firstly, it took place between the different local stakeholder groups. Secondly, mutual learning during the negotiation process made it possible to overcome different opinions among stakeholders from the local, regional, and national levels. Thirdly, mutual learning between society and science has been accomplished during the participatory process (Wallner, 2010; Wallner et al., 2010).

In interviews, which were conducted during and after the discussion process, the participants were asked about their opinions towards the multi-stakeholder participatory process. It turned out that most participants had a positive attitude towards the participatory process and welcomed that not only experts, but also local inhabitants could actively contribute und collaborate. However, some interviewees were rather hesitant and sceptical whether the gathered objectives and measured would be implemented (Aerni, 2005). In the case of the Swiss Alps Jungfrau-Aletsch WHS, continuation of the process was secured by involving some participants in the development of concrete project proposals based on the objectives and measures. In some cases, sufficient money was available for implementing the projects immediately. In other cases, detailed project plans to secure financial support by the state and cantonal government departments had to be written. The problem in this stage of the process is that immediate actions are not always visible for the public and former participants. There is a time lag between the participatory process and the visibility of

continuous results, which puts the recently established ownership and common responsibility at risk (Wallner and Wiesmann, 2009). These uncertainties concerning the outcomes of the process can undermine the newly created management body's authority and make it easy for local stakeholders to blame the failure of the project on the management (Wallner et al., 2010).

The multi-stakeholder participatory process in the region of the Swiss Alps Jungfrau-Aletsch WHS has helped to address various conflicting issues and raise awareness of differing views among and also within the involved stakeholders (Wallner, 2010). Participatory processes hold enormous potential for management of protected areas. However, the limitations of these approaches must also be seriously considered, as for example inherent multi-level power play can threaten continued participation (Wallner and Wiesmann, 2009).

4.3. Environmental Co-operatives VEL and VANLA (The Netherlands)

In 1992, the dairy farmers of the Northern Frisian Woodlands in the Netherlands founded the two environmental co-operatives VEL (Vereniging Eastermar's Lânsdouwe) and VANLA (Vereniging Agrarisch Natuur- en Landschapsbeheer Achtkarspelen) in close co-operation with scientists from Wageningen University and Research Centre (Stuiver et al., 2003). They were among the first environmental co-operatives in the Netherlands. Environmental co-operatives are regional groups of mostly agricultural entrepreneurs, and in some cases citizens or other local stakeholders, whose aim is to integrate environment, nature and landscape objectives into their farming practices (Wiskerke et al., 2003a; Wiskerke et al., 2003b). The ultimate goal of the environmental co-operatives is to make farming more sustainable, both economically and ecologically (Rooij, 2004).

The Northern Frisian Woodland is characterised by a unique landscape, which consists of a mosaic of grassland parcels, surrounded by hedgerows and belts of alder trees, and has been influenced and shaped by agricultural activities for a long time (Rooij, 2004). Since the mid 1980s, the Dutch government has implemented environmental rules and regulations in order to reduce the impact of agriculture on the environment. These regulations however were often not adequate for the Frisian Woodlands (Wiskerke et al., 2003b). Amongst others, the environmental regulations aimed at reducing the nitrogen losses from livestock production, which should protect the valuable landscapes and minimise "acid rain" and groundwater pollution (Rooij, 2004). The Frisian dairy farmers therefore had to face the issues of growing economic pressure and high financial investments on the one hand, and restricted possibility of farm expansion due to the environmental regulations on the other hand (Wiskerke et al., 2003b; Rooij, 2004).

The environmental co-operatives helped creating a sense of belonging, unity, and solidarity among the dairy farmers in that region. They provided better incomes for their members, increased their knowledge and skills, built a large social network, and helped gaining more self-esteem. Only one year after the start, already 85% of the local farmers had joined the environmental co-operatives VEL and VANLA. Within the co-operatives various activities are carried out, focusing on either one of the two core elements: "nature and landscape track" and "mineral track". Activities of the nature and landscape track are trying to implement nature conservation and landscape management by the farmers. Activities of the mineral track are dealing with prevention of nitrogen loss and nutrient management (Rooij, 2004).

In the 1990s, one of the environmental regulations declared ecologically valuable landscape elements (such as hedges and belts of alder trees) acid sensitive and severely restricted animal husbandry next to such areas. After a period of negotiation with local, provincial and national governments, the farmers which were participating in VEL and VANLA committed themselves to maintain and increase their effort for preserving nature and landscape. A total of 240 kilometres of alder tree belts were restored. In return, the above-mentioned environmental regulation concerning acid sensitive landscape elements was not applied to

this region (Wiskerke et al., 2003b). Other activities of the nature and landscape track led to the restoration of 220 ponds, an increase of biodiversity in 80 hectares of farm edge areas, and active protection of ground-breeding birds in 240 hectares. These actions not only improved biodiversity in the region, but also the farmer's incomes. It is estimated that revenues from environmental and nature programmes financed by the European Union and the national government account for about 10% of the farmer's total income. Additionally the nature conservation and landscape management activities also have benefits for the entire region. For instance lead the restoration of old sandy paths, which now can be used as walking trails and cycle tracks, to a stimulation of rural tourism (Rooij, 2004).

Activities of the mineral track encompass amongst others the creation of the Nutrient Management Project VEL & VANLA in 1998. Environmental regulations prescribed the injection of cattle slurry manure into the soil instead of surface application in order to fight acid rain. The injection requires heavy machines which cannot easily be used in the Northern Friesian Woodlands because of the high groundwater level in the lower-lying areas and the small parcels typical of this area. The environmental co-operations therefore negotiated with the local and national authorities to get permissions to surface-apply slurry manure. As a consequence the Nutrient Management Project was launched, in which 60 farmers with a total of 2400 hectares participated and became a field laboratory (Wiskerke et al., 2003b). During the project, a range of nutrient management measures were implemented and tested by the dairy farmers. The involved researchers from Wageningen University then developed the scientific foundations for different measures and combinations of them (Wiskerke et al., 2003a). The whole project focused on an inter- and trans-disciplinary approach to develop sustainable dairy farming systems, practices, and necessary technologies. Not only the scientists, but also the local dairy farmers were actively engaged in this process (Stuiver et al., 2003). Within the project, the farmers and scientists developed a "cycle system" with improved nitrogen efficiency. The aim was to improve the manure quality in order to reduce nitrogen losses in the soil. This could be achieved by changing the feed of the cattle (such as reducing protein and increasing fibre levels). The combined measures of the project led to a better grass quality, improved the soil, and raised the overall grassland production (Rooij, 2004).

Roep et al. (2003) conclude that "*... the VEL and VANLA farmers have successfully developed a range of interconnected and carefully balanced novelties, resulting in a more sustainable development of farming and the rural area*". The authors state that the success of these environmental co-operatives is based on five strategic components: (1) self-governance (motivation of members and high level of participation), (2) enrolling capacity (strong support from members of parliament and political parties), (3) heterogeneous knowledge production (trans-disciplinary research by scientists and farmers), (4) integration (of projects, aspects and ideas), and (5) effective reformism (development of new practices) (Roep et al., 2003).

In the Northern Frisian Woodlands, the environmental co-operatives VEL and VANLA acted as new mode of rural governance and tried to bridge the gap between the state and the farming population (Wiskerke et al., 2003b). They developed a broad network with strategic alliances (such as environmental and consumer organisations, scientific researchers,...) and gained the potential to exert remarkable political influence at local, regional, and national level (Rooij, 2006). Still, for the environmental co-operatives not only the broad acceptance, support, and participation from the local dairy farmers was important, but they also depended on a favourable governmental environment. Requests for support and a higher degree of self-governance from other environmental co-operatives were turned down by the Dutch Ministry of Agriculture even though the above mentioned project received positive evaluations. Furthermore, exceptions from generic regulations are only going to be granted in scientific research programmes such as in the case of VEL and VANLA (Wiskerke et al., 2003b). Wiskerke et al. (2003b) state that "*The Dutch Ministry of Agriculture is still reluctant and fearful to share governance at local level*".

During 1992 and 2003 the number of environmental co-operatives and similar organisations has grown to around 300 in the Netherlands. This illustrates the support and need for this new mode of rural governance amongst farmers and other rural stakeholders (Wiskerke et al., 2003b).

4.4. Globally Important Agricultural Heritage Systems (GIAHS)

Globally Important Agricultural Heritage Systems (GIAHS) are "*Remarkable land use systems and landscapes which are rich in globally significant biological diversity evolving from the co-adaptation of a community with its environment and its needs and aspirations for sustainable development*" (FAO, 2011a). In 2002, the idea to develop the concept of GIAHS came up and a proposal was submitted to the Global Environment Facility (GEF), which funded the project (FAO, 2008b). The project is a Food and Agriculture Organization of the United Nations (FAO) initiative and is executed and implemented by FAO, in close collaboration with United Nations Development Programme (UNDP), United Nations Educational, Scientific and Cultural Organization (UNESCO), International Fund for Agricultural Development (IFAD), Biodiversity International, United Nations University (UNU), bilateral donors, and others (FAO, 2011a).

Worldwide, centuries of traditional land use and agricultural land management have created specific human-influenced landscapes. These landscapes have been adjusted and shaped by generations of farmers, herders and forest dwellers, and reflect the relation of humans and their surrounding environment. Indigenous and traditional agricultural systems have resulted not only in outstanding aesthetic landscapes, globally significant agricultural biodiversity, resilient ecosystems, and valuable cultural inheritance but also in the sustained provision of multiple goods and services and food and livelihood security (FAO, 2008b; FAO, 2011a).

Dynamic human management strategies raised the resilience and robustness of these agricultural landscapes and made it easier to compensate changing environmental, social and political conditions. For instance minimises the use of several species and varieties of crops the risk of crop failure and provides steady yields over the long term. This strategy is beneficiary both for farmers (because of livelihood security) and for the ecosystem (because of high biodiversity and ecosystem resilience) (FAO, 2011a).

However, together with traditional agriculture also the closely linked and valuable landscapes started disappearing. Without ongoing agricultural management these landscapes are declining, as they are adapted to and dependent on farming activities. Major social, political, and economic changes often do not allow for small-scale traditional farming and either result in its intensification or abandonment (FAO, 2008b). Unsustainable practices, overexploitation of resources, as well as preference of exotic domesticated species and agricultural specialisation threaten the viability of these globally important agricultural systems. Loss of traditional knowledge systems and gaps in transmission are further increasing this threat (FAO, 2011a). The management of these systems and associated agro-biodiversity will only be possible, if the cultural diversity is preserved and economic viability of the local farming populations secured (FAO, 2008b). According to FAO (2008b; 2011a) "*The dynamic conservation of GIAHS is vital to the future of humankind, and should be treated at the international level as an ecological/cultural resource of utmost global significance*".

According to FAO (2008a, 2008b), the overall goals of the project are:

- To identify and safeguard Globally Important Agricultural Heritage Systems and their associated landscapes, agricultural biodiversity and knowledge systems
- To mobilise global and national recognition and support for GIAHS
- To enhance global, national, and local benefits derived through the dynamic conservation, sustainable management, and enhanced viability of GIAHS

- To demonstrate “local livelihood benefits – global environmental benefits linkages” through agro-ecosystem approaches
- To establish a long-term programme building on the experiences and lessons learnt of a number of pilot systems
- To disseminate key best practices and lessons between implementing agencies, recipient communities and countries

During the preparatory phase from 2002 until 2006 about 200 GIAHS were identified, of which five became pilot demonstration systems (FAO, 2011a). These five traditional agricultural systems can be found in six different pilot countries (Algeria, Chile, China, Peru, Philippines, and Tunisia) and cover a total area of 112,000 hectares (FAO, 2008a; FAO, 2011a). Additionally, two more countries (Kenya and Tanzania) were added in the piloting of dynamic conservation of GIAHS (FAO, 2011a). A methodological framework and a step by step approach for implementing participatory development and “dynamic conservation” in these systems was developed. Furthermore, global and national support and co-funding arrangements for the full scale project was raised and a communication strategy and plan was set up during this preparatory phase. In May 2008, two years after the preparatory phase, the implementation phase (5 years) started in order to carry out the proposed actions (FAO, 2008b).

Through the support and conservation of GIAHS the project is expected to generate ecological, social, and economic benefits at local, national and global levels. The sustainable conservation and support of the agricultural systems and their associated landscapes, agricultural biodiversity, and knowledge systems, will contribute to reducing poverty and ensuring food and livelihood security and well being of traditional rural communities. But also on global level, GIAHS provide several services, such as soil health and soil biodiversity, water quality, reduced wind erosion, resilience to climate change, and benefits for humans (food, income, aesthetics, quality of life,...) (FAO, 2011a).

In Europe, a total of five different Globally Important Agricultural Heritage Systems have been identified so far (FAO, 2011a):

- Lemon Gardens (Southern Italy)
- Traditional Agro-Ecosystems in the Carpathians Region
- Mobile Pastoral Systems (Romania)
- Traditional Reindeer Herding in the Arctic Region (Siberia –Russia)
- Dutch polder systems

Lemon Gardens (Southern Italy)

Peninsula Sorrentina, which is located in Southern Italy near Naples, is widely-known for its lemon gardens. From Vico Equense to Vietri sul Mare the outstanding lemon terraces stretch along the coast, up to altitudes of not more than 350 metres. Peninsula Sorrentina is the northern limit of lemon cultivation, because of the lemon’s sensitiveness to cold climates. In the 18th century, Italy started exporting lemons to England and America and therefore increased its lemon cultivation significantly. Olive trees, vineyards and woodland were replaced with lemon gardens. The lemons had to be protected against the salty sea winds and coldness, which is why windbreaks and shelters were set up. The so-called “pagliarelle” was made out of straw and was put on top of a pergola, to provide protection against cold weather. Olive trees, nut trees, and wood tables served as windbreaks to reduce the impact of the salty winds. The presence of terraces, lemons pergola, windbreaks, short stony walls, and footways, all together arranged and developed by generations of farmers, resulted in a

beautiful landscape of traditional agriculture, which is a unique experience for tourists (Grego, 2007).

These lemon gardens, which are cultivated on an area of approximately 700 hectares, are of great economical value for the entire region. In this area, mostly small-scale farms with often less than a hectare of farmland can be found. The cultivation and maintenance of the lemon gardens is very time-consuming, exhausting, and arduous. The output of 12 – 20 tons per hectare is lower than the national average. Still, lemons from this area are a unique product, which is exported to many parts of the world. In addition to the lemon production, this agricultural system also provides benefits for tourists. Each year thousands of tourists are attracted by the aesthetic landscape that has been formed by this farming style and evolved over centuries (Grego, 2007).

However, there are a number of factors that endanger this traditional agricultural system. Compared to farming styles in the South of Italy and other Mediterranean countries, these labour intensive and expensive lemon terrace are hardy competitive. Still every effort necessary to conserve this traditional farming practice should be taken, in order to protect this unique heritage. Peninsula Sorrentina's landscape and scenery show that farmers skilfully reduced the natural phenomenon of land degradation and environmental damage, which otherwise is very common in Italy (Grego, 2007).

Traditional Agro-Ecosystems in the Carpathians Region

The Carpathians are Europe's largest mountain range and form an ecoregion of global biodiversity significance. Seven countries cover parts of the Carpathian Mountains: Austria, Czech Republic, Poland, Slovakia, Ukraine, Hungary, and Romania. Because of its remarkable agricultural biodiversity and cultural diversity, especially the Western Carpathian region was submitted as GIAHS and selected as candidate system (Brindza et al., 2002).

For centuries, Slovakia and the neighbouring countries of the Western Carpathian region were primary crossing point of east-west and north-south movements of ethnic groups. At the moment, fifteen distinct ethnic groups settle in this region, brought new information, traditional knowledge, techniques, practices, and systems with them. Also a lot of different plant varieties were exchanged via migrants and lead to a high genetic variety. Approximately 3,000 old- and land-races derived from 300 domesticated and introduced plants can be found in the Western Carpathian region. The origin of these crops ranges from Asia and Africa to America (Brindza et al., 2002).

The high ethnic diversity of this region has not only enriched its agricultural biodiversity but also its knowledge base. The combination of different sources of traditional knowledge and experiences significantly enhanced the ecological sustainability and economic viability of the agricultural system. Ingenious and often unique practices – such as the "bryndza" (sheep milk cheese) production or Tokay wine making – have been developed through the input of other ethnic groups (Brindza et al., 2002).

The unique agro-ecosystems of the West Carpathian region provide numerous goods and services, both for humans and the ecosystem. They provide environmental services and support higher biodiversity, soil and water restoration, climate regulation, and carbon sequestration. Also livelihood services such as food and energy security, social and cultural services, and quality of life are generated by agricultural systems. Furthermore, they encourage technological and knowledge services such as local and indigenous knowledge and agricultural production and household techniques (Brindza et al., 2002).

Not only the goods and services of the GIAHS, but the agricultural systems itself have to encounter a number of threats and challenges. Similarly to many other systems and regions, the traditional knowledge sooner or later needs to be transferred to the next generation, or otherwise it will be lost. Also in the Western Carpathian region this transfer turns out to be a big problem as the younger generation favours mass-production systems instead of

traditional agricultural management methods. Conserving this knowledge is becoming more and more urgent in this region. Additionally, raising awareness and appreciation for traditional agro-ecosystems is crucial. As the genetic diversity is diminishing as well, also this challenge needs to be addressed in future. While first breeders worked with more than 130 different plant species, present breeding focuses only on 36 plant species. Finding, identifying, conserving, propagating and cultivating remnants of the original varieties should be enforced in order to revive the former agricultural biodiversity in the Western Carpathian region (Brindza et al., 2002).

With the following actions the GIAHS project in the Western Carpathian region will conserve and sustainably manage the traditional agricultural systems: (1) establish a monitoring of restoration measures, (2) create a national database on plant species cultivation and utilisation, (3) in situ conservation and revitalisation of agro-biodiversity, (4) traditional knowledge revitalisation, (5) establishment of a base for traditional agro-ecosystems legal protection, (6) create awareness of importance of traditional agro-ecosystems conservation, and (7) create an action plan for recognition, conservation, and sustainable management of unique and ingenious systems (Brindza et al., 2002).

Mobile Pastoral Systems (Romania)

The commune of Intorsura Buzaului in Romania is one of the former transhumant centres, in which presently also pendulation occurs. Transhumance and pendulation are the two main mobile pastoralist systems typical of Romania. Pendulation occurs throughout Romania's mountain regions and takes livestock over relatively short distances (up to 20 kilometres) to summer pastures. Transhumance only occurs in a few areas on the northern slope of the Carpathians and is the movement of people with their sheep over longer distances (200-300 kilometres) from summer pastures near the mountain villages in the transhumant centres of southern Transylvania to lowland winter pastures in the two Romanian regions Wallachia and Moldavia (FAO, 2011b).

The two mobile pastoral systems are of great importance and value for Romania. Above all, they provide livelihood security in regions where alternative incomes are limited. There is a strong demand for high quality products not only among the Romanian population, but also in other European countries. Additionally, these two traditional agricultural systems maintain ecosystem functioning and are essential for the conservation of many valued habitats. Through their extensive management they have created and maintained specific landscape types, which would not exist without them. These semi-natural pastoral grasslands exhibit high species richness and attract many tourists with their scenic beauty (FAO, 2011b).

In Romania, especially in mountain areas, still many people are dependent on pastoralism. However, changes in the political and economic system have caused the agricultural sector to support more intensive and sedentary livestock production. Recent and rapid increased economic competition from imported products undermines the competitiveness of pendulation and transhumance. Lack of awareness, recognition, and knowledge of the threats and challenges pastoralism is exposed to, is leading to a decline of this agricultural system and has consequences for livelihoods, the environment, and the agricultural biodiversity. Present land tenure is also a key problem threatening pastoralism. Since land ownership has become more and more fragmented, it gets more difficult for shepherds to find trails which they can use. Former trails often do not exist anymore and many landowners do not want flocks of thousands of sheep to pass their land. As a result, many conflicts with foresters, landowners and authorities arise (FAO, 2011b).

Measure for increasing the viability of mobile pastoral systems in Romania include: (1) identification and dissemination of the benefits of mobile pastoralism for Romanian society, (2) advocacy and implementation of a legal and policy framework to support pastoralists, (3) establishment and development of pastoralist associations and networks, (4) creating

awareness of the importance of pastoralism for tourism, and (5) general advocacy amongst the wider Romanian and international public (FAO, 2011b).

Traditional Reindeer Herding in the Arctic Region (Siberia – Russia)

Reindeer herding has been carried out in the Arctic Region (Siberia – Russia) for 3,000 – 5,000 years by many distinct ethnic groups such as the Nenets, Chukchis, Saamis, Sel'kups or Chuds. Both nomadic (e.g. Nenets) and sedentary (e.g. Saamis) forms of reindeer herding exist. The animals are herded in groups of 3,000 individuals and provide food and livelihood security for the communities. Hunting and fishing provides additional food (FAO, 2011c).

At present, traditional reindeer herding is diminishing more and more. After the breakup of the Soviet Union, the reindeer farms were privatised and reduced in size. Without subsidies and social safety nets the farms were not able viable. As a consequence, poverty increased, the reindeer population declined by 75%, and the herd size declined to an average of 1,000 individuals. Reduced veterinary care now leads to increased diseases; geographic isolation and geo-political separation (closed international borders) make reindeer herding impossible. Wolf predation, as well as unemployment and migration of the younger generation to urban areas threaten this traditional agricultural system (FAO, 2011c).

One way of coping with this situation is designing new small-scale enterprises for sustainable reindeer herding and for replenishing genetic stocks from increasing wild deer populations. Furthermore, it is necessary to change the institutional and economic environment, as well as the policies, in order to ensure the socio-economic and cultural viability of reindeer herding in the tundra. This, in fact, will not only conserve this traditional agricultural system, but also the biodiversity associated with it (FAO, 2011c).

Dutch polder systems

From the 12th century onwards traditional polders have been built in the Netherlands. Since then the swampy delta regions have been drained into the rivers, creating arable land for farming. Additionally to traditional polders that may be a few hundred years old, the government started to build large-scale modern polders in the mid-20th century. In the 12th century, when people started draining the area, the land was still above sea and river level. Thus, draining canals were sufficient to remove the water of the swampy soil. The soil consists to a large extend of peat, which could not grow anymore because of grazing, drainage, and oxidation. The soil lowered approximately to the sea and river level and could not be drained by digging drainage channels anymore. Dykes were built to keep the tidal river water out of the polder system. The original drainage canal system was still used to drain, but the water was pumped out at the end of the channel by wind-driven pumping systems. Since the 15th century, windmill-pumps have been built in the Netherlands and today, about 1100 windmills can still be found in this area, which have been preserved with support of the government. Soon after the World War II, the traditional windmills got replaced by a new pumping system and had been shut down (Schoubroeck, 2010).

The traditional Dutch polder systems harbour a characteristic and unique flora and fauna. A huge variety of different birds can be found in the areas with shallow, slowly moving water, and also in the nearby grassy fields. In the swampy areas and shallow water, many different grass species and plants can be found. These remnant swamp patches are very important for overall biodiversity in these agricultural systems. In the 1970s, in some areas farming activity was reduced and nature reserves established. However, this led to a reduction of biodiversity, as the landscape and ecosystem did not receive the necessary traditional management measures, to which they had adapted over centuries. It became clear that only sustainable agricultural activity can sustain and conserve these remarkable polder landscapes (Schoubroeck, 2010).

Unsustainable farming techniques and climate change are probably the main threat to Dutch polder systems. Lower water tables might be good for production of grass and accordingly for the farm economy on the short term, but lower water tables also cause peat to oxidise at higher rates and result in lower soil levels. At present, soil levels are being lowered by 10 to 50 centimetres per century, which gradually makes it more difficult to keep the sea and river water out. Compromising different interests will be a major challenge in the future. Additionally, both water from the river catchment areas and the sea are threatening large parts of the Netherlands. With climate change causing the polar ice melts, more effort will be needed to sustain the dykes and keep the water out of the lower-lying land areas (Schoubroeck, 2010).

The most important and sustainable actions for conserving the traditional polder systems should focus on the agricultural system itself. Making sure that the polder areas are going to be cultivated and managed by farmers in future is probably the best way to conserve them. New co-operations between farmers and nature organisations help maintaining the biodiversity in the area. The creation of regional products (e.g. cheese, milk) and regional marketing help attracting tourists and make farming more lucrative and sustain livelihood security. Even though tourism is becoming more important, still dairy farming remains the economic stronghold in this area, as more than 90% of the economic activity relies on dairy production (Schoubroeck, 2010).

4.5. Local knowledge of medical plant uses and traditional crops and their local varieties in Eastern Tyrol (Austria)

In the Austrian province Eastern Tyrol, an ethnobotanical project was conducted, which examined local knowledge of medical plant uses in animal healthcare and traditional crops and their local varieties (Vogl-Lukasser et al., 2006a; Vogl-Lukasser et al., 2006b; Vogl-Lukasser et al., 2007). Part 1 of the project focused on animal healthcare and aimed at finding and documenting traditional local knowledge of medical plants, their usage, preparation, and administration. Additionally, local experts in the field of traditional animal healthcare were identified (Vogl-Lukasser et al., 2006a). In Part 2, information about traditional crops and local varieties that are still being cultivated in the research area was gathered. Seeds and voucher specimen were collected and photo-documented. This part not only aimed at preserving traditional crops themselves, but also the associated knowledge of these local varieties (Vogl-Lukasser et al., 2006b).

Local knowledge of medical plant uses in animal healthcare

Eastern Tyrol mainly consists of hilly and mountainous areas. Adaptive management of natural resources by generations of alpine small farmers has created a typical diverse and multifunctional landscape (Vogl-Lukasser and Vogl, 2004). Traditionally, alpine small farmers were and partially still are to a high extend self-sufficient. Little infrastructure and harsh and long winters made it necessary to be prepared for the cold season. Until the post-war period (between 1950s and 1970s), many different activities and techniques allowed for and assured this self-sufficiency. Gradually, mechanisation and motorisation also became available in the mountainous regions and made life a lot easier for the farmers. Better infrastructure (e.g. streets, rails...) made it on the one hand possible to buy food and seeds, and on the other hand to sell products. Many farmers reduced their “mosaic” of subsistence activities and instead focused on dairy farming and cattle breeding (Vogl-Lukasser et al., 2007).

Because of the lacking infrastructure and rough conditions in winter, alpine farmers still had to be more or less self-sufficient. Interviewees stated that usually farmers either could not afford a veterinarian or the farms were too isolated to get quick help in cases of emergency. In addition, there were not many veterinarians in that region. Accordingly, farmers had to some extend be able to help and cure their animals themselves. Common and most important medical plants and veterinary preparations had to be available on the farms at all

times. Like in the seed production and seed management, the situation changed when also isolated farms were able to be accessed quickly and easily, as medication of livestock by farmers no longer was a necessity (Vogl-Lukasser et al., 2006a).

In order to assess and conserve the current state of traditional knowledge of medical plant uses in animal healthcare a total of 144 local farmers were interviewed. The interviewees were considered experts in the field of traditional animal healthcare and got mentioned during snow ball sampling. They were asked about general measures for sustaining animal health, medical plants that preventively support animal health, known veterinary diseases, traditional veterinary preparations, and veterinary plant uses (Vogl-Lukasser et al., 2006a).

The analysis of the data on traditional animal healthcare revealed that older people have significantly more knowledge of veterinary plant use than younger ones (Vogl-Lukasser et al., 2006a). This finding goes together with the conclusion of Hadjichambis et al. (2008) and Brindza et al. (2002), who state that traditional knowledge is “getting older” and needs to be passed on to the next generation in order to be preserved. A difference in knowledge between male and female interviewees could not be proven in this project. The gathered information about medical plants and their application was being examined by veterinarians. They partly agreed with and confirmed the information provided by the interviewees. However, some applications of traditional veterinary plants they strongly advised not to use. Interestingly, only a quarter of the interviewed people mentioned the most common and useful species. Many veterinary preparations are not being used anymore, but still known from the childhood. Nowadays, in cases of emergency the veterinarian is called immediately (Vogl-Lukasser et al., 2006a).

Vogl-Lukasser et al. (2006a) propose a number of activities and measures in order to counter the loss of traditional knowledge of veterinary plant use. Creating awareness and organising seminars and training courses on traditional animal healthcare would certainly draw attention towards this endangered cultural heritage. These seminars should not only be held within small communities but also at regional level, in order to facilitate transfer and exchange of knowledge. Veterinarians also play an important role in the conservation of this traditional knowledge. Their skills in and promotion of this thematic field could significantly help reactivating and utilising it. Especially for organic farmers, who are not allowed to use chemically synthesised allopathic veterinary medical products or antibiotics for preventive treatment, these phototherapeutic products would be a useful and valuable alternative to ensure animal health. Further research on traditional veterinary plant use is needed to document and conserve this knowledge in the first place, and scientifically analyse its effectiveness (Vogl-Lukasser et al., 2006a).

Local knowledge of traditional crops and their local varieties

Traditional crops and their local varieties played an important part in alpine farming systems. It was in the 20th century, when farmers were able to buy seeds and no longer had to store them from their own crops. Prior to World War II, hardly any farmer bought seeds from professional seed producers. Instead, they saved some of the crops and used it as seeds in the next season. In case some farmer did not have enough seeds, he was helped out by the community. Exchanging, giving away, and buying seeds within the community or region was very common and with the time, people knew where to get best quality seeds from. Over the time, the traditional crops were selected by farmers for particular traits or their adaption to local conditions with better yields. This resulted in a huge diversity of different landraces, as every farmer selected differently. Taste, seed and crop storability, crop yields, and adaption to local climate are only some of the traits traditional crops were selected for. In the 20th century, when farmers were able to buy the seeds they needed, traditional crops and local varieties started to diminish. As soon as there were other seed sources, farmers no longer saved their own seeds (Vogl-Lukasser et al., 2007).

The information about traditional crops was collected via interviews. 123 persons in Northern and Eastern Tyrol were identified and interviewed. Detailed information about the local

varieties such as source of seeds, size of cultivated area, cultivation method, renewal of seeds, duration of cultivation, selection of seeds, and utilisation frequency was gathered (Vogl-Lukasser et al., 2007). A database, which contained all the collected information, was created and used for the statistical analysis (Vogl-Lukasser et al., 2006a, Vogl-Lukasser et al., 2007). Most of the interviews were recorded using a digital voice recorder. Seeds and voucher specimen of the traditional crops were collected and pictures taken (Vogl-Lukasser et al., 2006a).

The 123 interviews on traditional crops revealed that local varieties of 20 different crops still exist in Tyrol. Out of the 218 different "seed lots" (physical units of seeds used to produce the next season's crop [Louette, 2000]) that were documented during the interview, 168 were found *in situ*. 114 seeds of different seed lots were collected and stored. 58 interviewees cultivated more than one local variety. A maximum of ten seed lots per cultivator was encountered. Unfortunately, only a few of the variety names (except those of potatoes) were known and could be restored. Most seeds have been cultivated over a period of more than 50 years. However, during this time often seed renewal occurred. Often traditional crops are still being cultivated, but the seeds are not produced in the region. Seed renewal with seeds from external seed producers is very common. In all, a dramatic loss of local varieties has been noticed during the last decades, as seeds can be bought externally and self-sufficiency is not vital anymore (Vogl-Lukasser et al., 2007).

According to Vogl-Lukasser et al. (2007), an integrated concept for conserving Tyrol's traditional crops and local varieties *in situ* should be developed. *In situ* conservation is especially important because of the following reasons: (1) key elements of traditional crops cannot be captured and stored off-site (e.g. in a gene bank), (2) agro-ecosystems continue to generate new genetic resources, (3) a backup to gene bank collection is necessary, (4) agro-ecosystems in centres of crop diversity provide valuable natural laboratories for agricultural research, and (5) the Convention on Biological Diversity mandates *in situ* conservation (Brush, 2000). Documentation of local varieties, creation of awareness of the importance of traditional crops and their cultivation, and professional consultation for interested and active seeders is essential for conserving and promoting these objects of cultural value. Additionally, people and projects focusing on agro-biodiversity and conservation of local varieties should receive further financial and scientific support. In order to preserve these traditional corps for the next generation of young farmers, it is important to keep cultivating rare and endangered local varieties and conserve this valuable agro-biodiversity (Vogl-Lukasser et al., 2007).

4.6. Revitalisation of Sami Languages (Norway)

Sami languages are spoken in Norway, Sweden, Finland and Russia. They belong to the Finno-Ugric language family and can be divided into ten main dialects groups, which differ from each other to such an extent that they could equally be considered as seven or eight different languages. Five different groups of Sami are living in Norway: the Northern Sami, the Lule Sami, the Southern Sami, and two small minority groups, the Eastern Sami/Skolte Sami, and the Pite Sami. However, these groups are not exclusively living in Norway, as language boundaries often extend across national borders (Koskinen, 1995; Norwegian Ministery of Labour and Social Inclusion, 2009).

Northern Sami is the most widespread of the Sami languages in Norway. Approximately 25,000 people are speaking this language, half of which as well speak, read, and write Sami, while the other half has only oral competence in the language. It is estimated that less than one thousand people speak Lule and Southern Sami, and only a few people speak Eastern Sami/Skolte Sami and Pite Sami in Norway today (Norwegian Ministery of Labour and Social Inclusion, 2009). In UNESCO's red list of endangered languages, Northern Sami is classified "definitely endangered" (grade 3, the language is used mostly by the parental generation and up). Lule, Southern, and Skolte Sami are ranked "severely endangered" (grade 2, the

language is used mostly by the grandparental generation and up). Pite Sami is classified "critically endangered" in Norway (grade 1, the language is used mostly by very few speakers, of great-grandparental generation) (UNESCO, 2003; UNESCO, 2011).

In 2008, the Norwegian Ministery of Labour and Social Inclusion published a report on Sami policy. This report presents information about overall principles of the Government's Sami policy, data on the diversity of Sami Society, the formal status and authority of the Sami Parliament, and demonstrates specific issues and challenges that need to be addressed by the Norwegian Government (Norwegian Ministery of Labour and Social Inclusion, 2008). It was discovered that the situation of the Sami languages is critical, which is why the government prepared a plan of action for the Sami languages in Norway (Norwegian Ministery of Labour and Social Inclusion, 2009).

With the action plan for Sami languages, the government wants to reach the following goals (Norwegian Ministery of Labour and Social Inclusion, 2009):

- The Sami languages of Northern Sami, Lule Sami, and Southern Sami shall survive as living languages in the future.
- The Sami languages shall be made visible and promoted.
- Every individual shall have the right to learn the Sami languages.
- Sami linguistic rights shall be promoted and made known.
- The three Sami languages: Northern Sami, Lule Sami, and Southern Sami shall be given equal opportunities to develop.
- Public institutions shall become conscious of using the Sami languages: Northern Sami, Lule Sami, and Southern Sami.
- Knowledge of the Sami languages in Norway shall be developed and preserved for the future

The government therefore seeks to prevent the Sami languages from extinction. Special efforts are made to conserve Southern Sami and Lule Sami, as they are more endangered and vulnerable than Northern Sami. In the case of Eastern Sami/Skolte Sami and Pite Sami, both local and boundary-breaking projects must be developed, based on the actual situation of these languages. The Norwegian Constitution states that it is the government's duty to ensure that Sami people can secure and develop their language, culture and society (Norwegian Ministery of Labour and Social Inclusion, 2009). This resulted in the development of the Sami Act, which affirms that Sami and Norwegian are of equal worth and which created the representative body (Sami Parliament of Norway) for Sami people. The Sami Parliament has amongst others a central role in the work on the Sami languages (Sami Act, 1987).

The action plan for Sami languages was developed in consultation with the Sami Parliament and other ministries that are concerned. It was presented in spring 2009 and has a timeframe of five years. It contains different measures that aim at increasing the number of people actively using the Sami languages. The plan of action is divided into three different themes: learning, using, and seeing. A total of 66 different measures have been developed and can be found in the action plan for Sami languages (Norwegian Ministery of Labour and Social Inclusion, 2009).

The learning section of the action plan tries to boost instructions in Northern Sami, Lule Sami and Southern Sami at all levels. Especially in kindergartens and schools there is a lot of potential for revitalising the Sami languages, as the foundations for the development of Sami are being laid in these institutions. Some parents do not have the competence to pass Sami on to their children as mother tongue. In these cases it is important that kindergartens and schools undertake the task of transferring the Sami language to the next generation. Language nests (places where the younger generation meets old people whose mother

tongue is a Sami language) and language immersion programmes offer the opportunity to learn and practice the language. The action plan also tries to secure the offer of primary and secondary education in Sami for everyone who has the right to it. An increase of quality of education in Sami is expected to raise the numbers of people learning this language at school (Norwegian Ministery of Labour and Social Inclusion, 2009).

The action plan also aims at increasing the use of Sami in the public services. It is important that a minority language does not lose its value in comparison with a more dominant language. As many Sami people lack reading and writing skills in Sami, the use of Norwegian is easier and seems more appropriate. The result is that Sami is perceived less valuable and applicable and its use in everyday life is being reduced. The action plan therefore tries to develop situation and areas, where the language has to be used and is regarded more useful (e.g. at work, in contact with the public services,...). In 2007, an evaluation of the language provisions in the Sami Act revealed that the majority of public services for which the language provisions apply, do not fully comply with the requirements of the law (Norwegian Ministery of Labour and Social Inclusion, 2009). The language provisions of the Sami Act give Sami people the right to use their language in contact with public services (Sami Act, 1987). The main reason for the shortcoming is the lack of Sami language competence among the staff in the public sector. Recruitment of Sami speaking staff in these areas, translation of public documents, and use of the Sami languages within the government are only some of the planned measures (Norwegian Ministery of Labour and Social Inclusion, 2009).

The third theme of the action plan for Sami languages contains measures to make these languages more visible to the public. Creating awareness of their endangerment and of their presence is important to improve the status of the languages within society. The visibility of the Sami languages is also crucial in order to regain cultural and language idendity. Sami literature, Sami films, Sami festivals, and Sami theatre play an important part in creating this public awareness and in ensuring that Sami speakers encounter their language in as many situations as possible. Using Sami place names on road and place names signs is another measure that keeps the Sami languages in the people's heads. Within administrative districts for Sami languages, the Sami name must always be placed first on the sign. In addition to the awareness, it shall also boost the value of the languages (Norwegian Ministery of Labour and Social Inclusion, 2009).

On February 10th 2011, the first status report on the action plan for Sami languages was presented. Since 2009, 23 million Norwegian krone (approximately 3 million Euros) have been spent on revitalisation measures of Sami languages. So far, the most important result of the action plan and its measures is the greater awareness of and focus on Norway's responsibility for the Sami languages. During the evaluation of the action plan, several measures have been strengthened and new measures have been added (Norwegian Ministery of Labour and Social Inclusion, 2011). As the numbers of children learning Sami as either first or second language at primary and lower secondary school have fallen significantly between 2006 and 2007, there is still a lot work to be done in order to revitalise the Sami languages. However, the overall trend during the last 17 years (1990 – 2007) is a positive one. The number of pupils learning Sami languages doubled within that period (Norwegian Ministery of Labour and Social Inclusion, 2009).

5. Results and Discussion

Ten European projects dealing with biocultural diversity were analysed and summarised in systematic tables (Appendix I). Each table provides general information about the project such as project name, research focus, involved stakeholders, reasons for research, findings and outcomes of the project, and recommendations and conservation strategies. These tables are intended to extract key information and give overviews of the projects. Detailed information about the projects can be found in Chapter 4.

5.1. Linkages Made in Biocultural Diversity Projects

Biocultural diversity projects are dealing with different aspects of world's diversity. As biological and cultural diversity are linked inextricably, conservation efforts which sustain several facets of diversity in an interdisciplinary way should be integrated in biocultural projects. Instead of dealing only with one aspect of diversity, the selected European bicultural diversity projects make linkages between various forms of biological, cultural, and linguistic diversity (Table 2).

Most projects that have been analysed in this thesis (7 of 10) combine the fields of biological and cultural diversity and aim at conserving them (4.2 Jungfrau-Aletsch-Bietschhorn World Heritage Site; 4.3 Environmental Co-operatives VEL and VANLA; 4.4 GIAHS Italy, Slovakia, Romania, The Netherlands; 4.5 Local knowledge of medical plant uses and traditional crops and their local varieties in Eastern Tyrol). Out of these projects, the majority focuses on combining conservation efforts dealing with semi-natural agricultural landscapes and biodiversity (including agro-biodiversity and traditional crops), and with farming practices and traditional agricultural systems. Especially the projects 4.4 (Italy, Slovakia, Romania, The Netherlands) and 4.3 put their emphasis on conserving traditional farming systems and their associated landscapes. Similarly, project 4.5 aims at conserving local knowledge and practices, and (agro-) biodiversity. Additionally, knowledge of medical plant use and traditional crops has been documented and conserved. In project 4.2, a management plan has been developed, which conserves nature and habitat, economy and culture, and organisation and communication in the project region.

Project 4.6 Revitalisation of Sami Languages in Norway focuses on conserving and revitalising the endangered Sami languages and their closely associated cultural heritage (such as traditional knowledge, customs, and believes). Keeping these minority languages alive is a big step in the direction of conserving linguistic diversity and preserving the embodied cultural diversity and traditional knowledge.

Two projects (4.1 RUBIA and 4.4 GIAHS Russia) have only one main entry point. RUBIA emphasises the importance of traditional ecological knowledge and documented this knowledge in a number of Mediterranean countries. It focused on various aspects of this cultural knowledge and recorded traditional plant uses and technologies and tools related with them. The main goal of the project 4.4 GIAHS Russia is to conserve the traditional agricultural system of reindeer herding in Siberia.

Table 2: Overview of the interlinking aspects of biological and cultural diversity of the Projects.

Chapter	Project name		Location	Linkages made
4.1	RUBIA		Albania, Algeria, Cyprus, Egypt, Italy, Morocco, Spain	Documentation of ethnobotanical knowledge related to traditional plant uses and comparing this knowledge with other countries in the Mediterranean region. Documentation of technologies and tools used. Evaluation of traditional neglected crops and their agronomic feasibility.
4.2	Jungfrau-Aletsch-Bietschhorn World Heritage Site		Switzerland	Multi-stakeholder participatory process to develop a management plan for the World Heritage Site. The management plan contains measures for nature and habitat, economy and culture, and organisation and communication.
4.3	Environmental Co-operatives VEL and VANLA		The Netherlands	Strengthening the role of local farmers and making farming in the region more sustainable (nutrient management). Nature conservation and landscape management.
4.4	GIAHS	Lemon Gardens	Italy	Conserving traditional agriculture systems and associated landscapes.
		Traditional Agro-Ecosystems in the Carpathians Region	Slovakia	Conserving traditional crops, traditional agriculture systems, associated landscapes, and agro-biodiversity.
		Mobile Pastoral Systems	Romania	Conserving traditional agriculture systems and associated landscapes.
		Reindeer Herding in the Arctic Region	Russia (Siberia)	Conserving traditional reindeer herding and revitalising this agricultural system.
		Dutch polder systems	The Netherlands	Conservation of the traditional agriculture system and associated and adapted biodiversity by improving sustainability.
4.5	Local knowledge of medical plant uses and traditional crops and their local varieties in Eastern Tyrol		Austria	Documentation of local knowledge of medical plant uses in animal healthcare and traditional crops and their local varieties.
4.6	Revitalisation of Sami Languages		Norway	Preserving Sami languages from becoming extinct and revitalising them. At the same time, the Sami culture and its associated knowledge, customs and beliefs are being preserved.

In the Global Sourcebook on Biocultural Diversity, Maffi and Woodley (2010) present 45 different projects dealing with and conserving biocultural diversity all over the world. The biggest share of these projects aim at conserving biocultural diversity in the tropic regions (Central and South America, Central Africa, South Asia, and Pacific Region), as biocultural diversity tends to be higher in those areas (Harmon, 1996; Nettle, 1999; Stepp et al., 2004; Loh and Harmon, 2005). Only one project in Italy represents biocultural diversity research of Europe.

As Maffi and Woodley's (2010) projects focus mainly on the tropics, the question is raised whether the linkages made in these projects differ from the European ones. For the analysis, the projects were grouped according to their main research focuses (Table 3). The biggest part (21 out of 45 projects) focused on the conservation of local knowledge and biodiversity. 10 projects aimed at conserving local knowledge and providing sustainable resource use. The conservation of linguistic, cultural, and biological diversity was emphasised by 5 projects, 4 projects supported religious practices and environmental conservation. 3 projects dealt with cultural management and documentation of local knowledge, 2 focused on

Table 3: Interlinking aspects of the project presented in Maffi and Woodley (2010). Source: Maffi and Woodley, 2010 (modified and summarised).

Linkages Made	Number of Projects	Project Numbers
Local knowledge – Biodiversity conservation	21	1, 2, 3, 6, 8, 11, 12, 19, 22, 25, 26, 30, 31, 32, 35, 36, 37, 38, 39, 42
Local knowledge – Resource use	10	4, 5, 7, 13, 14, 20, 21, 24, 27, 28
Conservation of Linguistic – Cultural – Biological diversity	5	16, 29, 40, 41, 44
Religious practices - Environmental conservation	4	10, 15, 33, 43
Cultural management – Documentation of Local Knowledge	3	23, 34, 45
Local knowledge – Traditional crops	2	17, 18
Legal issues – Biodiversity conservation	1	9

local knowledge and traditional crops, and 1 project worked on legal issues and biodiversity conservation.

Similarly to the European set of projects, most projects that have been analysed by Maffi and Woodley (2010) aim at conserving both biological and cultural diversity. Local knowledge plays an important part in biocultural diversity conservation. The vast majority (36 out of 45 projects) either documents or supports local knowledge and traditional practices. Two thirds the projects focus on local knowledge, biodiversity conservation and sustainable resource use. However, it appears as if the projects of Maffi and Woodley (2010) tend not to focus as much on agricultural practices and knowledge as European projects do.

Interestingly, 4 projects are revitalising religious practices and support environmental conservation. During the literature search, not a single biocultural diversity project has been encountered that was conserving religious practices and traditions in Europe. This does not necessarily mean that none of the European biocultural diversity projects are focusing on religious aspects of cultural diversity. There may be some projects in Europe, which emphasise the importance of conserving religious practices related with the environment, but obviously there are only few of them as they unfortunately have not been found during the literature search. It may however indicate that religious and spiritual aspects are more present and important in tropic regions of the world (the project have been carried out in Latin America, Caribbean, Africa; Peru; India; and Ethiopia). Vice versa it shows that in Europe biocultural research in this field is not as prioritised.

5.2. Defining Biocultural Diversity in Europe

The idea of this research question was to investigate whether different perceptions and interpretations of the concept of biocultural diversity could be indentified between Europe and the rest of the world. As already mentioned in previous chapters (Chapter 1, 0, and 5.1) biocultural diversity research by and large has its research focus on tropical regions. This of course raises the question, how the concept of biocultural diversity is perceived in regions, which are bioculturally not as diverse as the tropics and therefore not the primary target of research.

Unfortunately, none of the ten presented projects provided a definition of biocultural diversity. Most likely the reason for this is that none of the projects was explicitly labelled to investigate biocultural diversity. A search for the term “biocultural diversity” in all digitally available and used literature of the ten projects (articles, papers, presentations,...) revealed that “biocultural

diversity" (except for the reference sections) only appeared in two publications: Vogl-Lukasser et al. (2006b) and Vogl-Lukasser et al. (2007).

This shows that there is actually biocultural diversity research being conducted in Europe, but it is not labelled and perceived as such. The searches that have been conducted during the literature search using the scientific online databases Scopus, Science Direct, and Springer Link have been listed in a separate table (Appendix II). Searches for the keyword "biocultural diversity" revealed only 29 (Scopus), 8 (Science Direct), and 1 (Springer Link) results. After adding the words "alps" or "Europe" to the term, the databases provided not a single search result.

Since none of the projects defined biological diversity, this research question cannot be answered. It is however likely that the perception and interpretation of this concept in Europe is very similar to the rest of the world, as the analysis in the previous chapter showed that the main entry points for integrated conservation and linkages made in the analysed European projects are comparable to those of the projects of Maffi and Woodley (2010).

5.3. Monitoring and Evaluations of the Biocultural Diversity Projects

Ensuring that the end of a project is not necessarily the end of research and implementation activities is crucial. The benefits for the scientific community and other stakeholders are much larger if the project is not designed as dead end, but as an ongoing process of research. Implementing, evaluating, and monitoring of results is vital for the positive perception of and attitude towards the project and for making sure that the results do not disappear in a drawer.

Three of the ten biocultural diversity projects in Europe (Table 4) have not carried out a monitoring or evaluation during the project phase (4.1 RUBIA, 4.3 Environmental Co-operatives VEL and VANLA, and 4.5 Local knowledge of medical plant uses and traditional crops and their local varieties in Eastern Tyrol). However, it was made sure that the results of the project were still visible and advantageous after the project period.

The RUBIA project developed a database in which all of the gathered information and data on traditional plant uses had been stored. Additionally, the traditional knowledge has been disseminated via booklets, an Atlas of Useful Plants of the Mediterranean, and special sections in botanical gardens and anthropological museums (RUBIA, 2011).

In the case of the environmental co-operatives VEL and VANLA in the Netherlands no evaluation was carried out either. During the years after the project, the number of environmental co-operatives and similar organisation has increased to about 300 in 2003. This gives evidence of the success and positive evaluation of VEL and VANLA (Wiskerke et al., 2003).

The gathered information of the project Local knowledge of medical plant uses and traditional crops and their local varieties in Eastern Tyrol was stored in a database and analysed statistically. The collected seeds of the different seed lots were sent to the provincial government of Tyrol. A small portion of the seeds was separated and will be cultivated in Eastern Tyrol in order to maintain and conserve these traditional crops *in situ* (Vogl-Lukasser et al., 2006b).

Table 4: Monitoring and evaluation plans of the Projects.

Chapter	Project name	Research focal point	Is Monitoring planned?
4.1	RUBIA	Albania, Algeria, Cyprus, Egypt, Italy, Morocco, Spain	Project ended in 2005; No monitoring planned
4.2	Jungfrau-Aletsch-Bietschhorn World Heritage Site	Switzerland	Management plan has been developed; Evaluation of multi-stakeholder participatory process was carried out during and after the process Monitoring of changes in values and potential of the WHS
4.3	Environmental Co-operatives VEL and VANLA	The Netherlands	No monitoring planned
4.4	GIAHS		Implementation in pilot systems still running (until April 2013) Monitoring and evaluation according to FAO procedures and guided by GEF Evaluation Office
4.5	Local knowledge of medical plant uses and traditional crops and their local varieties in Eastern Tyrol	Austria	Project finished No monitoring planned
4.6	Revitalisation of Sami Languages	Norway	Implementation phase from 2009 until 2014 Evaluation via Status reports (First one released 10 Feb 2011)

The management plan of the project 4.2 Jungfrau-Aletsch-Bietschhorn World Heritage Site suggests a systematic monitoring and evaluation for the World Heritage Site. An evaluation of the measures and projects recommended in the management plan shall determine whether they are being effectively implemented in line with the goals and objectives. A network of research institutions and administrative bodies will carry out the monitoring. The aim of the monitoring is to examine changes in the JAB region rather than project activities. It will be monitored whether the values and potential of the World Heritage Site are actually being sustained over the long term and whether they can even be improved (Jungfrau-Aletsch-Bietschhorn World Heritage Association, 2005).

For the 4.4 GIAHS projects, a thorough monitoring and evaluation process has been designed. It will be carried out in accordance with FAO procedures and guided by the GEF Evaluation Office. During the implementation phase of the projects, a number of reports have to be prepared. The *Inception Report* will be prepared immediately after die Inception Workshop and will include amongst others a detailed First Year and Annual Work Plan. *Annual Project Implementation Reviews* will provide an analysis of the project performance and information about the experienced constraints, the lessons learnt, and recommendations for future orientation in addressing key problems. The *Project Terminal Report* will be prepared during the last three months of the project. It is a comprehensive report summarising all activities, achievements, and outputs of the project, lessons learnt, objectives met, not achieved goals, and structures and systems implemented. In addition to these internal monitoring mechanisms, at least two independent external evaluations will take place. The *Mid-Term Evaluation* will examine the project's progress towards the achievement of outcomes and will identify course corrections if needed. The *Final Evaluation* will focus on the same issues as the mid-term evaluation. Additionally, it will assess the sustainability of results and the achievement of global environmental objectives. Recommendations for follow-up activities should be provided as well. The results of the monitoring and evaluation process will be disseminated via networks and forums and will contribute to the implementation of future projects (FAO, 2008a).

The project 4.6 Revitalisation of Sami Languages in Norway is still in its implementation phase (from 2009 until 2014), yet a first assessment has been carried out. The status report was published in February 2011 and determined whether the action plan for Sami languages is being implemented properly and the goals are being achieved. During the evaluation of the

action plan, several measures have been strengthened and new measures have been added (Norwegian Ministery of Labour and Social Inclusion, 2011).

5.4. Drivers of Biocultural Diversity Loss in Europe

The reasons for diversity loss are manifold and cannot be traced back to a single factor. Many different drivers of biocultural diversity loss put pressure on the biological, cultural, and linguistic heritage and can have synergetic and amplifying effects upon each other (Maffi and Woodley, 2010). During the analysis of the thesis, the underlying threats and drivers of change of the selected European biocultural diversity projects have been investigated and summarised (Table 5).

Consistently to Maffi and Woodley (2010, modified), the specific drivers of biocultural diversity loss have been grouped into five different categories:

1. *Environmental degradation*: Unsustainable farming practices that are threatening both the agricultural system and biological diversity.
2. *Economic and development pressures*: Traditional agricultural systems are often economically less competitive than intensive mass-production farming systems. Rather big pressures of intensification are acting upon these traditional systems, as the younger generation in many cases favours profit-orientated farming styles and practices. Unemployment and poverty also threatens biocultural diversity, because it often leads to unsustainable strategies that maximise yields in the short term at the expense of biological and cultural diversity.
3. *Legal framework and land tenure issues*: Lacking of legal framework and too rigorous (environmental) laws and regulations can both have a negative impact upon traditional agricultural systems and their associated biological and cultural diversity. Keeping the balance between developing a legal basis for supporting such systems and restricting exploitations and unsustainable farming practices is difficult to achieve but very important. Land tenure issues can also cause a decrease in biocultural diversity. Especially for pastoral communities in Romania, it is getting more and more difficult to find trails which they and their flock can use. Geographical isolation, geo-political separation, and conflicting interests among stakeholder are further drivers of biocultural diversity loss.
4. *Acculturation and loss of traditional knowledge*: The lacking transmission of traditional knowledge to the next generation and combination with the fact that the elderly people that possess this knowledge are getting older and fewer, is a serious threat to cultural diversity. Without being able to pass on knowledge to the next generation, it can only be conserved *ex situ* (e.g. in databases). Many projects mentioned lack of awareness and appreciation as specific reason for biocultural diversity loss. Drawing attention towards the project's subjects of protection is an essential step for gaining broad acceptance and support. Formal educational systems which discourage traditional practices are another cause for diversity loss. Little value and self esteem of minority languages often cause a shift towards dominant languages. Little possibility of using and encountering the languages in everyday life further increases the pressure upon them. Another serious driver of cultural diversity loss is migration to urban areas. In most cases traditional knowledge is not being needed anymore when living in cities, which is why it is often getting lost.
5. *Global threats*: Global challenges such as climate change, globalisation, mechanisation, and motorisation are also causing and increasing biocultural diversity loss. These drivers are not limited to Europe, but they act and threaten diversity on a global level.

Table 5: Drivers of biocultural diversity loss in Europe.

Categories of Drivers of BCD Loss	Specific Drivers of BCD Loss	Projects
1. Environmental degradation	Unsustainable farming practices	4.4 (The Netherlands)
2. Economic and development pressures	Lacking competitiveness of traditional agricultural system	4.3, 4.4 (Italy, Romania)
	Intensification of agricultural system	4.4 (Slovakia, Romania)
	Unemployment and poverty	4.4 (Russia)
3. Legal framework and land tenure issues	Lack of legal and policy framework	4.4 (Romania, Russia)
	Environmental rules and regulations made sustainable farming impossible	4.3
	Land tenure issues (using of trails by shepherds)	4.4 (Romania)
	Geographical isolation and geo-political separation	4.4 (Russia)
	Conflicting interests among stakeholders	4.2, 4.4 (Romania)
4. Acculturation and loss of traditional knowledge	Lacking knowledge transfer to the next generation	4.1, 4.4 (Slovakia, Russia), 4.5, 4.6
	Ageing of the already elderly generation that possesses traditional knowledge	4.1, 4.4 (Slovakia, Russia), 4.5, 4.6
	Lack of awareness and appreciation	4.1, 4.4 (Slovakia, Romania), 4.5, 4.6
	Formal educational systems which discourage traditional practices	4.1, 4.5
	Little value and self esteem of minority language	4.6
	Little application possibility of minority language	4.6
	Migration to urban areas	4.4 (Russia)
5. Global threats	Climate change	4.4 (The Netherlands)
	Mechanisation, motorisation	4,5

The specific factors of biocultural diversity loss that were encountered most frequently during the analysis of the projects belonged to the category acculturation and loss of traditional knowledge. “Lacking knowledge transfer to the next generation”, “ageing of the already elderly generation that possesses traditional knowledge”, as well as “lack of awareness and appreciation” were mentioned in five of the ten projects (4.1, 4.4 Slovakia, 4.4 Romania / 4.4 Russia, 4.5, and 4.6). In this selection of projects these are the most wide-spread specific drivers and challenges that need to be addressed. “Lacking competitiveness of traditional agricultural systems” has been encountered in three, and “intensification of agricultural system”, “lack of legal and policy framework”, “conflicting interests among stakeholders”, and “formal educational systems which discourage traditional practices” in two different projects each.

Maffi and Woodley (2010) have identified similar drivers of biocultural diversity loss: (1) Environmental degradation and local over-exploitation of natural resources, (2) Development pressures, (3) Land and resource tenure issues, (4) Introduction of non-native species and monocultures, and (5) Acculturation and socio-economic change. The specific factors, which have been encountered in most projects of Maffi and Woodley (2010) are “lack of transmission of local biodiversity knowledge to younger generations” (lack of communication between Elders and youth, disinterested youth, few opportunities for traditional teachings) (11 of 45 projects), “formal education systems which discourage traditional practices and

world views" (7 projects), and "sovereignty and land claims, illegal incursions on indigenous territories; illegal grazing" (6 projects) (Maffi and Woodley, 2010).

The analyses have shown that the most frequently mentioned drivers of diversity loss of Maffi and Woodley (2010) are similar those identified in the selected European projects. Both analyses revealed that lacking knowledge transfer to the younger generation is one of the most often encountered threats. Formal education systems which discourage traditional practices are also high in rank in both analyses.

5.5. Conservation Strategies and Solutions

The analysis of the published literature of the biocultural projects in Europe not only revealed common drivers, which are responsible for biocultural diversity loss, but also conservation strategies and recommendations (Table 6). The many different authors provided a number of various solutions to their project's challenges and issues. The different individual recommendations have been grouped into five different thematic categories:

1. *Project design*: These recommendations aim at improving the project itself. Making sure to involve as many of the concerned stakeholder groups as possible increases the acceptance and support of the project. Minimising the time lag between the project and implementation phase reduces uncertainties concerning the outcome of the process and maintains confidence and enthusiasm. Continuation of participation and monitoring of the implementation process are important parts of the project and can greatly improve overall acceptance and outcomes of the research.
2. *Political and legal framework*: Some authors advise a change in the strategic and political agenda of policy-makers and cultural stakeholders, as well as a change in the educational system towards better integration of traditional knowledge. These changes are needed in order to sustainably promote and conserve cultural diversity and traditional local knowledge. Bridging the gap between the government and various stakeholders (e.g. farmers) via establishing networks, environmental co-operations, and similar associations, can help implementing diversity-conserving measures more efficiently and willingly.
3. *Regional development and livelihood security*: Definitely an important strategy towards sustainable conservation of bicultural diversity is the support of regional development and livelihood security. Developing and maintaining sustainable farming practices is not only conserving the agricultural system itself, but also the associated semi-natural agricultural landscape. Ensuring the socio-economic and cultural viability of agricultural systems is an important challenge that definitely needs to be addressed and managed. One way of providing livelihood security for farmers is to stimulate demands for local products and development of regional marketing strategies.
4. *Conserving traditional knowledge and creating awareness*: Many different recommendations and conservation strategies deal with conserving traditional knowledge and creating awareness. Several authors stress the need for further research and documentation of traditional knowledge. The knowledge should be distributed, exchanged, transmitted, revitalised, and applied, in order to conserve it for future generations. The transmission of traditional environmental and linguistic knowledge is essential for guaranteeing that this cultural heritage is passed on to the next generation. A revitalisation of traditional knowledge can be achieved by organising seminars and providing professional consultation and help. Creating awareness of the importance and many benefits of the project's protective goods and traditional knowledge is considered the one of the first step towards conservation of biocultural diversity.

Table 6: Recommendations/Conservation Strategies for conserving biocultural diversity in Europe.

Categories of Recommendations/ Conservation Strategies	**Specific Recommendations/Conservation Strategies**	**Projects**
1. Project design	Involvement of different stakeholders	4.2, 4.3
	Minimise time lag between participatory process and visible results	4.2
	Secure continuation of participation and results monitoring	4.2, 4.4, 4.6
2. Political and legal framework	Change in the strategic and political agenda of policy-makers and cultural stakeholders	4.1, 4.3
	Changes in the educational system towards better integration of traditional knowledge	4.1, 4.5
	Legal protection of agricultural systems and protective goods	4.3, 4.4 (Slovakia, Romania, Russia)
	Bridging the gap between farming population and the government	4.3
	Development of associations, networks, and environmental co-operations	4.3, 4.4 (Romania, The Netherlands)
3. Regional development and livelihood security	Developing and maintaining sustainable farming practices	4.3, 4.4 (Italy, Russia, The Netherlands)
	Ensuring the socio-economic and cultural viability	4.3, 4.4 (Italy, Russia, The Netherlands)
	Encouraging of local products and regional marketing	4.4 (Italy, The Netherlands)
4. Conserving traditional knowledge and creating awareness	Further research and documentation of traditional knowledge (TK)	4.1, 4.4, 4.5
	Distribution, exchange, revitalisation, and application of TK	4.1, 4.4 (Slovakia), 4.5, 4.6
	Transmission of traditional environmental and linguistic knowledge	4.1, 4.6
	Providing professional consultation and organising seminars	4.5
	Creating awareness of the benefits and importance of protective goods	4.4 (Slovakia, Romania), 4.5, 4.6
5. In situ conservation of (agro-) biological diversity	In situ conservation of veterinary applications and traditional crops	4.1, 4.5
	Replenishing genetic stocks	4.4 (Russia
	Conservation and revitalisation of agro-biodiversity	4.4 (Slovakia)

5. *In situ conservation of (agro-) biological diversity*: Similarly to the conservation of traditional knowledge, it also is important to conserve biological diversity (such as traditional crops and agro-biodiversity) *in situ*. It is beneficial to store seeds of local varieties in gene banks, but for several reasons (chapter 4.5 and Brush, 2000) it is necessary to cultivate traditional crops *in situ*. Most agricultural ecosystems harbour a characteristic and unique flora and fauna, which has adapted to human disturbances. Without agricultural management this biodiversity would be lost.

The biocultural diversity projects provide several conservation strategies and solutions to the challenges and constraints encountered during their project phases. Involving several different groups of stakeholders in the planning and implementation phase helps mediating conflicting issues and expectations. A monitoring and evaluation of the project makes sure that the experienced constraints, lessons learnt, and recommendations are being recorded and distributed.

The success of a project not only depends on the project design and stakeholders, but also on the political conditions. This is also true for networks and environmental co-operations (see chapter 4.3 and 4.4). Without political support, conservation of biocultural diversity is hardly possible (Wiskerke et al., 2003b; FAO, 2011b).

Ensuring sustainable development and agriculture systems not only helps conserving the traditional knowledge embodied in these cultural systems but also supports biological and landscape diversity (Brindza et al., 2002; Wiskerke et al., 2003b; Grego, 2007; Schoubroeck, 2010). Over generations, the farmers created and shaped semi-natural agricultural landscapes with their activities and practices. Accordingly, the associated landscapes are best being managed by farmers and their traditional agricultural systems (FAO, 2008b; FAO, 2011a).

In the previous chapter, the lacking transmission of traditional knowledge and its “ageing” has been identified as serious threat to cultural diversity. It does not surprise that many authors (projects 4.1, 4.4, 4.5, and 4.6) advised further research on and documentation of traditional knowledge. At least equally important is the distribution, exchange, revitalisation, and application of this knowledge. Transmission of traditional knowledge to the next generation will help conserving the valuable cultural heritage.

6. Conclusions

Seven of the ten European projects (4.2 Jungfrau-Aletsch-Bietschhorn World Heritage Site, 4.4 GIAHS [Italy, Slovakia, Romania, Russia, The Netherlands], and 4.6 Revitalisation of Sami Languages) planned and carried out a monitoring and evaluation. Out of the projects with monitoring strategies, the evaluation process of the GIAHS projects is the most thorough. Even though it might be too comprehensive for some (especially smaller) projects, it might still serve as a source from which instructions and guidelines can be drawn.

The analyses of the factors causing biocultural diversity loss have revealed that the ten European biocultural projects mentioned similar drivers as Maffi and Woodley (2010). Both analyses revealed that lacking knowledge transfer to the younger generation is one of the most frequently encountered threats. Formal education systems which discourage traditional practices are also high in rank in both analyses. In Europe, lacking knowledge transfer to the next generation, ageing of the already elderly generation that possesses traditional knowledge, as well as lack of awareness and appreciation were mentioned in four of the ten projects. Even though only ten biocultural projects have been identified in Europe (compared to 45 in Maffi and Woodley, 2010), the factors threatening biocultural diversity are pretty similar to those found in Maffi and Woodley (2010). It might well be possible that the major problems and drivers affecting biocultural diversity can be found all over the world and can be separated into global threats (e.g. globalisation) and globally spread but local acting threats (e.g. lacking knowledge transfer).

In addition to the specific drivers of biocultural diversity loss, the projects also provided several conservation strategies and solutions to challenges and constraints encountered during their project phases. The key recommendations that have been extracted from the European projects are the following:

- *High degree of participation*: raises acceptance of the project and mediates conflicting expectations
- *Monitoring or evaluation*: greatly improves overall acceptance and outcomes of the research
- *Development of networks and environmental co-operations*: they can gain considerable political influence and promote conservation interests on a political level
- *Regional development and livelihood security*: sustainable farming practices will also conserve associated landscapes and biodiversity; regional marketing can increase demands for local products and provide income security for the farmers
- *Conservation of traditional knowledge*: documentation, distribution, exchange, transmission, and application of traditional knowledge in order to revitalise it
- *Creating awareness*: of the benefits and importance of protective goods is one of the first step towards conservation of biocultural diversity
- *In situ conservation of (agro-) biological diversity*: it is good to store seeds of local varieties in gene banks, but still it is necessary to cultivate traditional crops *in situ*

Parts of the author's recommendations aim at improving the design, acceptance and subsequently the effectiveness of the conservation projects (e.g. high participation, monitoring). Some strategies have the potential of simultaneously conserving multiple aspects of biocultural diversity (e.g. regional development, sustainable farming practices), while others focus on specific aspects (e.g. conservation of traditional knowledge, *in situ* conservation of biological diversity).

Even though little attention has been paid to Europe in biocultural diversity research so far, there is nevertheless considerable research being conducted in this field. Although research and projects on biocultural diversity are carried out in Europe, they are rarely titled that way.

In fact, none of the examined projects of this thesis was tagged “biocultural”, which makes them difficult to find. An explanation for this situation might be that the concept of biocultural diversity is not yet as well known in Europe, as it is in other parts of the world. Promoting the concept of biocultural diversity might increase the number of interdisciplinary projects and research.

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10. Appendix I

Table 7: Analytical table of RUBIA project.

Projects	Research Focus	Stakeholders	Reason for Research	Findings and Outcomes	Recommendations, Conservation Strategies
Pieroni et al., 2006	Comparative ethnobotanical field survey; medical plant uses in traditional animal healthcare	RUBIA research consortium which consisted of eight universities and research centres in Holland, Italy, Spain, Greece, Cyprus, Morocco, Egypt, and Algeria	No comparative fieldwork on medical plants uses in traditional animal healthcare in the Mediterranean has been carried out before,	136 veterinary preparations and 110 plant taxa were recorded; Some uncommon veterinary phytotherapeutical indications that have never been recorded before; strong link between human and veterinary medical practices; centralised database	Further research in this domain; eco-sustainable projects that use plant-based remedies in traditional and new agricultural and animal breeding systems (needs a change in the strategic and political agenda of many national veterinary services); urgent need to document TK concerning traditional plant uses
González-Tejero et al., 2008	Traditional plant use in the Mediterranean; evaluate ethnobotanical knowledge; conserve diversity;	RUBIA research consortium	There has not been a previous study with researchers working simultaneously and with the same methodology in different countries of the Mediterranean sphere; coordinated collection of ethnographic data	985 catalogued plant species, of which 406 have medical use; taxonomic information, habitat and abundance, medical use, and application was recorded in a centralised database	Extend the research to other areas of the Mediterranean; this study might be a base for future phytochemical and pharmacological studies
Hadjichambis et al., 2008	Wild and semi-domesticated food plants and their consumption in the Mediterranean region	RUBIA research consortium	Gathering data about popular uses of wild food plants in order to prevent the knowledge from being lost; few studies on wild food plants have been conducted in the Mediterranean region	406 plants are gathered and consumed in the 7 study areas, comprising 294 different taxa; plants, used plant parts, models of consumption, utilisation as food medicine was documented	Further recording and preserving of traditional knowledge; infusion of traditional ecological knowledge to future generations; novel curricula in schools and universities; changes in the agenda of many local policy-makers and cultural stakeholders
Della et al., 2006	Ethnobotanical research of wild edible plants in Cyprus	RUBIA research consortium	Only few ethnobotanical studies focused on wild edibles in Cyprus	Data base of 78 species; common local name, its uses, used part of the plants and preparation and administration processes were recorded	Further research on non cultivated edible plants as basis for finding renewed food plants; further documentation, preservation and distribution of traditional knowledge
Pieroni et al., 2005a	Traditional ethnobotanical knowledge related to the use of local medical plants	RUBIA research consortium	No ethnobotanical work has been carried out in Albania before	Approximately 70 botanical taxa and 160 preparations (mainly from plants, but also animal products and minerals)	Further phytotherapeutical research, combination of modern evidence-based phytotherapy and ethnobotany
Pieroni et al., 2005b	Traditional pharmaceutical knowledge (TPhK), cultural adaptation to social changes	RUBIA research consortium	Lack of knowledge about folk pharmaceutical and medical practices in multi-cultural contexts and among migrant groups	79 botanical taxa and 115 plant-based preparations, encompassing 167 folk phytotherapeutical uses	Further research on the use of traditional phytotherapeuticals and Western Pharmaceuticals among migrants, and exchange of TPhK between migrants and host population

Table 8: Analytical table of Jungfrau-Aletsch-Bietschhorn World Heritage Site (Switzerland).

Projects	Research Focus	Stakeholders	Reason for Research	Findings and Outcomes	Recommendations, Conservation Strategies
Swiss Alpine Research	Multi-stakeholder participatory process, Combining nature conversation and endogenous development	WHS Management Centre; Swiss National Centre of Competence in Research (NCCR) North-South; local stakeholders	Initial acceptance of WHS was based on very diverse and conflicting expectations rather than on common goals and strategies; need for a WHS Management Plan based on broad acceptance	Development of a WHS Management Plan; integration of local stakeholders in the process; good acceptance of participatory process and Management Plan	Minimise time lag between participatory process and visible results; Secure continuation of participation and results; Also try to involve stakeholders that feel less concerned; Power play

Table 9: Analytical table of Environmental Co-operatives VEL and VANLA (The Netherlands).

Projects	Research Focus	Stakeholders	Reason for Research	Findings and Outcomes	Recommendations, Conservation Strategies
VEL and VANLA	Sustainable farming; Nature conservation, landscape management; Nitrogen loss, nutrient management; Endogenous development and self-governance	Local dairy farmers, Wageningen University	Environmental regulations made farming difficult, alternatives had to be searched to make farming more sustainable	Restoration of 240km of alder trees, 220 ponds, increase of biodiversity in 80ha, protection of ground breeding birds in 240ha; "cycle system" with improved nitrogen efficiency, better grass quality, improved soil, higher overall grassland production with lower inputs	Environmental co-operatives can result in a more sustainable development of farming and the rural area; They bridge the gap between farming population and the state and can gain remarkable political influence; Still, it needs a favourable governmental environment

Table 10: Analytical table of Globally Important Agricultural Heritage Systems (GIAHS).

Projects	Research Focus	Stakeholders	Reason for Research	Findings and Outcomes	Recommendations, Conservation Strategies
Lemon Gardens (Southern Italy)	Cultural diversity (traditional agricultural systems); Biodiversity (conserving landscapes)	No information provided	Conservation of traditional agriculture systems and their landscape	Strong competition; difficult, labour intensive and expensive agricultural practice	Sustainable lemon cultivation; Export of products;
Traditional Agro-Ecosystems in the Carpathians Region (Slovakia)	Cultural diversity (traditional agricultural systems, traditional crops); Biodiversity (conserving landscapes and agro-biodiversity)	Agrogenofond Nitra; Institute for Biodiversity Conservation and Biological Safety (Slovak Agricultural University); Governmental institutions	Conservation of traditional agriculture systems and their landscape; High ethnic diversity; High agro-biodiversity (3,000 land-races)	Inter-generational transfer of traditional knowledge; Lacking legislative framework; Climatic factors; Population awareness; Changes in breeding methods;	Establishment of monitoring; national database on plant species cultivation and utilisation; conservation and revitalisation of agro-biodiversity; traditional knowledge revitalisation; legal protection of agro-ecosystems; creating awareness; action plan for recognition, conservation and sustainable management of agricultural systems;
Mobile Pastoral Systems (Romania)	Traditional agricultural system; Conservation of typical pastoral landscapes	No information provided	Need for legal support of pastoral systems; Decline of agricultural system and endangerment	Agricultural policies; Economic competition; Lack of legal protection; Lack of technology and infrastructure; Unfavourable tenure system; Lack of awareness of the benefits; Lack of knowledge of importance for conservation; Insufficient market for products; Decrease in wool industry	identification and dissemination of the benefits of mobile pastoralism; advocacy and implementation of a legal and policy framework to support pastoralists; establishment and development of pastoralist associations and networks; creating awareness of the importance of pastoralism for tourism; general advocacy amongst the wider Romanian and international public;
Traditional Reindeer Herding in the Arctic Region (Siberia – Russia)	Cultural heritage (agricultural system)	No Information provided	Conservation of traditional reindeer herding;	Poverty and reduced salaries; Reduced veterinary care; Geographic isolation and market constraints; Geo-political separation; Wolf predation; Resource exploitation pressure; Unemployment; Family and network breakdowns; Urban migration of youth; Reindeer slaughter by new external managers	designing new small-scale enterprises; replenishing genetic stocks from increasing wild deer populations; changing the institutional and economic environment and policies; ensuring the socio-economic and cultural viability;
Dutch polder systems	Cultural diversity (agricultural system); Biological diversity (conservation of semi-natural agricultural landscape)	No information provided	Sustainable agriculture is endangered	Rising water level; Climate change; Lowering land levels;	Maintaining sustainable agriculture; Co-operations between farmers and nature organisations; Regional marketing;

Table 11: Local knowledge of medical plant uses and traditional crops and their local varieties in Eastern Tyrol (Austria).

Projects	Research Focus	Stakeholders	Reason for Research	Findings and Outcomes	Recommendations, Conservation Strategies
Vogl-Lukasser et al., 2006a (Part 1)	local knowledge of medical plant uses in animal healthcare	Division of Organic Farming (University of Natural Resources and Life Sciences, Vienna); Governmental institutions	Documentation of traditional knowledge in animal healthcare; Knowledge is "getting older"; Application of knowledge is diminishing	Older people have more knowledge of medical plant uses; Many veterinary preparations are not used anymore; Much knowledge within the region, but the single person has little knowledge; Storage in database	Creating awareness; Organising seminars; Exchange of knowledge within the region; Get veterinarians to promote this knowledge
Vogl-Lukasser et al., 2006b (Part 2)	traditional crops and their local varieties	Division of Organic Farming (University of Natural Resources and Life Sciences, Vienna); Governmental institutions	Increased diminishing of traditional crops; Documentation of traditional crops and associated knowledge	20 traditional crops and 168 seed lots; Documentation of information about local varieties (source of seeds, selection of seeds,...); Storage in database	In situ conservation of traditional crops; Creating awareness; professional consultation for interested and active seeders; financial and scientific support for people and projects focusing on agro-biodiversity and conservation of local varieties

Table 12: Analytical Table of Revitalisation of Sami Languages in Norway.

Projects	Research Focus	Stakeholders	Reason for Research	Findings and Outcomes	Recommendations, Conservation Strategies
Revitalisation of Sami languages in Norway	Linguistic diversity; Support of Northern, Lule, Southern, Skolte, and Pite Sami; Cultural diversity	Norwegian Government; Sami Parliament; Local stakeholders	Endangerment of Sami languages; Boost Sami languages; Increase their "worth" compared to Norwegian	A total of 66 measures for the 3 themes: learning, using, and seeing; Implementation of measures within 5 years	Support language learning in schools and kindergartens; Increasing the use of Sami in the public services; Creating awareness of language endangerment for concrete measures see Norwegian Ministry of Labour and Social Inclusion, 2009

11. Appendix II

Table 13: Keywords used in scientific online databases and number of document results (Searches carried out on 13 Sept 2010).

Keywords	Searched Fields	Scopus	ScienceDirect	SpringerLink
“biocultural diversity”	title, abstract, keywords (TAK)	29	8	1
“biocultural diversity” AND alps	TAK	0	0	0
“biocultural diversity” AND europe	TAK	0	0	0
"Intangible cultural heritage"	TAK	51	1	8
"language maintenance"	TAK	272	35	6
"language maintenance” AND europe	TAK	7	3	0
"endogenous development" AND europe	TAK	35	3	0
biodiversity AND index	all fields	4,191	20,037	15,401
biodiversity AND index	title	58	15	11
"biodiversity index"	title	11	3	2
"biodiversity index"	TAK	230	43	9
cultural AND index	title	87	32	16
"cultural index"	title	0	0	0
"cultural index"	TAK	20	5	2
linguistic AND index	title	27	4	4
"linguistic index"	title	3	0	0
"linguistic index"	TAK	19	6	1

12. Kurzzusammenfassung

Hintergrund: In den 1990er Jahren wurde zunehmends erkannt, dass nicht nur die biologische Vielfalt, sondern auch die kulturelle und linguistische Vielfalt weltweit dramatisch abnehmen und ähnliche Faktoren für diesen Verlust verantwortlich sind. Das relativ junge Konzept der Biokulturellen Vielfalt („biocultural diversity“) versucht die drei verschiedenen Vielfalten und ihr Ausprägungen interdisziplinär zu betrachten und erforschen. Diese Masterarbeit setzt sich als Ziel einen Überblick über derzeitigen Stand der Forschung auf diesem Gebiet zu geben. Zusätzlich wurden europäische Projekte zum Thema Biokulturelle Vielfalt untersucht und Faktoren für deren Verlust und mögliche Schutzstrategien extrahiert und analysiert.

Methodik: Mittels Literaturrecherche wurden insgesamt 10 europäische Projekte ausfindig gemacht, die sich mit dem Konzept der biokulturellen Vielfalt beschäftigen. Die von den Autoren publizieren Informationen zur Gefährdung der europäischen Schutzgüter und mögliche Schutzmaßnahmen wurden analysiert und mit den weltweiten Daten von Maffi and Woodley (2010) verglichen.

Ergebnisse: Im Zuge der Untersuchungen stellte sich heraus, dass ähnliche Faktoren für den Verlust an Biologischer Vielfalt in Europa und dem Rest der Welt verantwortlich sind. Mangelnder Transfer von traditionellem Wissen von der älteren Generation auf die jüngere und starre Bildungssysteme, die die Weitergabe von traditionellen Werten und Erfahrung behindern, sind für einen Großteil des Verlusts an Biokultureller Vielfalt verantwortlich.

Fazit: Die in den Projekten identifizierten Schutzmaßnahmen und –strategien können und sollen als bewährte Methoden zukünftige Projekte in dem Themenfeld unterstützen.

13. Abstract

Background: It was in the 1990s, when researchers became aware that not only biological diversity, but also cultural and linguistic diversity are being lost at dramatic rates and that the ongoing worldwide loss of biodiversity is paralleled by and seems to be interrelated with the extinction crisis affecting cultural and linguistic diversity. The newly emerged field of biocultural diversity can be defined as the sum of the diversity of life in all its manifestations. This thesis aims at providing an overview of the concept of biocultural diversity, identifying European biocultural diversity projects, and extracting information about threats and conservation strategies of them.

Methods: During the literature search, a total of 10 different European biocultural diversity projects have been identified. The information about threats, drivers of diversity loss, conservation recommendations and strategies have been extracted, analysed and compared with the worldwide results of Maffi and Woodley (2010).

Results: The analyses of the factors causing biocultural diversity loss have revealed that the most frequently mentioned drivers of Maffi and Woodley (2010) are similar to those identified in Europe. Both analyses revealed that lacking knowledge transfer to the younger generation is one of the most frequently encountered threats. Formal education systems which discourage traditional practices are also high in rank in both analyses.

Conclusion: The identified conservation strategies and recommendations from the projects should act as best practices and contribute to the implementation of future projects.