Sveriges Lantbruksuniversitet
Swedish University of Agricultural Sciences

Faculty of Landscape Architecture, Horticulture and
Crop Production Science

The Landscape Architect's Guide to the World of Solid Waste

Justyna Grudziecki & Pitchayan Buachoom

Degree Project • 30 Credits
Landscape Architecture Programme / Landskapsarkitektprogrammet
Alnarp 2016

The Landscape Architect's Guide to the World of Solid Waste

Landskapsarkitektens guide till sopornas värld

Justyna Grudziecki
Pitchayan Buachoom

Supervisor: Anna Peterson, Lecturer at the Department of Landscape Architecture, Planning and Management, SLU

Examiner: Mads Farsø, Associate Senior Lecturer at the Department of Landscape Architecture, Planning and Management, SLU

Co-examiner: Caroline Dahl, Managing Director at Movium Alnarp

Credits: 30
Project Level: A2E
Course title: Master Project in Landscape Architecture
Course code: EX0775
Programme: Landskapsarkitektprogrammet / Landscape Architecture Programme

Place of publication: Alnarp
Year of publication: 2016
Cover art: "garbage1" by Pablo Ares Gastesi (CC BY-SA 2.0) (Flickr [online], available: https://www.flickr.com/photos/pagastesi/4588137208/ [2016-04-02])
Online publication: http://stud.epsilon.slu.se

Keywords: waste, solid waste, waste management, municipal solid waste, waste landscapes, landfill, deponi, avfall, avfallshantering

SLU, Swedish University of Agricultural Sciences
Faculty of Landscape Architecture, Horticulture and Crop Production Science
Department of Landscape Architecture, Planning and Management

garbage has to be a poem of our time because
garbage is spiritual, believable enough

to get our attention, getting in the way, piling
up, stinking, turning brooks brownish and

creamy white: what else deflects us from the
error of our illusionary ways, not a temptation

to trashlessness, that is too far off, and,
anyway, unimaginable, unrealistic . . .

- A. R. Ammons, *Garbage* (1993)

PREFACE

Just like our friendship, the idea for this thesis was born while taking the master's course 'Planning Project - Energy Landscapes and Master Planning' at the Swedish University of Agricultural Sciences in the spring of 2015. A study trip to Sysav, local waste-to-energy plant, has been an eye-opener for both of us. There it was - an immense sea of garbage, just a few kilometers from the city center. Vast quantities of waste - a part of it produced by ourselves - waited to be processed in various ways. It made us realize how little we knew about waste and how much can be done with it. This visit made an imprint on our hearts - an imprint that could not be blurred by the course of time and the changes happening in our lives. So here we are today - one year older, richer in knowledge and experiences, with a dream of changing the world. We hope that this thesis will increase awareness and understanding of the problems, but also *the opportunities*, that waste creates. If we can influence one person, our mission has succeeded.

We wish to thank our supervisor, Anna Peterson, for her time, guidance and valuable comments. She has provided us with critical feedback, inspiration and much needed encouragement during the time of writing our thesis.

Without the support, help and patience from Matteus and Monta, as well as the rest of our families, this project could not have been realized.

TO ALL THE PASSIONATE SOULS, ALL THE VISIONARIES, THAT BELIEVE IN CHANGE.

Malmö, 2016-05-13

Justyna Grudziecki & Pitchayan Buachoom

ABSTRACT

The objective for this master's thesis was to highlight the magnitude of the waste-related issues through investigation of the impacts that solid waste has on the landscape. Our ambition was to prove the potential of creating new landscape values with waste. To get a deeper understanding on the topic, a literature review was carried out.

Through this approach, we have managed to conclude that waste is an ever present part of people's lives and a growing global issue. Solid waste impacts the landscape in various ways - both directly and indirectly. The direct impacts are strongly connected to the landfill sites, where the garbage is accumulated and buried in the ground. Here, waste affects the region visually in a pronounced way, occupying the land. Other examples of evident disruption are unpleasant odors, dust, noise or damage to the infrastructure caused by heavy vehicles used for transportation of waste materials. Indirect impacts of garbage involve various levels of environmental pollution. It is primary due to methane and leachate generated on waste sites during decomposition of organic material and percolation of water through garbage. Both substances cause number of issues connected to the landscape, including vegetation damage, air and groundwater pollution, fires and global warming. Even health hazards, which may not seem related to the land, affect animals, potentially leading to population changes that eventually impact the landscape.

Landscape architects can work with solid waste through transformation and re-designing of waste sites into landscapes with new function and appearance, as well as implementing prior waste products into design projects and raising awareness of the garbage-related issues among the public.

The thesis is concluded with a discussion of the challenges for our society, as well as a reflection on why landscape architects should take the role as active agents in the waste management practice.

SAMMANDRAG

Målet för denna masteruppsats var att belysa allvaret av de avfallsrelaterade frågor genom en undersökning av de effekter som avfall har på landskapet. Vår ambition var att visa att det, inom landskapsarkitektur, finns en potential till att skapa nya landskapsvärden med hjälp av avfall. För att få en djupare förståelse för ämnet har en litteraturstudie genomförts.

Genom detta tillvägagångssätt har vi lyckats komma fram till slutsatsen att avfall är en ständigt närvarande del av människors liv och ett växande globalt problem. Avfall påverkar landskap på olika sätt - både direkt och indirekt. De direkta effekterna är starkt kopplade till deponier, där sopor ackumuleras och grävs ner i marken. Här påverkar avfall regionen visuellt på ett uttalat sätt och ockuperar land. Andra exempel på uppenbara effekter är obehagliga lukter, damm, buller och skador på infrastrukturen som orsakats av tunga fordon, som används för transport av avfall. Indirekta effekter av sopor involverar olika nivåer av miljöföroreningar. Det sker primärt på grund av metan och lakvatten som genereras vid avfallsanläggningar, under loppet av nedbrytningen av organiskt material och filtrering av vatten genom avfall. Båda substanserna orsakar ett antal problem kopplade till landskap, inklusive vegetationsskador, föroreningar i luft och vatten, bränder och växthuseffekten. Även hälsorisker, som oftast inte kopplas till land, påverkar djur, vilket på sikt kan leda till populationsförändringar och påverkan på landskapet.

Landskapsarkitekter kan arbeta med avfall genom omvandling och omgestaltning av platser där sopor hanteras till landskap med nya funktioner och utseenden, samt genom att implementera tidigare avfallsprodukter i olika designprojekt och öka medvetenheten om de avfallsrelaterade problem bland allmänheten.

Uppsatsen avslutas med en diskussion om utmaningarna som berör vårt samhälle, liksom en reflektion om varför landskapsarkitekter bör ta en roll som aktiva aktörer inom avfallshanteringen.

CONTENTS

9 | INTRODUCTION

BACKGROUND

Waste is a constant part of our lives. From the very first day of our existance we generate waste through the processes of living, eating, consuming and even dying. We may not intend to do so, but our complex and fast-paced lifestyles have made it inevitable. Almost every product we buy comes with a bag, box or other kind of cover that ends up in a trash bin. Most things we own and use eventually become waste - ”Every candy bar has a wrapper; every apple has a core.” (Tammemagi 2000, p. 3).

Humans produce daily around 1.2 kg of waste per person, which constitutes for 1.4 billion tons of garbage every year (World Bank 2012). Day by day, this vast amount is increasing due to the growing global population (Tammemagi 2000). Our consumption and lifestyle are closely related to the generation of waste. It takes 1.6 Earths to support humanity’s demand on nature - we consume our resources in a faster rate than nature can provide annually (Global Footprint Network 2016). In 2015 the Earth Overshoot Day landed on August 13. In a period of less than eight months, people used more natural resources than our planet is able to produce during twelve months’ time. According to Global Footprint Network (2015) this overshoot means that ”(...) we are drawing down the planet’s principal, rather than living off its annual interest. It leads to a depletion of Earth’s life-supporting natural capital and a buildup of carbon dioxide in the atmosphere.”. Factors such as living standards, the degree of industrialization, local climate and public habits play dominant roles in the production of waste. The consumption is higher in the developed countries where economic development and urbanization have a major foothold (World Bank 2012). Urban dwellers generate therefore around twice as much garbage as their rural counterparts.

But where does all the garbage go? Waste has been an integral part of our landscapes for over two million years (Rathje & Murphy 1992). There is no doubt it has impacted our surroundings in various ways - it has been shaping our infrastructure and settings for centuries (Engler 2004). However, as the global population increases limiting the available space on our planet

(Tammemagi 2000), the need for mitigating waste becomes greater than ever. We believe that landscape architects play an important role in this task, having the ability to form spaces and to influence the future appearance and function of human environments.

Our consumption patterns and ultimately waste production are growing global issues. Solid waste management is an urgent matter that requires attention and serious actions. We are both at the stage in our lives where thoughts of establishing a family are not abstract ideas. Choices we make today impact our future, but also the future of the coming generations. As the United Nations' World Commission on Environment and Development defines: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (World Commission on Environmental Development 1987, p. 45). We, as planners and architects to-be, wish to contribute to a safer future for the inhabitants of our planet. We believe that an improved management of solid waste can be a step in the right direction, and therefore wish to examine how landscape architects can work with this issue.

In this thesis we have chosen to explore the subject of solid waste and its impact on the landscape. We study a number of cases where waste has been utilized in various ways, as well as provide examples on how it can be used in the design practice.

RESEARCH QUESTIONS

How does solid waste impact the landscape?
How can solid waste create new landscape qualities?

OBJECTIVE

The thesis attempts to highlight the magnitude of the problem that the solid waste creates by investigating its impact on the landscape. The aim is to increase awareness and understanding of the waste-related issues among the general public as well as professionals within the field of landscape architecture, planning and politics. Through this work we wish to examine how landscape architects can work towards mitigating the negative effects of garbage by implementing solid waste into the design and planning practice. Our ambition is to prove the potential of creating new landscape values with waste.

LIMITATIONS

The focus of the thesis centers around solid waste and waste disposal in general. We do not immerse ourselves in any specific topic nor waste product - instead, we attempt to have a holistic approach throughout the entire paper. The subject of circular economy is not directly discussed.

The examples given in the thesis are taken from different parts of the world. However, as we live in Sweden and have a local perspective, we focus only on industrialized countries with similar prerequisites and conditions. Our research is therefore limited to the countries in Europe and in North America.

As landscape architects and planners to-be, we look at the topic of waste from our point of view, continuously deliberating on how the subject can be related to the field of landscape architecture.

METHOD AND MATERIAL

The paper deals with the matter of solid waste and its impacts on the landscapes in Europe and North America. Due to the broadness of our subject, the method for the paper was of purely theoretical character.

To get a deeper understanding on the topic of waste, a literature review was carried out. The aim of this approach was to find out and confirm what was already known, to gain new evidence and to test existing theories (Gillham 2010). Our method was based on gathering a broad spectrum of material relevant for the theme of waste, its disposal and management. The material was then critically reviewed and analyzed in order to provide a theoretical framework for discussions in the final part of our thesis. As it is stated in the book Mixed Methods Reserch (Hesse-Biber 2014), the focus of the literature review centers on critical evaluation of the relevant material, rather than summarizing all the literature on the research topic. The critical assessment was conducted through comparison of gathered data with different sources and confirming their validity.

The material gathered for the review consists of multidisciplinary peer reviewed literature on waste and other digital sources, such as e-books, websites, videoclips and reports. Relevant literature in form of scientific articles and publications, books and dissertations was collected. We searched for our sources in the local university library and databases such as Primo, Libris, Ebrary, Google Scholar and Web of Knowledge. Amongst the keywords we used were: waste, solid waste, waste management, municipal solid waste, waste landscapes, landfill, deponi, avfall, avfallshantering, waste site and garbage. We have also searched for additional literature in the lists of references of the collected relevant publications, in order to examine the primary sources. As stated by Hesse-Biber (2014, p. 38) it is preferable to turn to primary data sources as opposed to secondary - ”(...) always return to the primary source, as any issues that arise can more clearly be elucidated in a ”conversation” with a primary text or project.”.

Our cooperation was based on dividing the workload between the two. An outline for the report was created jointly, forming the basis for our work. The different chapters of the thesis were originally written separately, then reviewed by each of us and eventually joined together. All the changes and ideas for the thesis, as well as the layout and visual features of the paper were continuously discussed and verified with each other.

OUTLINE

The thesis is a theoretical study consisting of four chapters as listed below:

- Solid Waste - What Is It?
- How We Have Managed Waste
- The Situation With Waste Today
- What We Can Do

The first section is an introduction to the subject of the thesis. It explains the concept of solid waste, its disposal and management. The aim of this part is to provide the reader with the necessary knowledge on the topic and to form a framework for further discussions. Next chapter refers to the historical findings about waste and describes how its management has developed over time. It is a base for further comparisons and analysis. This section is followed by a part centered around waste's impacts on the landscape. It demonstrates the importance of the topic and presents examples of the threats that garbage poses to our planet. The last chapter analyzes earlier reviewed concepts and discusses landscape architecture's role in waste management. Finally, the thesis culminates into a discussion that sums up our findings answering the research question, examines the method and draws conclusions.

DEFINITIONS OF CONCEPTS

SOLID WASTE

Solid waste is any discarded or abandoned element, which may be solid, liquid, semi-solid or containerized gaseous material. In the thesis words as garbage, trash, residue and waste are used as substitute for the term 'solid waste'.

MUNICIPAL SOLID WASTE (MSW)

"More commonly known as trash or garbage, consists of everyday items we use and then throw away, such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries. This comes from our homes, schools, hospitals, and businesses." (United States Environmental Protection Agency 2014)

SOLID WASTE MANAGEMENT

Systematic administration of activities which provide for the collection, source separation, storage, transportation, transfer, processing, treatment, and disposal of solid waste (Resource Conservation and Recovery Act 2002).

LANDSCAPE QUALITY

In this thesis the term is used as a name for a value of cultural, social, biological and/or visualaesthetic character that can be found within a landscape, created as a result of human action.

LANDFILL

"A landfill is a carefully designed structure built into or on top of the ground, in which trash is separated from the area around it. Landfills contain garbage and serve to prevent contamination between the waste and the surrounding environment, especially groundwater." (Advanced Disposal 2016)

ANAEROBIC DIGESTION

"Anaerobic digestion is a series of biological processes in which microorganisms break down biodegradable material in the absence of oxygen." (American Biogas Council 2010)

BIOREMEDIATION

A process of using naturally occurring organisms to neutralize or remove contamination from waste, by breaking down hazardous substances into less toxic or non toxic ones (National Research Council 1993).

SYNERGY

"The interaction or cooperation of two or more organizations, substances, or other agents to produce a combined effect greater than the sum of their separate effects." (Oxford Dictionaries 2016)

16 | LITERATURE REVIEW

SOLID WASTE - WHAT IS IT?

DEFINING WASTE

Nearly everything we do in the course of our lives generates some kind of leftover material that is thrown away. Any discarded, unwanted object or element that has been rejected, damaged and deemed unuseful can be defined as waste or garbage. Waste is all around us. It has been a constant of our existence from the very first day we were born. It cannot be avoided - in fact, waste is a creation and part of nature:

> "THE SQUIRREL EATS A NUT AND DUMPS THE SHELL. IN SOME PLACES THE OCEAN FLOOR LEAKS OIL AND POLLUTES MARINE HABITATS. GUANO, THE EXCREMENT OF SEAFOWL, KILLS PLANTS AND RENDERS THE BIRDS' OWN HABITAT STERILE. LAVA AND ASH SPEWED FROM VOLCANOES CAN DESTROY WHOLE ECOSYSTEMS." (ENGLER 2004, P. 1)

Our behavior is no exception to this scheme - we discard objects we do not use, we pollute, devour and devastate. We put effort into producing materials exploiting nature's resources, then use them for a brief moment in time until we no longer need them. The things get shredded, buried, burned or simply left in nature, impacting the environment. This master's thesis is dedicated to these things - the leftover parts rejected by mankind, with focus on solid waste in particular.

There are many definitions of solid waste. As described by the United States Department of Environmental Conservation (2014), the term means "any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved material in domestic sewage, or solid or dissolved

materials in irrigation return flows or industrial discharges which are point sources subject to permits under section 402 of the Federal Water Pollution Control Act, as amended (86 Stat. 880), or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954, as amended (68 Stat. 923)." (Resource Conservation and Recovery Act 2002; United States Department of Environmental Conservation 2014). Consequently, the term solid waste does not imply that the waste is actually *solid* - it includes any discarded material that may have a solid, liquid, semi-solid or containerized gaseous form.

The consolidation of European countries through European Union (EU) has brought a need for developing a common standard on waste, compliance of national legislation and unification of waste management policy. Creating a mutual waste-terminology and adapting it by the member states has considerably contributed to achieving this ambition, even though there still exist disagreements between the legislative bodies (Twardowska 2004).

The European definition of waste is given by the latest EU Council Directive 91/156/EEC, comprising a set of categories and subcategories of residue. The directive describes waste as any material listed in the given categories, which the holder discards, intends to or is required to discard. Some of these are, for example, Q7: Substances, which no longer perform satisfactorily (e.g. contaminated acids, contaminated solvents, exhausted tempering salts, etc.), or Q8: Residues of industrial processes (e.g. slags, still bottoms, etc.). This definition replaced the previous one, given by the Council Directive 75/442/EEC, which did not refer to any specific list, but considered differences in the national law: "waste is any substance or object which the holder disposed or is required to dispose of pursuant to the provisions of national law in force" (ibid. p. 8).

What separates the two definitions, American and European, is the broadness of their scope. Although the EU description follows with a detailed list of what is classified as waste, it does not differ a lot from the American interpretation. The definition given by the Resource Conservation and Recovery Act is not as detailed but still quite thorough, yet leaving room for own interpretation. The main function of the itemized list of residue given by the EU, is to "(...) increase the transparency of the listing system and to simplify existing provisions in order to establish a common terminology for the states, (...), to provide support to the generation of precise and reliable statistics on waste generation, which, in turn, are indispensable for improving waste management." (Twardowska 2004, p. 9).

Beside the European definition on residue given by the Council Directives, there exist other international laws of a broader geographical scope in Europe. These consist of OECD (Organisation for Economic Co-operation and Development) Council Decisions and the Basel Convention related to transboundary movements of waste. The latter one has the strongest

influence on the waste terminology, as it has been ratified by 151 parties worldwide, that except for European member states include most of Asia, Oceania and South America (Twardowska 2004).

The Basel Convention defines residue as follows: ”Wastes are substances or objects which are disposed of or are intended to be disposed of, or are required to be disposed of by the provisions of national law” (United Nations Treaty 1989). It is thus highly similar to the EU Council Directive 75/442/EEC. Definition of waste given by the OECD Council Decision, on the other hand, is formulated as follows: ”Wastes are substances or objects, other than radioactive materials covered by other international agreements, which: (1) are disposed of or are being recovered; or (2) are intended to be disposed of or recovered; or (3) are required, by the provisions of national law, to be disposed of or recovered.” (Organisation for Economic Co-operation and Development 2001).

Although the three European regulations interpret waste in a similar manner, there is a need for a uniform terminology in order to avoid all the discrepancies between the directives in force leading to misinterpretation and confusion. Having multiple laws operating simultaneously in the same area creates issues between the European countries, which in turn impacts international waste management practice (Twardowska 2004). While some countries function under several definitions, others have no legislative regulations on waste at all. The existing definitions on the other hand vary greatly, depending on economic, cultural, geographical and political conditions. A uniform, clear and shorter definition, similar to the American one, could contribute to a harmonization of Europe and influence the general status of the national environmental legislation.

WASTE MANAGEMENT PRACTICE

EVERY YEAR PEOPLE PRODUCE AROUND 1.4 BILLION TONS OF GARBAGE (WORLD BANK 2012). THIS MASSIVE AMOUNT HAS TO GO SOMEWHERE. WHAT HAPPENS WITH ALL THE WASTE? WHAT DO WE DO WITH IT?

Waste, both matter and idea, is strongly associated with dirt. It has constantly been repressed and distanced by the mankind - yet it shapes our lives and landscapes. We create special sites for garbage, allocating it to dumps, landfills, plants and incinerators - moving it as far from us as we can (Engler 2004). We keep forming places to fight our wastes. Our discomfort with dirty environments triggers us to tighten control of the garbage. Waste management is our way to deal with it.

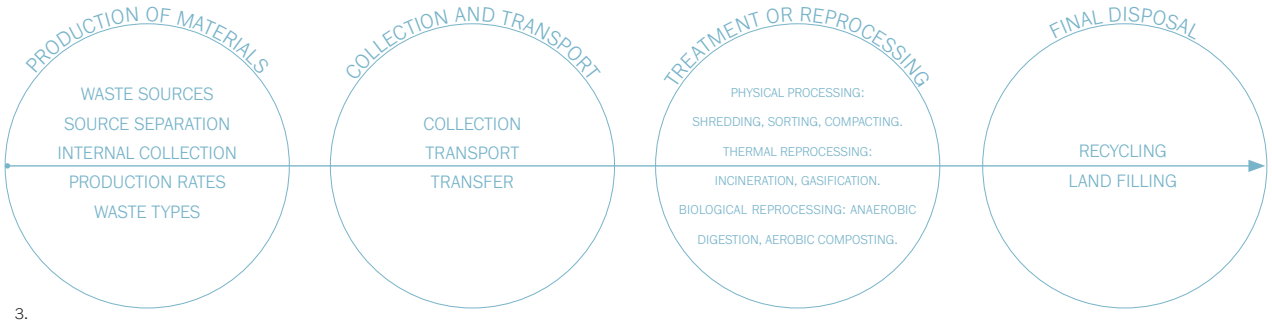
Systematic administration of actions providing for collection, source separation, storage,

transport, processing, treatment and monitoring of waste materials can be defined as waste management (Demirbas 2011; Resource Conservation and Recovery Act 2002). Its purpose is to secure clean and healthy living environment, as well as to promote the reuse of material within the society.

Nature has perfected its ways of taking care of the naturally created wastes within the environment: "(...) shells decompose and fertilize new growth; devastated sea and land turn into adaptive habitats. All forms of waste are eventually consumed, used, and recycled in a chain of matter and energy flow." (Engler 2004, p. 1). Humans have however continuously created new types of materials at an accelerating rate, without securing recovery mechanisms for the growing quantities of garbage circulating it back into natural systems. Our waste management concept is an attempt to do so, having the following goals (Demirbas 2011, p. 1281):

1. REDUCTION OF TOTAL AMOUNT OF WASTE BY REDUCTION AND RECYCLING OF REFUSE.
2. RECYCLING AND RE-INTRODUCTION OF SUITABLE GROUPS OF SUBSTANCES INTO PRODUCTION CYCLES AS SECONDARY RAW MATERIAL OR ENERGY CARRIER.
3. RE-INTRODUCTION OF BIOLOGICAL WASTE INTO THE NATURAL CYCLE.
4. BEST-POSSIBLE REDUCTION OF RESIDUAL WASTE QUANTITIES, WHICH ARE TO BE DISPOSED ON "SUITABLE" LANDFILLS.
5. FLEXIBLE CONCEPT CONCERNING FLUCTUATIONS IN WASTE QUANTITIES AND THE COMPOSITION OF DOMESTIC WASTE. NEW DEVELOPMENTS IN THE FIELD OF WASTE MANAGEMENT MUST BE INCLUDED INTO THE SYSTEM.

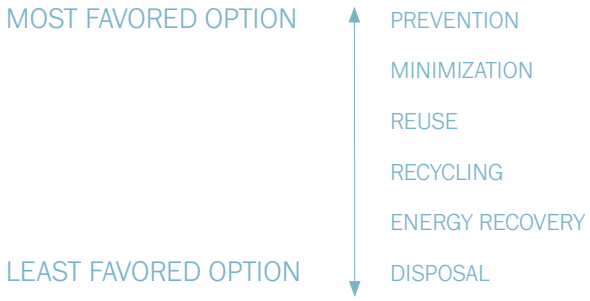
The system is comprised of (1) generation of waste material, (2) its collection and transport, (3) treatment of residue into useful products and (4) disposal. Each of these parts is then divided into several subparts listed in the graph below (Figure 3. Components of waste management system):



3.

The aim with the currently existing waste management practice is to safely remove, treat, dispose or recycle generated waste materials. There exist however large gaps and differences in the management systems between developing and industrialized countries. This is due to social aspects, the degree of industrialization, local climate, cultural habits and having an awareness of the more obvious resource limitations which often exist (ibid.).

Modern waste management systems set out to diminish environmental issues and protect our resources (Engler 2004; Hebel et al. 2014). The operating strategies can be classified into categories such as prevention and minimization of generated waste, re-use and recycling, thermal treatment with energy recovery and disposal (landfilling). Out of these, prevention and reduction of garbage are the most prioritized ones as they do not involve additional energy use (Demirbas 2011; Hultman & Corvellec 2012). The second priority has recycling, which is currently one of most promoted strategies in the waste management practice. It focuses on recovery of waste products into raw materials that can be used for new purposes. Illustrated in the graph below is the hierarchy of the management strategies (Figure 4. Waste management hierarchy).



4.

Three globally most common approaches dealing with waste treatment are recycling, incineration and landfilling. Recycling is a convertion of waste materials into matter that can be transformed into new products used for the original or other purposes (Mohamed 2012). It is favored by many countries and regarded as environmentally benign as it reduces humans' demand for natural resources and diminishes the amount of solid waste. Incineration on the other hand is a less favored option, as it involves a release of ash and other emissions into the atmosphere. In other words, incineration is a combustion of waste material, which can be used for energy production in form of electricity or useful steam and heat. The remaining third approach is the deposit of waste on landfills. It implies burial of garbage in the ground in connection to a facility that is sepatared from the area around it. Landfilling has been the cornerstone of waste management for ages and still continues to be the most common path for nations worldwide (Tammamagi 2000).

Waste management is an utterly important issue in the modern society of today. It is essential for the wellbeing of humans and other inhabitants of our planet, as well as for the future generations. Using sustainable methods of waste treatment is crucial in order to achieve the environmantal goals: "Unsuitable waste management practices result in the loss of resources and energy, which could be recycled and produced from a large part of the solid waste. Solid waste knowledge is hard won and too easily lost" (Demirbas 2011, p. 1286). Hence, there exists a global need for raising awareness and spreading knowledge connected to waste and its management. The following chapters of this thesis attempt to highligt existing waste issues and discuss variuos ways of coping with them.

22 | HOW WE HAVE MANAGED WASTE

HOW WE HAVE MANAGED WASTE

To learn from where we have been is to know where we will go.

ANCIENT WASTE MANAGEMENT

It has been shown that the creation of waste is an unequivocal sign of human presence. The chain of waste reaches back about two million years; human beings have along that chain been leaving traces of garbage all over the world (Rathje & Murphy 1992). There was no distinct or qualified way of managing waste back then - the residue simply amassed where people threw it. Beside sweeping away trash from sleeping quarters and activity areas, nothing was done to reduce or mitigate the mountains of waste that would become a fundamental strain in people's lives (Barbalace 2014).

"THERE ARE NO WAYS OF DEALING WITH GARBAGE THAT HAVEN'T BEEN FAMILIAR, IN ESSENCE, FOR THOUSAND OF YEARS, ALTHOUGH AS THE SPECIES HAS ADVANCED, PEOPLE HAVE INTRODUCED REFINEMENTS. THE BASIC METHODS OF GARBAGE DISPOSAL ARE FOUR: DUMPING IT, BURNING IT, TURNING IT INTO SOMETHING THAT CAN BE USEFUL (RECYCLING), AND MINIMIZING THE VOLUME OF MATERIAL GOODS..." (RATHJE & MURPHY 1992, P. 33)

Our attitude towards waste is integral in most cultures, religions and societies. For instance, garbage in the society has always been associated with class and geographical margins, and it was widely correlated with purity and cleansing in holy teachings (Engler 1995). The ancient Maya, for example, deposited their organic waste in open dumps. The accumulated piles probably experienced occasional explosions from the methane gas building up inside, leaving some of the piles burning, creating room for even more waste to be accumulated (Rathje & Murphy 1992).

The next example comes from the Bronze Age Troy, where littering indoors was a common concept of managing waste. When the trash has been accumulated enough according to the

owner's limits, all it took was a cover of few layers of clay and the issue was gone. Eventually, this process came to an end, resulting in demolitions of entire buildings when they finally became uninhabitable (National Solid Wastes Management Association 2008; Rathje & Murphy 1992).

All waste issues were not this 'easily' managed and garbage was not solely accumulated indoors - not in Troy, not anywhere. Even in Troy larger debris was thrown into the streets. The accumulated waste over time reached about 4.7 feet (1.43 m) per century, meaning that the upcoming generations literally lived on the former generations' waste (Rathje & Murphy 1992).

During that period waste was an integral part of the landscape - landscapes were essentially built with waste. There was no concern about the environment or health and people lived in close proximity to garbage. In fact, trash was so elemental in people's lives, that it simply accumulated wherever they were - both indoors and outdoors. The only waste management at the time was unorganized sweeping away of trash in order to hide it, until it no longer could be hidden.

ERUPTION OF MODERN WASTE MANAGEMENT

The mountains of waste are a constant reminder that an efficient system of waste disposal is not always compatible with social ends like economic development and modernization. It is also by the same token that generations of waste, in all of their shapes, are not a sign of social disaster. These small and noble changes can be seen throughout the history, and one can argue that it is a price we pay for learning to do something important really well.

IN 1893, WILLIAM STEWART HALSTED, THE CHIEF OF SURGERY AT JOHNS HOPKINS UNIVERSITY HOSPITAL, BECAME THE FIRST SURGEON TO WEAR A PAIR OF STERILE GLOVES DURING AN OPERATION. THIS EVENT UNFORTUNATELY TURNED AMERICAN HOSPITALS INTO DISPENSARIES - THE GOAL HOWEVER WAS NOT TO CREATE MORE GARBAGE, BUT TO SAFEGUARD THE WELLBEING OF THE PATIENTS DURING SURGERY (RATHJE & MURPHY 1992, P. 40).

Eventually, garbage removal became a reality of the modern society starting out with the threat of disease, making it a public responsibility in both Europe and in the United States. An appalling notion is that people today find it difficult to appreciate how horrible conditions of daily life in Western world cities were just a century ago (Johnson et al. 2011; Rathje & Murphy 1992). Garbage, wet and solid, was lying around adjacent to one's home, affecting the image of the landscape and increasing disease among people. Research shows that the industrial revolution in the nineteenth century was the starting age for mankind to discard

goods in the world (Tammemagi 2000; Hebel et al. 2014). It was a transition from an agrarian society to an urban and industrialized one. This culprit of age gave us tin cans, corrugated cardboard, ready-made clothes, commercial packaging and factory-cut lumber along with tons of other mass-produced materials - all of them much familiar constituents of american landfills today (Engler 1995; Rathje & Murphy 1992; United States Environmental Protection Agency 2016).

The first modern and serious attempt to cleaning streets in the United States came from Colonel George E. Waring, Jr in the late nineteenth century in New York (Phillips 1998; Rathje & Murphy 1992). Waring and his two thousand employees cleared the streets of New York from waste and transported the residue to incinerators and to the Atlantic Ocean. The disposal in the Atlantic Ocean ended quickly after complaints from affluent owners of the shorefront in New Jersey. This was a turning point for the municipal waste management in the United States and by 1910, 80% of the cities had a municipal run system for waste disposal - compared to 1880 when this number was less than 25% (Rathje & Murphy 1992). In other words, the development of municipal waste management rose rapidly in the United States during a 30-year period.

The image of the landscape filled with mountains of garbage had slowly begun to change, especially in the urban areas. The city streets became gradually cleaner, but the masses of daily produced trash were still conspicuous in the urban peripheries. Garbage was imprinted in every corner of the landscape and only serious health consequences were able to initiate the change.

THE DEVELOPMENT OF LANDFILLS

Although the shift of people's attitudes was noticeable resulting in cleaner streets, waste would eventually be accumulated somewhere. New waste systems were built as municipalities started to dispose the garbage on landfills (ibid.). Landfills can be considered symbols of the developed world's obsession - it is here we can find nearly anything about our consumer society, and it is safe to say they can be seen as a growing social problem (Tammemagi 2000). However, history tells us the situation was completely different when it all started.

Waste disposal, similar to the cleaning of New York's streets in the late nineteenth century, had one single purpose: to get rid of waste from the streets and into incinerators. Sanitary landfills started out as a solution to the polluted air caused by the incinerator plants and the open dumps that lied upon the American cities. A sanitary landfill, described in its simple form, is a place where new waste is hauled and covered with about six inches (0.15 m) of

non-decomposable material (e.g. soil and crushed glass) (National Solid Wastes Management Association 2008).

The landfills were situated in different places between that period, but they all shared the same concept - concern for public health (Rathje & Murphy 1992). The popularity of having sanitary waste sites gradually increased, and by the 1930s a range of examples could be found on both coasts in the United States. They got the biggest boost during the Second World War, when they became an obvious choice for waste disposal, having surpassed former solutions like smoke-belching incinerators. Their remains served a purpose of redesigning landscapes, as landfills were designed to be covered up. Depending on the location, landfills would help to turn margin terrain such as wetlands, into productive real estate (Engler 1995; Engler 2004; Rathje & Murphy 1992).

Along with the growing popularity, the constituents of an ideal landfill changed over time, albeit the basic principles remained the same. The first change concerned the site the landfill occupied. It was believed that wetlands, or any other low-laying areas, were suitable for reclaiming the land in a later scenario. This assumption had two crucial wrongs: (1) the environmental importance and (2) the hazardous waste that could be drained out of the landfills was not well understood. Many of the landfills were situated in the worst place imaginable, which the forthcoming generations later had to deal with. (National Solid Wastes Management Association 2008).

Eventually, landfills began to separate into two types - wet and dry. Wet landfills consist of, as the name indicates, waste material saturated with as much water as possible. The reason for this is to support bacterial growth and biodegradation. However, leachate will eventually find its way through the waste and is usually pumped back on top, creating a close circuit (Advanced Disposal 2016; Tammemagi 2000). Dry landfills are dry and have to be retained that way. The assumption here is that the dryer the waste site is, the less risk it poses of contaminating ground water. Unlike the leachate in wet landfills, the leachate in dry landfills is collected and treated - either at the site or via the local municipal sewage facility (Rathje & Murphy 1992).

Landfills also produce methane gas, which can be utilized to generate power. The higher the mountain of waste grew, the more pipes had to be installed (National Solid Wastes Management Association 2008). The more waste was hauled, the more space it would occupy. A new layer, known as a 'lift', begun when the stockpile reached the far side. Slopes and contours were being shaped according to the engineers pre-planned specifications, as the landfill's lifts accumulated. When the depot had reached its limits, a final cap, usually made of the same material as the ground, was put on top. The garbage lot was then officially closed but would continue to produce methane gas for another fifteen to twenty years ahead. This way of re-

covering land has been going on for a while, and looking back at the last centuries, most parts of the present contours of Manhattan, Brooklyn, Bronx, Queens and New Jersey have been shaped by landfills (Rathje & Murphy 1992).

The development of landfills can be seen as trading air pollution for polluted grounds - from the smoke-belching incinerators to dumping potentially hazardous waste into the open ground. The public health concern might have decreased, but the impacts on the landscape were greater. A heavy burden was laid upon landscapes that eventually turned into a scenery filled with dumping grounds, initially put in bad locations. However, there is a positive side to it as well. The technique of closing landfills has made it possible to reuse and utilize the land, saving up valuable space.

EMERGENCE OF TECHNOLOGICAL INNOVATIONS

Not all of our waste ends up in household trash containers - some of it, for example food, gets thrown into the garbage disposer, if there is one. This invention was commercially available in the 1930s, but did not become a standard in the American homes until the 1970s. However, garbage disposers have made an immense impact of contributing to a better quality of life among the American societies. One specific example is from the small town of Jasper, Indiana in 1950. The town had a disturbing open dump, a population of 6800 inhabitants and a recent history of hog cholera. Something had to be done and the community voted to install a garbage disposer in the kitchen sink of every household. This vote made Jasper the first community in the United States to put its destiny in the hands of new technology. At the same time, Jasper discontinued the collection of wet garbage and banned the disposal of wet waste into trash cans (Rathje & Murphy 1992).

These decisions had no destructive effect on the sewage system and resulted in fewer flies in the town. The widespread availability of garbage disposers made it possible to limit the organic household waste to a minimum. This was made without garbage collection and the result was remarkable. Soon after, other communities began to implement what was called 'the Jasper Plan' and the garbage disposers became a tool for mitigating organic household waste (Phillips 1998; Rathje & Murphy 1992). Garbage disposers and the ban of wet waste disposal into trash cans had a positive impact on mitigating the organic waste in open dumps, thus resulting in a cleaner environment and an overall improved condition of the landscape.

Like its cousin North America, Europe favored cheap technical waste solutions such as landfills and incineration without energy recovery for a long time. It was believed that these management approaches were able to solve the waste crisis with no damage on human health

or the environment (Tammemagi 2000). Households had to cope with the increasing waste volumes, which put pressure on waste treatment facilities. This led to a technological and organizational change with an emphasis on reuse, sorting and recycling - a discourse neglected and almost banned in almost every country since the 1970s. When the changes came in place, household waste was once again in the spotlight, since its rate of increase was highest in the industrialized countries (Buclet & Godard 2001).

One technological development in particular was the emergence of the resource-recovery facilities introduced due to fear of resource shortage and expensive fuel. These were equipped with pollution-control devices and, as the name hints, they turned waste into energy. Like many of other technological fixes, resource-recovery facilities ware also a product originated from Europe (Rathje & Murphy 1992).

One basic form of resource-recovery facility, that eventually became a widespread option, was the 'mass-burn' incinerator. Here waste was fed into a furnace without the need of separating the materials. The burning mass would then heat water in pipes or in a central boiler in the furnace walls, producing steam that drove a turbine in order to generate electricity (World Bank Technical Guidance Report 1999; Rathje & Murphy 1992). However, incinerators like these polluted the air and after the Clean Air Act of 1970, thirteen of the New York City's incinerators had to shut down because they did not meet the federal emission guidelines (Phillips 1998; Rathje & Murphy 1992).

An overall improvement for waste management can be observed as the result of implementing new technology. Installing of garbage disposers in the American households helped to decrease the amounts of organic waste threatening the landscape, while the development of resource-recovery plants made it possible to generate energy from waste. These inventions influenced the character of the landscape, which shifted from a scenery of open dumping grounds to a landscape portrayed by a large amount of treatment facilities with an industrial nature.

WASTE MANAGEMENT IN THE AFTERMATH OF WORLD WAR II

Recycling became a concern during the Second World War when it emerged from England, finding its way to the United States in the late 1960s. It was first established by hundreds of grass-roots 'buy-back' centers, but the problem was the excess of recyclable material (Rathje & Murphy 1992). Despite the failure of the grass-roots efforts, recycling soon got set in motion by events not initially connected to recycling at all. Litter, the waste that is out of place, got more attention than the waste that normally ends up where it is supposed to be. This

can be exemplified in the highway litter in the 1960s, when bottles after bottles were thrown out of the cars' windows. Response to this behavior was a bottle bill, first passed in Oregon in 1972, where a five or ten cent deposit was mandated for certain glass and metal beverage containers (Engler 1995; Rathje & Murphy 1992).

In 1992 the goal for waste recycling in the United States was set to 25% by the Environmental Protection Agency (Phillips 1998). The deadline was not met but a broad public support was risen - not because of recycling being a good environmental deed, but because of its profitability (Rathje & Murphy 1992). Furthermore, large scale composting that has been around in Europe for a while, first arrived to the United States around the 1980s (Epstein 1997). This industry has unfortunately started out with some difficulties, due to its expensiveness, possible odors, need of vast space and hazardous element filtering (Rathje & Murphy 1992).

Around that time, source reduction was slowly making its way into the industry, having stronger impact on Europe rather than on North America (Hays 2000). The concept meant using smaller amounts of materials in the products, extending their useful lifetime and minimizing the volume of their toxic constituents (Hebel et al. 2014). This approach was common among Mexican-American households, whose food loss rates were much lower than in the Anglo-American households. Instead of discarding the unconsumed food, the ingredients were replenished and leftovers incorporated into the next meal (Skibo et al. 1995).

Seattle's garbage collection system inaugurated in 1981 was a trial-and-error case in the spirit of source reduction method. It was based on 19-, 32-, or 60-gallon bins (72, 121 or 227 liters). The average household filled three and a half 32-gallon cans per week, but by 1992 this rate came down to around one 32-gallon bin/week. The reason was having incentives for life style changes, rather than overriding the lifestyles. However, by 1957, a British civil servant named C. Northcote Parkinson formed a law called 'Parkinson's Law' stating: "Work expands so as to fill the time available for its completion". This law can be applied to garbage and is then formulated "Garbage expands as to fill the receptacles available for its containment". To prove the 'Parkinson's Law of Garbage', 90-gallon containers were introduced in the city of Phoenix in 1980 and the result was an abnormal high rate of waste (Rathje & Murphy 1992). Take away the receptacle and you, in some way, take away the trash (Korst 2012).

LESSONS LEARNED

We have learned from the history that over the course of two million years, the landscape has been constantly exposed to the society's waste. Garbage has been an integral part of the landscape and people's lives since the beginning of our time. Through the course of history,

mankind has made its best efforts to sweep away the waste and hide it out of sight, until it no longer could be hidden. Waste became an ever-present part of people's surrounding, shaping the everyday landscapes of men.

There were no records of organized waste management systems up until the late 19th century. The first efforts of cleaning up the society's mess involved clearing of the streets from garbage, which later on was burned in the incinerators. The urban landscape characterized by mountains of trash began to transform and the city streets became cleaner. However, waste was still accumulated in the urban peripheries spreading disease and environmental pollution. Eventually, the amounts of garbage got so big, that the cities could no longer store the growing waste masses. Instead, new management systems were built as municipalities began to dispose the trash at landfills - a new era was born. Waste's environmental and physical impacts on the landscape were even greater than before.

Garbage became so conspicuous in people's everyday lives, there was no escape from it. This growing problem led to the invention of various technological fixes that would improve the management of waste. One of them was garbage disposer, which effectively decreased the large quantities of organic residue ending up in the American open dumps. Another important invention were resource-recovery facilities that allowed incineration with generation of energy. The landscape characterized by piles of garbage collected on landfills had slowly begun to transform into one distinguished by industrial plants with vast chimneys reaching the sky.

Incineration and landfilling turned out to be unsustainable and alternative waste management systems started to emerge. The waste landscape embarked on a journey of diversification. Recycling, composting and source reduction slowly developed over the course of time, turning the landscape into a multitude of diverse scenes. However, even the shortage of resources during the World Wars was not able to change people's attitudes towards consumption - with growing population grew the amounts of garbage, more than ever before.

31 | THE SITUATION WITH WASTE TODAY

6.

THE SITUATION WITH WASTE TODAY

THE MEANING OF LANDSCAPE

There is no doubt that waste plays a significant role in our lives. It has been a part of the human history for two million years (Rathje & Murphy 1992) and will probably continue to play its role for centuries to come. There are over seven billion people on this planet (Geohive 2016; Worldometers 2016), each of us producing certain amount of garbage every day. Ultimately, the generated waste reaches vast quantities, eventually impacting the landscape in one or another way. This creates issues all over the globe, causing multiple chain reactions with devastating consequences (Tammemagi 2000).

To recognize the value of landscape, we need to first understand what is meant by the term. As defined by the Council of Europe (CoE), landscape is "AN AREA, AS PERCEIVED BY PEOPLE, WHOSE CHARACTER IS THE RESULT OF THE ACTION AND INTERACTION OF NATURAL AND/OR HUMAN FACTORS." (Council of Europe 2016; Déjeant-Pons 2006, p. 369). This interpretation is general yet precise, and even though European, it can be applied all over the world. Usually while referring to landscape, we mean visible features of a region (Merriam-Webster Dictionary 2016), including physical elements of various landforms and human features. Landscape reflects therefore a coalescence of people and place - a synthesis of living and non-living components.

CoE also states that it is a "KEY ELEMENT OF INDIVIDUAL AND SOCIAL WELL-BEING AND ITS PROTECTION, MANAGEMENT AND PLANNING ENTAIL RIGHTS AND RESPONSIBILITIES FOR EVERYONE." (Déjeant-Pons 2006, p. 364). Landscape is therefore a common responsibility of the human kind - a resource ought to be treated with care and respect. Its importance can simply be reflected by the amount of land accessible to each of us on the surface of the globe. It is estimated that BY THE YEAR 2020 ONLY 1.5 HECTARES will be granted for housing, food production, waste disposal and other needs for each person (Tammemagi 2000). Because much of the Earth's area is uninhabitable due to various geophysical or climatological conditions, only a small portion of the planet can be utilized

by the humans. This is why land can be seen as a scarce resource that needs to be protected.

People, as well as other inhabitants of our planet, are all part of the landscape. We are entirely dependent on it and its supplies - THE EARTH IS LITERALLY ALL WE HAVE. The landscape is therefore an utterly valuable resource (Tammemagi 2000). Beside its material and physical values, it also has a social and cultural worth. The Council of Europe recognizes landscape as a paramount element of human life:

"THE LANDSCAPE IS AN IMPORTANT PART OF THE QUALITY OF LIFE FOR PEOPLE EVERYWHERE: IN URBAN AREAS AND IN THE COUNTRYSIDE, IN DEGRADED AREAS AS WELL AS IN AREAS OF HIGH QUALITY, IN AREAS RECOGNIZED AS BEING OF OUTSTANDING BEAUTY AS WELL AS EVERYDAY AREAS" (DÉJEANT-PONS 2006, PP. 363-364)

IMPACTS OF WASTE

The anthropogenic impact, specifically our waste generation and disposal, influence the landscape in various ways. The impacts are many - some of them evident and obvious, other less conspicuous. Many people are not aware of the effects waste has on our planet or simply do not associate them with garbage. In this chapter we discuss how the landscape is affected by waste - directly and indirectly.

Landscape is strongly connected to visual aspects. The term is often used while describing an area of land that has a particular quality or appearance (Merriam-Webster Dictionary 2016). The garbage that we generate is treated in different ways. Large portion of it gets accumulated and piled up on landfills, where it eventually ends up buried in the ground (El-Fadel et al. 1997; Tammemagi 2000). In this case, the impact waste has on the surrounding landscape is very pronounced - it affects the region visually, taking up valuable land. This type of effect can be seen as direct, as it can personally be experienced just by overlooking the area. Even other factors as odor, dust, noise or potential damage to the infrastructure caused by heavy machinery, are examples of evident disruption.

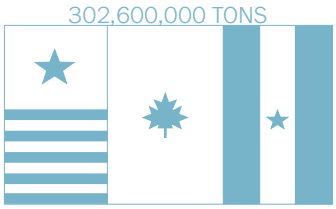
Beside the obvious effects that the waste has on the landscape, there exist many more, less apparent impacts. One of the most dangerous is environmental pollution - both at local and global scale. Decomposition of biodegradable organic material generates methane, which is one of the primary greenhouse gases (El-Fadel et al. 1997; Gunders 2012; McKone & Hammond 2000). The gas poses serious environmental threats once released into the atmosphere, but can also be a danger to the facility itself, as it is flammable and may cause fires and explosions. Leachate is another problematic substance originating from waste. It is a contaminated liquid generated through percolation of water through garbage. Both methane and leachate

bring about number of problems connected to the landscape, which include vegetation damage, air and ground water pollution, fires and climate change. Health hazards, which may not seem related to the land, impact animals (and humans), potentially leading to population change ultimatelly influencing the landscape. (El-Fadel et al. 1997)

WASTE BY NUMBERS

The discourse of how waste impacts the landscape has been mentioned momentarily. To understand its sincere impacts, we briefly look at the amount of waste generated in North America and Europe.

The total amount of municipal solid waste generated in NORTH AMERICA (UNITED STATES, CANADA AND MEXICO) IN 2012 WAS 302.6 MILLION TONS (Environmental Protection Agency 2014; Statistics Canada 2015; Castrejón-Godínez et al. 2015). Out of the 302.6 million tons, American households generated approximately a total of 251 million tons of waste, from which 87 millions were recycled. Or to put it in other terms - the Americans generated 1.81 kg of waste per capita per day (Environmental Protection Agency 2014), which constitutes for approximately 660.65 kg of waste per person in a year (1.81 kg * 365 days).



7.

This can be compared to the EU-28 member states, where the waste per capita the same year (2012) was around 500 kg (Eurostat 2015). THE SAME YEAR, A TOTAL OF 274 MILLION TONS OF WASTE WAS GENERATED FOR THE EU-28 MEMBER STATES. It comes to no surprise that the countries with the most inhabitants produced the highest volumes of municipal solid waste (e.g. Germany 55 million tons and France 38 million tons). (Eurostat 2016). Numbers do not lie, it is a straight forward reality and it is a reality where we as experts have to change the outcome for the years to come. It is although remarkable to see slight similarities between the continents.

8.

IN THE UNITED STATES

The current challenge of mass-landfills indicates a turning point of waste management in urban areas. The approaches for waste disposal and management emerging during the mid-20th-century, have industrialized forms of planning and made engineering obsolete. These cannot keep up with the complexity of contemporary urban waste streams (Bélanger 2009). Household waste in the United States, for example, possesses high levels of food loss. It is

estimated that its vast majority ends up on landfills, representing the single largest component of municipal solid waste for the nation. An estimate of merely 10% of the available and edible food is being recovered every year in the United States. The barriers for food recovery involves liability concerns, distribution and storage logistics, as well as funds needed to collect, package and distribute it. Another obstacle is the federal department, where tax reductions have expired for companies distributing recovered food (Gunders 2012), making it harder for companies with low revenue to establish themselves.

Closing the material loop is, as professor of landscape architecture Pierre Bélanger describes it, the most significant shift in the economies of waste management. It involves public regulatory agencies and private turnkey enterprises to engage in a loop of economic and ecological synergies in order to counteract the dependance on landfilling (Bélanger 2009). The effect of recycling is statistically powerful. If all the 25.5 million tons of reliable goods now discarded in American landfills were reclaimed through reuse each year, an estimation of 100 000 new jobs would emerge in this industry alone (ibid.).

Furthermore, the effect of recycling would multiply through technological innovations and spinoffs (Stewart et al. 2000), making it surpass the conventional industry of waste landfilling. The synergies and spinoffs from new development show how new systems can be created when urban ones are tightly designed to be integrated in regional land-based resources. When mixed, these systems can demonstrate the efficiency of landscape strategies and solve multiple challenges at once. An example is the development from tighter environmental control and stronger economic synergies between the U.S Department of Agriculture's Comprehensive Nutrient Management Planning Program and the U.S Army Corps of Engineers' Beneficial Material Reuse Management Program in the mid-1990s. They involved diversion of land application of sludges and dredgeates, which are two important land reclamation strategies that have the potential to restore the history between downstream and upland sites within watersheds in a region (Bélanger 2009).

It is especially important for landscape practitioners to participate in the design and planning of sites involving excavated materials from the mouth of the river to abandoned industrial sites. It is where bioremediation alone cannot solve the brown field challenge. The new integrated regional economics offer a powerful model for the reuse of land, and it is where remediation costs can be neutralized by overall returns from productive land development (ibid.).

The American landscape has been undergoing a change from a scene once dominated by mass-landfills to one comprised of new systems, where synergies and technological advancements are a key factor. Closing the material loop in the United States is not a concrete project, but a vision for an improved waste management. This approach can be seen as recycling,

where materials are used for different purposes throughout their lifespan, maximizing their economical value and environmental liability. By doing so, we do not only create synergies, but also protect our scarce resources, as well as mitigate the wear-and-tear on our landscapes.

IN EUROPE

From one continent to another, the focus is now shifting towards Europe and the municipal solid waste management in the continent.

The differences between United States and Europe are many, but one particular aspect must be emphasized and it is the legislations. There is a joint collaboration within all the member states of the European Union (EU) meaning that what is decided must be implemented by all. There are three different type of decisions made: regulations, directives and recommendations. Regulations are binding in its entirety; are directly applicable to all Member States and do not need to be incorporated into national law. Directives set mandatory goals but it is up to the Member State to choose the method of approach. Recommendations, on the other hand, are just what they are - recommendations. Therefore they are not binding (BNDES 2010). However, Europe constitutes of non-EU members too. Consequently, these countries do not abide by the rules and legislations of the European Union and can therefore, within this subject, cause a gap in the continent.

The United States is a federation, meaning that all states have power: The national government however, still has the monopoly over the constitutional authority. The Environmental Protection Agency (EPA) is for example responsible for establishing national standards for solid waste management, as well as the monitoring and supervision of the states. The directives come from the federal law to the states, where responsibilities are delegated to regulate the market for municipal waste management (Phillips 1998).

It is difficult to coordinate a unified timing for solid waste management in Europe, because it is comprised of diverse countries, all with different policies and economies. This results in an irregular development within the continent. However, there is a common issue every country in Europe faces - how to define a new municipal waste management policy, substituting or completing a regime that in the past was focused basically on elimination. Despite the common concern for how to replace the elimination techniques, governments set different objectives and implementations for the types of waste. Italy was for instance the first country in Europe to deal with packaging waste - beverage packaging to be specific. France was targeting the domestic packaging waste market, while Germany and the Netherlands focused on the whole packaging field. Meanwhile, the tendencies in Greece pursued the French solution

(Buclet & Godard 2001).

Despite the heterogeneity of the chosen methods, they all point out the necessity to develop recycling and energy recovery. Some countries however do not emphasize the reduction of waste from the source or refilling, while others do. Germany and the Netherlands for example, have both set regulations for limiting the use of packages, thus reducing the waste at the source. Meanwhile there are no such regulations in Greece, France and Italy (ibid. p. 306).

The background to how governments of Europe choose to work with waste management might not portray an image of the relation solid waste has to the landscape. However, it does give a clue to what direction Europe is facing in terms of solid waste management.

The province of Foggia in southeastern Italy is the second largest province in Italy with an approximate area of 7 000 km^2. Separate waste collection did not exist here until 2007. There was no pressure from the municipalities to adopt these innovations, and they proved to be ineffective if there were any. In 2014 however, the treated waste for the separate waste collection reached on average 60% of the municipal waste, corresponding approximately 11,776 tons of waste (Morone et al. 2015). What this tells us is, that there might have been some kind of scrutiny during the last seven years for which landscape level actors exerted pressure on municipalities, which has evidentially proven to be effective.

Moving up north to a region in Europe, where waste disposal relies heavily on landfills, are the Baltic states comprised of Estonia, Latvia and Lithuania. Despite a waste generation considered to be much smaller than the more developed countries in the EU (less than 450 kg/capita in 2011), the landfilling is notable (Filho et al. 2015) - it is however a process going through a transposition. To meet the requirements of the European Union, the Baltic states started to close the old dumping grounds and build new sanitary landfills. By 2009 all the old waste sites were closed. The transition was a time-consuming work throughout the three countries, requiring competence from responsible actors and devotion from households, in order to reach the desired quality (Voronova et al. 2013; Filho et al. 2015).

One aspect the Baltic states share regarding solid waste management, is that municipalities are responsible for planning and organizing the collection of garbage. However, the similarities end there and the scenarios vary for each country. In Estonia, the solid waste management tends to rely on the private sector (Voronova et al. 2013), while in Lithuania central authorities play a strong role. The drawback of private sector approach is that it can leave undesirable consequences. With little or no control from the authorities, the private sector steers the waste treatment process. Furthermore, municipalities in the Baltic states are many and often small in size, and the capacity to organize effective waste management is not always ade-

quate. It can however be compensated by cooperations between municipalities and sharing of resources. In Latvia and Lithuania, municipal waste management is coordinated through a regional principle, where numerous municipalities are creating cross-municipal structures for waste management. This means sharing of facilities, human and financial resources, and other significant utilities for a long term planning success (Filho et al. 2015).

Out of the three Baltic states, Estonia adapted to the European Union the quickest. It did not have any transition period for meeting the recovery targets of the EU Packaging Directive - the system was instead introduced instantly and has proven effective. In Lithuania on the other hand, waste at landfill sites had to be closed in 2011 (Voronova et al. 2013). The system for collecting packaging waste was based on certificates, and proven inadequate for the recovery targets. In 2013 ut had to be reviewed, which until this day has not yet been initiated because of lack of will among the politicians (Filho et al. 2015).

The development of new recovery facilities has progressed well in Estonia thanks to a high landfill tax combined with a ban of unsorted municipal solid waste. The landfill tax has furthermore increased the landfill gate fee, which together with the disposal system allowed Estonia to drastically reduce landfilling of municipal solid waste. Lithuania has not implemented any landfill tax - the result is low landfill gate fees and the obstruction of actions towards recycling (ibid.).

Implementing taxes and bans for non-sustainable waste management approaches has proven to play an important role in municipal waste treatment. Stricter regulations have had positive effects on mitigating landfilling operations, resulting in more sustaianble management systems. The change of landscape from a scene of landfills to energy-recovering facilities can especially be seen in the cities of Malmö in Sweden and Aalborg in Denmark.

IN SWEDEN AND THE ÖRESUND REGION

Malmö and Aalborg are both examples of how concrete problems are solved in situations characterized by technical and political uncertainty. In just 50 years, both regions have transformed into landscapes of energy recovery. Prior to 1960s, waste disposal were relied upon landfills and between 1970s and 1980s, both Malmö and Aalborg started to discard organic waste in incinerations. Heat recovery was introduced shortly before the 1970s in both cities. In the 1980s, Malmö implemented landfill gas extraction with energy recovery at its major landfill site. Both cities also initiated separation of yard waste for composting and land application for the compost in the 1980s (Johnson et al. 2011).

Malmö and Aalborg applied electricity generation to their already established heat production facilities and improved the energy recovery efficiency between 1990 and 2005. In 2010, Aalborg and Malmö improved their facilities yet again, with the introduction of additional heat production via condensation of vapor in the flue gas. The success story continues when the development of systematic wastewater treatment between 1970 and 1980 was carried out. Malmö implemented a system for organic matter removal combined with heat and power production via anaerobic digestion of sludge, all at once, while Aalborg divided it into two steps some time later (ibid.).

Sysav (South Scania Waste Company), a waste company owned by 14 municipalities in Scania in southern Sweden, specializes in recycling and utilizing household waste as a resource (Sysav 2016). In 2015, Sysav estimated that each individual in the 14 municipalities, generates about 510 kg annually. Furthermore, 5246 tons of recyclable material were transported to the recycling stations in Scania (Retur 2016). These materials end up as either potential energy or at the premises of Återskapa - a workshop in Malmö, where children and adults are able to use their creativity in order to obtain innovative solutions for their daily work, or just to experiment with the materials (ibid.).

75 % of the Swedish municipalities, including Malmö, outsourced their collection and transportation of solid waste to the private sector in 2009. However, Malmö municipality still has the potential to affect the collection and transportation of its solid waste. One example is that the municipal enterprises need to follow the municipal policies related to environmental precaution in all services and products from external parties. The policies for Malmö state that environmental, social and ethical requirements should be made in all public contracts, and that these requirements should be made for a long-term sustainable development. The policy also declares that the requirements should be proportional - meaning that economic reality and environmental ambitions must be balanced. An example is an initiative from the municipality in recent years, where the collection of solid waste must be carried out with vehicles run on biogas. Malmö not only decreases the environmental burdens in relation to waste collection, but also increases the demand for biogas by implementing this strategy (Bernstad et al. 2013).

Between 2005 and 2010, Malmö introduced separate digestion of biodegradable waste. This is waste commonly derived from households, restaurants and other food-producing industries. Even though the progression has been going well in this part of Scandinavia, it is predicted that extensive improvements for energy-to-waste are not likely to happen in the future. The reason behind it is the growth and development of waste prevention and recycling programs, which are likely to become more successful (Johnson et al. 2011).

Furthermore, two areas in Malmö have been functioning as a test bed for innovative solutions - Bo01 and Augustenborg. Although they have their geographical dissimilarities, the aims of the projects were comparable. The idea of ecological sustainability was still connected to eco-villages when Bo01 was in its initial stage in the late 1990s. The way of increasing sustainability came from decentralization and small-scale systems. Bo01 was therefore, to a large extent, planned similar to an eco-village, where self-sustainability became a key factor (Danish Architecture Centre 2014; Bernstad et al. 2013). All of the used energy was to be produced within the area, and the aim for solid waste was to close the loops within the district (Bernstad et al. 2013). The developers and property owners wanted to try a new solution by implementing a food waste disposal system in the kitchen sinks in about 200 apartments in the area (Naturvårdsverket 2008).

Another approach for waste disposal in Bo01 is the vacuum system, connecting five hundred households. The waste is separated in two different inlet doors - food waste and residual waste. The garbage is going through the chutes and is then collected in underground tanks from where it is sucked by vacuum into a collection vehicle (Bernstad et al. 2013).

The approach with Augustenborg is a bit different. Unlike Bo01, it was an existing residential area where modern waste management was implemented upon obsolete systems. The existing waste streams had to be investigated and the aim was also to influence the recycling behavior through improved possibilities for on-site recycling and information strategies for households (ibid.). A number of recycling buildings have been constructed in the area since the end of the 1990s. The tenants were allocated with keys to one specific building, depending on where in the area they lived. Household waste could be separated into nine different on-site fractions in the recycling buildings; colored and clear glass, plastic, paper, metal packaging, newspapers, batteries and residual waste. Organic household waste could be disposed in compost reactors, one in each recycling building (Bernstad et al. 2011).

By the early 2000s, tenants in Augustenborg had the possibility to recycle household waste in the area, but in order to dispose bulky, hazardous trash and e-waste (electronic/electrical waste), the tenants needed to seek a recycling center approximately 10 km away. This would require a vehicle and by this time, only one in five inhabitants in the area owned a car. However, some physical adjustments were implemented when the changes of 2008 took place in the area. The residents were now able to dispose hazardous waste, e-waste, oils and fats. The compost reactors were removed and food waste was to be on-site separated in paper bags for later removal in separate waste bins (Bernstad et al. 2013).

These modern approaches of waste disposal might sound good in theory, but what can we learn from these systems?

The food waste disposal system at Bo01 was evaluated as a catalyst for personal environmental thinking and the quality of the organic matter has been high (Naturvårdsverket 2008). It was also evaluated with a low sludge volume resulting in a rather inefficient transport to the treatment plants (Bernstad et al. 2013). The vacuum system met with issues connected to the residents' mis-sorting of waste, and two years after the installation, less than 30% of the organic waste was separately collected within the system. This resulted in locks being installed on all inlet doors for food waste chutes. It improved the quality of the waste collection and it has since then been possible to use food waste collection in the area for biogas production (ibid.). The implementation of recycling houses in Augustenborg had not proven to be as effective as the potential verified to be - high accessibility does not guarantee high levels of household waste recycling (Bernstad et al. 2011).

Another example is Stockholm, the capital of Sweden with a population of about 900,000 inhabitants and a land area of 188 km^2, situated in northern Europe. Stockholm is one of Europe's leading cities with high environmental standards, where the emphasis has been put on a sustainable future. A major part of the municipal solid waste in Stockholm such as paper, plastic and construction and demolition is incinerated, while organic waste is treated by composting or anaerobic digestion (Uz Zaman & Lehmann 2011).

The statistics gathered come from 14 waste facilities in Stockholm for 2006. Five government-owned treatment facilities in Stockholm treated a total of 836 thousand tons of waste. In addition to this, nine private treatment facilities treated a total of 1.1 million tons of waste the same year (ibid.). This results in a total of about 1,936 million tons of waste going through the waste facilities in Stockholm in 2006. However, the national waste data for Sweden in 2010 is characterized by an equal share of recycling and incineration, 49%, and only 1% of the waste going to landfills (Milios 2013).

An effective nationwide result for mitigating landfills can be seen in the implementation of landfill taxes in 2000, the ban of combustible waste to landfill in 2002, and the ban of organic waste to landfill in 2005 (ibid.). The exposed hazardous waste is at its minimum and other communities can achieve great changes by implementing the right kind of legislations, where Sweden is an inspiring example.

The landscapes in Sweden are characterized by a low percentage of landfills and a high percentage of treatment facilities, thanks to the strict regulations. The image of Swedish landscapes reflects the direction that the country is taking - laws control the waste, instead of letting waste to control the landscapes.

IN CANADA

Canada has, contrary to the the case in the Baltic States and in the European Union, a different approach to waste management. Municipal waste management in Canada is regulated by provinces and territories, and administered by waste management industries under contract to municipal or regional authorities. The waste management industries also provide services under contract to industrial, commercial or institutional waste generators. Some areas in Canada, where it is not yet devolved, are however regulated by the federal government (Giroux 2014). To simplify, Canada's waste management is a mixture of the systems utilized in the United States, with the involvement of states and the authority from the government, as well as and the system used in Estonia with the private sector running the management of waste.

The four provinces that disposed the most waste in 2010 were Ontario with 10 304 000 tons of waste, Quebec with 6 496 000 tons, Alberta with 4 368 000 tons and British Columbia with 3 024 000 tons. It is not surprising in the areas, where the population for a nation is the highest (ibid.). The total waste per capita for the nation was 729 kg in 2010. Durin that year Nova Scotia, British Columbia, New Brunswick and Ontario disposed less waste per capita than the national average, while Alberta was the province with the highest waste disposal rate per capita at 1 052 kg (ibid.).

Like other countries, Canada follows a waste hierarchy prioritizing waste reduction and prevention (Sawell et al. 1996; Giroux 2014). Seven out of fourteen jurisdictions in Canada have some form of waste prevention or waste-reduction initiatives. The remaining seven do not have any jurisdiction-specific initiatives for targeting waste reduction (Giroux 2014). The next stage in the hierarchy is the recycling approach - an approach steadily growing for each coming year. Between 2000 and 2010, waste diverted to recycling or organic processing facilities in Canada, increased with 33%. In numbers, it is equal to a change from 6 832 000 tons to 9 072 000 tons of municipal solid waste going through recycling or turning up as compost (ibid.).

One example utilizing the composting strategy is the composting facility in Hamilton Harbor, built by a public-private partnership between the City of Hamilton's Waste Division, Maple Reinders Constructors and Christiaens Group. The facility can process a maximum capacity of 90,000 tons of wet garbage annually and meet the disposal need of one million people. The operative costs for running this facility are 25-35% lower than landfilling costs, and it do not require any pre-development bioremediation. It results in the nearby landfills running towards bankruptcy and in extension, their termination from the waste market all together (Bélanger 2009).

The fourth R is the recovery approach, meaning turning waste to energy. This approach is becoming more and more popular worldwide, especially the anaerobic digestion utilizing energy for biofuel. It is believed that Europe now has over 10 000 operating facilities for this kind of energy recovery, where it has left some communities fossil-fuel-free. However, the traditional thermal treatment with energy recovery for treating municipal solid waste facilities are few in numbers in Canada, and they are mainly seen in Europe and in the United States. These facilities in Canada are large, only five in number and treat mixed municipal solid waste. Construction of the additional institutions is underway and they typically need provincial or territorial approval - both in order to be constructed and to operate (Giroux 2014).

Canada's last stand for fighting municipal solid waste are the notorious landfills and conventional incineration. It is estimated that around 97% of the municipal solid waste diverted after recycling, composting and recovering, ends up at landfills - an approximate of 27 000 000 tons. There are almost 2 000 operating landfills in Canada, and all accept municipal solid waste. However, the shift towards having fewer and larger regional landfills rather than numerous and small ones, has been pushed through provinces during the last 10-20 years. The larger ones would meet improved environmental standards. Conventional incineration is considered to be less favorable than landfills, since they reduce the amount of waste with no energy recovery (ibid.). However, landfills in general seem to be phased out since they either cannot compete with other waste disposal techniques or are being merged into fewer and bigger ones.

THE CONUNDRUM WITH WASTE TREATMENT

The industrialization and urbanization of the world have led us to the realization that the contemporary urban areas are the main energy consumers. The design of the traditional waste disposal including, but not limited to, reliance on landfills, has to be changed as landfills continue to run out of space and move further away from cities resulting in monetary and environmental losses. Urban areas today account for two-thirds of the global primary energy consumption (Song et al. 2016). However, in the perspective of the fossil energy deficiency and an increasing awareness of global warming, renewable energy is being promoted. Waste-to-energy approach is among one of the promising alternatives.

There are several alternatives for implementing waste-to-energy technologies - all of them considering varying contents of the waste. Waste incineration is suitable for municipal solid waste with non-biodegradable matter and low moisture. It is a process where organic waste reacts with excess oxygen during combustion in a furnace, and the produced heat can be used for power generation (ibid.). Anaerobic digestion involves no oxygen and happens when

microorganisms break down organic biodegradable matter, in order to generate biogas for energy purposes. These two measures are considered to be the main waste-to-energy technologies. Other innovations such as landfill gas recovery, gasification and pyrolysis are being implemented on a much smaller scale. Furthermore, there are some significant correlations between the technological advancement and the economic and environmental performances - the better the technology behind waste disposal, the better the economic and environmental performance (Song et al. 2016).

What we see in our research on modern waste management is a shift from landfilling to ”cleaner” management approaches - in particular incineration. Energy recovery has over the last two decades become more and more common, both in Europe and in North America. We see an advantage in the legislative and regulatory work in the United States with the Environmental Protection Agency responsible for establishing national standards and monitoring of the states. It minimizes the gaps in the waste management practice throughout the country. A uniform terminology and legislation on waste in Europe would prevent the discrepancies between the directives in force, which today lead to misinterpretation and confusion. The challenge however lays within the complexity of Europe, which is a multicultural continent with many actors involved.

Various examples prove positive effects of increased recycling rates, such as economic profit, job creation and lower facility operating costs. This approach has found its way into the daylight, becoming the most preferable waste management alternative in the modern society. Recycling is today quite common in Europe, but is still infrequent in North America. We see a need for other approaches promoting prevention and reduction of garbage on both continents, in order to obtain a sustainability and mitigate impacts of waste on our landscapes.

45 | WHAT WE CAN DO

WHAT WE CAN DO

The problem with waste is not whether we choose to accept it or not, but how we choose to deal with it.

TRANSFORMATION OF WASTE SITES

Waste is an ever present part of our lives that has become a symbol for today's socio-environmental issues. It is seen as a surplus of our culture, a result of how we fail to manage and evaluate our impact on the world (Engler 1995). Environmental issues connected to waste have motivated professionals and civic reform groups to organize changes in waste management (Manfredi et al. 2010) for social attitudes and urban design approaches.

Waste deposit has been, and still is, the most common waste management approach word wide (ibid.). The design behind landfills was previously motivated by people's attitudes towards waste and our constant wish to remove it from our lives (Engler 2004; Tammemagi 2000). For many years garbage has been distanced from our everyday landscapes. However, the constant increase in population and progressing urbanization have significantly limited the available land that could be utilized by humans (Tammemagi 2010). This has created a need for new solutions, decreasing our dependence on landfills by their elimination or transformation (Engler 2004; Thaïsa 2013).

Previously, waste institutions were solely managed by engineers, hidden from the public view. It has brought about many problems and hindered our society from progress:

"FAILURE TO PERCEIVE WASTE AND MISCONCEPTION OF WASTE HINDER OUR DECISIONS ABOUT HOW TO MANAGE VARIOUS KINDS OF WASTE AND RESTRAIN OUR ABILITY TO CREATE MEANINGFUL, EVOCATIVE LANDSCAPES."
(ENGLER 1995, P. 12).

However, the once hidden waste landscapes have with time found their way to other discipli-

nes, such as landscape design practices, and into the light of the public.

Mira Engler, a professor of landscape architecture and researcher on waste, has studied the modern ways of coping with waste sites. These aim to normalize and decentralize waste systems by transferring smaller institutions into our everyday environments. The emphasis is put on the aesthetic aspects that are true to the "MULTILAYERED ECOLOGICAL, SOCIAL, AND ECONOMIC FUNCTIONS" of these sites (Engler 2004, p. 4). Engler manifests that the waste landscapes should become an integral part of community life by being more accessible to public and visually dignified.

Waste disposal sites have been transformed into landscapes with new purposes since 1970s (Engler 1995). It has since then become more and more popular to work with the so called 'waste parks' or 'disturbed sites' - a term used by professor of landscape architecture Elizabeth K. Meyer (2007). Meyer focuses not only on waste sites, but also on other polluted or contaminated landscapes previously used for industrial purposes. To be considered safe, disturbed sites often involve processes of remediation before the grounds can be used by humans. They often turn into large parks that, according to Meyer, should be recognized as landscapes of consumption as well as production. It means that they should both focus on ecological aspects, but also on the remaining elements of the industries embedded in these sites. Meyer claims:

"THINKING ABOUT LANDSCAPES OF CONSUMPTION AND PRODUCTION REQUIRES THINKING OF THE CIRCULATION OF NEED, DESIRE, MATERIAL, GOODS, ENERGY, AND WASTE ACROSS DISCIPLINARY CATEGORIES SUCH AS NATURE AND CULTURE, ECOLOGY AND TECHNOLOGY, AND EVEN PUBLIC AND PRIVATE. WE NEED DESIGN STRATEGIES THAT MAKE VISIBLE THE PAST CONNECTIONS BETWEEN INDIVIDUAL HUMAN BEHAVIOR, COLLECTIVE IDENTITY, AND THESE LARGER INDUSTRIAL AND ECOLOGICAL PROCESSES." (MEYER 2007, P. 64).

Waste parks include solid waste, wastewater, toxic waste, and nuclear waste. They can sometimes fulfill both the traditional park uses, such as social interaction and recreation, and the contemporary uses, such as land remediation and recycling practices. Managing the disposal sites in a proper manner can turn waste facilities into waste parks, waste museums or waste gardens, depending on the interdisciplinary work behind it (Engler 1995).

Much of the literature on design and planning that deals with waste landscapes, refers to Mira Engler's classification of waste-related design approaches (Czerniak & Hargreaves 2007; Gabrys 2013; Meyer 2007; Thaïsa 2013). We have therefore chosen to describe this categorization in-depth, as it represents the ways architects and planners work with waste. According to Engler (1995), eight distinct and delineate approaches can be found: (1) camouflage, (2) restoration, (3) recycling, (4) mitigation, (5) sustainable, (6) educative, (7) celebrative

and (8) integrative. Each category is associated with a certain profession or discipline which represents certain values, interests and outlook.

Camouflage and restoration approaches carry traditional aesthetics in landscape architecture, as well as promote and enhance selected landscapes above others (Meyer 2007). The recycling method aims to strengthen economic or social benefits (e.g. turning liability into amenity or a community park turning waste land into profit). The mitigation and sustainable approaches, favored amongst environmental scientists and engineers, mainly focus on site remediation using natural systems, later seeking economic return to support the maintenance expenses. While the educative and celebrative methods put human awareness into focus and interrelate to each other, they also share their contrasts. The educative measure teaches the reality of waste, while the celebrative uses waste as a metaphor, denying its presence. Finally, the integrative is what one might expect - an interdisciplinary approach that combines other methods and ideas. (Engler 1995)

Following pages present examples for each of these eight approaches.

10. CAMOUFLAGE APPROACH - THE OCEANSIDE WATER POLLUTION CONTROL PLANT IN SAN FRANCISCO, CA.

CAMOUFLAGE As the name says, the purpose of this method is to disguise and blend new structures into the surrounding landscape, due to visual and/or practical aspects. The Oceanside Water Pollution Control Plant (OWPCP) in San Francisco, CA is a wastewater treatment plant completed in 1993. The facility was constructed on a 49 000 m^2 large area adjacent to the San Francisco Zoo, located between Ocean Beach and Lake Merced. The plant has a capacity of up to 660 000 cubic meters per day during rain storms, treating 20 percent of the city's flows (San Francisco Water Power Sewer 2014).

OWPCP is built largely underground inside a hill, with 70 percent of its area covered by 1.8 meters of soil (SPUR 2014). The purpose of the camouflage design is to limit odor and noise impacts on the surrounding neighborhoods. The facility is also engineered to withstand earthquakes as well as to serve a future Zoo expansion over its roof (ibid). This underground construction blends into the natural marine landscape, allowing to utilize the land for various purposes. It is a smart, energy-efficient and easy on the eye design. The biosolids produced due to wastewater's secondary treatment are used for agricultural land application purposes, while the generated methane gas covers 30 percent of the plant's electrical needs (ibid).

Although the underground structure is beneficial in many ways because of its visual and practical aspects, it also has its flaws. Due to the area's difficult marine conditions, the facility faces numerous problems with coastal erosion - mainly involving potential damage to a tunnel comprising a sewage underneath the Great Highway (San Francisco Water Power Sewer 2014; SPUR 2014). There is a need for continuous coastal management in order to protect the plant from the rising sea level. Accelerated corrosion due to the local maritime climate is another challenge, creating a need for continuous maintenance to ensure seismic reliability as well as safe operation during all weather conditions (San Francisco Water Power Sewer 2014).

11. THE OCEANSIDE WATER POLLUTION CONTROL PLANT IN SAN FRANCISCO, CA.

RESTORATION The strategy seeks to reconstruct a waste site, returning it to its former state and condition. An example of a restoration approach can be found at Dyer Landfill in Florida, conducted by Gentile Glas Holloway O'Mahoney & Associates, Inc. on behalf of Palm Beach County (Martin & Tedder 2002; 2GHO 2016). The project became reality after the state environmental officials had been alarmed by the poor operating conditions at the site. At the time, the landfill collected over 500 tons of garbage a day more than its projected capacity (Sun Sentinel 1989). Accumulated piles of waste reached 3 meters above the allowed hight by the Solid Waste Authority's permit, lacking enough cover to trap water leaching through the garbage.

Dyer Landfill was closed in 1988 and a project for new resource recovery plant and landfill was initiated (2GHO 2016). The reclamation of the 323 000 square meter area meant transformation of the site into its previous condition - a wetland surrounded by cypress forest, which included both passive and active recreation uses. New landscape qualities were created by reestablishment of the historical wetlands and over 12 000 native trees. The design involved also creation of an educational native habitat and recreational attractions such as a BMX bicycle track and a golf driving range. The site is today called Dyer Park, comprising various amenities such as courts, fields, bike trails, walking paths and pavilions. It has biological, recreational and cultural value and can be seen as an asset for the community and landscape of Palm Beach.

12. RESTORATION APPROACH - DYER LANDFILL IN PALM BEACH COUNTY, FL.

RECYCLING The method aims to strengthen economic or social benefits. Danehy Park in Cambridge, Massachusetts was previously a city landfill, closed in the 1970s and recycled for the new development. The land was originally used for extraction of clay to manufacture bricks, creating a deep pit into which garbage was dumped (City of Cambridge 2016). After fulfilling its destiny as a dumping site, over 1.5 millions m^3 of material was deposited on top of it, in order to create a stable ground upon which the new park could be shaped.

It is today a multi-purpose recreational facility where residents can study nature and play sports, bike or jog (Freshkills Park 2010). The wasteland has turned into a community resource, providing new landscape qualities and amenities for the residents of Cambridge. Introduction of plants and animals into the site has created habitats and biological values, giving the area new purpose and dimension. Totally, over one thousand plants of varying species were introduced to the area (City of Cambridge 2016). A wetland controlling flooding has been created upon an existing one, which previously posed a contaminating threat. It has today a buffering function for the surrounding environment, as well as it provides home for wildlife.

The project of Danehy Park demonstrates how to effectively reuse and transform a disposal site. It takes advantage of the existing structures, developing them into forms with new design and purposes. It meets both the cultural needs and environmental constraints, providing the community with a recreational setting which it can profit from. As the City of Cambridge (2016) has adequately put it: ”A perceived liability has been transformed into an aesthetically pleasing and environmentally safe park to be enjoyed by all.”.

13. RECYCLING APPROACH - DANEHY PARK IN CAMBRIDGE, MA.

MITIGATION This strategy seeks to weaken the impacts of infected land or water in the surrounding environment through natural processes. The technique with so called 'natural kidneys', where toxic water is cleansed throughout a number of ponds, small pools or even swamps (Meyer 2007), was invented by the environmental engineer Bill Wolverton, and has since its invention been implemented throughout several sites in the United States. Crosby Arboretum in Picayune, Mississippi is an example, where rich wetland habitat was created.

The site is today a protected natural area nurturing over 300 species of native to the Pearl River Drainage Basin trees, shrubs, grasses and wildflowers (Crosby Arboretum 2016). At the conservatory, indigenous plant species and their real-life ecosystems can be studied. The purpose of the Arboretum is to raise awareness and educate the public about their environment. It provides research opportunities, protects the region's biological diversity and is a place for recreation and enjoyment. A landmark for the area is the Pinecote Pavilion showed at the picture below (Figure 14), which has received a number of architectural awards.

The Crosby Arboretum is a platform for knowledge, a recreational retreat and a very important asset from the biological and environmental point of view. It coalesces with the surrounding environment and mitigates its negative impacts in an effective manner.

14. MITIGATION APPROACH - CROSBY ARBORETUM IN PICAYUNE, MS.

SUSTAINABLE This approach centers around economics, resource conservation and self-sufficiency of waste sites. The Water Garden in Santa Monica, California designed by SWA Group/Laguna Beach is an ongoing project (May 2016), where reclaimed wastewater from the on-site treatment facilities is used for landscape irrigation (Water garden 2016). The design involves transformation of a water reservoir into a river walk with bridges and dock landing in a modernized outdoor environment, that integrates indigenous, drought-tolerant plants (OTL 2016). The reclaimed water is being discharged into storm drains and diverted to Santa Monica's Urban Runoff Recycling Facility, where it is firstly treated, then reused for landscape irrigation.

The purpose of the sustainable approach is to conserve large amounts of water through a reduction in evaporation, runoff and irrigation. It considers wastewater as a resource, making use of it to the maximum extent possible. Beside its practicality, Water Garden is also an attractive outdoor space with recreational and aesthetic values. The project is an innovative take on the problem, from which the City of Santa Monica can profit - an example of an attractive design that provides durable and sustainable solution.

15. SUSTAINABLE APPROACH - WATER GARDEN IN SANTA MONICA, CA.

EDUCATIVE

The educative approach seeks to raise awareness and change attitudes towards waste. The MIRA Trash Museum in Hartford, Connecticut, established in 1995, is an example of how waste is exhibited, inviting people to experience and learn more about its realm (Connecticut Resources Recovery Authority 2011). It is a museum, where the general public can explore the recycling processing center, as well as the exhibits on all aspects of material management (Materials Innovation and Recycling Authority 2016). The center features also a gift shop, where products manufactured of reused or recycled materials are sold.

At the Trash Museum, visitors can learn about problems with waste management and the different ways of coping with them, such as source reduction, recycling, landfilling and energy recovery (Connecticut Resources Recovery Authority 2011). Various exhibits featuring art created with trash or works connected to waste management and environment are displayed.

The purpose of the facility is to educate, inform and raise awareness. It is a platform for knowledge, as well as a functioning recycling center that promotes resource recovery. The Trash Museum can be compared to a soft approach that seeks to change public's attitudes towards waste - it is a great example on how we can influence and improve our environment with small measures.

16. EDUCATIVE APPROACH - TRASH MUSEUM IN HARTFORD, CT.

INTEGRATIVE The strategy is a combination of all of the above mentioned approaches. Its interdisciplinary perspective results in a diverse and versatile way of managing waste. An example of this method is Byxbee Park in Palo Alto, California designed by Hargreaves Associates and the artists Peter Richards and Michael Oppenheimer in 1990. The park is constructed upon a thick cap of soil, covering an 18-meter-layer of garbage. The former landfill by the waterfront was transformed into a recreation area that incorporates fragments of its former industrial character. It uses artifacts such as telephone poles arranged in rows, concrete highway barriers organized in chevrons and oyster-shell paths, connecting the site to the historic past of the region (Lee 2013).

The purpose of the design was to provide the city of Palo Alto with a stimulating environment for recreation, but most of all to "respond to the conditions of landfill below, within the context of the surrounding confluence of complex ecosystems." (Hargreaves Associates 2012). It is an artistic take on a practical approach that meets the needs of the park's users and encourages to contemplation.

17. INTEGRATIVE APPROACH - BYXBEE PARK IN PALO ALTO, CA.

CELEBRATIVE In this approach waste or its management is highlighted, dramatized and used as a metaphor of refuse, excess and resource management. The artist Mierle Laderman Ukeles, a pioneer and leader of this method, has worked with issues of positive social change. Ukeles' projects include 'Flow City' in the Marine Transfer Facility in New York City, which is a series of sequential, participatory environments and observation points, with a purpose of letting people to experience with own eyes the labor of the maintenance workers (Herzogenrath 2001). The approach transforms the facility into a theater, where the dumping operation is the performance.

The purpose of the project was to make people aware of the consequences of their lifestyle and consumer choices (Krug 2006). Through installation of a platform with three separate views, Ukeles wanted to present a truthful image of the city life. While one of the views showed a panorama of the city, the view in the opposite direction displayed barges loaded with urban waste, waiting to be transported and deposited in a landfill. The third view comprised of video monitors viewing educative information about ecological urban issues.

Mierle Laderman Ukeles sought to educate, inform and engage the public through her art (ibid.). With simple means, she managed to get public attention and raise awareness of the waste-related issues of our modern society - "Flow City serves as the suture that draws the extremes of the natural-culture dialectic into visible coexistence." (Philips 1995 see Krug 2006).

* * *

As we can see, there are many ways of working with waste sites. All of the above described approaches, more or less, differ from one another. There is no way of identifying the best or most beneficial strategy, because all waste sites - just like any site or landscape - are specific and unique. Every project is different and needs to be carried out individually, in a way that is appropriate for it. This is where the landscape architect has a crucial function. The architect's role is to determine the site's conditions, problems and challenges, to identify its current or future users, and to analyze which approach and design will be the most suitable and favorable for the given place. The choice of method is strictly connected to the purpose, as well as the desired outcome of the project. For instance, if the aim of the transformation is to economically profit from it, then perhaps the best approach is the *recycling* method. Similarly, if raising awareness and providing information among the public is in focus, *educative* is the way to take. It is important to remember that there is no uniform procedure of waste site transformation. Analysis should always be the first step and basis for every project.

The majority of modern transformation cases concerns former landfills, mainly because waste deposit has been, and still is, the most common waste management approach word wide

(Manfredi et al. 2010). There are many challenges involved in raising new structures on top of landfills, due to their composition. One of them is sinking or settlement of the surface, while another is methane gas emission (Bouazza & Kavazanjian 2011). Both depend on waste decomposition, which over time causes diminishing of the trash mass and production of the hazardous gas. Even possible migration of waste by-products poses risks to the site, its surroundings and the local environment (ibid.). Transformation of landfill sites is therefore dependent on factors such as composition and age of trash, the degree of its compaction and local climate - to name a few. All of these determinants set limits for the design and influence what type of structure could be built upon the landfill, which proves the uniqueness of every project of this type.

Through the examples described on the previous pages of this chapter, we can see that waste can be turned into something positive. Despite its negative impacts on the environment and land, we can create new landscape qualities with garbage. The effect it has had, and still has, on our planet can never be undone - traces of our waste will leave a mark on the Earth's surface for thousands of years to come. Although we cannot do anything to change the past, we can do a great deal to influence the future. As landscape architects, we can promote intelligent designs that maximize potential of space, foster biodiversity and ecosystem services, but also that educate and inform the public, raising awareness and changing attitudes among the civil society. We can plan spaces that combine function with creative design, not only meeting the users' needs, but also creating aesthetic or cultural qualities.

To demonstrate how waste can contribute to creating new values, we choose to describe a European project from Copenhagen, Denmark, that integrates some of the site transformation strategies characterized on the previous pages. Amager Bakke is a top-modern waste-to-energy facility that will be completed in 2017. It uses some of the latest and most advanced technologies to secure an efficient and environmentally friendly waste management and energy production (Amager Ressource Center 2015). The purpose is to minimize environmental impacts, simultaneously ensuring highest possible power efficiency and profitability.

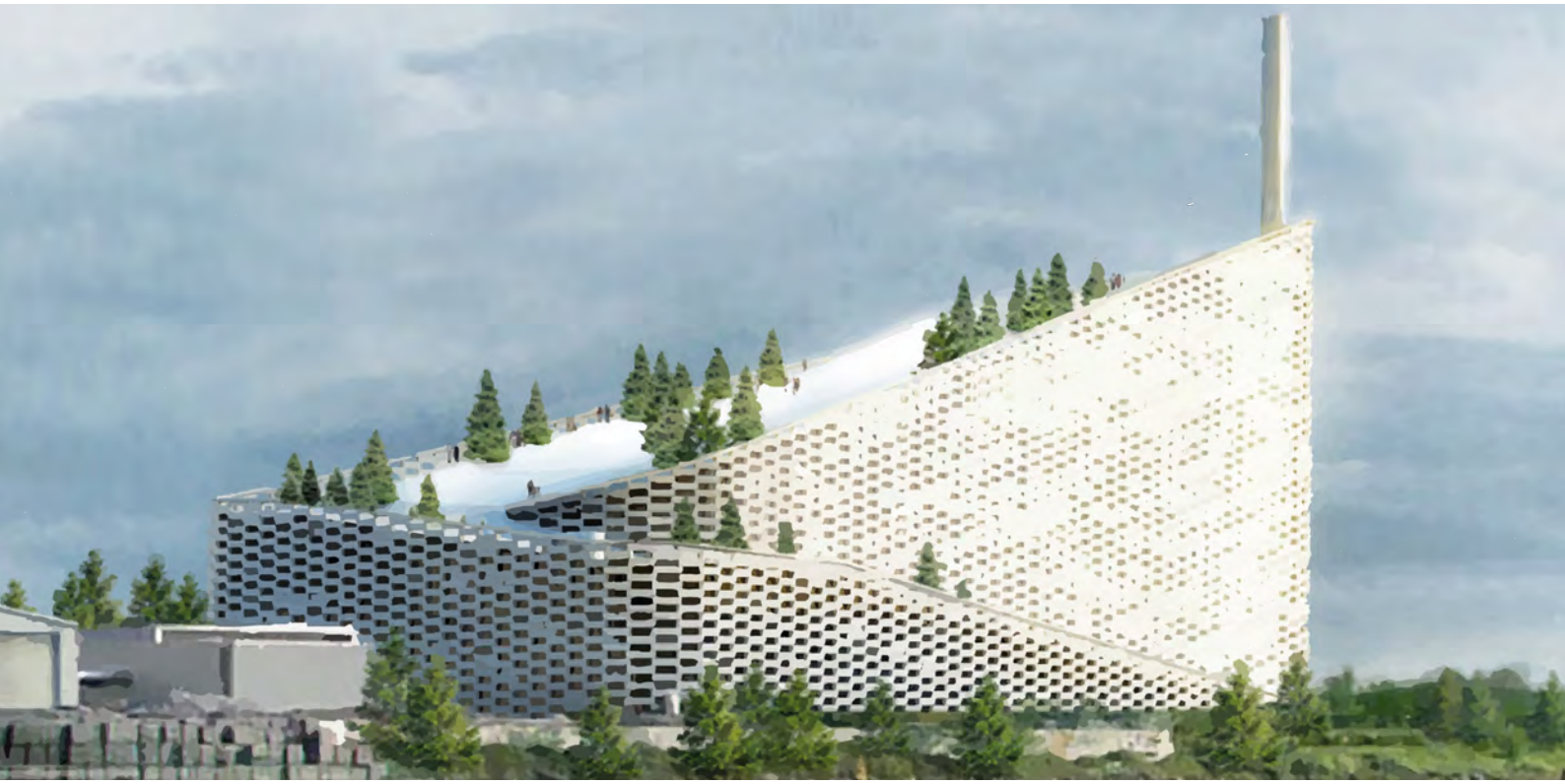
The plant will be a large building, reaching 85 meters in height, becoming the highest structure of this type in Copenhagen and therefore a new landmark for the city. It will be shaped and will function as a ski slope, providing the citizens with a multi-purpose, year-round recreation area on top of the facility's roof (see Figure 18 on the next page). The surplus energy generated through waste combustion will be used for cooling the slope during the warmer days of the year (ibid.).

The top of the facility will comprise a space for greenery with various functions - it will be a city park for leisure activities such as skiing, climbing, walking or running; as well as a place

for enjoyment with spectacular views overlooking the city and the Öresund region. A visitor center will be established in connection to the site, allowing studies of nature, recreation and technology. The project is also described as a catalyst for new development in the surrounding area, which today has an industrial character (Amager Ressource Center 2015).

Amager Bakke turns liability into amenity. It cleverly disguises the incinerator plant, while providing space for recreational uses for the citizens and comprising a new destination for tourists - it combines *camouflage* and *recycling* methods. Factors such as economics, self-sufficiency and sustainability are central in this project, which is common for the *sustainable* approach. Besides functioning as a waste treatment facility and a city park, the project also seeks to educate the public through a visitor center, which integrates the *educative* strategy. Finally, Amager Bakke comprises a new landmark for the city of Copenhagen, bringing the subject of waste management closer to people and showing garbage as a positive thing, rather than negative - which can be seen as a take on the *celebrative* approach.

Through this example we can see that the integrative strategy has many advantages and works on multiple levels - it might be therefore seen as the preferable method. However, it is important to remember that every site is unique and the project of Amager Bakke is a new development, which allows for a complicated and technologically-advanced design that "ticks all the right boxes". Therefore, essential to bear in mind is that every design should be site-specific.



18. THE PROJECT OF AMAGER BAKKE - COPENHAGEN, DENMARK.

WASTE AS A RESOURCE

Transformation of landfills and disposal sites that have fulfilled their role is one way of working with waste as a landscape architect. Yet, there are other measures to be taken, involving softer approaches. Landscape architecture is a broad field that does not only involve design and creative thinking - it is based on observations, analysis, human interaction and dialogue. The role of the profession means often to mediate the people's voice in planning, but it can also have a much deeper sense. It is to bring people closer to our landscapes, to make people notice their value and understand their story.

Our society keeps pulling away from garbage, constantly forming places to fight our wastes (Engler 2004; Tammemagi 2010). We associate waste with dirt - something that needs to be moved out of sight. Often, we do not wonder what happens to it after we have thrown it away, nor do we see its value or potential:

"INSTEAD OF BEING INCLUDED IN A METABOLIC CYCLE AND FLOW MODEL OF GOODS AND RESOURCES, WASTE IS CONSIDERED WITHIN A DEAD-END SCENARIO OF A LINEAR PROCESS; TO BE LITERALLY BURIED FROM VIEW – OUT OF SIGHT, OUT OF MIND – AS A FORMLESS SUBSTANCE THAT HAS NO VALUE AND IS THEREFORE COVERED BY THICK LAYERS OF EARTH OR BURNED TO ASHES." (HEBEL ET AL. 2014, P. 7)

What is trash for one individual might not be trash for another. There are big disparities in different cultures and social perceptions. Humans are creatures highly susceptible to the visual factors and aesthetics. A simple thought that something could be formed out of garbage might trigger negative emotions in varied social groups. It is therefore hard to acknowledge waste as a possible resource and building material. However, authors of the book *Building From Waste* reckon that waste should count among the renewable resources of our planet (Hebel et al. 2014).

Instead of distancing and repressing the garbage, our society could make use of it and turn it to our advantage (ibid.; Tammemagi 2010). Professor of landscape architecture and researcher on waste Mira Engler claims:

"I CONTEND THAT WASTE SHOULD BE BROUGHT CLOSER TO OUR EVERYDAY ENVIRONMENTS AND NORMALIZED, AND SYSTEMS OF WASTE TREATMENT SHOULD BE DECENTRALIZED, WITH AESTHETICS EMPLOYED TO FACILITATE THE CHANGE." (ENGLER 2004, P. XV)

Acknowledging waste as a resource and future building material would be a step in the right direction. Landscape architects can influence this shift and contribute to changed attitudes towards garbage by implementing waste materials into design projects (Hebel et al. 2014).

There is a finite number of projects concerning waste sites, but a boundless number of planning tasks regarding our public spaces and other types of landscapes. Reuse of secondhand materials would contribute to a sustainable development and diminish our demand on resources, but also reduce the costs of site designs. In order to secure the future of our own, as well as the future of the next generations, there is a need for tenable solutions and shift of attitudes in today's consumer society:

"CONCEPTS FOR FUTURE CITIES CALL FOR ARCHITECTS AND DESIGNERS TO THINK, WORK, AND CREATE IN A HOLISTIC, CIRCULAR SPIRIT, INCORPORATING ECOLOGIC, INDUSTRIAL, SOCIAL, AND ECONOMIC PRINCIPLES THAT WOULD ALLOW THEM TO CREATE EFFICIENT SYSTEMS WHEREBY MATERIALS LIVE THROUGH SEVERAL STATES OF FORMATION AND USE OVER THEIR ENTIRE LIFE SPAN, WITHOUT EVER BEING SEEN AS WASTE MATTER." (HEBEL ET AL. 2014, P. 18)

It is important to remember that waste has many forms and a large portion of it can be utilized for new purposes. Landscape architects can therefore contribute to a more sustainable world through the implementation of products that lost their prior function into design projects.

RAISING AWARENESS

Working with waste does not only include transformation of disposal sites or using garbage as a building material. It also involves communication and reaching out to public. Landscape architects are to a large extent responsible for the management of the landscapes, and play an important role for their appearance and the way they function. As practitioners, they operate as mediators of the civic voice. The European Council advocates a democratized view of landscape, which involves "increasing awareness among civil society, private organisations and public authorities of the value of landscapes, their role and changes to them" (Déjeant-Pons 2006, p. 370). Landscape architects play an essential part in this task.

Raising awareness involves spreading knowledge and deliberate recognition of the landscape. It is a way to co-creation of meaning and redefining what landscapes represent: "Comprehending the perceptions, meanings and values of a landscape is based on the knowledge and its articulations by those who encounter the landscape." (Butler & Åkerskog 2014, p. 443). In order to influence people's attitudes towards waste sites and garbage in general, it is therefore essential to provide the public with necessary information concerning these matters. Landscape is a widely contested and frequently misunderstood concept, which creates the need for exploring and explaining it (ibid).

Waste should be brought into the spotlight of the public eye, instead of being suppressed and

distanced (Engler 2004). There is much to be done in this case and one thing is sure - information is key. Involving the public in different participatory processes connected to waste-related projects is one way to tackle this task (Déjeant-Pons 2006). There are however other, 'softer' measures to be taken while embarking on this path. Speaking creatively through design or art, creating information boards, signs, posters or other visual features communicating facts about places where waste has been deposited or utilized, can contribute to a broader understanding of the landscapes and their background. To communicate the knowledge about places' history is equally important in order to develop an understanding amongst public, to recognize their values and aspirations attached to those landscapes (Butler & Åkerskog 2014).

Conclusively, increasing awareness of the civil society aims to shift attitude, which ultimately will alter how waste landscapes are perceived. It is important to bridge the gap between waste and resource, but also to inform about the ways our current waste management systems drain the world's capital. Waste might be the problem of today, but the opportunity of tomorrow.

62 | CONCLUDING THOUGHTS

18.

CONCLUDING THOUGHTS

CONCLUSIONS

The vast quantities of solid waste impact the landscape in various ways - both directly and indirectly. The direct impacts are strongly connected to the disposal sites, where the garbage is buried in the ground. Here, waste affects the region visually in a pronounced way, occupying the land. Other examples of evident disruption are unpleasant odors, dust, noise or damage to the infrastructure caused by heavy vehicles used for transportation of waste materials. Less conspicuous, or indirect impacts of garbage involve various levels of environmental pollution. It is primary due to methane and leachate generated on landfills during decomposition of organic material and percolation of water through garbage. Both substances cause number of issues connected to the landscape, including vegetation damage, air and groundwater pollution, fires and global warming. Even health hazards, which may not seem related to the land, impact animals, potentially leading to population changes that eventually impact the landscape.

Despite the negative effects that garbage has on our surroundings, waste can be utilized in various ways in order to create new landscape qualities. This can be achieved mainly through waste site transformation projects within the design practice. These types of projects involve no longer functioning landfills, existing waste facilities or new developments. Through a broad range of approaches, landscape architects can plan for those places to combine function with creative design, not only meeting the users' needs, but also creating aesthetic, cultural, social or biological values. Waste, in its various shapes and forms, can even be implemented into the architectural projects as a building material or design element. Reuse of products that lost their prior function can contribute to a sustainable development, diminish our demand on resources, but also connect the sites to our culture and history, creating different qualities in the landscape.

The objective for this thesis was to highlight the magnitude of the waste-related issues through investigation of the impacts that solid waste has on the landscape. Through the literature review we have managed to conclude that waste is an ever present part of people's lives and a growing global issue. Multiple studies have proven that garbage is an increasing problem in the contemporary society (Engler 2004; Global Footprint Network 2016; Hebel et al. 2014; Tammemagi 2000).

It quickly became apparent that the subject of solid waste is broad - it can be teared into fragments, classified into categories and processed in a multidisciplinary perspective. Waste is a global phenomenon affecting every country, region, state, city and individual on this planet. Every animal in the animal kingdom, including humans, leaves trails of trash. This is a widespread reality all over the world - whether it may be shells from nuts or plastic containers for dairy products.

The history has showed us that over the course of two million years, the landscape has constantly been exposed to the society's waste. Garbage has been an integral part of people's surroundings since the beginning of our time, shaping the everyday landscapes of men. However, there were no attempts of organized waste management until the late 19th century. Collecting and handling garbage became a public concern along with the industrialization and the increased consumption. Since then, mankind has made its best efforts to sweep away the waste and hide it out of sight, until we started running out of space and the environmental damage became too great. Mass-landfilling and incineration were no longer sustainable systems that had to be changed. This led to the emergence of technological innovations and alternative management methods such as energy recovery and recycling. All of our mistakes and failures from the past have lead us to the point, where we finally start to notice the severity of the waste-related issues. However, the consumer society of today has a long way to go until our problems may be considered solved.

None of the impacts the waste has had on our planet can be reversed or undone. Although we cannot do anything to change the past, we can do a great deal to influence the future. We believe that landscape architects play an important role in this task. Our ambition with this thesis was to prove the potential of creating new landscape values with waste. Through our study, we discovered that it is possible to mitigate the negative effects of garbage by applying various planning strategies and implementing solid waste into the design practice. It is however important to remember that there is no uniform solution to the landscape damage - every case is unique and needs to be carried out individually. Therefore, we see a strong need for the change of public attitudes, in order to develop further methods and to bring waste closer to our lives.

While conducting our research, we stumbled upon an immense sea of literature. The majority of the studied material was mainly of biological, environmental and technological character. Writing this thesis has been an endeavor of forming new knowledge and connections in order to relate our paper to the field of landscape architecture. Waste is a landscape problem - it is however not directly reflected by the literature, except for a few publications written by Mira Engler and Pierre Bélanger, both working with waste. Engler has been a frontrunner and promoter of the subject for a very long time. Bélanger takes a broader perspective, often incorporating other disciplines and focusing on renewable energy rather than waste landscapes. We recommend these two authors for further reading about the topic of garbage. Mira Engler's book *Designing America's Waste Landscapes* (2004) and article *Waste Landscapes: Permissible Metaphors in Landscape Architecture* (1995), have both been key material for our paper, since they relate landscape to the solid waste, the problems we face and examples of how we can overcome them.

During the time of conducting our research, we were met numerous times by perplexity and confusion from our peers. It is a pity to see that the relationship between waste and landscape architecture is not in an intimate state, since we are - or should be - advocates for the environment. We believe that there is a substantial lack of focus on the matter of garbage in this educational field. Solid waste management should play bigger role within the studies of landscape architecture and its academic projects, given the fact that the profession often transcends multidisciplinary boundaries. Tragic it seems, what William Rathje and Cullen Murphy said in their book *Rubbish!: The Archaeology of Garbage* (2001), appears to be true - waste is only attractive when there is an economic profit to be made.

Our method, which was a literature review, could easily be broaden through excursions to waste sites or interviews with specialist from different fields. Excursions were however not an option, due to financial limitations. Even though we live in a close proximity to a landfill site and a waste-to-energy plant, which we visited multiple times before, we felt it would not be

a fair representation of the covered research area. Due to time limitation and the broadness of the chosen subject, a proper preparation for interviews could not be made. Our prior knowledge on the topic was confined to only a few articles and as a result, we did not know what kind of questions we would ask or even who they should be directed to, in order to get a deeper understanding than the one that could be obtained through a literature study.

The focus area of this study was North America (especially Canada and the United States) and Europe. We chose these regions, because we felt they were a fair representation of the modern industrial society, which many of the developing nations try to mimic. Another reason was conventionality. Both of us are limited in our linguistic abilities and that is why we decided to study the english-dominated part of the world, which both EU and North America are at large.

The study of how solid waste impacts the environment is not a new one. It has been more or less acknowledged by science since people started to care about the environment. It is thus not a surprise that our thesis results in comparable conclusions to those previously stated in the similar research area. The importance of our findings is however not that it shows solid waste as a contemporary problem, but that it will continue to be one for every living organism on this plane, as long as we do not take comprehensive actions. As one of the disciplines representing the environment, landscape architects have a strong position to make a great contribution for the generations to come. By broadening our understanding of the fundamental methods of solid waste management, we can better plan for the future generations. It is essential that the research in this area continues. Raising awareness is vital for the knowledge to reach the public domain.

The challenge for our society is to change our consumption patterns and to minimize our generation of waste. Turning non-renewable inorganic garbage substances into a resource would be a favorable solution for many of our problems (Hebel et al. 2014). However, we have not yet invented a way to accomplish such a task. There is much that can be done by an individual, in order to contribute to a cleaner environment and a better future for our planet. A simple example can be the conscious rejection of plastic bags while shopping for groceries. One can easily choose a more durable fiber bag, which could help to reduce the use of the single-use ones. Re-use is better than recycling. The production of five average-sized plastic bags emits one kilogram of CO_2 and requires crude oil, both as raw material and for energy needed for its manufacture (ibid.). There is a great need for the shift in attitudes towards waste, but most important is to move away from our wasteful lifestyles. Nothing we do can change the past, but everything we do can change the future.

REFERENCES

2GHO (2016). Dyer Landfill Reclamation. http://2gho.com/dyer-landfill-reclamation/ [2016-07-05].

Advanced Disposal (2016). Learn about landfills. http://www.advanceddisposal.com/for-mother-earth/education-zone/learn-about-landfills.aspx [2016-04-08].

Amager Ressource Center (2015). ARC og Amager Bakke. https://www.a-r-c.dk/amager-bakke/arc-og-amager-bakke [2016-07-11].

American Biogas Council (2010). What is Anaerobic Digestion? https://www.americanbiogas-council.org/biogas_what.asp [2016-05-11].

Ammons, A. R. (1993). *Garbage*. New York. Norton.

Barbalace, K. (2014). The History of Waste. http://EnvironmentalChemistry.com/yogi/environmental/wastehistory.html [2016-05-10].

Bélanger, P. (2009). Landscape As Infrastructure. *Landscape Journal*, vol. 28 (1), pp. 79-95.

Bernstad, A., la Cour Jansen, J., Aspegren, H. (2011). Local strategies for efficient management of solid household waste – the full-scale Augustenborg experiment. *Waste Management & Research,* vol. 30 (2), pp. 200–212.

Bernstad Saraiva Schott, A., Aspegren, H., Jansen, J., Bissmont, M. (2013). *Modern Solid Waste Management in Practice. The City of Malmö Experience*. Dordrecht: Springer.

BNDES (2010). Analysis of Various Treatment Technologies and Final Disposal of Solid Waste in Brazil, Europe, USA and Japan. BNDES FEP N°02/2010.

Bouazza, A. & Kavazanjian Jr., E. (2011). *Construction on Former Landfills*. Ira A. Fulton Schools of Engineering. Tempe: Arizona State University. http://faculty.engineering.asu.edu/kavazanjian/wp-content/uploads/2011/08/32_Construction-on-Old-Landfills.pdf [2016-07-09].

Buclet, N., Godard, O. (2001). The evolution of municipal wastemanagement in Europe: how different are national regimes? *Journal of Environmental Policy and Planning,* vol. 3 (4), pp. 303-317.

19.

Butler, A., Åkerskog, A. (2014). Awareness-raising of landscape in practice. An analysis of Landscape Character Assessments in England. *Land Use Policy*, 36 (2014), pp. 441–449.

Castrejón-Godínez, M. L., Sánchez-Salinas, E., Rodríguez, A., Ortiz-Hernández, Ma. L. (2015). Analysis of Solid Waste Management in México: A Study Case in the Central Region. *Journal of Environmental Protection*, vol. 6, pp. 146-159.

City of Cambridge (2016). Mayor Thomas W. Danehy Park. http://www2.cambridgema.gov/CityOfCambridge_Content/documents/danehy.pdf [2016-07-06].

Connecticut Resources Recovery Authority (2011). CRRA Trash Museum in Hartford. http://www.crra.org/pages/edu_museums.htm [2016-05-10].

Council of Europe (2013). The Territorial Dimension of Human Rights and Democracy. https://rm.coe.int/CoERMPublicCommonSearchServices/DisplayDCTMContent?documentId=09000016802f7dfd [2016-04-08].

Crosby Arboretum (2016). About The Crosby Arboretum. http://crosbyarboretum.msstate.edu/sites/crosbyarboretum.msstate.edu/files/files/crosbyoverview.pdf [2016-07-06].

Czerniak, J. & Hargreaves, G. (2007). *Large Park*s. New York, US: Princeton Architectural Press.

Danish Architecture Centre (2014). MALMÖ: BO01 - AN ECOLOGICAL CITY OF TOMORROW. http://www.dac.dk/en/dac-cities/sustainable-cities/all-cases/master-plan/malmo-bo01---an-ecological-city-of-tomorrow/ [2016-05-11].

Déjeant-Pons, M. (2006). The European Landscape Convention. *Landscape Research*, vol. 31 (4), pp. 363 – 384.

Demirbas, A. (2011). Waste management, waste resource facilities and waste conversion processes. *Energy Conversion and Management,* vol. 52, pp. 1280-1287.

El-Fadel, M., Findikakis, A. N., Leckie, J. O. (1997). Environmental Impacts of Solid Waste Landfilling. *Journal of Environmental Management* (1997) 50, pp. 1–25.

Engler, M. (1995). Waste Landscapes: Permissible Metaphors in Landscape Architecture. *Landscape Journal,* vol. 14 (1), pp. 11-25.

Engler, M. (1997). Repulsive Matter: Landscapes of Waste in the American Middle-Class Residential Domain. *Landscape Journal*, vol. 16 (1), pp. 60-79.

Engler, M. (2004). *Designing America's Waste Landscapes*. Baltimore: The Johns Hopkins University Press.

Environmental Protection Agency (2014). *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2012*. Washington: United States Environmental Protection Agency (5306P).

Epstein, E. (1997). *The Science of Composting*. Boca Raton: CRC Press.

Eurostat (2015). Municipal waste generation and treatment, by type of treatment method. Available: http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsdpc240 [2016-04-17].

Eurostat (2016). Municipal waste. http://ec.europa.eu/eurostat/data/database Database by themes / Environment and Energy / Environment / Waste (env_was) / Waste streams (env_wasst) / Municipal waste (env_wasmun) [2016-04-17].

Filho, W. L., Brandli, L., Moora, H., Kruopiené, J., Stenmarck, Å. (2015). Benchmarking approaches and methods in the field of urban waste management. *Journal of Cleaner Production*, vol. 112 (2016), pp. 4377-4386.

Freshkills Park (2010). Danehy Park, Cambridge MA. http://freshkillspark.org/blog/danehy-park-cambridge-ma [2016-07-06].

Gabrys, J. (2013). *Digital Rubbish: A Natural History of Electronics*. Ann Arbor, US: U OF M DIGT CULT BOOKS.

Geohive (2016). Current world population (ranked). http://www.geohive.com/earth/population_now.aspx [2016-05-01].

Giroux, L. (2014). *State of Waste Management in Canada*. Kanata Ontario: Giroux Environmental Consulting (Prepared for Canadian Council of Ministers of Environment).

Gillham, B. (2010). *Case Study Research Methods*. London, GB: Continuum.

Global Footprint Network (2015). Earth Overshoot Day 2015. http://www.overshootday.org/ [2016-04-08].

Goves, B. (2006). *Logging Railroads of the Adirondacks*. Syracuse: Syracuse University Press.
Gunders, D. (2012). *Wasted: How America Is Losing Up to 40 Percent of Its Food from Farm to Fork to Landfill*. NRDC Issue Paper (IP:12-06-B).

Hargreaves Associates (2012). Byxbee Park. http://www.hargreaves.com/projects/PublicParks/Byxbee/ [2016-07-08].

Hays, P. S. (2000). *A History of Environmental Politics Since 1945*. Pittsburgh: University of Pittsburgh Press.

Hebel, D. E., Wisniewska, M. H., Heisel, F. (2014). *Building from Waste.* Basel/Berlin/Boston, AT: Birkhäuser.

Herzogenrath, B. (2001). *From Virgin Land to Disney World: nature and its discontents in the USA of yesterday and today.* Amsterdam: Rodopi.

Hesse-Biber, S. N. (2014). *Mixed Methods Research*. New York, US: Guilford Press.

Hultman, J. & Corvellec, H. (2012). The European Waste Hierarchy: from the sociomateriality of waste to a politics of consumption. *Environment and Planning A*, vol. 44, pp. 2413 – 2427.

Iranpour, R., Stenstrom, M., Tchobanoglous, G., Miller, D., Wright, J., Vossoughi, M. (1999). Environmental Engineering: Energy Value of Replacing Waste Disposal with Resource Recovery. *Science*, no. 285, pp. 706-711.

Johnson, B. H., Poulsen, T. G., Aage Hansen, J., Lehmann, M. (2011). Cities as development drivers: from waste problems to energy recovery and climate change mitigation. *Waste Management and Research,* vol. 29 (10), pp. 1008-1017.

Korst, A. (2012). *The Zero-Waste Lifestyle - Live Well by Throwing Away Less*. New York: Ten Speed Press.

Krug, D. (2006). Ecological restoration: Mierle Ukeles, Flow City. *Green Museum*. http://greenmuseum.org/c/aen/Issues/ukeles.php [2016-07-07].

Lee, L. (2013). The Dismemberment of Byxbee Park. *Landscape Architecture Magazine*, October 29. https://landscapearchitecturemagazine.org/2013/10/29/the-dismemberment-of-byxbee-park/ [2016-07-08].

Love, S. (2013). Architecture as material culture: Building form and materiality in the Pre-Pottery Neolithic of Anatolia and Levant. *Journal of Anthropological Archaeology*, vol. 32 (4), pp. 746–758.

Manfredi, S., Tonini, D., Christensen, T. H. (2010). Contribution of individual waste fractions to the environmental impacts from landfilling of municipal solid waste. *Waste Management*, 30 (2010), pp. 433–440.

Martin, W. L., Tedder, R. B. (2002). *Use of old landfills in Florida*. Tallahassee, FL: Florida Department of Environmental Protection.

Materials Innovation and Recycling Authority (2016). Trash Museum. http://www.ctmira.org/recycling/trash-museum/ [2016-07-07].

McKone, T. E. & Hammond, K. (2000). Managing the Health Impacts of Waste Incineration. *Environmental Science & Technology Use*, pp. 380-387.

Merriam-Webster Dictionary (2016). Landscape. http://www.merriam-webster.com/dictionary/landscape [2016-05-02].

Meyer, E. K. (2007). *Uncertain Parks: Disturbed Sites, Citizens, and Risk Society*. In J. Czerniak and G. Hargreaves (eds.), Large Parks (New York: Princeton Architectural Press), pp. 58–85.

Milios, L. (2013). *Municipal waste management in Sweden.* Copenhagen: European Environment Agency (Copenhagen Resource Institute).

Mohamed, A. (2012). *Municipal Solid Waste: Recycling and Cost Effectiveness*. Hauppauge, US: Nova.

Morone, P., Lopolito, A., Anguilano, D., Sica, E., Tartiu, V. E. (2015). Unpacking landscape pressures on socio-technical regimes: Insights on the urban waste management system. *Environmental Innovation and Societal Transitions*, pp. 1-13.

National Research Council (1993). *In Situ Bioremediation: When Does it Work?* Washington, D.C.: National Academy Press.

National Solid Wastes Management Association (2008). Modern Landfills: A Far Cry from the Past. *National Waste & Recycling Association,* August 2008, pp. 1-12.

Naturvårdsverket (2008). *Waste Disposers Deal with Food Waste in Malmö*. Stockholm: Swedish EPA.

Organisation for Economic Co-operation and Development (2001). Decision of the Council concerning the Control of Transboundary Movements of Wastes Destined for Recovery Operations (C(2001)107). http://acts.oecd.org/Instruments/ShowInstrumentView.aspx?InstrumentID=221&InstrumentPID=217&Lang=en&Book=False

OTL (2016). Transforming Santa Monica's Water Garden Office Complex. http://otl-inc.com/transforming-santa-monicas-water-garden-office-complex/ [2016-07-07].

Oxford Dictionaries (2016). Synergy. http://www.oxforddictionaries.com/definition/english/synergy [2016-05-11].

Phillips, J. A. (1998). *Managing America's Solid Waste*. Golden, Colorado: NREL.

Rathje, W. L., Cullen, M. (1992). *Rubbish!: The Archaeology of Garbage.* Tucson: University of Arizona Press.

Resource Conservation and Recovery Act (2002). Solid waste disposal act (42 U.S.C. §6901 et seq. 1976). http://www.epw.senate.gov/rcra.pdf [2016-04-24].

Retur (2016) Nr. 1. http://www.sysav.se/foretag/Kundservice1/Kundtidningen-Retur/ [2016-04-10].

San Francisco Water Power Sewer (2014). San Francisco's Wastewater Treatment Facilities. http://sfwater.org/modules/showdocument.aspx?documentid=5801 [2016-07-05].

Sawell, S. E., Hetherington, S. A., Chandler, A. J. (1996). An Overview of Municipal Solid Waste Manamgement in Canada. Waste Management, vol. 16 (5/6), pp. 351-359.

Skibo, J. M., Walker, W. H., Nielsen, A. E. (1995). *Expanding Archaeology*. Salt Lake City: University of Utah Press.

Song, J., Yang, W., Li, Z., Higano, Y., Wang, X. (2016). Discovering the energy, economic and environmental potentials of urban wastes: An input-output model for a metropolis case.

Energy Conversion and Management, vol. 114 (2016), pp. 168-179.

SPUR (2014). Invisible infrastructure of Ocean Beach: The Oceanside Water Pollution Control Plant. http://www.spur.org/news/2014-04-11/invisible-infrastructure-ocean-beach-oceanside-water-pollution-control-plant [2016-07-05].

Stahlschmidt, V. (1984). Can Comporting Compete With Controlled Tipping? *BioCycle* 25, pp. 34-38.

Statistics Canada (2015). Waste disposal by source, province and territory (Newfoundland and Labrador, Prince Edward Island, Nova Scotia). http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/envir25a-eng.htm [2016-04-17].

Sun Sentinel (1989). State Finds Problems At Landfill Officials Term Dyer 'Disordered Operation'. http://articles.sun-sentinel.com/1989-04-20/news/8901200963_1_landfill-site-regional-landfill-landfill-slopes [2016-07-05].

Sysav (2016). Om Sysav. http://www.sysav.se/Om-oss/[2016-04-10].

Tammemagi, H. Y. (2000). *Waste Crisis*. Cary, US: Oxford University Press. E-brary. [2016-04-08].

Thaïsa, W. (2013). Landscapes of industrial excess: A thick sections approach to Gas Works Park. *Journal of Landscape Architecture*, vol. 8 (1), pp. 28-39..

Twardowska, I., Allen, H. E., Kettrup, A. F., Lacy, W. J. (2004). Solid waste - what is it? I: Twardowska, I., *Solid Waste: Assessment, Monitoring and Remediation*. vol. 4. Waste Management Series. Amsterdam: Elsevier B.V., pp. 3-30.

United Nations Treaty (1989). Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. Basel. http://www.unido.org/fileadmin/user_media/Services/Environmental_Management/GUDDIS/Legal_Frameworks/basel_convention.pdf [2016-04-24].

United States Department of Environmental Conservation (2014). What is Solid Waste. Available: http://www.dec.ny.gov/chemical/8732.html [2016-04-08].

United States Environmental Protection Agency (2014). *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2012*. Washington: EPA.

United States Environmental Protection Agency (2016). Municipal Solid Waste. Available: https://www3.epa.gov/epawaste/nonhaz/municipal/index.htm [2016-04-08].

United States Environmental Protection Agency (2016). Advancing Sustainable Materials Management: Facts and Figures. Available: https://www.epa.gov/smm/advancing-sustainable-materials-management-facts-and-figures [2016-05-11].

Uz Zaman, A. & Lehmann, S. (2011). Urban growth and waste management optimization towards 'zero waste city'. *City, Culture and Society*, vol. 2, pp. 177-187.

Water Garden (2016). Sustainable Transformation. http://www.wg-la.com/pdf/WG-Sustainability-Lake-Water-SMURRF-11aug2015.pdf [2016-07-07].

World Bank (2012). What a Waste: A Global Review of Solid Waste Management. http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTURBANDEVELOPMENT/0,,contentMDK:23172887~pagePK:210058~piPK:210062~theSitePK:337178,00.html [2016-04-10].

World Bank Technical Guidance Report (1991). *Municipal Solid Waste Incineration*. Washington D.C: The World Bank.

World Commission on Environment and Development (1987). *The Brundtland Commission: Our Common Future*. Oxford: Oxford University Press.

Worldometers (2016). World population. http://www.worldometers.info/world-population/ [2016-05-01].

IMAGES AND FIGURES

Cover: Pablo Ares Gastesi. (2010). *garbage1*. Flickr [online], available: https://www.flickr.com/photos/pagastesi/4588137208/ [2016-04-02]. (CC BY-SA 2.0).

1. Alan Lavine. (2013). *King of the Trash Hill.* Flickr [online], available: https://flic.kr/p/eRjo3W [2016-04-02]. (CC BY 2.0).

2. Yves Maurer. (2013). *IMG_1491.* Flickr [online], available: https://www.flickr.com/photos/96877470@N06/10525326893/ [2016-04-02]. (CC BY-SA 2.0).

3. Author's Own Work. (2016-05-10).

4. Author's Own Work. (2016-05-10).

5. Charles Dietrich. (2007). *733340-R1-03-4_004*. Flickr [online], available: https://flic.kr/p/3Ka955 [2016-05-12]. (CC BY 2.0) .

6. Kate Gardiner. *Molokai Landfill*. Flickr [online], available: https://flic.kr/p/3vhUzS [2016-05-12] (CC BY-NC 2.0).

7. Author's Own Work. (2016-05-10).

8. Author's Own Work. (2016-05-10).

9. Martin Ng. (2010). □□□□□□□□□□□□□□□. Flickr [online], available: https://flic.kr/p/8furRT [2016-05-12] (CC BY-SA 2.0).

10. Author's Own Work. (2016-07-05).

11. Author's Own Work. (2016-07-05).

12. Author's Own Work. (2016-07-06).

13. Author's Own Work. (2016-07-06)

14. Author's Own Work. (2016-07-07).

15. Author's Own Work. (2016-07-07).

20.

16. Author's Own Work. (2016-07-07).

17. Author's Own Work. (2016-07-07).

18. Photocapy. (2006). *Peninsula Arraya*. Flickr [online], available: https://www.flickr.com/photos/photocapy/318958268/ [2016-04-02]. (CC BY-SA 2.0).

19. mingz chong. (2011). *more?*. Flickr [online], available: https://www.flickr.com/photos/31927948@N08/5678447407/ [2016-04-02]. (CC BY 2.0)

20. ibid.

Back Cover: Alan Levine. (2013). *Where Your Crap Goes.* Flickr, Available: https://flic.kr/p/eRjoG1. (CC BY 2.0) [2016-05-12].