



**Universiteit Utrecht**

# The importance of cultural ecosystem services and their evaluation in the context of ecosystem service assessment frameworks

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Comparative study of users' perceptions (preferences) of cultural ecosystem services and disservices in and outside the city of Leipzig

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## Abstract

Human beings are strongly connected with their surrounded environment. The dependencies range from resource supply for human use, ecosystem service provision, to contributions to human wellbeing and welfare. Ecosystem services are under decline, which calls for maintenance and protection strategies, and concepts for sustainable use. Cultural ecosystem services are hard to quantify and measure due to their intangible and non-consumptive attributes. Once destroyed, these services are even harder to replace than other ecosystem services. In the background of environmental degradation and increasing global urbanisation, people are tempted to attach greater importance to the natural setting and services provided by nature. Various approaches exist for the assessment of ecosystem services but an interdisciplinary, agreed-upon methodology to capture and evaluate these services adequately among ecological, economic and societal interests in a balanced way is still missing.

The importance of ecosystem services and cultural services was investigated in urban (i.e. park) and suburban (i.e. allotment garden associations) areas of the city of Leipzig based on 66 short face-to-face interviews in summer of 2015. Demographic data was recorded to uncover respondents' preferences for ecosystem services and cultural ecosystem services in particular. Data analysis was performed by descriptive analysis and correlations in SPSS. Differences in demography and service use among the areas were disclosed.

Different preferences for ecosystem services were found between urban and suburban locations, between age groups and respondent's educational level as well as between the current and general service use. Provisioning services, partly in combination with cultural services, were most likely mentioned by older respondents in suburban areas. Cultural services per se or in combination with regulation were more important in the urban park area. Preferences for cultural services were dependent on the time of the week (i.e. working day or weekend). Ecosystem disservices, i.e. disturbances by nature that people perceive as unwanted, were barely mentioned within the scope of the survey. Variations were found between the current service use and the use in general absent the present moment. Participatory approaches in ecosystem service assessment are indispensable in identifying spatial distributions and importance of specific (e.g. cultural) services. Local investigations on ecosystem services and user's involvement provide an opportunity to capture besides ecosystems' visible values also the intangible dimension. The incorporation of the cultural dimension in ecosystem service assessment frameworks can therefore be enabled. Measuring and assessing of natures' services contributes due to value identification leading to sustainable resources use.

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## List of Acronyms and Abbreviations

ESS	Ecosystem Services
CES	Cultural Ecosystem Services
MEA	Millennium Ecosystem Assessment
EDS	Ecosystem Disservices
UEDS	Urban Ecosystem Disservices
HWB	Human Wellbeing
EU	European Union
MDG	Millennium Development Goal
SDG	Sustainable Development Goal
TEEB	The Economics of Ecosystems and Biodiversity
MAES	Mapping and Assessing of Ecosystems and their Services
IPBES	Intergovernmental Platform on Biodiversity and Ecosystem Services
TEV	Total Economic Value
PES	Payment for Ecosystem Services
i.e.	id est (that is)
e.g.	exempli gratia (for example)
etc.	et cetera (and so on)
ibid.	ibidem (in the same place)

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## 1. Introduction

Human beings are dependent on the environment they live in and that surrounds them. This environment includes the provision of essential services by earth's ecosystem such as food and clean water but also, thinking one step ahead, regulating mechanisms for diseases or climate and subjective perceived services like spiritual fulfilment or aesthetic enjoyment, just to mention some of the provided goods (MEA, 2005). Nature itself passed through a change of interpretation and perception by humans from past times until today. Earlier, nature was seen as the wild and dangerous opposite of civilisation that needs to be tamed and cultivated to be applicable for humans. Nowadays, there is an understanding of protecting nature and its beneficial character including the services supplied, which mostly takes part in industrialised parts of the world (Lyytimäki & Sipilä, 2009; von Döhren & Haase, 2015).

The beneficial character of nature in terms of service provision and capturing of these elements is the subject of this report, including disservices perceived by human beings. In the following, the scientific state of the art and identification of current lacks of knowledge contributes to the problem definition.

### 1.1. Problem definition

Benefits people obtain from ecosystems are defined as ecosystem services. For better understanding of the topic and to enable their capture and assessment they are commonly grouped into provisioning services, regulating services and cultural services (MEA, 2005).

First efforts to identify ecosystem services (hereinafter also called ESS) were made in the 1970's and it became a topic in literature as of 1990 according to the quantity of scientific articles (de Groot et al., 2010). The Millennium Ecosystem Assessment (MEA) established the ESS concept between 2003 and 2005 with a classification in regulating, provisioning and cultural ecosystem services (hereinafter also called CES). Supporting services (e.g. nutrient cycle) as an additional group are understood as the basis for the abovementioned categories (MEA, 2005). Ecosystem degradation and biodiversity loss took place in the past decades and is still happening today in the background of industrialisation. That is why approaches to measure and quantify these changes emerged in order to protect ecosystem's service provision (Sukhdev et al., 2014). The concept of ecosystem services enables 'the valuation of the multiple services from ecosystems and landscapes, the identification of trade-offs between different land use scenarios, and also informs decision making in land use planning' (Schaich et al., 2010). The understanding of society's benefit from nature

helps to identify services used by different stakeholders and supports the motivation of protection of these services (Martín-López et al., 2012).

One reason for the attractiveness of the ESS concept is that it potentially helps us to describe links between human and nature and humans' dependencies on nature (Haines-Young & Potschin, 2012). These connections are complex and a transdisciplinary approach in research is necessary. For instance, one need to describe and map services for monetary evaluation while others are more interested in policy making to reduce human impact on services delivery by nature (Haines-Young & Potschin, 2012).

Due to different interest, aim and purpose of the investigation the respective classification and evaluation system has to be applied or developed. Furthermore, an appropriate definition of the object of research needs to be set to meet the goal and scope of the research.

### *1.1.1. Relevance in society and policy*

Ecosystem services are relevant for society, emphasised in development policy and therefore an important factor of sustainable development. Levin (2012) argues 'sustainability (...) includes the stability of financial markets and economic systems, of reliable sources of energy, as well as of biological and cultural diversity' and 'the preservation of the services that we derive from ecosystems'. Protection and maintenance of service provision by nature ensure human livelihood. The Co-evolution between human wellbeing and ecosystem services justifies the societal relevance of the ESS concept (Bieling et al., 2014). Humanity is strongly influenced by ecosystems and changes of this system have a significant effect on cultural identity and social solidity (MEA, 2005). The interdependency justifies protection and careful management of natures' resources in the shape of services sufficiently. The ESS concept is considered to be a keystone in conservation and resources management as well as in ecological and environmental economics due to the bridging function of ESS between environment and society (Wu, 2013).

Urban landscapes are besides their recreational character associated with ESS due to biodiversity. Urban biodiversity experiences increasing importance due to urbanisation trends that again influences nature and also ecosystem services (Lyytimäki et al., 2008). The concept of ESS and ecosystem disservices (hereinafter also called EDS) is thus relevant in biodiversity preservation and enhancement planning. The integration of ecological, social and economic elements may open the door for sustainable analysis and management of urban biodiversity (Lyytimäki et al., 2008).

Furthermore, the demand to identify and quantify the linkages between biodiversity and ESS is present. The fact that ecosystem services experience overconsumption and humanity faces challenges like climate change and population growth calls for



agendas towards conservation of biodiversity and environmental protection (Sachs et al., 2009).

There are attempts to safeguard the protection of ecosystems, the provision of services, biodiversity or environmental sustainability by the EU and global institutions that will be described hereinafter:

The United Nations brings among other things sustainability in environmental concerns into focus by the Millennium Development Goals (MDG) that were framed in 2000. These goals are designed to initiate action to improve peoples' lives and among all halving extreme poverty (Sachs et al., 2009). The UN adopted eight health-related development goals with an implementation deadline in 2015. The major goals that are meant to be fulfilled are eradication of hunger and poverty, achievement of universal primary education, gender equality, reduction of child mortality, disease prevention (HIV/AIDS, malaria, etc.) and global development partnerships (WHO, 2008). Goal seven with the strongest relation to nature deals with the warranty of environmental sustainability, which includes access to safe drinking water sources and improvement in sanitation (ibid.). Sub-targets concerning ecosystems are for instance the integration of principles of sustainable development in country policies or the reverse of loss of environmental resources (ibid.). Furthermore and with regard to global decline of biodiversity and ESS a significant reduction of the current degree of biodiversity loss is desirable (Sachs et al., 2009). Links between different goals enable the investigation of interdependencies, e.g. reduction of biodiversity loss that might go along with poverty alleviation (ibid.).

The MDG pay attention to environmental factors because of their impact on human health. Intentions like limitation of population's exposure to natural hazards, destruction or degradation of natural resources imply the maintenance of provisioning and regulating services (WHO, 2008). The MEA (2005) stresses that their undisturbed supply and quality should be secured since ecosystem services have a major influence on livelihoods on most of the poor.

As a follow-up action on the MDG the Sustainable Development Goals (SDG) were initiated in 2012 in Brazil by the UN Rio+20 summit. Key tasks of these goals were the supplement and continuation of the MDG after their deadline in 2015 (Griggs et al., 2013; Sachs, 2012). The SDG emerged from the widespread understanding that global environmental objectives need to receive greater attention beside the poverty-reduction objectives (Sachs, 2012). The idea of a set of SDG was very well received because of the growing need for globally effective sustainable development (ibid.). Improvements in wellbeing, food security, sustainable water security, universal clean energy and governance are emphasised. Furthermore, the focus lies on healthy and productive ecosystems with sustained biodiversity and ecosystem services. The goal is supposed to be reached by improved management, valuation, measurement and restoration (Griggs et al., 2013). While looking at the SDG, a paradigm shift from the three pillars of sustainable development consisting of

economical, social and environmental pillars towards a nested concept is considered (ibid.). Therefore Griggs et al. (2013) defines sustainable development as 'development that meets the needs of the present while safeguarding Earth's life-support system, on which the welfare of current and future generations depends'.

In the course of the Potsdam initiative on biological diversity (G8+5 in 2007) an analysing process on global economic benefit of biodiversity was started off. The costs of diversity loss, the missing out on protective measures and prices of effective conservation are investigated within that scope (TEEB, 2010). The concept of ecosystem services is supposed to be examined by this initiative.

The European Union established the EU 2020 Biodiversity Strategy that supports the idea that ecosystems' benefits provided to people should be protected and restored (Plieninger et al., 2013b). Biodiversity and ESS are according to the EU 2020 declared as the groundwork for labour, economy, wealth and wellbeing (ibid.). To meet the agreed-upon aims concerning biodiversity and global commitments under the Convention on Biological diversity (CBD) six target accompanied by 20 associated activities were set (Maes et al., 2013).

The urgency to react to environmental and ecosystem degradation is emphasised by the notion *planetary boundaries* that stands for the idea that essential global ecosystem functions are being pushed past enduring thresholds which might result in abrupt, non-linear and harmful outcome for humanity (Sachs, 2012).

Ecosystem services play an ambivalent role for economy and markets. On the one hand they deliver products for the market, e.g. agricultural or forestry goods, but are on the other hand by about 60% under decline caused by agricultural growth, fisheries, forestry and urban uses (Kinzig et al., 2011). The social and environmental costs of the service provision and production is either insufficiently measured or not considered at all (ibid.). Payments for ecosystem services (PES) as a combination of environmental protection and financial aid may give incentives to ESS users to take environmental costs into account (Ring et al., 2010). Carefully designed, this mechanism can improve and protect the environmental conditions by involving sellers and buyers and regulate the consumption of ESS without allowing free entry to the common goods (Kinzig et al., 2011).

The societal relevance of the topic is given by connection between human wellbeing, the environment and its services. The anthropocentric view on nature that is mostly assumed in ESS concepts and assessment frameworks implies protection, preservation and maintenance strategies for ecosystems.

Ecosystem services play an important role in development and environmental policies as well as in economy. They are of comprehensive importance in the three sections of sustainable development: economic, social and environment.

The scientific and societal importance of ESS and their capture indicates the demand of research on this topic. An agreed-upon definition of ecosystem services and of ecosystem disservices is needed in science and policy in order to avoid ambiguity in

valuation. The contributing role of ESS to human wellbeing and welfare has to be identified to describe interdependencies in order to reach ecosystems' protection. Valuation methods and frameworks for ESS assessment follow different purposes. But what is the best way to assess cultural ecosystem services? The importance for ESS and CES in specific areas can be captured by the quantification of utilization of services by service users (i.e. participants of a survey, respondents of an interview etc.). Due to this capture of ESS uses, preferences for specific services in different areas can be derived. The model of preferences assumes that individuals have clear, comprehensive and to some extent stable preferences that are expressed in the individual's decision making (Castro et al., 2011). Furthermore, the recording of demographic data of ESS users gives detailed information about the importance of services among different people in the corresponding area and therefore, their preferences for ESS and CES.

## **1.2. Research objective and research questions**

The objective of the research was to find possibilities to identify and assess cultural ecosystem services and to approach the topic from a theoretical and practical perspective. Information about difficulties of defining ecosystem services and finally capturing them are given. The special role of CES in valuation and assessment mechanisms is pointed out. Demand for research is given and therefore the main research question of the report is:

*How can assessment of CES be integrated into ESS valuation in order to achieve protection, maintenance of ecosystems' values and sustainable use?*

In the theory part based on literature review definitions for ecosystem services are given. Within the scope of ecosystem service assessment the most common valuation frameworks are exemplified. A comparison of classical and innovative methods for ESS assessment is done, including new approaches of measuring cultural services. From identified difficulties of their assessment, recommendations are derived later on. The development of an entirely new framework for ESS valuation is difficult within the limits of these thesis but comments and advises even the way for further research.

For the practical part of the thesis interviews were conducted in urban and suburban areas in the city of Leipzig. The results obtained from interviews give information about the use of ESS and CES and the perception of ecosystem disservices in the respective areas. Demographic data of the respondents is recorded to compare the users' characteristics in the areas including their preferences for service use. The importance of ecosystem services and cultural services for the respondents in general and relations between different service uses is analysed. Statistical analysis

by SPSS helps to process and illustrate the data obtained. Questions answered by the area-specific data obtained in Leipzig are as follows:

*Which ecosystem services and cultural ecosystem services are used in the different areas of Leipzig?*

*Are there linkages between the use of ESS and CES and the respondents' demographic data for the case of Leipzig?*

Users' preferences for ESS are derived from the given answers. The importance of ecosystem services and nature is investigated by the frequency of visit of the determined area. More information to characteristics of the study area and the content of the interview guideline is given in the method part below (see chapter 3). The survey was conducted in three different areas in Leipzig to enable comparisons between the study sides. Preferences for ESS in urban and more rural areas are opposed in order to point out differences and similarities and to test the first hypothesis.

*Hypothesis 1: Preferences for ecosystem services vary among the selected study areas (between park and public garden associations).*

The second hypothesis regarding ESS and CES use and preferences is tested by the results obtained. The concept of preferences is illustrated in the theoretical part. The existence of correlations between ecosystem service use and demographic parameters, i.e. age, gender and education level, and between different ESS is examined for the case of Leipzig.

*Hypothesis 2: Use of ESS and CES and the importance attached by respondents vary with the demographic parameters (age, education, gender).*

In summary, this work contributes to find out how cultural services can be evaluated (theoretical objective) and what preferences of EES and CES can be observed under consideration of the demographic background and location of the respondents (practical objective). Recommendations for better incorporation of CES in assessment frameworks in order to reach better maintenance and protection of service provision are given in the discussion (chapter 5).

## 2. Theory

In the theory chapter the concept of ecosystem system service is explained. Different approaches for assessing ESS but also CES and the concept of preferences for services are part of this chapter. First of all, the research framework for this report and theoretical implications for the development of the interview guideline for the practical part are introduced.

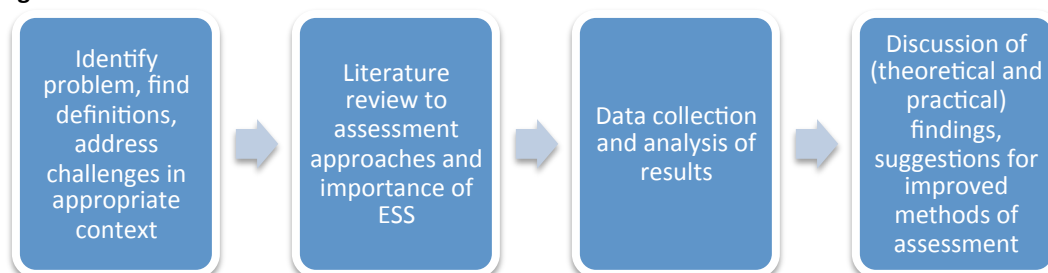
### 2.1. Theoretical framework

The framework for this report combines the review on literature and the results obtained from data collection by interviews. The literature review created the basis for the practical section. In the theoretical part of the research, problems and challenges in defining and assessing ESS and CES were identified. Possible approaches for ESS valuation that either already exist or new attempts and suggestions were derived. The relations and interdependencies between ecosystem services and human wellbeing were highlighted within this report.

As illustrated in figure 1, the practical part including fieldwork and data analysis follows the theory.

The interview guideline for the data collection was developed with knowledge gained in the first phase (i.e. problem identification, address challenges). The concept of users' preferences for ecosystem services and cultural services was taken into account and is presented in the hypothesis set. The discussion joins the theoretical and practical findings. This includes an interpretation of results obtained from fieldwork with regard to ESS uses and interrelations in different areas. The findings were, on the one hand, linked to existing literature and led, on the other hand, to recommendations and suggestions that contribute to improvements of the current situation of ESS assessment and CES valuation in particular.

**Figure 1: Theoretical framework**



The ESS classification system used as a basis for the development of the interview guideline for the data collection part is the Common International Classification System (CICES) version 4.3 by Haines-Young and Potschin in 2012 (see table 1).

**Table 1: Simplified classification system CICES (retrieved from CICES.eu/resources on 27.01.2016)**

Section	Division	Group	Class
Provision	Nutrition	Biomass	Cultivated crops
			Reared animals and their output
			(Others)
		Water	Surface drinking water
			Ground drinking water
	Material	Biomass	Fibres and plant material
			Genetic material
			(Others)
		Water	Surface water for non-drinking purposes
			Groundwater for non-drinking purposes
Regulation & Maintenance	Mediation of waste, toxics etc.	Mediation by biota	Bio-remediation by micro-organisms etc.
			Filtration/Sequestration/Storage/Accumulation by micro-organisms etc.
		Mediation by ecosystems	Filtration/Sequestration/Storage/Accumulation by ecosystems
			Dilution by atmosphere, freshwater etc.
			Mediation of smell, noise etc.
	Mediation of flows	Mass flow	Stabilisation and erosion rate control
			Buffering and attenuation
		Liquid flow	Hydrological cycle and water flow maintenance
			Flood protection
		Gaseous/ air flow	Storm protection
			Ventilation and transpiration
	Maintenance of physical, chemical, biological conditions	Lifecycle, habitat protection	Pollination and seed dispersal
			Maintaining population and habitats
		Disease control	Pest control
			Disease control
		Soil formation	Weathering process
			Decomposition and fixing
		Water conditions	Chemical conditions of freshwaters
			Chemical conditions of salt waters
		Atmosphere & Climate	Global climate regulation and GHG reduction
			Micro and regional climate regulation
Cultural	Physical and intellectual interaction with environment	Physical interaction	Experiential use of plants, animals, environment
			Physical use of environment
		Intellectual interaction	Scientific
			Educational
			Heritage, cultural
			Entertainment
			Aesthetic
	Spiritual, symbolic and other interaction with environment	Spiritual or emblematic	Symbolic
			Sacred or religious
		Other cultural outputs	Existence
			Bequest

For the construction of the typology the MEA classification was used as a starting point and refined afterwards. The CICES was developed from the work on environmental accounting by the European Energy Agency. The idea behind it is to find a standardised way of describing ecosystem service outputs (i.e. here just biotic environment) as they directly or indirectly contribute to human wellbeing. Therefore, the classification system is framed around human needs. A further distinction is made between final ecosystem services, ecosystem goods or products and ecosystem benefits. The system is supposed to be mainly applied as a mapping rather than an assessment tool (Haines-Young & Potschin, 2012).

The three main categories (i.e. sections) are provision, regulation/maintenance and cultural. As illustrated in table 1 in the simplified classification nutrition, energy and material rank among provision, mediation of waste and flows and maintenance of prevailed conditions among regulation/maintenance and physical, spiritual or other interaction with the environment among the section cultural. Smaller clusters were built from sections (i.e. provision) into divisions (i.e. nutrition), into smaller groups (i.e. biomass) and finally even smaller classes (i.e. cultivated crops).

The detailed division of the system enables an application in particular geographical regions on national and moreover like suggested by the EU MAES working group on European scale (Haines-Young & Potschin, 2012).

The guideline designed for this report that aimed on specific areas in Leipzig can thus be based on the CICES classification.

The following chapter (2.2.) gives various definitions of ecosystem services and especially of cultural ecosystem services as well as a characterization of ecosystem disservices and emphasises difficulties in describing the terms.

## **2.2. Defining ecosystem services**

To execute good research the object of investigation has to be defined in a profound way. The problem of ecosystem services is their definition that is not consistent in scientific literature. An agreed-upon, meaningful definition of ESS is still missing even though many attempts for their classification are present (Fisher et al., 2009). The definition also depends on the purpose of investigation. Economic valuations of ESS have a different content-related focus than socio-cultural surveys for service preferences and therefore a different definition.

However, in the majority of cases ecosystem services are defined as benefits people obtain from ecosystems. This definition was proposed by the MEA in 2005. Ecosystem services can also be defined as benefits human populations derive, directly or indirectly, from ecosystem functions (Costanza et al., 1997). Other definitions include the living environment and describe ecosystem services as conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfil human life (Fisher et al., 2009).

ESS can be approached from different perspectives. Either from a natural scientific viewpoint with the ecosystem as a starting point focusing on natural habitats or from a social scientific position focusing on social phenomena like lifestyles in urban environments concluding that ecosystem services are a concept that links biodiversity with lifestyle (Lyytimäki et al., 2008).

Furthermore, a subdivision of ESS in smaller groups might be useful in some cases, for instance in intermediate services, final services and benefits. Both groups of services result from structure and processes of the ecosystem. Intermediate services like water regulation etc. can lead to final services like water production, storm protection or stream flow. Benefits result from these final services, e.g. drinking water, recreation, property protection or water for irrigation and will be to the advantage of human beings and contribute to their wellbeing. Final services in combination with other forms of capital provide benefits to human welfare (Fisher et al., 2009).

Depending on the purpose of research another differentiation in ecosystem functions, processes and services might assist. Here, ecosystem functions are the intermediates between ecosystem processes and services. These functions are therefore characterised as the ecosystem's capacity to provide goods and services for direct or indirect satisfaction of human needs (de Groot et al., 2010). The use of the provided services and goods can be valued in economic, ecological and other terms.

Besides anthropocentrically and ecologically oriented description of ESS also more economical approaches find their definition. The Economics of Ecosystems and Biodiversity defines the ecosystem service concept as 'flow of value to human societies as result of state and quantity of natural capital' (TEEB, 2010).

Economically derived definitions are required for economic accounting of natures' services. For these accounting final ecosystem services are supposed to be components of nature that are directly enjoyed, consumed, or used to yield human wellbeing and refer to end-products of nature. Components are intermediates of the production of these goods and unequal to processes or functions. At the same time, intermediates are not immune against double counting, i.e. clean water itself (i.e. provisioning service) additional to the natural filtration process (i.e. regulating service). The product is therefore counted as a final product and an intermediate at the same time. The given definition implies that ESS are isolated from non-ecological contribution to final products and a combination with any other inputs like capital or labour effects that the service will not be identified as ecological anymore. Thus, a concrete ecological set of elements is described in contrast to broader definitions (Boyd & Banzhaf, 2007).

Economic definition of services does not automatically lead away from biophysical studies but combine economics and biophysics. Thus, consistency between market accounting and ecosystem accounting can be reached (Boyd & Banzhaf, 2007).



Ecosystem services of different groups make various benefits available to humankind. Referring to the three main groups of the MEA, provisioning services provide benefits from final goods and their demand is described as demand of needed good per capita or space unit. For regulating services count that maintaining the desired environmental state provides benefits. It is related to the required amount of regulation to meet these conditions. Cultural ecosystem services that provide benefits by experiences result from interaction with the environment like the number of visitors the park (Wolff et al., 2015).

A special role is attached to these cultural services in this report. They are therefore defined separately below:

The MEA (2005) defined CES vaguely as ‘nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences’. This definition is being criticised because it does not clearly separate between the terms services, benefits and values (Milcu et al., 2013).

Cultural ecosystem services have a special role because of their intangibility, emotional and mental benefits and partly non-consumptive character (Milcu et al., 2013). CES have to be measured with non-monetary methods in order to fix their poor quantification and integrate them into ESS frameworks (Martín-López et al., 2012; Milcu et al., 2013; Szücs et al., 2015). Cultural values of a landscape or an ecosystem are important and worth protecting because they are unique, irreplaceable and have an increasing importance in economic societies (Guo et al., 2010; Szücs et al., 2015).

The interaction between humans and ecosystems is mandatory for the presence of CES because they evolve from human-ecosystem relationships. Cultural ecosystem services are contributions of ecosystems to non-material benefits like experiences or capabilities (Chan et al., 2012a).

More precise, cultural ecosystem services can be seen as the result of dynamic and complex relationships between ecosystems and human in landscapes over a long period of time and are not purely ecological phenomena (Plieninger et al., 2013b).

Even though CES can be traced back to the human dimension of ecosystems and landscape, they are used indirectly, e.g. through using nature as a meeting point or as an object of inspiration (Schaich et al., 2010). ESS and CES as a subgroup have something in common: various definitions exist in literature for CES but no common, agreed-upon definition has been found yet. Approaches that define their characteristics give them a shape.

Benefits resulting from cultural ecosystem services can be of physical, emotional or mental nature, have often a subtle or intuitive character and are expressed in indirect forms of appearance. The benefits of CES result from their non-consumptive direct use values (Milcu et al., 2013).

Evidently, researchers argue whether CES are used directly or indirectly. Another obstacle of identifying cultural values lies in the ESS framework that has a weak social pillar and the fact that a defensible framework for CES does not exist (Chan et al., 2012b).

To explain all relevant terms for this report, ecosystem disservices or environmental disservices are the topic of the following paragraph.

The approach of EDS is relatively new even though the idea that natural processes might harm human or cause nuisance is not (von Döhren & Haase, 2015). The term ecosystem disservices was firstly mentioned in 1998 and received rising attention according to the quantity of publications since 2009, mostly in studies about agriculture (e.g. nutrients run-off, erosion, etc.) or urban ecosystems (Lyytimäki & Sipilä, 2009; von Döhren & Haase, 2015).

A common definition is missing like it is the case for ESS and CES. The idea behind identifying and capturing of disservices is that nature does not only provide benefits but also disadvantages at the same or other places for ecosystem service users, so called disservices. Ambiguity among services might appear if one assesses a service as benefit while it is at the same time a disservice for someone else, i.e. pollination that is essential for reproduction but might cause allergies.

Positive relation or correlation between ecosystem services and disservices might be identified in various cases. For instance may a forest provide wild products that are enjoyed or used by humans but simultaneously initiate scariness by wild animals (Plieninger et al., 2013b).

Disservices might be caused by nature (nuisance, darkness, etc.), humans (e.g. through damage) or changes in ecosystems (e.g. invasive species). Perceived EDS may be related to an either high or lacking diversity in urban nature (Lyytimäki et al., 2008). The ecosystem disservice approach might be applied additionally to the ESS concept to capture disadvantages of nature or negative impacts of ecosystems towards human beings (von Döhren & Haase, 2015).

Ecosystem disservices emerged from human's negative perception of nature or the perception of disturbances. At the same time both, ecosystem degradation that is caused indirectly or directly by human activity and negative effects associated by undisturbed ecosystems are seen as EDS (Lyytimäki & Sipilä, 2009). For identifying EDS the origin of the disservices, either man-made or natural, is therefore not crucial but the fact that the function is perceived as negative for human wellbeing is.

Examples for disservices that occur in urban areas, so called urban ecosystem disservices (UEDS) (von Döhren & Haase, 2015), are damages to physical structures like decomposition of wood, roots breaking pavements, shade as cover for burglars, noise caused by frogs and birds, insecurity induced by dark forest or park, birds excrements that accelerate corrosion, animals as disease vectors, protected species that restrict other uses in certain area and so on (Lyytimäki & Sipilä, 2009; von Döhren & Haase, 2015).

Economic costs arise from these urban disservices either directly (e.g. by species control or removal of urban green) or indirectly (e.g. decrease in property value by nearby unmanaged or wild green areas, plant growth on road side that induce worse view and therefore accidents or health problems caused by pollination) (Lyytimäki & Sipilä, 2009). Indirect costs are, as it is the case for ESS, harder to measure than direct ones. Investigations on EDS were done by review on scientific papers, interviews and determination of their intensity so far.

The recognition of EDS in connection to ESS is weak even though a growing number of publications can be recorded. The contextualising of negative ecosystem effects as part of the structure and functions of ecosystems brings new incentives for assessment frameworks.

An effective framework for an approach that addresses socio-ecological means and is both, participatory and interdisciplinary, requires an equivalent handling of ESS and EDS (Lyytimäki & Sipilä, 2009; von Döhren & Haase, 2015).

The binding element of the concept of ecosystem services and disservices is the anthropocentric orientation. The concept itself and possible approaches for the assessment of either ecosystem services in general or CES in particular is the topic of the next chapter.

### **2.3. The ecosystem service concept**

This subchapter addresses general conditions for ESS assessment. The most common and innovative approaches for valuation are described, followed by approaches that might be used for cultural values because of their special role among the ecosystem service groups.

#### **2.3.1. *Conditions for assessment***

Overall, the theory used for this report is the concept of ecosystem services. This concept links ecosystem functions with human livelihood quality and justifies conservation of nature and a sensitive management of the environment (Ghazoul, 2007). Even though the concept as an instrument for land use planning and management has become more popular in recent years, the communication between scientific research and local actors and decision makers is still inadequate (ibid.).

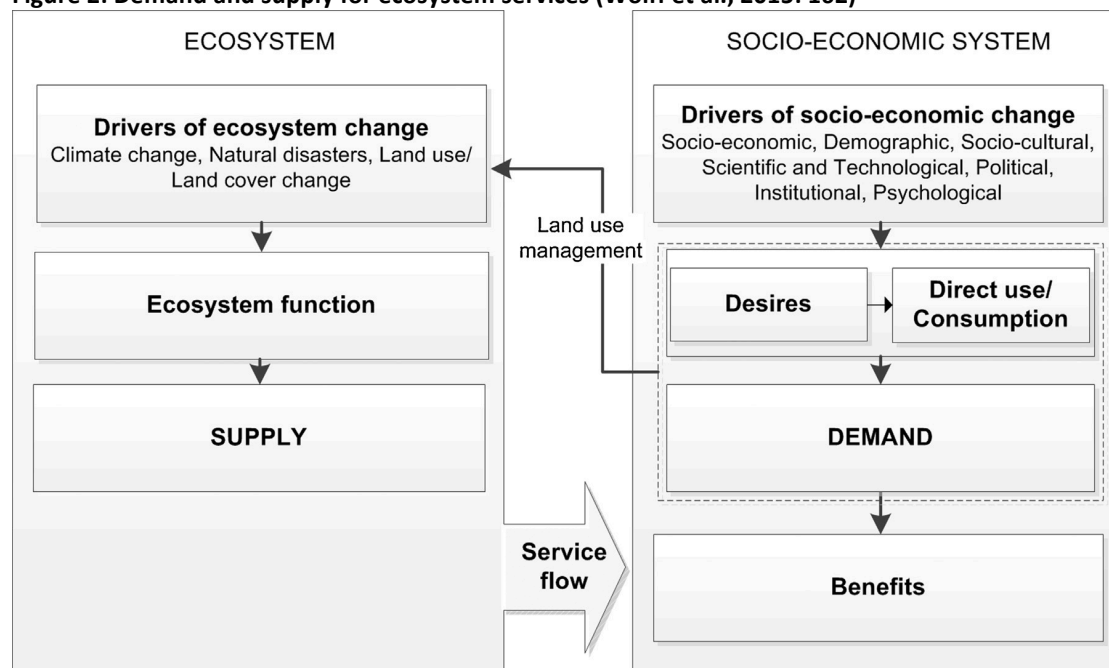
Various valuation methods for ESS exist. A range of them, selected by a high level of recognition or innovation, is described in this chapter. Assessment might have varying objectives like environmental protection or economic quantification and is promoted by different stakeholders. The quantity of existing assessment mechanisms is justified by different purposes of the valuation. Decisions concerning what to address and who to address need to be set in advance to reach reasonable assessment.

The relevance of ecosystems and their services can be expressed in different ways depending on the purpose of investigation. For ecological purposes the health status of the system or indicators like biodiversity might be useful. If socio-cultural means are focussed, peoples' relations to ESS or the importance they attach to cultural identity are of prime importance. Economic assessments could be based on the total economic value of ESS that sum use and non-use values, e.g. the amount of wood used plus the value of existence of the forest. Possibilities to translate economic or socio-economic values in monetary values within the scope of economic assessment are for instance market pricing, travel cost pricing for CES or avoided damage costs for regulating services (de Groot et al., 2010).

Besides the thematic focus the direction of assessment has to be determined. Most of the well established assessment methods capture the provision side of ESS in contrast to new approaches, i.e. participatory mapping, that identifies the demand for ESS. The change of mind from assessing stocks and distribution to mapping spatial differences represents a chance for increasing policy relevance of ESS values (Wolff et al., 2015). Furthermore, assessment of the demand by mapping or other methods of capture suggested in more recent studies is easier to apply and more practicable (ibid.).

As illustrated in figure 2, the existence of demand for ESS is caused by the socio-economic system and would not be present without it. Desire or direct use of resources and consumption by human beings (e.g. crop or fresh water) are triggers for ESS demand. Service supply is provided from the ecosystem side by ecosystem function.

**Figure 2: Demand and supply for ecosystem services (Wolff et al., 2015: 162)**



Humans benefit from service flow from ecosystems so that demand for services or environmental goods is at best satisfied. The graphic (see figure 2) shows the interrelation between the ecosystem and the socio-economic system that represents the dependency of human on nature (see also chapter 1).

Like the ESS concept is required for the elaboration of valuation frameworks, ecosystem service assessment needs classification schemes for the division of ESS in reasonable groups. Classification systems like MEA classification, the Common International Classification of Ecosystem Services (CICES) etc. are needed to group the existing services in main and subgroups in order to avoid double-counting, bias or wrong determination of services used. The starting point for assessment approaches that will be emphasised in the following chapter (see chapter 2.3.2.) is a preferably clear sorting of ESS in groups. Indeed, efforts have to be done to improve classification systems, especially in the field of cultural services, but the concept itself pioneers to better understanding of ecosystem service use and valuation.

Clarity about the belonging of a service to a certain group is not always given because of the different dimensions an ESS can have. Many ecosystem services have a non-material or intangible dimension that might be more important than the material benefit obtained from it. For instance fishery that provides food but is also a way of life that has its roots in ethical and spiritual developments and contributes to identity formation. The cultural dimension might be perceived as more important (Chan et al., 2012a).

The allocation of ESS to groups can change over time due to creation of environmental awareness or knowledge gain so that ecosystems and their services experience a revaluation. For example, a forest that originally had a provisioning function for human serve as carbon sink or for regulation of water resources as well (Wolff et al., 2015). Recent developments like climate change or depletion of resources might influence this reinterpretation.

Furthermore, valuation and assessment are always connected with choices that are made by the ESS user, thus human beings (Costanza, 2000). ESS valuation cannot be seen isolated from choices and decisions human make about the ecosystem. This leads to the concept of preferences that will be discussed below in detail (chapter 2.4.). Choices for one or another service always imply weighting between competing alternatives. The result is that one service will be valued higher than another one unless valuation can be avoided in the case of win-win situations (Costanza, 2000).

Assessment of ESS can have various purposes and address different goals by diverse means but is still mostly associated with monetary evaluation that contributes to economic accounting (Chan et al., 2012a). The tangibility and comparability of financial terms make this valuation method attractive in decision and policy making. Otherwise, the inclusions of a wider range of goals valued in other terms, i.e. sustainability in ecology or social justice, besides economic objectives might lead to comprehensive assessment addressing all concerns of sustainable development.

Participation of stakeholders or service users in ESS assessment might help to solve issues of ambiguity in valuation and raises the awareness towards nature's outputs and benefits leading to appreciation and, in turn, to protection and careful treatment (Costanza, 2000).

### 2.3.2. *Selection of ESS assessment approaches*

Approaches for ecosystem service assessment emerged because of the demand for an accounting system for natural capital in order to enable service valuation, mapping and policy making (Haines-Young & Potschin, 2012). ESS cannot be valued if they cannot be described or measured. Assessment approaches and valuation frameworks help to clarify a couple of concerns: identification of services, value assignment or support in environmental management policies (Martín-López et al., 2012).

In the following table approaches for ESS valuation established since 2001 are characterised briefly. The most known and two innovative approaches were selected. Information about the first emergence of the approach, the classification of ESS used, the method applied and the textual focus are listed (see table 2).

The table represents five approaches for ESS assessment and one platform (IPBES) that contributes to formation of consensus in the valuation debate. The ecosystem service mapping application and *Mappiness* are smartphone applications that require the users' participation. MEA, TEEB and MAES are assessments performed by working groups involving different stakeholders from different fields, from institutional to individual level.

The approaches address different scales. The TEEB or MEA operate on a worldwide scale in contrast to EU- or country-specific methodologies. The selection of methods used to assess ESS differs between the approaches chosen as well. ESS values are analysed by economic terms (e.g. willingness to pay for a service), subjective estimation of importance of a service, by identification of drivers of change, etc.

The same division of services in provision, regulation, supporting and cultural is used by the MEA and TEEB. The MAES and the ESM-application apply the Common International Classification System (CICES) that distinguishes between provision, regulation/maintenance and cultural ecosystem services.

The objectives vary among the mechanisms mentioned. The Millennium Ecosystem Assessment and the smartphone apps focus ecosystems' contributions to human wellbeing. The TEEB, IPBES and MAES make changes of ecosystems, biodiversity and environmental degradation a subject of discussion.

**Table 2: Approaches for the assessment of ecosystem services**

Approach	Year	ESS groups	Method	Content reference
MEA (Millennium Ecosystem Assessment)	2001-2005	<b>Provisioning</b> (food, fresh water, wood, fibre, etc.) <b>Supporting</b> (nutrient cycle, soil formation, etc.) <b>Regulating</b> (climate & flood regulation, water purification, etc.) <b>Cultural</b> (aesthetic, spiritual, educational, recreational values, etc.)	Analysis of direct and indirect drivers of change, scenario development (worldwide)	Contribution of ESS to human wellbeing, ecosystem changes (past and future)
TEEB (The Economics of Ecosystems and Biodiversity)	2008	<b>Provisioning</b> (wild foods, crops, fresh water, etc.) <b>Supporting</b> (soil formation, nutrient cycle, photosynthesis, etc.) <b>Regulating</b> (climate regulation, filtration of pollutants, pollination, etc.) <b>Cultural</b> (recreation, spiritual and aesthetic values, education, etc.)	Economic concepts and tools, incorporate natures' values in decision making by recognizing, demonstrating and (if possible) capturing values, i.e. WTP or monetary quantification (worldwide)	Biodiversity loss, ecosystem degradation, maintenance of natural capital and thereby provided ESS
MAES (Mapping and Assessment of Ecosystems and their services)	2008	<b>Provisioning</b> (nutrition, material, energy) <b>Regulation &amp; Maintenance</b> (mediation of flows & waste, maintenance of biological conditions, etc.) <b>Cultural</b> (physical, intellectual, spiritual and other interaction with biota)	Assessment and mapping of ecosystems and ESS (EU-wide)	Interaction ecosystem-socioeconomic system, ESS that create drivers of change to ecosystem due to benefits, values and socio-economic response
IPBES (Intergovernmental platform on biodiversity and ecosystem services)	2012	(None)	Assessing and reviewing scientific information, formation of consensus (worldwide)	Research on biodiversity and ecosystem services
ESM-App (Ecosystem service mapping application)	(under development)	<b>Provisioning</b> (nutrition, material, energy) <b>Regulation &amp; Maintenance</b> (mediation of flows & waste, maintenance of biological conditions etc.) <b>Cultural</b> (physical, intellectual, spiritual and other interaction with biota)	Mapping of user's location via GPS, time, ecosystem or land-use type and ESS used	Importance of ESS in different ecosystems and land-use types
<i>Mappiness</i>	2010	(None)	Mapping of user's location via GPS and capturing of users' well-being (UK)	Human wellbeing and environmental setting

Following, the approaches introduced in the table (see table 2) are described more detailed.

### MEA

The Millennium Ecosystem Assessment detected changes in ecosystems worldwide between 2001 and 2005 and investigated consequences for human wellbeing 50 years before and after present times. Under the auspices of the UN representatives of international institutions, governments, business, nongovernmental organisations and locals build the board of stakeholders participating in the assessment (MEA, 2005).

In fact, the MEA deals with the connection between environment and humanity. Nature provides services that are used by humans in terms of benefits. In turn, human action influences and changes ecosystems and hence, the provision of ESS. The framework of the MEA is applied to document and analyse the consequences of environmental change for ecosystems and human wellbeing and allow a better understanding of the subject (Carpenter et al., 2009).

The four working groups involved in the assessment deal with conditions and trends, responses of ecosystems, scenario development and sub-global assessment always under consideration of the intensity of linkages between ESS and human wellbeing and its determination (MEA, 2005).

The recognition that ESS degradation often involves impairment to wellbeing and the extent of ecosystem's degradation of approximately 60% causes the establishment of approaches like MEA. Not just degradation but also unsustainable use of resources, e.g. fish stocks, air or water, is considered by the mechanism. In the background of attempts to increase the providing functions of an ESS, another one is often degraded due to imbalanced use or extraction. A change or increase in use of one service might result in net gain for wellbeing or economy but induce at the same time growing expenses in the shape of degraded services or systems that might lead to poverty or social conflicts. To identify and analyse ESS and changes the MEA determines for the three categories (except supporting services) the associated subservices, status (either growth, decline or both) and adds relevant notes. Furthermore, the human use, whether rising or declining, is recorded (MEA, 2005).

Four plausible scenarios referring to the future of ESS and HWB are developed under the assumption that either increasing globalisation or increasing regionalisation will take place and managing ecosystems and its services will be either proactive or reactive. The scenario *Global Orchestration* is a reactive approach to poverty and problems of ecosystem, focusing on global trade and high economic growth. The second reactive scenario *From order to strength* focuses on regional markets and is characterised by low economic growth. The world's development towards a regionalised, fragmented world is assumed. Proactive scenarios concentrate on long-term maintenance of ESS like *Adapting mosaic* where local institutions and local



ecosystem management strategies are strengthened going along with an initially low economic growth. In contrast, the scenario *TechnoGarden* stands for relatively high economic growth and highly managed ecosystems. According to this set-up the world will develop towards a globally connected world relying strongly on environmental techniques (MEA, 2005).

The Millennium Assessment assume that supply and resilience of ESS are affected by changes in biodiversity. Meeting the increasing demand for services while reversing the degradation occurred requires changes in policy, institutions and treatment (MEA, 2005).

### TEEB

The Economics of Ecosystems and Biodiversity (TEEB) is one common approach for ESS valuation, using the MEA classification that captures, identifies and measures services in monetary and other terms in order to avoid further degradation of ecosystems (Sukhdev et al., 2014). The international initiative emphasises the global economic benefit of biodiversity to stress growing costs of ecosystem degradation and biodiversity loss. Practical actions to these issues are worked out by proficiency from science, economics and policy (Ring et al., 2010).

The TEEB emerged among others as a follow-up activity of the MEA, also in the background of increasing interest in linking ecosystem services to human wellbeing (de Groot et al., 2010). This explains why the categorisation of ESS is the same for MEA and TEEB. Different to the MEA, human wellbeing and the dynamics of the socio-ecological systems are considered, which demands for further research on the topic (Ring et al., 2010).

Ecosystem service flows are seen as the gain society receives from natural capital. Human wellbeing can be ensured due to maintenance of natural capital. Therefore the sustained provision of future flows of ESS is crucial under changing conditions or in the case of ecosystem degradation. Biodiversity and ESS are linked to ecosystem's resilience in this conception and are seen as a continuous system (TEEB, 2010).

In 2008 the general project framework that reached widespread attention was presented in the TEEB Interim Report. End-user reports generated in two years thereafter with regard to topics and challenges were meant to support national and international policy makers, businesses and citizens. The reason for the decline of ESS lies according to the TEEB in the disregard in economic decision making. The underlying economic model allows resource extraction or service use without fixed limits, consumption without consciousness about consequences and production without restrictions to external costs (Ring et al., 2010).

In the valuation method of the TEEB a major distinction is made between tangible values like food or fibre, and intangible values like cultural services. For instance, the amount of food as a provisioning service might be easier to quantify economically than cultural, intangible values that need other adjusted quantification strategies

like willingness-to-pay (WTP) for ESS or travel cost analysis. Additionally, it is differentiated in direct use values, non-use values and indirect values. Direct use values are goods that can be directly consumed and priced in markets, e.g. water or crops. Non-use values influence decisions made about ESS and human action but are difficult to value in monetary terms. Spiritual importance of a landscape, values of existence or inspiration from nature belong to these values. Mainly regulating services count as indirect use values that represent a main part of the TEV but remain unnoticed in daily accounting of ESS users. Services like water purification, flood protection or climate regulation are increasingly but just recently assigned in monetary terms (TEEB, 2010).

The TEEB framework consists of a sequence with a maximum of three steps for the analysis of the ESS value. First of all, the value has to be recognised. Recognising a value might be enough in order to reach maintenance or guarantee future service provision if consensus about the value is present. For instance, law justifies the protection of a national park and therefore service provision in that area is secured so that following steps of value identification can be left out. If necessary, the second step of demonstrating the value is applied. The consequences of changes resulting from alternative management options are demonstrated by calculating costs and benefits that will arise. Rather the effects of change than the TEV of the system are measured. This step might contribute to a more efficient use and identification of ecosystem's resilience in order to avoid tipping points followed by irreversible destruction. The third and last step would be capturing the value by the help of mechanisms to cooperate values in decision making due to incentives or pricing. A demonstration of a service in monetary terms is easy if the cultural consensus about the ESS is strong and the science behind it is clear. In case of ambiguity, plurality of convictions towards a service or participation of multiple ESS a plain recognition is more appropriate. Instruments of the capture are payments for ESS or the introduction of tax breaks for preservation. The creation of markets for sustainable products and for ESS are aspired (TEEB, 2010).

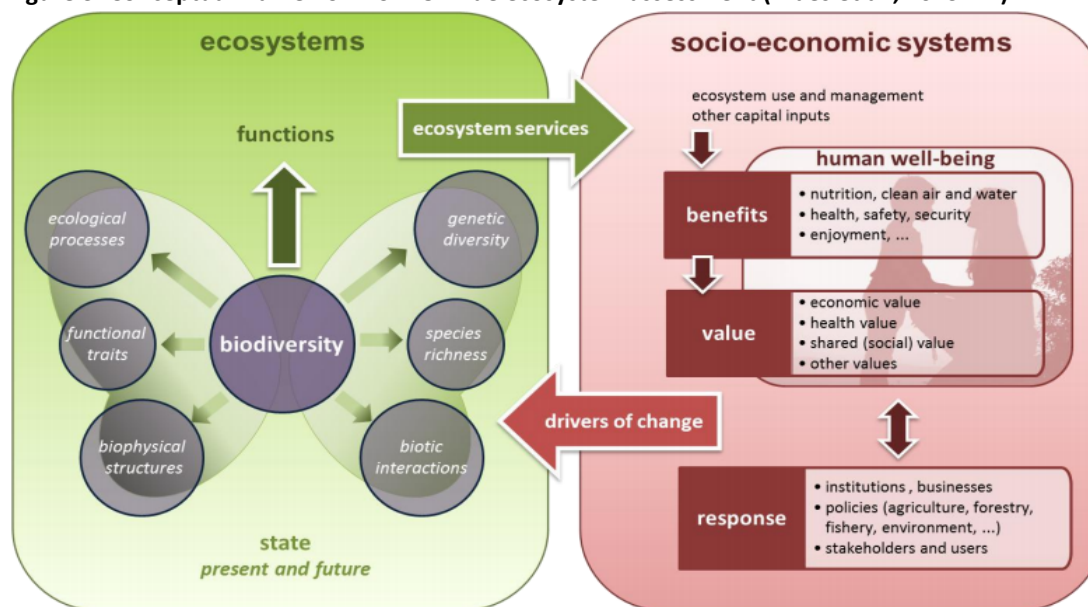
The overall aim of the TEEB is to create and provide a basis of knowledge for evaluation of natural capital and ESS flows. Complex matters should be addressed due to economic assessment (Ring et al., 2010).

### MAES

The third approach mentioned is the Mapping and Assessment of Ecosystems and their services (MAES) that is part of the EU biodiversity strategy 2020. More specific, it is designed to map and assess the state of ecosystems and their services in the EU member states on national level supported by the European commission. The approach promotes the CICES classification and serves for assistance in decision-making in policy and belongings of urban sustainability, sustainable development of natures' resources and climate regulation (Maes et al., 2015).

The conceptual framework presents the clear interrelation between ecosystems and the socio-economic systems and responses from one to another. Biodiversity, ecosystem conditions and services are therefore linked to human wellbeing like illustrated below (see figure 3).

**Figure 3: Conceptual framework for EU-wide ecosystem assessment (Maes et al., 2013: 17)**



Thus, wellbeing depends significantly but not exclusively on ecosystem services. Human wellbeing consists according to the MAES framework of benefits obtained from ESS and the contributed value to the socio-economic system and society. Responses to these benefits come from different levels, i.e. from an institutional to the individual dimension. Drivers of change emanate from the socio-economic system. The main goal of the MAES in line with the MEA is the provision of a critical evaluation framework based on the best possible information to enable decisions on complex issues in society (Maes et al., 2015). Overall, the work done by the EU and the member states add to the assessment of economic values of ESS. Visualisation by mapping identifies problems spatially explicit and can be used as a descriptive communication tool. Among others changes in land cover, supply and use of ESS, trends in agricultural production or afforestation can be presented graphically for a certain period of time (Maes et al., 2013).

### IPBES

In 2012 the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) was founded, modelled after the International Panel for Climate Change (IPCC) but with regard to different topics. The assessment mechanism was meant to follow the work of the MEA (MEA, 2005). The underlying idea of the platform is the provision of a knowledge basis by reviewing and assessing most recent scientific reports on global scale. Information that contribute to the concerns of

environmental change and its connection to policy-relevant issues are compiled under the auspices of the United Nations Environment Program (Beck, 2014).

The IPBES emerged due to insufficient reaction and response of the society to degradation and disturbance of biodiversity and the demand for a comprehensive overview of global and regional trends in biodiversity and associated ESS. The identification of reasons for past changes and predictions of future changes in ecosystems is intended to support decision making. The chance of this mechanism is to involve many different stakeholders and to mediate between scientists, policy makers and others. The disconnection between science and policy can be repealed by globally acting. Enduring organisations like IPBES are striving towards this aim (Beck, 2014; Larigauderie & Mooney, 2010). Furthermore, not exclusively scientific but also knowledge and task force of the persons affected and locals might be incorporated in the platform's base in order to find other solutions to complex biodiversity loss besides economic valuation (Beck, 2014).

The working steps of the panel are the generation of knowledge, the identification of priorities and finally, enabling a dialogue. The aim is to create a basis for assessment including the relevant science in a transparent process of negotiations by involvement of a wide variety of stakeholders in combination with a multidisciplinary expert approach (Beck, 2014; Larigauderie & Mooney, 2010). Biodiversity and ESS are under influence of global and local changes in form of degradation, climatic modifications and others. Improved prognoses towards changes and environmental impacts belong to the IPBES' set of goals (Larigauderie et al., 2012).

In the scientific and policy community the focus on ESS has been adopted extensively. This is why new beneficial approaches for research, protection or maintenance and development emerge continuously (Carpenter et al., 2009).

Several new approaches work in the way of participatory assessment of environmental settings and mapping of the current location by technical devices from which two selected examples are described in the following. Mostly the user of the app, therefore the owner of the technical device (e.g. smartphone or pad) is used as a sensor in this approach.

#### ESM-App

One of these apps is the ESM-App (Ecosystem service mapping application) developed by the *Helmholtz Centre for Environmental Research* and the University of Kassel that is currently under development. The user maps the ESS he/she uses and selects the ecosystem or land-use type of the current location. Data of location by GPS and also of time is captured and displayed on a map after data input. The records of the ESM-App provide planning research, policy makers, educational institutions and interested audience with insights in spatial distribution of ESS. A large scale data input and data density gives information about importance and use of ESS for specific locations (Priess et al., 2014).

### Mappiness

Another smartphone application called *Mappiness* records the relation between environmental conditions or elements and the feeling of users at this location to investigate a relationship between both. The involvement of the user results in data about human wellbeing influenced by nature's services and disservices. The application, designed for Apple devices, was used to collect data from the United Kingdom so far. Variables recorded are the actual position of the participant (i.e. inside, outside or in vehicle), the type of the land cover and the weather outside (including temperature, wind speed, rainy or sunny). Furthermore, the current activity is received whereof mainly CES, e.g. walking, hiking, gardening, bird watching, sports, are available to choose. The participant states with whom he/she is with (i.e. family, partner, workmates, nobody) and if he/she is at home, working or elsewhere. The happiness level as contribution to wellbeing from zero (not at all) to one hundred (extremely happy) is recorded subjectively (MacKerron & Mourato, 2013). The application *Mappiness* contributes mainly to the investigation of relations between CES and human wellbeing. Furthermore, information is given about where people are the happiest with regard to their location in the environment. It should be considered that these statements could not be seen isolated from the company the participants have or for what purpose they are where they are.

Participatory approaches with valuation by and involving of stakeholders in the sense of citizen-science as a new approach was conducted in this report through guided interviews.

The priority position of market-based assessment mechanisms in ESS valuation frameworks has been justified indirectly by their restricted application to tangible provisioning, regulating and supporting services. This implies the assumption that cultural ecosystem services will most likely never be captured adequately by monetary or market terms (Chan et al., 2012a). Even though ESS assessment tools operate in many cases and on large spatial scales the intangible value dimension of ecosystems including CES is still incorporated insufficiently. The awareness of the importance of these cultural services and benefits is present but incorporation in common assessment mechanisms is not (Chan et al., 2012a; MEA, 2005).

#### *2.3.3. Special case of assessing cultural values*

Recent research on ecosystem service assessment focus mainly on biophysical or economic and monetary valuation but socio-cultural assessment that requires alternative approaches remains mostly unnoticed or stays absent from efforts of ESS characterisation (Plieninger et al., 2013b; van Berkel & Verburg, 2014). Assessment mechanisms that capture invisible or intangible value of a landscape are necessary for the integration of cultural values in ESS frameworks. As a foregoing condition to

assessment, cultural ecosystem services and preferences need to be identified (Chan et al., 2012b).

Conventional economic approaches that work with monetary valuation are not applicable for the majority of cultural services. For the integration of CES in ecosystem service frameworks other mechanisms need to be incorporated to enable a balanced valuation among all groups of ecosystem services (Szücs et al., 2015).

An approach to fill knowledge gaps for CES is the connection of ecosystem service research with cultural landscape research including human geography, landscape ecology and spatial planning to investigate non-material landscape values (Schaich et al., 2010). A uniform indicator-based list for the identification of CES is not developed so far but would contribute to clear identification (de Groot et al., 2010). A first attempt to divide CES in subservices was done by the MEA (2005) resulting in ten smaller clusters: cultural diversity, spiritual and religious values, knowledge systems, educational values, inspiration, aesthetic values, social relations, sense of place, cultural heritage as well as recreation, and ecotourism.

The value related to CES and its contribution to wellbeing depends on individual perception and is therefore of subjective character what makes people's involvement indispensable (Milcu et al., 2013). For questionnaire- or survey-based assessment of CES a high quantity of participants is necessary to obtain representative statistical results and to be protected against outliers in the analysis.

Research on consistent quantitative and qualitative valuation methods of CES is demanded. Several studies on cultural ecosystem services suggested participatory mapping approaches for CES assessment, i.e. by Plieninger et al. (2013b), which use the human as a sensor for cultural service valuation.

Plieninger et al. (2013b) performed spatially explicit participatory mapping in a study that combined mapping and structured interviews on CES and several disservices. The results were analysed statistically and with GIS-based techniques. The application of CES mapping assessment including local populations' perception in protection and management of cultural landscapes creates a basis for the development of sustainable land management (Plieninger et al., 2013a).

If cultural values associated with ecosystems would be systematically considered benefits for many kinds of initiatives, including spatial planning, ecosystem-based management, integrated conservation and development schemes, and payments for ESS would result from it (Chan et al., 2012a)

Mapping tools, i.e. the identification of inventories by mapping of cultural ecosystem services represent a chance in CES assessment. Trade-offs with regard to other ESS can be detected (Szücs et al., 2015).

A limited set of cultural values can be reflected by economic indication and measured in market terms to a large extent, like recreation or ecotourism, due to willingness to pay for ESS or travel cost pricing (Milcu et al., 2013).

There is no doubt about the value of cultural benefits that nature provides to people but their measurement remains difficult (Chan et al., 2012a). The involvement of stakeholders by participatory mapping presents a practicable solution to difficulties in CES capturing. By mapping, prioritised areas for service delivery can be identified which is of importance in conservation management or in policy-making. In contrast to regulating or provisioning services that can be measured based on biophysical data, cultural services demand for more heterogeneity in valuation. Due to the understanding of spatial determinants the measurement, e.g. of spiritual determinants, cultural identity or heritage, can be more explicit but monetary valuations is still a challenge and can just be approached by mapping and user's participation (van Berkel & Verburg, 2014).

#### **2.4. Preferences for ecosystem services**

As already emphasised above, personal preferences are the basis for ecosystem service assessment (Costanza, 2000). For the practical part of the report the theory of ESS preferences was used. The hypotheses that were tested by the data obtained are based on the concept of preferences.

Differences in use or of preferences for ecosystem services appear among age, gender, place of residence, education level, etc. of respondents. Several studies brought the evidence for this assumption through questionnaire-based investigations (e.g. Martín-López et al. (2012), Bieling et al. (2014), etc.). Martín-López et al. (2012) conducted a study in Spain and point out that provisioning services are mostly acknowledged in rural areas and by elderly people while younger people in urban environments more likely perceive regulating services. Furthermore, male respondents pay more attention to provisioning services than females that attach more value to regulating services. Overall, cultural ecosystem services are assumed to be more important or more frequently mentioned in urban ecosystems (Martín-López et al., 2012).

Also regarding the use of cultural services variations between urban and rural landscapes occur. City dwellers perceive natures' aesthetics, tourisms in nature, environmental education and biodiversity's value of existence as more important than residents of rural areas. Rural residents value recreational hunting and local ecological knowledge higher (Martín-López et al., 2012).

Furthermore, the perception of ecosystem disservices varies depending on the age of the addressed person. Teenagers will perceive different disservices, but also ESS, because their radius of movement is normally higher compared to the radius of older people that are more restricted to the surrounded or close environment (Lyytimäki & Sipilä, 2009). Demographic change and aging of the population in many industrialised countries will lead to altered perceptions towards services.

Socio-cultural preferences involve individual perception, knowledge and the value ascribed. Demographic or socio-cultural factors affect social preferences towards

ecosystem services. A study in Spain with nearly 4,400 questionnaires in eight different study areas showed that the most frequently recognised ESS among all participants is the regulating service air purification. The awareness of nature's capacity of service delivery or provision is recognised by almost all respondents (Martín-López et al., 2012).

A participatory mapping study on cultural ecosystem services by Plieninger et al. (2013b) conducted in a cultural landscape in Eastern Germany show that aesthetic values, social relations and educational values are the most important services for respondents. Bundles of services and patterns of perception of these bundles based on different socio-economic backgrounds were identifiable as well as CES provision patterns with respect to intensity, richness and diversity.

Changes in demand or preferences for ESS may have influence on many factors, e.g. adaption in lifestyle, pressure on natural resources, increasing wealth or wellbeing, negative consequences for land management etc. (Wolff et al., 2015). For instance, a novel societal demand for cultural ecosystem services, i.e. leisure, protection of cultural heritage and features of cultural identity can be recorded (Plieninger et al., 2013a; Wolff et al., 2015).

Within the scope of a questionnaire-based study on social preferences regarding the delivery of ecosystems in a semiarid region in Spain it was found out that the majority of the respondents recognised ecosystem service' importance to wellbeing and were willing to conserve these services. The most frequently mentioned services were regulating services like maintenance of water and air quality that prove the respondents' understanding of the relation between conservation of ESS and local wellbeing (Castro et al., 2011).

The field of ESS preferences is relatively new in research. Wolff et al. (2015) identified 31 studies that mapped the demand for ecosystem services. Most studies focused on Europe or had a wider geographical range when cultural ecosystem services were focused. The demand for regulating services was mapped, especially for flood protection, pollination, erosion control and carbon sequestration. Regarding provisioning services the demand for food, energy and water was emphasised. Studies that took CES into account focussed either on recreation or ecotourism. Just two reports mapped more intangible values like identity, spiritual meaning or cultural heritage (Wolff et al., 2015).

Social preferences determine the demand for ecosystem services and thus, the shape of nature. An increased use of one service might imply consequences or decline of another. Conflicts between groups of stakeholder or ESS users might emerge because preferences evolve individually and the purpose of use might vary. The next chapter follows up on the interrelation between human beings and nature in the context of human wellbeing and welfare.



## 2.5. Ecosystem's contribution to human wellbeing and welfare

Human wellbeing arises from adequate access to the basic materials for a good life that is needed to sustain freedom of choice and action, health, good social relations and security (Haines-Young & Potschin, 2012). The MEA use the same five components to characterise human wellbeing (Jax & Heink, 2015).

In recent literature the terms human wellbeing and welfare are often used interchangeable or their distinction remains unclear.

Bieling et al. (2014) use human wellbeing, quality of life and welfare synonymously and define it as a matter that is 'typically addressed through focusing on issues such as economic resources, health and education, whereas linkages to our natural surroundings are rarely considered'.

Human wellbeing can be measured in terms of the extend to which people lead a healthy and happy life while welfare, defined as state welfare, is seen as the institutional arrangements made for unemployed, sick or elderly people (Veenhoven, 2000).

Thus, welfare addresses economic and financial matters and safeguards a basic stock of human essentials but does not give information about human wellbeing. If the basic needs are satisfied (e.g. food, housing, social issues), a good level of human wellbeing influenced by additional factors (environmental setting, equity etc.) can be reached. Human wellbeing refers to the overall condition and happiness and is therefore, compared to welfare, a more subjective factor and additionally depended on the different scale of peoples' perception. That means that human wellbeing goes beyond economic wealth and includes other factors like health or social relations that are ignored by welfare (Jax & Heink, 2015).

In the debate on ecosystem services, cultural services and possible assessment mechanisms, it has to be mentioned that ESS are strongly interlinked with human wellbeing. Ecosystem services are either of positive (i.e. provision of benefits) or negative nature (i.e. reason for disturbance). They contribute, besides to wellbeing, also notably to economic activities and global employment by creation of labour force in the food sector and reverse to loss of capital in case of ecosystem degradation (MEA, 2005).

The ecosystem service concept has been widely exploited to identify the numerous benefits of biodiversity to human welfare, i.e. their relation to health, economy, landscape or agriculture (Lyytimäki et al., 2008).

Linking the functioning of ecosystems to human welfare and understanding this relation is important for decision making and for environmental policy (Fisher et al., 2009). Maintenance and protection of environment's ability to provide services is of vital importance.

In 2005 the first widely recognised attempt to assess how nature contributes to human wellbeing was done by the MEA with the assumption that wellbeing depends

on ecosystem services (Bieling et al., 2014; Wu, 2013). In recent literature HWB is seen as the key element of ESS assessment and described as the main component of the ESS concept. Also the MEA put the ESS-HWB relationship at the core of their framework (Jax & Heink, 2015). Ecosystem service assessments have an anthropocentric focus, which explains their close relation to wellbeing or welfare concerns.

The reasons for the relation of experiencing natural environments and human health, wellbeing and happiness are evolutionary or result from physical exercise, recreation or social interaction. Furthermore, natural environments are supposed to have less bad characteristics than urban environments (MacKerron & Mourato, 2013). Even though this interrelation is clear it is still difficult to assess the biophysical features of nature towards wellbeing (Bieling et al., 2014). It is acknowledged in the scientific community that ecosystem services are ecosystems' contributions to wellbeing but the concept of wellbeing, especially the social component, is elaborated unsatisfactorily and remains imprecise (Wu, 2013). The Commission on the Measurement of Economic Performance and Social Progress (CMEPSP) proposes a multidimensional definition for human wellbeing with eight key components that should be taken simultaneously into account (Stiglitz et al., 2009):

- Material living standards (i.e. income, consumption and wealth)
- Health
- Education
- Personal activity including work
- Political voice and governance
- Social connections and relationships
- Environment (in present and future condition)
- Insecurity (economic or of physical nature)

While some factors can be measured easily, others need sensitive assessment methods in order to address both, the objective and the subjective dimension of human wellbeing that are both essential (Wu, 2013).

The state of wellbeing depends on the accumulated ecosystem output of goods and benefits. That means that the provision of benefits and goods enables a change in the status of human wellbeing (Haines-Young & Potschin, 2012). Thereby the relationship between ESS and wellbeing is not linear. An increase of a service that is available in large quantity relatively to the demand would just slightly increase wellbeing in contrast to a scarce ESS where a small decrease can significantly reduce HWB (MEA, 2005).

The MEA found out that 15 of the 24 investigated ecosystems were declining and created the connection to human welfare. The decline is supposed to have a large

and negative impact on future human welfare and therefore also on wellbeing (Fisher et al., 2009).

Ecosystem services therefore contribute in contrast to cultural services to both, welfare and human wellbeing. Following, the contribution of CES to human wellbeing is illustrated.

Cultural ecosystem services play a special role in their connection and contribution to human wellbeing. They are on the one hand generally less directly linked to human wellbeing than provisioning or regulating services. On the other hand, their potential for replacement is low (Plieninger et al., 2013b). While degraded provision or regulating services can be replaced by other means, e.g. bottled water as a replacement for a contaminated spring, cultural ecosystem services have less possibilities for a substitution (Bieling et al., 2014; Plieninger et al., 2013b). A carefully handling of cultural service resources is implied by the difficulty of replacement.

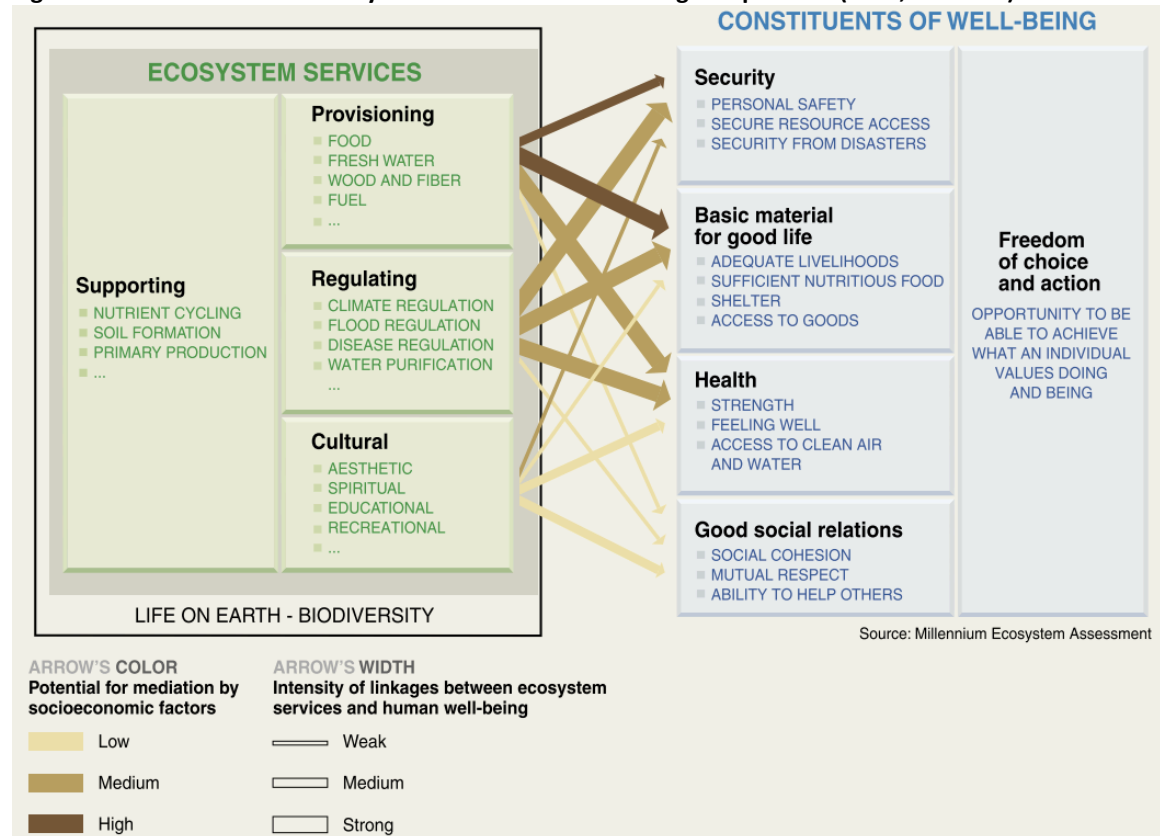
With regard to increasing economic development of a country it can be emphasised that the dependency on provisioning and regulating services will decrease while dependency on cultural services increases (Guo et al., 2010). That is why industrialised regions record a higher demand for CES than developing ones. Provisioning services contribute widely to provision of basic material for life. Regulating services ensure, among others, climate regulation or airflow (Bieling et al., 2014). These services have a significant direct influence on the survival of the population. Cultural services have a less direct linkage to wellbeing compared to the other service groups, which is justified by their distinctive character and different kind of contribution to wellbeing, e.g. by identity formation, compensation to daily life through recreation or spiritual self-realization.

In the background of increasing urbanisation in industrialised countries cultural ecosystem services gain once more importance. Recreation in urban nature, balance to everyday life through natural environments, demand for green areas, etc. have a great importance for city dwellers.

CES add to subjective wellbeing, especially to the social components of ESS and happiness and is therefore indirectly represented. The following image (see figure 4) shows the differences in intensity of relationships and the potential for replacements of ESS by socioeconomic means.

According to figure 4, provisioning services are strongly linked to material provision and health but also easy or by medium expenses replaceable. The potential for mediation of regulating services with regard to security, basic material and health has an intermediate level but a strong linkage to these factors. Cultural services show, as described above, less intensive relations to security, material provision and health but at the same time low potential for compensation or replacement.

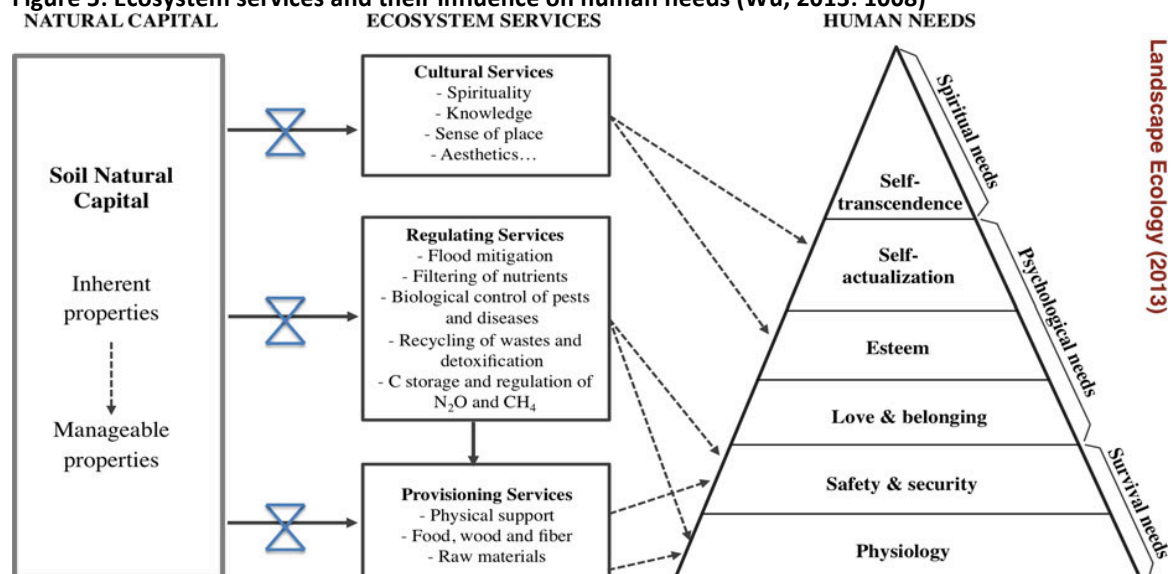
Figure 4: Relation between ecosystem services and wellbeing components (MEA, 2005: 50)



What is noticeable is the connection to social relation, which is stronger than for regulation or provision.

The figure below (figure 5) illustrates the connectedness with ecosystem service to human needs from satisfaction of basic physiological essentials to spiritual wants.

Figure 5: Ecosystem services and their influence on human needs (Wu, 2013: 1008)



It is illustrated that provisioning and regulating services are indispensable for human's survival.

Psychological and spiritual needs, which can be satisfied by cultural service provision, are not essential for survival but represent basic components of human wellbeing and happiness. These needs are addressed if the basis for existence is secured. The explanations for the less direct linkage of CES to wellbeing lies in the order of how needs are satisfied (see pyramid of figure 5).

In the following, the applied methodology and methods are explained (see chapter 3).

### 3. Methodology

The research was conducted in different areas of the city of Leipzig (Germany). 66 short face-to-face Interviews were carried out in August and September of 2015 in order to find out what ecosystem services and especially cultural services people use in the moment or prefer generally in urban and more rural areas of the city. Data regarding the respondent's perception of nature and ecosystem disservices, frequency of visit and distance covered for ESS use was recorded. The analysis was done with SPSS in a descriptive statistics part and by correlations applied to the answers respondents gave.

#### 3.1. The study areas

The data collection for the practical part of the research was conducted in three areas of the city to reach variety of answers of respondents and to enable comparability in order to find similarities and differences between the locations. In Appendix 2 a map illustrates the locations of the research in Leipzig. One area of investigation was the *Clara-Zetkin-Park*, which is close to the city centre. The park is part of the alluvial forest that stretches arch-shaped from north to south within the city limits. To conduct the interviews a well-attended place in the park was chosen which is called *Sachsenbrücke* (Anton-Bruckner-Allee 50). The bridge separates the southern and western part of the city through the river *Weißer Elster* and represents a way for traffic (mainly for bikes and pedestrians) and a place for recreation.

Furthermore, two public garden associations were selected that still belong to the city of Leipzig but are situated on the outskirts and have a more rural, suburban character. Public garden associations (German: Kleingartenvereine) are areas of garden plots that are governed by an association that let plots for little price to interested parties. A fence surrounds each of the plots. The main ways are accessible for visitors. One of the selected associations was *Naturfreunde e.V.* in Liebertwolkwitz (Störmthaler Str. 60) that aggregates 120 gardens with an average size of 400 m<sup>2</sup> on a total area of 60,000 m<sup>2</sup> in the south of the city. The second association was *Sommerland Lausen e.V.* (Zschochersche Allee 76) Lausen-Grünau situated in the southwest. It includes a total area of 17,000 m<sup>2</sup> and 35 gardens with an average size of 470 m<sup>2</sup> (retrieved from <http://www.kleingarten-leipzig.de/> on 07.10.2015).

#### 3.2. Data collection method

The data collection was performed via short face-to-face interviews, guided by the interviewer (author) in German language. The interviews were conducted between mid-August and mid-September in 2015. In total, 66 interviews were conducted in the three mentioned areas. Respondents in the park and the gardens were chosen

randomly to obtain a representative group of different people among different age groups, gender and education. The interviews were carried out under good weather conditions when it was sunny and warm outside and people were tempted to spend their spare time outside.

The interviewing in urban and more rural areas enabled comparisons between the locations. Additionally, in order to work out differences between working days and weekends one half of interviews in *Naturfreunde e.V.* was conducted on a Monday, the other half on a Saturday.

The underlying concept of this data collection was to get the information directly from the user through using the human as a sensor. The data obtained is subjective but with an appropriate quantity it is usable for analysis.

### 3.2.1. *Design of the interview guideline*

The focus laid on the perception of nature, ecosystem services and cultural ecosystem services. The aim was to measure the importance that people attach to ESS by ranking questions and an open question to the current service use. It was asked for reasons of possible disturbance to find out if nature causes disservices besides service provision. Demographic data of the respondents was included in order to reveal preferences for ESS in connection to the respondents' background with regard to age, education level and gender (see Appendix 1: Interview guideline). The interview guideline that presents the basis of the quantitative research was designed with help of knowledge obtained from literature and own ideas leading to fulfil the objectives mentioned in chapter 1.2. In the header of the guideline the interview number, date, time of the day and the location of survey was captured for a clear allocation at a later time. It included six quantitative questions regarding perception of surrounded nature, distance covered to reach the location, frequency of visit, ESS use and presence of disservices additionally to three questions concerning age of birth, education level and gender. Two tables were given to the respondents to evaluate first, the importance they attach to ecosystem services in general and second, to cultural ecosystem services in general (see table 3 & 4). The grouping of services made was based on the CICES (version 4.3).

**Table 3: Ranking of ecosystem services**

Ecosystem services	Value
Provision (vegetables, fruits, etc.)	
Regulation (fresh air, water regulation, etc.)	
Recreation, sports, environmental education	
Nature as social place (barbeque, picnic, etc.)	

**Table 4: Ranking of cultural ecosystem services**

Cultural ecosystem services	Value
Inspiration, creativity (ideas, themes for drawing, etc.)	
Compensation to everyday life, gardening, go mushrooming, etc.	
Spiritual experience (connectedness to nature, yoga, religious connection, etc.)	
Beauty of nature, aesthetic (value of existence)	

The respondents were asked to give values from 4 (highest importance) to 1 (lowest importance) to the respective ESS while assigning each value just once for each table.

A brief explanation of ecosystem services was given, followed by an open question that aims on finding out which ecosystem service the respondents use at the present moment.

Besides benefits from ecosystems also environmental disservices (e.g. noise, insects, darkness) were be considered to cover ‘goods’ and ‘bads’ of the ecosystems’ supply (Lyytimäki & Sipilä 2009). In the guideline one question (question 6) mentioned disservices in order to call attention for both sides of effects: benefits and disturbances.

By combination of the current ecosystem service use and the determination of the location the importance of certain ESS in this area was be worked out. The combination of frequency of visiting the area and the distance covered to reach the spot was checked for relations.

### 3.3. Conditions for analysis

To analyse the answers given in the interviews the program IBM SPSS 20 (statistical package for social science) was used. In total, 66 cases were entered manually with one or more variables for each question. Questions with multiple answers have either several values or were split in several variables (see chapter 4.2.2).

First of all, according to the questions appropriate variables for respondents’ answers were listed in SPSS with the appropriate scale level (i.e. nominal, ordinal or metric). A nominal scale was used for incomparable answers, e.g. a person names recreation as the most important ESS while another mentions provision. The two items were not comparable with each other offhand. Results for ordinal scale levels can be arranged in a row and sorted, like grades or values of a ranking from 1 to 4. Elements like respondent’s age, year of birth or income in monetary terms are on metric scale levels. Metric scales have a zero point and are characterised by constant intervals between the values. In contrast, for ordinal scales statements about the intermediate intervals cannot be made.

In the first part of the data analysis descriptive statistics in the shape of bar diagrams, frequency tables, cross tables and tables of mean values illustrates the results. The analysis of mean values for ecosystem service use was applied for a ranking of ESS and CES. Bivariate statistics was used for the correlations (in SPSS:



Analyse > Correlations > Bivariate). Correlations show to what extent two characteristics are related to each other and if a positive or negative connection exists. Relations between ESS use and demographic elements, and between ESS itself were examined. A positive correlation showed increasing values in characteristic one and at the same time increasing values in characteristic two. A negative correlation shows opposing values, i.e. increasing values for one element and decreasing values for the other one.

Correlation measures like Pearson and Spearman give information about the intensity of the connection. Causality cannot be measured by correlation but rather the connectedness of two variables can be worked out.

Dependent variables for the analysis of correlations were age, gender and level of education. The independent ones were the variables dealing with ESS or CES use obtained from the ranking and the open question.

To investigate correlations in SPSS all relevant variables for ESS use (users' preferences) and for demography were added to bivariate analysis. After the selection of the appropriate correlation coefficient, positive and negative correlations with different levels of significance were obtained. Significant results, i.e. a level of significance from 0.01 to 0.05, that were tested in both directions (two-sided) have been used for the result part.

The choice of the correct correlation coefficient, either Pearson or Spearman, was oriented towards the characteristic with lower scale level. For the correlation between demographic data and the current use of ESS the correlation measure Pearson was applied. The lowest scale level was nominal, determined by the variable for the current use. In the ESS and CES ranking for general use in combination with the respondents' age and education level the Spearman coefficient was used because the lowest scale level present was ordinal. The Spearman measure is also called rank coefficient. The difference to Pearson is that the values are transformed in ranking variables before calculation.

**Table 5: Intensity level of correlation**

Value	Intensity of correlation
0	No relation
0 to 0.2	Very weak (positive) relation
0.2 to 0.4	Weak (positive) relation
0.4 to 0.7	Moderate (positive) relation
0.7 to 0.9	Strong (positive) relation
0.9 to 1	Very strong (positive) relation
1	Perfect relation

Furthermore, differences in ecosystem service use in the different study area were shown. The research questions for the practical objective (see chapter 1.2.) is answered by the results obtained with help of the described methods.

## 4. Results

The following chapter presents the results obtained by data analysis in the shape of illustrations, tables and calculations and includes a brief description of the findings. Firstly, an introduction to the analysis is given below.

### 4.1. Introduction to data analysis

In total 66 interviews were conducted. 36 interviews were conducted in the urban park in August (area c) and additionally 30 interviews were conducted in the two garden associations, thereof 20 in *Naturfreunde e.V.* (area a) and 10 in *Sommerland Lausen e.V.* (area b) in September (see table 6). In the garden associations interviews were conducted in the morning, afternoon and during weekdays and weekend. The research in the park was performed on working days in the early and late afternoon. The distribution of interviews among the areas and the corresponding interview number is given in table 6.

**Table 6: Distribution of interviews among study areas**

Study area	Interviews number	Quantity
a) <i>Naturfreunde e.V.</i>	1-10 and 21-30	N=20
b) <i>Sommerland Lausen e.V.</i>	11-20	N=10
c) <i>Clara-Zetkin-Park</i>	31-66	N=36
<b>Total</b>		<b>N=66</b>

In this chapter observations made during the data acquisition and the statements given by the respondents are given in verbal form or illustrated in diagrams and tables. Variables for respondents' answers to the questions were created in SPSS. An overview of the coding of variables, labels and scale levels is given in chapter 4.2.2. (Coding of variables).

The subchapter of descriptive statistics presents the following characteristics for the entirety of interviews: age distribution, education level, distribution of gender, perception of nature, frequency of visit, distance covered to use the service, current use of ecosystem services and mean values for an ESS and CES ranking. A comparison of results obtained on a working day and on the weekend was performed for the garden area *Naturfreunde e.V.* Furthermore, results for the garden associations and the park were contrasted in a comparative study. Differences and similarities were discussed in the discussion part (chapter 5).

Finally, the demographic information (i.e. age, education, gender) were brought in correlation with the current use of ecosystem service and with the ecosystem services and cultural services the respondents use in general, also absent the location of the interview. Correlation measures (i.e. either Pearson or Spearman, according to relevance) and the significance level of the combination at hand were listed.

The figures presented in this chapter are illustrations created by SPSS. The given tables were mostly part of the SPSS analysis or were sometimes based on own calculations (for some frequencies and percentages). The interview guideline (in German) can be found attached in Appendix 1.

## 4.2. Data Analysis

In the following, observations made during the data collection and the coding of variables for the analysis by SPSS and the results itself are presented. The comparative study between the study area and for different days of week as well as correlations is part of this chapter.

### 4.2.1. Observations

While the interviews were conducted between 24<sup>th</sup> of August and 18<sup>th</sup> of September a high willingness to take part was observed among the participants. In the garden associations (areas a and b) the participation was very high (100%) and the addressed persons were interested in taking part in the survey. In the urban park (area c) the participation was also high but three people rejected the participation. Overall 69 people were asked and 66 took part. The willingness to contribute was therefore 95.45%.

For area a (*Naturfreunde e.V.*) interviews were conducted once on a Monday morning and on a Saturday after lunch. The same was planned for the *Sommerland Lausen e.V.* (area b) but the same people were encountered during the week and on the weekend. Area b is significantly smaller and the quantity of garden plots is not as high as in area a.

Respondents among all areas had difficulties in making the decisions for the ESS and CES ranking of question 5. All listed services seemed to be important to the interviewed persons but the fact that they were asked to decide made them giving values and an order to the services.

### 4.2.2. Coding of variables

To process the obtained information of the interviews in SPSS the answers had to be coded by variables and labels. In table 7 the questions of the interview, the corresponding variables, possible characteristics of the attributes and the associated scale level are listed.

Question 6 aimed on identifying environmental disservices. A list of possible answers was given but also the possibility to name other items that were quantified manually later on (chapter 4.2.3.).

**Table 7: Coding and labels of variables**

Question (Number)	Variable	Label (meaning)	Scale level
How do you like nature at your present location? (1)	Like (V1)	5 (very good), 4 (good), 3 (intermediate), 2 (not particularly), 1 (not at all)	Ordinal
How often do you spend your free time at this place? (2)	Frequency (V2)	5 (daily), 4 (several times a week), 3 (several times a month), 2 (once a month), 1 (rarer, never)	Ordinal
Did you ever hear of ecosystem services?	Known (V3)	0 (No), 1 (Yes)	Nominal
Which ecosystem services do you use <b>at the moment</b> ? (3)	Provision (V4), Recreation (V5), Air (V6), Water (V7), Sports (V8), Regulation (V9), Balance to everyday life (V10), Beauty (V11), Cultural (V12), Meeting point (V13), Bird watching (V14), Inspiration (V15)	For each variable: 0 (used), 1 (not used)	Nominal
What distance did you cover to use this ecosystem service? (4)	Distance (V16)	8 (<1km), 7 (1-5km), 6 (6-10km), 5 (11-15km), 4 (16-20km), 3 (21-25km), 2 (26-30km), 1(>31km)	Ordinal
How important are the following ecosystem services for you <b>in general</b> (meaning and condition of nature)? (5a)	Food (V17), Regulation (V18), Recreation (V19), Social place (V20)	For each variable: 4 (very important), 3 (important), 2 (rather unimportant), 1 (unimportant)	Ordinal
How important are the following ecosystem services for you <b>in general</b> (philosophy of nature)? (5b)	Creativity (V21), Balance to everyday life (V22), Spirituality (V23), Existence value (V24)	For each variable: 4 (very important), 3 (important), 2 (rather unimportant), 1 (unimportant)	Ordinal
What is the most disturbing thing in the nature surrounding you? (6)	Disturb (V25)	1 (shade), 2 (mosquitos, insects), 3 (noise), 4 (animals eating harvest), 5 (darkness, fear, insecurity), 6 (no disadvantages), 7 (other)	Nominal
When were you born? (7)	Birth (V26)	Year of birth	Metric
How many years did you go to school after primary school? (8)	Education (V27)	0 (0-5 years), 1 (5-8 years), 2 (further education)	Ordinal
Select your gender. (9)	Sex (V28)	0 (male), 1 (female)	Nominal

Before asking for the current service use (in question 3) a short description of ESS was given to explain what ecosystem services are and briefly, how they can be divided in groups like provision, regulation and cultural services. The respondents were allowed to name one or more services. In total, the interviewed persons mentioned 12 different services. At first all answers were recorded separately. It

means that for every answer one variable was recorded with the either the characteristic 'used' (0) or 'not used' (1). Besides the three main groups of ecosystem services, also subservices were mentioned and recorded separately, e.g. regulation or just air.

**Table 8: Assignment of respondents' answers to ESS groups**

Respondent's answer	Assigned ESS groups
Provision of food	> Provision
Air, water, all regulating services	> Regulation
Recreation, sports, balance/ compensation to daily life, beauty/existence and aesthetics of nature, nature as meeting point, bird watching, inspiration, all cultural services	> Cultural

The answers given were arranged in the three main groups according to the CICES (i.e. provision, regulation/maintenance, cultural services) to reach clarity and enable a transparent visualization (see table 8).

Also combinations of service between service groups and the use of all services were captured, which results in 7 possible answers in total (see table 9). For instance, if the respondent mentioned for the current ESS use the beauty of nature and the provision of food, the corresponding group is provision and cultural. A new variable was therefore created.

Additionally to the variables directly derived from the answers of the interview new variables were also needed to split the data set for the comparisons between study areas and to enable an improved visualization, e.g. for the respondents age (see table 9).

**Table 9: New variables created from data**

Description	Variable	Label (meaning)	Scale level
Location of respondent (N1)	Location (V29)	0 (park), 1 (garden)	Nominal
Groups of ESS used <b>at the moment</b> (N2)	ESS groups (V30)	0 (provision), 1 (regulation), 2 (cultural services), 3 (provision and regulation), 4 (provision and cultural), 5 (regulation and cultural services), 6 (all services)	Nominal
Age of respondent (N3)	Age (V31)	No labels	Metric
Groups of ages (N4)	Age groups (V32)	0 (<18), 1 (19-29), 2 (30-39), 3 (40-49), 4 (50-59), 5 (60-69), 6 (70-79), 7 (80-89), 8 (>90)	Ordinal

The new variable location (N1) enabled the division of data by SPSS in order to compare the ESS preferences and demographic data of respondents for the different areas. Thus, the data from the urban park was compared with the data from the more rural garden associations.

The age of respondents was captured in year of birth to get detailed and gapless statements. Later on, the age of birth was converted in age of respondents in SPSS by the subtracting the year of birth from the year of survey (2015). The actual age of

the respondents was given in a new variable (V3). From this variable, age groups were built in variable N4 for summarizing and therefore greater clarity in tables and figures.

#### 4.2.3. Descriptive statistics

The first part consists of a descriptive analysis of the results for the entirety of the data. Initially, parts of demographic data were analysed to present an overview of age groups, education level and gender of the respondents. The participants were asked for their age of birth.

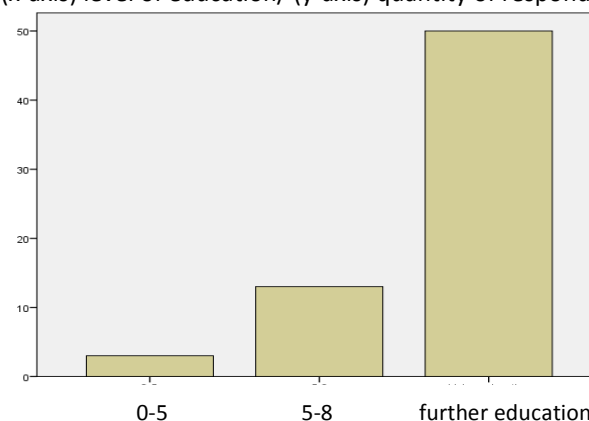
Strongly represented, while looking at the total amount of interviews, were the age groups from 19 to 29 years and from 70 to 79 years (see table 10). Fewer respondents were in age between 30 and 69 years.

**Table 10: Distribution of age groups (N=66)**

Age (in years)	Frequency	%
<18	1	1.5
19-29	20	30.3
30-39	8	12.2
40-49	2	3.0
50-59	7	10.6
60-69	7	10.6
70-79	18	27.3
80-89	3	4.5

Subsequently, the respondents were asked how many years they visited school after primary school in order to find out their level of education. Five to eight years can be classified as the German *Abitur* or secondary school certificate. Less than five years mean *Hauptschule*, which is the lowest school-leaving qualification. All persons that attended school between eight and ten years in total including primary school or that left school earlier were included. It should be taken into account that the former school education of the GDR consisted of ten years in total.

**Figure 6: Level of education (in school years after primary school) (N=66)**  
(x-axis) level of education/ (y-axis) quantity of respondents



Higher education means that the respondents finished or are currently involved in vocational training, visit or visited a technical college, university or others. Like illustrated in figure 6, the majority of persons interviewed completed additionally to school another education or were currently in the process of further education.

Three out of 66 interviewed persons went to school up to five years after primary school. One fifth went between five and eight years to school after primary education.

The interviewer recorded the participant's gender. In total, more women than men were interviewed (see table 11). The share of female respondents is 56.1% and the share of male respondents is 43.9%.

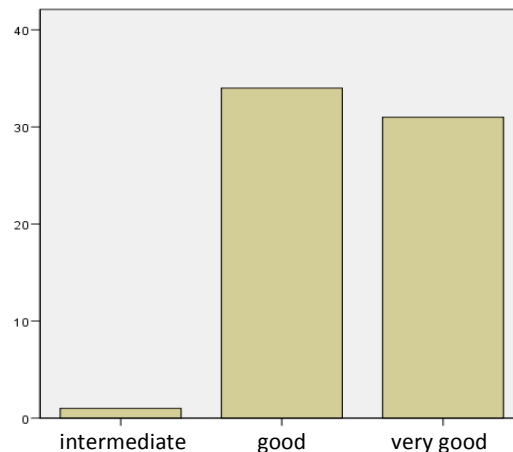
**Table 11: Distribution of gender (N=66)**

Gender	Frequency	Percentages (%)
<b>Male</b>	29	43.9
<b>Female</b>	37	56.1

The actual first question besides demographic facts was about the respondent's perception of nature and how they like nature at the present location (see figure 7). People were asked to decide between the following attributes: very good, good, intermediate, not really and not at all.

**Figure 7: Perception of surrounded nature (N=66)**

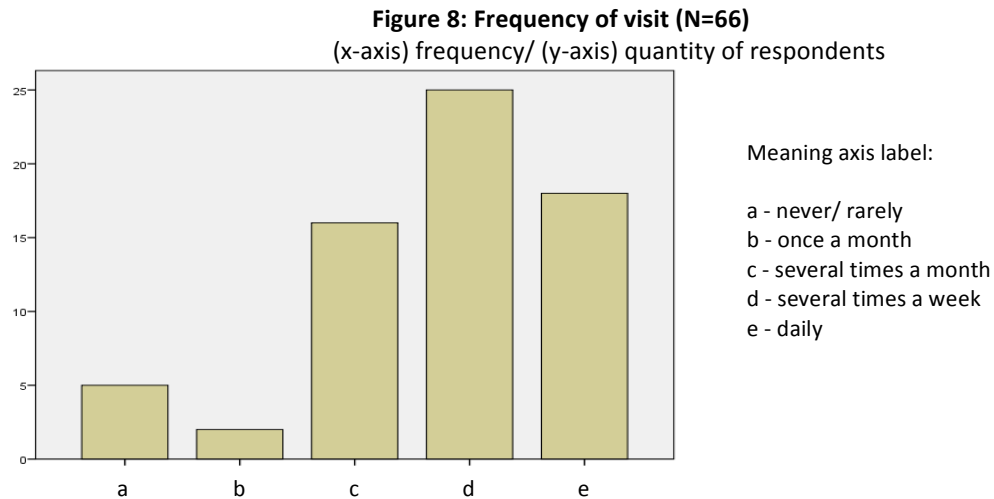
(x-axis) perception of nature/ (y-axis) quantity of respondents



More than half of the persons interviewed (52%) perceived the nature at their current location as good. Less but still many people (47%) state that they perceive the nature surrounded as very good. The lowest rating given was intermediate, thus a neutral perception of nature. Among all respondents the last two ratings (i.e. not really and not at all) were not mentioned.

Furthermore, the frequency by what interviewed persons visit the respective place had to be worked out (see figure 8). Respondents had five options varying from daily, several times per week or month, once a month to never or rarely. 37.88% of

the respondents spend their spare time several times a week in the park or in their garden. It is therefore the most common answer. 18 of them spend their time daily and 16 of them several times a month in the corresponding location. Five respondents visit never or rarely the places.



The cross table (see table 12) show the combination of respondent's frequency of visiting the location and the distance they cover to reach it, based on place of residence. Most respondents (54.55%) covered a distance of one to five kilometres. The second most mentioned distance stated by 15 respondents is less than one kilometre. The combinations most frequently mentioned were daily visits (18.8%), several times a week (19.7%) or several times a month (13.64%) with a distance covered between one and five kilometres. Seven out of 66 persons indicated that they visit the respective location never, rarely or once a month. Nobody mentioned the distance between 26 and 31 kilometres.

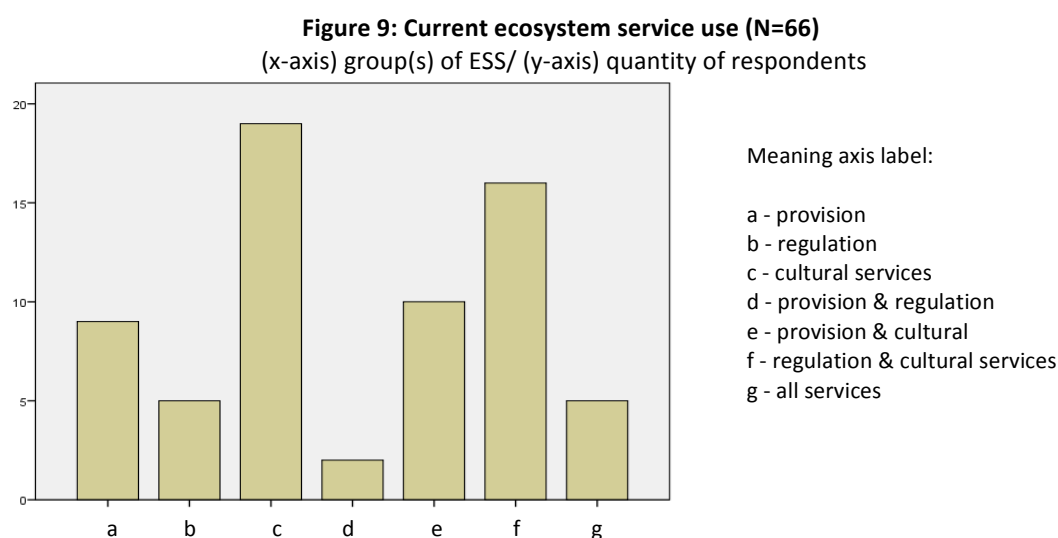
**Table 12: Distance covered & frequency of visit (N=66)**

		Distance (in km)							Total
		> 31	21-25	16-20	11-15	6-10	1-5	< 1	
Frequency	never/ rarely	1	0	0	0	1	1	2	5
	once a month	0	0	0	0	0	1	1	2
	several times a month	0	0	1	0	1	9	5	16
	several times a week	1	1	1	2	3	13	4	25
	daily	0	0	0	1	2	12	3	18
Total		2	1	2	3	7	36	15	66

Within the scope of the interview respondents were asked whether they ever heard of ecosystem services. The term itself was not really known even though respondents of the survey were using according to the statements at least one service. 95.5% of the respondents never heard of ESS as such.



The current ecosystem service use of a single group or combination of groups is illustrated in figure 9. 27.27% used exclusively cultural ecosystem services in the moment of interviewing, which is evidently the largest share of respondents. The combination of regulating services and cultural services, and the combination of provisioning services and cultural services are the second and third most mentioned options. Nine respondents used only provision in the moment of the interview. The use of exclusively regulation or else, the use of all services, were mentioned five times each. The combination of regulation and provision was the least mentioned answer.



Furthermore, people were asked how much importance they attach to ecosystem services in general also beside the current use and independent of their present location (question 5). Respondents gave values from 4 (most important service) to 1 (least important service) to ESS and CES in two separated tables.

**Table 13: Mean values for ESS and CES ranking (N=66)**

ESS (first ranking)	Mean	CES (second ranking)	Mean
Provision	2.45	Inspiration, creativity	1.95
Regulation	2.64	Compensation, gardening, going mushrooming	3.06
Nature as social place	2.20	Spiritual experience	1.92
Recreation, sports, education	2.71	Beauty of landscape, aesthetics of nature	3.06

Mean values in table 13 show that recreation, sports and environmental education were the most important services with a mean value of 2.71. Regulating services were valued as second most important with 2.64. Provisioning services get the third rank with 2.45. Nature as a social place has the lowest mean value (2.2).

In the second ranking that compares cultural services two categories share the first place. Compensation to daily life, gardening, go mushrooming and beauty of landscape, aesthetics of nature and value of existence have both the highest mean values (3.06). And both, the spiritual experience including connectedness to nature,

yoga, religious connection and inspiration, creativity (including ideas or themes for drawing) have lower values ranging from 1.92 to 1.95. Values of the second ranking showed more variations than in the first ranking. The first ranking aimed on basic groups of ESS. These categories were more equally important to the respondents than in the second where just subgroups of cultural services were represented.

#### 4.2.4. Comparative study

In the following, a comparison between the different areas was conducted. The two garden associations (area a and b) were therefore summarised in one area because both of them are located on the city outskirts and are therefore more rural. Differences between study area c and the areas a and b (summarised) were pointed out. In this subchapter the *Clara-Zetkin-Park* (N=36) is always mentioned first, followed by the summarised garden associations (N=30).

**Table 14: Distribution of age groups (N=36; N=30)**

Park (N=36)	Frequency	%	Garden Associations (N=30)	Frequency	%
<b>&lt;18</b>	1	2.8	<b>&lt;18</b>	-	-
<b>19-29</b>	20	55.6	<b>19-29</b>	-	-
<b>30-39</b>	8	22.2	<b>30-39</b>	-	-
<b>40-49</b>	1	2.8	<b>40-49</b>	1	3.3
<b>50-59</b>	2	5.6	<b>50-59</b>	5	16.7
<b>60-69</b>	1	2.7	<b>60-69</b>	6	20.0
<b>70-79</b>	3	8.3	<b>70-79</b>	15	50.0
<b>80-89</b>	-	-	<b>80-89</b>	3	10.0

As illustrated in table 14, the distribution of age groups in the park showed a high concentration of 55.6% in the group from 19 to 29 years. Approximately one fifth of the park respondents (22.2%) were between 30 and 39 years old. The youngest person asked was under the age of 18 and the oldest respondent was not older than 79 years. Contrasting to this distribution were the age groups in the garden associations. Half of the respondents were between 70 and 79 years old. The majority of 80% was between 60 and 89 years old. The youngest person interviewed was between 40 and 49 years old. The age groups between younger than 18 up to 39 did not exist among the interviewed persons in the gardens. People in the age group between 80 and 89 years were not encountered in the park area.

More homogeneity was evident in concerns of the respondents' education level (see table 15). For both, the park and the gardens count that the majority of respondents experienced a further education additionally to school. 16.7% of the park respondents went to school between five and eight years after primary education. Just one out of 36 respondents was currently still in school. The case is similar for garden tenants but about 30% finished no further education. Two out of 30 respondents went up to five years to school after primary school. 23.3% visited school between nine and twelve years in total.

**Table 15: Level of education (in school years after primary school) (N=36; N=30)**

Park (N=36)	Quantity	%	Gardens (N=30)	Frequency	%
0-5	1	2.8	0-5	2	6,7
5-8	6	16.6	5-8	7	23.3
Further education	29	80.6	Further education	21	70.0

A higher level of education was present among respondents in the park. 80.6% of the respondents finished or were currently involved in any kind of further education in comparison to the garden tenants where 70.0% had a further education. That makes a difference of 10.6%.

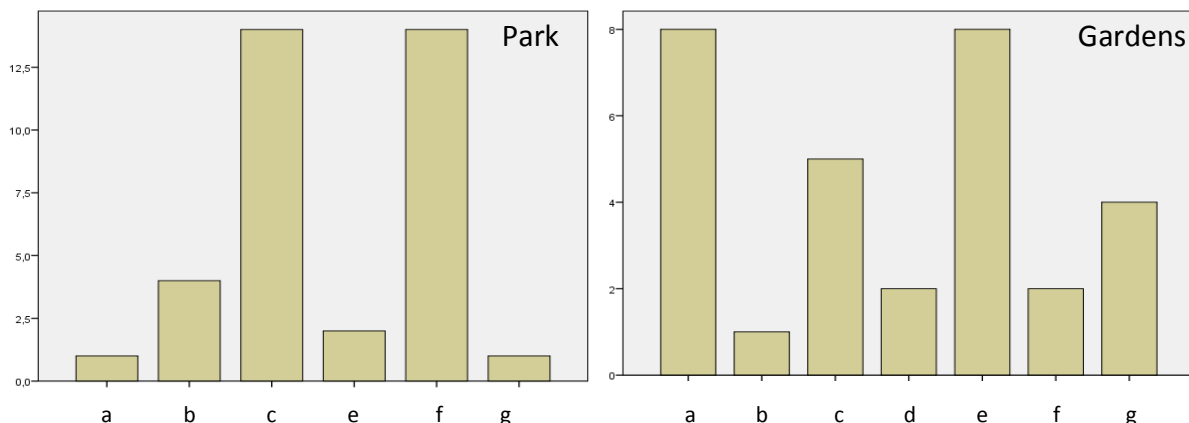
**Table 16: Distribution of gender (N=36; N=30)**

Park (N=36)	Quantity	%	Gardens (N=30)	Frequency	%
Male	17	47.2	Male	12	40.0
Female	19	52.8	Female	18	60.0

In general, more women than men were asked. 52.8% of the park respondents were women and 47.2% were men. The difference of percentages between male and female was higher in the garden associations and lied between 40% and 60% but it was still relatively equal (see table 16).

Comparing the awareness of ecosystem services, no one of the respondents in the garden association was aware of ecosystem services in contrast to three of 36 among respondents in *Clara-Zetkin-Park*. The respondents that were aware of ecosystem services were 25, 29 and 31 years old. The share of peoples' awareness of ESS was therefore 8.33%.

**Figure 10: Current ecosystem service use (N=36; N=30)**  
(x-axis) group(s) of ESS/ (y-axis) quantity of respondents



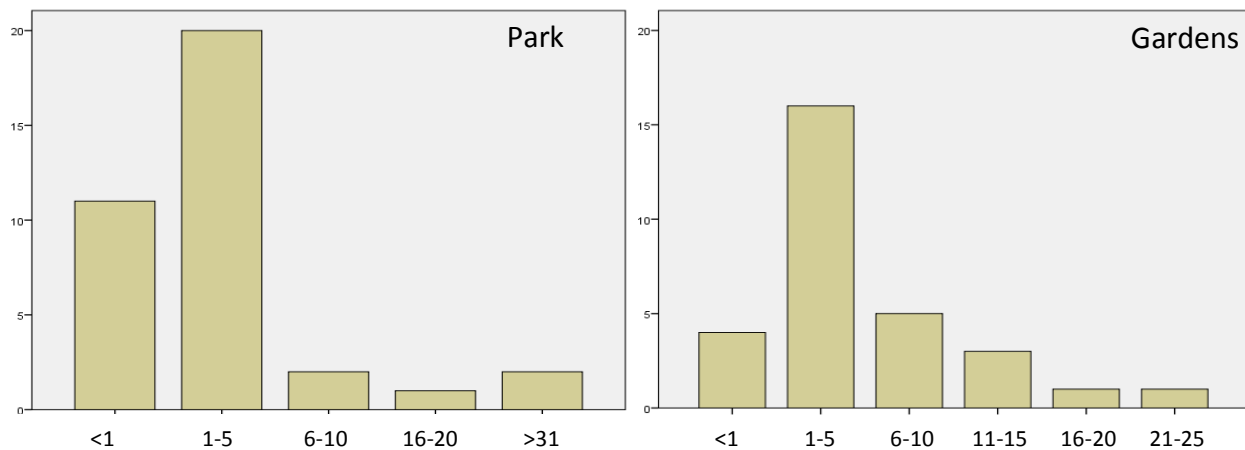
Meaning axis label: a - provision; b - regulation; c - cultural services; d - provision & regulation; e - provision & cultural; f - regulation & cultural services; g - all services

The bar charts above present the current use of ESS in relation to quantity of respondents that mentioned the specific service or combination of services (see figure 10). Visitors of the park mentioned mostly cultural services and regulation combined with cultural services. The third most mentioned service with a gap to the

first and second rank was regulation itself. Different from this, provision and the combination of provisioning and regulating services were the most mentioned ESS in the more rural gardens. Regulation per se was more important in the park than in the gardens. Overall, all possible categories were mentioned at least once in the public gardens. The category 'provision and regulation' was not mentioned in the park but two times in the gardens. The use of all services at the same time was mentioned four times by garden tenants but only once among the respondents in the park.

As illustrated in figure 11, the distance that most people cover to use the named ecosystem service(s), equally for the park and the gardens, was one to five kilometres. More respondents in the park covered less than one kilometre than in respondents of the gardens.

**Figure 11: Distance covered for current service use (N=36; N=30)**  
(x-axis) distance in km/ (y-axis) quantity of respondents



Fewer persons mentioned six to 25 kilometres. Nobody in the garden association indicated a higher distance than 25 kilometres. More than 31 kilometres was mentioned two times in the park but the range from 21 to 25 kilometres has been left out.

The upper cross table shows results for the park, the lower one the results for the garden associations (see table 17). The frequency of garden visits for garden tenants was higher than park visits of the park goers. Half of the garden tenants visited their garden daily. Approximately 97% of all garden respondents visited several times a week or daily the garden and covered mainly small distances from one to five kilometres. One respondent of the gardens covered a larger distance of 16 to 20 kilometres, which resulted in a lower frequency of visit.

In comparison to the garden associations, respondents in the park covered small distances from zero to five kilometres but went to the park less often. Most people went to the park several times a month or a week (except for bad weather like rain

or winter). Five respondents stated that they never or rarely visit the park which can be explained for instance by the visit of the city as a tourist.

**Table 17: Distance covered & frequency of visiting (N=36; N=30)**

		Distance (in km)					
Park		> 31	16-20	6-10	1-5	< 1	Total
Frequency	never/ rarely	1	0	1	1	2	5
	once a month	0	0	0	1	1	2
	several times a month	0	0	1	9	5	15
	several times a week	1	1	0	7	2	11
	daily	0	0	0	2	1	3
	Total	2	1	2	20	11	36

		Distance (in km)						
Gardens		21-25	16-20	11-15	6-10	1-5	< 1	Total
Frequency	several times a month	0	1	0	0	0	0	1
	several times a week	1	0	2	3	6	2	14
	daily	0	0	1	2	10	2	15
	Total	1	1	3	5	16	4	30

The ranking of ESS use in general showed some differences between the study areas (see table 18). Among the park visitors regulating services had the highest mean value (2.97), which is the highest score, followed by nature as social place (2.58) and provision (2.39). Garden tenants gave the highest score to nature as social place, followed by provision and recreation, sports and education. The lowest mean value in the park got recreation, sports and education. For the respondents in the gardens regulation has the lowest value.

**Table 18: Mean values for ESS ranking (N=36; N=30)**

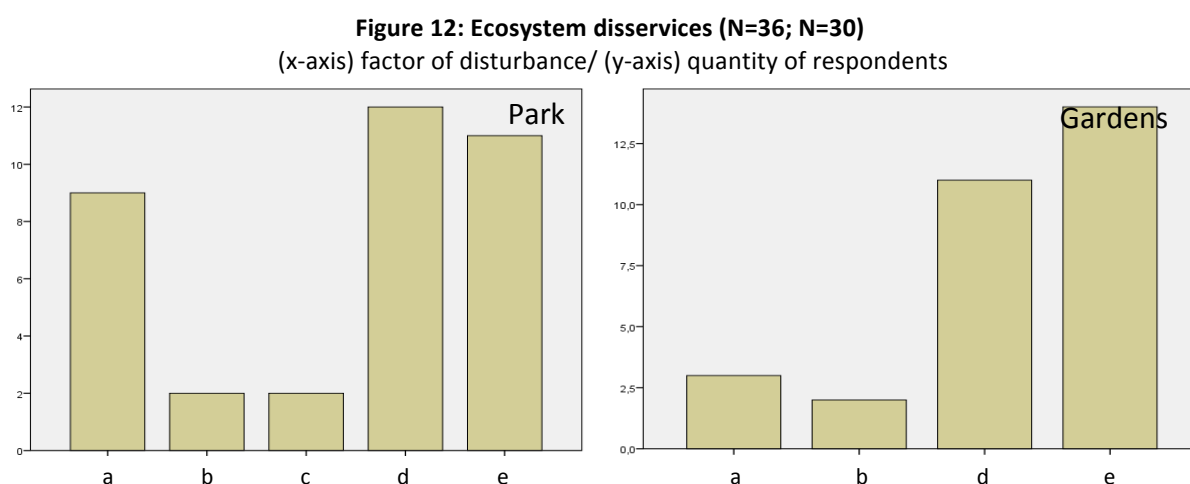
ESS (first ranking)	Mean (Park)	Mean (Gardens)
Provision	2.39	2.53
Regulation	2.97	2.23
Nature as social place	2.58	2.87
Recreation, sports, education	2.06	2.37

**Table 19: Mean values for CES ranking (N=36; N=30)**

CES (second ranking)	Mean (Park)	Mean (Gardens)
Inspiration, creativity	2.08	1.80
Compensation, gardening, going mushrooming	3.17	2.93
Spiritual experience, connectedness to nature	1.61	2.30
Beauty of landscape, aesthetics of nature	3.14	2.97

For the ranking of cultural ecosystem services, compensation, gardening and going mushrooming got the highest score in the urban area (3.17), followed by beauty of landscape and aesthetics of nature (see table 19). The score for beauty of landscape and aesthetics of nature among the garden tenants was with 2.97 the highest, closely followed by compensation, gardening and go mushrooming (2.93). The spiritual experience held the second lowest score among the respondents in the gardens (2.30) and the lowest among the park visitors (1.61). The group with the lowest mean value in the garden associations was inspiration and creativity (1.80), which had the second lowest score among the park respondents (2.08).

Nature, besides the delivery of benefits, causes also disturbances. Some of these ecosystem disservices were listed in the 6<sup>th</sup> questions with the option to add a disservice that is not mentioned. Furthermore, respondents could have stated that no EDS exist and nothing disturbs. The responses are illustrated in figure 12.



Meaning axis label: a - mosquitos, insects; b - animals eating harvest c - darkness, fear, insecurity; d - nothing disturbs; e - other

Most of the park visitors perceived nothing as disturbing and saw no disadvantages in nature where they are located. Mosquitos and insects were the most important disturbing factor. Two respondents each mentioned animals eating harvest and darkness inducing insecurity as disservices.

The answers mentioned besides the predefined ones were as follows: Five respondents in the park mentioned garbage and pollution as a factor, two respondents mentioned too many people, and others (each factor mentioned once) referred to environmental destruction, excessive use of the river by motorboats, artificiality of the place and dogs' excrements.

Most of the garden tenants perceived disturbances that are not mentioned in the selection. Answers given two times were neglected gardens and small aircrafts causing noise. Other tenants mentioned wind turbines, rats, moles, noise by other tenants or dogs, extreme nature conservationists, public garden regulations or lacking participation, non-compliance to the regulations, bad weather or others.

Eleven of 30 respondents in the garden mentioned no disturbances by nature. Small quantities of two or three respondents perceived either insects and mosquitos or animals that eat the harvest as disturbing.

The answers in the different areas for the open answer were strongly deviating. The only commonality recorded is the destruction of the environment, which was once mentioned in park and once in the gardens.

#### 4.2.5. Comparison by parameters

For the garden association *Naturfreunde e.V.* interviews were conducted on a working day (Monday) and on the weekend (Saturday) to find differences and similarities in ecosystem service use and range of respondents. The interviews with number 1 to 10 and 21 to 30 were used. For each characteristic (i.e. working day and weekend) 10 interviews were conducted.

According to table 20, the average age of the respondents interviewed during the week was 67.4 years and therefore approximately three years higher than among the respondents asked on the weekend (64.2 years).

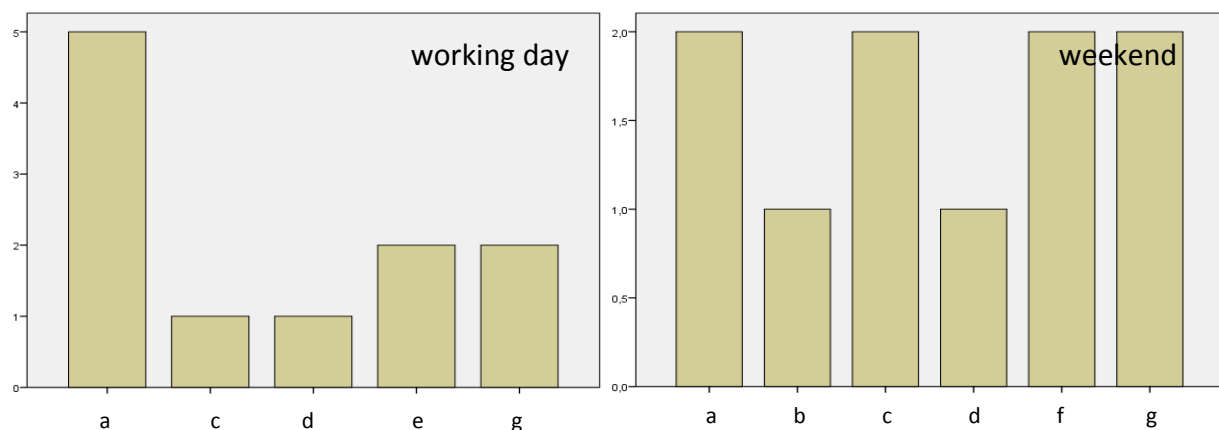
**Table 20: Distribution of age groups (working day; weekend)**

Garden (working day)	Frequency	%	Garden (weekend)	Frequency	%
<b>40-49</b>	1	9.1	<b>40-49</b>	-	-
<b>50-59</b>	1	9.1	<b>50-59</b>	4	40.0
<b>60-69</b>	2	18.2	<b>60-69</b>	3	30.0
<b>70-79</b>	6	54.5	<b>70-79</b>	3	30.0
<b>80-89</b>	1	9.1	<b>80-89</b>	-	-

During the week a range from 40 to 89 years was present. During the weekend the age range varied between 50 and 79 years and is therefore smaller.

The current ecosystem service use differed between working days and weekends as shown in figure 13.

**Figure 13: Current ecosystem service use (working day; weekend)**  
(x-axis) group(s) of ESS/ (y-axis) quantity of respondents



Meaning axis label: a - provision; b - regulation; c - cultural services; d - provision & regulation; e - provision & cultural; f - regulation & cultural services; g - all services

Provision and the combination of provision and cultural services were more frequently mentioned on weekdays. Regulating services itself were mentioned once on weekends but not on weekdays. The current use of regulation and cultural services in combination were mentioned twice on weekend but not during the week.

**Table 21: Mean values for ESS ranking (working day; weekend)**

ESS (first ranking)	Mean (working day)	Mean (weekend)
Provision	2.27	2.50
Regulation	2.27	2.20
Nature as social place	3.27	3.10
Recreation, sports, education	2.18	2.20

The highest mean value on weekday and weekend got nature as a social place (see table 21). During the week recreation, sports and education were at the lowest score. On the weekend provision had a higher value than regulation and recreation, sports and education. Overall, the differences between the values of the first and second column were just marginal.

**Table 22: Mean values for CES ranking (working day; weekend)**

CES (second ranking)	Mean (working day)	Mean (weekend)
Inspiration, creativity	2.45	1.70
Compensation, gardening, go mushrooming	3.09	2.80
Spiritual experience	1.82	2.50
Beauty of landscape, aesthetics of nature	2.64	3.00

In comparison, inspiration and compensation and/or gardening had higher values on weekdays than on the weekend. The other way around, the spiritual experience and beauty of landscape and aesthetics of nature had a higher score among the respondents on weekends.

#### **4.2.6. Correlations of ecosystem service use**

The performance of correlations showed relations between ecosystem service use and the characteristics of the respondents (i.e. age, education, gender). Furthermore, the relation between the uses of ecosystem services, at the current moment of the interview or in general, was investigated. Thus, the ESS use at the moment (nominal) or in general (ordinal) was considered as independent variables. The dependent variables were age (metric scale), education level (ordinal scale) and gender (nominal scale).

The first correlation was done with Pearson for the current ESS use (dichotomous characteristic: 0 – ESS used; 1 – ESS not used). For Pearson, variables were considered to be interval scaled and their connection was supposed to be linear. The results in table 23 considered all interviews conducted.



**Table 23: Correlation of current ESS use and demographic elements and between ESS itself (N=66)**

Correlating elements	Significance	Pearson correlation
Education level * provision	0.05	0.296
Nature as meeting point * regulation	0.05	0.267
Cultural services * regulation	0.01	0.576
Age * provision	0.01	-0.535
Provision * air	0.05	-0.261
Beauty/ value of existence of nature * water	0.05	-0.270

The Pearson coefficient shows correlations between the respondents' age and the utilisation of provisioning services (-0.535) and between the education level and provision (0.296). Furthermore, relations between the use of cultural and regulating services including their subservice are common. Provisioning services and air as a regulating service also correlate for the total quantity of interviews (-0.261).

If the data was divided into two different datasets, in park and gardens, more specific statements to correlations and connections between ecosystem services itself and respondents' data were enabled. Thus, differences regarding the type of correlations (positive or negative) were analysed separately for the study areas (see chapter 5: discussion).

The following tables shows correlating results between current ESS use and demographic elements and between ESS use itself for the park separately (see table 24). Correlations exist for respondents' age and the use of water (0.439), the education in relation with doing sports in nature (0.491) and for combinations of regulating and cultural services (0.561), and provisioning services with cultural services.

**Table 24: Correlation of current ESS use and demographic elements and between ESS itself (Park)**

Correlating elements	Significance	Pearson correlation
Age* water	0.01	0.439
Education level * sports	0.01	0.491
Cultural services * Regulation	0.01	0.561
Provision * inspiration	0.05	0.421
Provision * recreation/ tranquillity	0.01	-0.380
Beauty/ value of existence of nature * water	0.01	-0.483

In table 25 the correlations exclusively for the current ESS use among garden respondents are listed. A relation between the two demographic elements gender and education can be observed for the first time (-0.383). Furthermore, many correlations exist for subservices of cultural services and subservices of regulation, e.g. nature as meeting point and water or compensation/free time/gardening and water. Also between regulating services itself, e.g. water and air (0.535), and between cultural services itself, e.g. nature as meeting point and beauty of landscape (0.681), relations are evident.

**Table 25: Correlation of current ESS use and demographic elements and between ESS itself (Gardens)**

Correlating elements	Significance	Pearson correlation
Gender * education level	0.05	-0.383
Education level * water	0.01	0.501
Education level * nature as meeting point	0.01	0.501
Water * air	0.01	0.535
Regulation * water	0.01	0.598
Compensation/free time/ gardening * water	0.01	0.535
Beauty/ value of existence of nature * water	0.01	0.681
Cultural services * water	0.01	0.681
Nature as meeting point * air	0.01	0.535
Cultural services * regulation	0.01	0.641
Nature as meeting point * regulation	0.01	0.598
Nature as meeting point * water	0.01	1.00
Nature as meeting point * compensation/free time/ gardening	0.01	0.535
Cultural services * beauty/ value of existence of nature	0.05	0.423
Nature as meeting point * beauty/ value of existence of nature	0.01	0.681
Nature as meeting point * cultural services	0.01	0.681

The correlations of ESS and CES use in general (beyond current use) are listed below. With regard to the different scale levels the Spearman rank coefficient was used for these correlations. In contrast to Pearson, variables were modified in ranking variables before calculation. The correlations were performed for the combination of age (in years: metric scale), educational level (ordinal scale) and general ESS use (ordinal scale). The gender variable (nominal) was not considered in this calculation. Correlations between ESS and gender did not appear on a significant level and the combination between demographic data including gender appeared already in the calculation by Pearson.

The results of the correlations are listed in table 26 to 28. The values of the general ecosystem service use might be different from the values of the current use. A general opinion was demanded in contrast to the ecosystem services recorded at the present moment of interviewing. At the beginning, the study areas were summarised and all answers for the general use were observed.

**Table 26: Correlation between ESS and CES use in general and demographic elements and between ESS itself (N=66)**

Correlating elements	Significance	Spearman correlation
Age * provision	0.05	0.260
Age * spiritual experience	0.01	0.426
Regulation * recreation, sports, education	0.01	-0.516
Spiritual experience * inspiration	0.01	-0.537
Provision * nature as social place	0.01	-0.442
Regulation * nature as social place	0.01	-0.393
Balance to everyday life, gardening, go mushrooming * beauty of landscape	0.01	-0.360

Correlations are noticeable between the respondent's age and the use of nature for provisioning (0.260) and spiritual experience (0.426). All correlations between ecosystem services itself, between provision and cultural services (e.g. provision and nature as social place), between regulation and cultural (e.g. regulation and recreation, regulation and nature as a social place) and between cultural services among themselves (balance and spiritual experience) are negative.

Among the park respondents a negative correlation between their age and the use of nature as a social place is present (-0.381) (see table 27). The correlations between ESS itself are all negative no matter if it is a combination of regulating and cultural services, between provision and cultural (e.g. nature as social place or recreation) or between cultural services itself (e.g. regulation and recreation or balance to everyday life and beauty of landscape).

**Table 27: Correlation between ESS and CES use in general and demographic elements and between ESS itself (Park)**

Correlating elements	Significance	Spearman correlation
Age * nature as social place	0.05	-0.381
Provision * recreation, sports, education	0.01	-0.568
Provision * nature as social place	0.01	-0.565
Regulation * recreation, sports, education	0.01	-0.571
Regulation * nature as social place	0.01	-0.502
Spiritual experience * inspiration	0.01	-0.560
Balance to everyday life, gardening, go mushrooming * beauty of landscape	0.01	-0.450

In table 28 a positive correlation between the respondent's age in the gardens and provision (0.469) and between age and spiritual experience or nature connectedness is present (0.533). Besides this, just negative correlations were found between age and the use of inspiration and between ecosystems services itself. These significant negative correlations occur between subgroups of cultural services (e.g. inspiration and spirituality), between provision and regulation and between regulation and subgroups of cultural services

**Table 28: Correlation between ESS and CES use in general and demographic elements and between ESS itself (Gardens)**

Correlating elements	Significance	Spearman correlation
Age * provision	0.01	0.469
Age * spiritual experience	0.01	0.533
Age * Inspiration	0.05	-0.425
Provision * regulation	0.01	-0.503
Nature as social place * spiritual experience	0.01	-0.568
Regulation * recreation, sports, education	0.05	-0.422
Nature as social place * recreation, sports, education	0.01	-0.495
Inspiration * spiritual experience	0.05	-0.443

## 5. Discussion

The interpretation of the results and theoretical findings from literature were brought together in this chapter. The findings from the practical part of the research based on the description of figures and tables given in the result chapter are discussed below (see chapter 5.1.). Answers and statements to the main research questions, hypothesis and sub-questions also in relation to literature are given afterwards (see chapter 5.2.).

### 5.1. Discussion of results

First of all, the basic results of the study in Leipzig are stated. Subsequently, descriptions and interpretations to the obtained result are given for better understanding.

#### 5.1.1. *Basic results*

Respondents of different age groups and/ or with a different level of education prefer or use different ecosystem services (table 14 & figure 10). People interviewed in the areas outside the city are older than those interviewed in the urban area (table 14). Furthermore, the older the people are the more they use provisioning services. If the respondents are younger they prefer the ecosystem service nature as a social spot among other services in the current moment (table 27). In contrast, the social function of nature in general reaches the highest importance on the city outskirts (table 18).

The educational level is higher among the urban participants (table 15). A higher level of education goes along with making less use of provisioning services and also making less use of nature for physical interaction like sports among the urban participants (table 23 & 24). Male respondents in more rural areas tend to have a higher level of education (table 25 & 28). Moreover, the covering of small distances from the respondent's place of residence accompany a high frequency of visits to the respective area (table 12 & figure 11).

The comparison of the study areas shows that respondents' preferences for ESS and CES differ between urban and more rural areas, and also between the current and general use (table 19 & figure 10).

In general, respondents prefer in the present moment mainly cultural services followed either by their combination with regulation or with provision (also proven by correlation of ESS) (figure 9 & table 23). On the outskirts of Leipzig the combination of provision and cultural services or provisioning services itself are used. Urban respondents prefer either cultural services or the combination of cultural and regulating services most (figure 10). A greater variety of combinations of cultural service use is present in the areas outside of Leipzig (table 25).

The concept of ecosystem services is not familiar to people. A small share of people (8.3%) in the urban area ever heard of ESS.

Consensus on perceived ecosystem disservices between or in between study areas does not exist.

Preferences for cultural services and the current ESS use depend on the day of the week, i.e. working day or weekend (table 22). The users' preferences for ESS in general are independent of the time of the week, the respondent's age and education (table 21).

The present use of cultural ecosystem services (or a subservice of CES) is related to the use of regulation for urban and more rural areas (table 23 & 25).

All significant correlations between ecosystem services and cultural services with regard to the general use are negative; equally for all study areas.

Different correlations appear for the present ESS use and the use of ecosystem services in general due to respondent's distinctive value allocation to services.

### *5.1.2. Detailed interpretation of results*

#### Age

The use of ESS depends on the respondent's age and varies with the purpose of visit. Elderly people might search more for tranquillity that is found in the more rural (garden) areas while younger respondents were mainly found in the urban park.

In total, mainly younger and older people were interviewed. People in the age between 30 and 69 years were barely found. Middle-aged people were most likely occupied with work, children's education or other things.

The comparison between working day and weekend shows that people interviewed during the week were on average older than on weekends reasoned by the peoples' occupation (table 20). Retired people might get the chance more often to visit their garden on working days compared to working persons that most likely use the weekend for this.

The connection between higher age and use of provisioning services is proven by a moderate negative correlation (-0.535) in table 23 (with regard to the coding of the current ESS use: 0 – used; 1 – not used) and supported by the moderate positive correlation between respondent's age and the importance of provision in more rural areas (table 28). The correlation is not significant in the urban area because it is valid for people of higher ages.

The park visitors use nature more likely as a social spot when they are younger. Meeting up in the park for picnic, barbeque, walking etc. is a simple solution but does not provide a high level of comfort. Due to this, the older the people the less they use the park as a social spot and might prefer other places (table 27).

A moderate positive correlation shows that a lower age of urban respondents is linked to the use of the ESS water (table 24), which need to be further investigated

to state causalities. The perception of water as regulating or cultural service is not clarified. Furthermore, the older the people in garden areas are the more importance is attached to the spiritual use of nature (table 26 & 28), which result from owning a garden and the implied connectedness to nature.

A weak negative correlation among urban respondents presents the connection of a higher age when the respondents are men (table 27). Younger respondents are therefore most likely of female sex. This connection does just appear with the coefficient Spearman and is not significant if Pearson is applied. The reliability of this result has to be tested with a higher quantity of samples to allow correct assumptions.

### Education

The connection between less physical interaction with nature (e.g. sports) and a higher educational level (table 24) might be explained due to less free time, more working hours and therefore less opportunities to follow activities in nature or to do sports outside.

Additionally, a higher level of education goes along with less use of provisioning services (table 23). The preference of older people to use provisioning services and improved possibilities in education today compared to past times explain this connection. Gardening and self-provision was more typical in the former generations (i.e. post-war period or GDR) with less possibilities in academic education compared to present times.

Respondents in more rural areas with a higher level in education tend to mention the use of the ESS water and nature as a meeting point less (negative moderate correlations) (table 25). Causality cannot be given from the collected data. Also, these relations are not supported by any other correlations and an explanation is not possible due to the small sample size.

A minor tendency shows that male respondents on the city outskirts have a higher education level than female respondents (table 25 & 28). Women had fewer possibilities of further education in previous generations owed by their responsibility for children's education and household in the traditional understanding of roles.

### Visiting nature

Absent from one intermediate valuation of nature that might result from EDS or external disturbances, nature's overall perception is at least good (figure 7).

People visit the respective location mainly several times a week because a garden needs regular caring or people cross the park regularly on their way home or on purpose for recreational reasons. Short ways are more practicable and enable a more frequent stay. The proximity to green spots in urban areas or closeness to the rented garden might influence the selection of the place of residence as well (table 12).

### Ecosystem services

Respondents mentioned mainly CES for the present service use because they identified recreation and leisure as cultural values (figure 9). The combination of cultural and regulating services has the second highest importance due to the elements clean air and purified water that are essentials for life. Regulating services among the park visitors might be associated with the existing river and its recreational effect. Double counting and ambiguity of services cannot be excluded in this question. The combination of provision and cultural services at the third rank can be explained by the garden tenants' willingness and/or obligation to plant their garden area partly with food or a small share of people that collect fruits, berries or herbs like wild garlic in the park. Regulating services are mainly used in addition to another activity, e.g. the use of fresh air while taking a walk or while meeting friends outside.

The mean values for CES show more variety in values compared to the first ranking of ESS even though the textual difference between the categories is smaller (table 13). The mean values for the four categories of the ESS ranking are relatively balanced (between 2.20 and 2.71). People attach greater importance either to one or another service depending on their individual preferences (e.g. compensation and gardening: 3.06; inspiration and creativity: 1.95). Overall, these values present tendencies and do not give information about the importance of individual service use. Correlations help to identify relations between the different services.

### Comparison of study areas

Obviously, the distribution of age groups differs significantly between the garden associations and the park. Younger people, between 19 and 39 years old, were interviewed in the urban park justified by their higher degree of mobility compared to elderly people (table 14). The central location of the park indicates a high fluctuation of people due to its connection between two districts. Younger people that benefit from the good reachability of the spot accept more easily a higher degree of noise and unrest. Garden tenants are mainly people in the age between 60 and 89 years.

A 10.6% higher share of park respondents participated in a further education compared to the garden respondents. The reason might lie in the differences of generations. People over 70 years experienced the war and had fewer possibilities in education when they were young.

60% of the garden respondents were female (table 16). Women have a higher life expectancy than men. A possible explanation would be that the men either already died or that the women do the gardening because of better physical fitness, which include being outside and therefore being available for an interview. Furthermore, gardening and cultivation were seen as a women's domain in its traditional understanding.

In the urban area 8.3% of the respondents heard of ecosystem services before. These people were of a younger generation and probably heard of it in school, university or got in touch with it due to interest in environmental topics.

The small distances covered to reach the respective area indicate that garden tenants live most likely in the suburban or village areas compared to the park visitors, that live close to the park in urban and central areas (figure 11). More respondents in the urban area cover an even smaller distance under one kilometre, which shows even more closeness to their residential area. Visitors of the city or people visiting friends or family might mention the highest distance of more than 31 kilometres to visit the park.

#### *Comparison of current ecosystem service use*

Urban respondents use cultural services more frequently, while provision or the combination of provision and cultural services is more important on the outskirts areas (figure 10). Using regulation in combination with CES is common among urban participants. Garden tenants might cultivate their own plants and receive recreational benefits through it, while park visitors give importance to recreation by taking a walk, exercise or enjoying nature's beauty. Regulating services are presented due to breathing fresh air, taking advantage of the existence of the river or the existence of the entire functioning ecosystem with its flows and stocks. The differences in ecosystem service use between the selected areas can thus be explained by different purposes of visit and different preferences of people for either provisioning or recreational areas.

#### *Comparison of general ESS and CES use*

Regulating services are the most important services for urban respondents probably because they are associated with basic essentials for life, e.g. the air to breathe (table 18). In comparison, garden tenants give the least importance to regulating services. This contrast to park respondents might be caused by the invisibility of regulating services or lacking awareness of regulating services existing in nature. Absent the current service use, the social function of nature is the most relevant for persons asked in the gardens resulting from the association's collective motive as the basic idea. Neighbourhood relations in the garden associations that grew (partly) over several decades justify this valuation.

Among the cultural services, compensation, gardening and nature's beauty achieve the highest values equally for urban and garden areas (table 19). Urban respondents value the spiritual experience as the least important service most likely due to its intangible character. Contrasting to this, inspiration and creativity obtained the lowest value among respondents on the outskirts of Leipzig.



### Comparison of EDS perception

The perception of nature's disadvantages depends on the way people use the environment, e.g. for leisure or gardening (figure 12). Disadvantages identified beside the predefined answers do mostly not meet the requirements for EDS but are other disturbing factors. This shows that respondents are not sensitised for the topic, as it the case for the ESS concept.

### Comparison by parameter (time of the week)

During the week 50% of the respondents use only provision or provision in combination with other services, which might be seen as a replacement for work or a habit of older people that are more used to self-sufficiency that is embedded in their education and experiences (figure 13). Consistent with the current ESS use, gardening related to provision has a higher importance to respondents asked on a working day than on weekends. The current service use on weekends varies from provision to use of cultural services (optional in combination with regulating services) or the use of all services equally and shows therefore more variety.

Preferences for the use of CES are different on working days and weekends, which might be depending on the respondents' ages (table 20 & 22). Gardening and compensation as the main preference on working days contrast with the CES beauty of nature on weekends due to recreational reasons. The preferences for ESS show just little differences in values what is reasoned by the similarity of respondents' worldviews in between the study area (table 20).

### Correlations of current ESS use

The use of cultural ecosystem services or associated subservices (e.g. compensation, gardening, etc.) goes along with using regulating services. This statement is supported by a positive moderate correlation (0.576) for the entirety of interviews (table 23) and also for the study areas separately (urban: 0.561; more rural: 0.561), which underpins the reliability of the relation (table 24 & 25). The weak positive correlation between nature as a meeting point as subservice of CES and regulation itself (0.267) validates the connection stated above (table 23). The use of cultural services might go along with the appreciation of a clean and healthy environment, provided due to regulating services.

A negative correlation is present between the nature's beauty and the ESS water (-0.483) in the urban area. Respondents taking advantage of the beauty and existence of nature do most likely not use the service water at the same time. This negativity, in contrast to the positive relations mentioned above, can be explained due to the ambiguity of group allocation of water, if e.g. respondents associate water with a provisioning service instead of a regulating service. Contrary, results of the garden areas show a positive moderate correlation for nature's beauty and the use of water (table 25). Plants need water to grow and to be perceived as beautiful by the

gardeners. Gardening activity might bring these two ecosystem services closer together. A difference between the study areas is evident.

Besides the moderate values for the combination of cultural and regulating services one perfect correlation (1.0) for suburban areas is present between nature as a meeting place and the use of water. It means that respondents using the social component of nature indicate the use of water simultaneously. The small sample size should be taken into account at this point. Very few garden tenants mentioned this service and most likely addressed the use of all ecosystem services, which includes also the social component. The statistical reliability is not given because of the small sample size.

A weak negative correlation (-0.261) is evident for provision and air (table 23). If respondents mention provision as the current ecosystem service use they do less likely mention the ESS air at the same time (table 23). This connection is not present in the urban or suburban areas individually and does therefore not have a significant meaning for the study.

Among the urban respondents, two correlations between provisioning and cultural services are evident that do not appear on the outskirts (table 24): One positive correlation between provision and inspiration and another but negative one between provision and recreation. Considering the fact that just one person mentioned provision for the current use it is not a reliable result (figure 10).

Relations between two regulating services appear among garden respondents but not in the park area. The use of water and air and the use of regulating services and water are marked by moderate positive correlations which means that the use of one service goes along with the use of the other service (table 25). A sensitisation for nature's regulating services is present among the respondents, leading to the use of more than one service with regard to regulation.

Significant correlations between provision and other services in the garden areas are missing, which indicates that they were mostly likely mentioned individually.

#### Correlations for ESS and CES use in general

If respondents attach more importance to regulating services they find recreation, sports and education less important and the other way round. Also the correlation between nature as a social place and regulation is negative (table 26). This is opposing to the positive connections between regulation and CES stated above for the current use. A possible explanation is that regulating services are probably not always perceived as important even though they are used constantly. Either essential services are taken into account, which implies a broader view on ecosystems functioning or the respondent's focus aims more on his/her own subjective wellbeing (table 27). Furthermore, respondents were asked to arrange the services in a row, which leads to gradations of importance and to negative correlations.

The spiritual experience (including connectedness to nature, religious reference or yoga) is negatively moderate correlating with inspiration or creativity in both sample groups. If for instance nature connectedness is important to the respondents, inspiration is less important. Stating a clear causality between these groups is difficult because it is not clear if just nature connectedness, yoga or spirituality is addressed or if the entire group is meant.

A higher importance of provisioning services goes along with less use of the CES nature as a social place in the urban areas (and adverse). As describes above (see paragraph 'age') younger people prefer nature as a social spot among provisioning services, which is also justified by the small share of people mentioning provisioning functions in the urban park.

The same counts for the negative correlation between provision and recreation, sports and education mentioned in the urban area. Recreation is less important if provision gets higher values. But, provision in the sense of gardening might include recreation in the perception of the respondent. It depends on the people's interpretation of provision. Either the provision of food in general is assumed or the cultivation of plants for own food supply. Respondents have different interests and therefore prefer food supply among sports or recreation among gardening etc. These correlations are not present in the suburban area because of the collaborative character of the garden associations and the combination of provision and social function of nature that might be in people's mind.

Respondents giving more importance to regulating services in the more rural areas prefer less likely provisioning services (table 28). Knowing that both services are essentials for life, this correlation might occur due to the decisional character of the questions (value between 1 and 4) rather than through solid causalities.

Recreation, sports and education are negatively correlating with nature as a social place in the gardens (table 28). A clear causality cannot be derived from it. This counts equally for the correlation between the CES compensation, gardening and nature's beauty (table 26). Causality between the uses of either one or another service can just be explained due to the users' liking, rather than due to obvious connections between use and non-use of services.

Correlations appear almost exclusively between the categories of the first ranking and between the categories of the second ranking, except for the negative moderate correlation between nature as a social place, and spirituality and nature connectedness found in the suburban area (table 28). Here collective and individual actions refer for decision. Respondents that attach high importance to joint actions and social functions of nature might use individual factors (e.g. spiritual experience etc.) less and adverse.

Besides the relations between age and provision, and gender and education level, correlations do not appear between demographic parameters and ecosystem services simultaneously for current and general ESS use on a significant level.

## 5.2. Answering the research question

The sub-questions and hypothesis set in chapter 1.2. are answered and discussed below. Responses to the main research questions are given subsequently. The findings are discussed with respect to existing literature.

### 5.2.1. Sub-questions and hypothesis

One hypothesis is about identifying the relation between the importance respondents attach to ESS and CES and their demographic background. The sub-question that is answered by the following statements according to the hypothesis is:

*Are there linkages between the use of ESS and CES and the respondents' demographic data for the case of Leipzig?*

The importance of ecosystem services in this research is equated with the use of the services, equally for the current and the overall use. It is proven that the respondent's age and level of education influence the ESS use. Martín-López et al. (2012) also emphasised the relation between age and ecosystem service use; the results of the study conducted in Spain, and these of the present case show that elderly people mostly acknowledged provision as the service used. In contrast, younger respondents mostly mentioned regulating services (Martín-López et al., 2012). In the performed research young people are tempted to use mainly regulating and cultural services that contribute directly to their quality of life. Respondents with a lower level of education (in this case just school education without any further education) give more importance to the ESS provision. Martín-López et al. (2012) also identified this linkage.

The connection between the respondent's gender and the ESS use cannot be directly proven by practical findings. Martín-López et al. (2012) have proven that there is a gender-differentiated role regarding the perception of ecosystem service. Male respondents are tempted to perceive mostly provisioning services, in contrast to women perceiving mainly regulating services. This fact is reasoned by the more pronounced pro-environmental behaviour of women and different roles in agro-ecological labour focussing on men (Martín-López et al., 2012).

The relation between ecosystem disservices and demographic elements cannot be investigated by the obtained data because disservices by nature are hardly perceived by respondents. A study on community woodlands in England presented a low importance of EDS ascribed by local residents (Agbenyega et al., 2009). Local people might best comply with the surrounded environment, which explain the findings of the study in Leipzig and the one in Eastern England. Here, just the perception of EDS

is considered and not the varying background conditions of the areas. In the following, the other sub-question and hypothesis will be discussed:

*Which ecosystem services and cultural ecosystem services are used in the different areas of Leipzig?*

The second hypothesis assumes that variations of preferences for ecosystem services occur by locational change. Respondents in urban areas evidently perceive other ESS as important as respondents in more rural areas. People in the gardens on the city outskirts mainly acknowledge provisioning services per se or in combination with regulation, while urban respondents mentioned the use of cultural services itself or CES in combination with regulating services. Martín-López et al. (2012) support the assumption in a slightly modified way: Rural people mostly recognise provisioning services and urban people mostly perceive regulating services. The analysis of the mean values (table 18) show that regulating services have the highest importance in urban areas for general use, which is not the case for the suburban areas. The statement in literature is supported by findings of the case study conducted but the study by Martín-López et al. (2012) examines data from Spain and not for the case of Leipzig.

The perception of urban dwellers focuses on recreational and aesthetic values despite the essential character of food provision (Martín-López et al., 2012). The disconnection of causalities between food provision and supply for human use nowadays especially in urban areas leads to this shift in value perception.

A study based on peoples' preferences for ecosystem services and their willingness to pay for ESS conducted in six locations in Southern Spain (Almeria) showed that regulating services are the most likely perceived services, followed by cultural and provisioning services. Furthermore, significant differences in the stakeholder's view about provisioning, regulating and cultural services were identified (Castro et al., 2011). In contrast, the study in Leipzig shows that cultural and provisioning services are the most acknowledged services that participants use. Regulating services in urban and more rural areas of Leipzig are the second mentioned group of services but mentioned in combination with the prioritised service group (e.g. provision and regulation). The present service use and the general ESS use demonstrate differences, which might be reasoned by the selected sample groups. Tourists that were involved in the study in Spain, besides the local population, might perceive other ESS than residents. The participants of the study at hand were mainly locals so that the differences are reasoned by other factors, e.g. different age groups. Analogous to the findings above: The study by Castro et al. (2011) refers to another area than Leipzig but still similarities and differences can be transferred to the study at hand.

The respondent's view on ESS groups is diverse, agreeing to Castro et al. (2011). For instance, respondents on the outskirts perceive provision as own sufficiency with food by gardening while urban respondents equate provisioning in the park with an additional supply to conventional food, e.g. herbs or berries.

Castro et al. (2011) noticed more consistency in the importance attached to cultural services as for regulation or provision that showed more different options. Quite the contrary was found for the Leipzig case. According to table 9 respondents state many different options for the perceived CES while for regulation and provision one or three different groups were mentioned.

Local population in Andalusia gave a higher importance to provisioning services than tourists or workers that acknowledged just cultural and regulating services (Castro et al., 2011). The respondents in the urban areas in Leipzig assigned the lowest importance to provision but were mostly locals at the same time. Just a few tourists with a long distance of arrival were asked. The statement of Castro et al. (2011) can therefore be partly supported.

Studies on ESS for the area of Leipzig are to date very few (e.g. Kroll et al. 2011, Haase et al. 2012, Burkhard et al. 2012). Users' preferences for ESS and CES were not explicitly considered so far so that reports related to other areas were used for comparisons of the results in this subchapter.

### *5.2.2. Main research question*

The increasing demand and importance for cultural and regulating services especially in urban areas (e.g. hydropower, recreation) may induce human's encouragement to protect and maintain ecosystems and biodiversity (Guo et al., 2010). Institutional arrangements, changes in demography and climate or economic conditions put pressure to Europeans' cultural landscapes also in the background of polarizing land uses that lead to intensification in (sub-) urban areas and rural exodus (Plieninger et al., 2013; Verburg et al., 2010). The emergence of conservation measures for ecosystem services and biological variety is likely supported by human being's dependence on it. Within the scope of answering the research question, recommendations will be given how cultural ecosystem services can be better integrated in ecosystem service assessment.

*How can assessment of CES be integrated into ESS valuation in order to achieve protection, maintenance of ecosystems' values and sustainable use?*

#### Identify CES

A major problem of integrating CES in ecosystem service assessment frameworks seems to be inconsistency in definition. The basic prerequisite to measure goods and services provided by ecosystems is an operational definition that enables the creation of an appropriate classification scheme that can be used for quantification

and as a decision-making instrument (Nahlik et al., 2012). Ecosystem services are more commonly defined in literature than cultural services in particular. The only commonality among definitions of ESS and CES is the fact that they are associated with human's benefit (Kline et al., 2009). Ecosystem services and cultural services are anthropocentric notions that refer to human beings and are either equated with benefits or lead to benefits (Nahlik et al., 2012).

Cultural ecosystem services are non-material and non-consumptive outputs of ecosystems able to change or affect people's physical and mental state by physical setting, location or situations. In particular, CES are fundamentally dependent on the biotic environment and their benefits result from human's interaction with the environment (Haines-Young & Potschin, 2012; Wolff et al., 2015). They are used after the satisfaction of humans' essential needs like the need for food or clean water or air. Studies on cultural services therefore reach more informative value in regions of industrialised countries (like the study conducted in Leipzig) because essential needs are fulfilled and the attention towards these services is bigger.

Some studies identify CES as directly used services (e.g. Milcu et al., 2013) while others allocate them to indirectly used services. A categorization to indirect use values is more appropriate because of their non-material and inconsumable character. Burkhard et al. (2012) raise the question where CES, e.g. spiritual enrichment, education or recreation, are in fact consumed. It could be at the place of the supply or at the user's home so that spatial analysis is hampered.

Furthermore, some cultural services have to be seen in the context of their development in order to identify the combinations of multiple services that contributed to their existences, such as the CES recreation. It is considered as a cultural service but is actually the sum of multiple inputs. The natural setting (e.g. forest, park, etc.), human impact (e.g. built infrastructure like benches) and social input create the recreational benefit obtained (Boyd & Banzhaf, 2007). Clear group allocations schemes do not exist and still need to be developed.

For assessing CES correctly a distinction between ecosystem functions (e.g. recreation), processes (e.g. variety in landscape) and services (e.g. hobby) is necessary (Calvet-Mir et al., 2012). Functions and processes become services if they are utilised for human benefit (Fisher et al., 2009). Thus, ESS contribute to human wellbeing and would not exist without beneficiaries (Boyd & Banzhaf, 2007; Calvet-Mir et al., 2012).

Furthermore, the terms cultural services and cultural values are often confusingly used in literature. Cultural values are easily counted to CES if a precise identification is not executed (Chan et al., 2012b). A clarification is given by Chan et al. (2012b) that propose to understand services as the production of benefits, which are in turn the values for people. These values go far beyond CES and include concerns like contributions to identity formation by nature, symbolic meaning of landscapes, historically developed natural settings, sense of place, etc.

The need for regulatory measures for sustainable use of resources including ESS and the necessary extension of protection and maintenance strategies is widely recognised among the scientific society. To achieve this aim firstly ESS contributions to human wellbeing have to be quantified and communicated. Secondly, possible trade-offs between ecosystem services per se and between ESS and manmade services need to be assessed. Once the value of ecosystems and their services is identified it can be incorporated in national policies and economic decision making in order to reach the proposed objectives in protection and sustainability (de Groot et al., 2010; Le Maitre et al., 2007; Nahlik et al., 2012). The valuation of cultural services requires, as emphasised in the theory part, a special treatment. Furthermore, it needs to be clarified in valuation who is addressed, i.e. who the beneficiary is. The conducted research identified cultural services as frequently used ESS by local population in urban and suburban areas (in Leipzig) and underlined their linkage to human wellbeing (i.e. due to perception of nature). This fact calls for preservation and responsible handling of ESS but especially cultural services for the benefit of locals but also visitors and tourists.

Maintaining biodiversity is necessary to ensure ecosystem service delivery so that protection goals for preserving biodiversity count as well towards safeguarded ESS supply.

#### *User's participation*

The valuation of cultural services requires the involvement of local actors to capture besides the tangible elements also all invisible ones that are important for the region. Community involvement and participatory mapping of material and non-material supply improves the evaluation of ecosystem and landscape services (Fagerholm et al., 2012). The distribution of benefits in relation to the actual resources can be analysed, which is mandatory for landscape management and environmental protection strategies on local level. The identification of services used in a specific area enable the creation of ecosystem service bundles, i.e. a set of services that appear simultaneously in repetition over space or time that is used to analyse interactions between ESS (Raudsepp-Hearne et al., 2010a). The study at hand uses correlations to establish connections between ESS and CES uses to enable statements regarding synchronised or opposing use, which leads to similar results. Correlations between different ESS used and users' preferences are rarely analysed by now and literature exists just for a few selected areas. However, the identification of interactions and trade-offs between ecosystem services under consideration of their linked character represent broad opportunities for their inclusion in land management decision making (Carpenter et al., 2009; MEA, 2005). More comprehensive and far-reaching policies can be derived from investigations working in the described manner on small scale.



Calvet-Mir et al. (2012) identified CES in home gardens in North-eastern Spain by involving people in conversations about their sense of place or beliefs. Aspects of CES that are hard to capture by structured methods resulted from this qualitative method (Calvet-Mir et al., 2012). Qualitative investigation including respondent's education might capture CES better than standardised quantitative techniques.

The participation of social groups acting in the respective region where cultural services wanted to be analysed is indispensable. The involvement of ecosystem service users (stakeholders) and their preferences for CES give information about the dispersion of cultural services and the importance attached to them by users. The low degree and few options of replacement of CES demonstrate the necessity of their preservation and protection. Educational work is imaginable at hotspots of CES delivery, e.g. in the shape of signs, guided tours by experts for public or other offers of environmental education. The enlightening concept of protected areas, e.g. national parks, could be transferred to non-protected areas, e.g. parks in the inner city to raise people's awareness.

The unique aesthetic character of (cultural) landscapes provided by CES (e.g. aesthetic beauty, cultural heritage, spirituality or inspiration) might represent incentives for tourists and lead to economic gain for a region (Brown, 2006). To safeguard this trade sustainable tourism with respect to nature's sensitivity is required.

Van Berkel & Verburg (2014) located and quantified monetary CES (i.e. willingness-to-pay and travel cost analysis) in an agricultural landscape in the Netherlands using photo manipulations with removed landscape elements, residential infill, etc. The study combined spatial analysis and mapping, user's survey and economic quantification in order to prioritise areas for maintenance and restoration and reach the conservation of CES delivery (van Berkel & Verburg, 2014). Nonlocal population can possibly address the value of cultural services like beauty of nature, aesthetic or inspiration more objectively than locals that have a personal connection to the area. The conducted study in Leipzig shows that people use and prefer different CES (and also ESS) in the present moment than in general. A differentiation between these two cases is rarely done in recent literature, but might give more specific information to users' preferences. This information is helpful for integrating cultural services and values in ESS assessment frameworks and to validate the results obtained regarding service use.

On the other side, ecosystem service user's participation also includes the risk that the obtained benefit is not connected with underlying ecosystem functions by the user (Castro et al., 2011). Ecosystem services might therefore be wrongly addressed and, in a broader sense, quantified inaccurately. Observations made during the research in Leipzig show the insecurity of allocation for the ecosystem service water to a certain group. Furthermore, wrong interpretations of users' statements regarding the classification might result in misleading assumptions. The danger of

underestimation or false quantification of environments' values cannot be avoided completely due to people's involvement. Castro et al. (2011) propose an integrative approach for ESS accounting that cover more than the social and economic dimension and also include all other dimensions (e.g. ecological, biological) that contribute to the preservation of the social-ecological system. It is questionable what unit in measurement would be used for a combined approach. The scale of evaluation might be diverse according to different disciplines and need to be 'calibrated' before summarising and comparing.

A shift from monetary and biophysical analysis applied today towards the inclusion of ecological, socio-cultural and monetary perspective helps to consider stakeholders' positions and the incorporation of intangible cultural services (e.g. by socio-cultural preferences) (Fagerholm et al., 2012; Martín-López et al., 2012; TEEB, 2010). Among all existing approaches varying from ecological, cultural-social (stakeholders seen as beneficiaries) and economic (values estimation of market and non-market values) assessment methods, the capture of users' preferences for ESS in combination with socio-economic information present the most appropriate way to address cultural ecosystem services. The identification of importance of services by quantity or distribution of use by beneficiaries might support environmental policy decisions on local and regional level best (Castro et al., 2011). Promoting of the public's understanding and rising of people's awareness for nature's supply of ESS and CES leads to a better understanding of environmental management and supports the evolvement of new nature conservation models that ensure human wellbeing (MEA, 2005). By recognising CES preferences in an area, bundles and hotspots of their use can be identified. Areas of specific importance for CES supply can therefore be better determined and protected (e.g. due to marking of protected areas).

Upcoming approaches using mapping via smartphone application result in subjective (i.e. due to varying personal perceptions and preferences) and selective outcomes (i.e. reasoned in the need for suitable technical device and person's interest in downloading). Advantages of this method of data acquisition are the large radius of obtained information in a relatively short time compared to face-to-face interviews and the simplicity and cost-effectiveness of gathering information. Applications focus increasingly on human perceptions and their feelings connected to the location of interest.

Especially in the background of increasing urbanisation in industrialised countries the factor of happiness become more important, which is influenced by intact ecosystems and continuous ESS and CES supply. A contrary theory implies that human action indeed causes changes to the world's ecological system but tracing back from environmental degradation leading to reduced human wellbeing is not finally proved. Nevertheless, it is evident for some places (Raudsepp-Hearne et al., 2010b). Alienation from nature of modern urban society (e.g. due to technology,

food industry, etc.) is a risk factor to research involving human's participation. The considering of relevance of obtained answers with regard to bias caused by natural disconnection of people is necessary previously to the evaluation of results.

The capture and assessment of cultural ecosystem services due to the inclusion of users perception holds methodological challenges. Subjectivity or egocentricity in requirements for landscape cannot be bypassed and are unavoidable part of the data collection. In some cases scientific standards might not be fulfilled due to this issue (Plieninger et al., 2013b).

Obviously, user's participation in valuating cultural services is a strategy with pros and cons but need to be considered for full value accounting in order to reach maintenance and sustainable use.

### *Incorporation of CES*

To assess CES adequately the cultural dimension of ecosystem services need to be incorporated in assessment framework in order to evaluate all ESS groups adequately and to overcome the weak social pillar of the ESS concept. A simple addition of CES to existing frameworks for assessment of material values might not be sufficient. The rethinking of the ESS concept as a whole including adaptations and changes to enable a balanced assessment for CES in combination with provisioning and regulating services would pave the way towards comprehensive ecosystem service assessment (Chan et al., 2012a). The variations in the general understanding of culture as part of the term CES with regard to the place in the world should be taken into account. For instance and depending on the study area (and the respective continent or country) religious or spiritual values might be more relevant than natures' aesthetics or recreational matters might overweigh the cognitive functions received by nature or others.

Cultural ecosystem services might be better addressed through demand side mapping and a minor involvement of the supply side of services, justified by their intangible and non-consumptive character. Provisioning and regulating services can be better addressed due to supply side capturing and are easier to quantify. The CICES scheme is by its origin a tool that is more appropriate for mapping than for assessment (Haines-Young & Potschin, 2012). The detailed fragmentations support service identification but associated values (e.g. in economic, ecological or other terms) are not included, which impede assessment. ESS use can be quantified but for their valuation additional information need to be included, e.g. PES, travel cost method or avoided damage costs.

People's perception of ecosystems and their services and value allocation might be different from the values that policy makers or economists attach to ESS (Kumar & Kumar, 2008). Therefore and especially for the assessment of cultural ecosystem services the participation of local population and service users in the respective region need to be combined with expertise of decision makers to achieve a well-

balanced evaluation that represents the interests of all stakeholders. Conflicts in land management can be avoided if the relevant cultural services are identified previously to policy resolutions.

Monetary valuation of ESS is the easiest and most likely comparable method for accounting but holds challenges for cultural ecosystem services. Different methods like ranking of importance of CES or value allocating to services that can be subsequently transferred to quantifiable terms might contribute to an adequate incorporation of CES.

Protection and maintenance of CES on a small scale can be achieved by strengthening the environmental awareness. Ecosystem service users protect what they know about and perceive as worth protecting. With regard to the result that the ESS concept is not familiar to many respondents in the area of Leipzig, efforts in environmental education (e.g. information boards, campaign days, events or presentations) will result in more consciousness towards user's contribution to maintenance and protection of cultural and other ecosystem services that pave the way for a sustainable handling with sensitive ecosystem services.

Development goals and multinational strategies (see chapter 1.1.1.) target the reduction of negative impacts on resources, biodiversity and ESS and their protection but have to be communicated comprehensibly with society in the sense of stakeholder's involvement.

### 5.3. Limitations of research

#### Method discussion

Generally speaking, a higher quantity of samples or interviews leads to more reliable statistical results and supports the representative character of the findings. A sample size of 66 is a feasible size for the research with regards to the duration of the data collection phase and the fact that one interviewer was on-site. Nevertheless, a plus in quantity would enable more comparisons also between respondents in one study area.

The method of conducting short quantitative interviews at the spot of the ecosystem service use is appropriate for the results that wanted to be received. The guiding of the respondents through the interview enabled the direct answering of interposed questions that came up.

Several studies (e.g. Castro et al. 2011) connect the analysis of users' preferences with an investigation of the user's willingness to pay for the maintenance of the ecosystem. This additional point is important for decision and policy makers and would increase the informative value of the research.

The focus of the applied method lies on the supply of services for human benefit and is marked by an anthropocentric view. A shift of this focus towards nature conservation would include the maintenance of service delivery but avoid at the

same time the missing out on environmental risks or threshold underestimation. A broader survey including expert interviews and specialist's advice additionally to interviewed service users facilitates research towards maintenance and protection strategies.

#### Application discussion

The application of the interviews is discussed in detail below:

- Changing the parameter 'weather' was not possible because people rarely spend their time outside under bad weather conditions. People would rather stay at home or in their garden shed. A data collection phase over several months would be a chance to record also data of respondents at bad weather. Even if very few participants will be encountered a sufficient quantity of interviews would be reached over a longer time period.
- The statements about the frequency of visits imply that weather is good and that the season of the year is adequate. Including winter month into the accounting of the survey would distort the frequency of visit.
- A direct comparison between rural and urban preferences for ESS cannot be given by this research because the public gardens are located at the city borders and therefore do not have an exclusively rural character. Instead of this, an analysis of differences between urban and suburban green areas was enabled.
- The differences of respondents' age groups in *Clara-Zetkin-Park* and the two allotment associations hinder a direct comparison between users' preferences with the same demographic parameters. Statements regarding service use and demographic elements of participants for the respective areas are made instead.
- The information with regard to the respondents' education would be more specific if the obtained certificate or qualification would have been recorded. The label 'further education' gives no information about the type of qualification or the visited institution. It cannot be said whether respondents took or take part in vocational training, went or go to university or finished any other course of education. On the other hand, a more detailed survey could result in less data if demanded details are too intimate in the respondent's opinion.
- Furthermore, the ambiguity of group allocation of ESS represents one source of error in the research conducted. Some ecosystem services might have unclear meanings and are therefore hard to classify, especially for laypersons. Water as an ESS has the highest degree of uncertainty. According to the CICES it can be classified as a provisioning service as surface or groundwater for (non-) drinking purposes, as a regulation or maintenance service in the hydrological cycle or for protection of water conditions, or as a cultural

service as the value of existence or in form of physical, intellectual or spiritual interaction. Also the provision of food might be assumed by respondents in the sense of self-sufficiency or the general supply of food. To categorise respondents' answers correctly more knowledge or more detailed tables for ESS groups could be provided. The realisation in the form of a short interview is questionable because the attention span of participants is restricted to a certain period. Adding illustrations to support the comprehension of the ESS concept and the group classification is imaginable. In general, if the interview is too specified or too long it could lead to a lower degree of willingness to participate in the interview.

- The listing of mean values gives an overview of the highest score given to an ESS in average but does not consider the individual perception that may vary between the highest and lowest values. By asking participants to rank services by positive values pre-written positive statements will be achieved that might distort the results due to overestimation of valuation given (Calvet-Mir et al., 2012).
- The grouping of services, e.g. for recreation, sports and education, in one larger group impede a separation in the analysis afterwards but is applied for reasons of simplicity and understandability in the interview.
- The relation between ESS use and gender could have been investigated more deeply. These connections did not appear in the correlations conducted and need other methods and possibly a higher quantity of samples in order to be identified and to be statistically meaningful.
- EDS are considered in the interview but the statements given cannot be analysed any further due to an insufficient quantity of samples. The exclusion of the option 'no disturbance' would demand people's answer to that question and result in more quantity of responses that can be brought to further analysis afterwards. The study conducted focuses more on the goods provided by nature than on environmental disservices. If the term EDS had been explained in advance to the respondents (e.g. as for ESS), answers would have possibly been more directed to EDS than on any other (manmade) disturbances.

The interview guideline could be used for surveys in other locations with a similar environmental setting (i.e. temperate climate, interior of country, lowland) and within the same cultural circle. The values respondents attach to nature and services, and their worldviews are likely to be similar. The existence of allotment gardens in an area to compare is required to ensure analogy. The transferability of the interview guideline to other countries, e.g. the Netherlands, is therefore given, provided that an appropriate translation is given. Results are expected to be alike if local population visiting comparable spots in a city of equal size is asked (i.e. park

close to city center or gardens in suburban areas). A higher degree of environmental awareness that is imaginable in the Netherlands, owed by a divergent educational system, leads to a better identification of ESS and CES, which would possibly modify the results with regard to better group allocation or more variety in answers to the current ESS use.

The results obtained from the interviews give an idea of wellbeing aspects of the respondents. For combining socio-economic factors with the preferences for ESS and CES more economic data is required. An inclusion of economic data (e.g. income) would enable a socio-economic analysis and therefore create the linkage to welfare aspects.

## 6. Conclusion

In summary, preferences for ESS and CES are developing, as proven in the study in Leipzig, under the influence of respondent's age and education. Provisioning services were more important to elderly people in suburban (garden) areas compared to respondents in the urban park that were of younger ages, had a higher educational level and attached the greatest importance to CES. Regulating services in combination with either provision for the (suburban) gardens or with cultural services in the (urban) park had the second highest importance in the respective area. Divergent preferences for ESS in urban and suburban areas are therefore present. ESS users in Leipzig identified more CES than services of other groups (i.e. regulation or provision). Differences are evident between the ecosystem service use in the present moment of interviewing and the overall importance respondents attach to ESS and CES. Tendencies for simultaneous or opposing use of ESS and CES were identified by correlations. The key finding thereof is that the current use of CES (or subgroups) and regulating services (or subgroups) is positively correlating but marked by negative correlations for the general use. Anyway, the correlations found between ESS and CES for the general use are without exception negative. The conducted study showed how preferences for ESS could be identified by stakeholder's participation.

Defining and identifying CES correctly is the main obstacle that needs to be addressed before measurement and valuation. Afterwards, the integration of the value of CES in ESS assessment frameworks can be reached through combination of various methods of capture, e.g. identifying hotspots of service delivery, spatial determination of service supply and mapping, and economic value capture due to respondent's involvement. This enables the inclusion of cultural services and values. Even though user's participation does not lead to objectivity of responses and might hold inherent bias, it is necessary for CES assessment, which represents the basis for protection and preservation strategies as well as for sustainable consumption of these services. A full value accounting can just be reached by the involvement of all stakeholders benefiting from the addressed cultural services.

A better mediation of knowledge between science and public and the preparation of knowledge for the society leads to more attention in environmental concerns. The maintenance of ecosystem services and also measures for environmental protection can be forwarded by involvement of the public.

Sustainable use of resources, e.g. ESS or CES imply the identification of values provided to human beings but also the capture of the meanings of ESS for the environment to not harm or further degrade the surrounded environment. Especially urban areas are highly dependent on ecosystems' benefits due to their intense relation to human wellbeing and also, to economic welfare. Intended protection and



maintenance strategies are anchored in development goals on a global and national level, but a regional adaptation is necessary in order to succeed in the long term.

#### Recommendations for further research

Ecosystem disservices were hardly identified in the study areas in Leipzig and need further investigation in order to give statements based on statistical results. Extended research on ecosystem disservices that captures not just disturbances for human being but also risk factors for ecosystems (e.g. measuring the reduction of ecosystem service provision) is necessary to better identify and locate hotspots of ecosystem degradation.

Qualitative interviews in the same or a comparable study area (see chapter 5.3.) would result in more in-depth identification and capture of CES and make service use visible that is not noticed at first sight (e.g. sense of place, identity formation by nature, cultural heritage, etc.).

The connection between ESS preferences and gender was emphasised in literature (e.g. Martín-López et al., 2012) but was not evident in the study area at hand. The next step could be to find another study area with same attributes (i.e. geographical, climatic and cultural conditions) and to check the results obtained in Leipzig against findings in another city or another country. Spatial differences in the importance of CES can be investigated.

The specific importance of cultural values, e.g. sense of place, identity formation, historical values, etc., can be further investigated in either the same or a comparable area. A qualitative method with an explanatory character would support the identification and capture of these values.

In general, CES research has more relevance in industrialised countries so that investigations in these areas are more reasonable than in areas with different economic and societal preconditions.

As indicated in the introduction, cultural ecosystem services in the context of ESS assessment frameworks need an innovative accounting system, which includes the entirety of intangible and invisible services and values supplied by nature. The development of a new framework that addresses all ecosystem service groups adequately has not yet been developed and is a mission of further research. Suggestions and ideas given in this report could serve as a starting point for this task.

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## Appendix 1: Interview guideline

1

Interviewnummer:

Untersuchungsgebiet: ☐ KGV ☐ Clara-Park

Datum/Wochentag/Uhrzeit:

### Interview-Leitfaden (Masterarbeit, Josephin Helka)

Im Rahmen meiner Masterarbeit im Studiengang ‚Nachhaltige Entwicklung‘ (Universität Utrecht) führe ich einige Interviews zum Thema Nutzen und Nutzung der Natur durch. Es dauert ca. **10 Minuten**. Natürlich werden die Daten anonym ausgewertet. Wären sie bereit mich bei der Datenerhebung für meine Abschlussarbeit zu unterstützen?

1. Wie gefällt ihnen die Natur in der sie sich gerade befinden?

- ☐ sehr gut
- ☐ gut
- ☐ egal
- ☐ nicht besonders
- ☐ gar nicht

2. Wie oft verbringen sie ihre Freizeit in dieser Natur?

- ☐ Täglich
- ☐ mehrmals pro Woche
- ☐ mehrmals pro Monat
- ☐ einmal pro Monat
- ☐ seltener/ nie

*(vorlesen) Haben sie schon einmal von Ökosystemdienstleistungen gehört?*

*Ökosystemdienstleistungen sind Leistungen, die die Natur bereitstellt. Diese Leistungen bezeichnen, was Menschen von der Natur in Anspruch nehmen, um davon zu profitieren. Dabei handelt es sich z.B. um Versorgungsleistungen (Früchte, Holz), Regulierungsleistungen (frisches Wasser, frische Luft) oder kulturelle Leistungen (Erholung, Sport in der Natur).*

3. Welche Ökosystemdienstleistungen nehmen sie in diesem Moment in Anspruch?

---

4. Welche Distanz haben sie zurückgelegt um diese Leistung der Natur in Anspruch zu nehmen?

- ☐ < 1 km
- ☐ 1-5 km
- ☐ 6-10 km
- ☐ 11-15 km
- ☐ 16-20 km
- ☐ 21-25 km
- ☐ 26-30 km
- ☐ > 31 km

5. Wie wichtig sind Ihnen Ökosystemdienstleistungen im Allgemeinen?  
Geben Sie in den Tabellen eine Wertung (in Punkten) für die aufgeführte Ökosystemdienstleistung an (4 Punkte = sehr wichtig, 3 Punkte = wichtig, 2 Punkte = eher unwichtig, 1 Punkt = unwichtig).

*Bedeutung und Zustand der Natur*

Ökosystemdienstleistung	Wertung (1 bis 4)
Versorgung (Gemüse, Früchte, etc.)	
Regulierung (frische Luft, Wasser)	
Erholung, Sport, Bauen in der Natur	
Natur als sozialer Ort (Grillen, Picknick etc.)	

*Philosophie der Natur*

Ökosystemdienstleistung	Wertung (1 bis 4)
Inspiration, Kreativität (Ideen, Motive zum Zeichnen etc.)	
Ausgleich zum Alltag, Gärtnern, Pilze sammeln etc.	
Spirituelle Erfahrung (Naturverbundenheit, Yoga, religiöser Bezug etc.)	
Schönheit der Landschaft, Ästhetik an und für sich (Existenzwert)	

6. Was stört Sie am meisten in/an der Natur, die Sie umgibt?

- ☐ Schatten
- ☐ Stechmücken, Insekten
- ☐ Lautstärke (Frösche, Vögel)
- ☐ Tiere, die Ernte fressen
- ☐ Dunkelheit (Angst, Unsicherheit)
- ☐ Keine Nachteile/ stört nicht
- ☐ Sonstiges: \_\_\_\_\_

7. (Nicht vorlesen) Verraten Sie mir Ihr Geburtsjahr?

19\_\_

8. Wie viele Jahre haben Sie nach der Grundschule die Schule besucht?

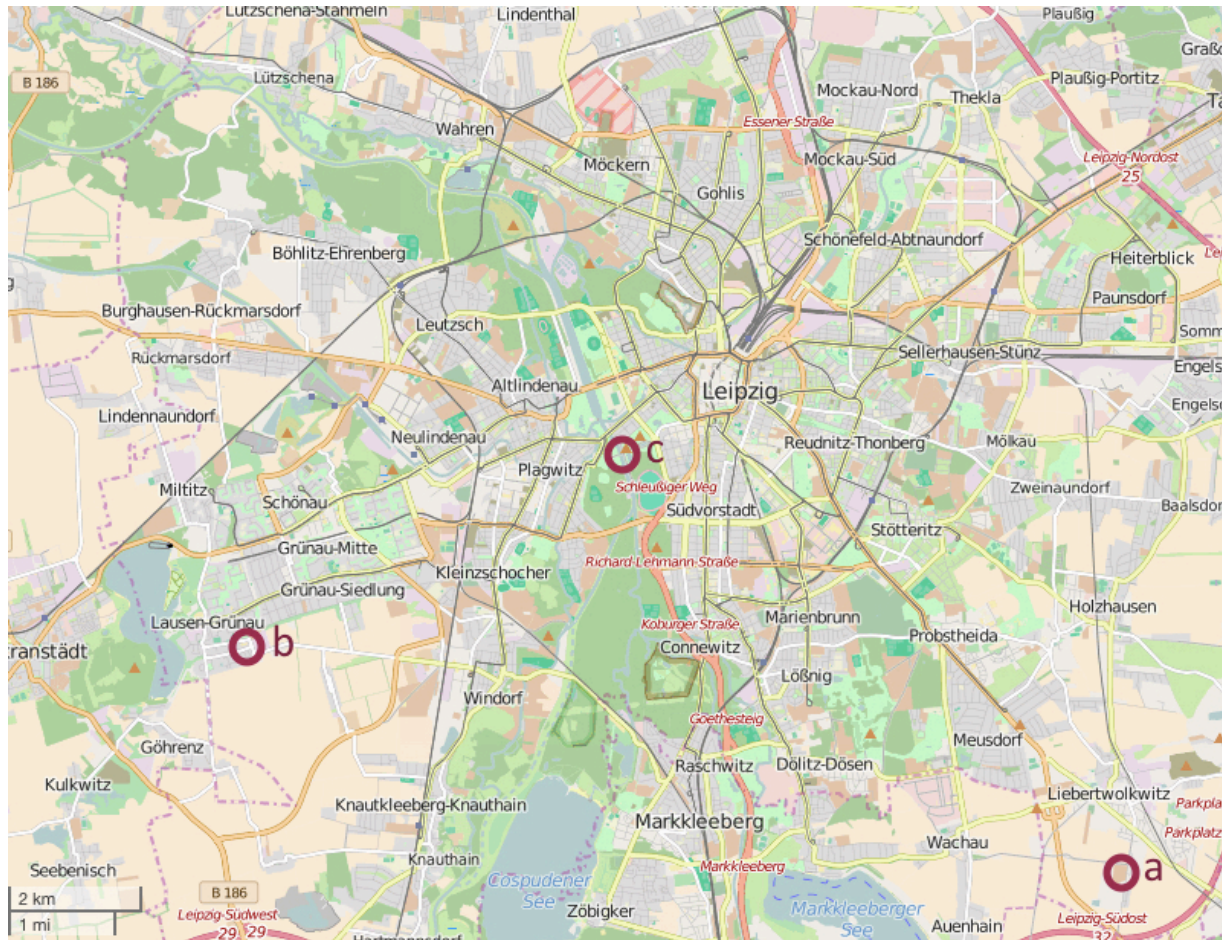
- ☐ 0-5 Jahre
- ☐ 5-8 Jahre
- ☐ weiterführende Ausbildung (Studium, Berufsausbildung, etc.)

9. (Nicht vorlesen) Geben Sie Ihr Geschlecht an.

- ☐ Männlich
- ☐ Weiblich

Vielen Dank für Ihre Zeit und Aufmerksamkeit!

## Appendix 2: Map of study areas



Source: Retrieved from <http://www.openstreetmap.org/> on 22.03.2016

Legend map:

Study area a: Allotment association *Naturfreunde e.V.*, Störmthaler Str. 60, 04288 Leipzig

Study area b: Allotment association *Sommerland Lausen e.V.*, Zschochersche Allee 76, 04207 Leipzig

Study area c: *Clara-Zetkin-Park, Sachsenbrücke*, Anton-Bruckner-Allee 50, 04107 Leipzig

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## Declaration of Authorship

### Declaration of Authorship

I, Josephin Helka, hereby certify that this thesis has been composed by me and is based on my own work, unless stated otherwise. No other person's work has been used without due acknowledgement in this thesis. All references and verbatim extracts have been quoted, and all sources of information, including graphs and data sets, have been specifically acknowledged.

This paper was not previously presented to another examination board and has not been published.

Date and place:

Leipzig, April 8<sup>th</sup> 2016

Signature:

Josephin Helka