

How exposure to ecosystem services affects human health?



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How can we identify and use ecosystem services to stimulate human health and wellbeing in an urban context?

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Foreword

During the international minors at the CAH Vilentum Almere students have been obliged to do a research. The final product of this course is a thesis. The students are responsible to come up with a related subject which fits in the curriculum of the course.

I, Erik Essink, have studied Nature, Economics and Living Environment. During this course I am inspired by sustainability. This is a very wide concept and covers lots of dimensions. During this research I want to look for a different approach of sustainability. I would like to approach sustainability on a way green environment contributes to a sustainable future. In this way I want to make a connection between the international minor Urban Dynamics and Rural Innovation. The research will cover both fields as well urban- as rural space.

This research is something which I could not do totally on my own. During my search for a good internship I made contact with one of the professors of Utad (Universidade De Trás-os-Montes e Alto Douro in Villa Real, Portugal). Luckily I could change my internship into my thesis subject, and could use the information for both. First of all I would like to thank professor Edna Cabecinha (environmental engineering) for her support and to make it possible to organize this opportunity. Further I would like to thank the next persons:

- professor Ronaldo Gabriel (sport science) for his help and provision of information.
- Pedro Silva-Santos (Noctula) for helping and using the right articles and keep the project focussed.
- The people which were involved during the field work and the practical weekend we had in de GEOPark.

For coaching I would like to thank Jan Jorrit Hasselaar, it was a pleasure to work together.

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Summary

The human population in the world is growing every year. The growth will occur mainly in the urban regions. Scientists estimate that in 2050 three quarters of the population will live in an urban setting. (Hanskia, et al., 2012; Pearson, 2014) This causes a rise in illnesses in city environment. People in an urban setting easier suffer from chronic inflammatory disorders for example allergic and other auto immune diseases.

It may be well known that greenery has lot to offer for health and wellbeing (quality of life). Many scientists have proven a beneficial relationship between health and wellbeing (Maas J. B., 2010; Assessment, 2005; G, 2009; Health Council of the Netherlands & RMNO, 2004). Less clear is the influence of the contribution ecosystem services has on health and wellbeing. Lots of articles refer that there has not been enough research in these subjects, for example Ding Ding and Gebel Klaus refer to more research to possibilities for assessing the natural recreate environment (Ding. D, 2012), Paul Blaschke also refers to a better tool to evaluate the natural environment:

“Public health decision-makers might use the review to justify a demand for more rigorous and objective evaluation of interventions which aim to use the natural environment for health promotion. Further research is necessary to investigate whether comparable effects are observed in different populations, environments and social contexts, and the longer-term significance of repeated exposure on health. Policy makers should therefore be wary of translating the findings of studies which have been conducted only in specific settings, for defined indicators and subjects, into generalised statements of universal benefits” (Blaschke, 2009).

This is why I chose in this research to investigate the relationship between the ecosystem services and the health and wellbeing (specified in the four diseases). This research can be seen as a preparation on the main research done by Utad (Universidade De Trás-os-Montes e Alto Douro in Villa Real, Portugal).

This research is based on four non-communicable diseases, namely: Depression, Diabetes, Heart diseases and Obesity. There has been done a lot of research in these non-communicable diseases. In the main research these diseases have been chosen because of the strong relationship between these diseases; they are related to each other by strong ties with the metabolic syndrome.

Desk research has shown that lots of scientists refer directly to health and wellbeing (Maas. J, 2009; National Park Service U.S. Department of the Interior, 2013; Russel, et al., Humans and Nature: How Knowing and Experiencing Nature Affect Well-Being, 2013). In that researches health and wellbeing has been used but not as a first priority. Health and wellbeing is a very abstract form of concluding a direct health benefit.

This research has tried to find direct benefits connected to the diseases.

In the literature, I investigated, I found a strong relation between physical exercise in a green environment and the human health. It can even be specified to the diseases. A green environment offers high beneficial effects on the four mentioned diseases. Exposure to a green environment makes people de- stress/ relax because it distracts peoples mind. Therefore they do not think about their daily stress. Unstressed people show a lower heart rate (blood pressure) than people with a lot of stress. A high heart rate causes a bigger chance on heart related diseases and depression.

A green environment has a lot to offer to people with diabetes. In average people with diabetes cannot handle high temperature very easily. Green environment may also be known for their cooling effect of a small area. But the green environment not only cools down, it also causes a better balance in glucose and insulin level because people are active in a green environment. People with low physical activity have a higher risk on heart diseases and obesity.

Physical exercise in a green environment stimulates health and wellbeing. Physical activity, three to four times a week, significantly reduces the chance on this diseases. These exercise should have a duration of 30-60 minutes per time. In most of the related articles scientists refer to this amount of time. It depends on the person how intense the physical exercises can be.

For city planners en politicians it should be helpful if they could dispose of a practical tool that can show which ecosystem services are beneficial for health and wellbeing. During this research a grid has been developed as a first step to an easy to handle tool. With such a tool they can make better plans for a green environment.

The grid gives a good indication which ecosystem services stimulates health and wellbeing (related to the diseases). This report already gives a guideline for park developers about how to integrate a stronger health aspect in future plans. They can also use it for the already existing parks and nature areas.

The main message of this research is to make people healthier by the use of ecosystem services. The most important is the physical activity of people confederate to a natural environment.

1. Introduction

During the course Nature, Economics and Living environment I discovered that urban settlements have to be developed with care and every single project is different. But a few things are coming back every time. Sustainability is one of them. Nowadays it is so important, because it is a never ending process. There are always better solutions for new innovations. Sustainability can be interpreted in several different ways. The most common definition is the one conceived by the United Nations in the report published in 1987.

Sustainable development can be defined as: *Development that meets the needs of the present without compromising the ability of future generation to meet their own needs* (United Nations WCED, 1987).

It is important to take in account the future generations. And if green is the source to keep people healthier we should use it in a better way. An effective planning system, with good guidance is necessary to develop the right places. This is an important contribution to prosperity and growth. It ensures that poorly designed developments of urban environment and those in the wrong places don't get built. It delivers the new homes, shops and services that communities want. It protects the things that concern to all of us; from open spaces, green fields and productive agricultural land to historic city centres, towns and villages. Scientists expect three quarters of the world population will live in an urban environment by 2050 (Hanskia, et al., 2012; Pearson, 2014). With this growth exportation it is even more important to create the right green environment in and around cities. For this research we have formulated the following research question:

How can we identify and use ecosystem services to stimulate human health and wellbeing in an urban context?

Green is not only pretty but it also contributes to human health. In the past there has been found evidence that green spaces in urban environment can improve life expectancy and decrease health complaints

"There is more direct evidence that green space in an urban environment can improve life expectancy and decrease health complaints. Much of this is thought to be due to a favourable environment for people to exercise" (Bird, 2004).

There has been done a lot of research in green environment in relationship with human health:

- The influence of nature on social, psychological and physical well-being (Health Council of the Netherlands & RMNO, 2004)
- Green space, urbanity, and health: how strong is the relationship (Maas, et al., Green space, urbanity, and health: how strong is the relation?, 2006)
- Health and wellbeing benefits of conservation in New Zealand (Blaschke, 2009)
- Human and nature: how knowing and experiencing nature affects well-being (Russel, et al., Humans and Nature: How Knowing and Experiencing Nature Affect Well-Being, 2013).

With the rural growth exportation, three quarters of the population will live in an urban setting by 2050. It is even more important to understand the prevention of illnesses in a city environment. Green has a lot to offer for recovering of diseases.

It has been confirmed that green has a positive influence on human health and wellbeing. “This research has shown that the presence of green space in people’s living environment has an important effect on health. The causes of this effect remain unknown, however. As stated above, previous research has mainly focused on showing the relationship between exposure to green environments and wellbeing. The dominant theories in the field all consider stress reduction and attention restoration as a central causal mechanism” (Maas, et al., Green space, urbanity, and health: how strong is the relation?, 2006).

So to make sure our future generation also can make use of a healthy environment, a sustainable approach is needed, considering the interactions between the services from the healthy ecosystems that stimulate health and wellbeing.

This report is structured in different chapters. To make it clear what the topic is about there will be started first with an introduction of the problem. In this chapter will be explained what the problem is and why it is important to investigate. First of all the term ecosystem and ecosystem services will be explained. After this chapter the focus will be on the four diseases. Second what is the underlying relation between them. This will be discussed in the chapter about non-communicable diseases. After that I will focus on the disease itself and the relationship with the green environment. After all it will be clear that physical activity plays a key role in this research. And finally the final product the grid will be explained in chapter about the grid.

1.1 Problem description

As written in the introduction, green contributes to a healthier environment. Several scientists have proven this (Blaschke, 2009; Maas J. B., 2010; Health Council of the Netherlands & RMNO, 2004). But still unknown is what actual causes this benefits. What in a green environment makes people do relax and recover easier from diseases? And which kind of ecosystem services can help to improve the recovery? These still are questions scientists cannot answer and ask for more research. People often don't even realize the benefits they get from exposure to a green area.

There are several models showing the relationship between green environment and human health and wellbeing (AmyM.Villamagna a, 2013; Blaschke, 2009; Health Council of the Netherlands & RMNO, 2004). But these models are still abstract. They mostly show an input and an output, but what actually causes those outputs? The methodology is often not clear or unfinished. The models show steps in a process but they don’t show which steps lead to which outcomes. No research has been done which shows the connection between different ecosystem services and the direct effect on human health and wellbeing.

There is still a gap in the knowledge, since we still don’t know which elements in green/ecosystem services help people recover from certain diseases like stress or obesity (there are only some strong indicators). It is a well-known problem at scientists and there are different reports referring the need for more research in this subject (Russel, et al., Humans and Nature: How Knowing and Experiencing Nature Affect Well-Being, 2013; Maller C. , et al., 2009).

If we can understand what causes the health and wellbeing benefit of green, we maybe can change our green structure plans to a more sustainable approach. In the last decade there has been an increase for example in, depressions, obesity, heart diseases and diabetes, often caused by a bad lifestyle.

1.2 Target group

It is obvious that planning and accessibility of green in an urban setting is essential to provide possibilities for people to make use of the eco system services. With the result of this research an important step has to be made for city planners, policymakers, municipalities and governments. It should help them to make a better plan for a green environment and check the existing green environment for health benefits for the mentioned diseases. With the right approach and green structure people can recover more easily and faster and save cost in health care (KPMG Advisory N.V. is a subsidiary, 2012).

1.3 Literature research

The current research is a literature research. Done to see what the available literature says about the relation between health and wellbeing and ecosystem services, because there is a lot of reference in the literature. This research can be seen as a preparation on the official research done by professors: Ronaldo Gabriel, Edna Cabecinha and Maria Moreira, which will be published in October 2014. In the main research the relationship between four diseases and ecosystem services will be investigated in a practical situation. In that research the focus is on the four non-communicable diseases: Depression, Diabetes, Obesity and Heart diseases, because these diseases often occur in urban environment and they provide the number one cause of death worldwide. Furthermore a lot of research has already been done in this diseases. That's the reason why in my research I will focus on the same four non-communicable diseases: Depression, Diabetes, Obesity and Heart diseases. Because of the big variation in diseases I have chosen to do research in general aspect. For diabetes I made a very conscious choice for type two of diabetes. I made this choice because for type one people are dependent on insulin injection or medication. This has a big influence on their performance in nature and in an urban setting.

The main focus first was on obesity. Later on I decided to add more diseases to have a better overview of the beneficial effects of green. This is why obesity is worked out much more than the other diseases. It also explains a lot of points in this chapter which later on will be used in other chapters.

During this thesis I will try to understand which kind of "green" ecosystem services can contribute to improve the health and wellbeing related to the above four mentioned diseases.

The main question in this research is:

How can we identify and use ecosystem services to stimulate human health and wellbeing in an urban context?

I specify the main question in sub questions: four related to the diseases and two in general:

- What kind of beneficial effects has an ecosystem services on obesity?
- What kind of beneficial effects has an ecosystem services on depression?
- What kind of beneficial effects has an ecosystem services on diabetes?
- What kind of beneficial effects has an ecosystem services on cardiovascular disease?

During this thesis I will investigate the relationship between the nature and green environment related to human health and wellbeing. I will look for answers on questions like: what kind of benefit does green give for specific diseases. We will specify this on ecosystem services which are beneficial for depression, diabetes, heart diseases and obesity. By doing this we will help to create an instrument that can be used in the future by city planners to plan nature in urban settings to improve the human health on a natural way, and so the quality of life. The basis of this instrument will be a grid which shows the ecosystem services which have a positive contribution to the mentioned diseases. This grid will be based on the available knowledge.

With this grid a start will be made to close the gap in the knowledge and will make an interconnection between a lose information that exists of health related to the green environment. This grid will be a basis for a new theoretic methodology which can be used to employ the green as a medicine and tool to recover in a natural way.

2. Ecosystems

An ecosystem can be defined as the most basic level of a natural unit of living things (animals, including humans; plants; and micro-organisms) and their physical environment (DEFRA, 2007). Ecosystem can be territorial or marine, inland or coastal, rural or urban. They can also vary in scale. There are small local ecosystems but there are also large national and international ecosystems. Examples of international ecosystems are; coral reefs, desert and rainforest. On local level it is better recognised as woodlands, grassland, marshes, heathland, rivers, peat bogs, rocky shores (DEFRA, 2007).

2.1 Ecosystem services

All of the humanity uses ecosystem services daily (for example). But what are they? Ecosystem services can be defined as: “the benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as regulation of floods, drought, land degradation and disease; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious, and other nonmaterial benefits” (Assessment, 2005).

In addition to this definition there is no clear explanation of an ecosystem service. There is a framework designed by Millennium Ecosystem Assessment which divided ecosystem services in different categories:

- Provisioning services – the products obtained from ecosystems, including fresh water, food, fibre (e.g. timber, cotton, wood fuel), genetic resources, biochemicals, natural medicines and pharmaceuticals (Assessment, 2005)
- Regulating services – the benefits obtained from the regulation of natural processes, including air quality regulation, climate regulation, water/flood regulation, erosion regulation, water purification, disease and pest control, pollination, buffering pollution (Assessment, 2005)
- Cultural services – the non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic enjoyment (Assessment, 2005)
- Supporting services – the services that are necessary for the production of all other ecosystem services, including soil formation, photosynthesis, primary production, nutrient cycling and water cycling. These ecosystem services in turn provide a range of benefits that support human health, wellbeing and prosperity (Assessment, 2005)

These categories are connected to a conceptual framework, designed by Millennium Ecosystem Assessment. Within this framework there is shown how ecosystem services are beneficial and how it contribute to the health and wellbeing of the humanity. Figure one this figure includes health, the health related subjects they mention here is just a small amount of benefits an ecosystem can provide health and wellbeing.

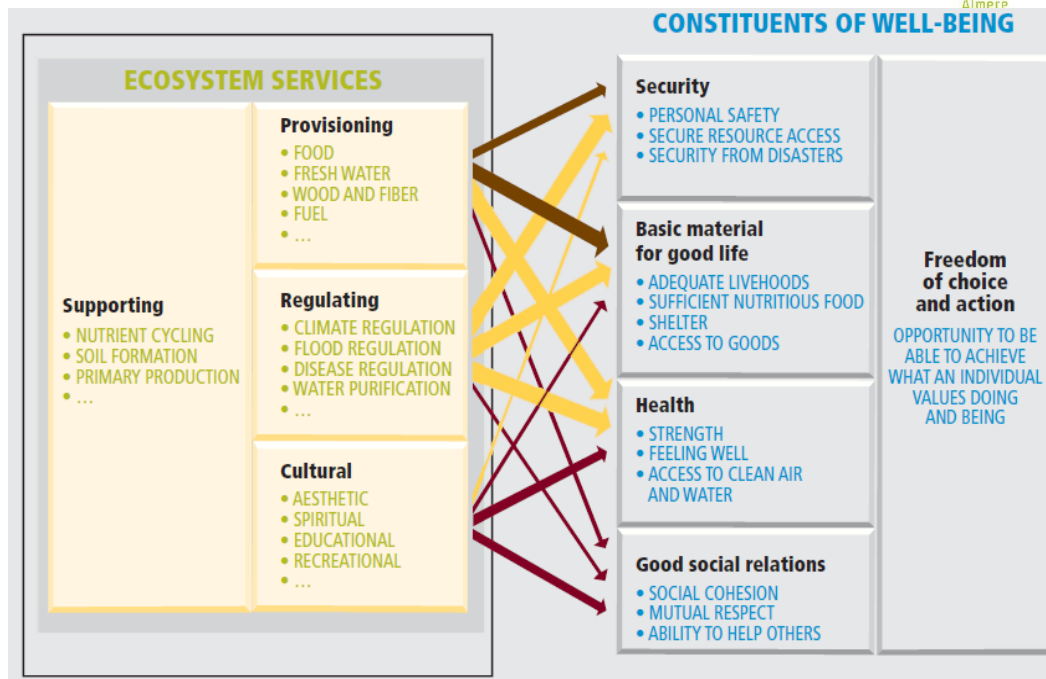


Figure one Ecosystem services and their benefits (Assessment, 2005)

The conceptual model shows the connection between the ecosystem services and the profit it gives to us. These profit is split up in: security, basic material for good life, health and good social relations. For this research the main interest is focused on the health factor which an ecosystem provides us. Under health there are some sub categories: strength, feeling well, access to clean air and water. These sub categories are abstract and incomplete. In this report we will mention more subcategories to underpin the health benefits of ecosystem services.

People mostly look at nature assuming that nature just has one ecosystem service. In reality one ecosystem can offer more than one ecosystem service. Let's take for example a forest: the recreational factor in a forest is mostly very high but it also can be used for production of wood, it retains carbon, it regulates local climate, contains biodiversity and it produces oxygen. Often the focus is just on one ecosystem service which means that the others will

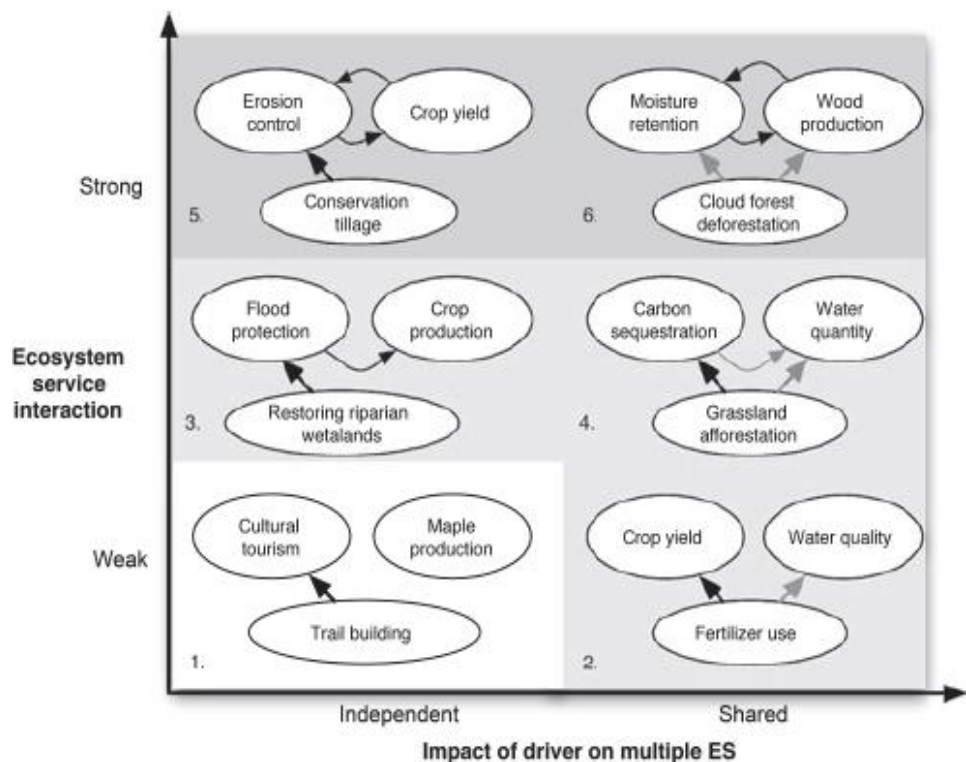


Figure two Interaction of ecosystem services (Bennett. E, 2009)

be forgotten or play a less important role. Unilateral approach of an ecosystem service can be risky. For example a too intensive focus on one cultivation of a crop can make it more sensitive to pest and diseases (Bennett. E, 2009; Wageningen University, Planbureau voor leefomgeving, 2010). This shows that ecosystem services are closely connected to each other and help each other to become and stay strong (figure 2).

For example most vegetation can only multiply when pollination takes place. This is very important for the vegetation. When too much chemicals have been used the insect population will decrease. This influences the natural fertilization. But in a strong ecosystem other insects will take over. Mostly (overall) the ecosystems will be affected by human anthropogenic, which will lead to degradations of the ecosystem services.

2.2 Kinds of ecosystem services

There has been written a lot about ecosystem services, what they are and which benefits they can provide. What kind of ecosystem services are we looking for at this moment? Figure three shows an overview of ecosystem services. The figure is split up in different columns: provisioning, regulating, regulating, culture and supporting. In the first column the services are enumerate, the second column gives the explanation for each service. The table is based on the model of figure three (Assessment, 2005).

Service	Comments and Examples
Provisioning	
Food	Production of fish, wild game, fruits and grains
Fresh water*	Storage and retention of water for domestic, industrial and agricultural use
Fiber and fuel	Production of logs, fuel wood, peat, fodder
Biochemical	Extraction of medicines and other materials from biota (the animal and plant life of a particular region, habitat, or geological period)
Genetic materials	Genes for resistance to plant pathogens, ornamental species and so on
Regulating	
Climate regulation	Source of and sink for greenhouse gases; influence local and regional temperature, precipitation and other climatic processes
Water regulation (hydrological flows)	Groundwater recharge/discharge
Water purification and waste treatment	Retention, recovery and removal of excess nutrients and other pollutants
Erosion regulation	Retention of soils and sediments
Natural hazard regulation	Flood control, storm protection
Pollination	Habitat for pollinators
Cultural	
Spiritual and inspirational	Source of inspiration; many religions attach spiritual and religious values to aspect of wetland ecosystems
Recreational	Opportunities for recreational activities
Aesthetic	Many people find beauty or aesthetic value in aspect of wetland ecosystems
Educational	Opportunities for formal and informal education and training
Supporting	
Soil formation	Sediment retention and accumulation of organic matter
Nutrient cycling	Storage, recycling, processing and acquisition of nutrients
*While fresh water was treated as a provisioning service within the MA, it is also regarded as a regulating service by various sectors. Figure three (Assessment, 2005, p. 12)	

Looking at the column of the explanations it may be clear that everyone needs ecosystem services to keep (be) healthy. The only difference is the accessibility for people. Earlier researchers suggested that the access to green space coincides with the economic status of a population. Dr. Jolanda Maas wrote in one of her researches that the social economical factor plays a big role within this theme (Maas, et al., Green space, urbanity, and health: how strong is the relation?, 2006, pp. 587 - 592). *"Scientists are routinely taking into account income and other differences in their studies. The question is no longer, do people, living in greener neighbourhoods, have better health outcomes?"* (They do.) Rather, the question has become, do people, living in greener neighbourhoods, have better health outcomes when we take income and other advantages associated with greener neighbourhoods into account? (Kuo F. E., 2010`).

Now we know what ecosystem services are and what they do, it is easier to structure them. Figure four shows a conceptual model of land use and what the effect will be. It is a schematic representation of how a public used area is connected to aquatic and wild-life based recreation. It is equally important to consider how ecosystems interact and collectively respond to a stimulus (e.g. land management). The strong connection among ecosystems suggests that land-use and conservation decisions often compromise trade-offs and synergies.

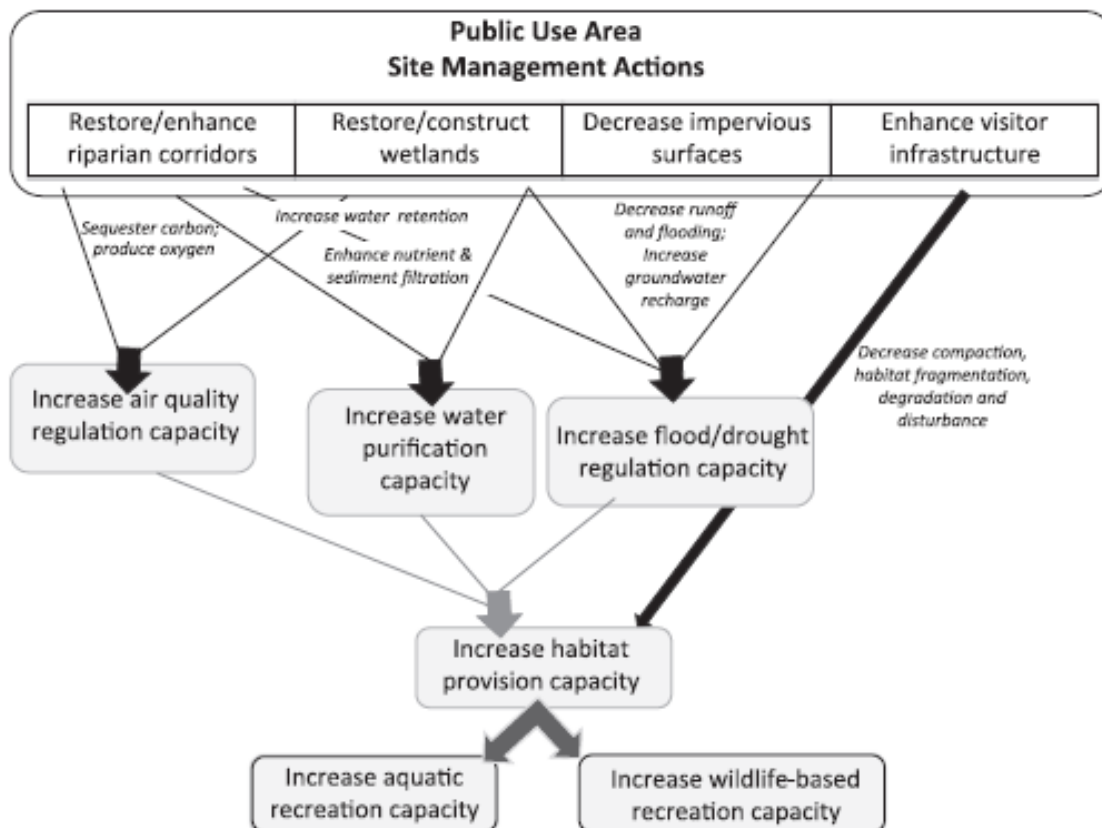


Figure four conceptual model management actions in relationship to ecosystem services.

(AmyM.Villamagna a, 2013)

This conceptual model illustrates the effects of site management actions on interconnected ecosystem services, including focal services such as wildlife-based recreation (e.g., bird watching) and water purification. The actions are shown (top) as rectangles; black arrows represent direct effects on a subset of services; descriptions of key biophysical changes are noted in italics beside the arrows. Services that are secondarily affected are shown in light grey, rounded rectangles; secondary effects

are shown as light grey arrows; capacities of wildlife-based and aquatic recreation, influenced by the services and actions above them in the schematic, are shown in dark grey, rounded rectangles.” (AmyM.Villamagna a, 2013).

The health factor is less visible in this model, but it shows the increase of the recreation capacity. The focus in this model is mainly directed on planning of the different green developments and how they affect the aquatic- and wild-life recreation capacity. The ecosystem services related to health are intergraded. These will be discussed in chapter the grid. In this chapter the grid will explained.

All these ecosystem services occur in all kind of green environments. But finally the research will focus on the ecosystems which are most beneficial for humans. So the focus will be on the human

habitat. Like urban nature: nature in an urban setting (e.g. gardens, parks, leisure parks, (green verges) berms, hedgerows and swimming waters. These habitats can be defined in different kinds of green (Health Council of the Netherlands & RMNO, 2004):

Agricultural nature: a primarily agricultural landscape with small set-aside patches of nature (nest guards, fallow land, ditch sides).

Production forest: nature in woodland that is primarily managed for timber production. Traditional rural nature: nature in a small-scale, man-made landscape with a high level biodiversity, which is preserved partly for historical reasons.

Natural forests: nature in woodland where management is geared towards more authentic vegetation.

Wild nature: nature in an environment that develops spontaneously and can be maintained with minimal management (natural rivers, marshy woodland, etc.).

2.3 The relationship between human health and ecosystem services

Visiting green spaces has commonly been associated with several positive emotions such as, peace, serenity and happiness (Blaschke, 2009) It directly affects stress and mental fatigue and has indirect effects by serving as a buffer against the health impacts of stressful life events (Maas J. B., 2010).

There are three main mechanisms which can influence human health and wellbeing by natural environment (Health Council of the Netherlands & RMNO, 2004):

- Physical activity
- Social capital
- Direct Effects

Physical activity: Green space provides opportunities to partake in physical activity; regular physical activity is strongly associated with better physical and mental health outcomes (figure four), and can play a role in both preventing and managing chronic disease (Blaschke, 2009).

Social capital: Green space may facilitate the development of social capital by providing places to interact with other members of the public and undertake (partake) activities with groups, and by strengthening people's sense of attachment to their living environment. There is a well-established link between social capital and improved physical and mental health (Blaschke, 2009).

Direct effects: It has been proposed that nature has direct effects on health and wellbeing. Attention has largely been focused on so-called 'restoration' effects—recovery from stress and attention fatigue, enabling people to reflect on issues beyond their routine thoughts and activities (Blaschke, 2009).

2.4 Ecosystem service related to health

In the past there has been done several studies to the relation between health and wellbeing and nature or ecosystem services (Health Council of the Netherlands & RMNO, 2004; Kuo F. , Parks And Other Green Environments Essential Components of a Healthy Human Habitat, 2010; DEFRA, 2007). One of those researches is the research done by the Health council of the Netherlands and RNMO. They created a model which shows beneficial effects for health and wellbeing during exposure to green environment.

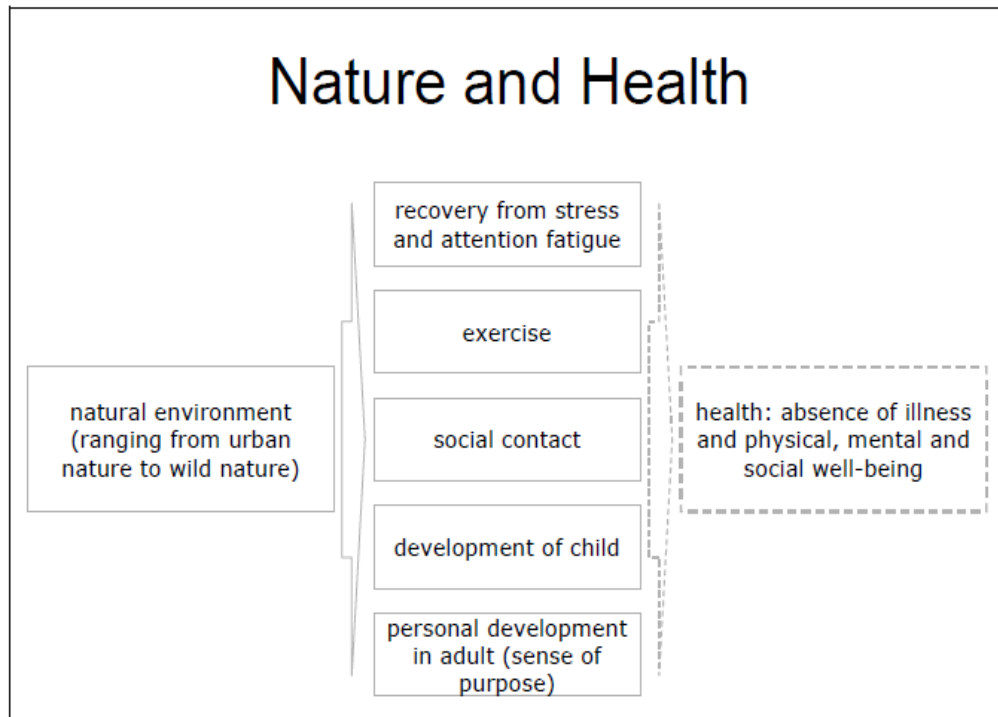


Figure five Schematic overview of the possible beneficial effects of nature on health. (Health Council of the Netherlands & RMNO, 2004)

Simply by walking or cycling through a green environment provides benefits. For example natural view or sounds have positive influence on health and wellbeing (Maas. J, 2009; Russel, et al., Humans and Nature: How Knowing and Experiencing Nature Affect Well-Being, 2013). It has even been proved by Russ Parsons that driving in a green environment reduces stress and blood pressure (Parsons. R, 1998). During the use of green area's we already use different ecosystem services. Think about food, sounds, water and aesthetic values, unnoticed we use them every day. Mostly people notice them when they are not there anymore. Let's take water for example. We not only rely on water to drink but also for production. During drought farmers need water to grow their crops and to keep them healthy and fit. But when the drought remains there will be a bad harvest and it will inflict on the price. During times of crisis people have less to spend and when vegetables or fruit are getting expensive people will buy less. This will make them more receptive for diseases.

"Mental health and wellbeing are fundamental to quality of life and productivity of individual, families communities and nations enabling people to experience life as meaningful and to be creative and active citizens" (Bird, 2004).

3. Non-communicable diseases

Non-communicable diseases are world's leading cause of death. Killing every year more people than all other causes combined. In 2008 57 million people in total died, two third of this number (36million) cause of non-communicable diseases (Alwan, 2010).

"Non-communicable diseases are caused, to a large extent, by four behavioural risk factors that are pervasive aspects of economic transition, rapid urbanization and 21st-century lifestyles: tobacco use, unhealthy diet, insufficient physical activity and the harmful use of alcohol" (Alwan, 2010)

For this research I have chosen for four non-communicable diseases, depression, type II diabetes, heart diseases and obesity. All these diseases are non-communicable, but they are allied to each other in certain ways. All these mentioned diseases can be reduced by therapy (Saligram, 2012). But why to reduce diseases when you can prevent them? For instance 80 percent of the heart diseases, 80 percent of type II diabetes and 40 percent of cancer can be prevented by avoiding tobacco, eating healthy food and increasing physical activity (Alwan, 2010).

3.0.1 Connection between the non-communicable diseases

The four mentioned diseases don't seem to be related to each other. But actually there is a harmony between these diseases, called metabolism syndrome. The metabolism syndrome is the process where the body transforms the food you eat in usable energy (U.S. Department of Health and Human Services, 2014).

Food contains lots of carbohydrates, fats and proteins. During the digestive the body normally is able to break down these energy forms and transform them into acids and sugars. Your body can use this fuel right away, or it can store the energy in your body tissues, such as your liver, muscles, and body fat (U.S. Department of Health and Human Services, 2014; van Loon & Schaafsma, 2014).

In a metabolic disorder the process of transforming the carbohydrates, fats and proteins is disturbed. When this happens, you might have too much of some substances or too little of other ones that you need to stay healthy.

Primary symptoms are (van Loon & Schaafsma, 2014):

- insulin resistance;
- glucose intolerance;
- hyperinsulinemia (chronic elevated level of insulin);
- high blood pressure;
- dyslipidaemia (high triglycerides and plasma LDL-cholesterol, low plasma HDL-cholesterol);
- disorders of blood coagulation.

Metabolic disorder can come over times. Mostly it affects some organs like liver or pancreas. One example when this happens is diabetes type two, but it also can cause heart diseases or obesity. So by the metabolic disorder this four diseases are strongly interconnected.

3.1 Obesity

Excess body weight poses on one of the most serious public challenges of the 21st century for the European regions (WHO Regional Office for Europe, 2007). According to data being overweight affects almost 30-80 percent of Europe (adults). For children this is a little different, 20 percent of the children is overweight and a third of this group is obese. (WHO Regional Office for Europe, 2007). Obesity is already responsible for 10 to 13 percent of deaths in this group and uses 2-8 percent of the total health costs in parts of the European Union. (World Health Organization regional office for Europe, 2014).

Globally it is body mass which causes the sixth largest disease burden (Stephens. S, 2014). Nowadays almost one third of these people are overweight (Institute for Health Metrics and Evaluation, University of Washington, 2014).

3.1.1 Body Mass Index

BMI is officially called Quetelet index. BMI is the well-known indicator to see if people are on the right weight or not. With the BMI you can make a calculation of the person's weight per square meter (kg/m²). For example an adult who weighs 70kg and is 1.75m tall will have a BMI of 22,9 (World Health Organization regional office for Europe 2, 2014).

Some common conditions related to being overweight and/ or obese include:

Weight (KG)	70
Length (meters)	1,75
	$70/(1,75*1,75)$
BMI	22,9

premature death, cardiovascular diseases, high blood pressure, osteoarthritis, some cancers and diabetes (World Health Organization regional office for Europe 2, 2014).

BMI is divided in different graduation of classes. For people who have a BMI 18.5 or lower there can be said that they are underweight for their length. Between 18.5 and 24.9 people have a normal weight for their size. But everything what comes after is about to get obese. It starts with a little bit overweight in Pre-obesity, to obesity class III which means that people are extremely large for their length and that they are in the risk group of getting diseases. Table six shows the schematic overview of the different classes.

Numbers in May 2014 show a big increase in overweight people over the last thirty years. The worldwide population of adults with a body-mass index (BMI) of 25 kg/m² and a larger increased between "1980 and 2013 from 28·8% (95% UI 28·4—29·3) to 36·9% (36·3—37·4) in men, and from 29·8%

(29·3—30·2) to 38·0% (37·5—38·5) in women. Prevalence has increased substantially in children and adolescents in developed countries; 23·8% (22·9—24·7) of boys and 22·6% (21·7—23·6) of girls who were overweight or obese in 2013" (Institute for Health Metrics and Evaluation, University of Washington, 2014).

BMI	Nutritional status
Below 18.5	Underweight
18.5–24.9	Normal weight
25.0–29.9	Pre-obesity
30.0–34.9	Obesity class I
35.0–39.9	Obesity class II
Above 40	Obesity class III

Figure six (World Health Organization regional office for Europe 2, 2014)

3.1.2 When do we call it overweight and when does it become obese?

The world health organization uses three definitions for overweight and obesity. The definition is divided in three groups: adults, adolescents (10-19 years old) and school-aged people (5-9 years old).

“In adults, WHO decides overweight is having a body mass index (BMI) of ≥ 25.0 kg/m², and obese is having a BMI of ≥ 30.0 kg/m² and pre-obesity is having a BMI of 25.0–29.9 kg/m² (World Health Organization , 2003). Overweight includes pre obesity and obesity”.

“In adolescents aged 10–19 years, WHO decides overweight and obese are adolescents with a BMI-for-age value above +1 Z-score and above +2 Z-scores, respectively, relative to the 2007 WHO growth reference median (Onis. M, 2007)”. Z-score is the standard deviation (Londen school of Hygiene and Tropical Medicine, 2014).

“In school-aged children aged 5–9 years, WHO defines overweight and obesity as the proportion of children with a BMI-for-age value above +1 Z-score and above +2 Z-scores, respectively, relative to the 2007 WHO growth reference median (Onis. M, 2007)” Z-score is the standard deviation (Londen school of Hygiene and Tropical Medicine, 2014).

3.1.3 Possible causes of obesity

Between 1980 and 2008 over 50 percent of the people in the WHO European region were overweighted. In high income countries, where man generally are more active than women (WHO European Region , 2014). In these country's almost every one out of two women were insufficiently physical active.

Physical activity is one of the most import exercises for the human body. For obesity it is one of the main medicines to prevent and to decrease their weight. But unfortunately the 21th century has become a century in which people get more inactive. One of the main reasons is the sedentary behaviour. People mostly sit during their working day, when they come home it is easy to continue this sedentary behaviour. Mostly adults but definitely children, when returning from a day of work or school they come home and watch television or play videogames. Obesity in children has been associated with lower levels of physical activity and fitness (Hassink. S, 2008).

“A sedentary lifestyle may include one or more weekly sessions of intensive exercise, which may be more common among people with more education. This sedentary behaviour does not represent the opposite of physical activity, but corresponds to a complementary dimension of behaviour. The distinction between physical activity and sedentary behaviour has implications for both assessing and preventing obesity and related diseases” (WHO European Region , 2014).

Family affluence is associated with overweight and obesity in most of the countries which are surveyed during this research of World Health Organisation and Health Behaviour in School-aged Children. Those countries from lower affluence families were more likely to have problems with overweight or obese (WHO Regional Office for Europe, 2009).

People with a lower social economic status, are also more susceptible to increase risk of low cardiorespiratory fitness, low physical activity levels and increased rates of obesity (World Health Organization regional office for Europe, 2014).

3.1.4 Morbidity

Overweight and finally obesity has been associated with a long list of diseases with which the course can be obesity (WHO Regional Office for Europe, 2007). This list exists out of eighteen mentioned diseases. But for this research there are just four of the diseases relevant:

- cardiovascular diseases: coronary heart disease (including ischaemic heart disease, angina pectoris and myocardial infarction), hypertension, dyslipidaemia and stroke;
- type II diabetes and insulin resistance;
- psychological and social problems;
- Obesity;

3.1.5 Types of activity

Sedentary behaviour is a major problem when we look at obesity. That's why physical activity is so important for our daily routine. But there are big differences in physical activity. And physical activity can in some cases be dangerous for your health. But the physical activity varies according to the fitness level of the individual. But in general persons doing moderate intensity activity will increase their heart rate, increase their breathing and feeling an increase in body temperature (National Institute for Health and Clinical Excellence National Collaborating Centre for Primary Care, 2006; Ewing. R, 2014).

Daily activities with a moderate intensity can include activities such as brisk walking or cycling, structured exercise or sports (World Health Organization , 2010; Eckel. R, 2013; KR, 1999). All kind of sports or physical activity contribute to energy expenditure and so can contribute to the maintenance of a healthy weight or weight loss.

As a healthy behaviour can also be understood, their normal daily activities, like walking or cycling to school and work, walking a dog, housework and gardening. The daily activities which are needed during one day can be achieved by several short physical activities or by insensitive exercise of 10 min or more (National Institute for Health and Clinical Excellence National Collaborating Centre for Primary Care, 2006). There are many physical activities which can be seen as good for your health and therefore to help or prevent obesity:

brisk walking	general house cleaning
cycling	painting and decorating
swimming (moderate effort with)	general callisthenics (sit-ups, push-ups, chin-ups)
stair climbing (with moderate effort)	gentle racquet sports such as table tennis and badminton (social)
gardening – digging, pushing mower or sweeping leaves	golf – walking, wheeling or carrying clubs.

Figure seven (National Institute for Health and Clinical Excellence National Collaborating Centre for Primary Care, 2006)

“It is very difficult to increase the activity level in the people who are obese. First of all, the increasing level of their habitual activities require changes of lifestyle” (KR, 1999).

A daily physical exercise is recommended for children and young people. Young people should do at least physically exercises for 60-90 min per day. For adults 30 minutes of moderate intensity activities is a good indicator to stay fit. It also makes the chance on chronic diseases smaller (Saris. M, 2003; Hassink. S, 2008; National Institute for Health and Clinical Excellence National Collaborating Centre for Primary Care, 2006). With this increase of activities it is not ruled out that you are prevented from obesity. Obesity is also related to eating habits. And to lose weight they will need an appropriate diet (Sharman. J, 2009; KR, 1999).

3.1.6 Injuries

In general, physical activity is very healthy. If not it does not only keep you fit but it also contributes to lower chances on cardiovascular disease, cardiovascular disease and type II diabetes (G, 2009). But overweight and inactive people have more risk of injury or accidents. Especially when people increase their level of activity gradually, they will have a higher chance on injuries. The greatest risks from physical activity are faced by:

“People who take part in vigorous sports and exercise. People who do excessive amount of exercise are unlikely to face undue risks. People with existing musculoskeletal disease or at high risk of disease” (National Institute for Health and Clinical Excellence National Collaborating Centre for Primary Care, 2006).

3.1.7 Green and obesity

The environment in which people live has a big influence on the physical activity. It seems that environments armed with a good infrastructure and accessibility, are beneficial for weight and health problems (National Institute for Health and Clinical Excellence National Collaborating Centre for Primary Care, 2006). A good infrastructure stimulates the walkability of people (King. A, 2011).

Research from the past shows a significant interaction in neighbourhood income and percentage overweight/obese ($p=0.015$). In the higher income neighbourhoods there is a lower percentage of overweight/obese by individuals (48%). In neighbourhoods with lower income this percentage is higher (58-62%) (King. A, 2011). Adults living in higher walkable neighbourhood have a lower BMI, this is caused by easy accessibility of physical exercise (King. A, 2011). At the neighbourhoods with high income environment strategies may include increasing sidewalks or planting trees to improve walkability. For instance it has been found that in neighbourhoods which are less walkable, people were less active, and likely to decrease physical activity to gain weight over time (Ding. D, 2012).

But it is not only because of the walkability of a neighbourhood what makes people go and exercise more. Research shows a link between physical activity that takes place outdoors and positive health outcomes. And it is also associated with indoor sedentary lifestyle and negative health consequences (G, 2009).

A Dutch scientist writes in one of her reports that the children living in neighbourhoods with a green space of at least 75m², within 500 meters spend 15% of their free time outside. Which means 1,5 hours per day, 6,5 hours per week. Within this 15% the children reduce the risk of getting obese with 25 percent. This percentage was only found by boys, perhaps due to the more active nature of their play (KPMG Advisory N.V. is a subsidiary, 2012). A half an hour walk for adults is comparable with reducing the BMI level with 0.11-0.14 for males and 0.20 for females (Sarma. S, 2014).

3.1.8 Metabolic equivalent unit

To give advice or dis advice in activity to undertake by people there must be a scale which makes visual what kind of activity has what kind of influence on the energy and oxygen in blood. The metabolic equivalent unit a procedure which shows how much oxygen there is in the blood and how many one physical activity cost. One metabolic equivalent (MET) can be defined as the amount of oxygen consumed while sitting (Jetté , Sidney , & Blümchen , 1990). This procedure is for every one different. MET will be calculate in the following way (Crajaé, et al., 2013);

$$\text{Energy consumption per minute Kcal/min/kg} = \frac{\text{MET} * 3.5 * \text{body weight}}{200}$$

The MET concept also can is used for intensity levels (in METs), for specific selected physical exercises. “In spite of its limitations, the MET concept provides a convenient method to describe the functional capacity or exercise tolerance of an individual as determined from progressive exercise testing and to define a repertoire of physical activities in which a person may participate safely, without exceeding a prescribed intensity level” (Fletcher, Froelicher, Hartley, & Has, 1990). Figure eight give an overview of the oxygen uptake at different ages.

Age	Men	Women
20-29	43 (±22) 12 METs	36 (±21) 10 METs
30-39	42 (±22) 12 METs	34 (±21) 10 METs
40-49	40 (±22) 11 METs	32 (±21) 9 METs
59-59	36 (±22) 10 METs	29 (±22) 8 METs
60-69	33 (±22) 9 METs	27 (±22) 8 METs
70-79	29 (±22) 8 METs	27 (±22) 8 METs
Metabolic equivalent unit (MET); 1 MET = 3,5 ml * kg oxygen uptake Figure eight (Fletcher, Froelicher, Hartley, & Has, 1990)		

With the MET procedure it is possible to calculate the need of calories per activities. But it also give a good indication how intensive a physical activity can be. In figure nine is a schematic overview of outside physical activities, there MET value and there physical effort in Kcal per hour. With these two tables eight and nine

Energy consumption per minute in the various forms of exercise			
Activity	MET	Activity	MET
Lie/ sit	1.0	Medium circuit training	6.0
Walk (3,2km/h)	2.5	Nordic Walking (6.4km/h)	6.0
Light circuit training	3.0	Swimming (recreate)	6.0
Walking (5km/h)	3.5	Cycling (16-19km/h)	6.0
Golf	3.5	Spinning (interval training)	7.0
Gym exercises	4.0	Tennis	8.0
Walking (6km/h)	4.0	Circuit training	8.0
Walking (6.4km/h)	5.0	Cycling (recreated 19-22km/h)	8.0
Cycling (15km/h)	5.0	Running (8,4km/h)	9.0
Aerobics	5.0	Swimming (crawl)	10.0
Dancing	5.5	Running (10.0 km/h)	10.5

Figure nine (Cra  , et al., 2013)

3.2 Diabetes

Diabetes mellitus is a group of metabolic diseases characterized by an increased blood glucose level (hyperglycemia). The elevated blood glucose level causes a low level of insulin. Insulin is a hormone which influences the glucose metabolism. Insulin is a hormone manufactured by the beta cells of the pancreas, which is required to utilize glucose from digested food as an energy source (Loghmani, 2005).

Within diabetes there are two different types, type I and II of diabetes. In type I the body does not produce insulin on its own, which means a daily doses of insulin has to be injected. One in every six hundred children has type I diabetes.

With type II diabetes there is enough insulin in the body but the body does not use all the insulin, which comes available because of food intake. Diabetes can be the result of overweight and/ or not enough physical activity. With the increase of obese people the number of people with type II rises.

With type II the body will cause insulin resistance in the liver and skeletal muscle which increases the glucose production in the liver. As a result there is an overproduction of fatty acids by fat cells and causes insulin in deficiency. Reduction in blood glucose levels can be obtained by changes in food intake and increase in physical activity (D. Hordern, et al., 2012; Loghmani, 2005; Hassink, Zapalla, Falini, & Datto, 2008).

Contributing factors of type II diabetes (Loghmani, 2005):

- Obesity
- Age (onset of puberty is associated with increased insulin resistance)
- Lack of physical activity
- Genetic predisposition
- Racial/ethnic background (African American, Native American, Hispanic and Asian/Pacific Islander)
- Conditions associated with insulin resistance, (e.g., polycystic ovary syndrome)

A healthy weight decreases the chance on developing type II diabetes (Church, 2011). It is very important for overweight people or people with diabetes to keep the right weight, doing this by physical exercise. This decreases the unbalance- and the need for insulin (Hassink, Zapalla, Falini, & Datto, 2008; E. Yardley, J. Sigal, A. Perkins, C. Riddell, & P. Kenny, 2013; Church, 2011).

There is a strong prove that type II diabetes develops easier and quicker by people who are insufficiently active. Physical activity often goes synchronous with other lifestyle strategies. A physical lifestyle has beneficial effect for the development of type II of diabetes and improving glycaemic control in those with pre-diabetes (D. Hordern, et al., 2012). Lifestyle modification, including exercise training now represents a central strategy in diabetes.

The change in lifestyle should be based on a physical active life but also a nutritional custom diet. By following these adjustments, they have found a reduction of 58 percent of type II diabetes in United States (D. Hordern, et al., 2012). In the same time the people involved in this program showed a weight loss of 7 percent.

The lifestyle change has the same characteristics as the advice for people with overweight or obese. The new lifestyle recommends and exercise prescription of a minimum of 150 minutes of moderate to vigorous intense physical activity during the week. These exercises spread out over at least 3 days of the week, with no more than two consecutive days between the exercises (J. Armstrong & J. Sigal, 2013; Bowman & Foster, 2007; D. Hordern, et al., 2012). In table ten is a schematic overview of minimum exercise for people with type II diabetes and pre-diabetes.

Type of exercise	Intensity	Duration, week	Frequency
Aerobic (large muscle activities) e.g. walking, running, cycling and swimming.	Moderate: 40–59% VO_2R or HRR 55–69% HR_{max} RPE 12–13 OR	210 min total	No more than two consecutive days without exercising
	Vigorous: 60–84% VO_2R or HRR 70–89% HR_{max} RPE 14–16	125 min total	
Resistance (multi joint exercises, progressive, large muscle groups)	Moderate to vigorous 8–10 exercises 2–4 sets 8–10 repetitions ^a 1–2 min rest intervals	60 min (included in totals above)	2 or more times/week

VO_2R = VO_2 reserve, HRR = heart rate reserve.

^a Resistance training repetitions should be performed at a weight that cannot be lifted more than 8–10 times (70–84% of 1 RM).|

Figure ten (D. Hordern, et al., 2012) Minimum exercise prescription recommendations for people with type II of diabetes or pre-diabetes.

This physical exercise (aerobic) what can be seen as a lifestyle change can vary from walking, cycling and jogging to swimming. These exercises all typically involve the same movements of the same large muscle groups over extended duration of time. Mostly people use 40 to 60 percent of an individual's aerobic capacity during the exercises (E. Yardley, J. Sigal, A. Perkins, C. Riddell, & P. Kenny, 2013; Bowman & Foster, 2007) Exercises should take at least ten minutes. The first five to ten minutes of aerobic exercises are good for the muscle glycogen. After a certain time (depending on the person and exercise) the body will use other kind of energy sources like glucose and non-esterified fatty acids which then become the main source of energy (E. Yardley, J. Sigal, A. Perkins, C. Riddell, & P. Kenny, 2013).

In the literature there is no information to be found about the relationship between a green environment or nature and diabetes. Except for an indicator which a green environment provides. In a research report written by a Canadian they mention: "People with diabetes may have greater susceptibility to adverse effects from heat than people without diabetes" (J. Armstrong & J. Sigal, 2013). Green areas provide cooler areas during the summer months than the urban settlements. Which means that people with diabetes will have less problems with physical activity in a green environment.

Another Canadian research shows that Canadian pharmaceutical companies have made an activity program in their geographical area. The activity program is based on a local walking trail and covers a FITT (frequency, intensity, time and type) construction (Bowman & Foster, 2007).

3.3 Cardiovascular diseases

Nowadays cardiovascular diseases, remain the leading cause of death worldwide. This disease effect both genders. In Europe cardiovascular diseases effect the high number of death before the age of 75: 42 percent of the men and 38 percent of the women died due the result of cardiovascular diseases (Perk, et al., 2012).

Cardiovascular diseases are strongly connected to lifestyle. Especially the use of tobacco, unhealthy diets, physical inactivity and physiological stress. Almost three quarters of the death may have been caused by change in lifestyle (World Health Organization , 2003). A healthy lifestyle is important for future quality of life. So the aim is to start early with a lifelong program of healthy lifestyle (Perk, et al., 2012). In the European guidelines on cardiovascular diseases prevention in clinical practice reports they refer to start during the pregnancy. After this it is important to continue with a school program on healthy education or smoking cessation (World Health Organization , 2003).

Hypertension (high blood pressure) is one of the most important? Variable risk factors for cardiovascular disease and death. The heart is mostly damaged by a chronic high blood pressure (Sharman. J, 2009). This finally will result in failure of the heart, and causes a heart attack.

For this research we will only focus on the physical activities or activities related to environmental benefits. And in the literature there is a clear message for people with cardiovascular diseases. There is a daily or weekly aerobic exercise program required. Physical activity provides overtime a lower blood pressure which helps to prevent against heart attacks. It is good to make a program for 3 or 4 sessions a week during at least 40 minutes (Eckel. R, 2013; Perez-Terzic C. , 2012). Aerobic exercises cover lots of benefits for the health and wellbeing. For all the four diseases but also especially for cardiovascular disease.

Benefits of aerobic exercises (Perez-Terzic C. , 2012).

- Increase tolerance of ischemia
- Improve insulin sensitivity and glucose levels
- Decrease blood pressure
- Reduce weight and fat stores
- Decrease blood viscosity and enhance fibrinolytic activities
- Boost cognitive functioning, mental health, and reduce stress
- Increase bone density and improve osteoporosis
- Enhance muscle strength and endurance
- Improve balance, coordination, and level of independence
- In the activities of daily living

The aerobic exercises are good for blood pressure control and improve inflammatory profile and exerts antithrombotic (clot of blood formed within a blood vessel and remaining attached to its place of origin) effects. Aerobic exercise training has also been effective in controlling fear and depression, which have been linked to the development of coronary artery disease (Selig, et al., 2010). That is often the cause of heart attacks.

In the research that has been done by Carman M Perez-Terzic there is found that for every one metabolic equivalent unit (MET) increase in aerobic activity, there is a reduction in cardiovascular diseases by 25 percent (Perez-Terzic C. , 2012). In this research 1452 males and 741 females were participating.

3.1 Cardiovascular diseases and connection with the green environment

To improve the status of cardiovascular disease it is important to combine different aspects. First of all it has been proven that (aerobic) physical exercises lowers the blood pressure over time (Sharman. J, 2009; Perez-Terzic C. , 2012). And a lower blood pressure causes less heart problems. Second of all the problem of cardiovascular diseases is caused by stress. For these two indications evidence has been found that green provides benefits health.

In the past several researches have been done to stress and exposure to a green environment. In one of this researches done by Paul Blaschke, he showed that there are significant health benefits from exposure to a green environment. For the research he let people sit down and observe the nature for 14 minutes followed by a walk of 16 minutes (in nature). The result was a significant reduction in stress (measured by biochemical and cardiovascular indicators). The test, compared with similar activities in an urban setting, also improved the mood and vigour (Blaschke, 2009). Other scientists write that by visiting a park, interacting with animals, gardening or simply view to nature contributes to a beneficial effect for cardiovascular diseases (Maller C. , et al., 2008). The exposure to nature or the view causes a rapid reduction in stress, blood pressure and muscle tension. Within minutes the body responds on exposure to nature. The most obvious visual when the body is already stressed (Bird, 2004), stressed people recover faster in green than in a concrete setting. The green environment also contributes to a healthier blood glucose level. It has even been proved that a green environment can accelerate the recovery from surgery (Blaschke, 2009; Kuo F. , Parks And Other Green Environments Essential Components of a Healthy Human Habitat, 2010).

“Pleasant rural scenes, which were comprised of trees, water, blue sky, clouds and animals such as lambs and calves, had the greatest effects in reducing blood pressure and increasing self-esteem, while a non-significant but positive effect was shown in the improvement of mood. The results from this study were useful in establishing that green exercise is more effective than exercise alone in improving both cardiovascular and mental health related measures” (Maller C. , et al., 2008). Natural areas, with nice landscapes and places to do group based activities are more often associated with activities. The activities facilitate a social contact which has been shown to reduce the risk of developing chronic diseases such as depression and cardiovascular disease (Townsend, Beyond Blue to Green: The benefits of contact with nature for mental health and well-being, 2010).

As written before exposure to a green or natural environment has major beneficial feature. But what does this mean for physical exercises in a green environment? Natural environment looks inviting for people and is so associated with group activities (Townsend, Beyond Blue to Green: The benefits of contact with nature for mental health and well-being, 2010). Group activities increase physical

activities, improve mood and are helping to manage weight. Because the activities take place in nature or green environment provided with fresh air, they are associated with respiratory health benefits (Townsend, Beyond Blue to Green: The benefits of contact with nature for mental health and well-being, 2010). Not only exposure to a real green environment contributes to a better health outcome. It has been proved that showing pictures of nature during exercise appears to have beneficial effects on cardiovascular health and mental health (Maller C. , et al., 2008). It is very important to start on a low level and build up slowly. Following the advices of the American Heart association “it is better to have some physical exercise than none” (Eckel. R, 2013). With a slow start it is easier to increase the intensity, frequency and duration of the exercises.

3.4 Mental health

Depression is a major worldwide mental health problem which infects yearly 121 million people (World Health Organisation , 2014). The picture in figure eleven shows a world map of the gradation of the level of depression in the specific countries. In the world is there a big variations in level of depression. In Europe depression of people is on an average level, accept for the Netherlands. Worldwide the burden of mental and substance use disorders increased with 37.6 percent between 1990 and 2010. It mostly has been caused by population growth and ageing (Whiteford, et al., 2013).

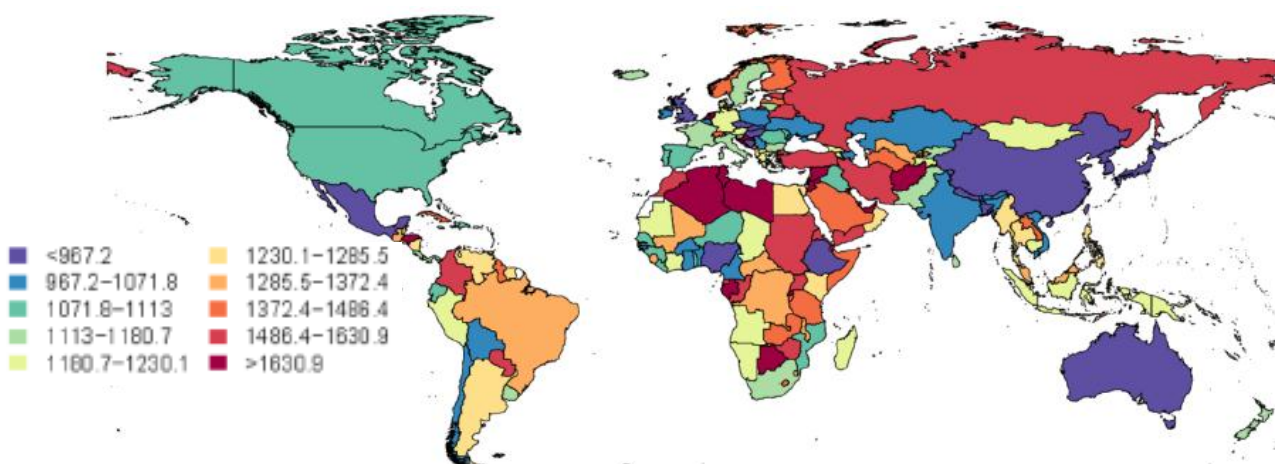


Figure eleven Rates (per 100,000 - 2010) Depression related countries (Ferrari, et al., 2013)

Depressions occur in different gradations (Ferrari, et al., 2013; Nieuwenhuijsen , et al., 2009), mostly they start with similar symptoms. “Symptoms of depressive disorder include the presence of one or two core symptoms of low mood and/or loss of interest, coupled with other symptoms such as feelings of inadequacy and hopelessness, sleep disturbance, weight change, fatigue, impaired concentration, agitation or slowing down of movement and thought, and suicidal ideation” (Nieuwenhuijsen , et al., 2009).

For this research I will just focus on the basics of depression. Literature does not make big differences in the different variations of depression (related to a green environment). Depression or stress has a lot of several causes. Mostly they arise from too high pressure that a person can handle. One of the causes of stress is work pressure but also wrong eating behaviour, too much coffee, alcohol, too less sleep and too less physical movement can lead to a depression (Founds Psychological Health, 2014).

A green environment has forces which makes recovery easier and faster (Kuo F. , Parks And Other Green Environments: Essential Components of a Healthy Human Habitat, 2010). For mental health

green has a lot of benefits to offer. In the already existing researches there is written a lot about the impact of green environment related to mental health, or depression.

Nowadays “Currently, approximately 21 percent of general practitioners use exercise as a therapy in the treatment of mental disorders. Green exercise therapy may be even more effective than just exercise and could, therefore, be utilized as an alternative or complementary treatment therapy to antidepressants” (Pretty, et al., 2011)

During exercises in a green environment people get attracted by its surroundings. The green surrounding's will deduce people's mind what causes that they will de-stress (Blaschke, 2009; Maas, J, 2009). “Many reported feeling happier, calmer and emotionally uplifted just thinking of a walk in the country, and described it as a place where you could go to get away from your troubles” and alleviate depression” (Townsend, Beyond blue to green The benefits of contact with nature for mental health and well-being, 2010).

What in a natural environment gives us relaxation? Many scientists write about the beneficial effect of green in general. But there are big beneficial aspects. Green views and environments stimulate health and reduce aggression, increase mood and reduce stress (Kuo F. , Parks And Other Green Environments: Essential Components of a Healthy Human Habitat, 2010). Just looking to nature already provides huge benefits (Bushell & Powis, 2009).

The trees and vegetation in a park or green space help to reduce stress and accelerate recovery (Tibbatts, 2002). Even the feeling and sound of the wind rustling in the trees, water flow in a river or pond, the smell of the soil or plants and the heat of the sun warming the body are all natural services provided by nature (Maller C. , et al., 2008; Townsend, Beyond blue to green The benefits of contact with nature for mental health and well-being, 2010). These services give an intrinsic motivation to people to go outside.

“Participating in physical activity in green settings is associated with decreased feelings of tension, confusion, anger and depression, while exhibiting greater feelings of revitalization” (Pretty, et al., 2011)

Green environment might stimulate health by the way of encouraging and enabling physical activity. Whether it will be walking and biking along tree-lined streets, gardening, ecological restoration volunteering, hunting, hiking, kayaking, or participating in sports and outdoor games in parks and recreation areas, it reduces the debilitating effects of stress on cardiovascular health (Kuo F. , Parks And Other Green Environments: Essential Components of a Healthy Human Habitat, 2010). Green space not only let people recover from stress, it also stimulates social capital by providing places to interact with other members, and undertake activities with groups. When this happens people feel more attached to their living environment. There is a well-established connection between social capital and improved physical and mental health (Blaschke, 2009). For example participating in green gym has shown significant improvements in mental health, the people who participate reduced their level of stress and reduce their weight (Townsend, Beyond blue to green The benefits of contact with nature for mental health and well-being, 2010).

Greener neighbourhoods are also associated with reduced rates of mortality and better self-rated health. Occur less illness (particularly mental illness) and greater resilience to stress (Blaschke, 2009). Parks that encourage walking as a form of exercise have been correlated with lower levels of depression (Bushell & Powis, 2009).

4. Physical activity

It may be clear that physical exercises offer huge beneficial effects (Maller C. , et al., 2009). The main reason of the benefit is the increase in heart rate which is caused by the physical exercises (Ewing, Meakins, Hamidi, & Nelson, 2014). Physical activity offers lots of benefits. Not only people with the mentioned diseases will benefit from it. In a research done by Carmen. M Perez-Terzic she showed an overview of benefits of physical activity.

Benefits of physical activity (Perez-Terzic C. , 2012):

- Increase tolerance of ischemia
- Improve insulin sensitivity and glucose levels
- Decrease blood pressure
- Reduce weight and fat stores
- Improve cholesterol profile by increasing serum high-density lipoprotein cholesterol levels and reducing serum triglycerides
- Enhance endothelial function
- Decrease blood viscosity and enhance fibrinolytic activities
- Improve depression
- Boost cognitive functioning, mental health, and reduce stress
- Increase bone density and improve osteoporosis
- Enhance muscle strength and endurance
- Improve balance, coordination, and level of independence in the activities of daily living.

That physical exercise is good for health should be clear. Depending on the purpose of the exercises there are different health benefits.

It is even proven that physical exercise in a green neighbourhood reduces the risk of mortality with 20-30 percentage (Maas, Verheij, Groenewegen, De Vries, & Spreeuwenberg, Green space, urbanity, and health: how strong is the relation?, 2006; Bird, 2004). But physical activity offers more. Physical presence in nature is clearly correlated to life satisfaction and awareness (Russel, et al., Humans and Nature: How Knowing and Experiencing Nature Affect Well-Being, 2013; National Park Service U.S. Department of the Interior, 2013).

5. The grid

This research is based on a lack of information in ecosystem services related to health and wellbeing. This research is the literature review of the main research which will be finished in October 2014 by Utad. This review is based on the available literature.

City planners don't only need the right information, but they also need a tool to help them in making choices: is green needed in an urban setting and which green offers which benefits. Pedro Silva-Santos, Marina Ferreira (Noctula), and I developed a grid. The grid is a tool which can be used to examine a nature or green area. It examines the availability of ecosystem services which provide health and wellbeing benefits. With the grid a city planner can get an indication which ecosystem services offer benefits for specific diseases and wellbeing. So he can take into account which kind of nature or green he has to plan to make use of the desired benefits. He even can evaluate which benefits existing nature or green offers and what has to be changed if the objectives will be changed.

The grid is based on another scientific model namely the one presented by Roly Russell in Humans and Nature: How knowing and Experiencing Nature affects Well-being (Russel, et al., Humans and Nature: How Knowing and Experiencing Nature Affect Well-Being, 2013). This model is based on the principle of knowing, perceiving, interacting and living within (figure twelve).

People experience ecosystems in a variety of ways. We use it for picking berries, listening to natural sounds, enjoying the view and exercising in it. We even know the consequences of being in a green area. It offers lots of benefits. It already starts on the primary school with small lessons about animals or plants. Perceiving an ecosystem will follow by interacting with the nature.

Interaction can also be associated with physical activity and direct multisensory interactions with ecosystem components. Living in or close to nature gives an all-day interaction with ecosystem services which are providing several benefits (Russel, et al., Humans and Nature: How Knowing and Experiencing Nature Affect Well-Being, 2013).

Our main focus is: how and which ecosystem services provide benefits for the four diseases.

For the grid we have made, we used the four channels for the four diseases (knowing, perceiving, interacting and living within). These channels work as a central conception.

Lots of ecosystem services are related to at least one of the channels. Lots of references refer to health and wellbeing. This is the reason we added a more general column with wellbeing. These column does show general information. Health and wellbeing is like a container concept. It has too much influence to keep it out but it does not show very valuable information related to the diseases.

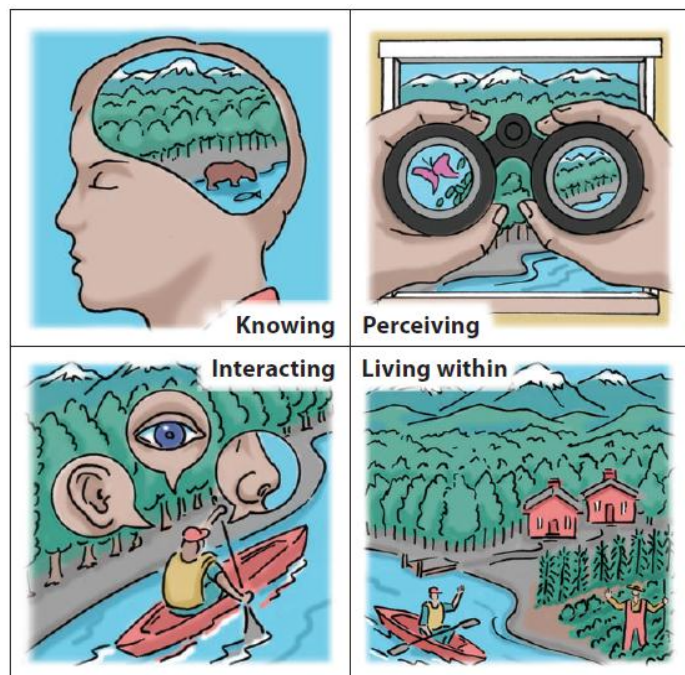


Figure twelve. The Four channels of human interactions with ecosystems: knowing, perceiving, interacting and living within (Russel, et al., Humans and Nature: How Knowing and Experiencing Nature Affect Well-Being, 2013).





















The ecosystem services are classified in different subgroups: sounds, view, smell and taste, water, recreation, flora and fauna. Within these groups we divided all the by source available ecosystem services. Some better known than others. We chose for a limited number of subgroups to avoid a too complicated instrument. We chose these subgroups because they are closely related to the already mentioned channels: knowing, perceiving, interacting and living within and because these are mentioned most in literature. To use subgroups I ordered the ecosystem services under the right sub group.

The grid gives a good indication in which field there is strong evidence and in which field there is less. Every evidence is numbered and connected to the article it belongs to. The grid gives a clear indication about which ecosystem services scientific knowledge is available and which is not.

The grid has been build up from existing references. To keep the grid small the references are numbered. All these numbers refer to references added in the table in appendix one. This is just an abstract overview of the used references. In appendix two is the complete and concrete overview of all the used references included all details.

5.1 Caesura of the grid

To make the grid easy to check we have been used a well thought caesura. Every disease has an own number of articles. To make it equivalent every column is divided by four because of the four different categories of valuating. All the ecosystem services which are providing good characteristics are numbered with articles. These articles reflect how the ecosystem services contribute to a beneficial effect for the four mentioned diseases. The number of articles depends per disease. But the specific number is divided by four. These four represent the four different levels of valuing the ecosystem services. The four levels are shown with colours.

Depression	Obesity	Diabetes	Heart diseases	Wellbeing
 1 - 4	 1 - 3	 1 - 2	 1 - 4	 1 - 7
 5 - 9	 3 - 6	 3 - 4	 5 - 8	 8 - 14
 10 - 14	 7 - 10	 5 - 7	 9 - 12	 15 - 21
 14 - 18	 11 - 15	 8 - 10	 13 - 16	 22 - 29

These four categories are connected in a scale from high to low: a very high health benefit, high health benefits, medium health benefits and low health benefits. This is calculated per disease to make it more specific. It also can be a more specific guideline to do improvements in a specific area for a specific disease. These colour series can be used during the evaluation of the area or new plan to represent the amount of observed ecosystem services.

Together with the grid we developed a table. This table is included in the appendix. It shows all the references and the sentences where the grid is based on. The grid only shows the amount of references and the titles of the documents. To give users a better understanding what has been published in literature an extra table has been made which accords to the grid and shows the sentence used in the grid as base (this table is presented in the appendix).

The grid has been build up out of seven columns starting with the subgroups than going to the variables and from the variables going to the four diseases and finally wellbeing. The grid shows what kind of green environment has what kind of benefits (presented in chapter 5.2).

The grid can be used by city planners and policymakers as indication for the planning and developing of new green areas and nature reserve, or it can be used with examining of already existing green areas and nature reserves on the availability of health benefits.

5.2 The grid non-communicable diseases in relation to ecosystem services

	Non-communicable diseases					
	Variables	Depression	Diabetes	Heart diseases	Obesity	Wellbeing
Sounds	Sounds of nature	2✓				2✓
	Sounds of flowing water	2✓				2✓
	Sounds of the birds					2✓
	Sounds of the wind	2✓				2✓
View	Flowers in different colours					2✓
	An aesthetically beautiful landscape					1, 2✓
	Visible waves of the sea maybe lake?					2✓
	Streets with trees					18✓
	Natural Landscape			2, 15✓		1, 3✓
	Agricultural landscapes	2✓		2✓	2✓	2✓
	Green spaces	2, 6, 18✓	18 ✓	6, 18 ✓	2, 6, 13, 28✓	2✓
Smell and	Fresh air - In the mountain, sea side					4✓
	Smell of wet earth	2✓				2✓
	Smell of the trees					1✓

	Berries - berries, mushrooms					2✓
Flora	Native flowers					10✓
	Species/vegetation				33✓	2, 18✓
	Graze landscape					2✓
	Trees				29, 33✓	
Water	Lake					2✓
	Nature river	2✓		2✓		
Fauna	Wildlife- fish, turtles, birds ,Dolphins, horses, butterflies, lambs, calves etc	2✓				2✓
	Pets	2, 14✓		15✓	17✓	7✓
Recreation	Sport and recreational infrastructure - Hiking, cycling, running places to sit down, places for picnic			42✓	42✓	2, 6✓
	Routes for horse riding	2✓		8✓	2, 34✓	
	Spaces to relax	2, 35✓	35✓	35✓		35✓
	Trails for walking – in florest, gardens, wood	1, 2, 11✓	1, 2, 6, 18 ✓	2, 6, 11, 13, 32, 35✓	2, 27 ✓	1, 2, 6✓
	Routes to practice race		23, 25, 26✓	24✓	25 ✓	2, ✓
	Spaces for physical exercises and green gyms	5, 6, 2, 11, 15, 19, 22✓	5, 18, 20✓	2, 5, 15, 20, 21✓	12, 13, 19, 20, 21✓	6, 9✓

Routes for cycling	2, 18☑	23, 25☑	18, 24, 25☑	2, 21, 25, 27☑	2, 8☑
Exhibition of photograph in green space	15☑		15☑		
Boat tour circuit	2☑			2☑	
Area to fish	2☑			2☑	2☑
Local to practice aerobics			38☑	38☑	
Space to do vigorous exercise – zumba, move heavy objects and other		23, 37☑	24, 37☑		
Fields multiplayer games - football, basketball, hockey, tennis rugby, tennis, handball, judo, rowing, Place to swim, kayaking, yoga, Skating Squash canoeing among other	18☑	25, 26, 39☑	13, 18, 39, 41☑	25, 34, 39☑	2, 8☑
Field to practice Golf		23, 26☑			
Water Activities		40☑			
Total variables for each disease	18/4= 4,5	10/4=2,5	16/4=4	15/4=3,75	29/4=7,25

☑ - Yes

☒ - No

○ - No information

The grid gives a good indication what already has been written in literature. In some of the variables is done more research than in others. For example there is a lot of articles in the subcategories of ecosystem services which provide physical exercise. These ecosystem services are closely related to the four mentioned diseases, especially to the three diseases diabetes, obesity and cardiovascular diseases.

On the other hand we can see that a lot of ecosystem services which provide effects on senses is related to depression.

Nearly all the mentioned ecosystem services are related to wellbeing.

6. Conclusion

In the literature you can find information about the ecosystem services and green and which elements in a nature environment cause the health benefits. The outcome of this research is a clear grid which contains an overview of the available literature in relation to the four non-communicable diseases. The grid is a first step to an easy to handle tool (for city planners, policy makers and so on). The grid shows a strict connection between ecosystem services and the four non-communicable diseases. The ecosystem services have a lot to offer. Exposure to green has good quality characteristics. The characteristics can be divided in three groups physical, psychological and social. All the health benefits for the four diseases are related to at least one of these characteristics.

Physical activity

A green environment has a lot to offer for the physical conditions of people. It not only helps to recover faster but it also helps to get the physical condition to a higher level. It also improves the immune system and helps people with diabetes to improve their blood glucose level.

Psychological

There is a strong relation between the accessibility of green and the physical activity. Good accessible green can lead to improved cognitive functioning. It leads to a better self-respect and mood. A green environment helps to de-stress. Overall it improves mental health.

Social

In a greener environment all kinds of people are more generous and more desirous of the connection between each other. There are closer and stronger social ties in neighbourhoods. People are more willing to trust and it can be concluded that there is a healthier social functioning in a green neighbourhood.

The central question of this research is: *How can we identify and use ecosystem services to stimulate human health and wellbeing?*

The developed grid can be used to develop a tool to identify if ecosystem services contribute to stimulate human health and wellbeing. The grid shows lots of natural sources which are beneficial for human health. Using this grid during examining natural areas it gives a clear indication if the area offers benefits for human health or not. It even shows for which diseases the benefits obtain. So the grid can be used as evaluation tool but it also can be used for developing areas. It can be used as guideline during the planning phase of projects.

The developed grid is restricted to the four mentioned non communicable diseases.

Sub questions

1. What kind of beneficial effects has an ecosystem services on obesity?

In the literature scientists mostly refer to a daily physical activity of 60-90 minutes for young people and 30 minutes for adults. Good accessibility helps people to exercise easier. In neighbourhoods with good accessible infrastructure people have a lower BMI than in neighbourhoods which are less accessible.

Children who live within a distance of 500 meters from accessible green, spend more time outside (15 percent). Playing outside in a green environment delivers 25 percent less change to get obese.

2. What kind of beneficial effects has an ecosystem services on depression?

Depression is nowadays a worldwide problem. During this research I have found significant data which shows a good relationship between green and benefits for depression. Nature offers un noted movements, sounds and smells. Several researches show that movement, sounds and smell attract attention of people. So when depressed people walk outside or even sit in a green environment they unstress. Exposure to nature makes people feel happier, calmer and gives a better mood. A walk in a green environment feels like getaway of your problems.

3. What kind of beneficial effects has an ecosystem services on diabetes?

Literature does not come up with clear beneficial effects of green for diabetes. Mostly the authors refer to physical activity. A few articles have been found which say that green gym helps people with diabetes. But the main base is the physical activity. One of the articles refer to one of the disadvantage of diabetes namely: people with diabetes may have greater susceptibility to adverse effects from the heat than people without diabetes. This is where green offers beneficial effects. Green provides a cooler environment than just a rural area.

4. What kind of beneficial effects has an ecosystem services on cardiovascular disease?

Cardiovascular disease can be decreased by twenty five percent, with a good training program. Research shows that exposure to green can lower the heart rate directly. Literature also strongly refers to physical exercises in nature. Green elements which lower the blood pressure are trees, water, blue sky and animals. It even has been proven that exposure to green makes people recover faster from a surgery.

7. Discussion

The main question has been answered in headlines. The developed grid is usable for the four chosen diseases, but not in general. It gives an indication of the benefits of ecosystem services in relation to the chosen diseases. For other diseases or goals it is not usable in this form, but the principle of the grid can be used in general for other goals. It has to be filled with other ecosystem services and literature depending on the goal.

This grid is a first step to develop an easy to handle tool. The next step is to develop a tool and test in practice before it can be implemented.

I did the research during my internship at Uta and my research was a part of the main research three professors are doing. The outline of the research is sustainability (human health) in usability in the urban setting. The main research has its restrictions and so had my research.

It should take too much time to investigate all diseases, so a choice had to be made. The main research is focussed on four non communicable diseases, because these diseases often occur in urban environment and they provide the number one cause of death worldwide. Furthermore a lot of research has already been done in these diseases, so we could find some literature.

We even had to make a choice in the ecosystem services, we classified them in different subgroups: sounds, view, smell and taste, water, recreation, flora and fauna. We chose these subgroups because they are closely related to the mentioned channels: knowing, perceiving, interacting and living within. Another reason was that these are mentioned most in literature in relation to the chosen diseases.

The grid shows strong relation between ecosystem services which provide physical exercise and the four diseases, such as trails for walking, cycling and fields for multiplayer games. The question is: is this only caused by the physical exercise or is there influence of the ecosystem services? The main research will answer this question. In literature is found that use of green environment is significantly correlated with accessibility. In neighbourhoods with good accessible green children spend more time outside (15 percent), thereby good accessible green stimulates the physical exercise. Physical exercise is also strongly related to the social aspect. People start doing exercise more easily with in a small group than individual. Fields for multiplayer games are mentioned many times in literature.

Within the four diseases which are investigated depression is an exception. Depression shows a tied relation with a lot of the ecosystem services.

8. Recommendation

At this moment we know what kind of health benefits green can offer in general and also related to the four diseases. In this research we tried to create a grid which shows ecosystem services related to the four mentioned diseases. The developed grid is restricted to the four mentioned non communicable diseases. These diseases are just a small number of non-communicable diseases. There may be more diseases which may have beneficial effects by exposure to green. For other diseases or targets a similar grid could be developed. These gap can be filled by future research.

The exact numbers and the practical working of the grid also has to be proved. In the main research this will happen, but for now it is still unknown. Further research has to lead to exact extent of beneficial effect.

Based on this literature review close ties are visible. There are lots of information available related to this subject. But there isn't found any article which has the same research question, only related. For this reason I don't do very strong statements in this research. The main research by Utad will soon come up with strong statements based on their own data set, which can prove the outcomes I found in this literature research.

As mentioned in chapter 2 Ecosystems, by degradation of one system more systems will degrade. This will finally influence the health benefits nature offers to the humanity. Before implementing a high intensive pressure on an area, it is useful to know what an ecosystem can handle before it will degrade.

In addition to the health benefits green has, it offers also financial benefits. Financial benefits are not mentioned in this report. This has already been done in the document TEEB: The Economics of Ecosystem and Biodiversity (KPMG Advisory N.V. is a subsidiary, 2012). "A green environment to 10 million people shows that benefits could be as high as EUR 400 million" (KPMG Advisory N.V. is a subsidiary, 2012)

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Appendix 1

1. Healthy parks healthy people central - *Forest bathin*, (s/d) - <http://www.hphpcentral.com/article/where-you-walk-matters>
2. Townsend, Mardie and Weerasuriya, Rona (2010) *Beyond Blue to Green: The benefits of contact with nature for mental health and well-being*
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9. Healthy parks healthy people central – *More than green spaces*, (s/d) - <http://www.hphpcentral.com/article/more-than-green-spaces>
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14. Australian companion animal council (2009), *The Power of Pececits, The benefits of companion animal ownership*
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21. <http://www.architecture.com/Files/RIBAHoldings/PolicyAndInternationalRelations/Policy/PublicAffairs/RIBACityHealthCheck.pdf>
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All these references are explained in the table which is connected to this grid. This table added in the appendix two (page 45). Here is the source is worked out and the used sentence is written down. With the table and the grid it is very easy and fast to hunt down the sources with the data.

Appendix 2

Non- communicable diseases				
"subject"	Author	Page	cited in, (data)	Effects
Sounds of nature	Mardie Townsend and Rona Weerasuriya, <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i>	22	Ouset, P.; Nourhashemi, F.; Albarede, J. and Vellas, P. (1998) <i>Therapeutic gardens</i> , Archives of Gerontology and Geriatrics, vol. 6	"The wind rustling in the trees, the water running out of a pond, the smell of the damp soil, the heat of sun warming the skin, face, hands and arms, all this is an encouragement to natural relation, and brings a feeling of physical and mental well-being "
Sounds of flowing water	Mardie Townsend and Rona Weerasuriya, <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i>	22	Ouset, P.; Nourhashemi, F.; Albarede, J. and Vellas, P. (1998) <i>Therapeutic gardens</i> , Archives of Gerontology and Geriatrics, vol. 6, pp. 369–372. Nilsson, K. (2006) <i>Forests, trees and human health and wellbeing</i> , Urban Forestry and Urban Greening, vol. 5, no. 3, pp. 109–109	"The wind rustling in the trees, the water running out of a pond, the smell of the damp soil, the heat of sun warming the skin, face, hands and arms, all this is an encouragement to natural relation, and brings a feeling of physical and mental well-being " "A plethora of research has shown humans appreciate the diverse features offered by nature such as the varied foliage in a wood, the sound of bird song or the sight of ocean waves lapping at the seashore" "The therapeutic effects gained from the sounds of flowing water and the wind rustling through the leaves has also been given increasing attention in recent studies "
Sounds of the birds	Mardie Townsend and Rona Weerasuriya, <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i>	18	Nilsson, K. (2006) <i>Forests, trees and human health and wellbeing</i> , Urban Forestry and Urban Greening, vol. 5, no. 3, pp. 109–109.	"A plethora of research has shown humans appreciate the diverse features offered by nature such as the varied foliage in a wood, the sound of bird song or the sight of ocean waves lapping at the seashore" " Big trees and small trees, glistening water, chirping birds, budding bushes, colourful flowers. These are important ingredients in a good life"
Sounds of the wind	Mardie Townsend and Rona Weerasuriya, <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i>	18 22	Nilsson, K. (2006) <i>Forests, trees and human health and wellbeing</i> , Urban Forestry and Urban Greening, vol. 5, no. 3, pp. 109–109. ¹ Ouset, P.; Nourhashemi, F.; Albarede, J. and Vellas, P. (1998) <i>Therapeutic gardens</i> , Archives of Gerontology and Geriatrics, vol. 6	"The therapeutic effects gained from the sounds of flowing water and the wind rustling through the leaves has also been given increasing attention in recent studies" "The wind rustling in the trees, the water running out of a pond, the smell of the damp soil, the heat of sun warming the skin, face, hands and arms, all this is an encouragement to natural relation, and brings a feeling of physical and mental well-being "
Flowers in different	Mardie Townsend and Rona Weerasuriya, <i>Beyond Blue to</i>	18 ¹ 87 ²	Nilsson, K. (2006) <i>Forests, trees and human health</i>	¹ "A plethora of research has shown humans appreciate the diverse features offered by nature

colors	<i>Green: The benefits of contact with nature for mental health and well-being</i> ^{1,2}	88 ²	<i>and wellbeing , Urban Forestry and Urban Greening</i> , vol. 5, no. 3, pp. 109–109. ¹	<p>such as the varied foliage in a wood, the sound of bird song or the sight of ocean waves lapping at the seashore” “The therapeutic effects gained from the sounds of flowing water and the wind rustling through the leaves has also been given increasing attention in recent studies” “Nature matters to people. Big trees and small trees, glistening water, chirping birds, budding bushes, colourful flowers. These are important ingredients in a good life”</p> <p>²“Subjects reported the underlying causes for these psychological and emotional pleasures were the varied greenery of the woodlands and colours of flowers, the open space and sense of distance, the opportunity to view wildlife”</p>
An aesthetically beautiful landscape	<p>http://www.hphpcentral.com/article/where-you-walk-matters¹</p> <p>Townsend, Mardie; Weerasuriya, Rona (2010) <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i>²</p>	10 ² 13 ²	<p>Li, Dr. Quig¹</p> <p>Kellert, S. and Derr, V. (1998) <i>A national study of outdoor wilderness experience</i>, Yale: School of Forestry and Environmental Studies, Yale University, CT.²</p>	<p>¹“ We all instinctively feel that the sense of well-being that comes from spending time in a natural environmental, with a spectacular scenery, sounds and sights of the outdoor, is totally different experience from walking in our suburban streets .”</p> <p>²“Aesthetic value (physical attraction and beauty of nature): adaptability, heightened awareness, harmony, balance, curiosity, exploration, creativity and an antidote to the pressures of modern living”</p> <p>²“Ulrich and colleagues have found that places for which people typically have an aesthetic preference—settings which evoke moderate levels of interest, pleasantness and calm—are usually found to be places where recovery from stress takes place”</p>
Visible waves of the sea (maybe lake?)	Townsend, Mardie and Weerasuriya, Rona (2010) <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i>	18	Nilsson, K. (2006) <i>Forests, trees and human health and wellbeing , Urban Forestry and Urban Greening</i> , vol. 5, no. 3, pp. 109–109.	“A plethora of research has shown humans appreciate the diverse features offered by nature such as the varied foliage in a wood, the sound of bird song or the sight of ocean waves lapping at the seashore” “The therapeutic effects gained from the sounds of flowing water and the wind rustling through the leaves has also been given increasing attention in recent studies “
Streets with trees	Frances, E. (Ming) Kuo (2010) <i>Parks And Other Green Environments: Essential Components of a Healthy Human Habitat</i> ¹	31 ¹		¹ “Green outdoor environments might promote health by way of encouraging and enabling physical activity—whether it be walking and biking along tree-lined streets, gardening, ecological restoration volunteering, hunting, hiking, kayaking, or participating in sports and outdoor games in parks and recreation areas.

				Green views and environments might also promote health by reducing the debilitating effects of stress on cardiovascular health, or by preventing the accidents caused by mental fatigue, or by preventing the harm caused by aggression and violence, or by improving air quality."
Natural Landscape	<p>Healthy parks healthy people central - <i>Forest bathin</i>, (s/d) - http://www.hphpcentral.com/article/where-you-walk-matters ¹</p> <p>Tabbush, Paul; O'Brien, Liz (2002), <i>Health and Well-being Trees, Woodlands and Natural Spaces</i> ²</p> <p>Maller, Cecily; Townsend, Mardie; St Leger, Lawrence; Henderson -Wilson, Claire; Pryor, Ms Anita; Prosser, Ms Lauren; Moore, Dr Megan (2008), <i>Healthy parks, healthy people – The health benefits of contact with nature in a park context</i> ³</p> <p>Townsend, Mardie and Weerasuriya, Rona (2010) <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i> ⁴</p>	<p>3²</p> <p>14³</p> <p>12⁴</p>	<p>Li, Dr. Quig ¹</p>	<p>¹"We all instinctively feel that the sense of well-being that comes from spending time in a natural environmental, with a spectacular scenery, sounds and sights of the outdoor, is totally different experience from walking in our suburban streets."</p> <p>²"Research has identified contact with, or visual appreciation of, natural scenes as providing a means to stress recovery"</p> <p>³Cardiovascular health - "Although campaigns addressing smoking, physical activity, cholesterol, and alcohol consumption are already in place, they could be supplemented by the promotion of the health and wellbeing benefits arising from exposure to nature through visiting a park, interacting with pets, gardening, habitat restoration, or simply contemplating a natural view."</p> <p>⁴"To display a stress response involving high levels of physical arousal in the face of an unthreatening natural setting would be maladaptive, since this process would cause fatigue and lead to chronic cardiovascular and endocrine responses that would adversely affect health."</p>
Agricultural landscape s	<p>Townsend, Mardie and Weerasuriya, Rona (2010) <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i> ¹</p>	<p>59</p> <p>58</p> <p>33</p>	<p>Health Council of the Netherlands and Dutch Advisory Council for Research on Spatial Planning Nature and the Environment (2004) <i>Nature and Health. The influence of nature on social, psychological and physical wellbeing</i>, Health Council of the Netherlands and RMNO, The Hague.</p> <p>J., Peacock; R., Hine and J., Pretty (2007) <i>Got the blues, then find some</i></p>	<p>"Farms and agricultural landscapes are suitable for those seeking to address both social and medical needs, such as psychiatric patients, those suffering from depression, people with learning disabilities, people with a drug history, disaffected youth as well as people suffering from work-related stress or obesity"</p> <p>"Pleasant rural scenes, which were comprised of trees, water, blue sky, clouds and animals such as lambs and calves, had the greatest effects in reducing blood pressure and increasing self-esteem, while a non-significant but positive effect was shown in the improvement of mood. The results from this study were useful in establishing that green exercise is more effective than exercise"</p>

			<p>greenspace: The mental health benefits of green exercise activities and green care, Report, 2007.</p> <p>Lindemuth, A. (2007) <i>Designing Therapeutic Environments for Inmates and Prison Staff in the United States: Precedents and Contemporary Applications</i>, Journal of Mediterranean Ecology, vol. 8, pp. 87–97.</p>	<p>alone in improving both cardiovascular and mental health related measures.”</p> <p>“Decrease in illegal activity and drug use, higher self-esteem, and lower anxiety and depression levels were seen as outcomes of the horticulture therapy programs”</p>
Green spaces	<p>Blaschke, Paul (2013), <i>Health and wellbeing benefits of conservation in New Zealand</i> ¹.</p> <p>Townsend, Mardie and Weerasuriya, Rona (2010) <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i> ²</p> <p>Bird, Dr William (2004) <i>NATURAL FIT Can Green Space and Biodiversity Increase Levels of Physical Activity?</i> ³</p> <p>Vancouver (2011), <i>Healthy by natures</i> ⁴</p> <p>Frances, E. (Ming) Kuo (2010) <i>Parks And Other Green Environments: Essential Components of a Healthy Human Habitat</i> ⁵</p>	<p>1156¹</p> <p>29²</p> <p>12²</p> <p>6³</p> <p>14⁴</p> <p>6⁵</p> <p>31⁵</p>	<p>F., Gómez; L. Gil and J., Jabaloyes (2004) <i>Experimental investigation on the thermal comfort in the city: relationship with the green areas, interaction with the urban microclimate</i>, Building and Environment, vol. 39, no. 9, pp. 1077–1086. ²</p>	<p>¹“Green space may facilitate the development of social capital by providing places to interact with other members of the public and undertake activities with groups, and by strengthening people’s sense of attachment to their living environment. There is a well-established link between social capital and improved physical and mental health”</p> <p>¹“also found no association between the amount of green space in the area in which people live (either useable space or total space) and mortality from either cardiovascular disease (e.g. heart attacks or strokes) or lung cancer”</p> <p>¹“The findings of the New Zealand studies discussed in section 3.4.2 contrast with international research, which has shown that greener neighbourhoods are generally associated with reduced rates of mortality, better self-rated health, less illness (particularly mental illness) greater resilience to stress, and reduced rates of overweight and obesity.”</p> <p>²“The spaces were visited on days which were hot and sunny and when air temperatures were significantly higher than on average days. Results showed a positive association between the frequency of visits and time spent in green spaces, and the benefits and well-being reports provided by participants during the survey”</p> <p>²“Participating in physical activity in green settings is associated with decreased feelings of tension, confusion, anger and depression, while exhibiting greater feelings of revitalization”</p> <p>² “The questions focused on: activities conducted in public green spaces, participant evaluations</p>

				<p>and preference for these places; distance to the areas from home, frequency of visits; and health questions which had a focus on mental stress as well as being overweight and obesity, the latter two known indirectly to affect mental health and well-being.”</p> <p>³ “The rise in inactivity and obesity is now high on the Government agenda. There is growing recognition that natural green space can increase levels of physical activity. However, the huge potential that green space can offer is still not fully recognised. A better understanding of the relationship between exercise and wildlife-rich open space will help the Government reach targets to increase levels of physical activity, as well as provide a significant economic reason to maintain green space.”</p> <p>⁴ “The relationship between nature and physical activity is strong. Evidence shows green space reduces obesity and this translates into economic benefits in reduced health care costs.”</p> <p>⁵ “Greener environments enhance recovery from surgery, enable and support higher levels of physical activity, improve immune system functioning, help diabetics achieve healthier blood glucose levels, and improve functional health status and independent living skills among older adults”</p> <p>⁵ “Green outdoor environments might promote health by way of encouraging and enabling physical activity—whether it be walking and biking along tree-lined streets, gardening, ecological restoration volunteering, hunting, hiking, kayaking, or participating in sports and outdoor games in parks and recreation areas. Green views and environments might also promote health by reducing the debilitating effects of stress on cardiovascular health, or by preventing the accidents caused by mental fatigue, or by preventing the harm caused by aggression and violence, or by improving air quality.”</p>
Fresh air - In the mountain, sea side	http://www.hphpcentral.com/article/for-our-health%E2%80%99s-sake		Ulrich’s, Roger	<p>“(…)an instinctive approach to recovery and convalescence during and after illness has been to seek respite at a seaside or mountainous retreat to breathe fresh air and spend time a natural environment”</p>

Smell of the trees	http://www.hphpcentral.com/article/where-you-walk-matters		Li, Dr. Quig	"(...) research too and this finding implicate our sense of smell as well. They suggest that the natural fragrance of trees known as phytoncides of the reduction in blood pressure observed during the forest walking."
Smell of wet earth	Townsend, Mardie and Weerasuriya, Rona (2010) <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i>	22	Ouset, P.; Nourhashemi, F.; Albareda, J. and Vellas, P. (1998) <i>Therapeutic gardens</i> , Archives of Gerontology and Geriatrics, vol. 6, pp. 369–372.	"The wind rustling in the trees, the water running out of a pond, the smell of the damp soil, the heat of sun warming the skin, face, hands and arms, all this is an encouragement to natural relation, and brings a feeling of physical and mental well-being "
Berries (berries, mushrooms)	Townsend, Mardie and Weerasuriya, Rona (2010) <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i>	20	Hansmann, R., Hug, S.-M. and Seeland, K. (2007) <i>Restoration and stress relief through physical activities in forests and parks, Urban Forestry and Urban Greening</i> , vol. 6, no. 4, pp. 213–225.	"An Estonian study, which evaluated the restorative effects of nature as well as its connections to human health, indicated that respondents gained positive effects and benefits from activities such as observing nature, taking walks in natural surroundings, hiking and hunting, gathering berries and mushrooms, gardening, fishing and working in the forest"
Species/vegetation	Townsend, Mardie ; Weerasuriya, Rona (2010) <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i> ¹ Frances, E. (Ming) Kuo (2010) <i>Parks And Other Green Environments: Essential Components of a Healthy Human Habitat</i> ² Tibbatts, David (2002), <i>Your parks The benefits of parks and greenspace</i> ³	20 ¹ 2 ¹ 13 ² 15 ³	Velarde, M. D.; Fry, G. and Tveit, M. (2007) <i>Health effects of viewing landscapes: Landscape types in environmental psychology, Urban Forestry and Urban Greening</i> , vol. 6, no. 4, pp. 199–212. ¹	¹ "Most perceived scenes with vegetation (natural elements) as a major source of delight, whereas built scenes were a source of displeasure in urban park settings" ¹ "The conviction that contact with nature—for example through viewing landscapes that contain vegetation, water and other natural features—ameliorates stress and benefits humans in general" ² "Vegetation is associated with better social behavior across the board. More green translates to less aggression, less transgression, more socializing, and more acts of caring" ³ " The trees and vegetation within parks and greenspace help to reduce the effects of pollution, regular exposure to outdoor green environments reduces stress and accelerates recovery, and regular exercise and activity reduces the incidence of obesity and other associated life threatening diseases."
Native flowers	Healthy parks healthy people central – Biodiversity, our health depends on it, (s/d) - http://www.hphpcentral.com/article/biodiversity-our-health-depends-on-it		Professor IIKKA HANSKI	"The connection between biodiversity and reduced allergic prevalence was particularly associated with de spices richness as native flowering plants (...)"
Graze	Townsend, Mardie ;	17	Ottosson, J. and Grahn, P.	"Narratives dating back centuries describe

landscape	Weerasuriya, Rona (2010) <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i> ¹		(2008) <i>The role of natural settings in crisis rehabilitation: How does the level of crisis influence the response to experiences of nature with regard to measures of rehabilitation?</i> , Landscape Research, vol. 33	<i>gardens, pastoral landscapes and natural settings with miniature lakes and meadows, as places where people can take refuge, find shelter and comfort during moments of sadness and pain; as places where the body and mind can both heal</i>
Trees	Canadian Fitness and Lifestyle Research Institute and Participaction (s/d) <i>Health Benefits of Outdoor Play for Children and Youth</i> ¹ ² David Tibbatts (2002), <i>Your parks The benefits of parks and greenspace</i> ²	2 ¹ 15 ²		¹ <i>"For instance, they note that the amount and intensity of activity of grade school children may be influenced by the amount and diversity of 'green' or environmental features available (i.e.: trees, and gardens) on school grounds. Perhaps equally as important for participating outdoors is the amount of 'green space' surrounding residential areas and proximity to parks as it contributes to activity, healthy weight and reducing health inequalities."</i> ² <i>" The trees and vegetation within parks and greenspace help to reduce the effects of pollution, regular exposure to outdoor green environments reduces stress and accelerates recovery, and regular exercise and activity reduces the incidence of obesity and other associated life threatening diseases."</i>
Lake	Townsend, Mardie ; Weerasuriya, Rona (2010) <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i> ¹	11	Kaplan, S. (1995) <i>The Restorative Benefits of Nature: Towards an integrative framework</i> , Journal of Environmental Psychology, vol. 15, pp. 169–182.	<i>"First, natural environments provide opportunities to gain distance from routine activities and thoughts. This is referred to as "being away". It may be associated with easily accessible natural environments within urban areas, as well as with more distant areas in close proximity to the sea, mountains, lakes, streams, forests, meadows and other idyllic places commonly used to "get away" from busy city living"</i>
Nature river	Mardie Townsend and Rona Weerasuriya, <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i>	58		<i>"Pleasant rural scenes, which were comprised of trees, water, blue sky, clouds and animals such as lambs and calves, had the greatest effects in reducing blood pressure and increasing self-esteem, while a non-significant but positive effect was shown in the improvement of mood. The results from this study were useful in establishing that green exercise is more effective than exercise alone in improving both cardiovascular and mental health related measures."</i>
Area to	Townsend, Mardie and	20	Hansmann, R., Hug, S.-M.	<i>"An Estonian study, which evaluated the</i>

fish	Weerasuriya, Rona (2010) <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i>	58	and Seeland, K. (2007) <i>Restoration and stress relief through physical activities in forests and parks, Urban Forestry and Urban Greening</i> , vol. 6, no. 4, pp. 213–225.	<i>restorative effects of nature as well as its connections to human health, indicated that respondents gained positive effects and benefits from activities such as observing nature, taking walks in natural surroundings, hiking and hunting, gathering berries and mushrooms, gardening, fishing and working in the forest</i> “A research project undertaken by the University of Essex to measure the effects of 10 green exercise activities (such as walking, cycling, horse riding, fishing and canal boating) involved 263 participants from four counties in the United Kingdom... Initial evaluations of these initiatives by the School of Health and Social Care at Oxford Brookes University found that participants of the “Green Gym” groups showed significant improvements in mental health scores, a reduction in depression, and a trend towards reduction in weight.”
Wildlife- fish, turtles, birds ,Dolphins, horses, butterflies ,lambs, calves etc	Townsend, Mardie ; Weerasuriya, Rona (2010) <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i> ¹	74 ¹ 30 ¹	Antoniolio, C. and Reveley, M. (2000), <i>Randomised controlled trial of animal facilitated therapy with dolphins in the treatment of depression</i> , British Medical Journal, vol. 331, pp. 1231–1234. ¹ R., Pinder; A., Kessel; Green, J. and Grundy, C., (2009) <i>Exploring perceptions of health and the environment: A qualitative study of Thames Chase Community Forest</i> , Health and Place, vol. 15, no. 1, pp. 349–356. ¹ E., Rothe; B., Vega; R., Torres; S., Soler and R., Pazos (2005) <i>From kids and horses: Equine facilitated psychotherapy for children</i> , International Journal of Clinical and Health Psychology, vol. 5, no. 2, pp. 373–383. ¹	¹ “A recent study has examined the effects of dolphins on mildly to moderately clinically depressed patients (who scored 11 or more on a ‘modified’ Hamilton Rating Scale for Depression and Beck Depression Inventory), and who were off medication and psychotherapy for four weeks prior to the study” ¹ “Horses are believed to be unique in the manner in which they respond to humans and, due to the sensitivity they show the environment, they are believed to have the ability to read people in terms of their feelings and intentions; Equine-facilitated therapy (EFT) is a type of therapy which is commonly used to address mental health issues such as “behavioural and attention deficit disorders, eating disorders, abuse issues, depression, anxiety, relationship problems and communication requirements” ¹ “Pleasant rural scenes, which were comprised of trees, water, blue sky, clouds and animals such as lambs and calves, had the greatest effects in reducing blood pressure and increasing self-esteem, while a non-significant but positive effect was shown in the improvement of mood.”
Pets	Townsend, Mardie ;	87 ¹	A, Timperio; J, Salmon;	¹ “Sixty-nine inpatients diagnosed with a mental

	<p>Weerasuriya, Rona (2010) <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i>¹</p> <p>Healthy parks healthy people central –Still your best Friend, (s/d) -Fout! De</p> <p>hyperlinkverwijzing is ongeldig.²</p> <p>Australian companion animal council (2009), <i>The Power of Pets, The benefits of companion animal ownership</i>³</p> <p>Maller, Cecily; Townsend, Mardie; St Leger, Lawrence; Henderson-Wilson, Claire; Pryor, Ms Anita; Prosser, Ms Lauren; Moore, Dr Megan (2008), <i>Healthy parks, healthy people - The health benefits of contact with nature in a park context</i>⁴</p> <p>Barking Dogs (s/d) <i>The Big Picture</i>⁵</p>	<p>7³</p> <p>52⁴</p> <p>2⁵</p>	<p>B,Chu and opoulos, Andrian N. (s/d) <i>Is dog ownership or dog walking associated with weight status in children and their parents?</i> Health Promotion Journal of Australia 2008 19 (1):60-63⁵</p>	<p><i>illness and a history of drug or alcohol abuse met for one hour each day for four weeks in different experimental settings. Half of the patients were in a control group, while the other half had animals such as dogs, rabbits, ferrets and guinea pigs visit the class each day, and each member was permitted to observe, hold, interact or play with the animals if the group was not being disturbed."</i></p> <p>² "On the psychological side, the mere fact of owning a pet and having something to nurture, care for and spend time with – an animal friend – is of sufficient to improve quality of life and promote health"</p> <p>³ "Pets also appear to provide a powerful buffering effect against grief. In one study of elderly people who had recently lost a spouse, having a strong attachment to a pet was associated with significantly less depression".</p> <p>⁴ "The role of pets in cardiovascular health has also been explored Research by Allen, Blascovich and Mendes (2002) studied cardiovascular reactivity in 240 married couples of which half were pet owners. The study found that, in comparison with their non-pet owning counterparts, pet owners had 'significantly lower heart rate and blood pressure levels during a resting baseline, significantly smaller increases (i.e. reactivity) from baseline levels during ... [the intervention activities], and faster recovery"</p> <p>⁵ "In 2008 the Health Promotion Journal of Australia⁶ published results showing that dog ownership was indeed associated with a lower risk of obesity among Children."</p>
<p>Sport and recreation al infrastructure</p> <p>Hiking, cycling, running places to sit down, places for picnic, camping</p>	<p>Townsend, Mardie and Weerasuriya, Rona (2010) <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i>¹</p> <p>Blaschke, Paul (2013), <i>Health and wellbeing benefits of conservation in New Zealand</i>²</p> <p>Recreation & open space element (2011), <i>An element of the general plan of the city and county of san Francisco</i>³</p>	<p>49¹</p> <p>21¹</p> <p>32¹</p> <p>11²</p> <p>2⁵</p>	<p>Sherman, S. A.; Varni, J. W.; Ulrich, R. S. and Malcarne, V. L. (2005) <i>Post-occupancy evaluation of healing gardens in a pediatric cancer center, Landscape and Urban Planning</i>, vol. 73, no. 2-3, pp. 167–183.¹</p>	<p>¹ "For example, a group of three healing gardens has been provided adjacent to a children's cancer centre in Southern California. The three gardens are abundant with plants and flowers but also with various unique features such as brightly coloured cloth butterflies providing shade for children, wooden benches and chairs, water features, mosaics and a mailbox-sized 'wish house' where children can place wishes they have written."</p> <p>¹ "A Summary of the Contribution of Parks to Human Health and Wellbeing: Provide a variety of settings and infrastructure for various levels of</p>

				<p>formal and informal sport and recreation, for all skill levels and abilities e.g. picnicking, walking, dog training, running, cycling, ball games, sailing, surfing, photography, bird watching, bushwalking, rock climbing, camping”</p> <p>¹ “There was also emphasis on natural places providing opportunities for “relaxation, peacefulness, freedom and leisure pursuits such as walking, bike riding, motorbike riding, horse riding, camping, sailing, fishing, surfing, swimming, waterskiing and body boarding”</p> <p>² “This study found that sitting down observing nature (14 minutes) followed by walking in nature (16 minutes) resulted in a significant reduction in stress (as measured by biochemical and cardiovascular indicators) as well as improved mood and vigour, compared with similar activities in an urban setting.”</p> <p>³ “Physical recreation reduces obesity and risk of cardiovascular disease, diabetes and other health ailments. Public open spaces, whether playgrounds, picnic fields or even just engaging streets, can help build community by giving neighbors a realm in which to get to know each other, and giving children a safe place to play.”</p>
Routes for horse riding	<p>Bird, Dr William (2004) <i>Natural fit - Can Green Space and Biodiversity Increase Levels of Physical Activity?</i>¹</p> <p>Townsend, Mardie and Weerasuriya, Rona (2010) <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i>²</p> <p>Toben, F. Nelson; Stovitz, Steven D.; Thomas, Megan; M. LaVoi, Nicole; Bauer, Katherine W. and Neumark-Sztainer, Dianne (2011) <i>Do Youth Sports Prevent Pediatric Obesity? A Systematic Review and Commentary</i>³</p>	17 ¹		<p>¹ “Moderate exercise includes walking, cycling, swimming, gardening, horse riding and conservation work (if possible in the context of a wildlife-rich environment). This level of activity is enough to raise the pulse to over 60% of the maximum heart rate⁸, which is the threshold to improve cardiovascular health.”</p> <p>² “A research project undertaken by the University of Essex to measure the effects of 10 green exercise activities (such as walking, cycling, horse riding, fishing and canal boating) involved 263 participants from four counties in the United Kingdom... Initial evaluations of these initiatives by the School of Health and Social Care at Oxford Brookes University found that participants of the “Green Gym” groups showed significant improvements in mental health scores, a reduction in depression, and a trend towards reduction in weight.”</p> <p>³ “Only one of these studies examined the type of sport youth were involved in and found that participants in some sports were more likely and</p>

				in others were less likely to be overweight than nonparticipants. Sports with a higher level of obesity included rugby, swimming, judo, and tennis, and sports with lower levels of obesity included gymnastics, handball, horse riding, and dance, although the sample within each of these sports was relatively small."
Spaces to relax	<p>Townsend, Mardie and Weerasuriya, Rona (2010) <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i> ¹</p> <p>Bushell, Robyn; <i>Healthy Parks, Healthy People, Healthy Tourism: The ASEAN Healthy Tourism Strategy addressing threats from tourism at Ha Long Bay World Heritage site, Vietnam.</i> ²</p>	<p>14¹</p> <p>6¹</p> <p>30²</p>	<p>Thompson, M.; Kennedy, R. and Igou, S. (1983) <i>Pets as socializing agents with chronic psychiatric patients: An initial study</i> in A. Katcher and A. Beck (eds), <i>New Perspectives on our lives with companion animals</i>, University of Pennsylvania Press, PA, pp. 427–435. ¹</p> <p>R., Pinder; A., Kessel; J., Green and C., Grundy (2009) <i>Exploring perceptions of health and the environment: A qualitative study of Thames Chase Community Forest</i>, Health and Place, vol. 15, no. 1, pp. 349–356. ¹</p>	<p>¹ "Many reported feeling happier, calmer and emotionally uplifted just thinking of a walk in the country, and described it as a place where you could go "to get away from your troubles" and "alleviate depression". Others described the aesthetic pleasures which were inherent in the outdoors such as "birds, flowers, and enjoying the sun on the face, walking in the wind and even the rain"</p> <p>² "The evidence points to many positive health benefits of relaxation in nature, especially for lifestyle related health problems. These include heart disease, diabetes, strokes, cancers, disabilities, depression, osteoporosis, anxiety and sleep problems"</p>
Trails for walking – in forest, gardens, wood	<p>Mardie Townsend and Rona Weerasuriya, <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i> ¹</p> <p>Healthy parks healthy people central - Forest bathin, (s/d) -</p> <p>Fout! De hyperlinkverwijzing is ongeldig. ²</p> <p>Blaschke, Paul (2013), <i>Health and wellbeing benefits of conservation in New Zealand</i> ³</p> <p>Mitrione Steve; MD MLA;</p> <p>Larson, Jean(2013) <i>Healing by Design: Healing Gardens and Therapeutic Landscapes</i> VOL.02 ISSUE 10⁴</p>	<p>30¹</p> <p>32¹</p> <p>58¹</p> <p>32¹</p> <p>4¹</p> <p>11 ²</p> <p>21⁵</p> <p>6⁵</p> <p>17⁶</p>	<p>Pinder, R.; Kessel, A.; Green, J. and Grundy, C.(2009) <i>Exploring perceptions of health and the environment: A qualitative study of Thames Chase Community Forest</i>, Health and Place, vol. 15, no. 1, pp. 349–356. ¹</p> <p>Health Council of the Netherlands and Dutch Advisory Council for Research on Spatial Planning Nature and the Environment [HCNDACRSP] (2004) <i>Nature and Health. The</i></p>	<p>¹"Many reported feeling happier, calmer and emotionally uplifted just thinking of a walk in the country, and described it as a place where you could go "to get away from your troubles" and "alleviate depression."</p> <p>¹"Areas with natural landscaping, green neighbourhood meeting places, group-based nature activities such as walking, shared gardens for the elderly and allotment gardens can facilitate social contact, which has been shown to reduce the risk of developing chronic diseases such as depression and cardiovascular disease as well as to increase longevity"</p> <p>¹"Studies have shown that walking for older adults has numerous mental health and well-being benefits such as improvements in cognitive function in older women; reduced depression; and improved social ties"</p> <p>¹"A research project undertaken by the University</p>

	<p>National recreation and park association (2010) <i>Parks And Other Green Environments: Essential Components of a Healthy Human Habitat</i>⁵</p> <p>Bird, Dr William (2004) <i>Natural fit - Can Green Space and Biodiversity Increase Levels of Physical Activity?</i>⁶</p> <p>Healthy parks healthy people central, where you walk matters</p> <p>www.hphpcentral.com⁷</p> <p>Lawrence, D. Frank; Greenwald, Michael J.; Winkelman, Steve; Chapman, James; Kavage, Sarah (2009), <i>Carbonless footprints: Promoting health and climate stabilization through active transportation</i>⁸</p> <p>Godbe, Geof f r e y (2009), <i>Outdoor Recreation, Health, and Wellness Understanding and Enhancing the Relationship</i>⁹</p>		<p><i>influence of nature on social, psychological and physical wellbeing</i>, Health Council of the Netherlands and RMNO, The Hague¹</p> <p>Peacock, J.; Hine, R. and Pretty, J. (2007) <i>Got the blues, then find some green space: The mental health benefits of green exercise activities and green care</i>, MIND Week Report, February 2007. Urgência¹</p>	<p><i>of Essex to measure the effects of 10 green exercise activities (such as walking, cycling, horse riding, fishing and canal boating) involved 263 participants from four counties in the United Kingdom... Initial evaluations of these initiatives by the School of Health and Social Care at Oxford Brookes University found that participants of the "Green Gym" groups showed significant improvements in mental health scores, a reduction in depression, and a trend towards reduction in weight."</i></p> <p>¹ "Research on the physiological health benefits of gardening, for example, has shown that gardening: reduces the risk of cardiovascular disease, improves the health of diabetes patients"</p> <p>¹ "Areas with natural landscaping, green neighbourhood meeting places, group-based nature activities such as walking, shared gardens for the elderly and allotment gardens can facilitate social contact, which has been shown to reduce the risk of developing chronic diseases such as depression and cardiovascular disease as well as to increase longevity"</p> <p>¹ "A Summary of the Contribution of Parks to Human Health and Wellbeing: Provide a variety of settings and infrastructure for various levels of formal and informal sport and recreation, for all skill levels and abilities e.g. picnicking, walking, dog training, running, cycling, ball games, sailing, surfing, photography, bird watching, bushwalking, rock climbing, camping"</p> <p>¹ "There was also emphasis on natural places providing opportunities for "relaxation, peacefulness, freedom and leisure pursuits such as walking, bike riding, motorbike riding, horse riding, camping, sailing, fishing, surfing, swimming, waterskiing and body boarding"</p> <p>¹ "Documentation from history describes Egyptian physicians advising disturbed patients to walk in gardens"</p> <p>² "Also known as parks and protection areas in other countries, has even more benefits than previously envisioned", "(...) analysed the effects of spending time in forest environments on mood, immune function and stress levels".</p> <p>² "This led him to conclude that the risk psycho-</p>
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				social stress-related diseases are decreased by time spent walking in forest environments.”
Trails for walking – in florest, gardens, wood	<p>Russell, Roly; Guerry, Anne D.; Balvanera, Patricia; Gould, Rachelle K.; Basurto, Xavier; Chan, Kai M.A.; Klain, Sarah; Levine, Jordan; and Tam; Jordan (2013) <i>Humans and Nature: How Knowing and Experiencing Nature Affect Well-Being</i>¹⁰</p> <p>Mitrione, Steve; Larson, Jean (s/d) <i>Healing by Design: Healing Gardens and Therapeutic Landscapes</i> VOL.02 ISSUE 10¹¹</p> <p>Maller, Cecily; Townsend, Mardie; Pryor, Anita; Brown, Peter; and Leger, Lawrence ST (2005), <i>Healthy nature healthy people: ‘contact with nature’ as an upstream health promotion intervention for populations</i>¹²</p>			<p>² “In one study the profile of mood states (POMS) test was used to show that forest bathing trips significantly the score of vigour in subjects, and decreased the scores for anxiety, depression and anger”</p> <p>³ “A number of laboratory studies have suggested that volatile substances in forests have beneficial effects on human immune function”</p> <p>³ “This study found that sitting down observing nature (14 minutes) followed by walking in nature (16 minutes) resulted in a significant reduction in stress (as measured by biochemical and cardiovascular indicators) as well as improved mood and vigour, compared with similar activities in an urban setting.”</p> <p>³ “have focused on the popular practice of ‘Shinrin-yoku’ (‘forest bathing’ or ‘leisurely visit to a forest’). Many of the studies in this area now use controlled—and usually crossover—experimental designs, in which participants typically carry out a relatively short period of activity (walking and/or sitting down and ‘taking in the scenery’) in a forest environment”</p> <p>⁴ “16 participants walked for 6 km in both a forest setting and an urban setting, and found that the forest walk resulted in significant increases in concentrations of the hormones adiponectin and DHEA-S, which may be protective against heart disease, obesity and diabetes”</p> <p>³ “Greener environments enhance recovery from surgery, enable and support higher levels of physical activity, improve immune system functioning, help diabetics to achieve healthier blood glucose levels, and improve functional health status and independent living skills among older adults.”</p> <p>⁴ “Encourage Exercise: Gardens that encourage walking as a form of exercise have been correlated with lower levels of depression.”</p> <p>⁵ “Greener environments enhance recovery from surgery, enable and support higher levels of physical activity, improve immune system functioning, help diabetics achieve healthier blood glucose levels, and improve functional</p>

			<p>health status and independent living skills among older adults”</p> <p>⁵“But exercise is not the only answer. One particularly striking example of the health benefits of contact with nature beyond mere exercise comes from Japan, where scientists examined the impacts of “forest bathing”—a walk in the forest—on blood glucose levels in noninsulin- dependent diabetic patients.”</p> <p>⁶ “Moderate exercise includes walking, cycling, swimming, gardening, horse riding and conservation work (if possible in the context of a wildlife-rich environment). This level of activity is enough to raise the pulse to over 60% of the maximum heart rate, which is the threshold to improve cardiovascular health.”</p> <p>⁷“In this update on Dr Li’s latest work, we examine his latest research findings that show that spending time in forest environments, also known as national parks and protected areas in other countries, has even more benefits than previously envisioned. Walking has long been promoted as an activity beneficial to human health: an accessible, free, and easy way to develop fitness that is suitable for people of all ages. It’s been advocated as an aid in the prevention and control of modern diseases such as obesity and diabetes, as well as being useful in the treatment of mental health conditions such as depression”</p>
			<p>⁷“In this update on Dr Li’s latest work, we examine his latest research findings that show that spending time in forest environments, also known as national parks and protected areas in other countries, has even more benefits than previously envisioned. Walking has long been promoted as an activity beneficial to human health: an accessible, free, and easy way to develop fitness that is suitable for people of all ages. It’s been advocated as an aid in the prevention and control of modern diseases such as obesity and diabetes, as well as being useful in the treatment of mental health conditions such as depression”</p> <p>⁷“Walking has long been promoted as an activity beneficial to human health: an accessible, free, and easy way to develop fitness that is suitable</p>

				<p>for people of all ages. It's been advocated as an aid in the prevention and control of modern diseases such as obesity and diabetes, as well as being useful in the treatment of mental health conditions such as depression.”</p> <p>⁸ “The Prescription Trails concept began within a grantfunded multi-agency partnership as a program to write prescriptions for walking to patients with diabetes.”¹³</p> <p>⁸ “Walking and bicycling, on the other hand, are inherently active, and have been associated with a lower likelihood of obesity”</p> <p>⁹ “Brisk walking for just three hours a week or half an hour each day is associated with a 30 to 40 percent lower risk of heart disease in women”</p> <p>¹⁰ “The same authors have noted in other research that the benefits of visiting natural spaces may be disproportionately larger for those who are ailing the most; for example, elderly people with a particularly low “psychophysiological balance” (defined as general helplessness, frequency of hospital visits, and low tolerance of other people) are the most positively affected by a visit to a garden as measured by heart rate and blood pressure changes”</p> <p>¹¹ “Other benefits include improvements to the mood of older adults who visit the park frequently lower levels of anxiety and sadness following a visit to the park lower stress levels and lower levels of depression associated with the increased physical activity of park users”</p> <p>¹¹ “Explore how contact with nature via parks could contribute to population health priority areas (especially in cardiovascular disease and mental health).”</p> <p>¹² “Recent research has investigated the effects on depression and overall mental health of exercising outside in a nature-based setting, such as a park—termed ‘green exercise’”</p>
Routes to practice race	<p>Mardie Townsend and Rona Weerasuriya, <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i>¹</p> <p>Barbara Davis (s/d) <i>Center for Childhood Diabetes,</i></p>	<p>21¹</p> <p>5²</p> <p>14⁴</p> <p>16⁵</p>	<p>RR, Pate; M, Pratt; SN, Blair and al. (s/d) <i>Physical activity and public health. A recommendation from the Centers for Disease Control and Prevention and the American College</i></p>	<p>¹ “A Summary of the Contribution of Parks to Human Health and Wellbeing: Provide a variety of settings and infrastructure for various levels of formal and informal sport and recreation, for all skill levels and abilities e.g. picnicking, walking, dog training, running, cycling, ball games, sailing, surfing, photography, bird watching,</p>

	<p>Department of Pediatrics, University of Colorado School of Medicine, Aurora, CO² http://www.athleteinme.com/ ArticleView.aspx?id=352³ Schwarzenegger, Arnold; Chrisman, Mike; Coleman, Ruth (2005) <i>The Health and Social Benefits of Recreation</i>⁴ Escudero, Dra. Pilar Martín (2004), <i>Ejercicio Físico</i>⁵</p>		<p><i>of Sports Medicine. JAMA</i> 1995;273:402-407³</p>	<p><i>bushwalking, rock climbing, camping</i> ² "Although exercise is important for all people, it is essential for people with type 2 diabetes... <i>Moderate Physical Activity for One Hour: Hiking, Light gardening/yard work, Dancing, Golf</i> <i>(walking and carrying clubs), Bicycling, Walking, Weight lifting (general light workout) and</i> <i>Stretching</i>" ³ "Moderate" exercise, moderate increase in heart rate: brisk walking, cycling slow, jogging slow and swimming slow" ⁴ "Obesity and diabetes can be greatly reduced through regular aerobic exercise and physical activity. Recreation activities, such as running, brisk walking, swimming and bicycling are excellent for elevating the heart rate and lowering the incidence of heart disease obesity and diabetes, if done regularly" ⁵ "Normas de autocontrol para el ejercicio y modificaciones de insulina: <i>TenisNadar, Correr, Golf, Ciclismo, Fútbol, Hockey, Ciclismo, Squash, Remo</i>"</p>
<p>Space to do vigorous exercise – zumba, move heavy objects and other</p>	<p>¹ Davis, Barbara (s/d) Center for Childhood Diabetes, Department of Pediatrics, University of Colorado School of Medicine, Aurora, CO ²http://www.athleteinme.com /ArticleView.aspx?id=352 ³http://www.athleteinme.com /ArticleView.aspx?id=325</p>		<p>² RR, Pate; M, Pratt; SN, Blair et al. (s/d) <i>Physical activity and public health. A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. JAMA</i> 1995;273:402-407 ³ M, Tanasescu; MF, Leitzmann; EB, Rimm et al. (s/d) <i>Exercise type and intensity in relation to coronary heart disease in men. JAMA</i> 2002;288:1994-2000.</p>	<p>¹"Although exercise is important for all people, it is essential for people with type 2 diabetes... <i>Moderate Physical Activity for One Hour: Hiking, Light gardening/yard work, Dancing, Golf</i> <i>(walking and carrying clubs), Bicycling, Walking, Weight lifting (general light workout) and</i> <i>Stretching</i>" ²"Vigorous" exercise, substantial increase in heart rate: Basketball, cycling fast, lawn mowing (push mower), moving heavy furniture, racquetball, running, singles tennis, stair machine, swimming fast and zumba" ²"A large Harvard study of male health care professionals shows how various types of exercise can lower the risk of coronary heart disease: <i>Running, Weight-training, Rowing and Brisk walking</i>" ³"You've said that regular exercise is important for the health of diabetics. But, can I still be competitive at an elite level if I have diabetes? ANSWER: The short answer to this is, yes, you definitely can. Even with diabetes, athletes can succeed at an elite level: Rowing: Sir Steven Redgrave (UK) won several gold medals in rowing at 5 successive Olympic Games from 1984 to</p>

				2000.” ³ “A large Harvard study of male health care professionals shows how various types of exercise can lower the risk of coronary heart disease: Running, Weight-training, Rowing and Brisk walking”
Spaces for physical exercises and green gyms	Townsend, Mardie and Weerasuriya, Rona (2010) <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i> ¹ Healthy parks healthy people central – <i>More than green spaces</i> , (s/d) - http://www.hphpcentral.com/article/more-than-green-spaces ² Blaschke, Paul (2013), <i>Health and wellbeing benefits of conservation in New Zealand</i> ³ Maller, Cecily; Townsend, Mardie; St Leger, Lawrence; Henderson-Wilson, Claire; Pryor, Ms Anita; Prosser, Ms Lauren; Moore, Dr Megan (2008), <i>Healthy parks, healthy people - The health benefits of contact with nature in a park context</i> ⁴ Bird, Dr William (2004) <i>NATURAL FIT Can Green Space and Biodiversity Increase Levels of Physical Activity?</i> ⁵ Barton, Jo; Colbeck, Ian; Hine, Rachel; Mourato, Susana; MacKerron, George and Wood, Carly (s/d) <i>Chapter 23: Health Values from Ecosystems</i> ⁶ Golden gate national parks conservancy (s/d) <i>Parks prescriptions profiles and resources for good health from the great outdoors</i> ⁷	95 ¹ 58 ¹ 97 ³ 12 ³ 36 ³ 15 ⁴ 16 ⁴ 6 ⁴ 6 ⁵ 1161 ⁶ 2 ⁷ 6 ⁹ 1 ¹⁰ 7 ¹³	Adlard, P.;Perreau, V.; Pop, V. and Cotman, C. (2005) <i>Voluntary exercise decreases amyloid load in a transgenic model of Alzheimer’s disease</i> , Journal of Neuroscience, vol. 25, no. 17, pp. 4217–4221. ¹ Pretty, J. (2004) <i>How nature contributes to mental and physical health</i> , Spirituality and Health International, vol. 5, no. 2, pp. 68-78. ¹ ⁴ Pretty, J.;Peacock, J.; Sellens, M. and Griffin, M. (2005) <i>The mental and physical health outcomes of green exercise</i> , International Journal of Environmental Health Research 15(5): 319-337. J., Thompson Coon; K., Boddy; K., Stein; R., Whear; J., Barton and M.H., Depledge, (2011) <i>Does participating in physical activity in outdoor natural environments have a greater effect on physical and mental wellbeing than physical activity indoors?</i> A systematic review. Environmental Science & Technology, 45, 1761–1772. ⁶	¹ “Exercise is also known to foster healthy muscle and bone development, maintain health and independence in the elderly, reduce their risk of falls, improve mental health, reduce cognitive impairments, and delay the onset and reduce the severity of Alzheimer’s disease and dementia in both elderly men and women” ¹ “The results from this study were useful in establishing that green Exercise is more effective than exercise alone in improving both cardiovascular and mental health related measures.” ¹ “The “Feel Blue, Touch Green” study described previously showed that membership in the group increased opportunities for physical activity/exercise, which contributed to improved mood, cardiovascular benefits and helped to manage weight, as well as providing opportunities to breathe fresh air, providing associated respiratory health benefits.” ² “That is where parks come in, as, unlike gymnasiums, they are accessible and affordable to all people and provide a range of different activities to enjoy.” ³ “They found that compared with other types of volunteering, environmental volunteering was more strongly associated with subsequent physical activity, as well as better self-reported health and fewer symptoms of depression.” ³ “Greener environments enhance recovery from surgery, enable and support higher levels of physical activity, improve immune system functioning, help diabetics to achieve healthier blood glucose levels, and improve functional health status and independent living skills among older adults.” ⁴ “Physical activity has recently been proved to be equally effective as medication in the treatment of depression in elderly people” ⁴ “while exposed to photographs of green spaces compared with other spaces, found that green

				exercise appears to have benefits both for cardiovascular health and mental health.”
Spaces for physical exercises and green gyms	<p>Steve Mitrione, MD, MLA Jean Larson, <i>Healing by Design: Healing Gardens and Therapeutic Landscapes</i>⁸</p> <p>http://www.architecture.com/Files/RIBAHoldings/PolicyAndInternationalRelations/Policy/PublicAffairs/RIBACityHealthCheck.pdf⁹</p> <p>Diana E Bowler, Lisette M Buyung-Ali, Teri M Knight, Andrew S Pullin (2010), A systematic review of evidence for the added benefits to health of exposure to natural environments¹⁰</p> <p>National recreation and park association (s/d) <i>Prescribing Parks for Better Health Success Stories</i>¹¹</p> <p>Frances, E. (Ming) Kuo (2010), (2010) <i>Parks And Other Green Environments:Essential Components of a Healthy Human Habitat</i>¹²</p> <p>World health Organization (sd) <i>Global Recommendation on physical Activity for Health</i>¹³</p>			<p>⁵“The rise in inactivity and obesity is now high on the Government agenda. There is growing recognition that natural green space can increase levels of physical activity. However, the huge potential that green space can offer is still not fully recognised. A better understanding of the relationship between exercise and wildlife-rich open space will help the Government reach targets to increase levels of physical activity, as well as provide a significant economic reason to maintain green space.”</p> <p>⁶“Green exercise therapy is defined as facilitated green exercise activities. Evidence suggests that these activities may have therapeutic applications; for example, they may provide an effective treatment for mild to moderate depression through reconnection with nature and the positive mental health benefits that come hand in hand with this. Currently, approximately 21% of general practitioners use exercise as a therapy in the treatment of mental disorders. Green exercise therapy may be even more effective than exercise alone and could, therefore, be utilised as an alternative or complimentary treatment therapy to antidepressants”</p> <p>⁶ “Participating in physical activity in green settings is associated with decreased feelings of tension, confusion, anger and depression, while exhibiting greater feelings of revitalization”</p> <p>⁶“Access to nature can encourage participation in physical activity (green exercise)2:individuals with easy access to nature are three times as likely to participate in physical activity and, therefore, are 40% less likely to become overweight or obese.”</p> <p>⁷“Despite the clear evidence that increased physical activity reduces obesity, chronic disease, and stress, the medical community seldom advises patients to increase exercise.”</p> <p>⁷ “In 2003 the Chicago Park District launched a program to provide free gym membership to all Chicago residents whose physician diagnosed them with an obesity-related disease (e.g., diabetes, asthma, high blood pressure, heart</p>

				<p>disease) and prescribed exercise as part of their treatment. The program sought to eliminate cost as a barrier to exercise for these patients and to create an incentive for physicians to refer patients to the District's fitness centers."</p>
<p>Spaces for physical exercises and green gyms</p>				<p>⁸"Encourage Exercise: Gardens that encourage walking as a form of exercise have been correlated with lower levels of depression."</p> <p>⁹"By designing places people want to use, we can create the conditions for regular physical activity and thereby reduce obesity and related health problems, like diabetes."</p> <p>¹⁰"There is also some evidence that physical activity can have positive benefits for mental health, for instance, lowering depression."</p> <p>¹¹ "Health System New Impact program, the coalition developed a clinically focused park prescription effort to reduce obesity in underserved youth and encourage healthy lifestyles through increased connections to parks and recreation."</p> <p>¹² "Greener environments enhance recovery from surgery, enable and support higher levels of physical activity, improve immune system functioning, help diabetics achieve healthier blood glucose levels, and improve functional health status and independent living skills among older adults"</p> <p>¹³ "For children and young people of this age group physical activity includes play, games, sports, transportation, recreation, physical education or planned exercise, in the context of family, school, and community activities. In order to improve cardiorespiratory and muscular fitness, bone health, cardiovascular and metabolic health biomarkers and reduced symptoms of anxiety and depression, the following are recommended: 1. Children and young people aged 5–17 years old should accumulate at least 60 minutes of moderate- to vigorous-intensity physical activity daily."</p> <p>¹³ "It has been shown that participation in regular physical activity reduces the risk of coronary heart disease and stroke, diabetes, hypertension, colon cancer, breast cancer and depression. Additionally, physical activity is a key determinant</p>

				of energy expenditure, and thus is fundamental to energy balance and weight control”
Routes for cycling	<p>Maller, Cecily; Townsend, Mardie; St Leger, Lawrence; Henderson-Wilson, Claire; Pryor, Ms Anita; Prosser, Ms Lauren; Moore, Dr Megan (2008), <i>Healthy parks, healthy people, The health benefits of contact with nature in a park context</i> ¹</p> <p>Mardie Townsend and Rona Weerasuriya, <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i> ²</p> <p>Michael J.; Winkelman, Steve ; Chapman, James; Kavage, Sarah (2009) <i>Carbonless footprints: Promoting health and climate stabilization through active transportation</i> ³</p> <p>⁴ Davis, Barbara (s/d) <i>Center for Childhood Diabetes</i>, Department of Pediatrics, University of Colorado School of Medicine, Aurora, CO</p> <p>⁵http://www.athleteinme.com/ArticleView.aspx?id=352</p> <p>⁶ Frances, E. (Ming) Kuo (2010) <i>Parks And Other Green Environments: Essential Components of a Healthy Human Habitat</i>”</p> <p>⁷ Schwarzenegger, Arnold; Chrisman, Mike; Coleman, Ruth (2005) <i>The Health and Social Benefits of Recreation</i></p> <p>⁸http://www.architecture.com/Files/RIBAHoldings/PolicyAndInternationalRelations/Policy/PublicAffairs/RIBACityHealthCheck.pdf</p>	<p>21¹</p> <p>32²</p> <p>58²</p> <p>S100³</p> <p>5⁴</p> <p>31⁶</p> <p>14⁷</p> <p>6⁸</p>	<p>L, Frank; M, Andresen; T, Schmid (2004) <i>Obesity relationships with community design, physical activity, and time spent in cars</i>. Am. J. Prev. Med. 27, 87–97. ³</p> <p>L, Frank; J, Chapman (2004) <i>Integrating travel behavior and urban form data to address transportation and air quality problems in Atlanta</i>. Deliverable No.V.30, GDOT Research Project No. 9819. Georgia Department of Transportation and Georgia Regional Transportation Authority, Atlanta. ³</p> <p>RR, Pate; M, Pratt; SN, Blair and al. (s/d) <i>Physical activity and public health. A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine</i>. JAMA 1995;273:402-407 ⁵</p>	<p>¹“A Summary of the Contribution of Parks to Human Health and Wellbeing: Provide a variety of settings and infrastructure for various levels of formal and informal sport and recreation, for all skill levels and abilities e.g. picnicking, walking, dog training, running, cycling, ball games, sailing, surfing, photography, bird watching, bushwalking, rock climbing, camping”</p> <p>²“There was also emphasis on natural places providing opportunities for “relaxation, peacefulness, freedom and leisure pursuits such as walking, bike riding, motorbike riding, horse riding, camping, sailing, fishing, surfing, swimming, waterskiing and body boarding”</p> <p>² “A research project undertaken by the University of Essex to measure the effects of 10 green exercise activities (such as walking, cycling, horse riding, fishing and canal boating) involved 263 participants from four counties in the United Kingdom... Initial evaluations of these initiatives by the School of Health and Social Care at Oxford Brookes University found that participants of the “Green Gym” groups showed significant improvements in mental health scores, a reduction in depression, and a trend towards reduction in weight.”</p> <p>³ “Walking and bicycling, on the other hand, are inherently active, and have been associated with a lower likelihood of obesity”</p> <p>⁴“Although exercise is important for all people, it is essential for people with type 2 diabetes... Moderate Physical Activity for One Hour: Hiking, Light gardening/yard work, Dancing, Golf (walking and carrying clubs), Bicycling, Walking, Weight lifting (general light workout) and Stretching”</p> <p>⁵“Moderate” exercise, moderate increase in heart rate: brisk walking, cycling slow, jogging slow and swimming slow”</p> <p>⁶ “Green outdoor environments might promote health by way of encouraging and enabling physical activity—whether it be walking and biking along tree-lined streets, gardening, ecological restoration volunteering, hunting, hiking, kayaking, or participating in sports and</p>

				<p>outdoor games in parks and recreation areas.</p> <p>Green views and environments might also promote health by reducing the debilitating effects of stress on cardiovascular health, or by preventing the accidents caused by mental fatigue, or by preventing the harm caused by aggression and violence, or by improving air quality.”</p>
				<p>⁷ “Obesity and diabetes can be greatly reduced through regular aerobic exercise and physical activity. Recreation activities, such as running, brisk walking, swimming and bicycling are excellent for elevating the heart rate and lowering the incidence of heart disease obesity and diabetes, if done regularly”</p> <p>⁸ “Even small increases in walking and cycling could benefit our health, and people who report walking or cycling to work are healthier and less likely to be overweight than those who do not.”</p>
Exhibition of photograph in green space	Maller, Cecily; Townsend, Mardie; St Leger, Lawrence; Henderson-Wilson, Claire; Pryor, Ms Anita; Prosser, Ms Lauren; Moore, Dr Megan (2008), <i>Healthy parks, healthy people - The health benefits of contact with nature in a park context</i> ¹	Sec1:16 ¹	J., Pretty; J., Peacock; M., Sellens; and M., Griffin (2005) <i>The mental and physical health outcomes of green exercise</i> , International Journal of Environmental Health Research 15(5): 319-337. Sec1:16 ¹	¹ “Reporting on a study involving simulated green exercise (exercise on a treadmill while exposed to photographs of green spaces compared with other spaces), found that green exercise appears to have benefits both for cardiovascular health and mental health.”
Boat tour circuit	Townsend, Mardie and Weerasuriya, Rona (2010) <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i> ¹		¹ Pretty, J.; Hine, R. and Peacock, J. (2006) <i>Green exercise: The benefits of activities in green places</i> , The Biologist, vol. 53, no. 3, pp. 143–148. Peacock, J.; Hine, R. and Pretty, J. (2007) <i>Got the blues, then find some greenspace: The mental health benefits of green exercise activities and green care</i> , MIND Week Report, February 2007.	¹ “A research project undertaken by the University of Essex to measure the effects of 10 green exercise activities (such as walking, cycling, horse riding, fishing and canal boating) involved 263 participants from four counties in the United Kingdom... Initial evaluations of these initiatives by the School of Health and Social Care at Oxford Brookes University found that participants of the “Green Gym” groups showed significant improvements in mental health scores, a reduction in depression, and a trend towards reduction in weight.”
Local to practice aerobics	http://www.athleteinme.com/ArticleView.aspx?id=254 ¹			¹ “Aerobic exercise is beneficial for the cardiovascular system. In addition to strengthening the heart, exercise will stimulate the circulation, increase oxygen uptake by

				skeletal muscle, lower blood pressure at rest, and reverse the process of atherosclerosis. Aerobic exercise can effectively lower blood pressure in obese subjects with hypertension even if no weight is lost."
Football, basketball, hockey, tennis, rugby, tennis, handball, judo, rowing, Place to swim, kayaking, yoga, Skating, Squash, canoeing among other	Mardie Townsend and Rona Weerasuriya (2010) <i>Beyond Blue to Green: The benefits of contact with nature for mental health and well-being</i> ¹ Maller, Cecily; Townsend, Mardie; St Leger, Lawrence; Henderson-Wilson, Claire; Pryor, Ms Anita; Prosser, Ms Lauren; Moore, Dr Megan (2008), <i>Healthy parks, healthy people, The health benefits of contact with nature in a park context</i> ² Frances, E. (Ming) Kuo (2010) <i>Parks And Other Green Environments: Essential Components of a Healthy Human Habitat</i> ³ Bird, Dr William (2004) <i>Natural fit - Can Green Space and Biodiversity Increase Levels of Physical Activity?</i> ⁴ Toben, F. Nelson; Steven, D.Stovitz; Thomas, Megan; LaVoi, M. Nicole; Bauer, Katherine W., and Neumark – Sztainer, Dianne (2011), <i>Do Youth Sport Prevent Pediatric Obesity? A Systematic Review and Commentary</i> ⁵ Arnold Schwarzenegger, Mike Chrisman, Ruth Coleman (2005) <i>The Health and Social Benefits of Recreation</i> ⁶ Frances E. (Ming) Kuo (2010) <i>Parks And Other Green Environments: Essential Components of a Healthy Human Habitat</i> ⁷ http://www.yogajournal.com/health/2613 ⁸	32 ¹ 21 ² 31 ³ 17 ⁴ 2 ⁵ 14 ⁶ 30 ⁷ 16 ⁹		¹ "There was also emphasis on natural places providing opportunities for "relaxation, peacefulness, freedom and leisure pursuits such as walking, bike riding, motorbike riding, horse riding, camping, sailing, fishing, surfing, swimming, waterskiing and body boarding" ² "A Summary of the Contribution of Parks to Human Health and Wellbeing: Provide a variety of settings and infrastructure for various levels of formal and informal sport and recreation, for all skill levels and abilities e.g. picnicking, walking, dog training, running, cycling, ball games, sailing, surfing, photography, bird watching, bushwalking, rock climbing, camping" ³ "Green outdoor environments might promote health by way of encouraging and enabling physical activity—whether it be walking and biking along tree-lined streets, gardening, ecological restoration volunteering, hunting, hiking, kayaking, or participating in sports and outdoor games in parks and recreation areas. Green views and environments might also promote health by reducing the debilitating effects of stress on cardiovascular health, or by preventing the accidents caused by mental fatigue, or by preventing the harm caused by aggression and violence, or by improving air quality." ⁴ "Moderate exercise includes walking, cycling, swimming, gardening, horse riding and conservation work (if possible in the context of a wildlife-rich environment). This level of activity is enough to raise the pulse to over 60% of the maximum heart rate, which is the threshold to improve cardiovascular health." ⁵ "Only one of these studies examined the type of sport youth were involved in and found that participants in some sports were more likely and in others were less likely to be overweight than nonparticipants. Sports with a higher level of obesity included rugby, swimming, judo, and tennis, and sports with lower levels of obesity

				<p>included gymnastics, handball, horse riding, and dance, although the sample within each of these sports was relatively small.”</p> <p>⁶“Obesity and diabetes can be greatly reduced through regular aerobic exercise and physical activity. Recreation activities, such as running, brisk walking, swimming and bicycling are excellent for elevating the heart rate and lowering the incidence of heart disease obesity and diabetes, if done regularly”</p> <p>⁷ “Green outdoor environments might promote health by way of encouraging and enabling physical activity—whether it be walking and biking along tree-lined streets, gardening, ecological restoration volunteering, hunting, hiking, kayaking, or participating in sports and outdoor games in parks and recreation areas. Green views and environments might also promote health by reducing the debilitating effects of stress on cardiovascular health, or by preventing the accidents caused by mental fatigue, or by preventing the harm caused by aggression and violence, or by improving air quality.”</p>
	<p>Escudero, Dra. Pilar Martín (2004), <i>Ejercicio Físico</i>⁹ https://www.lilly.es/areas-terapeuticas/canal-de-farmacia/atencionfarmaceutica a /descargas/Diabetesyejercicio.pdf¹⁰</p>			<p>⁸ “Knowing what to eat, how to exercise, and why yoga is effective can help you avoid heart disease—and enjoy life!”</p> <p>⁸ “ It’s easy to get caught up in the latest scientific findings—the promising new drug, the life-saving surgery, the break-through insights into the complex relationship between cholesterol and heart disease—but if you’re willing to dig a little deeper, you’ll discover that ancient yogic teachings on diet and lifestyle reflect a practical wisdom that modern medicine is gradually validating.”</p> <p>⁸ “I’d been so excited about my new strength—which improves weekly—that I paid little attention to the scale, although I dropped a trouser size in a month. Part of my 15-pound weight loss resulted from all those fruits and veggies, but the experience taught me that yoga and other weight-loss measures are perfect partners. Making any lifestyle change is achingly slow, so what better way to practice patience than through yoga?”</p> <p>⁸“Keep in mind that achieving and maintaining a</p>

				<p>healthy body weight has benefits other than appearance, since excess body fat puts you at serious risk for a number of health problems. If your body fat percentage is greater than 30 percent for women or 25 percent for men, your risk of developing diabetes, heart disease, high blood pressure, and colon or breast cancer increases. So in addition to helping you feel better about yourself—which is crucial for those working to lose weight—yoga can inspire your commitment to better health. Besides putting me in touch with my body, yoga has made physical activity easier and more enjoyable. I'm motivated to add more cardiovascular exercise into my routine, thereby accelerating my weight loss and helping me reduce the likelihood of developing more health problems.”</p> <p>⁹“Normas de autocontrol para el ejercicio y modificaciones de insulina: Tenis Nadar, Correr, Golf, Ciclismo, Fútbol, Hockey, Ciclismo, Squash, Remo”</p> <p>¹⁰ “Es un tipo de ejercicio en el que la glucosa se quema en presencia de oxígeno con lo que el aprovechamiento de la energía es mayor; recomendado especialmente por los médicos porque requiere una respiración más profunda y un mayor trabajo del corazón. Entre ellos podemos encontrar: Caminar rápidamente Trotar, Bailar, Jugar al tenis, fútbol u otro deporte, Nadar , Patinar , Esquiar , Hacer excursiones a pie”</p>
Field to practice Golf	Davis, Barbara (s/d) Center for Childhood Diabetes, Department of Pediatrics, University of Colorado School of Medicine, Aurora, CO ¹ Dra. Pilar Martín Escudero (2004), Ejercicio Físico ²	5 ¹ 16 ²		<p>¹ “Although exercise is important for all people, it is essential for people with type 2 diabetes... Moderate Physical Activity for One Hour: Hiking, Light gardening/yard work, Dancing, Golf (walking and carrying clubs), Bicycling, Walking, Weight lifting (general light workout) and Stretching”</p> <p>² “Normas de autocontrol para el ejercicio y modificaciones de insulina: Tenis Nadar, Correr, Golf, Ciclismo, Fútbol, Hockey, Ciclismo, Squash, Remo”</p>
Water	Aramendi, José M. González	283 ¹		¹ “Andar es una de las actividades más

Activities	(s/d)Prescripción de ejercicio físico en la diabetes (II) <i>prescription of physical exercise in diabetes (II)</i> ¹			<i>recomendadas; sin embargo, en pacientes con neuropatía periférica¹ o artritis, es preferible la realización de actividades que no comporten soporte del peso corporal (natación, bicicleta, actividades acuáticas...) o, al menos, combinar los dos tipos de actividad"</i>
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¹ Diabetes is the most common cause of this type of nerve problem. It occurs when there is high blood glucose levels for a long time.