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Natural materials in Playgrounds: a History

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List of Abbreviations[1]

Landscape Architecture(LA): is the design of outdoor public areas, landmarks, and structures to achieve environmental, social-behavioral, or aesthetic outcomes. It involves the systematic investigation of existing social, ecological, and soil conditions and processes in the landscape, and the design of interventions that will produce the desired outcome. The scope of the profession includes landscape design site planning stormwater management environmental restoration parks and recreation planning; visual resource management; green infrastructure planning and provision; and private estate and residence landscape master planning and design; all at varying scales of design, planning, and management. A practitioner in the profession of landscape architecture is called a landscape architect.

Sustainable Architecture (S.A): is an architecture that seeks to minimize the negative EA of buildings by efficiency and moderation in the use of materials, energy, and development space and the ecosystem at large. The sustainable architecture uses a conscious approach to energy and ecological conservation in the design of the built environment.

The idea of sustainability is foremost about reimagining the relationship between human beings and living systems. The most powerful expression of this relationship is our built environment. How do we build now that there are six billion of us, now that our supply of Natural capital – water wood energy land must be far more effectively used? How do we make zero emission house? How do we design structures that can be reincorporated into the earth harmlessly and endlessly? How do we metabolize energy and water so that the sky and land improve rather than erode? In other words, given how many we are and how much we have come to expect, how do we live?

Greenways (GW): are the twenty-first-century park par excellence. Their implications are dramatic: for a relatively small amount of money, these narrow green corridors can reconnect parts of a city. They can weave themselves through a city, spreading themselves democratically to reach all areas. They can be attached to streams, rivers, or shores to provide soft edges and restore floodplains. And they function as pathways for people to travel using their own exertions, not as ancillaries to an avenue of cars. Though the idea of the Greenway is less than 15 years old, it has the potential to mobilize our life in cities, introducing pedestrian movement areas and acting as “green lungs”. [2]

Open Space(OS): can be defined as land and water in an urban area that is not covered by cars or building, or as any undeveloped land in an urban area. On the other hand, Tankel has suggested that open space is not only the land, or the water on the land in and around urban areas, which is not covered by buildings but is also the space and the light above the land. Open Space has also been described from a user’s point of view as being an arena that allows for different types of activities encompassing necessary, optional and social activities.

[1] https://en.wikipedia.org
[2]Earth Pledge Foundation Series on Sustainable Development.2000.Sustainable Architecture,White papers.pg,19-20

Natural materials (NaMa): "*Natural*" has to be one of the most abused words in our vernacular. When you use a material that appears Naturally on the planet you get a known quantity. Most buildings materials have been used for thousands of years. They are the things around us: stone, earth, trees. In the past century, humans have developed technology capable of creating synthetic compounds. The main problem with using synthetics is that you don't know how they will interact with the world. This is one reason why alternative builders have a strong propensity toward NaMa. For example, they often choose earth plasters over those containing industrial lime on Portland cement, and organic paints and stains over their mainstream commercial counterparts. In general, this reflects a healthy distrust of the newest miracle products and results in efforts to relearn older techniques that may still be of great use. As a consequence, the renewed interest in Adobe, Cob, straw, and stone construction.[3]

Gross motor skills (GMS): are the abilities usually acquired during childhood as part of a child's motor learning. By the time they reach two years of age, almost all children are able to stand up, walk and run, walk up stairs, etc. These skills are built upon, improved and better controlled throughout early childhood, and continue in refinement throughout most of the individual's years of development into adulthood. These gross movements come from large muscle groups and whole body movement. These skills develop in a head-to-toe order. The children will typically learn head control, trunk stability, and then standing up and walking. (Humphrey) It is shown that children exposed to outdoor playtime activities will develop better gross motor skills.

Risk assessment (RA): is a term used to describe the overall process or method where you:

- Identify the hazards and risk factors that have the potential to cause harm (hazard identification).
- Analyze and evaluate the risk associated with that hazard (risk analysis, and risk evaluation).
- Determine appropriate ways to eliminate the hazard, or control the risk when the hazard cannot be eliminated (risk control).

The **European Standards for Playground Equipment**: **EN 1176** and EN 1177 have been published to harmonize existing European standards.

Embodied energy (EmE): it refers to the total energy expended to produce a material, transport it to the point of use, and install it. This may sound simple but it is not. For having an accurate total you have to consider, for example, all the energy needed to create the machinery used to produce a material; the energy consumed to mine, harvest, process, synthesize , etc. every element used in any given material, even the energy expended to produce the lunches the truck drivers and construction workers eat while they are transporting and installing that material.

Straw bale gardening (SBG): is a new alternative to traditional soil gardening. It is a relatively new concept, which has been operating for some years. Pioneer of the method is Joel Karsten. (The method will be analyzed on Section 2 more detailed).

[3] Snell Clark.2004.The Good House Book : A common-sence Guide to Alternative Homebuilding. Lark Books.pg 41-42

U-values (Uv): measure how effective a material is an insulator. The lower the **U-value** is, the better the material is as a heat insulator. For example, here are some typical **U-values** for building materials: a cavity wall has a **U-value** of 1.6 W/m².

Carbon Footprint (CaF): is historically defined as the total emissions caused by an individual, event, organization, or product, expressed as carbon dioxide equivalent.

In most cases, the total carbon footprint cannot be exactly calculated because of inadequate knowledge of and data about the complex interactions between contributing processes, including the influence of Natural processes that store or release carbon dioxide.

Environmental Impact Assessment (**EA**): is the assessment of the environmental consequences (positive and negative) of a plan, policy, program, or in our case materials prior to the decision to move forward with the proposed action. Environmental assessments may be governed by rules of administrative procedure regarding public participation and documentation of decision making and may be subject to judicial review. The purpose of the assessment is to ensure that decision-maker consider the environmental impacts when deciding whether or not to proceed with a project/design.

A direct definition that has been given form the International Association for Impact Assessment (IAIA) that it is "*the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made*".

Life Cycle Assessment (LCA): Life Cycle Assessment is the commonly accepted methodology to systematically test the environmental impact of a product or in our case material. In an LCA all environmental effects relating to the three main environmental problems occurring during the life cycle of a product/material are analyzed for the extraction of resources until the end phase of demolition or recycling.

Life Cycle Cost and Value (LCCV): The definition of sustainable includes improving the comfort and health of the built environment while maximizing use of renewable resources, minimizing life-cycle costs and maximizing life-cycle benefits. The costs of maintaining and operating a building over its projected “lifetime” are the life-cycle costs. The benefits include the economic return and also the productivity, health, and well-being of the users who live in or work in the building. The full costs will also include the energy costs of the building the power plant, mining the coal, shipping the coal, constructing and maintaining the power system.

PREFACE

The purpose of this Master thesis is to investigate the vital role played by playgrounds in the field of Landscape Architecture. Meanwhile, it will be a fragmentary reference to the development of playgrounds in the twenty-first century. Through previous researches is affirmed the effects on Child development and the influences of the environment on the life of children.

Today's metropolises suffer from the lack of well-designed open spaces, playgrounds, and greenery. Children, who are obliged to grow up and live in big cities, are confronted with limited or defective green spaces. Studies have reported that open spaces, such as playgrounds and parks, play a decisive role in children´s proper development (Wooley.2003:39).

For centuries, the play has been characterized as a free and unprompted activity. Back then, it took place outside in Nature, either in the forests, lakes, fields, waterfalls or any place that attracted children to play and have fun. Later on, things have changed, when play equipment was developed. They paid attention only to Security and Regulations measures and the main purpose of having children´s playgrounds in the first place was lost (Frost.2010:1).

Our endeavor will be to reconsider the ways of constructing landscapes and urban open spaces. In particular, how playgrounds can, hence, to reduce their carbon footprint and to minimize environmental damages. One of the ways this can be done is by reducing the energy and environmental impact of the materials and resources we use to construct the play spaces by using other alternative products and systems, Natural or renewable construction materials as a way to reduce carbon emissions and also to build in a more environmentally friendly way.

The aim of this study will be to identify the appropriate knowledge and awareness approaches and collect ideas for projects and practical information of use of Natural Materials (NaMa) to those planning and implementing playground design.

Along the way, the thesis investigates how Natural Materials, such as Straw, Clay, Rammed earth, Earthbags, Earthship models, Bamboo and Wood, can be used individually or can be coalesced with the materials and equipment already exist on the play spaces in an absolute harmony.

Our research will be an attempt to introduce these Natural Materials to the Landscape Architectural Department. It will be stated which may be the problems or obstacles that need to overcome to gain wider acceptance and awareness as far as genuinely environmental construction methods, by presenting the advantages and disadvantages of the materials.

Each material is examined from the point of view of its energy savings in its production, construction costs and analysis of its building members, the carbon emissions caused by each material and their Environmental impacts. Under no circumstances can we compare them with the industrial products (e.g. steel, plastic) but we can only suggest alternative solutions.

Therefore, all this effort is being done to improve the needs of the user, which in this case are the children, for a friendlier environmental, small-scale bioclimatic playground design. Mainly with materials, which they will reach their Life Circle Assessment (LCA) and return back to the Earth.

Proving high quality, Natural outdoor play environments for children does not require expensive equipment, nor complex interventions to have a significant and positive impact on children´s health and well-being.

Ultimately, what we need is the prerequisite solutions for the lack of play in most densely populated areas.

During the development of the research major questions are going to be answered. These questions are brought up by Researchers and Authors that have discussed the benefits that children can be influenced for by a well-designed play space.

Through our research, we seek to answer the following questions that were created during the development of our research (Frost.2010:3) :

What is the unique history of playgrounds in countries such as the USA, Germany and the U.K.?

Why in the most densely populated areas there is still a lack of play environment? What are the consequences of this current situation?

What can we do to change/improve for the best the current situation and prevent future issues?

Do all these safety standards make play safer or more restricted to the children?

How can we improve the outdoor play environment?

What professionals have to point out to the matter of play and play environment for the proper development of the child?

What is the existing legislation and guidelines for the materials that are allowed to be used for play equipment?

What will be the positive and negative impacts of using NaMa in the playground design?

Most importantly, the answers that will be given will only be suggestions for the outdoor play improvement and under no circumstances to bring responsibilities to an operator.

Along the way cited a quote from Birksted. He reminds us that: "*Creating Landscapes within which we can work, play, live and learn, create the good life, is at the core of all we strive for"* (Birksted.2005:114).

Opportunities for a good quality play will not be the ultimate solution to all society´s problems but it can be the starting point. As rightfully Heseltine et al. point out characteristically: *"Playgrounds are not the universal treatment for every problem but taken with other opportunities for play, will help out the children to make the most of their growth and development"*(Heseltine et al.1987:12).

INTRODUCTION

Our future is in cities. More and more people are moving to urban centers. Upon researches (Department of Economic and Social Affairs.2014:1), it seems that by 2050 more than two-thirds of the world's population will be urban. The impact of all these changes will have a tremendous influence on the children development living in cities.

By making these cities healthy(WHO-Duhl et al.1999:1-8), more Naturally acceptable by improving the quality of life and in helping to deliver wider and longer-term social, environmental and economic benefits through a range of public policy priorities, is an exceptional challenge that we are ready to deal with

This research is intended to provide creative inspiration and guidance toward the implementation of playgrounds made of NaMa for integrated learning about ecology so the children living in big cities will get in contact with their Natural environment. Particular emphasis is placed on how these Natural methods can move towards cities that are more enjoyable, more interesting and greener.

A particular event that took place when I was in Elementary School became the conception of this thesis theme. As a child myself growing up in the city, I remember there were a lot of prohibitions of playing outdoors either because of the traffic of cars and lack of play areas or the existing play areas was either damaged or were not properly preserved. I consider myself lucky because near our residence was a Public park. There everything was possible. You had all the freedom you need to move around, create and imagine. I remember strongly that we were third-grade pupils and we built our own „ adventurous "playground, with materials that were available in the area, under the supervision of our teacher. We were visiting the Park with our teacher twice a month and we were continuing or starting from scratch, building our tree houses, ladder and many more.

It is worth mentioning, that another factor, in my motivation, to peer at this theme was, Froebel Friedrich Wilhelm August[4], a German pedagogue who laid the foundation for modern education based on the recognition that children have unique needs and capabilities. When I read some of his writings I was inspired by his philosophy and methods as also many others like me, that have been followed his task.

Initially, children's playgrounds will be historically reviewed in countries such as Germany, the USA, and the U.K. where playgrounds have emerged.

Our research will be divided into five main Sections.

In the first main Section, it will be analyzed the History of playgrounds, their developmental impacts, along the way, their effects on children´s development.

An equally significant aspect of it will be the Safety in play spaces, the laws, legislation, guidelines, and regulations that exist in other countries like Germany, the United Kingdom, the USA etc. in the residential environment.

In the second main Section, the research overviews NaMa that are competent to be utilized in the playgrounds. More specifically, the following materials will be mentioned : Straw/Straw bale, clay that appears in the form of Rammed earth, Cob, Earthships and earthbags, Wood, Bamboo, Stone, Water as a significant element of the landscape, a suitable choice of Trees, Native wildlife and plants as opportunities for learning in the playground

[4] https://de.wikipedia.org/wiki/Friedrich_Fr%C3%B6bel

field. After all, Playgrounds are places where young people/children and Natural environment are being united and interact with each other.

Along the way, they will be pointed out the Advantages and Disadvantages of using NaMa for the constructions in play areas. In conjunction with our proposals for long-term design solutions or immediate solutions.

Our research will be comprised of inexpensive (environmentally friendly) NaMa and manufacturing methods that save energy either on production or through bioclimatic behavior over time.

The examples of Natural playgrounds that will be examined are part of the Regions of Mecklenburg-Vorpommern and Brandenburg and they will be part of Section three.

In the course of our Research, methods that were used include a Survey Questionnaire, extensive interviews with creators/ Landscape architects of such kind of playgrounds and site surveys.

Included in this aim was a desire to uncover existing sources of NaMa, literature, publications in order to make such information available to those who are interested.

In the last main Section, is being considered the compound of the selected NaMa in the play areas.

For each material, it will be mentioned a concept of using them in public playgrounds.

Our research contains ideas and necessary information for the design process and implementation of Natural Playgrounds.

Through the development of the Research, we were in a position to answer specific questions, as stated in the Preface, and analyzed thoroughly in our final Conclusions (Section 5).

The achievement of this Master thesis will be to pursue the indispensable underpinning for a better healthier more environmentally friendly play opportunity for the children.

SECTION 1 PLAYGROUNDS: A HISTORY (1880-today)

1.1 Term of playground

A playground, play park, play space or play area is a space that designed particularly for children to allow them to play there. Usually displayed outdoors, equipped with facilities for entertainment.

While a playground is usually designed for children, there are exceptions. For instance, Berlin's Preußenpark is designed for people aged 70 or higher. In some playgrounds may have age limits.[5]

After a lot of observations from professionals, we see that playgrounds were being treated always differently unlike other outdoor spaces like public gardens, as far the requirements for a diligent design that provide recreation for children (Hendricks.2011.15).

Playgrounds are vital for children's development. A well-designed play space provides children with an appropriate user interface in a city where they enrich their knowledge regarding the environment that surrounds them(Walsch.2016:1). A friendly landscape can contribute to a wonderful fantasy world for children to play.

Play environments have many concepts, include many contexts and are used interchangeably throughout this thesis with either playgrounds or playspaces, play areas, playscapes, Natural playgrounds, outdoor play space etc.

In the following Sections will be further explored individually.

1.2 Towards a History of Playgrounds

The term playground is not something new. Maybe it was not called this way but we can see examples of play even from mythology.

Through historical references, foundings have been found of Greek clay vases that captured women and children playing or paintings of the early 5th century B.C that show children on swings and play in the forest (see below Fig.1.1).

[5] https://en.wikipedia.org/wiki/Playground

Figure 1.1: Painting of Jacques-Laurent Agasse, *The playground*
(Source: https://commons.wikimedia.org/wiki/File:Jacques_Laurent_Agasse_-_The_Playground_-_WGA00074.jpg)

The archetypal Agora – in Greek means the Gathering place -of the ancient world, children´s playgrounds, public squares, spaces to which they have adapted throughout history so as to serve the needs of people.[6]

There is not enough evidence to indicate the existence of playgrounds as such before their appearance in the early 20th century but this becomes apparent throughout our cultural heritage (Heyward et al.1974:131-168).

The playground is a byproduct of the industrial city of the 20th century. Despite the fact that other industries are developed rapidly, we see that playground grows at its own pace during the centuries.

It all started in the early 20th century when the streets lost their role as the public space and became reserved for use by motor cars. Due to the new circumstances, they built playgrounds to remove children from the new dangers of the road. Statements from the National Highway Protective Society of New York highlighted the numbers of children that were killed by cars and urged the creation of playgrounds (The McCook Tribune.1910:3).

Playgrounds are part of our legacy, it is who we are. It has been forgotten which was the main reason for their existence. From one point onwards, growing up we are evolving, but we forget in the process the importance that played by playgrounds in our growth.

For the last 150 years, there have been major changes in the development of the playground era. Firstly, there have been major changes at the beginning of the 20th century in the industrial cities, where social workers / progressive educators and psychologists urged Municipal governments to take action by constructing playgrounds so children can have a more supervised play area to play. The concept of the whole idea was that by supervising children´s play this could improve their development.

[6] Heyward Geoffrey .Rothenberg Marilyn.Beasley Robert R.1974.Children's Play and Urban Playground Environments A Comparison of Traditional, Contemporary, and Adventure Playground Types. Environment and Behavior pp131-168

At the beginning playgrounds were meant to promote public health, to prevent criminality, and protect children from the dangers that may occur in the city. (Burkhalter.2016:13-17)

Meanwhile, at the beginning of the 1930s social workers/educators sprouted the idea that it is more appropriate if children play with NaMa instead of playground equipment.

Later on, in the 1960s it was the decade of autonomy and built it yourself constructions in the playground areas and the decade was the adventure playground era where it was created.

In the 1980s it was a decade of crisis in the playground design. Things became more complicated. The safety regulations and the use of safer materials were increased.

Today´s playground´s design is to stimulate imagination and creativity and to increase the motor skills by placing playgrounds in public parks. (Galindo.2012: 6-7)

Our goal is to provide as complete as possible a detailed historical retrospection of the playgrounds.

Until the end of the 19th century, there were already playgrounds in the industrialized cities of Germany, the United States and England.

In the process, it will be referred to the history of playground concerning the above-mentioned countries.

I. GERMANY

Friedrich Froebel: the architect of kindergarten or garden for children.

Froebel Friedrich is the son of a Lutheran minister, followed by philosophers, educators, discussed here in all aspects of his educational program.

Figure 1.2: Friedrich Wilhelm August Fröbel, creator of the Kindergarten. (Source: http://froebelgaben.com/)

Undoubtedly, his work has had a great influence on the promotion of play and the Natural play environments for children.

A considerable body of researches about Froebel´s life has reported that Froebel himself as a child learned to love nature by playing in the woods, the forest, the plants, and the wildlife. All of which later on became the objects of his work and research as far the development of the children.

Few things we should mention as far his life. He became a forester´s apprentice so he can enrich more his knowledge as regards Nature and what it is constituted of. The main point that changed all the data and the idea of Kindergarten arose was when Froebel was accepted to teach in the Pestalozzi´s School.

Even though his education principles were completely different from the methods that they were using at the moment in the Pestalozzi's school, he resigned and opened his own School.

In 1837 he created an alternative Institution for small children to play and create, who named it Kindergarten in Bad Blankenburg. The main factor of his Kindergarten design was, that children should play outside in Nature and at the same time can play and educate themselves. And that this could be the major purpose of proper child development in the Pre-school Early Education.

As historians affirmed that Fröbel's idea of the kindergarten appealed and was banned on 7 August 1851 by the Prussian Government who disapproved his work as an *"atheistic and demagogic"* and*"destructive tendencies in the areas of religion and politics"*[7].(Frost.2010.30). So the government closed his school by disapproving his whole work. Other states also followed suit. The reason for the ban, however, seems to have been a confusion of names.

Following Froebel´s observations of how children were playing outdoors in Nature and improvising of games, gave him the idea of Kindergarten as it is still today.

The particularly important aim of his methods was, for the children to learn to cultivate a garden and observe the development of gardens through the laws of nature. Although, it was difficult at that time for all the children to have access to a Garden, so it made it really clear that at least they can have boxes or pots in which they can grow their own vegetables and plants.

All this had to be incorporated into Froebel´s kindergarten and later developed into the American Kindergartens and in many other countries. (Frost. 2010:26-33)

As he demonstrated that*: "Play is the purest most spiritual activity of man at this stage and, at the same time, typical of human life as a whole of the inner hidden Natural life in man and all things. It gives, therefore joy freedom contentment inner and outer rest peace with the world. It holds the source of that is good…Play at this time is of deep significance …the germinal leaves of all later life".* (Froebel, 1887: 55)

As noted above, Germany is the pioneer country that the term „kindergarten" has launched, based on playing, singing, practical activities such as drawing and social interaction, and the whole ideology of the upcoming playgrounds which were later followed.

Froebel ´s ideologies have inspired many Educators, Architects, Landscape architects etc. When I personally first read one of his books and his ideologies about Pre-school Early Education, I was inspired and motivated to enliven my knowledge thoroughly about play areas and that is the theme of my Master thesis.

A lot of playgrounds were built in the early ´20s and ´30s all over West Germany.

Most of them were designed by Landscape Architects and their use was more of an attraction park than a play area for children.

The first real «adventure playground» (we will analyze the term in the following subchapter) that was built in Western Germany was in 1967 in the Märkisches Viertel in West Berlin by the Youth and Sports Department of the Runickendorf District Council (Bengtsson.1970:98-101).

This first attempt was accepted and appreciated after a lot of doubts and conversations.

Pit Möller was the pioneer of this first attempt at creating adventure playgrounds in Germany.

Later on, in 1971 more adventure playgrounds were built in West Berlin.

It was suitable for the Age group of 6 - 12-year-old. It was built in the area of inhabited blocks known as Parrot Estate where 1000 people live in 288 flats.

It was mandatory that playgrounds to be located near children´s homes and do not have to travel to get there.

They were a lot of people that didn´t approve of this new kind of playground either because of a lot of noise near the residential areas (which was not more than 60 decibels). It was an area of 1800 m^2. The main activity was building huts.

[7] https://en.wikipedia.org/wiki/Friedrich_Fr%C3%B6bel

In the remaining part of the playground, trees and shrubs were planned. Children were building caves and huts.

It is worth mentioning that the children, through adventurous play, are more imaginative, curious and want to explore the world that surrounds them.

In a German Survey that made in 1973 by Hildegard Hetzer, Liselotte Benner and Liselotte Pee, "*Children's Games In The Open*", the subject was the education value of adventure playgrounds. The researchers detected different types of play: Games that go too far, exercise games, games with a purpose, playing a part and individual and group games.

Children can use materials and tools (hammer, saw) on the adventure playgrounds under the supervision of a responsible person. In this way, they learn to overcome fear and danger and become more creative (Bengtsson.1973:73-81).

II. USA

Records reveal that in 1821 that an outdoor gymnasium was placed in the schools without a supervisor or any instructor. In the 19th century urban areas where no longer safe for children to play.

That is why, the American playground movement was created and had actually begun in Boston in 1868 after they were inspired by a German model to create a sand garden(large wooden-mostly boxes filled with sand for children that can play in, the current sandpit). After a while, the idea had many followers and sand gardens were built in other cities in the U.S.A.

One of the first proven playgrounds manufactured in the U.S.A was built in 1885 in the yard of Boston Children´s Mission.

Figure 1.3: Early 1900's Playground Apparatus. Known as Jungle Gym by Sebastian Hinton.From the collections of the Texas/Dallas History and Archives Division, Dallas Public Library. (Source: https://rarehistoricalphotos.com/dangerous-playgrounds-1900s/)

Furthermore, in 1887 in San Fransisco´s Golden Gate Park the first playground was built, organized by the Massachusetts Emergency and Hygiene Association (MEHA).

In the playgrounds except for sandpits, they have added swings, teeter-totters (seesaws). During the late nineteenth century and early twentieth century playgrounds were multiplied in the big cities, after the public authorities administrative decision, that play is an essential element in the education of children.

An example of an urban park was Boston´s Charles bank Pleasure Ground designed by Frederick and Jond Olmsted.[8] (Wood. 1994:90)

After the changes that have been done as far the age limit for children to work, a group of women and educators was created in order to create areas for the children to play(Galindo.2012.4).

In 1906 the Playground Association of America (PAA) was founded. President Theodore Roosevelt helped with the playground success, serving as honorary president of the PAA and forming America´s national parks recreation areas national forests and many other.

The PAA has contributed to the creation of thousands of parks and playgrounds, influenced by the idea of the German outdoor gymnasium.

In 1920, the first playground standards were issued and the National Recreation Association (NRA) published the first recommendations for school playground equipment.

Shortly thereafter, it was Sebastian Hinton who patented the Jungle Gym playground equipment, where children could climb all levels as a form of exercise and play.

During the Great Depression in the 1930s playgrounds increased very fast in the U.S.A.

Later on, in 1940 because of World War II, all outdoor playground equipment were stopped.

In 1943, it was C.Th. Sørensen from Denmark who designed the first adventure playground.

Meanwhile, the movement of adventure playgrounds had a great resonance in Europe. In Switzerland, the first two playgrounds opened in 1955 and in Germany in 1967. (Frost.2010: 93-104).

These recreational facilities, designed by Architects or Landscape Architects, had characteristic features of rope ladders pyramids and many other types of climbing like a mechanical equipment mainly from steel. [9](Galindo.2012.7)

At this period of time, playgrounds look like more of an open-air gymnasium with supervisors, containing swings, slides and climbing equipment. New York was the first city which installed playgrounds in Public parks and schoolyards.

Alongside, the playground movement has also developed a network of Local Associations that had Annual sessions to discuss matters.

In the 1930s Local Governments stopped to pay playground supervisors and replaced all the playground equipment with steel structures.

An important man of New York city was Moses Robert, a politician who changed the image of the city by building Public parks as well as recreational facilities. He standardized the Playground design and placed playgrounds all over Central Park. But the playground equipment turned out to be totally different from the original plan and have come to be like pipe units from steel for exercising. These kind of playground were continuing to develop until 1960.

Between the sixties and the seventies, the playground has finally promptly developed. At this period of time, there were a lot of self-built playgrounds built. It was when the American playgrounds began to take safety guidelines and increased (Burkhalter.2016.14-20).

[8] Spencer Wood Suzanne. 1994. Turn of Centure Women´s Organizations Urban Design and the Origin of the American Playground Movement. Landscape Journal 13 p.90

[9] Galindo Michelle.2012. Playground Design.ISBN 978-3-03768-109-1. Braun Publishing AG.

In the 1980s new safety regulations included recommendations for removing hard equipment (metal bars by substituting soft materials such as wood and plastic).

The change of materials to wooden swing sets accelerated through the 1990s (Tovey.2003)

Wooden playground equipment started expanding at the beginning of the 21st century.

It was not long before Americans put so much trust into playground equipment that they failed to realize that the equipment itself did not designate a playground but children do.

III. U.K.

Adventure playgrounds

Figure 1.4: Children playing on a wooden climbing structure at Bandley Hill Adventure Playground(1967-1970).
(Source: https://www.talkingnewtowns.org.uk)

Historically most adventure playgrounds were established in urban areas in response to the lack of space for children so they can have more space and a creative play.

Adventure playgrounds originally were called junk playgrounds. The adventure playground is a nonpaved, fenced area that contains a play hut for indoor recreation and Natural areas for the construction of game structures. The requirements for an adventure playground include the use of tools (hammer, seesaw etc.) and materials so children can explore new play opportunities and learn from them. (Carlisle.2009: 11)

A Danish architect Carl Theodor Sørensen, who believed playgrounds should reflect the imagination of the child, not the architect, he created the first junk playground on the Emdrup housing estate in Copenhagen after the World War II (1943) hence observing how the children play in urban areas at a construction site.

It was an area of 7000 m^2, built in a six-foot high bank around the playground for reducing the noise by planting plants such as wild roses, acacia, hawthorn that were surrounded on the playground by creating a lance (Bengsston.1973.15). There is a consensus from professionals that believed that children in cities should have the same opportunities to play as the children in rural areas. (Fraser.2003.117)

Adventure playgrounds were seen by Sørensen as an opportunity to give children the chance to create their own play environments. (Fraser.2003:115)

Primarily, Adventure playgrounds were established in industrial areas that were abandoned and unusable which were not considered economically viable. (Benjamin 1974).

The playground structures were built by children which they were using tools for the first time on their own always with the supervision of an adult.

The greater part of the adventure playgrounds was mainly situated in London, but later on, Adventure playgrounds were spread to other cities of the U.K. and were mainly located in urban areas.

Such playgrounds were not used to be seen in provincial cities because the children there have enjoyed already this kind of freedom of play.

It is worth noting that another important founder of Adventure playgrounds is Marjory Allen or Lady Allen of Hurtwood which was the one forwarding the ism of free play across England, Europe, and the United States.

During her travels campaigning on behalf of displaced children, Lady Allen was shown a new play space in Copenhagen by Carl Theodor Sørensen. After this visit, she was inspired and this led her to build her own Adventure playground, as she renamed them, in the United Kingdom.

She started her journey of spreading the word about adventure playgrounds all over the World so that all children, and especially children with disabilities, can have the opportunity to a creative, imaginative, with no-restrictions, play.

We take the chance to report some of Lady Allen´s statements: ”*Children all they want is a place where they can create and destroy, where they can build their own world with their own skills at their own time and their own way. In our built up towns, they never find these opportunities of play and they are disappointed and unsatisfied with what exists today”* (Tovey.2007:49).

During the 1950s, there were a lot of examples of Adventure playgrounds around the U.K. such as London, Liverpool, Crawley, Grimsby. They were known as junk playgrounds or waste material playgrounds or bomb site adventure. The term Adventure play was first adopted in the U.K. to describe waste material play areas.

Head of National Playing Fields Association, Drummond Abernethy, played an important role in the proliferation of Adventure playgrounds and their further development.

The movement of Adventure playgrounds spread throughout Europe. In Switzerland, the first two playgrounds opened in 1955 and in Germany in 1967 (as we mentioned in the subchapter above).

In 1974 the Health and Safety Association disapproved the use and the construction of more Adventure playgrounds because of safety issues and was later banned by Local Authorities as an unacceptable action (Fraser.2003:129).

Adventure playgrounds offer a wide diversity of activities because of loose parts in the play area and great flexibility in the creative process. In this way, children learn more about the surrounded environment and learn how to deal with problems, to find solutions quickly and they develop their motor, social and physical skills (Fraser.2003: 128).

As Burkhalter highlights in his book that*: “Lady Allen made a big contribution to the success of the adventure playground”* (Burkhalter.2016.52).

It is important to mention that England now, has one of the lowest indoor space requirements in Europe, currently 3.5 m^2 for every child under 2 and 2.3 m^2 for every child aged three to five. (WHO 2015. Children in Europe:1-18).

Using the word adventure rather than junk playground she campaigned for a do it yourself play where all children especially children with disabilities, who were marginalized from conventional playgrounds, could engage in creative and imaginative play (Tovey.2003.129).

There is a growing interest in the health of children living in densely populated areas, and for that reason, the authorities are slowly waking up by offering more alternative structures to outdoor play areas.

For over more than a century there have been noteworthy changes in the equipment and the appearance of playgrounds. Only one thing cannot change, the essential role of the meaning of playgrounds in the first place which is their physical developments and the effect that the playground has on the children of urban areas. From the playgrounds, the children educate emotionally physically intellectually and socially. (Galindo.2012)

Adventure playgrounds are places where children can use Naturally their leisure time and can find absolute freedom, to develop self-confidence and be stronger and more resistant in many daily situations. It was the most revolutionary experiment ever existed for the period of time it was created and until today it seems to be an alternative action.

The above researchers have been analyzing play environments from their original discovery.

A question that needs to be answered nowadays is why we haven´t seen yet flourish of adventure or Natural playgrounds in the cities. It is because of the lack of knowledge of how these play spaces can function, the lack of competent persons having the appropriate knowledge on the subject and the lack of necessary construction space. A lack of resources, limited budgets, and local authorities restrictions and regulations as far as safety and risk avoidance is the main cause for the standardized playground designs of most playgrounds already exist.

A child loses easily his interest in a play area that he is going daily because has nothing new to intrigue him and to expand his fantasy and interests.

This is what they were struggling to succeed all the above followers of establishment the perfect play environment for children. This is what will be also our guideway.

Certainly, there are also many other countries that have followers of a more Natural environment for play for the children but attention will be focused on these three territories.

Nowadays there are more than a thousand adventure playgrounds in Europe. Most of them situated in England, Denmark, France, Germany, The Netherland, and Switzerland. There is also in Japan a notable amount of Adventure playgrounds.[10]

1.3 Playground Design

This master thesis does not pretend to design the perfect playground. Perfection cannot exist as it implies it is unnecessary to change anything, yet changes are one of the major prerequisites in the case of playgrounds.

What is perfect in one community can be totally unsuited to another. Everything matters, from the place, the culture, the heritage, the environment that the playground will be built to the human race and specifically to the children.

So our main consideration can only suggest pointers and indicators employ when constructing an individual play environment. The process of designing a playground should begin with thorough programming to better understand the needs of the owner and how and by whom the playground will be used. In the same way, a good understanding of the play environment and opportunities provided for play.

Besides children is our future. We have to revise our priorities and need to take immediate measures concerning playspaces and stop being idle on this subject that is not so important (Heseltine.1987).

[10] https://www.pgpedia.com/a/adventure-playgrounds

The important factor is that the environment should be able to be notified by children in order to facilitate play.

It is necessary to have a basic understanding of some of the main developmental aspects of children´s play so that you can design, play out and equip a playground. It is not just aesthetics, materials and construction but also depends on children´s needs(Masiulanis et al.2017).

There are three main elements of the landscape that children can benefit from. These are the following: places that you can hide, vegetation and water. If these elements exist on a playground design, then the main purpose of use to satisfy the user´s needs is completed.

The main developmental aspects of children´s play will be mentioned below and how can these be related to the provision of play environments.

Heseltine typically stated that:" *Playgrounds are too often viewed as a method of separating children from the environment rather than as places which enhance their play by separating them from their community and from interaction with it.*

By improving them, it will contribute to the needs of children and provide unique educational experiences". (Heseltine.1987: 20)

Hart R.(1974) in one of his works discussed how children explore the environment and only by developing an understanding of that exploration can other people, namely adults, mostly professionals(Landscape Architects, Architects, Gardeners etc.) can begin to design and provide play environment that will make sense to the children.

It is society´s responsibility to secure that each child has access to a series of play opportunities.

Furthermore, in the second Section of our thesis, we will explore the importance of the existence of NaMa and elements in the play areas and how the play environment and lifestyle can be improved remarkably as long as we select them in the play design. Just as how can be coalesced with the existing play equipment or otherwise even replacing it.

1.3.1 Issues in the design of playgrounds

Playgrounds and schoolyards comply with the Children´s playground Laws in an attempt to prevent injuries and to reduce lawsuits but because of that, playgrounds are becoming places that have a lack of creativity and imagination. It can also be a fun and safe play environment. All you have to do is notice the small details which are necessary for them to do so. Because children are the main protagonists in designing a playground, so they should be asked before the construction of a playground what they would really like(methods for this to be done is by conducting a Survey Questionnaire).

This is what we will try to accomplish even though we are not experts in the field but due to observations and our research, we will attain.

1.4 The role of Landscape Architecture in the Play Design

The role of the landscape architect in the play design has various roles that range from Design, such as creating a visually attractive entry to educate them, or by learning to play and co-exist in their own community.

As a landscape architect, you should indulge in the user´s needs, in this case, the children. Another important element is to allow flexibility in his play design so children can interact with them in the way in which they are most comfortable with.

Important factors include the community´s and child education professionals involvement, the location of the site that the playground will be built and the creation of a safe environment are the roles of the Landscape Architect.

Of greater importance is that a Landscape Architect must pay attention to climatic conditions as planting and varieties of plants have to be closely and sustainably planned (local plants).

A house might be more impractical if it is not designed properly to fit in its environment but plants on the one hand, if they are not suited to their environment or on the other hand plants, do not much together simply die or at the very best cannot thrive (Moore.1993).

Traditional playgrounds fail to meet the developmental needs of children because they do not promote activities involving loose materials and free play, and challenge themselves with having some risks. Playgrounds have been established, as the places where children can play free, explore nature, build their own houses with loose parts that can be found in their surroundings, and educate themselves.

In the case of our Study work, as regards the use of NaMa in playgrounds, it is advisable that Landscape Architects/ educators /playworkers and whoever is involved, to collaborate with craftsmen that have better knowledge on the methods and design together play areas for children. This is not an individual approach but a team collaboration with a major factor, the users, namely children.

1.5 Play- Definitions of play

A definition of play which has been described clearer is by Fröebel who argued that (1887:55): *"Play is the purest most spiritual activity of man at this stage and, at the same time, typical of human life as a whole of the inner hidden Natural life in man and all things. It gives, therefore joy freedom contentment inner and outer rest peace with the world. It holds the source of that is good…Play at this time is of deep significance …the germinal leaves of all later life".*

In fact, there is no simple definition which explains exactly what play is. A considerable body of statements from researchers/ experts of the field as regards the definition of Play and what is its purpose.

As Frost argues very well in his book by saying that: "*play which is beneficial to children is the one that is active, creative and social engaging the body and the mind of the children".* (Frost.2010: 84-85)

Furthermore, as Masiulanis(2017:4) stated that:*" play, in short, is the opportunity to practice life and the playground is a microcosm of the world in which that practice takes place".*

Playing is an activity that children adjust in their play environment.

In other words, the play is a chance of the children and everyone who wants to play, to gather information about their environment, to learn about it, to know their limits, to experience new things and challenges, to imagine, without restrictions of where to play.

To illustrate, the play makes a significant contribution to the development of the children (Heseltine.1987).

Another contributor which confirms the importance of play is Bengtsson who strongly alleged that: "*the main problem is that modern civilization interferes negatively sometimes in the*

spontaneous play of children in order not to develop properly and to create some kind of `psychological pollution´ ". (Bengtsson.1973.8)

1.6 The developmental impacts of playgrounds

There have been a lot of researches, books, both theoretical or practical, that have analyzed childhood learning and development and provide an important role for comprehension of how the Natural environment affects the life of the children.

Play environments have been changed and evolved over time, but as a response to new upcoming materials, innovative designs and methods of construction and new ideas.

Previous studies have reported that the children who had the opportunity of a good quality play seem that they developed better social, physical, emotional and intellectual skills, are healthier and have a great flexibility of solving problems than those who are deprived of children's activities.

The opportunity to develop through activities which promote the process of play is essential to the full and healthy development of children.

All the aspects of childhood development should be taken into account when some equipment for children is planned. (Heseltine.1987)

1.7 Effects on the child development

It is difficult to establish child development through the importance of the physical environment. There are a lot of economic, social and educational reasons which lay the underpinning of a better environment for the children.

Nevertheless, children are the greatest users of the outdoors and, therefore, are particularly vulnerable to the conditions of the physical environment in which its quality does affect their behavior patterns. (Eriksen.1985: Introduction x)

Children learn and develop both while playing and through the play itself.

The interaction of the environment is the fundamental part of their development (Fraser.2008:8).

1.7.1 Physical development

Physical development is not only children growing bigger but is about children growing up developing and maturing normally. Physical exercise helps strengthen muscles, improve muscular endurance, and cardiorespiratory functions.

Meanwhile, by offering a variety of activity settings the planned environment can intrigue a child´s interest to explore and can learn by playing in his own way.

There are two kinds of physical development, one is sensory and the other is the motor. Sensory skills excite impressions received through the senses, touching, tasting, seeing, hearing and smelling. Everything starts by censoring to the child´s growth.

Also important is motor behavior, which consists of motor activities that need strength and muscles to perform.

Researches show that the more motor activities children are performing, they can challenge themselves to see what are their limits, the healthier and happier they will be. [11]

For practicing and developing small motor skills playing outdoors is the perfect place to learn

1.7.2 Intellectual development

Children receive information from the environment that surrounds them. This information is employed by children in their intellectual development. From the point of view of society must make sure that children receive information that provides them with a range of choices and experiences through play.

This has implications in the provision of, for example, texture color sound and aesthetics. Children should be offered messages which are beneficial and which they must have to develop.

The play is part of the process by which children learn to develop some of the motor skills necessary for intellectual development.

Studies of movement patterns demonstrate how coordination increases with constant practice and recurrent use of playground equipment. Sand play, toys, and the Natural environment itself all help with perfecting the motor skills.[12]

Based on the theory of Piaget(2008), a Swiss psychologist whose main work study was child development stated the four stages of intellectual development. These are the following:

- Sensorimotor :0 – 1,5 years old
- Pre-operational: 1,5 – 2 years old and Toddlerhood: 2- 7 years old till through early childhood
- Concrete operation: 7 -12 years old
- Formal operational- Adolescence through adulthood: 12-18 years old.

1.7.3 Creative Development

According to creative play in or outdoors, offers plenty of opportunities to develop a better more creative way of play and all this burden falls into the playground designer to do so.

This key aspect of development can be provided most effectively through the involvement of parents, educators, and any other interested.

More than any other, the development of creativity in the area, which displays the limitations of the fixed equipment playground to provide the needs of children´s play.

Creative development can be stimulated by the alternative uses of materials, for example, NaMa such as sand and water or straw and clay or physical elements (Nicholson.1971: 5-14)

As Nicholson (1971:30-34) affirmed that: *"In any environment, both the degree of inventiveness and creativity and the possibility of discovery, are directly proportional to the number and kind of variables in it"*.

[11] http://www.jstor.org/stable/43620506?read-now=1&loggedin=true&seq=2#page_scan_tab_contents

[12] http://www.jstor.org/stable/43620506?read-now=1&loggedin=true&seq=2#page_scan_tab_contents

1.7.4 Social development

A lot of theorists and researched have stimulated their interest in children development. More specifically, Piaget(2008) had a range of theories about education and child development. A very typical theory of his is when he emphasized to the evolution of human being –not to stay inactive and repeat himself but to create, imagine, discover new paths. Playgrounds operate in this way. They should help children to identify concepts, to recognize, to create and imagine new ways and evolve.

Appropriate playspaces provide the opportunity for children to meet and interact with each other. It is important for the child at a young age to be in contact with other children. Until the age of four, children like to play with others but they prefer to play also individually.

As children get older, their ability and need to socialize increases and play takes place more in groups than individually.

Playgrounds provide a Natural meeting place in which socialization skills can be developed Naturally. Especially the area of swings is well known as a social point, for children but for parents also.

For the playground designer, the realization that social play is crucial means more attention must be paid to the use of space to enable children to develop social relationships. So it will be pointless if a playground designer will not add the swings as the main character of the play area (Heseltine.1987).

1.8 Playground space requirements in the regions of Germany, the USA, and the U.K.

As far playground design and equipment should be designed in a way that while children playing can explore their physical limits and recognize them. Must be able to assess the degree of difficulty involved in the play situation.

Design of a playground differs from any other recreational facilities.

The most important determination to be made are the types of equipment that will be installed n the area.

If the available space is limited then the playground planner is obviously limited in the type and size of the equipment to be installed.

The minimum space which must be kept clear of hazards is around a piece of equipment is called no enrichment zone. (Puhalla.2010.345)

For example, in New Zealand, the amount of indoor and outdoor space required is for indoor activity at least 2.5m^2 and for outdoor activity is 5m^2 per child excluding areas unavailable for play(toilet facilities, fittings, stored good, passageways, other areas unavailable etc.)[13]

As far London requires safe and stimulating play facilities, these are necessities for a child's future development. However, in such a densely developed and populated city, it is a challenge to provide such play spaces.

Standards for play provision are in addition to other quantitative standards for open space provision applied in open space strategies, although opportunities for the multifunctional use of

[13] https://www.myece.org.nz/centre-mininum-legal-requirements/147-minimum-amount-of-indoor-and-outdoor-play-space-and-the-design-layout-and-use-of-space

open space should be optimized. To overcome this issue, we've produced Supplementary Planning Guidance (SPG) for London boroughs.

The SPG can be used by those involved in planning local neighborhoods to deliver real improvements in the quality of play spaces.

This benchmark standard recommends a minimum of 10 m^2 of play space per child as a basis for assessing existing provision within an area. This standard is also intended to benchmark provision against other areas.[14]

As for Berlin, for calculating the demand of public playground space (§ 4 Sect.1 of the Children´s Playground Law) is specified a guideline value of 1 m^2 of playground space per child. The entire stock of public playground space in the city (usable, applicable) is approx. 220 ha (as of 2015).

On the basis of 3.6 million inhabitants as of 2015, the overall citywide requirement would be approx. 340 ha of the playground area. With a stock of approx. 220 ha of public playground space, or an average supply of approx. 0.6 m^2. of public playground space per child.

The level of supply with public playground space is, therefore, approximately 60 %.[15]

In the USA, since the Gross Motor Play Zone is typically the largest and main zone within a playground, it is helpful to determine the square footage that will be needed for this area early in the design phase. Research indicates that the greater the number of square feet allotted per child, there is a corresponding decrease in the number of injuries. Depending on the quality of Gross Motor plays equipment, it is 5.5 m^2 till 18 m^2 per child.[16]

1.9 Children´s Playground Laws

There is no law which defines how adventure or Natural playgrounds should operate but there are frameworks to do so. On this sub-section, it will be highlighted the main components of these legal frameworks and how they affect the operation of playgrounds. (Potter.2003)

Laws

Statute Law[17] is a Parliamentary law and there are a number of Acts whose provisions include playgrounds.

Statute Laws are of two kinds. One is the Criminal Law and the other is Civil Law.

The difference between them is that Criminal Law is concerned with punishment.

Adventure playgrounds or Natural playgrounds haven´t had a specific law that says how they should function (U.S. Consumer Product Safety Commission.2015).

[14] https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/supplementary-planning-guidance/play-and-informal

[15] http://www.berlin.de/senuvk/umwelt/stadtgruen/kinderspielplaetze

[17] **Statutory law or statute law** is written law set down by a body of legislature or by a singular legislator (in the case of absolute monarchy). This is as opposed to oral or customary law; or regulatory law promulgated by the executive or common law of the judiciary.

There is, however, a legal framework within which they must be operated, a combination of *Statute Law and Common Law*[18].

As for the British Standards are another important aspect of the legal framework within which adventure playgrounds operate and there are British and other standards for other fixed equipment playgrounds.

The Health and Safety at Work etc. Act (1974) and the Children Act 1989 are the major pieces of legislation which inform good practice in the health and safety operation of adventure playgrounds. There is a duty under some Sections(3 and 4) to ensure the health and safety of the users as far as it is practicable.

The Health and Safety Executive looks for a system´s approach to safety and for playgrounds to meet relevant standards and guidance.

These standards are related to the provision of unsupervised play.

British standards 5696 is concerned with play equipment for installation outdoors and gives guidance on the construction, design, installation, and maintenance of the play equipment.

An adventure playground is under the terms of the Health and Safety at Work etc Act 1974.

The Children Act 1989 came into effect on October 1991. Playgrounds in facilities which have been registered under the Act's requirements need to be safe and suitable for their purpose and meet relevant standards.

One particular service is given prominence in the Act daycare and supervised activities for pre-school and school-aged children outside school hours and on holidays.

Adventure playgrounds are required to be registered if they cater for children under eight and are open certain hours during the year. There are specific standards for children under 8 years of age playing with or using the adventure playgrounds, as for the quality of the building and its facilities (DIN Handbook 105.2010)

As far as Berlin[19](Senate Department for the Environment, Transport, and Climate Protection) is concerned, there are approximately 600,000 children and young people below the age of eighteen. There are approximate 1.850 public children's playgrounds for them in the area. Most of these playgrounds (1.840) are in public parks.

Additional playgrounds are located on schoolyards, in the Berlin forests. There are also private playgrounds in the green spaces of residential estates.

The requirements, planning, and construction of public playgrounds in Berlin are regulated by the Law on Public Children's Playgrounds (Children's Playgrounds Law- see below the applicable principles.

Principle 1: clarifies that in order to give children the opportunity to develop their mental and physical abilities and to promote social behavior, public playgrounds shall be established and maintained and the existing public playgrounds developed in accordance with this Act.

Principle 2: Scope of the application says that public play areas for children shall be created for the small settlement areas defined by the zoning plan, pure, general and special residential areas, village areas, mixed areas, and core areas, where residences are permitted there, and for areas which are in the aforementioned areas.

Principle 3: Areas of public facilities, in particular, green areas, may be made available for play. If the need for a public playground area cannot be met in accordance with § 4, they shall be made usable for the play games provided that they are suitable for this purpose.

[18] **Common law** also known as judicial precedent or judge-made law, or case law) is that body of law derived from judicial decisions of courts and similar tribunals.The defining characteristic of "common law" is that it arises as precedent.

[19] **(http://www.berlin.de/senuvk/umwelt/stadtgruen/kinderspielplaetze/de/gesetze/index.shtml)**

According to § 4, Open spaces for public schools, that are newly built, shall be prepared for play and, as far as school operations are not impaired, made available.

Principle 4: The district office forms a Playground commission and appoints parents, teachers and other experts as members. The Playground Commission should be involved in the planning and development of playgrounds at an advisory level.

Principle 5: Location of the playgrounds must be isolated from harmful emissions and sources of danger or, if not possible, should be shielded by appropriate shielding or other means of safety.

Playgrounds should be sheltered from the wind and laid out in a sunny location. Shaded areas are to be provided.

Principle 6: As far as *Playground types and playground sizes*

The following guideline applies to the individual types of the playground:

1. Toddler playgrounds 150 m² usable playing area
2. General playgrounds 2,000 m² usable playing area
3. Pedagogically supervised playgrounds 4,000 m² usable play area

The type, number, and size of playgrounds depend on the size of the service areas, the number of inhabitants, the type and density of the buildings and the particular local conditions within these areas.

Principle 7: *Condition and equipment of the playgrounds*

Playgrounds should be divided into different play areas for all the age groups, if they are of sufficient size, and must be considered the needs of disabled children also.

Principle 8: Review of playgrounds

Playgrounds are to be kept in usable and hygienically safe condition. They must be regularly checked for operational and traffic safety[20]

1.10 Risk Assessments

The Risk Assessments on an adventure playground are the following :

- It must be identified and be listed all of the buildings outside the playground area and recognize which may give rise to hazards.
- It must be identified and listed all hazards concerning health and safety.
- It must be identified and be listed any of the precautions that have been taken into account all the risks that have been derived.
- Assessment of the level of risk that may remain after the precautions have been taken.
- Appropriate measurements to eliminate Risk Reduction.
- Assessment of the severity of the risk to low-risk, medium risk, and high-level risk.
- The contribution of competent well-trained Stuff is absolutely necessary and determined to the concept of the Natural/adventure playgrounds as the success of such playgrounds depends on the quality and efficacy they provide (Potter.2003: 11-12).

1.11 Playground Safety Management System

Playground maintenance is one of the most important matters for the management of all outdoor and indoor play spaces.

When planning a playground, regardless of its size or where it will be placed, it is important to create a Playground Safety Management System.

The following should be included in the playground safety management system:

- Budget
- Inventory of existing playgrounds of the area
- Maintenance plan
- Inventory and Frequency of Inspections
- Risk assessment
- Risk management
- Documentation
- Certification
- Records of incidents /injuries (Potter.2003)

1.12 Regulations

Requirements and duties are mandatory based on Children Act 1989.

Children Act 1989 gives to the local authorities a general duty of regulations to inspect frequently the playground areas for any damage or replacement (Potter.2003: 23-25).

It has become crucial to develop legislation and guidelines for play spaces and play opportunities in the residential areas as the space requirements for playground facilities in urban cities are dramatically reduced.

The legislation is necessary for a national, regional level which states the rights of children within the space requirements.

The rights of children are affected when standards are developed for the distribution of space.

The legislation reflects the priorities of society towards the rights of children.

Some nations are taking very seriously the importance of play in the everyday life of children and try to offer the best way possible. The most exciting examples that can be found after studies are situated in the following countries: Sweden, Denmark, and Canada.

In Sweden, the following applies The Swedish Norms of Building state that children must have equal play opportunities regardless of the density of the residential.

In areas of multi-family housing, it is required from the Law to provide a variety of spaces for children to play in close to the dwellings. It is being established by the homeowner to manage and maintain the communal play area.

In Denmark, the following applies: The Danish Norms of Building (active since 1977) concerning requirements of children´s play and leisure are clearly itemized within the regulation governing Open spaces planning for residential developments.

When a project is planned for more than eight families, it is obliged an open space to be developed as a play space for children. Space is allocated on the basis of 20sq.m. per unit. On these play, areas must be taken into consideration plantings, play equipment, and fencing, accessibility for people with disabilities, traffic movement, and climatic conditions.

The Danish legislation is a good benchmark for comparing standards developed for play spaces.

In Canada, the following applies: The National Housing Act (NHA) is responsible for children´s play development in the residential environment.

In Units of over 20 families is obligatory play spaces to be provided for preschool and school-age children and community places. Playspace is allocated on the basis of 5 sq.m per unit consisted of three bedroom units.

Requirements for such areas in Canada are specified by municipalities or provinces.

Legislation governing play spaces can provide details on size, location, and accessibility for people with disabilities as demonstrated by the Danish regulations, or provide general information on space requirements, as Canadian regulations currently do.

Legislations and regulations for children´s play spaces as in the countries mentioned above are a step towards national legislation designed to protect child´s play.[21]

As stated in DIN EN 1176-1:2008-08 some playground equipment and equipment parts are required to be made difficult to access by children below the age of 3 or where the equipment is easily accessible for children of this age, for security matters. The EN 1176 series of standards started on the assumption that children do not play independently and unsupervised in publicly accessible playgrounds until age higher than 3 years old.
The new European Standards (EN 1176 and EN 1177) harmonize existing national standards.

It is likely there will be many changes to the Standard in the early years as experience is gained from practical implementation on site. The Standard is currently undergoing its first major five-year review and this will inevitably involve some changes. Common sense will remain a good guide(Eriksen.1985).

1.13 Types of Playgrounds

1.13.1 Playspace (1965)

The term playspace must be defined so that some uniformity of the approach is possible. Many definitions have been suggested, but the one we shall be using also was created by the internationally recognized architect, Aase Eriksen in 1965. She employs the word "*playspace*", defining it as *"an outdoor learning environment designed to support and suggest activities that are an essential part of the child´s learning and development-social, emotional.cognitive and physical"* (Eriksen.1985).

Playspace is the space for more play, new possibilities of play and perspectives. The form of a playspace may change from country to country but the objective remains the same.

A great playspace will stimulate children's imagination and creativity and it is designed with the intent of bringing children and people back to nature (Meyer.2010).

Appropriate playspaces provide the opportunity for children to meet and interact with each other. In the young child, the proximity of other children is important, but the interaction between them is not great- there is a preference for playing in the company of others rather than with them.

[21] http://www.jstor.org/stable/43620506?read-now=1&loggedin=true&seq=2#page_scan_tab_contents

As children get older, their capacity and need to interact face to face increases and play takes place more in groups.

1.13.2 Natural Playgrounds

Natural playgrounds are play environments that combine the NaMa, features, and native vegetation with creative landforms.

Natural playgrounds create a composite space of interplays of Natural environmental objects. They are designed by landscape architects or even artists, in ways that at the same time can challenge the children to play and educate themselves about the wonders of the Natural world.

Natural playgrounds encourage children to use their imagination through play, while at the same time discovering the smell of the textures and the miracles of the Natural world.

In addition, outdoor play spaces can be integrated into all teaching areas such as biology, ecology, mathematics etc. The virtual replaces the actual environment.

Play components may include earth shapes (sculptures), environmental art(5%)[22](artistic practices that have both historical and ecological character), native vegetation(45%) (trees, shrubs, grasses, flowers, lichens, mosses), boulders or other rock structures, dirt and sand, Natural fences(30%) (stone, willow, wooden), textured pathways, and Natural water features(20%)(fountains, streams etc). You can see below on Feature 1.1 the percentage of Natural Resources that can exist in the Natural Playgrounds. It is subjective, the amounts can be changed due to many factors on the process of design.

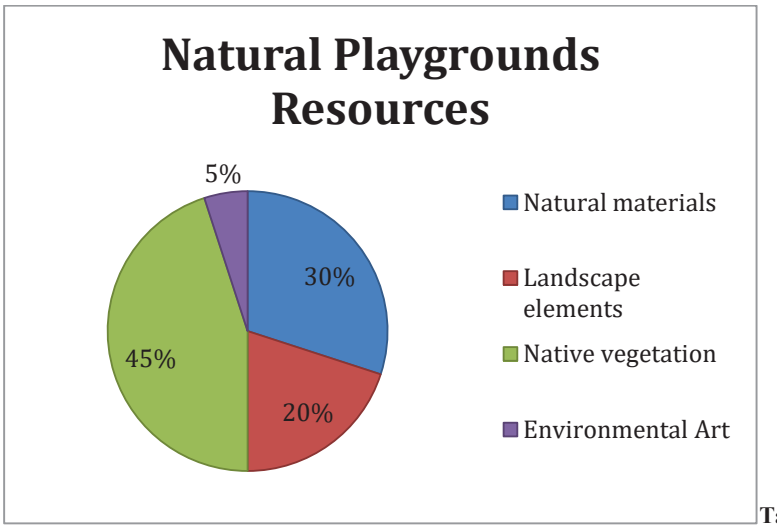


Table 1: Natural Playground Resources

Supporters/Researchers/Educators proclaim the importance of nature in the children´s lives and the developmental impacts that it has. They believe that Natural spaces let children learn to work together as a unity, develop their personality, socializing, to be in contact with all their senses when playing and widening imagination and creativity.

It is time to take action in developing more Natural Playgrounds. Nature offers the chance to cope with the unexpected.

[22] https://en.wikipedia.org/wiki/Environmental_art

NaMa is provided to children like sand piles and water buckets. An environment that is full of trees, bushes, streams, stones provide a lively space for children to nature play (Solomon.2014:122-124).

1.13.3 Playscape

A Playscape is a playful landscape characterized by the appearance of enjoyment by the public and all those that interact with it. Sometimes it is used to refer to playscapes that look like a Natural environment.

However, landscape architects and designers are increasingly using the term to refer to areas of cities that encourage interaction and enjoyment of all ages.

According to Fjørtoft (Jannson.2009:31): "*Good playscapes can be characterized by diversity in landscape elements, affordances for play, challenges, and safety, accessibility and resistance to wear".*

Playscape is designed to provide a safe environment for play in a Natural setting environment.[23]

The Natural playscape is defined as a space with as little artificial elements as possible. Using native plants, hills, lots of trees. Playscapes represent a Natural place such as a forest or waterways. Playscapes are designed in order to bring children back to nature.

Urban playscapes are similar to the Natural playgrounds as far as the need for specific play equipment. They are not defined by clear boundaries but through a shaping of the landscape to encourage play and interaction.

Playscapes offer a wide range of unlimited play options that allow people to use their imagination, play free and be creative. Playscapes offer a wide range of developmental benefits to children.[24](Migas Lynnel)

A wonderful example of a playscape is the Marge and Charles Schott Natural Playscape (MCSNP) At 1.6 acres, the playscape is as much a park as it is a playground. The playscape opened in 2011, situated in Cincinnati, Milford Ohio.

[23] www.asaninst.org/wp-content/cache/essay2017/childhood-playground-essay

[24] **Migas Lynnel-Director Play Right Australia Pty Ltd. Nature Playscapes vs Play Equipment or can we play Together?** https://www.parksleisure.com.au/includes/404.aspx?aspxerrorpath=/documents/item/2567.aspx

Figure 1.5: Marge and Charles Schott Natural Playscape

(Source: http://www.gwd-c.com/Natural_Play_Parks_Recreation_Cincinnati.htm)

1.13.4 Adventure playgrounds

An **adventure playground** is a determinate type of playground for children which can take many forms, a combination amid of "Natural playgrounds" and "junk playgrounds".

It is defined by the presence of playworkers- which is not available/forbidden when not supervised.

Playworkers take full responsibility for the health and welfare of children while they are on site.

The fact that there are no manufactured play-equipments on the area, children are free to play with all the NaMa, to explore, manipulate, directly experience with tools and materials and educate themselves (Museo Nacional Centro de Arte Reina Sofia.2014:10-11).

Usually, they provide outside space with a variety of play structures and an indoor space with tables and chairs, including materials for crafts, games etc. Adventure playgrounds provide opportunities for children of all abilities to mix together in an inclusive play environment and be united through play (Potter.2014)

The first planned playground was the Emdrup „junk playground" opened in 1943, in Emdrup, Denmark(as we have mentioned above on Subchapter 1.2 III).

Next in line was in 1948 an adventure „junk playground" in Camberwell, England.

Later on, there were a lot of examples of adventure playgrounds around the UK and were known as junk playgrounds or waste material playground or bomb site adventure.

The term adventure playground was first adopted in the UK by Lady Allen of Hurtwood, to describe waste material playgrounds.

Nowadays there are more than 1000 adventure playgrounds in Europe. Most of them situated in England, Denmark, France, Germany, the Netherlands, and Switzerland.[25]

1.13.5 Playgrounds for adults

Playgrounds for adults is something new that has started appearing in the last few years. In China, the USA and some countries in Europe have playgrounds designed only for adults.

These are outdoor spaces that feature fitness equipment designed for use primarily by adults, such as a few pieces of outdoor gym equipment or an entire fitness challenge course.

Outdoor gyms or ´playgrounds for adults´are rising up worldwide, from Europe to Asia.

[25] https://www.pgpedia.com/a/adventure-playgrounds

It is situated mostly in public parks and closed to the playgrounds.

The park becomes a place that the entire family can enjoy and take part in activities and fitness their mind and their soul.

There are few playgrounds for adults built around the world, that are designed primarily for adults : [26]

- In St. Louis the City Museum there is a jungle gym made of two repurposed airplanes, 10-story slides, and a rooftop Ferris wheel.[27&28]
- Go Ape located in Berkshire (UK) is an adventure forest that consists of rope ladders, zip lines, rope bridges, trapezes, and swings. There are 10 forest Segway experiences and 12 Junior adventures.[29]
- In Frechen, Germany it is a climbing center named Chumpanzodrome is well known as a training center for parkour specialists. The gym includes hundreds of walls to choose from and classes for all skill types.

1.13.6 Permaculture playground

Permaculture is a concept which was first introduced by two Australian scientists Dr.Bill Mollison and David Holmgren in 1978, in order to support sustainable development.

You can say that is an adoption of sustainability principles, a simulation of features observed in Natural ecosystems derived from Permanent Agriculture and social design (*Perma*nent+*Culture*+Agri*culture* =Permaculture).

Permaculture playground is a combination of topographic diversity, the use of vegetation and Natural play elements (rocks, fields, waterscapes). [30]

More specifically may contain fauna and flora, a different form of texture and size of plants, selection of plants that emphasize the seasonal changes, plants for crafting, plants that produce sounds, climate modification, play spaces, animals, wildlife Natural elements (rocks, lawns, fields, water).

Permaculture playground purposes are: children to acquire knowledge as far as nature is concerned through play in the Natural Environment, the connection of human with nature, integration play allowance with sustainability.

Permaculture playground design gets its origin from the application of permaculture designing philosophy to playgrounds. In this approach, the aim is to provide children with play spaces, constructing Natural play areas using vegetation, animals, topography, water and other Natural landscape elements. In this paper, brief information on the design of Permaculture playgrounds is presented for explaining Permaculture philosophy and proposals about their design in urban and rural areas are given (Zohre.2008).

Mollison (1991) argued that: *"Permaculture is a philosophy of working with, rather than against nature, of protracted and thoughtful observation rather than protracted and thoughtless labor, and*

[26] https://www.complex.com/style/2014/01/adult-playgrounds-around-the-world/
[27] http://voiceofplay.org/blog/move-kids-playground-adults/
[28] https://www.nytimes.com/2012/07/01/nyregion/new-york-introduces-its-first-adult-playground.html?pagewanted=all
[29] https://en.wikipedia.org/wiki/Go_Ape
[30] https://en.wikipedia.org/wiki/Permaculture

of looking at plants and animals in all their functions, rather than treating any area as a single product system".

An example of Permaculture playgrounds is the Westmoreland Nature Play Area, situated in Portland Oregon, constructed in 2014. It is a large scale project, with a 60-foot long creek whose waters can be pumped up to the top of a creek mound. There are a hill slide and a timber scramble.

1.14 Children and nature

After a lot of observational studies that have been conducted over the years, affirmed that we learn through experiencing new things by coming into contact with nature, via our senses (Moore.1993). The external world is, in fact, our sensory memory, hence, each of us has a different world. The number of physiologically identifiable sense mechanisms that actually exist is an ongoing progress.

Macmillan demonstrated that*: "Nature has been cited as a valuable component in children´s play and learning environments".*(Macmillan et al.2008:28)

After observational studies that have been conducted from Lisa Schicker(1987), it seems that children take into serious account Natural places for play. Within her Survey sample, 50 percent of all activity involving direct contact with NaMa including observation of wildlife. (Macmillan et al.2008:7).

When children explore Natural places they gain a better understanding of their surroundings and what does it consist of and make their own connections of understanding the World.

Young people where they have contact with the Natural environment may have stimuli with regard to the Natural environment and the wildlife as they grow older (Macmillan.2008).

As Macmillan claimed that: "*The Natural environment offers a wealth of play potential for young children, with trees and small patches of water the most valued elements. One tree can engage a child for days at a time or, periodically, over a span of years. Manufacturers of playground equipment have found it impossible to re-create such richness".* (Macmillan et al .2008: 29)

Through our research, we will try to refer to all the benefits that children can have through Natural play. However local authorities, till now have not been able to capture all the consequences that the absence of outdoor adventure play may have to the children's development.

It is forbidden, in the playset of a public playground, within landscapes to climb a tree, or to play with mud, to play with plants, build tunnels, houses or any idea comes in your mind. Children´s playground Laws / Regulations must change /redraw and reconsider to put these children needs first in line –so they can have a direct contact with Nature. Children and Nature have an interconnected bond.

1.14.1 Why children need open spaces

For the provision of play spaces to be effective the design must be based on an understanding of children´s play and developmental needs. This should be the basic prerequisite for a designer before designing a play space. Also, each educator /social worker or anyone involved in the educational system should be reminded of the importance of play in children´s lives and put it as a priority.

Previous researches that have been made report that the benefits of playgrounds are significant. Not only children play but learn at the same time (Macmillan et al.2008). They acquire knowledge about the environment that surrounds them without the need of memorizing something like they do at school but only with the use of senses. (Piaget.1962)

Play helps children to improve their :

- Cognitive development (including language skills, problem-solving and independent learning skills, memory, creativity, and imagination)
- Physical health and development (physically they get sick less and they recover faster).
- Mental health, happiness and emotional wellbeing (including building confidence, coping with stress, tackling anxieties and phobias, aiding recovery in therapeutic contexts, alleviating the symptoms of ADHD for some children when they come in contact with nature).
- Social development (including working with others, sharing, negotiating and appreciating other points of view).
- Risk management and resilience through experiencing and responding to unexpected, challenging situations.

Outdoor Natural playgrounds:

- They are designed to show children the beauty and the wonder of nature
- Natural resources are used in their basic form and not exploit to a point of satiety and not being replaced by nature.
- Outdoor playgrounds provide about 3 ½ times safer play than those typical playgrounds with the same money spent.
- They offer a safer play with more choices entertainment for all ages children. [31]

1.15 Summary of Section 1: Playgrounds: A History

In the first Section of our research, it was analyzed thoroughly the History of Playgrounds, and more specifically, in the countries of Germany, the USA, and the U.K.

To illustrate, Playground began as elaborate sandboxes, or sand gardens, providing space for children who were no longer safe to play in urban streets because of the automobiles. Over time, the structure of playgrounds has evolved through visible results.

Dr. Joe Frost(2010) has identified the major shifts in playground design over the last century, outlined here:

• 1880s-1890s: Sand Gardens.
• 1900s-1920s: Model Playgrounds.
• 1930s-1940s: Development slowed or suspended due to depression and war efforts.
• 1940s-1950s: Adventure or Junk Playgrounds.
• 1950s-1970s: Novelty Playgrounds.
• 1970s-1980s: Standardized Playgrounds.
• 1980s-present: Modern Playgrounds.

Playgrounds are part of our cultural heritage or even more part of our legacy, it is who we are. Much of the playground´s history has been forgotten, the main reason for their existence in the first

[31] (The play return by Tim Gill) https://rethinkingchildhood.com/

place. From one point onwards, growing up we are evolving, but we have forgotten the importance played by playgrounds in our growth.

Playground may be the most common sports facility known worldwide and, after founding of paintings from the 5th-century capture children play on swings, one of the most ancient activities.

Playing outdoors is the perfect place for practicing and developing gross motor skills, social skills cognitive skills, physical skills, and intellectual skills.

Natural settings can provide a variety of loose parts that enable children to shape their environment developing their creative and constructional cognitive abilities. When children use real elements like rocks, seeds, wood, flowers to play and build their fantasy world enriches the sensory of nature of play (Moore.2003)

Based on Surveys the interaction with nature improves also their health. A grand example of outdoor play space is the forest Schools that developed in the 1950s. They provided an educational trip, that children would have the opportunity of free play and get to know nature.

No matter where children live, what abilities they have, what language they speak, they all have something in common, chances for free play.

Through our research exploration, a reference is made regarding the existing Children´s Playground Laws, the Safety management, the guidelines and the requirements of outdoor play spaces in the residential environment. In the meantime, it is affirmed that there is no specific Law that forbids the use of NaMa in a play area. While actions should be made to have additional guidelines and Laws for the materials that will be used in play spaces. It is necessary to reestablish our playgrounds based on the new conditions and the environmental changes.

Ultimately, all we need is prerequisite active solutions to be part of the disentanglement of lack of play in densely populated areas and start thinking of play as a free movement as it was from the beginning and having a main focus the improvement of the Natural environment where children play and live.

In addition, in the following Section, it will be referenced the use of NaMa and Natural elements in Urban Open Spaces.

SECTION 2 NATURAL MATERIALS IN PLAYGROUNDS – AN OVERVIEW

2. The use of Natural materials and elements in Urban Open Spaces- Introduction

A definition of Urban Open spaces can be that it is a typification of the Urban Environment which is essential in the daily lives of people living in densely populated areas. However, the quality of the Urban environment has significant implications on elements of everyday life such as housing, education, children´s play, health etc. (Wooley.2004)

Jan Gehl has characterized urban open space on his book with a title as *"The life between buildings*[32]*"*

Lady Allen of Hurtwood rightly alleged that modern World will have a tremendous influence in children's play and she was absolutely right (Lady Allen of Hurtwood.1968).

Urban Open spaces play a fundamental role in creating a healthier play environment for the children which Architects and Landscape Architects are obliged to offer by providing a good quality playground design.

The importance of play for the child´s development has been proved by a wide range of researches. In the first Section of our research reference has been made to the effects on child development.

Playing is a necessity for children´s way of survival such as feeding, housing, and sleeping. As Piaget (1962) stated in many of his writings by characterizing Play as the child´s occupation.

It has been observed from many educators/researchers (Bengtsson.1973) that children have a need to experiment with NaMa that is available in their environment, such as earth, water, plants, stones, timber and so on. In this way, they learn by exploring their environment and the materials around it and they create their own imaginative world by playing. So, you can say that Natural materials are indispensable for play and a part of it.

It has been recognized that children love to play free and challenge themselves by any opportunity given, in an adventurous Natural play space. For these qualities bring their own sense of independence and freedom. The children are free to try out new ways of playing in an adventurous Natural playground, that they wouldn´t try before, especially those who live in big cities- there are all new to them.

These kinds of play areas are testing their limits, making them use their imagination and challenge them.

Froebel´s educational system was to use the garden as a space that combines culture and Natural activities. He used to use materials, such as blocks, stick, peas, paper, and clay to activate the imagination of the children and learning at the same time from them.

This is where we step in by saying that using NaMa has created a new era that uses nature without exploiting it.

In this spirit, the construction work of Landscape Architecture can consider adding the materials, which will be discussed below in detail, combined with bioclimatic architecture.

The main achievement will be the creation of a Natural playground that will prioritize the Safety of play combined with Education and the Amusement of children and visitors.

[32] https://gehlpeople.com/?s=LIFE+BETWEEN+BUILDINGS

2.1 Natural Elements[33]

If we go back in time and remember our childhood memories and what we found attractive to play with, we will all answer about the Natural elements that we first wanted to explore (sand, mud, water, stones etc.).

No matter from where you are, what religion, what culture or traditions we may have differed from each other, as kids we all had something in common, we wanted to explore the surrounding environment.

Each of the Natural elements can become a material for play. Water is one of the major and most creative play elements in play spaces. Other important elements that should not be missed by a playground are the following: Vegetation, soil, rocks, wildlife (animals, insects), a variety of colors and textures, ways to discover the seasonal changes through nature, sunlight, shadows. An environment that can activate all the senses. All of these elements one way or another is the ones who matter the most and remain indelible in our childhood memory.

The main target, of using the Natural environment as a play area, is to offer opportunities and chances for children to learn and interact with nature.

Natural play spaces have two important characteristics, one is the variation of elements that exist in the field and the second is the variety of colors and textures through vegetation.

All this mixture of physical elements (trees, shrubs, rocks, water elements, leaves, sand, wooden sticks) can broaden children´s imagination and thus create their own play environment which is unstructured.

Natural environment plays a key role in a child´s development. When children interact with the Natural elements like the vegetation (trees, shrubs, flowers, vegetables, etc.) or play with water features (fountains), or climbing rocks, they improve their GMS and use all of their senses to learn the Natural environment (City of Phillip.2011).

[33] http://www.portphillip.vic.gov.au/Play-Space-Strategy2011-web.pdf

2.2. Straw/straw bale as a material for structures in the Natural Playgrounds

2.2.1 Definition

Straw is the dried stems of grain-bearing grasses. It is harvested as a by-product of cereal grain farming. The nutritious seed head is cut –threshed-from the top of the plant once it is fully mature, with the seed head gone, the stalks are dried and baled.

The most common types of straw are wheat, oats barley, flax, and rice.
All of these are commercially farmed in most parts of the world. But any kind of straw can work, including hemp, spelt, rye, and other specialty grain and seed plants.
It is possible to bale and construct with almost any fibrous plant stems.
As long as the majority of seed heads are removed and the stems are thoroughly dry before baling, anything growing nearby can be baled and used.[34]

Since straw is a co-product of cereal production, is a renewable, cost-effective and readily available resource for any construction you will consider.
Like other plant-based materials, cereal crops use carbon dioxide through the Natural process of photosynthesis.
Sodagar et al. (2010: 51-65) estimated that 1 kg of straw sequesters 1.35kg of carbon dioxide.
As a renewable resource, plant-based materials are an effective means of removing and storing excess carbon – dioxide from the atmosphere. Crop-based materials, such as straw, are a co-

[34] https://en.wikipedia.org/wiki/Straw

product of food production, so unlike crops as Miscanthus, grown solely for bio-fuel, they do not place pressure on or compete with food production.

Though the price of straw bales depends on cereal production and depends from region to region so the answer will not be precise. But still, Straw bales remain one of the most inexpensive affordable materials.

2.2.2 Structure and composition of the material

Each stalk of straw resembles a long, thin hollow tree trunk.
That means that straw and trees have a similar chemical structure-*cellulose and lignin*- and a similar strength and durability. But because of the smaller dimensions, straw grows to maturity in one season only.

All straws vary in their physical properties and crop quality can also vary depending on the weather and soil conditions.

Typically, if a type of straw has been grown and stored successfully in your climate, then it will be an appropriate type of straw to use it for any construction you wish to do in an outdoor play space.

Each little tree trunk of straw is remarkably strong. Straw is hard to tear apart by hand. It also resists decomposing quite well (resilient).

When all of these tree trunks of straw are packed tightly together to form strawbales their final form is so resistant. After that, you can use your imagination and use them properly at your Playground design.

Although, straw has been used in the construction sector for many years now, always combined with other materials such as clay and sand.

In the late 1800s was invented the baler machine (see below Figure 2.1) which its function was to compress straw and hay into bales.

Pioneers in the Sand Hills of West Nebraska started using bales of meadow hay as a building material. Some of those buildings from the late 1800s and early 1900s may still exist. That confirms its durability over time (Magwood .2005: 62-65).

Figure 2.2: Baler machines in 1920 and in 2008

(Source:https://lambersongenealogy.wordpress.com/2010/09/22/wordless-wednesday-hay-baler-circa-1920, http://www.geograph.org.uk/photo/1406072)

The straw is first cut and raked into rows in the field. The baler pulled and powered by a tractor, straddles these rows and picks up the straw with a rotary rake.

The straw is then transported sideways, usually with moving stell fingers, which push one end of the straw bundle against a stop- a flat steel face. In this process, the straw is very roughly aligning in the direction perpendicular to the stop.

As the strawbale is being built up and pushed out of the baler, the face opposite the steel plate stop is trimmed with a cutter and the bale is mechanically tied lengthwise. The strawbales can also be tied with wire, but it is not customary to be done anymore.

Their size depends on the type of machine from which they are formed and on the usual local practice applied in relation to size.

Finally, there is also a difference in weight, which varies according to density and moisture content. Straw is a material that has a physical structure and retains its shape due to its tubular shape.

In addition to, it's very thin, almost microscopic coating, which has a waxy texture, makes it somewhat resistant to water.

The bundles are formed by tying a quantity of straw with special *polypropylene ropes* or twines. Depending on the type of binding in the straw bales, we can distinguish two types: the 2-strings and the 3 strings.

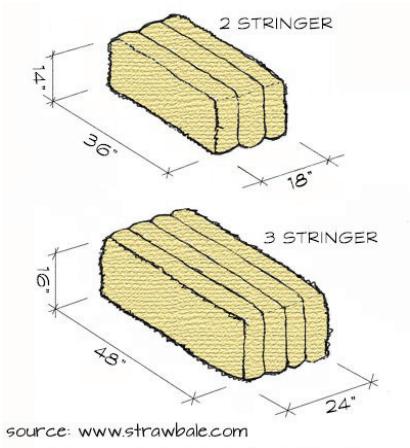


Figure 2.3: Approximate dimensions of two and three stringer straw bales (Source: www.strawbale.com)

Though bales were developed for agricultural uses the traditional bale, measuring approximately 1000 x 450 x 350 mm and waiting around 20kg, forms an ideal building unit. that can be stacked to form a *barrier* in playgrounds or can be used in gardening. Ways of construction that will be analyzed along the way. [35]

2.2.3 Ways of using Straw bales in Outdoor Urban Spaces

Over the years it has been developed the usage of Strawbale in the construction sector. Either as the filling of masonry for insulation or as an alternative of landscape beds instead of soil gardening. The concept of our survey is to use Strawbale as raised beds for plant husbandry and more specifically as a landscape border assembly for use as a play yard or edging around trees, to separate the zones in playgrounds according to the age group.

[35] https://en.wikipedia.org/wiki/Baler

Landscape Architects, Gardeners and everyone involved in the selection of the materials for the design of playground, utilize border or edging materials, such as fences, logs, bricks, wires, concrete blocks. In a play area, this kind of border items seem too heavy and sometimes unfriendly to the surrounding area. It is worth mentioning that is not practical in cases of cutting or trimming the grass of the playground as well as can cause damage to gardening equipment. Yet, as a flexible border for sidewalks, separate playground areas and driveways.
Only by exploring this material in outdoor urban spaces you will see its benefits.

2.2.3.1 Straw bale gardening (SBG)

Straw bale gardening (SBG) is a new alternative to traditional soil gardening. It is a relatively new concept, which has been operating for some years. Behind this idea lies the farmer and author Karsten Joel. It all started as an experiment and now has spread with an accelerated speed all across the world.
Straw bale is decomposed, the composition changes and straw bale become a planting material so you can grow later on vegetables, herbs, and other plants in them without the need of any digging, tilling or constructing a trellis to balance them. Regardless of the local soil, they do not have weeds, pests, and contaminates.

As long as the straw bales are kept separated from any soil you may have not any issue with dangerous weeds, pesticides,etc.that may be killing or otherwise contaminating your plants. All it just need is enough space and a sunny area outdoors.

Figure 2.4: Straw bale raised garden beds
(Source: https://gr.pinterest.com/pin/145944844155442367/)

SBG is a fairly simple process that involves using a tied straw bale, decomposing in the middle, and later on, plant your crops within the center of the bale.

One of the biggest advantages of SBG is that the gardener doesn´t need soil and need to purchase a container.

SBG can be also placed on a slope without any problem. You only need to position the bales to run up and down the slope. The use of wood stakes is preferable so the bales are stabilized in case of strong wind(Karsten.2015).

The most productive efficient SBG will have single rows of bales positioned end to end. This allows easy air circulation around the plants. A straw bale garden fills a variety of situations and needs, is relatively inexpensive, free of diseases and many more(Diane.2017).

More specifically, if you really think about it , behaves like a sponge, by absorbing water and being filled with materials that help the straw break down and later produce a variety of vegetables, herbs, and plants.

Figure 2.5: Growing vegetables, herbs and Annual plants in straw bales.
(Source: https://strawbalegardens.com/photos/before-after-3/)

It is suggested, the use of some ground cover such as wood, mulch between the rows of straw bale is a good way to keep weeds of grass from growing up between the rows of bales. All you need is to find the right harvested bales, fertilizer either organic or any lawn fertilizer. Ideal content analysis is a 10-10-10 NPK ,nitrogen(N), phosphorous(P),potassium(K) as experts(Karsten) recommend.
Next in line is a planting mix(sterile mix without weed seeds and soil) for creating the seedbed on the surface of the bales.
Later on, you need to condition the strawbales(the stage of composting) till they can support root growth. You have to wait 10-12 days of conditioning the straw bales before you start planting.
Between mid-April – the beginning of May is an appropriate period of planting (the material can be appropriate for Springtime). Earlier than that could not have the corresponding results.
As far as the maintenance of SBG it should be applied monthly doses of fertilizer as it happens also in the case of raised beds.
Watering the SBG can be in more than one ways. It can be first either placed a soaker hose end-timer in the middle of the bales as a technique, second with a drip system with regularly spaced emitters but it costs more or water recycling system (Karsten.2015).

Another entertaining structure can be a strawbale garden maze which will be used as an imaginative, educational play and at the same time a fun game.

Figure 2.6: Strawbale maze
(Source: https://colorado.ourcommunitynow.com/2017/10/08/behold-pumpkin-patch/straw-bale-maze/)

In conclusion, SBG has several Advantages over gardening and their placement in the playgrounds :

- It is not necessary to dig up soil or fill containers.
- The open structure of the straw bales (they can absorb several gallons of water) provides great drainage system, so it cannot overflow (even in cases of heavy rain) and can help in cases of soil erosion.
- The extra elevation of the plant surface helps children to have access, so they can explore and use all of their senses to learn all about vegetation.
- It is essential the playground location where the straw bales will be placed with the best sun exposure.
- In cooler climates, you can also plant straw bales. It is preferable to start earlier so you will have the desired results.
- The plants that grow in a straw bale don't need to be watered as often as plants grown in the soil.
- Placing straw bales in urban Open spaces can be practical and cost-effective.
- As an educational method can act as an aid for the proper development of children physically, mentally, emotionally and socially.

But there are some Disadvantages over gardening. These are the following:

- Groundcover is required. It is best to plant your garden on a layer of mulch or landscape fabric to keep out grass and weed from growing into your SBG.
- They have a limited lifespan. Because the whole method depends on the decomposition of the straw bale. SBG last for a single season. (Tullock.2015)

After an interview I took from the inventor of the idea of SBG, **Mr. Karsten Joel**, asking him all about the major factors regarding the Safety, Regulations, Maintenance, Appropriate materials, Weather conditions, Location of the material in play areas/parks, Costs, Environmental benefits.
I received the following interesting answers :

As far Safety: -I asked him if there is a concern as far the fertilizers used on the Straw bales it can be considered dangerous and the answer was that there is absolutely zero concern since fertilizers are quickly dissolved into the bales.

Even when they are necessary on the monthly maintenance, the amount is small of 1-2 ounces of dry fertilizer (that contains nitrogen) or can be of organic origin(bloodmeal). It is dissolved into the bales quickly. So again there is no great concern.
-Another concern was about the wires that are installed to the trellis that is above the straw bales. There is only a small possibility if an unsupervised child tries to climb up the trellis. But still, if the wires are bent over and tucked in correctly from the beginning, so there will be no sharp edges exposed and there are absolutely safe.
-In the questions, if there is a fear of rodents, the answer was that because Straw bales are wet they can not nest in a constantly wet material.
He confirms that Straw bale is a Natural and safe material and can be placed in Urban Open Areas.

As far Regulations: -To the question, if it is necessary the supervision of an expert the answer was that there is no need for an expert to be always controlling how things are going. But it is suggested if he can provide at the beginning some basic information so they can understand how this method works with the decomposition and how they can plant/ water their own plants/vegetables.
-To the question of whether there is a need for a specialist to be involved, the answer was that anyone can do this with less than 9 simple steps (we have mentioned above) and does not need any specific knowledge beforehand.

As far Maintenance: SBG method requires low maintenance when there is no weed and infrequent watering needed like in cases of typically raised bed gardens.

As far Weather conditions: SBG can be placed either cold climates or tropical climates. The specific method serves colder climates as well as Germany. After straw bales are decomposed are extremely warm. This can allow faster planting. Mr. Karsten informed us that are cases of SBG also in Philippines, Cambodia, that have extremely heavy rains but the straw bales work like a sponge.

As far Location of the material in play areas/parks: SBG should be placed somewhere in the outdoor urban play space that provides the best sun exposure.

As far Costs: Because of lack of digging or filling containers, straw bale the costs are low.

As far Environmental benefits: 100% sustainable.

Some interesting cases that Mr.Karsten Joel mentioned on his book through his recording of existing SBG from places around the world.

For our case scenario,(using the straw bales in the play spaces) it is worth mentioning some interesting examples that are taking place in the USA and Germany.

The first case is the development of a schoolyard garden situated in Minnesota at the Gideon Pond Elementary school as an educational project.
Kids learning how to garden and at the same time turns into a fun game.

Figure 2.7: Schoolyard garden in the Gideon Pond Elementary school in Minnesota
(Source: https://www.greenhomegnome.com/schoolyard-garden-straw-bale/)

Another case that we will refer to is located in Lüdenscheid, Germany at the Primary School Lösenbach.
With the collaboration of teachers and parents, a Straw Bale Garden was created as an Educational Project. The project is dated in 2016. It is an easy way to grow gardens and the project continues till today with success.

Figure 2.8: Children from the Primary School Lösenbach in Lüdenscheid that participated in the project.
(Source: https://www.strohballengarten.ch/2017/07/03/strohballenporojekt-der-offenen-ganztagsschule-l%C3%B6senbach/)

This is not a research to persuade you whether or not using Strawbale gardening or any other method or material that we will mention later on, but an attempt to approach the possibility of using such a method in outdoor play spaces and having a basic knowledge on the subject.

2.2.3.2 Straw bale as a landscape border

Figure 2.9: Strawbales used as a wall in a festival for kids to have fun.
(Source: www.flickr.com)

As we mentioned earlier another usage for straw bale, is to be used as a Landscape border assembly in play spaces. Because the material is seasonal(it is harvested the summer period around July) it can be a seasonal play activity, like an exhibition activity, so children of cities can have the opportunity to play with this material. In the case of SBG does not apply the same. SBG can function normally with the necessary care for one year.

The idea of using Straw bale as landscape border is the following :
There are different zones in playgrounds that separate the play activities based on the Age group. These zones could be divided into different layers of Strawbale borders and depending on the Age group, the level of difficulty arises. Straw bale borders can lead to the next level/area of play and so on.

Figure 2.10: Hide and seek play or climbing
(Sources: https://www.flickr.com/photos/27557265@N08/2897874573/https://www.alamy.com/stock-photo-child-blond-girl-by-straw-hay-bale-in-field-meadow-playing-children-102345567.html2.1.2)

At first, it is the *Quiet Area* which Strawbale wall can be used as an insulation from the surrounding sounds and a place for the small children (Age group 0-2 years) to have some space and explore the area by crawling, standing and learning to walk. A perfect place to set the benches, that parents will seat and check on their young ones –and of course benches could be also made of straw bales.
In the *Nature area* can be set the SBGmethod as we mentioned in subchapter 2.2.3.1.
In the *Open Area* should be provided an open space for play with different levels of Straw bale walls that can lead to the last level.

Figure 2.11: Children play a hurdles race with straw bales as the obstacles
(Source: https://www.flickr.com/photos/eyrie1/15778394681/in/photostream/)

It may appear as an upgrading ladder, which distinguishes the areas of each Age group. Last but not least, is the Active area where all the play activities happen.

It can be quite impressive the wealth of how many play opportunities can be provided with Straw bale, as a simple as it is material, without any manmade play equipment and help children developmentally physically, emotionally, socially and intellectually.

For example in Japan and more specific in Niigata on the island of Hoschu, sculptures of Animals are made from Wara (rice straw) each year for the Annual Wara Art Festival[36]. Art students are taking part in the festivals and create beautiful 3d sculptures of the leftover rice straw Wara by giving it another form.

[36] https://www.smithsonianmag.com/travel/check-out-these-wara-art-sculptures-japan-180965197/

Figure 2.12: Wara Art Festival, Niigata Japan, Sculptures of animals made of rice straw and wood.
(https://www.smithsonianmag.com/travel/check-out-these-wara-art-sculptures-japan-180965197/)

Or can be used as Art exhibition for Festivals in farmlands.

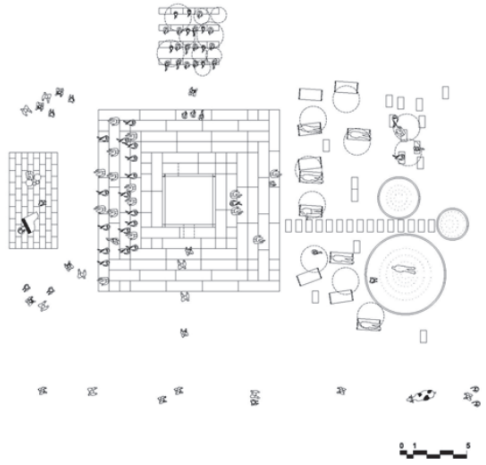
Figure 2.13: Straw bales used as an art exhibition for the Harvest Festival, USA
(Source: https://www.flickr.com/photos/34121831@N00/10876165906/)

Another example of using straw bales is the following by the Spanish collective Grupu IUT[37]. They built a tower of strawbales on the suburbs of Guimarães in Portugal dating in 2012. The tower was part of an exhibition and the project was one of the winners of Performance Architecture, an international competition organized by MoMA.
The bales were piled up in tiered *ziggurat formation*[38] around a thin metal structure which supported an elevated room, accessed by a narrow door. Installation was 13.6m x 13.6 m and a total height of 13m and contained 288 straw bales.

The structure remained rigid and secure due to the assembly and it is impressive the way how straw bales compressed under their own reinforcement was needed.
It is an invitation for the public use, to climb it, seat and rest. Imagine something like that standing on a playground area.
Straw bale is a rather unknown construction material, inexpensive and totally reusable. This intervention, notwithstanding its volume, left no trace in the landscape and no waste afterward. When the project was over all the straw bales were reintroduced by horse stables of the area.

[37] https://www.dezeen.com/2012/12/27/agricultural-mountain-of-straw-balesby-grupo-iut/

[38] ***Ziggurat****: is a type of massive stone structure built in Ancient Mesopotamia.It has the form of a terraced compound of successively receding stories or levels.*



Above: plan

Figure 2.14: Final project, Top view and Side view of the tower by Grupu IUT
(Source: https://www.dezeen.com/2012/12/27/agricultural-mountain-of-straw-balesby-grupo-iut/)

2.2.4. Carbon Footprint

Ecosystem Impacts	Embodied Energy	Carbon Footprint	Indoor Environment	Waste
Low to Moderate. Impacts largely the result of monoculture agriculture, including fertilizer, herbicide and pesticide use. Confirm practices with straw bale source to verify degree of impacts. Straw from organically grown crops will have the lowest impacts.	**Very low.** 0.24 MJ/kg* or 3.5–4.0 MJ per average two-string bale. No high heat process-es required. Produc-tion energy input split with embodied energy of cereal grain production.	**Very low.** 0.06 $kgCO_2e/kg^*$ or 0.2 $kgCO_2e/kg$ per average two-string bale. Production carbon output split with carbon output of cereal grain production. High carbon sequestra-tion potential.	**Very low to low.** Very low surface toxicity. No toxic off gassing. Material separated from interior air by plaster or sheathing.	**Very low to Low.** Construction: Leftover or unused straw is fully compostable. Polypropylene strings may be recycled in some jurisdictions. End of life: Straw is fully compostable. Embedded mesh will require separation.

Figure 2.15: Strawbale´s carbon footprint
(Source: Sodagar Behzad.Rai Deepak. Jones Barbara: Wihan Jakub. Fieldson Rosi.2010.The carbon-reduction potential of the straw-bale housing. School of Architecture- University of Lincoln)

Straw is a by-product of agricultural activity. It is usually baled and stored to be used as a bedding material for livestock housing.

From an environmental perspective, construction sustainability is a sector that gains considerable attention these days.

Nowadays, our need to find new materials/ new ways in the landscaping development site to partially replace the non-environmentally friendly materials is constantly increasing.

Straw is a Natural material that has excellent insulating capabilities, relatively low cost, significant mechanical properties when is packed in bales.

It is very resistant to fire, able to support a lot of loads and able to cope with strong impact, durable and eco-friendly (Sodagar et al.2011:51-65).

This has brought to a re-discovery of the use of straw as a construction material or in gardening.

However, this use does not absorb the entire availability of straw and the remaining amounts buried or, where local regulations still allow it, burnt. The practice of burning straw has obviously a negative impact on the environment since a considerable amount of CO_2 and other pollutants is produced and released in a short time.

For this reason, by finding new uses for straw can be extremely beneficial to the environment. The percentage of straw burnt in Italy in 2008 is listed in Table 2.2 (Maraldi et al.2008:2).

Plant	Overall Qty [x 10^6 kg d.m.]	Burnt	Conventional uses
Wheat	2100	30% - 40%	Bedding, animal feeding, paper industry
Barley	380	50% - 60%	Bedding
Oat	120	40% - 60%	Bedding
Rice	550	70% - 80%	Bedding

Table 2: Straw availability and amount burnt for different types of plants.Estimations for 2008.
(Source: Maraldi Mirko. Molari Luisa. Molari Giovanni.2008. Mechanical Characterization of the Straw bale for Use in Construction. University of Bologna-p.2)

2.2.5 Environmental Impacts

An important goal of a playground design is energy efficiency, which means creating a comfortable environment for children with minimum input from fossil fuels.

The enviable energy efficiency can be due to the good insulating properties of Straw Bales. The role of insulation is to minimize temperature loss or gain and therefore the amount of energy consumed to maintain the desired temperature.

Through a combination of thickness, the amount of air they entrap(air circulation), and the fairly low conductivity of straw itself, Straw bales offer insulation values.[39]

2.2.6 Costs [40]

The value of straw differs and depends on various factors. An example of straw costing will be presented hereinafter.

[39] https://buildabroad.org/2017/02/07/straw-bale-construction/
[40] https://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/faq7514

According to the Agriculture and Forestry of Government of Alberta (Canada) informs that straw´s value depends on various factors. These can be the crop grown, the propensity of the field to erode, the amount of residue on the field, soil organic matter and fertility level as well as the value of straw for bedding or feed.

The producer decides the price of straw depending on market demand in his area, the value of fertilizer needed to replace the nutrients that supplied by the straw. He may be considered also a risk value to cover erosion potential. Alternatively, the straw can be tied only to handle the heavy residue of a crop. Then the value of straw can be reduced.

Most grains produce between 40 to 60 pounds of straw per bushel. These values can be used to determine how many extra tillage passes may be required in the spring to handle the crop residue.

Baling example costs range from 9€ to 14 € per large round bale.
Hauling and stacking large round bales in the field will add another 3 € per bale.
Small square bales will cost between 80 cents to bale. Hauling and stacking small square bales in the field will add a further 80 cents per bale to the cost. This is the value that acreage owners will attach to the bales to reflect the convenience in handling the small packages.

Straw can also be valued according to its feeding value. Using current values for grass hay of around 74€ /ton, wheat straw should be worth about 35€ /ton, barley straw around 38€, oat straw approximately 47€, and pea straw almost 65€ /ton.
Baling, stacking and hauling costs will have to be added to these prices and when they are, the total price per ton will approach good quality hay prices.
The above costs represent only a base upon which to value straw. Straw´s value differs from region to region. Straw prices will vary considerably between regions of the province.

Other factors involved in straw pricing include local demand, soil erosion potential and possibly carbon sequestration.

2.2.7 Level of maintenance

Once the construction of SBG(SBG) or Straw bale sculptures or any other structure/idea for the playground project is expected to take place, it should be borne in mind that it takes some days of preparation of the method (in the case of SBG construction) before the application of the material in the area.

The completion of the project may take some weeks or even months. This, of course, depends on many factors such as the location where the project will take place, the complexity of the playground design, the workforce (experienced or not), the required finishes –coatings for their protection from moisture, storage of the materials before completion of the structures.

The level of maintenance differs from typical playground equipment. Their placement and transportation may be easier.

The main enemies for all NaMa, in general, is water and humidity. As long-term exposure to moisture can cause damage. To avoid this, the existence of a roof under the straw bale benches, the frequent measurement of moisture during construction and the application of Natural lime mortar and grout outside the surface of the various structures of straw bales, is a necessity.

In the case of SBG, it is recommended the use of a layer of mulch or landscape fabric to keep grass and weed out from growing into the bales. But despite that, SBG method requires low maintenance, when there is no weed and infrequent watering needed like in cases of typically raised bed gardens (Diane.2017).

2.2.8 Advantages and Disadvantages of using Strawbale[41]

Advantages

- Straw bale is made from a waste material. By bailing the straw, a new life is given to the material.
- An excellent insulation material.
- It is a practical construction element.
- It is cost effective
- The method of SBG (that we have analyzed on sub-section 2.2.3.1) is easily understood even if you are a novice and you haven´t tried before this method. With a simple attendance of a session/ seminar about SBG, he can create his own straw bale garden.
- There are 100% sustainable
- Straw bales have a low-embodied energy (see Figure 2.12) That means that during their manufacture low energy was used such as sunlight which is the main energy source for growing plant. The only, maybe, the energy needed is during the bailing process and their transportation to the location that playgrounds would be designed. But if you think that fiberglass, for example, requires a high amount of energy to produce.
- On the one hand, Straw bale is 100% biodegradable. That means that are capable of being decomposed by bacteria or other living organisms. All Natural materials are made to fade not to last. So after its limited lifespan, it returns back to the earth. On the other hand steel, plastic, cement are disposal wastes.
- It is free resistant
- Straw bale borders or Straw bale gardens can be beautiful to see in the landscape as the material has many choices about what you could do with it.

Disadvantages

- Since it is a relatively new method. You will need to learn and experiment without the involvement of an expert
- There are no laws (Children´s Playground Law) or any Restrictions as regards NaMa and additions and changes must be made.
- As far the safety requirements there is no law that adding the NaMa in the play spaces, the advisory service and the control by the competent body are needed so they can be done some changes or corrections or even additions to the existing Children´s playground Laws as it was mentioned before.
- Straw bales need to be kept dry as moisture is detrimental to many materials. This is done with the proper use of the coating.
- If straw bales are not available within a few kilometers from the site of your playspace construction, then the cost and the carbon emissions must be taken into consideration since the costs will be high.

[41] http://buildingwithawareness.com/the-pros-and-cons-of-straw-bale-wall-construction-in-green-building/

2.3 Cob as a material for structures and constructions in the Natural Playgrounds

2.3.1 Definition

Cob[42] is a Natural material and is usually a level below the surface soil, which is not suitable for building because it contains many organic elements. Cob is made from the subsoil, water, fibrous organic material (typically straw), and sometimes lime.

The contents of subsoil Naturally vary, and if it does not contain the right mixture it can be modified with sand or clay. Cob is fireproof, resistant to seismic activity, and inexpensive. It can be used to create artistic, sculptural forms, and its use has been revived in recent years by the Natural Building And Sustainability Movements.

Cob may be referred to as an "*unburned clay masonry*" when used in a structural context. It might also be referred to as an *"aggregate"* in non-structural contexts, such as a *"clay and sand aggregate"* or more simply as an *"organic aggregate"*, such as where the Cob is insulating filler between the post and beam construction.[43]

Cob and other forms of Natural building, which will be discussed below, promote artisting and freedom of expression.

Clay is the key ingredient of Cob. It is not used as much as it should be, can be set up more easily outdoors.

Clay is the result of the chemical weathering of rock and silicates such as feldspar, quartz, and mica. The diameter of clay grains is smaller than two one-thousands of a millimeter.

There are several types of clay. The most common are kaolin and montmorillonite.

Clay puddling is the traditional method but it is very labor intensive. It is laid by hand in thin layers of a minimum of 150mm. It is liable to cracking if allowed to dry out.

So, in order to find clay, you have to dig deeper. The soil found should contain at least 10- 25% of clay in order to be suitable for the mixture(see Fig.2.16).

[42] https://en.wikipedia.org/wiki/Cob_(material)

[43] https://en.wikipedia.org/wiki/Cob_(material)

Figure 2.16: Cob Shake test (http://www.buildNaturally.com/EDucate/Articles/Cob.htm)

Clay is found in nature in many different colors, which is of course good because one can use more than one kind in order to give different colors to its construction plan and also it could be a playful result for a playground equipment.

In most cases, the clay is bright in color and is irritating due to the various metal oxides that contain. A clay deposit will, therefore, stand out from its intense color: white, gray, blue, red (Rael.2010).

2.3.2 Structure and composition of the material

The components of Cob are three: sand, sludge, and clay. Their adhesive is clay. Their proportions and the quality of clay vary in each area and each soil.
Structural clay can be admixed with aggregates such as sand, gravel, pumice stone, marble or binders such as straw, other vegetable or animal fibers, wood, etc.
The soil is a product of slow rock degradation. Air, water, frost, and micro-organisms all work together to transform the rock into soil.

In nature, there are three basic types of rocks: pyrogenic (or explosive), sedimentary and metamorphosed. Each type of rock has different characteristics. There is a variety of color, hardness, density, duration, and chemical composition.

Clay soil provides a flexible building material used for thousands of years to build structures. Clay may be in the form of blocks (such as Adobe) or monolithic walls (such as Rammed earth and Cob). May Cob walls have the same ingredients as Adobe (clay, sand, and straw) but their difference is that Cob is sculpted in place when wet. This is why it is commonly referred to as *"sculptural Adobe"*. If the ingredients for Cob, can be found in the building site, then the cost is minimal (Easton.2007).

Examples of material used are the following :

Glass bottles or blocks embed easily in the Cob as the wall is constructed, and provide beautiful light glowing through the wall. Imagine if a structure like this was in a playground area, what sentiments and senses would be triggered in children.

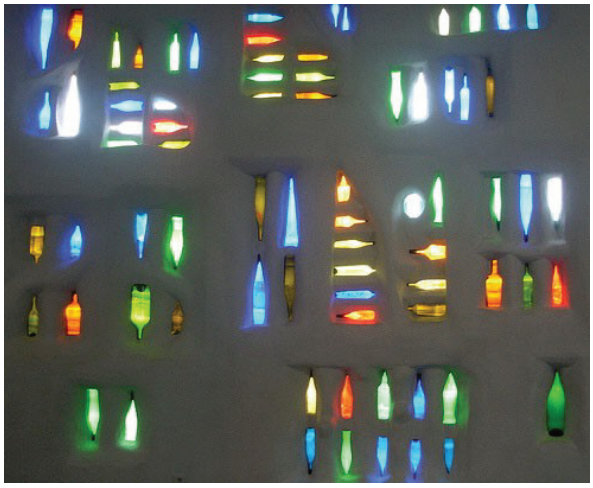


Figure: 2.17: Market Hall, Altenrhein – Switzerland (Source: http://www.krepcio.com/vitreosity/archives/001187.html)

Sculpted niches provide functional and aesthetic shelves. Also, benches, desks, and shelves are easily incorporated into the sculpted form. Completed walls are plastered with clay or lime to obtain a fine surface finish. Tiles or stones can be installed into the finish plaster to create color and aesthetic details.

Figure 2.18: Hotai Bottle Bench and detail, 1998 from Artist Jackie Stack, Indonesia
(Source: http://www.krepcio.com/vitreosity/archives/cat_bottle_walls.html)

The soil is graded according to the size of its grains. Generally, there are five basic types: gravel, sand, sludge, clay and organic soil. These five types will rarely find themselves in Nature. The different types are mixed by forming different blends. Clay is the binder, while the rest is considered to be inert (Easton.2007).

Clay, when mixed with water, creates a glue that works like cement in the concrete. The mixture in each region varies from region to region.

Each time the composition should be examined to see if it is needed and what percentage of improvement by introducing another mixture (e.g. sand). (Rael.2010).

2.3.3. Building techniques with clay

Depending on the climate, the seismicity and the social data, different techniques for the use of clay are applied at each location.
Building with clay has a long tradition in Germany and other European countries.
You can find structures that exist even today who have used these methods.

In the course of our Study, we will report some of the Building Methods that exist and which ones could be appropriate for an Outdoor Play Space.

2.3.3.1 Wattle and daub walls

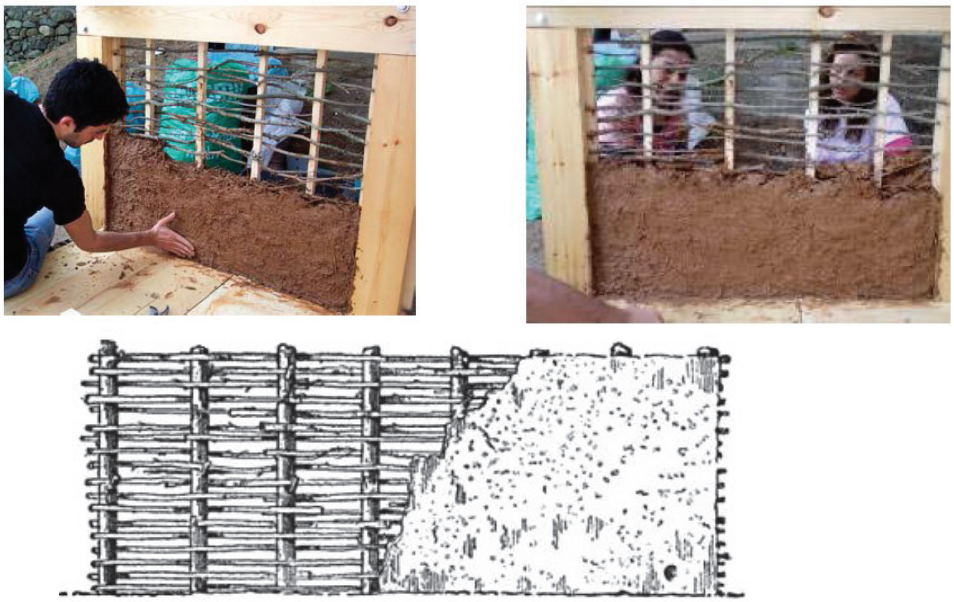


Figure 2.19: Wattle and daub technique (Sources: http://fysiki-domisi.blogspot.com/p/blog-page_11.html / http://www.homeschooljourney.com/jamestown-settlement-housing/)

Wattle and daub is a mixed building material used for making walls. Oak stakes are installed vertically into the frame, woven with lattice called(wattle) and covered with a sticky material usually made of a combination of wet soil, clay, sand, and straw. Finally, the surface is painted with lime. In Asia, they use bamboo instead of oak stakes since it is available in large production.

Wattle and daub have been used for more than 6,000 years and is still a basic construction building technique in many parts of the world.

The technique is becoming popular again in more Developed Areas as a low-impact Sustainable Building Technique.[44&45]

This technique can be appropriate for an outdoor play space to be used as a fence or barrier or edging border. It is an easy method that can be learned from primary school children, for example in an Educational Seminar about NaMa and how they can be used in the play area.

[44] https://en.wikipedia.org/wiki/Wattle_and_daub
[45] http://www.homeschooljourney.com/jamestown-settlement-housing/

2.3.3.2 Adobe

Figure 2.20: Mud bricks (Adobe), in different shapes for walling and roofing, let to dry in the sun. Rwanda-ActionAid school Project 2012 (Source: Personal archive of Thanos Bouziotopoulous)

Adobe is a building material made from earth mixed with water and other organic materials(e.g. straw, dung etc.). Most Adobe buildings are similar in appearance to Cob and Rammed earth buildings. Adobe is among one of the earliest building materials and is used throughout the world. Adobe has been shaped by hand, by pressing the mud mixture into an open timber frame and allowed to dry in the sun.[46&47]

Adobe can be used to build a variety of different architectural structures. It can provide a stable, secure wall system.[48]

To build with Adobe you have to consider the climate. Climate must have an Annual period of drought in order of the Mud bricks(Adobe) to dry out.

One of the enemies of this Natural method is moisture as it is in all NaMa. It can be either because of excessive rainwater or groundwater.

A successful stabilization and restoration of an Adobe structure depend upon how effectively a structure sheds water.

The importance of keeping an Adobe building free from excessive moisture cannot be overestimated.

Another enemy for Adobe structure is vegetation. Shrubs, trees and other foundation plantings may be causing physical damage. Because of their roots that may grow into the Adobe and trap excessive moisture in their roots and conducting it into the walls.

So, if it will be selected as a structural method in a Natural playground then it is absolutely necessary to be built away from vegetation.

It is worth mentioning that a water-tight roof /shed is indispensable to be provided, for precipitation from rainfall, otherwise it can not be appropriate for an Outdoor Play Space. [49]

[46] https://www.nps.gov/tps/how-to-preserve/briefs/5-adobe-buildings.htm
[47] Las Cruces New Mexico ,USA. October 1990.6TH International Conference on the conservation of Earthen Architecture.Adobe 90 Preprints
[48] https://en.wikipedia.org/wiki/Adobe
[49] https://en.wikipedia.org/wiki/Adobe

2.3.3.3. Rammed earth

Figure 2.21: Rammed earth Amphitheatre at the UBC Botanical Garden-Vancouver Canada, Project 2010 by Forma Design
(Source: http://rammedearth.blogspot.com/2010_09_01_archive.html)

Rammed earth is another Traditional Building Method. As its name implies, it is made of earth that is rammed or packed between wooden or steel forms.

Rammed earth is an ancient Technique. In China, Rammed earth buildings have been discovered which date back to 7th Century B.C.

A glaring example of Rammed earth structure is the Great Wall of China (begun over 5000 years ago) which was made from Rammed earth and stones. Through the years builders have compacted soil to create strong Structures only with materials that can find on the building site and of course manpower.

Rammed earth is a construction system that consists of walls made from moist, sandy soil or stabilized soil that is tamped into forms. Rammed earth structures provide massive exterior walls. It is suitable for many climates.

Its mixes vary widely. It contains 15-18% of clay, 3-8% sometimes cement, lime or fly ash, 35% silt, 50% of sand. It contains less water than the other earth construction types that it will be mentioned at this sub-section.

However, Rammed earth like Cob and Adobe should be protected by plastering externally, to provide additional protection from rainfall erosion (Calkins.2009).

We can see in Figure 2.21, an example of Rammed earth construction, located in Vancouver, Canada at the UBC Botanical Garden. The project dated in 2010 and planed by Forma Design[50]. The design of the project is a resemblance of the Fibonacci Numbers.

[50] http://formadesign.ca/

2.3.3.4 Earthbag

Figure 2.22: Earthbag shed by Geiger Owen, Bourbon USA
(Source: http://solisfarm.org/product/earth-bag-building-workshop/)

Earthbags were used 250 years ago, and more specifically in the Army (during World War I), for the creation of strong protective barriers against bullets or to prevent large floods.
Gernot Minke and Otto Frei played an important role in the 1960s and 1970s by constructing experimental wall systems using earth-filled bags as once were called (Geiger.2011).

Another important personage is Nader Khalili (Hunter.2004) who played a major role in the development of Earthbag construction. Starting with domed and vaulted assemblies of individual earth –packed bags. Later, they noticed that using polypropylene bags for stuffing,that could be obtained in uncut unstitched continuous tubes.

Structures with Earthbags and especially their usage in Open spaces is something totally new. For example, in Figure 2.22 we can see a project of Earthbag Building Workshop in Bourbon ,USA and is used either as a Garden shed, storm cellar, studio or can be used as an excellent play structure for climbing, jumping, sliding, crawling and many more motor skill activities.

This specific method offers more structural integrity than Adobe, more plasticity than Rammed earth, and more speed in construction than Cob.

Despite the fact that Earthbag is new compared to the other mentioned building methods, it offers superior economy and durability in domed and vaulted assemblies. Also, it offers broad possibilities for ultra-low-cost low impact construction. Earthbag provides unparalleled safety in wooded areas prone to wildfires and other sites since there are resistant to extreme weather conditions. It holds great thermal mass and cannot rot or be eaten by insects.

The method is easily learned, you don´t need to be an expert on the field to start building with Earthbags. But it is preferable for craftsmen that know the method to be assistants of the project. In the process of this subchapter, we will summarize all the existing techniques with Earth as a material and which one of them has been used in open spaces.

Figure 2.23: Earthbag Building Project in Healesville High School
(Source: http://www.ecoss.org.au/archive/programs-and-projects/cultural-homes-of-the-world)

2.3.3.5 Earthship

In the mid-1970s, Architect Michael Reynolds(2012) designed the first, as he called Earthship. Earthship is built from used automobile tires, rammed with earth and then coated in earth plaster. It is an alternative building method by using recycled materials. Each Earthship is built just below the ground level for heating and energy efficiency reasons. The tires are either laid on compacted subsoil or a foundation. Earthship has so many similarities with Rammed earth.

In one case it is used automobile tires instead of stiff flatforms for masonry. That is why they are called "*Rammed earth tire"*(Reynolds.2012).

The structure of the specific method is done as follows: First, each of the tires should be placed at its final point and then can be filled up with dirt and then compressed with the help of a hammer. A single tire can hold up to 150 Kg. The next tire is packed in line and then a second row is placed on top of it in a pattern. It can carry large loads and can be fire resistant.

It can reach up to eight rows to make up a wall. When the wall is finished then it is plastered with either mud or cement stucco. Only 45% of the materials used are Recyclable (cans, glass bottles, cement stucco, tires) (Guelberth et al.2002).

Because our Research has to do with the use of NaMa in Urban Open Spaces (playgrounds), we will not be expanding to further details about this technique.

An example of the use of the Earthship method it will be presented below:

In Healesville High School (Fig.2.23) students have participated in an Earthbag building through a voluntary project called ΄Home of the World'. Three houses were constructed one was with Earthship method, funded by The Andrews Foundation that would be current solutions in disaster areas that have a lot of Earthquake incidents.

2.3.4 Carbon footprint - Environmental Impact

Building Materials	Carbon Footprint (Kg CO_2 /Tone
Concrete blocks	**143**
Cob /clay	**22**
Strawbale	**10**

Table 3: Embodied Carbon of Building Materials. [51]

Cob has a significantly lower Carbon Footprint (CaF)than the concrete blocks, as shown in the table above. Since the ingredients of the CaF can be taken directly from where we are and there is no need of processing, they are able to have a low CaF. Straw bales are those that have the lowest CaF, either from the Cob or the Concrete.

Cob and all the above-mentioned earth materials have a clear advantage over other traditional/conventional building materials in terms of the Environmental Impact Assessment (EA). All of these earth materials are better in embodied carbon released. [52]

[51] https://sustain.ubc.ca/sites/sustain.ubc.ca/files/seedslibrary/APSC262_Project07%20UBC%20farm%20cob%20and%20straw_Team01.pdf_Naoko.pdf

[52] https://sustain.ubc.ca/sites/sustain.ubc.ca/files/seedslibrary/APSC262_Project07%20UBC%20farm%20cob%20and%20straw_Team01.pdf_Naoko.pdf

2.3.5 Bioclimatic behavior

A characteristic feature of this material is the low thermal conductivity due to the large mass of walls and high thermal efficiency.

In particular, clay absorbs and then releases the thermal energy slowly. In addition, in districts where the climate is dry, the summer days are hot while the temperature is falling in the evening. As a result, in the evening, all of the heat absorbed by the earth during the day is re-emitted into the interior of the structure. Correspondingly, the cold of the night is stored on the walls and smoothed with the innermost temperature of the structure during the day.

In the case of using this method in playgrounds, you can create ideal temperature conditions for play and explore Nature.

The behavior of this material is more pronounced for areas where the temperature changes sharply at night in relation to the day as in the desert.

The ideal thickness for clay varies depending on many factors such as the height of sea level, latitude, temperature, and precipitation (Snell.2009).

2.3.6 Costs[53]

Materials from the earth such as clay have the lowest energy consumption for their production as building materials.

Cob is a recyclable material as it can be dissolved and incorporated into the Natural environment. Mud bricks (Adobe) are sun-dried, another source of unlimited energy. Therefore, the greatest cost to such constructions is due to the workforce.

After a study at the University of Kassel by Professor Gernot Minke(2012), he proved that soil-derived materials consume only *1%* of the energy needed to produce manufactured materials, e.g. concrete.

A further reason for the choice of clay for our structure, apart from its high energy efficiency and low maintenance costs, is its ecological benefit due to its low energy consumption during its production.

Clay is in principle dense and heavy. It is clearly in the category of heat-insulating and not heat-insulating materials.

The clay in relation to all other heat-insulating materials has an extraordinary advantage. It is a material cooperative to modifications and adaptations of the thermal characteristics as dictated by the climate of each site to achieve maximum Energy savings at the lowest possible cost.

2.3.7 Level of maintenance

In the first days of construction, it is quite important that the mud bricks (Adobe)/Cob are in a shady place, for not losing their moisture.

Finally, after constructed we will have to wait for 30 days until they are completely dry and ready for use. Clay method does not require any special maintenance.

A structure of Cob can survive for centuries as have shown examples of construction. It is suggested annually to be plastered outside and inside the construction before the rain seasons.

[53] http://eartharchitecture.org/?cat=31 / Gernot Minke Walter de Gruyter GmbH.2012.Building with Earth : Design and Technology of a Sustainable Architecture. https://archive.org/stream/Gernot_Minke-Building_With_Earth/Gernot_Minke-Building_With_Earth_djvu.txt

2.3.8 Advantages and Disadvantages of using Earth [54]

COB

Advantages

- Thermal inertia
- They are breathable and have no dampness inside
- The CO_2 of a Cob house is almost nil compared to concrete and other structures(See above Subchapter 2.3.4)
- Ecological and Recyclable material
- Environmental friendly with Minimal Impact on the Environment
- Aesthetically beautiful as they coalesce well with the Surrounding Landscape
- Affordable due to the low cost of material and construction
- Energy-efficient
- No specific technical equipment is required
- Built from locally sourced Natural building materials
- Freedom of design
- Durable and long-lasting construction
- Fireproof and Earthquake proof
- Free from toxic emissions

Disadvantages

- Unsuitable overly sandy soils and excessively clayey
- Protection from rain and Humidity
- Problematic soil behavior in the Earthquake –tensile action
- It needs a lot of Space to be built.
- Bearing capacity and the Seismic Resistance of masonry is small.

[54] http://www.homecrux.com/cob-house-cost-why-cob-house/97115/

2.4 Wood[55] as a basic material of Natural playgrounds

2.4.1 Definition

Figure 2.24: Wood, basic material in play spaces (Source: www.pinterest.com)

Wood is a porous and fibrous structural tissue found in the stems and roots of trees and other woody plants.

It is a Natural composite of cellulose fibers that are strong in tension and embedded in a matrix of lignin that resists compression. Wood is sometimes defined as only the secondary xylem in the stems of trees, or it is defined more broadly to include the same type of tissue elsewhere such as in the roots of trees or shrubs.

Trees consist of six main layers: the outer bark, the inner bark, the cambium sapwood, heartwood, and the heart or pith. It also conveys water and nutrients between the leaves, other growing tissues, and the roots. Wood may also refer to other plant materials with comparable properties, and to material engineered from wood, or wood chips or fiber.

Wood is the most familiar Renewable material that is used all across the World. However responsible forestry provides multiple replanting when any wood felled. But it takes many years for trees to grow. It cannot be replaced as quickly as other materials such as bamboo that we will mention along the way.

Wood has been used for thousands of years for fuel, as a construction material, paper, for making tools, furniture, play equipment, and many others. Wood should be considered as one of the most valuable resources on the Planet. [56]

In the manufacture of play equipment wood was not used till the late 1960s. The first wooden play structures had little or no color at all (Hendricks.2011).

2.4.2 Ways of wood constructions in Outdoor Urban Spaces

Wood is nowadays one of the most common materials that is used for playground equipment. Most playground sets are made from wood.

There are a lot of benefits of using this material in a play area. One of them is Safety.

[55] https://www.mypowellrivernow.com/4941/wood-study-taking-place-vancouver-island/

[56] https://en.wikipedia.org/wiki/Wood

Wood is one of the most stable materials by providing a safe play Environment.It can withstand in different weather conditions.

Also, it can be either prestained or in its physical form. When it is prestained it can prevent injuries from getting cuts or splinters.

There are plenty of forms that wood can have in the playground area.
On the one hand can be used for improving the GMS(Gross Motor skills), by balancing, climbing, crawling etc (see below Fig.2.25).

Figure 2.25: Wooden playground sets for balancing, climbing, crawling etc.(Source: https://gr.pinterest.com)

On the other hand, can improve the Cognitive skills by learning, imagining, creating through their play environment.

Along the way, we see interesting examples of how wood has been transformed into a playground area. Like in the case of the Dragon Playground (see below Fig.2.26) located in Berlin created by Pro Garten Landschaft Architektur.

Figure 2.26: Dragon Playground in Berlin by Pro Garten Landschaft Architektur. The wood used was Black locust Oak.(Source: http://www.progarten-berlin.de/index.php?article_id=18)

Or in the case of the Monstrum Group based in Copenhagen. They create play spaces that are mainly based on stories or as a major factor in the culture of the area where the playground is to be built. All of their playgrounds are a dynamic Environment that invites kids to explore and learn multi-sensory experiences.

Figure 2.27: Cargoship in Sweden n Höganäs and Bramley Playground, Copenhagen by Monstrum
(Source : http://monstrum.dk/)

Other uses of wood in an Open Urban Play Area are unlimited. The material can be used for the construction of landscape borders (fences), benches, pathways, small bridges and many more.

Just have imagination and always think of the benefits that can have in child developmental needs.

Figure 2.28: Uses of wood in Open Urban Areas (Source : https://gr.pinterest.com)

2.4.3 Carbon footprint – Environmental impacts

Trees absorb CO_2 from the atmosphere and convert it into oxygen through the process of photosynthesis and later on break down the CO_2 into carbon that is sequestered in the wood, leaves, soil etc (Kutnar.2016). Investigations have shown that the total area of forest worldwide has decreased all these years.

In the case of wooden structures in Outdoor Urban Spaces, the carbon is kept out of the atmosphere for the lifetime of the structure— it is longer if the wood is reclaimed at the end of the structure´s life and re-used into other products.

Another aspect of wood's light Carbon Footprint (CaF) is the fact that wood as a material requires less energy to manufacture than other building materials(steel, concrete etc.), and most of that comes from renewable biomass (like in the case of bamboo that we will talk at the next subchapter) instead of fossil fuels.

2.4.4 Costs

Cedar and redwood are the most commonly selected wood for outdoor swing sets. These woods are known for being Naturally resistant to disease, rot, and insect infestation. These woods are also stable, need low maintenance and are affordable.

In terms of costs of wood differ on many factors. Depends on the playground set design, the transportation, the climate of the region, the size of construction, the maintenance and many more. Initial price can start from 700€ and prices can reach up to 15.000-20.000 € and more.[57]

2.4.5 Level of maintenance

A variety of wooden play equipment is built to last for a long time. However, they require a certain level of maintenance to remain in good condition and be kept operational.
It is obligatory playgrounds to be controlled regularly. Inspectors have to check everything that is in order, check of the wood for any signs of wood of mild splintering.
Overall, the maintenance process is not very time consuming and can help extend their LCA(LCA).

2.4.6 Advantages and Disadvantages of using Wood [58]

Advantages of wood

- Wood is relatively lightweight and unlike other materials, it is easy to cut.
- It is an organic, absorbent material.
- It is easy to handle the material and add decorative elements to the wood structures to increase curb appeal.
- It has good thermal, acoustic, mechanical, aesthetic properties.
- Relatively inexpensive.
- It can cooperate quite well with other NaMa.

Disadvantages of Wood

- It is vulnerable to water damage (Moisture)
- It is not fire-resistant (easily catches fire)
- It is vulnerable to insects(Termites)
- It is less Environmentally Sustainable choice than other Natural/green materials that we have mentioned on this Part of the Thesis.

[57] https://www.recunlimited.com/blog/woodplay-vs-cedarworks-playsets/
[58] https://www.quora.com/What-are-the-advantages-and-disadvantages-of-wood

2.5 Bamboo as a material for structures in the Natural Playgrounds

Figure 2.29: Bamboo as a construction material for playgrounds
(Source: http://jurassicpark.wikia.com/wiki/Bamboo_Forest)

2.5.1 Definition

Bamboo is an evergreen perennial flowering plant like rice, corn and sugar cane. Different to these, the lignin of its tissues becomes after some years a structure as hard as wood, but more flexible and lighter. The word Bamboo comes from the Kannada term *Bambu*, which was introduced to English through Indonesian and Malay. It belongs to the subfamily Bambusoideae of the grass family Poaceae which grows up all over tropical and part of subtropical regions of the world in more than 1250 species[59].

Unlike trees, bamboo culms emerge from the ground at their full diameter and can grow to their full height in a period of three to four months. Bamboos then are ready for harvest and appropriate for use in construction within three to seven years.

Bamboo contains a large quantity of starch, which attracts insects. Also, the presence of humidity can cause the appearance of fungus and lichens. So, it is important to take into consideration good procedures for cutting, drying, and treatment before use.

Bamboo is one of the fastest growing plants on Earth, due to a unique rhizome-dependent system. Its growth rate ranges from *30cm to 1m in 24 hours*(Gernot.2016). It is an ideal Renewable material.

Bamboos, in their wild form, grow on all of the continents but it is not widely being used in Europe since it should be imported. It is remarkable that Bamboo can survive temperatures as low as -29ºC. So it can withstand perfectly in countries like Germany, Sweden, etc.

The best bamboo product for building in Europe and in the USA is *Guadua angustifolia Kunth* which grows in Colombia (Gernot.2016).

[59] https://en.wikipedia.org/wiki/Bamboo

Bamboo has been in wide usage since ancient times, in countries like Japan and China, as a low-cost construction material for houses, flooring, bridges, furniture, instruments, food source, play equipment etc

2.5.2 Design and construction of the material

Bamboo is a type of plant that has been used in many ways of construction, due to its tensile strength, such as bridges, dams, scaffolding, house construction, etc.

Bamboo is a Natural material that has been used as a construction material with countries of South/East Asia, South Pacific and Central America.

In Hong Kong particularly, bamboo is being used as scaffolding for skyscrapers. In Japan, it is being used as fencing or decorative element such as fountains.

It has high mechanical resistance, low specific weight and easy to work with the material.

Because of the elasticity of the material arches can be easily created by forcing the bamboo´s growth into the form you want. Something that wood is not able to do. Bamboo can be cut into sheets and planks. And after a procedure of boiling and drying, they can later be used as for flooring, furniture etc.

After a lot of researches for the protection of the material from insects and rot is being found a mixture of "*borax*"[60] and boric acid.

There have been given three ISO Standards for Bamboo as a construction material. [61]

2.5.3 Ways of using Bamboo in Outdoor Urban Spaces

Bamboo like wood is a Natural composite material with high strength to weight ratio useful for structures. Bamboo has a higher compressive than wood. It is perfect for Sustainable construction.

In the process of this subchapter, reference will be made for a different kind of Bamboo uses in the playground areas.

2.5.3.1 Bamboo Fences

Bamboos have been used in various ways since ancient times. Thin Bamboo poles have been inserted into the ground, interlaced with horizontal Bamboo used as partitions to form Bamboo fences.

Species of Bamboo fences are being found throughout the world. Foundings of Bamboo that are of high quality exist in Asia(especially China and Japan).

[60] Borax: is wholly natural and has no inherently toxic ingredients. It doesn't cause cancer, accumulate in the body or in nature, or absorb through the skin. Borax is not harmful to the body or the environment with normal, external usage any more than salt or baking soda is.

[61] Gernot Minke.2016.Building with Bamboo: Design and Technology of a Sustainable Architecture .Second and revised edition

Bamboo fences can bring an exotic sense to the playground area. There is a range of different types of bamboo fences. Some dated from 1202.

It is worth mentioning that in Japan, until a decade they were re-building Bamboo fences as a preparation before New Years. The freshly cut new Bamboo for forming fences represents a new fresh Beginning for the New Year.

Even though their construction has been decreased in recent years there are still builders who construct like in the old days.

There is a variety of Bamboo fences, here it will be mentioned shortly the most interesting forms of Bamboo fences. These are :

- Kenninji fence
- Ginkakuji fence
- Shimizu fence
- Tokusa fence
- Teppo fence
- Nanzenji fence
- Bush Clover fence
- Katsura fence
- Bamboo branch fence (Bamboo used is made of stouter branches)
- Raincoat fence
- Numazu fence
- **Four-eyed fence** (Reference will be made below about this form)
- Kinkakuju fence
- Stockade fence
- Ryuanji fence
- Koetsu fence
- **Nanako fence** (Reference will be made below about this form)

Two forms of Bamboo fences we found interesting and are easy to build –even if you are not an expert.

First is the Four-eyed Bamboo fence which is one of the most typical and commonly used forms of Bamboo fence in Japan. There are four horizontal frame poles attached to the posts,vertical poles are attached alternately in front and behind of the horizontal frame (see Fig.2.30).

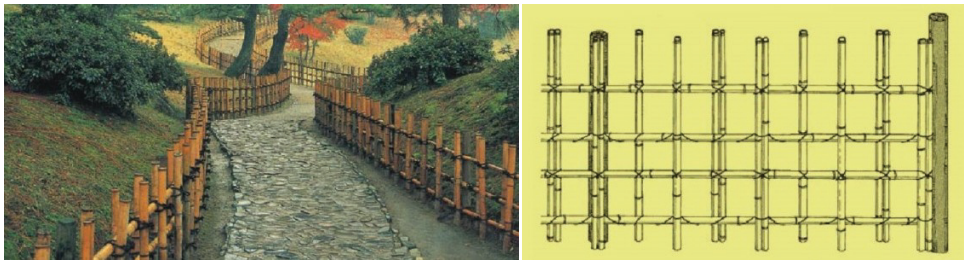


Figure 2.30: Four-eyed fence form, a sketch (Source: Yoshikawa.2009.70-79)

A second interesting form of Bamboo fence is made by curving Finley showed pieces of Bamboo and then there are being inserted into the ground. One of the simplest forms of fencing with Bamboo. It can be moveable since the bamboo pieces are inserted into the base (see Fig.2.31) (Yoshikawa.2009).

Figure 2.31: Type of bamboo fence –Nanako (Source: Yoshikawa Isao. Suzuki Osamu.2009. Bamboo fences.Princeton Architectural Press. Pp106-7)

2.5.3.2 Bamboo musical instruments

Figure 2.32: Bamboo musical instruments placed in Urban Open Areas (Source: www.pinterest.com / Personal Archive)

The installation of a Bamboo musical instrument in playgrounds offers nothing more than benefits. Bamboo is a sustainable natural material and cost-effective. The sounds coming out when you play are unique.

I repeat the quotes by Michelle Lazar [62] for I have seen no other statement that so appropriately introduces the need for Music in the Outdoor Play Areas: *" Music can be characterized by how it heals……. Although the power range and effectiveness of music as a healing tool have many variables there are certain traits that are Universal…. Music therapy improves the quality of life of children with special needs".* Bamboo musical instruments can be a wonderful addition in the Natural playgrounds and can have a positive impact.

Children can only be benefited from the Bamboo musical instruments and any other instrument made from natural or recycled materials. They can stimulate their senses and cultivate their personalities.

There are various benefits of using Music in the playgrounds. Some of them are the following:

- Music maintains attention

[62] https://www.accessibleplayground.net/2012/03/26/benefits-of-music-on-the-playground/

- Music supports and encourages children and adults to move.
- Music can help with memorizing
- Music brings you emotions and activates all of your senses
- Music can motivate children
- Music can be an aid to the fine motor, cognitive, social, intellectual and physical skills of children.
- Music play on the play areas can give children the opportunity to explore, discover, experience new things and learn from it.

Bamboo musical instruments are addressed to everyone. This is a key concept that in most cases is missing when designing and determining what is to offer on a playground. Music brings people together. Children become more social. No matter where are you from what language you speak, you can always communicate with sounds and movements. Maybe the installation of musical instruments made of bamboo or other natural materials can be the new meeting point on playgrounds instead of the swings area which is for decades the number one meeting point on a playground.

It is worth mentioning that Bamboo musical instruments do not cost as much as the ones made of steel. The prices of Steel musical equipment[63] can start from 300 and may reach 8.000 euros or more for installing a musical equipment. So, this becomes harder to be chosen as an essential element on the playgrounds because of the limitations of budegeting, since budget is one of the most important factors of a playground project. Then, Bamboo musical instruments can take their place. It will not be the same sounds and acoustics but it can be an alternative, affordable solution.

2.5.3.3 Kindergarten Classroom of Green School at Green Village[64& 65]

There is an alternative, sustainable Kindergarten Classroom built in Ayung River, Bali , all made of bamboo material. More specifically it is located in Sibang Kaja.

Special features of the project are the following: There is a central bamboo column that supports the whole structure-with a skylight in the center. The project was completed in 2008. Architects of the project were IBUKU team.

A unique characteristic of the structure is that the building has no walls and no doors. There is only a bamboo arch in the middle of the classroom for entering.

[63] https://www.percussionplay.com/

[64] https://www.archdaily.com/886235/kindergarten-classroom-at-green-school-ibuku
[65] https://www.archdaily.com/886235/kindergarten-classroom-at-green-school-ibuku/5a43ec41b22e387399000026-kindergarten-classroom-at-green-school-ibuku-image

The key role of the skylight that is in the roof functions as a passage for realising the light from above during the day. John Hardy, founder of the Green Village co-oparated with Jörg Stamm, a German structural carpenter, to design and build the Kindergarten.

The Kindergarten is part of a Green Village Community in Bali, Indonesia.

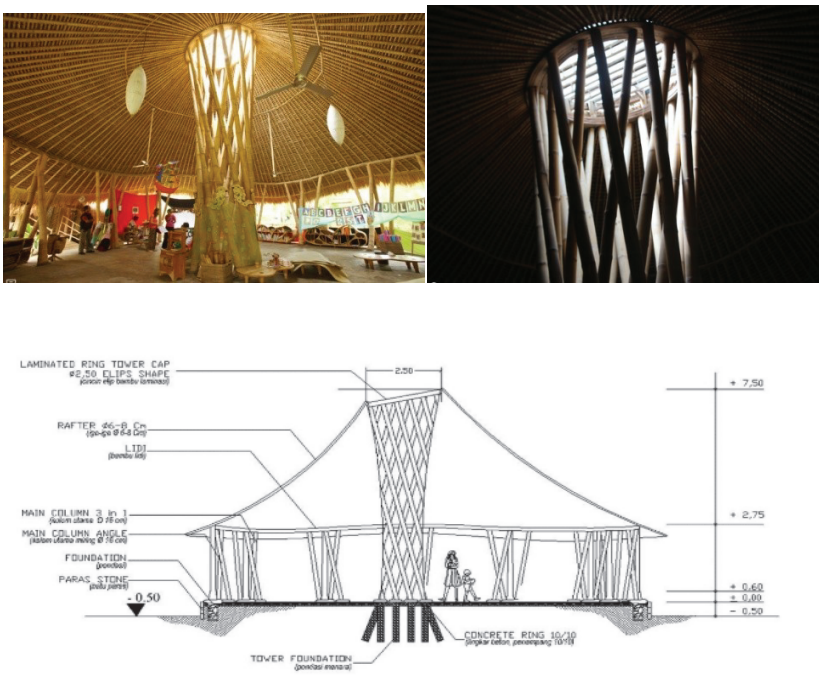


Figure 2.33: Kindergarten Classroom of Green School at Green Village, Bali, Indonesia

(Source: https://www.archdaily.com/886235/kindergarten-classroom-at-green-school-ibuku)

2.5.4 Carbon footprint – Environmental impacts

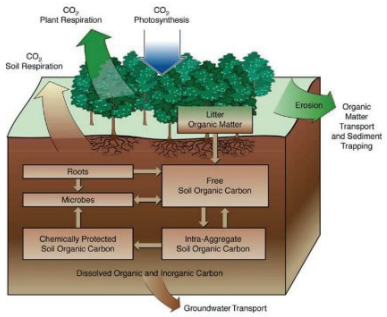


Figure 2.34: Carbon Cycle of Bamboo (Source: MOSO International BV[66])

Plants like bamboo that absorb CO_2 through photosynthesis make an important junction to the Climate. The stored Carbon uptake through photosynthesis may be re-emitted. CO_2 is locked in the material during the use phase. Because of its fast growth Bamboos can absorb more CO_2 than a tree does.

The difference between wood and bamboo is that wood has a higher standing volume on plantation whilst Bamboo has a higher yield.CO_2 of Bamboo is neutral over the full Life Cycle Assessment (LCA)[67].

Scientific studies have shown that Guadua angustifolia, for example, has the capacity to capture till 149.9 tons of CO_2. It produces 5,8 tons more biomass than other Forest species.

As for the Environmental Impacts of Bamboo it is worth noting that Bamboo forests have surprising Environmental benefits because the function as carbon sinks, produce oxygen, control soil erosion, provide organic matter, regulate water levels and used as an alternative of water pollution solution through the Root Zone Method (RZM), and contribute to the purification and regulation of the Environment.[68]

2.5.5 Costs

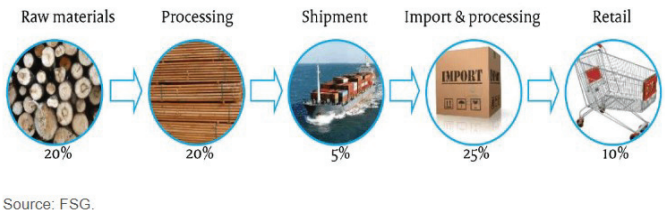


Figure 2.35: Price breakdown of value-added Bamboo products imported to Europe
(Source: https://www.cbi.eu/market-information/timber-products/value-added-bamboo-products/

[66] https://www.researchgate.net/publication/318012915_Carbon_footprint_of_bamboo_particles_rice_husk_and_wood_shavings-cement_composites
[67] https://www.researchgate.net/publication/318012915_Carbon_footprint_of_bamboo_particles_rice_husk_and_wood_shavings-cement_composites
[68] https://www.guaduabamboo.com/guadua/environmental-impact-of-guadua-bamboo

There are many factors that influence the cost of bamboo products/ structures. May have to do with durability, sustainability, innovative design, a combination of other materials, the appearance of the bamboo, consistency. Also it depends on the size of the material,the pretreatment process that has the material been submitted,shipment,import the material when it is not available in the area when the construction is to be made, different species of Bamboo(there are more than 1250 but not all are appropriate for construction), different zone range.

For example, for Zone 8 USDA, the Phyllostachys Angusta "*Stone Bamboo*[69]" costs for 1-3 feet height(0.3-0.9 meters height) approximately 26€ and up to 30 feet tall (9,00meters) can cost till 250-300 €.

2.5.6 Level of maintenance[70]

Through the recommendations of the experts of the field, it is disclosed that Bamboos can be planted at any time of the year in areas with mild climates or in colder climates.

But in the case of planting in a cold climate, bamboos should be planted outdoors a bit earlier so it can harden off enough to survive the first winter of the area.

If bamboo is planted late in the year, it is recommended to put heavy mulch to the plant for protection from wind and rain. On the other hand, in warm/ hot climates it is recommended to plant bamboo in Fall or Spring.

One of the most impressive things about Bamboo is the superabundant Growth of the new shoots each spring. Fargesia and Thamnocalamus are the hardest types of Bamboos.

At the beginning of spring, it should be placed fertilizer(either high nitrogen or lawn fertilizer or organic fertilizer)on Bamboo plant and repeat once again in the summer period.

Newly planted bamboos need frequent watering that is why it is preferable to get them from the nursery when bamboos have matured enough.

Bamboos like all the other plants need pruning to be maintained. As far groundcover bamboos can be clear at the end of the winter with shears or a mower.

2.5.7 Advantages and Disadvantages of using Bamboo (Gernot.2016 / Kutnar.2016)

Advantages

- Bamboo is a light construction material.
- It is a flexible material and can take a lot of forms due to its elasticity.
- It is cost effective.
- It is earthquake resistant, it has high tensile strength.
- It is one of the fastest growing plants.
- After four to six years can be harvested and used for a structural material.

[69] http://www.bamboogarden.com/price.htm

[70] http://bamboogarden.com/care.htm

- The yield of Bamboo is 3.3 times more in comparison with Wood.
- It has a low ecological footprint.
- Offers sustainability and abundant availability.
- Environmental Friendly.
- Durable and hardwearing.
- Biomass Production
- Reduction of Soil Erosion
- Water Retention
- Regulation of Hydraulic Flow
- Temperature Reduction
- Easy to look after (Low Maintenance)
- Variety of different color and style options.
- Hygienic

Disadvantages

- Bamboo is vulnerable when exposed in rain
- It has to be stored and protected properly from the rain.
- It is vulnerable to attack from insects and fungus.
- Cutting and transportations are low but in the case of import, the costs are higher.
- They do not exist official Regulations (in Europe).
- Bamboo is not a Certified construction material in Europe and Building control Authorities should consider it as a suitable construction material.
- Because of its round section and the tendency to crack easy, this complicates the execution of joints and supports.
- It varies in Size and Quality. Quality control becomes more complex when there are more than 1250 Bamboo species with different mechanical properties.

2.6 Rainwater Management in the use of play spaces [71] & [72]

Stormwater management in urban areas is becoming a necessity for seeking further reductions in pollution in our waterways.

Stormwater is water from rain. It flows from rooftops over the pavements and goes to the soil and lawn before it reaches a bank of river or stream.

The quality of runoff is affected by a variety of factors and depends on the season and the local meteorology. The big problem is, that as it flows collects a variety of waste materials on its way. Movement of this stormwater across the soil can cause soil erosion.

By harvesting the rainfall and storing it, then it can slowly be released the water back into the soil, either through irrigation or direct application. That is the process of *Rainwater Harvesting*.

In many developed countries is one of the ways of collecting water for drinking, for irrigation, for watering the animals, for watering the plants etc.

[71] https://en.wikipedia.org/wiki/Rainwater_harvesting
[72] https://rainwaterharvesting.tamu.edu/stormwater-management/

Advantages

- Rainwater harvesting from roofs and local institutions can make an impact on the availability of drinking water.
- Can supplement the subsoil water level and improve urban greenery.
- It is a cost-effective approach.
- It can mitigate flooding.

Disadvantages

- Related cost
- Seasonal variation

Another way of benefit from rainwater is the creation of a **Rain garden**[73]. It is one of the wide varieties of soil absorption systems. It is depression storage or a planted hole that allows rainwater runoff till it can infiltrate the soil.
A rain garden is an approach to rainwater harvesting that can prevent flooding and erosion. There are usually planted with native vegetation (wildflowers, ferns, shrubs, small trees etc.) that is hardy and eye-catching.
The basic purpose of a rain garden is to improve water quality in nearby bodies of water and that rainwater can become available for plants as groundwater.
Most of the Rain gardens are designed to be the endpoint of drainage. Improve water quality by filtering runoff and are aesthetically pleasing.

Figure 2.36: Rain Garden (Source : https://www.groundwater.org/action/home/raingardens.html)

2.7 Selection of suitable plants and trees for Natural Playgrounds

Introduction

When designing or planning a playground, it is necessary to take into account which environmental features/elements to select for the children´s play experiences.
Researches (Macmillan.2008) carried out during the years show that children use vegetation as a basic asset for creating their own playing in Nature.

Plants stimulate all of the senses: touch, eyesight, taste, smell and hearing so it is the perfect element for all Age groups to learn at their play areas everything about plants.

[73] https://en.wikipedia.org/wiki/Rain_garden

Plants can be easily converted into a play synthesis with their amendments of the sun, the shadows, the wind, the change of their color every season, their texture and most importantly their fragrance. As Vicki L. Stoecklin[74] rightly stated: *"Everything is a matter of senses. The best structures and all the educational formulations produced by the best educators in the world,*
they cannot replace how a child feels when he slips on the sand or when his hands are soiled by the mud, but neither can the moment of the mud the child's attention lies entirely in the glow of sunlight from the leaves, butterfly sight, or an ant colony".
Nicholson(1971:5-14) tested through observations that children prefer to be in contact with the Natural environment, with NaMa/elements, gravity, smells so they can learn to discover and explore with it. The connection with Nature can be beneficial even more vital for their health. And most importantly that plants are an invaluable resource for child development.

As designers, we are obliged to provide play opportunities to the children. This can be achieved by selecting the right planting in Outdoor Play Spaces.

A selection of plants that attract wildlife it can be educational as the children, while playing in playgrounds, observe birds, snails, butterflies, insects and learn about their Natural environment and what is included.

As Roger Hart (1973:69)explained in an article in Natural History by: *"The Natural environment offers a wealth of play potential for young children, with trees and water being the most important elements for play. One tree can engage a child for days at a time or periodically over a span of years. Manufacturers have founded impossible to recreate such richness".*

Plants can be designed into many different types of play settings and can, either individually, collectively or in combination with other elements, expand the sequence of play activities. Children can find amusing to collect parts of plants for their imaginative play, or climbing and playing hide and seek games behind them.

In combination with the other NaMa/ elements like Strawbale, clay, sand, rocks, water etc. plants can provide manipulative settings that are totally different from the static, fixed play structures.

Furthermore, plants can stimulate children´s imagination, discovery, and exploration of nature. There are some general guidelines (Macmillan et al.2008) which would be good to consider before proceeding with the construction of children´s outdoor spaces. These are the following:

- differ the size and the shape of the plants,
- differ the texture of leaves,
- the seasonal change
- fragrant plants
- plants that produce incredible sounds during winds(pine trees, bamboos etc.)
- Colorful trees

Plants are living materials used to define spaces and attract wildlife.

Plants can also block noises, can stabilize slopes and prevent soil erosion and offer protection from the desert, sun and the wind.

Nature increases the memory of the place, things, names, and qualities. Children, who come into contact with the environment and all the living things that surround it, (such as birds, animals, insects) observe how every animal lives, what they eat etc and have a direct influence with wildlife.

[74] **https://www.live-learn.org/resources/teachers/A_Sense_of_Place_Conference/Biophilia.pdf**

In a play area, children notice and compare their height with the height of the plants and trees. They can recognize the passing of the seasons from the different color of the leaves or when the leaves fall or when they bloom.

Deciduous trees such as birch and sallow(goat willow) are popular as climbing trees and well known for construction play (for example huts and shelters).

Small trees or shrubs are appropriate for building in and use their branches as play items and construct things. Also, elements such as rocks, water features work as landmarks.

The role of plants in the playgrounds, should not be only for aesthetic reasons but used as a game of exploration space and a variety of other play resources of their surroundings.
Moreover, plants that have fruits, seeds are attracted by butterflies, birds, insects, all of which charm the kids and create an imaginative play.

Since the overall plan of the play area is, however, pleasant and attracts children to play then it is really important for the community.

What else might be of value is that shade is the most important factor of a playground. This can be done with the correct selection of trees, especially deciduous trees and shrubs, which provide shade and protect against weather conditions such as heavy rains or strong winds.

Another important factor is the selection of native plants. The reason is that they are key components of the ecological and cultural heritage of the region.

There will be no exclusion of children with difficulties to enjoy nature, the plants. A variety of plants that can activate the senses of touch, taste, smell, and hearing can offer joy and fun and an educational nature.

As a first step, a List of Suitable Plants/Trees For Play Areas have been developed for purposes of play, relaxation, wildlife, habitat and shade quality in the play areas (see Appendix B) pp.
It is worth mentioning that it is appropriate to evaluate the existing planting in children´s outdoor spaces before selecting or developing a new design.

Vegetation plays a major role in improving the landscape and living. As well as, it will provide shade, prevents erosion, unifies the settlement, and enables daily contact with the Natural element. Deciduous species are best able to use the seasonal pattern of strong alternation between cold winters and warm summers (Moore.1993).

The plants that were selected have as their main purpose their particular characteristics to be combined with play activities, recognition of seasonal changes, recognition of the senses and exploration of the living things. The types of trees and shrubs that were selected to represent every season so that all year long the play areas will be ergonomic, productive and functional. The types of trees and shrubs that were selected to represent every season so that all year long the play areas will be ergonomic, productive and functional.
Further, it will be presented below some charts of the plants as a sensor of eyesight, touch, taste, sound, and smell. Also, a selection of plants appropriates for play activities such as climbing, hiding places, swinging, educational /imaginative play and play props.

For a hypothetical outdoor play, space was selected 50 plants (trees, shrubs, perennials, ornamental grasses, herbaceous plants, Annuals and groundcovers, and vines).

From the bar chart below (Table 4) you could see that from the 50 plants selected, of which 30 were trees suitable for hiding, climbing, and swinging. Shrubs /perennial plants were 10 and can be appropriate for hiding places, play props or also imaginative and cognitive play. The rest of them were ornamental grasses or groundcovers and vines which are suitable for educational play.
Through play, you can learn about the seasonal changes, use your senses and explore the surrounding environment.

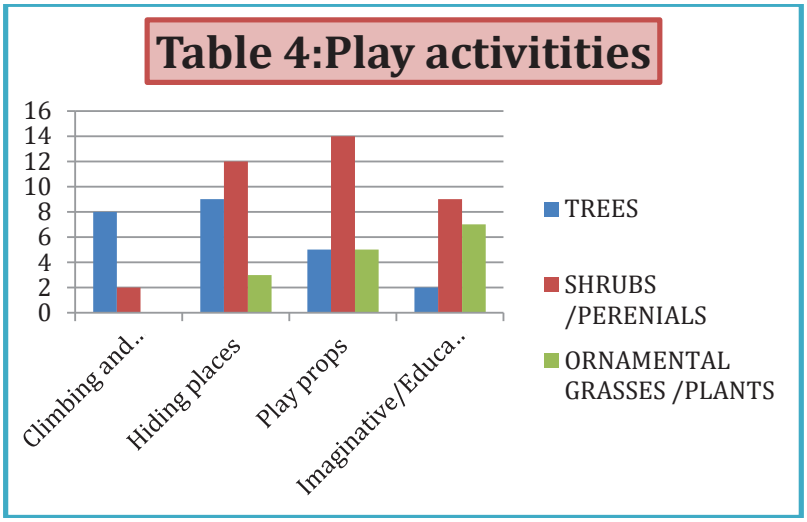


Table 4 : Play activities in combination with vegetation

Similarly, each plant that was personally selected it will be mentioned which emotions it represents. In other words, vegetation what senses it causes in children´s well-being.

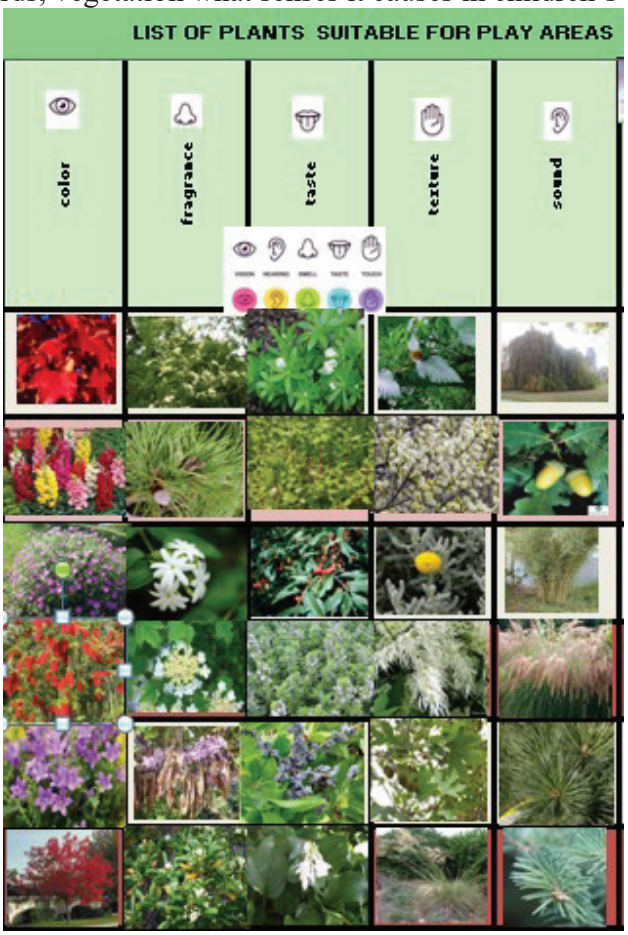


Table 5 : Summary table of plants that activate the five senses

Senses are the main source of all our knowledge of material external reality. We cannot know anything about the forms of matter or the forms of motion without our senses.

Subsequently ,in Table 5 above it shows a summary sample of our plant selection that activate the senses that will be analyzed in the process.

From Table 5 above you could see in the first column which plants should activate the sense of Vision. Either by their unique, intensive color in seasonal changes. Such as Acer rubrum that its leaves change color each Season by providing a beautiful result.Antirrhinum majus that has unique colors and an incredible shape that looks like the mouth of a dragon or dog and can easily activate the imagination in children.

Geranium sanguineum with different colors. Callistemon viminalis with an intensive red color and shape that looks like corn or any other form it can bring in a child´s mind.

Campanula portenschlagiana that has a nice purple color and its form look like an upside down bell that is why it is called campanula which in Greek means bell.

Pistacia chinensis with beautiful leave colors that are changing each season that can distract you.

As follows, in the second column of Table 5 are the plants that activate the smell.

Plants produce beautiful flowers with sometimes intensive fragrances and can activate immediately the sense of smell. They can also have leaves or fruits with a specific smell.

In the playground area, it is good to have many different scents. In this way, children will learn to recognize the diversity and uniqueness of each plant. The sense of smell function as an identifier and recalls memories of our life.

For example, Sophora Japonica is really fragrant and this can be captured in the memory of the child.

Pinus pinea has conical fragrant flowers. Jasminus officinale have a strong characteristic scented and should be considered to be placed in each playground. From this specific plant, I remember my childhood playing.

Next in line is Viburnum Opulus with a beautiful smell and a shape that looks like snowflakes and this can activate the creativity of the children.

Cercis siliquastrum has a soft fragrance and it can be also used as a play prop.

Pittosporum tobira is very fragrant in terminal groups.

Children will then be able to recognize on their own what is the particular plant and what impact had in their emotions.

Next in line is the sense of taste. It is really important for children to recognize which plants are edible. As children explore the environment want to taste everything that surrounds it. That includes the fruits, the leaves and the seeds of the plants. So you should be really careful as a designer of the playground what kind of trees to choose for your playground design.

Through their exploration of the plants they will analyze:

the showy taste of the fruits from Hosta Plataginea or Galium odoratum, Myrica Pensylvanica(Bayberry), Crataegus Laevigata, Cornus alba or The unique smell and taste of Thymus citriodorus.

Evidence show that all children love to interact with parts of the plants such as leaves and branches, different shapes and other physical phenomena to learn their Natural environment.

So, the sense of touch is one of the basic senses for the children as they learn in this way the different texture of the leaves.

Texture usually refers to the overall size of the leaves so textural sizes are relative to one another.

Ornamental grasses have narrow, fine-textured leaves (such as Acer rubrum, Antirrhinum majus). Others have medium textured leaves (Quercus robur). Large Hosta leaves are considered coarse textured.Due to the high contrast, coarse-textured plants attract the eyes and tend to hold it. Plants with coarse texture have features like thick branches, large leaves, and/or unique, bold features (irregular shapes, bold veins, variegated colors, etc). A coarse texture can give a space a smaller feel if applied to the perimeter of a space (such as Hosta plataginea, Platanus acerifolia, Platanus occidentalis, Pennisetum setaceum).

Texture can also refer to the smoothness(such as Santolina chamaecyparissus, Salix caprea) or roughness(Stipa Gigantea, Picea glauca, Thuja orientalis, Abies veitchii) on the surface each leaf. Alternatively, repeating similar leaf sizes and textures may provide a soothing or harmonious look.

The texture is not limited to foliage and can be found in flowers, blades, and bark of the plant, as well as in the plant's overall branching pattern (such as Teucrium chamaedrys, Phyllostachys aurea, Cercis siliquastrum).

Some leaves have thick juicy leaves, or needle-shaped and their arrangement are spiral (such as Pinus Pinea).

Last but not least is the sense of sound. When the wind blows in Autumn you can hear that trees produce a special sound that sounds like a melody.
Especially, Pinus pinea or Phyllostachys aurea produce a unique sound that interest children and the sounds they hear can be transformed into something else in their mind by using all their senses. Also, plants attract birds and insects so can activate at the same time the sense of seeing and hearing.

In addition, the selection of trees that are changing through the seasons is appropriate for the children to visualize the changing seasons.
From the bar chart below appears to be that deciduous trees are the aid of seasonal changes as the leaves of deciduous trees change color through the seasons (Acer rubrum, Platanus acerifolia) before they are shed in the fall.

In summer, the tree is thick with green leaves. A substance called chlorophyll colors the leaves green and helps the plant make food. During fall and winter, it is darker and the trees cannot make as much food. Children recognize all these changes during play and educate themselves.

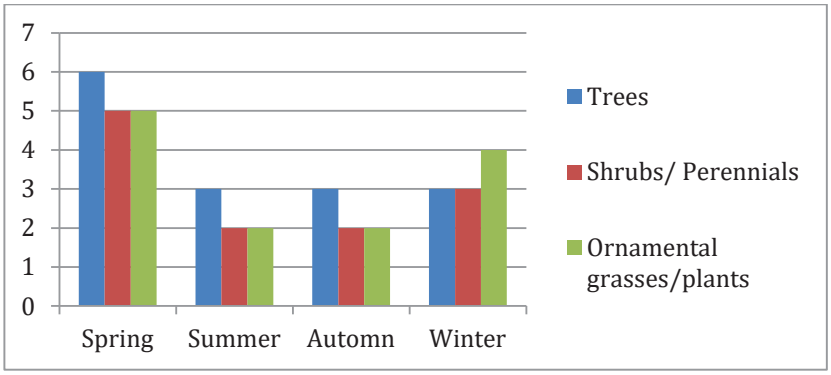


Table 6: Seasonal changes in Plants

2.7.1 Maintenance of plants and trees in play areas.

Over the years, some of the plants that are placed in playground areas are growing and maturing some aren´t. Others will require a replacement.

It is very important the right planning of plants so these plants will provide a wide range of activities for children to explore, imagine and play. Plants add a critical dimension of change and diversity to children´s environments.

A major problem in Playground areas is soil erosion.
The weather conditions and children at play can cause significant erosion on these sites. So we have to select the right plants that can help at this problem of erosion in playgrounds.

Low groundcovers or a Rain garden (as mentioned above in Subchapter 2.6) can help reduce erosion caused by water, wind and the feet of children, parents and whoever walks there.

Another coadjutor is the deciduous trees that can help in case of heavy rain or wind or ground surfaces with their large leaves and can stabilize soils on hillsides because of their roots.
When used as windbreaks, trees and shrubs can reduce erosion caused by strong winds.

For example, Cornus alba known as Tatarian dogwood is a tough shrub developing dense mats of roots.
Another example of a plant is Myrica Pensylvanica known as bayberry, which is an evergreen groundcover that shields the soil.

No matter what are the conditions, it is absolutely necessary to choose tough, drought-tolerant plants that can eliminate or reduce the need for watering.
On our list of plants suitable for play, areas were selected plants that need medium or low maintenance.
Because some plants have a deep root system and fuzzy leaves (Cotinus obovatus) that retain water and can survive in harsh conditions (Fagus sylvatica pendula).
Children can learn how drought-resistant native varieties of plants can adapt to local conditions and all about water conservation.

The choice of plants should be native and need to belong to the Hardiness zone of the region of playground construction. Thus, the specific plants can survive the local conditions.
Plants are selective for how much sun or wind can tolerate and have a specific soil type.

Therefore, the right choice of plants for the play area is an important factor for its subsequent evolution.

2.8 Combination of Seasons/senses and Natural Materials in the Play Areas

Natural playgrounds encourage children to use their imagination through play, while at the same time discovering the smells, the textures, the tastes and all the miracles of the Natural World.
In addition to the Outdoor Play, Spaces can be integrated into all teaching areas such as biology geology mathematics, physics etc.

Most of the activities can vary with the seasons and children can play different games at different times of the year. With peak periods of activity in May, June, August, and September.
Each season, each material should be connected.
In the rainy season, the playground remains quiet and most of the activities would be wet and unable to be used. Ideas of improving this are to be provided at the area shelters or even natural

shelters of earthbag or Cob and inside of the Natural playhouses should be a smaller play area similar to the one outside so in case of a bad weather you never stop playing.

The main idea of this adventurous Natural play Environment for children is to compare each NaMa with each Season and what Senses are triggered when you play and explore them.

In this Section (2), above were analyzed NaMa techniques and ways of using them in the outdoor play spaces.

Strawbale: to represent the *Spring Season*, after harvesting.

Cob: to represent the *Summer Season*.

Bamboo: to represent the *Autumn season*.

Earthbag: to represent *Winter Season* because of their resilience.

Most of the methods or even the materials are brand new to Designers, Architects, Landscape Architects and anyone that is involved in the Playground construction.

It is advisable each NaMa is placed in each selective Season on playgrounds. First, as an Exhibition to observe if these Play activities are approached by children, because for them also it will be something out of the ordinary. This could be done at Annual playground Exhibitions or Botanical Art Exhibitions for the introduction of the use of Nama in Outdoor Play Areas.

2.9 Summary of Part 2: Natural Materials in Playgrounds –An Overview

This research aims to change the way we are thinking when we construct/design an outdoor play space for children.

One of these ways to do that is by reducing the Carbon footprint (CaF) of the playgrounds of the big cities and to minimize the environmental impacts. Also reducing the energy of the materials(embodied energy) and the resources that we use by choosing alternative NaMa.

In this way, we have the opportunity to reduce the carbon emissions and also provide a healthier environment for children to play.

The majority of manufactured play structures use one or more of the following as the main construction materials: Wood, galvanized steel, aluminum. There are a few troubling aspects to the nature playground movement.

Our study´s work attempt would be to reconsider which materials designers choose for the construction of their play area and what other alternative solutions exist that can replace or coexist in the same play environment.

Nowadays, our need to find new materials/ new ways in the landscaping development site to partially replace the non-environmentally friendly materials is constantly increasing.

At this Section of our Research was introduced some of the NaMa and methods that exist and have been used in the construction sector. They can either be combined or work individually. The participation of craftsmen in the construction of the playspaces is advisable or in some cases required so that there is an element of originality and locality. If we cooperated with all the specialized craftsmen who are specified in the construction and creation of Natural constructions the result could be only profitable.

But as far as it is concerned the Safety Requirements, the advisory service and the control by the competent body are needed so they can be done some changes or corrections or even additions to the existing Children´s playground Laws.

Many existing playgrounds can be renovated or can be reconstructed by using these methods /materials which we studied in this Section. Thus, opening the way to new possibilities of

environmental benefits in terms of less pollution, less energy used and having better and healthier outdoor play spaces.

Another important factor in the development of playgrounds is vegetation which serves a unique and essential role.

SECTION 3

3.1 Cases of Natural Playgrounds in the Regions of Mecklenburg Vorpommern(MV) and Brandenburg (BB).

In this part of our thesis it will be referenced cases of Playgrounds in the regions of Mecklenburg Vorpommern and Brandenburg that had been used NaMa to be build or have a distinctive feature that distinguishes them from the others. The choice of playgrounds for the MV and BB area is our own personal opinion and approach.

In the area where we are located (NB), there are some interesting examples of playgrounds, which have as their main focus to provide entertainment, fun, exploration, and imagination through play.

Main Natural materials that were used in these playgrounds was wood and water as an element.

3.1.1 Hafenspielplatz (Harbor Playground) in Greifswald

Figure 3.1: Hafenspielplatz (Harbor Playground) in Greifswald (Source: Personal Archive)

The first case of a playground where we will study is located in Greifswald.

When you walk the pier, you notice a small, in dimension, playground area.

The playground makes an outstanding impression, even though it is a small one.

It is suitable for children aged 1-16 years old. The playground was completed in 2017 and Landscape Architect of the project was Mrs. Fiedler Sabine.

It is located at the walking area at the Harbor of Greifswald and overlooking the Old City.

The bulk of the play equipment is wooden, nicely designed, with a hanging net. The playground surface is all of the sand. There are chalks where you can paint on the wood.

There are different climbing levels across the bridge for every Age group.

Figure 3.2: Climbing Bridge, Slide (Source: From Personal Archive)

Figure 3.3: Hiding places below deck, steering wheel (Source: From Personal Archive)

The playground has plenty of coffee shops around it. So you can go for a walk at the Harbor and let the kids play at the playground while you enjoy your coffee.
After an interview we had with the Landscape Architect, Mrs. Fiedler, she informed us that this was one of the purposes of constructing the playground near the Harbor, so that children can employ themselves.

Although it has minimal vegetation, little grass around the play area and a few young trees were planted along the playground. In summer, a big issue can be the sun as few points are shaded.

Next, we visited the same area another playground that Mrs. Fiedler was the Project Manager. At this point, it was at the stage of construction and installation of the wooden play equipment in the yard of a Kindergarten.
Mrs. Fiedler was there supervising and coordinating the whole team. She spent some time and answered all of my questions.

Figure 3.4: Construction site set up outside the courtyard of the kindergarten (Source: Personal archive)

During the construction work, the children of the kindergarten were transformed in the school next door.

There were some interesting constructions, like the placement of a water pump in the middle of the courtyard.

The water pump(or as historically was called pitched pump) is a good opportunity for children to learn about history and how people back then had to use their strength and cleverness to bring water up from a hole in the ground. Also through play, they can learn how to use their strength to bring water out of the pump, how a pump works and how water flows (educational play). (see below Fig. 3.5).

Figure 3.5: Playing pump for water play construction(Source: Personal archive)

The only issue, which was at the moment, was the shading of the area as the trees that have been planted are young. There are many places around the kindergarten that need to stay shady during the day.
Actions took place to solve the temporary problem.

Figure 3.6: Side view of the kindergarten unobtrusive from the sun (Source: Personal archive)

3.1.2 Slavic Village Kindergarten in Passentin

Figure 3.7: Gatehouse of the Slavic Village, the fence that encircles the village, the Kindergarten of the village. (Source: Personal archive)

Next playground in line was the Slavic Village (Slawendorf[75]) Kindergarten. It is located in Passentin in the land of MV.

The Slavic Village[76] was built between 1994-1999 by Raetsch Dorothee. After excavations, it has been found remains of a Slavic Lowland Castle. This is why they chose to build there the village.

The Slavic Village now is an open-air archaeological museum and many schools, kindergartens are visiting to learn all about their roots and their cultural heritage.

Inside the village, there is a Kindergarten and around the Village, there are plenty of activities, such as a barefoot sensory path (see below Fig. 3.8).

Figure 3.8: Barefoot Sensory Pathway (Source: Personal Archive)

Every hut is a facility for an activity, hay hut works as a house for sliding, playing with straw and jumping from straw bale to straw bale. (See below Fig.3.9)

[75] http://www.slawendorf-passentin.de/
[76] https://en.wikipedia.org/wiki/Slavic_Village_Passentin

Figure 3.9 : Hay hut used as a sliding, jumping play space (Source : Personal Archive)

There is a hut that works as a theater,a cooking house with dome oven, a pottery hut, a fireplace that all the children sit together and discuss, tell stories and socialize.

Figure 3.10: A theater hut, Cooking house, a fire place (Source : Personal Archive)

Figure 3.11: Wooden play equipments and an improvised darts game.(Source: Personal Archive)

The most impressive part of the whole facility is a hidden playground underneath a European beech tree (Botanical Name: *Fagus Sylvatica Pendula*).
Children are jumping on mattresses, climbing on the tree, swinging. There are small tables and benches so you can sit, relax and enjoy the view.

Figure 3.12 : Underneath Fagus Sylvatica Pendula is a playground (Source: Personal Archive)

3.1.3 Playground in Culture Park of the Lake Tollensesee in Neubrandenburg[77]

It was around 1970 when in Neubrandenburg every playground had the Elephant slides (see below Fig.3.13). Designed by the *´Produktionsgenossenschaft Kunst am Bau*[78]*´*-
Prefabricated –concrete elements.

The designers were inspired probably by the Elephant sculpture by Josef Schlagerl [79]who designed them in 1953 in Vienne(See Fig.3.13-3)
After the gathering of many donations, the request of citizens of Neubrandenburg and the acceptance of the municipality, the renovation of the Elephant slide was in progress.
The idea was to be placed in the Culture Park of the Lake Tollensesee. The project was completed in the summer of 2017.

Figure 3.13: 1)Elephant slide in 1974 and 2) today after a renovation, Location Neubrandenburg / 3)Elephant Sculpture by Josef Schlagerl in 1953 (Source: 1974 By B. Bartocha Bundesarchiv Bild 183-N06060-0313, CC BY SA 3.0.de /2017 Personal Archive/1953 Schlagerl http://www.architekturfuerkinder.ch/index.php/pioniere/josef-schagerl/)

[77] https://www.moderne-regional.de/tag/ostmoderne-neubrandenburg
[78] http://www.kunst-am-bau-ddr.de/die-genossenschaft.html
[79] http://www.architekturfuerkinder.ch/index.php/pioniere/josef-schagerl/

At the same playground, besides the cement Elephant slide with mosaic elements, is a huge dragon slide that the rest of the dragon´s body is coming underneath the Earth. It is for climbing, sitting and having fun.

There is a corridor of lots of trials either for jumbing or climbing. The last trial leads to the Dragon´s slide and the kids ´ends up being eaten´from the Dragon when they are sliding.

Problems that were noticed by a child(5 years old), that was using at the moment the playground, was that the tale of the dragon is a bit high for this Age Group (2-5) and the Elephant´s slide has a great inclination.

Figure 3.14: Dragon Slide designed by Mark Hungered (Source: Personal Archive)

Last but not least in the same playground, is the unique Stone Bull covered with mosaic stones. It brings to memory the *´Tufsen*[80]*´*, the amorphous playground sculpture by Egon Møller-Nielsen, with its unique curved shape and the climbable, hollow interior.

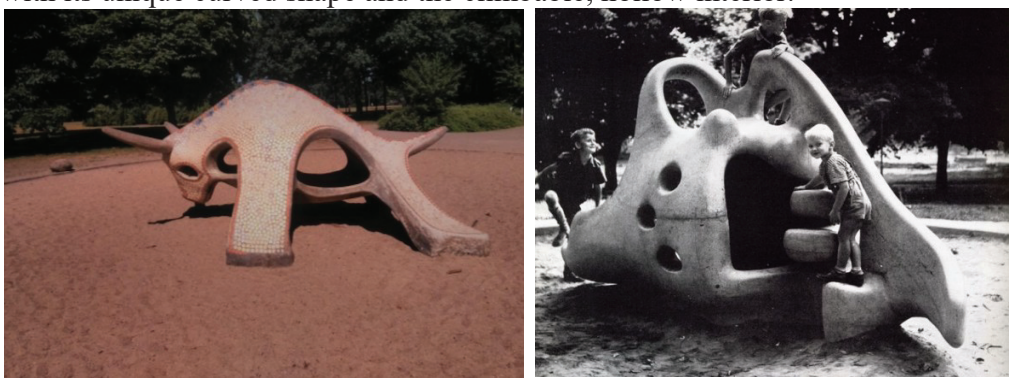


Figure 3.15: Stone Bull sculpture `Am Stier`, Kulturpark Neubrandenburg 2017 / Design of the Sculptor Egon Møller-Nielsen, Tufflen Humlegarten, Stockholm 1949 (Source: PersonalArchive/http://www.architekturfuerkinder.ch/index.php/pioniere/egon-moller-nielsen/)

Finally, we cannot omit the existence of the beautiful colorful mosaic benches that are across the playground. It is worth mentioning that all these structures were made of cement.

It should be advisable and more environmentally friendly that had been constructed out of Cob or the Rammed earth method that we have analyzed in Part 2 of the thesis. It could prevail just as well.

Perhaps the next Elephant slide to be built can be created of Cob or Rammed earth method.

[80] http://www.architekturfuerkinder.ch/index.php/pioniere/egon-moller-nielsen/

Figure 3.16: Colorful mosaic cement bench at the Culture Park Playground in Neubrandenburg.
(Source: Personal archive)

3.1.4. Neustrelitz Tier Park Playground (Zoo playground)

Our next case is the playground of the Zoo in Neustrelitz where its play equipment is made of wood. NaMa that has been used are : stones, rocks, sand and of course water as an element(see Fig. 3.17).

Figure 3.17: Water pump for water play (Source: Personal archive)

One of the high meeting points of this playground is a nice water play construction where children can use their strength to bring water out of the pitched pump (or as is commonly called water pump). Later they stand and observe how the water flows and in the middle of the playground a stream is created. But the play doesn´t stop there, children can find thousands of ideas to play with water.

Figure 3.18: Wooden Play equipment (Source: Personal Archive)

3.1.5 Playground and Green Space in Berlin[81&82]

The playground is located in Berlin- Friedrichshain. The designer of the project was Rehwaldt Landschaftsarchitekten.

One of the main factors that the designers have taken into account, before starting the playground design was, first in which Age Group it is addressed to.
For achieving having all Age group included, they separated the playground on two sides, with different elements, one is the ´Sea area´ and the other one is ´on the Earth´.

Figure 3.19: First part of the Playground: Climbing or sliding the iceberg, and the second part of the playground: Reclining or running ´the winding warm (Winderwurm) (Source: http://worldlandscapearchitect.com/playground-and-green-space-in-berlin-friedrichshain/#.W3r7jegzbcc)

You can either climb the iceberg (made from colored concrete, coated)or the walls, sliding or balancing. The playground is surrounded by a low fence. There is also a water pump play construction.
Next part of the playground is a Green Open Space as it is called Isle on the Earth (Eredninsel).
The Greenspace is constructed by prodigiousness wooden colored benches (as called Winderwurm) that is surrounded around the vegetation.
They can be used either as benches for sitting,recalling, for having picnic, for climbing, as a theatre stage and many other activities that put in a child´s mind.

Figure 3.20: Playing pump for Water play and Cement Iceberg for climbing and reclining
(Source : http://worldlandscapearchitect.com/playground-and-green-space-in-berlin-friedrichshain/#.W3r7jegzbcc)

[81] http://worldlandscapearchitect.com/playground-and-green-space-in-berlin-friedrichshain/#.W3r7jegzbcc
[82] https://www.landschaftsarchitektur-heute.de/projekte/details/1564

3.2Cases of Natural Playgrounds from all over the world.

In this sub-chapter has been collected 5 interesting Cases of Playspaces from all over the World. These five examples are among other´s suitable to collaborate with the NaMa that has been overvied in Section 2 of the Thesis.
They have a similar motif, to improve /develop a better play environment for the children.

3.2.1 Kukuk Playground in Zurich, Switzerland [83& 84]

Figure 3.21: Kukuk Playground,Manegg and SKB (Schule für Körper- und Mehrfachbehinderte (school for physical and multiple disabled), Zurich (Source: Galindo.2012.p200.Playground Design.ISBN 978-3-03768-109-1.)

For designing the specific playground eight play equipment designers were involved, so it would be suitable for physical and multiple disabled children.

The KuKuk - Kunst Kultur Konzeption company from Stuttgart, Germany, designed this adventure playground which is full of pathways and trials. The project was completed in 2011.

A major factor of the company before designing a play space is the impact and the influence that this specific space can have on the children, adults, and whoever will use the space.

More specifically, it is designed as a maze and children should pass a field of columns, a climbing structure before they reach the tower. It is constructed this way so children with wheelchairs can be able to pull themselves without any support.

Later, inside the maze, you could find a lot of sensory notions. The play equipment is made of wood (black locust) and it is colorful. The floor is all overlap with rubber.

[83] http://www.zumkukuk.de/en.html
[84] https://www.playground-landscape.com/en/article/view/841.html

Materials that were also used are plexiglass(the distorting mirrors),steel and ropes.

3.2.2 Kilburn Grange Park Play Center and Park, London, The United Kingdom[85]

Figure 3.22: Kilburn Grange Park Play Center and Park, London by Erect Architecture Company Zurich (Source: Galindo.2012.p108.Playground Design.ISBN 978-3-03768-109-1.)

The area where the adventure playground was built is the denominations of a Victorian Arboretum. Designers of the playground were Erect Architecture Company.
The project was completed in 2010. Materials that have been used are: timber, net, and most of them are recycled.

A major factor of the Designers was to retain the existing trees and around them to reconstruct the playground with new landscapes and wooden climbing structures. So that the existing vegetation remains in the historical space. There are different levels for every Age Group to enjoy playing.

Children can experience the change of the seasons and different sensory impressions as the playground are surrounded by trees and plants. The whole construction is a complex of play activities.

3.2.3 Giant Wooden Sculptures, Copenhagen,Denmark[86]

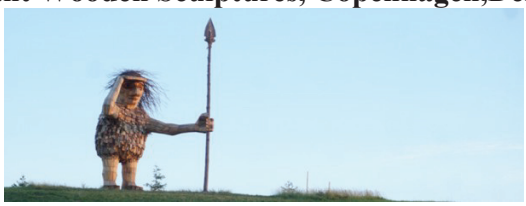


Figure 3.23: Joe the Guardian sculpture by Thomas Dambo (Source: http://thomasdambo.com/)

It is worth mentioning the work of an Artist/Designer Thomas Dambo, from Copenhagen-Denmark. He is creating giant wooden sculptures in the forests or public parks by using scrap wood / recycled materials.

All of the giant wooden sculptures (Trolls) are hidden inside the woods for children to search for them. They provide a map so you will find them all and at the same time having fun, lean and explore nature.

[85] **https://www.camden.gov.uk/ccm/content/leisure/outdoor-camden/great-parks-in-camden/?page=8#section-8**

[86] http://thomasdambo.com/

The purpose of these fairytale stories of the Giant Trolls wooden sculptures is to send a message to the world about the protection of the environment.

The Trolls are characterized as environmental patrons. It is a really interesting approach to teach children about the importance of environmental protection and what they can do to protect it. There have been constructed around the world a lot of this Giant wooden sculptures.

It would be more than interesting to see this kind of giants in a playground area or in a theme park.

You can see from the photos below the incredible work of these sculptures that have been from waste materials.

Figure 3.24: Some of the Giant wooden sculptures located in parks, forests etc. by Thomas Dambo
(Source : http://thomasdambo.com/)

3.2.4 Children´s Center and Teaching Garden, Toronto Canada[87]

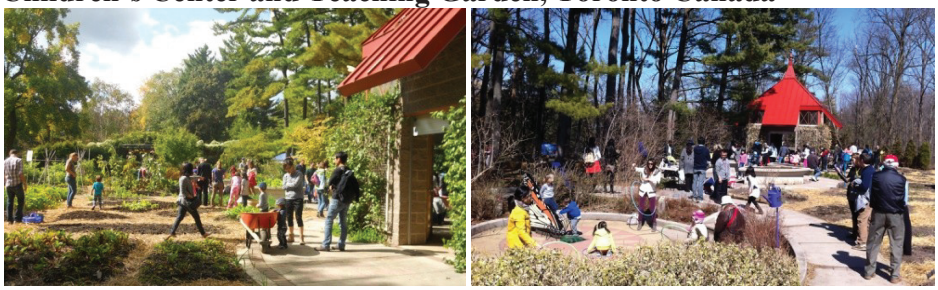


Figure 3.25: Children´s Center and Teaching Garden, Toronto Canada

At the James Boyd Children's Center in Toronto, children are learning how to harvest, how to plant trees and plants and how to take care of them later on and observe their development.

The main purpose of the Garden design is to stimulate children's interest to learn all about the Natural environment and all about gardening. It is located on the west side of Edwards Gardens. The garden has been separated into four play activities. The first part is the **Alphabet Garden** which children are guided along a winding path, searching for plants that begin with letters of the Alphabet.

The second part is the **Sensory Garden** which children must use all their five senses to explore the garden by comparing the plants and trees with things they know(For example a plant that is soft as lamb´s wool can be Stachys byzantina).

In the third part of **the Garden, there is a Dinosaur-Stegosaurus** who has touched the plants and children must find which plants he has munched on.

You could not of course miss a **Butterfly Garden** which has a giant butterfly Sundial and with this way children can learn how the movements of the sun affect plants. The butterfly garden has plant species that are especially attractive to butterflies. The garden includes also a Herb Garden and more.

This facility can be a good examplele for bother schools or kindergartens. For making things more interesting they could consider including also at their Garden classroom the method of SBG that we have mentioned in Section 2.

[87] https://torontobotanicalgarden.ca/learn/kids/childrens-learning-spaces/

3.2.5 Garden City Reserve, Port Melbourne Australia [88]

Figure 3.26: A curved Bench made of a Monterey cypress that was in 1930 in the Garden City Reserve, the famous ´Brontosaurus´rock climbing wall
(Source:https://www.google.de/maps/uv?hl=en&pb=!1s0x6ad66796feb0e145%3A0xf04567605324600!2m22!2m2!1i80!2i80!3m1!2i20!16m16!1b1!2m2!1m1!1e1!2m2!1m1!1e3!2m2!1m1!1e5!2m2!1m1!1e4!2m2!1m1!1e6!3m1!7e115!4shttps%3A%2F%2Flh5.googleusercontent.com%2Fp%2FAF1QipPpesTffsTTcuw35u-o7pNWKbta2UFUc19QbshZ%3Dw320-h240-k-no!5sportosaurus%20playground%20melbourne%20-%20Google%20Search&imagekey=!1e10!2sAF1QipMM22MA_aOyw2ax3WcLRdlvXJhjyFx22EZWUN1h&sa=X&ved=2ahUKEwjshL_cgZXeAhXLMywKHSriDa8QoiowDnoECAoQCQ#)

Garden City Reserve is one of the largest recreational parks, located in Port Melbourne, Australia.
It has a lovely play Space , Natural stones, an interactive water fountain , native plantings which are combined to offer nature play spaces for adventure to urban children.

The highlight spot of the playground is a huge ´´Portosaurus´ rock climbing wall and a real full size flying fox with disk type seat.

Landscaped gardens with native and exotic tree plantings and numerous indigenous garden beds offer a beautiful aesthetic result of the Reserve and attract a large number of birds.
The playground includes a metal slide, a chain walking bridge, a spinning cup with a hand wheel.

There is also an area which includes a vertical spiders web climbing frame, some monkey bars, all abilities bird nest swing and off course Natural play elements such as logs and rocks to clamber on. The most impressive feature of the Garden City Reserve is the carved wooden bench made of an old Cypressus macrocarpa commonly known as Monterey Cypress tree.
It was made to celebrate the memory of those kids who had climbed and had played with this tree at the same play space.

[88] https://tothotornot.com/hot-garden-city-reserve-portasaurus-playground-47-beacon-rd-port-melbourne/ / http://www.portphillip.vic.gov.au/garden_city_reserve.htm

3.3Awards and Competitions of the Best Playgrounds in Germany

The German **Spielraum** Prize is awarded every two years by the City of Hamburg and the Raum Messe und Medien GmbH in cooperation with GALK, the standing Association of cities (DST) and the German Olympic Sports Confederation(DOSB).
It will be referenced where prizes were given the dates 2015 and 2017.

The next Spielraum Awards 2019 has the theme *„Room for movement"*. The nominations will be announced on November 2019 at the Trade Fair Leisure, Sports and Exercise Facilities (FSB) in Cologne. All award-winning projects will be presented in the following edition of the Journal Stadt and Raum.

2015

The German Spielraum Award 2015 topic was *„Barrier-free plays and exercise spaces"*.
The Main Prize was awarded to Grünzug Hölkeskampring (Herne) with main them: A Space for all ages.
The Green Space Area *„ Hölkeskampring "* lies on the southeastern edge of this area. It was created an area with creating games such as a toddler area and an area for older children and in general, appropriate for families.
In the area where the Playground was to be built , there are Day care centers, schools, houses, a Hospital around it.

An important aspect was, to install play equipment for exercise addressed to the elderly group. All of the entrances to the Green Space have been equipped with tactile guidance systems at the sidewalks. It is worth mentioning that the park can be used from people with visual impairments without any restriction.

Figure 3.27: Green Space Area „ Hölkeskampring " in Herne
(Source : https://app.box.com/s/i6y69kjh00oly15h1zyqsir9dw5dn0f4/folder/5240940089)

Another Spielraum Prize 2015 was given to the Skate park in Allerpark (Wolfsburg).
The scope of this skate park was to renovate the existing Skate sculpture with the latest requirements in terms of Safety.

The Skate sculpture is a solid meeting place for everyone that has wheels. It is addressed to the Age Group from 8-45. All the entrances are accessible to wheelchair users.
Particularly noteworthy is the fact the Skate park design was created from a Group of people with Disabilities. The purpose of this Skate Park is equality for all who shared the area.

Figure 3.28 : Skate park in Allerpark –Wolfsburg (Source:
https://app.box.com/s/i6y69kjh00oly15h1zyqsir9dw5dn0f4/folder/5240950745)

Next in line, is the Award of a Tree house at Neuhofener Berg in Munich. The Tree house seems to float in three and a half meters height. Because of its barrier-free access it is addressed both children and adolescents.

However, it was designed either as a play object or as a space for movement.
It is a free open space in Nature and also it stimulates imaginative play.
The size of each tree house allows the access of two wheelchair users to stay and enjoy the view.
It is made of wood and steel elements.

Figure 3.29 : Tree house at Neuhofener Berg in Munich (Source:
https://app.box.com/s/i6y69kjh00oly15h1zyqsir9dw5dn0f4/folder/5240937001)

Second place of Spielraum Award 2015 was the Play Land Youth Club and Play Landscape in Oberhausen-Holten. Project Manager was the artist Apolonija Šušteršič and her team. They have developed an adaptable usable landscape Sculpture which responds to security issues, accessibility, sensory support and a variety of use. The location of the Play Land Youth Club is on the edge of the District and borders on one side of a water body. The tree house was designed according to the user groups, integrated into a spatial-design concept. The entire complex has free access to everyone.

Figure 3.30: Play Land Youth Club and Play Landscape in Oberhausen-Holten
(Source: Photo by Claudia Dreuße, https://app.box.com/s/i6y69kjh00oly15h1zyqsir9dw5dn0f4/file/424981298 61)

2017

This year´s topic was *´Themed playgrounds´*. The prize is awarded to a specialist jury- in general-exemplary scope or its sponsors and planners.
The guiding principle include elements of topography, vegetation, facilities etc. and has a main aim the involvement of the environment.
This year all of the submissions had a very creative planning and design approaches. There were eighteen nominations for *´Themed playgrounds´*. Because of the high quality of the applications the jury of experts decided unanimously to do something unusual, to honor all of them. Eighteen projects instead of the usual ten in recent years- received the coveted award. [89]

Figure 3.31 : The three main prizes in the First place for the German Spielraum Prize 2015.1) Donauwurm in Ingolstadt,2)Feuerwehr in Heidelberg,3) Rackerwerk in Hattinger (Source : http://www.fachmesse-stadt-und-raum.de/DSP.html /Kai Schumacher).

89 *http://www.fachmesse-stadt-und-raum.de/DSP.html*
https://app.box.com/s/i6y69kjh00oly15h1zyqsir9dw5dn0f4
https://www.dkhw.de/newsletter-bestellen/

3.4 Summary of Part 3: Cases of Playgrounds in Germany and all over the World

In this Section of our Research, reference was made to Cases of playgrounds in the Regions of MV and BB. The main Materials that have been used for their construction is either Natural or recycled ones or have a distinctive feature that, in my opinion, it is worth to be mention ed ,based on the subject of our Research. Briefly, the playground locations are in Greifsw ald,in Passen tin,in Neubrandenburg, in Neustrelitz and in Berlin.

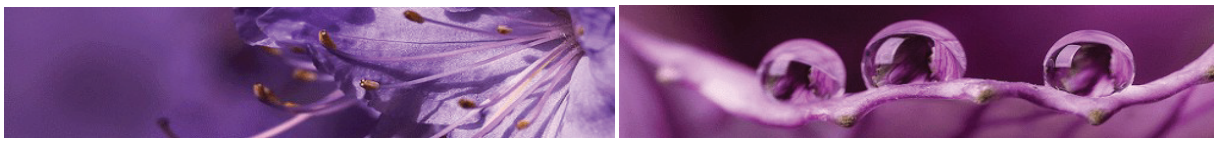
Similarly, an extensive Review was made of the existing Bibliography, to include Playgrounds from all over the World that have as their main purpose the construction of playgrounds that offer bet ter,health ier,environmentally friendly play opportunities to the child ren.The cases that were chosen are located in countries such as Switzerland, the U .K.,Denmark, Canada and Australia.

In the interim, a reference is made about Awards and competitions of the Best Playgrounds where they have taken part, particularly in Germany. There are of cource Awards and competitions in other places of the World and it would be interesting to investigate and make a comparison with other countries but we wanted to focus our attention in the country where we are located.

In short, over the years there are enormous efforts to change and improve the Outdoor Play spaces with a focus on users ne eds,namely children, and we are very pleased with the Results selected. Yet we must not be complacent and always improve and finding the best possible way of evolving to the best of Playgrounds.

Further,more in the next Section of our Research, a Survey Questionnaire was created wthe ith aim to record the point of view of Professionals in the field and how aware of they are of the matter of NaMa methods.

Section 4 Survey Questionnaire



4.1 Introduction

In this Section it will be analyzed and will be presented the design and methodology of the Survey Questionnaire of our Master thesis with title „ *Natural Materials in Playgrounds* ".

Due to the scientific approach of my Master's paper, the following Survey was developed to widen the scope of our investigation and record the point of view of experts (such as Landscape Architects, Architects, Civil engineers, Gardeners, Carpenters et cetera.)

Along the way, the Master´s thesis explores how NaMa such as Wood, Straw, Clay, Rammed earth, but also Rainwater management, Earthbags constructions, and Earthship models can coalesce with already existing (non-Natural) materials on the playground Spaces. The purpose of the paperwork, is to investigate the vital role of playgrounds in the field of Landscape Architecture, having a specific focus on the use of NaMa.

The evaluation Questionnaire on the certain topic aims to be the primary material for the further quantification of the data. After its processing quantitative and qualitative characteristics will emerge, which will allow me to arrive and to draw conclusions, as far as the existing knowledge and the recording of quality data allows it.

The Questionnaire was originally created as part of an interview where I would be interviewed a Landscape Architect, who designs Natural playgrounds in the area of Mecklenburg - Vorpommern and has as the main material for its construction of wood, clay, and water as an element. Because I was intrigued by the answers that I have received, I thought why not more opinions have on the matter instead of only one.

During its creation, have taken into account factors that are important for the construction of Natural playgrounds such as Safety, Maintenance, Cost, Vegetation, appropriate Materials, and Sustainability.

The review of the Bibliography in combination with the Methodology followed highlighted important theoretical axes that constituted the individual thematic units of the Questionnaire, such as knowledge of the use of NaMa in playgrounds, Regulations existed for the NaMa, Environmental behavior of materials, material reliability as well as Selection criteria for materials.

It was then sent electronically into a targeted sample of Professionals involved in the construction Sector of playgrounds aged ***18-75 years***. Out of the total of ***100*** Questionnaires sent, ***25*** were answered.

The Survey Questionnaire was sent to Professionals and Organizations from around the World. (such as Germany, Latvia, Lithuania, Ukraine, Bulgaria, France, the United Kingdom, Thailand, Georgia, Greece,etc.).

This Questionnaire can also be a Guide for Future Researches on Natural playgrounds.

4.2 Methodology and purpose of writing the Questionnaire

The methodology followed for the synthesis of the Questionnaire resulted from a three-stage survey:

In the first stage, secondary research was carried out, where an extensive review was made of the existing literature, English and German, on the specific subject, which aimed :

- In the identification of previous Surveys with the content of playgrounds made of NaMa or Natural / adventurous playgrounds (as made by Straw, Cob, sand, walls of Rammed earth Stones, Wood, Bamboo, Water Element etc.)
- In the framework of the secondary Research, meetings were held with Professionals /Educators who have dealt with Natural/adventurous playgrounds and visits to existing Natural play spaces in the area of Mecklenburg –Vorpommern where our University is located.

In the second phase, with the help of Bibliography and the Results of the qualitative Research - an initial-General Questionnaire was created consisting of a number of questions categorized in the following six Themes: Record of experts Opinion/ Knowledge and Experience in relation to the Natural Playgrounds, Selection criteria of Designing a playground, Selection of Vegetation in Play Areas, the Behavior of the Materials with respect to the Environment, Maintenance and the Safety Management in Playgrounds.

Based on the integrated Version of the Questionnaire, a pilot Survey was conducted on a total of 100 Respondents, which was the third and final Stage of the construction of the Questionnaire.
We received answers to our Questionnaire from organizations such as the Pan-Hellenic Association of Landscape Architects, the professors of Neubrandenburg University of Applied Sciences, the Assumption University of Thailand, former professors, Latvian Association of Landscape Architects, colleagues of the profession, students of Landscape Architecture and Natural building Associations located in Greece and France.
It was sent also to other Organizations around the Globe but we did not get a response, so we will not take them into account in the course of our Survey.

Its final form was built first on a Google Form(https://docs.google.com/forms/d/1u_D7J4oHw4tHjuNYk3rEChkcHTeYzlf8oK4TH3jBZG8/prefill) for creating our Survey and later on, we used the online statistical Survey web Application, ***Limesurvey*** (https://www.umfrage.hs-nb.de/index.php/911294?lang=en)and sent to the rest of the Respondents.
It remained active for about one month *(22 August -21 September)*.
It was divided into two groups, one is General Information (Gender, Age, Occupation) and the second group is Experts Opinion and Experience. The Questionnaire consists of 20 Questions.

Note that the Questionnaire will be listed in the Appendices in the document text below (See Appendix A).
This Research was conducted by the city of Neubrandenburg, Germany and addressed to Landscape Architects, mainly of Europe.

4.3 Purpose of the Survey Questionnaire.

The aim of this work is to present the Questionnaire as a research tool and to evaluate NaMa in Play areas.

The main aims, as we mentioned above, are: 1) to record Expert Opinions/Knowledge in relation to the Natural Playgrounds, 2) Selection Criteria of designing a playground, 3) Selection Of Vegetation in playgrounds 4) the Behavior of the materials with respect to the Environment, 5) the Safety Management in playgrounds,6) the Maintenance.
The Study of the above issues examines all the dimensions of the subject as they emerged from the review of the Literature and attempts to discern two Main issues of the Research: a) the current situation as regards the construction of playgrounds and b) the choice of using NaMa in the existing play areas or the construction of new playgrounds made of NaMa.

4.4 Analysis of pooled Data - Final Results

Initially, there are 3 questions regarding the Demographic data of the Sample (Age, Gender and Occupation).
It is noted that the percentage of Respondents is more women than men (62,96% women vs. 25.93% men and 11.11% did not answer), as shown in the Diagram below (see Chart 31)

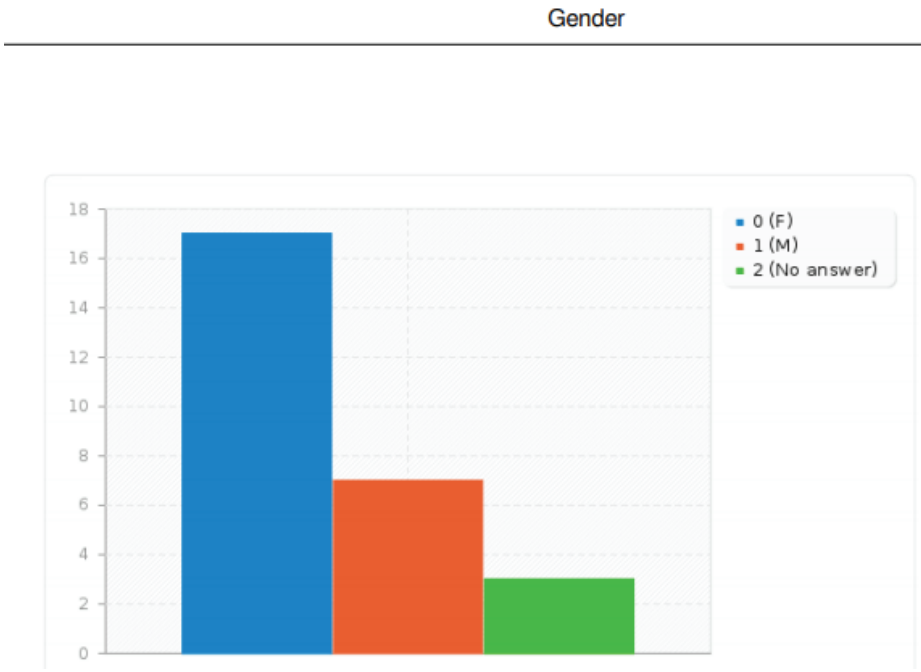


Chart 31: Allocation based on Gender

Similarly, with regard to Occupation the sample is distributed at the following percentages: The majority of Respondents were Landscape Architects(O2:34.78%), followed by Civil Engineers(O3: 30.43%), subsequently were Architects (O1:17.39%), and the rest of percentage have other Professions, such as artists, Natural builders, Gardeners, educators/ Professors.

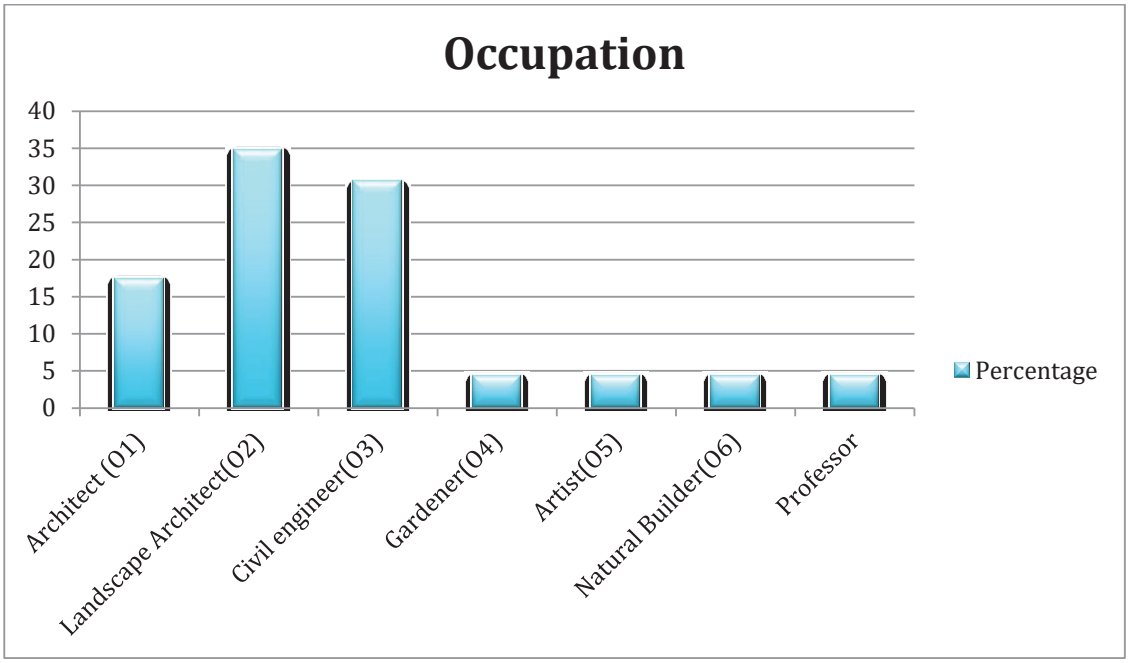


Chart 32: Allocation based on Occupation

With regard to age, the sample is almost distributed to the solar group of 18-35 years(O1) with 50%. The 35-50 age group (O2) is followed by 25%. And the rest 25% is followed by age group 50-75% (O3) (see Chart 33). It is easy to conclude that the sample belongs to the most active, modern and up-to-date piece of Landscape Architects - Architects.

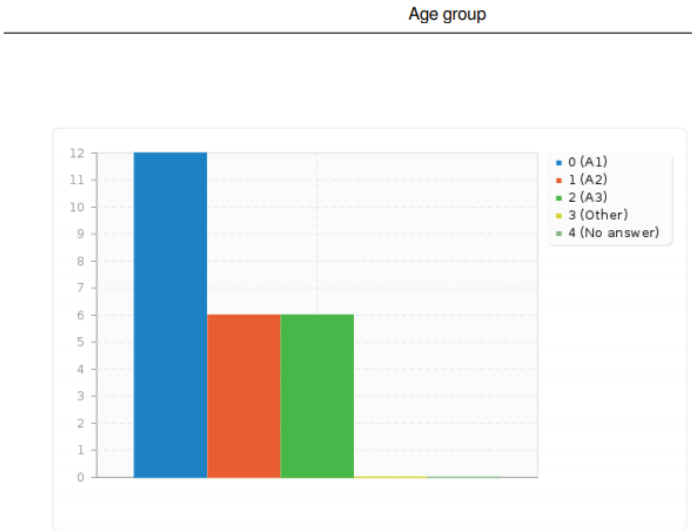


Chart 33: Allocation based on Age group

As we mentioned earlier, the Study attempts to discern two Main issues: 1) the Current Situation as regards the construction of playgrounds and 2) the choice of using NaMa in the existing play areas or the construction of new playgrounds made of NaMa.

We will then analyze all data collected after the survey for each category divided into six Categories: 1) to record expert opinions/knowledge in relation to the Natural Playgrounds, 2) Selection Criteria For Designing A Playground, 3) Selection Of Vegetation In Playgrounds 4) the behavior of the materials with respect to the Environment, 5) the Safety Management in playgrounds,6) the Maintenance.
All results were considered based on Gender, Age, and Occupation.

4.5 Record of Experts Opinion / Knowledge / Experience in Relation to The Natural Playgrounds

The replies received, with regard to whether *the Landscape Architect is responsible for the design of playgrounds*, were positive as we see in Chart 34 below.
The highest percentage of Respondents were *somewhat agreed* with **54.54%** the other **18.18%** were *completely agreed.*
13.64% of the respondents were negative. The remaining percentage of respondents remained neutral (**13.64%).**
Respondents commented that either it should be a close connection with users and owners or a multidisciplinary approach cocreation with parents, educators, and kids.
Also, that architects should be involved only if necessary.

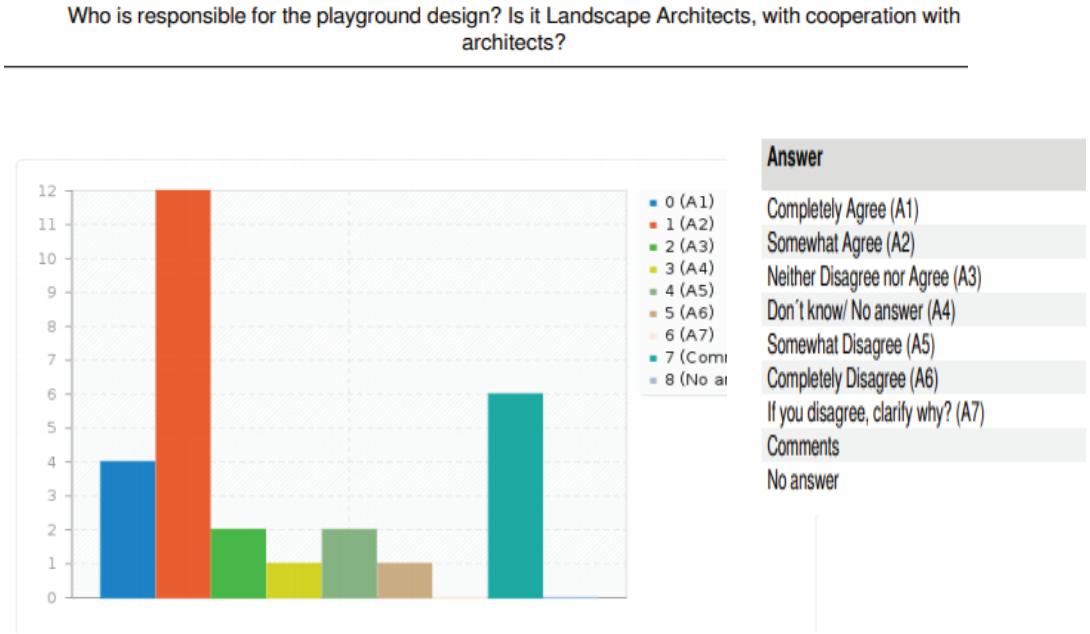


Chart 34: Responsible for the playground design

Along the way, they were asked whether *playground design belongs to or is part of the Arts*. The respondents answered positively with **72.73 %.** The **18.18%** of respondents wanted to remain neutral in this question. The rest of the respondents responded negatively(**9.09%**).

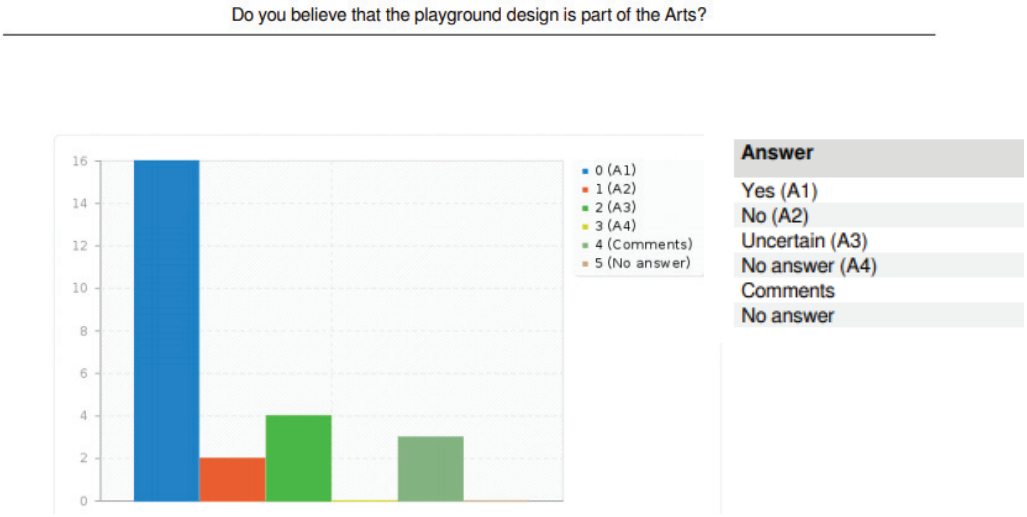


Chart 35: Playground Design as part of the Arts

To the question about *where they were influenced from,before planning or designing a playground*, they replied the following :

- Natural environment/ Landscape,
- the Age Group of users,
- the History of the place,
- the culture of the area where the playground will be built,
- the surroundings,
- the Climate,
- innovative objects /unusual shapes,
- Local materials,
- Childhood memories,
- the Location,
- the available space,
- Necessities of the users,
- Safety,
- Art

are coefficients for a professional to design a play area.

As far the experience, of our participants, in the design and construction of playgrounds: it was asked to analyze a Case of Study.

Case study A

Figure J : Village in Alt Schwerin (Source: From personal archive of Fiedler Sabine)

A creation of an old Village in Alt Schwerin with a big Windmill(concrete material of construction-see Figure B below), small houses(made of concrete with pigments, tiles, and wood-see Figure C), bridges, sculptures of animals(made of concrete), a water playground.
The location of constructing the playground was up in the hills and the valleys. Inside of the windmill is climbing elements that have been made of wood.

Figure K : Stages of windmill construction (Final stage, Initial manufacturing stage, a model of the windmill of Alt Schwerin Playground (Source: From the Personal archive of Fiedler Sabine)

Figure L: Details of play equipment made of wood, tiles, and concrete. (Source: personal archive of Fiedler Sabine)

Figure M : Playground Sandpit is constructed of wood, steel, and concrete(Source personnel archive of Fiedler Sabine).

Case study B

Figure N: Before and after its renovation (Source: Personnel archive of Urbane Inese)

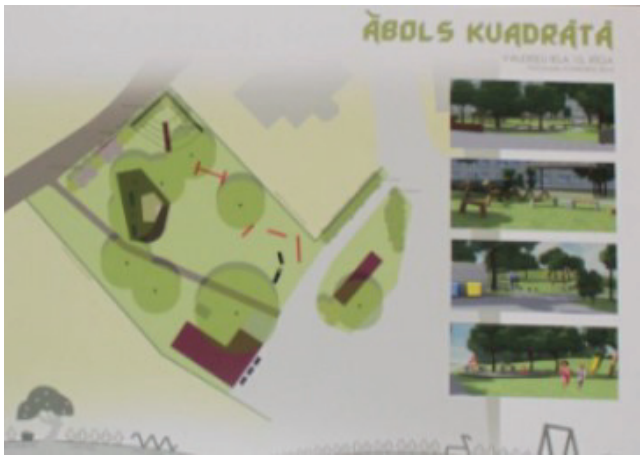


Figure O : Concept plan (Source: Personal archive of Urbane Inese)

Renovation of existing playground equipment, pruned and planted edible plants, used soil for the creation of a hill for sliding. Used existing shed to create blackboard, designed Natural wood animal sculptures.

Case study C

Wood deck construction

Figure P : Wooden deck construction for play and gathering (Source: From personal archive of Oyen Thomas)

The materials that were used for this playground project are: wood, metal, stones, plastic, sand, grass, plants, play equipment.

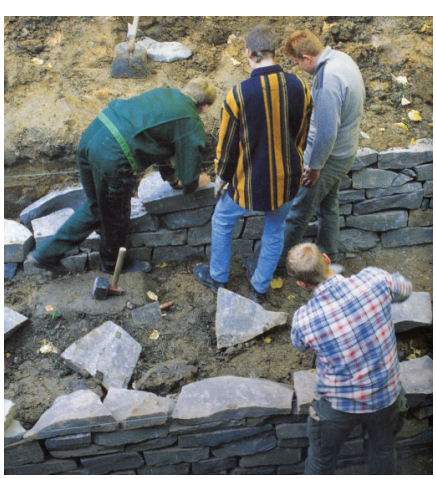


Figure Q: Details of the construction, before and after (Source: Personal archive of Oyen Thomas)

Case study D

Figure R: Details of play equipment (Source: from Personal archive of Seewald Julia)

We do not have enough information about the playground project but you can see on the figures above the foundations of the playground construction.
Materials that were used are steel, wood, concrete (in the foundations)

In addition, they were asked to tell me their point of view whether it would be preferable to have a training course or workshops in schools for children to learn all about preservation of playgrounds and be active members as their issue is concerned (their needs must be covered as they are the users).

The majority of participants responded positively with **88.88%**.
While the other remaining percentage of **11.11%** disagreed with the idea as they commented that in the workshops only adults should take part in.

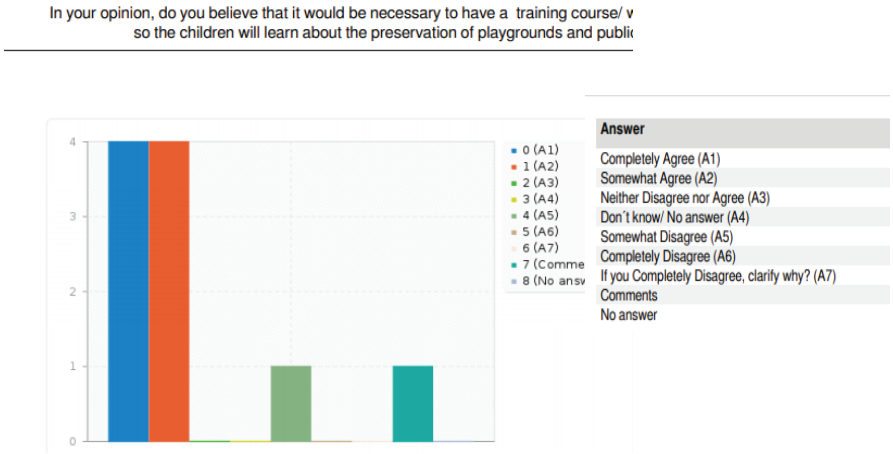


Chart 36 : Opinion of the participants whether or not a Training course /workshops should be add in the Educational System

4.6 Selection Criteria Of Designing A Playground

Then, the respondents were asked to list which are the main selection criteria in their opinion before they start planning a playground and which ones are prioritizing from the principal to the least important criterion.
The primary criterion of choice was, and with a large quantitative difference from the others, **the *playground location*** with **20.65%.**
Along the way, the criteria of Budget, Age Group, and Safety Management were selected with a **9.09 %**.
Public participation, Goals for the project, Maintenance plan, Regulations, and Drainage system are following with a **4.34%.**
The other criteria are at the **2.17%**
(see Chart 37 below).

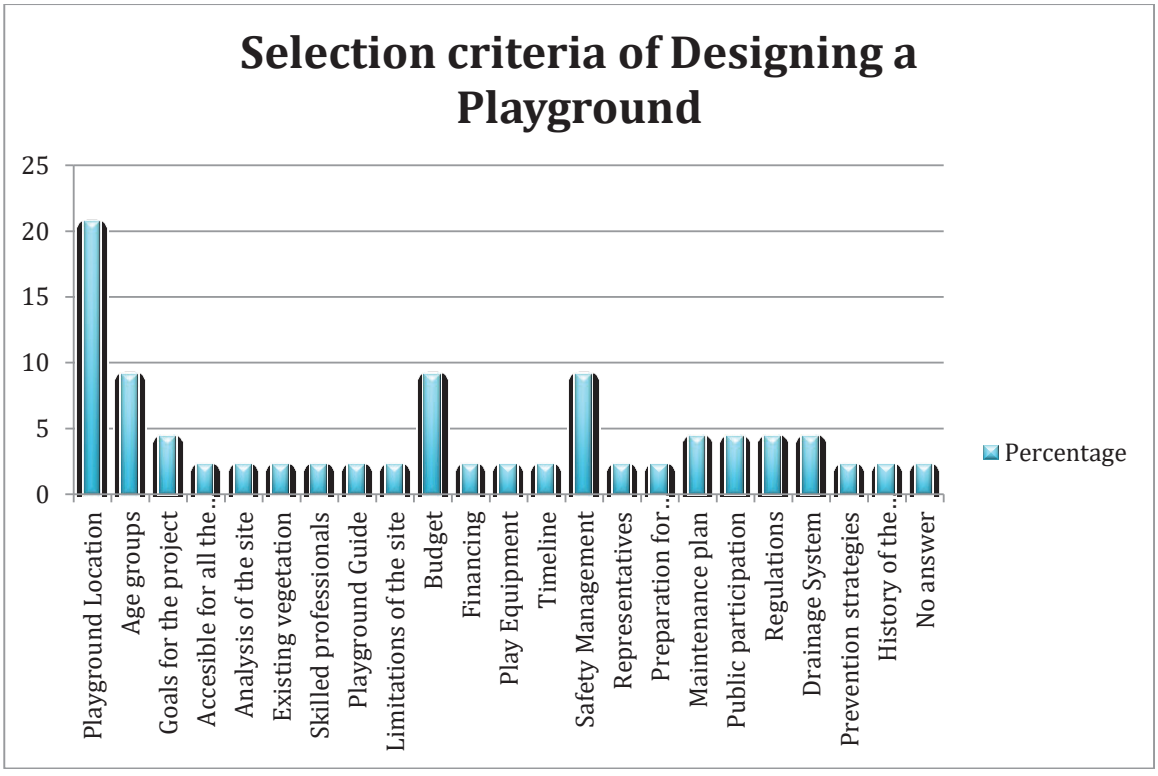


Chart 37: Selection criteria for a playground Design

Respondents commented on the following :

- that each case is considered differently and that Financing and Budget are always the main criteria.
- before you start designing you should consider the needs of the users by asking children/parents/educators of the neighborhood what they want.

Following this, they were asked to answer whether the existing playgrounds are functional or not. You can see from Chart 38 below that most of them answered that existing playgrounds are Moderately useful with **35.29%.** 23.53% find them slightly useful and 11.76% that are very useful. The rest of the respondents wanted to remain neutral in this question with a 17,65%.

We will point out some of the comments that were given to this question:
Firstly, in Latvia are not so many playgrounds in all of the cities and parents are driving far away from their home to visit playgrounds.
Second, there are a lot of playgrounds built without special demands.
Thirdly, in Greece, there are a lot of poorly maintain playgrounds without access to children with disabilities or there are too small in comparison with the percentage of users. Improvement is necessary.

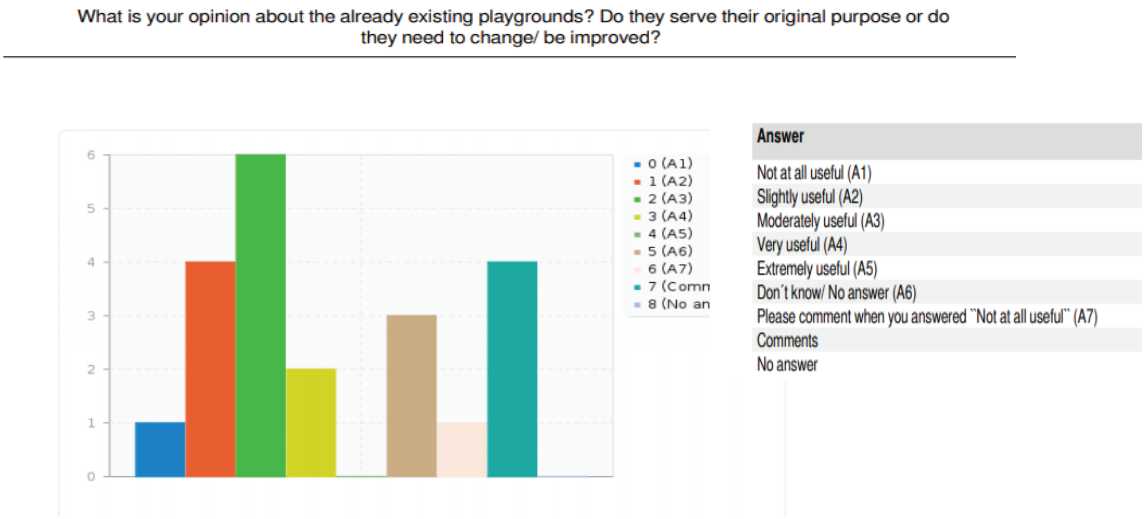


Chart 38: Utility of existing playgrounds

4.7 Selection of Vegetation in Playground the Behanior of the Materials with Respect to the Environment

When they were asked by what criteria they choose the appropriate plants for a play area, they answered the following :

- Selection of native plants (edible plants, with fragrant) that are appropriate for the certain Hardiness zone
- Biotope, climate, sun/shade, soil morphology, not poisonous plants.
- Existing vegetation, vegetation with an aim to restrict borders from outside of the playground
- Purpose of the playground
- Location including microclimate and design
- Maintenance (available personnel and budget after construction)

The main features of plants in playgrounds are the following based on the answers given to us:

- Provide shade, tolerance from wind
- Educational aspect
- Helps in mental health(antistress and relax)
- Feeling of nature
- Safety from external risks(with the use of bushes as borders)
- Development of the area
- Blossoming of Flowers, fruits
- Drainage
- Buffer of shadow
- Aesthetics
- Support child creativity(fine motor skills, social skills)
- The influence of the Natural environment on child behavior
- Ameliorate microclimate
- Contribute to biodiversity
- Add to the character of the space and the concept of the design.

Furthermore, when respondents were asked if they would place toxic plants on playgrounds for educational purposes a large percentage(55.55%) totally disagreed and commented on the question(see A7 bar in Chart 39). They strongly pointed out that to avoid unpleasant situations from hazards(such as toxic plants are) it is preferable to avoid placing them in this spaces. 33.34% of respondents agreed with this move and the rest remained neutral(5.56%).

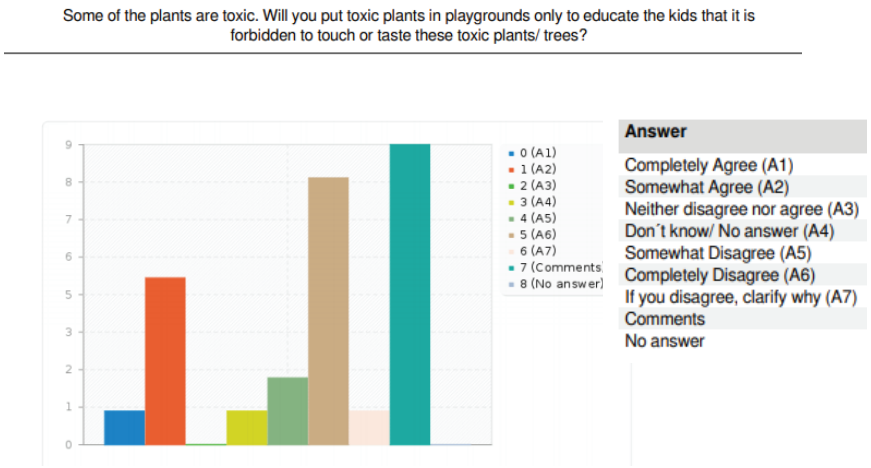


Chart 39: Placement of toxic plants in playgrounds or not.

4.8 The Behavior of The Materials with Respect to the Environment

The *Main Criteria* for selecting the materials in playgrounds are the following based on the answers given to us by the respondents:

- Natural and inclusive friendly materials,
- Fits into the budget of the playground project
- Design concept
- Effect on senses(smell,touch,sound,taste,vision)
- Safety and compliance with regulations
- Maintenance after construction
- Optical impression
- Purpose of the playground project
- Age group
- Time
- Local materials
- Available equipment(resources)
- Materials selected to adhere to the modern architectural standard
- Permeable surface
- Sustainability, interchangeability
- Location and site history
- Needs of users
- Durability
- Effort resistant

To the question of which of these materials(Metal, steel, wood, earth) is most appropriate for a Play Space Design we received the following answers:

- Depending on the environment the choice of the necessary materials.
- Quality
- Basic materials such as wood and earth
- Safe to use
- Eco-friendly materials
- Depending on the climate
- Financial reasons
- Different materials, educational nature
- Renewable materials
- Location and Concept of the playground design

To the question of whether they have chosen of using NaMa or in their construction of playspaces, the majority of people have replied :

- Waste of Wood /wood chips
- Sand
- Earth
- Bamboo
- Raised-bed gardens

- Vegetation(different kinds of grass, Fruit trees, berry bushes-non-toxic)
- Concrete (only to stabilize construction)
- Natural Stones/ hilly elements
- Pebbles, tiles
- bricks
- gravels
- Ropes
- Water
- steel
- Plastic
- Straw/mulch

All participants when asked to answer the question whether NaMa such Strawbale, Rammed earth, Earthships can be placed in a play area, a 66.67% agreed with this movement and the rest of 33.34% remained neutral(see Chart 40 below).
They commented that Rammed earth constructions are allowed in playground designs but for the other materials are restrictions for use in playgrounds but are allowed to be built in parks.

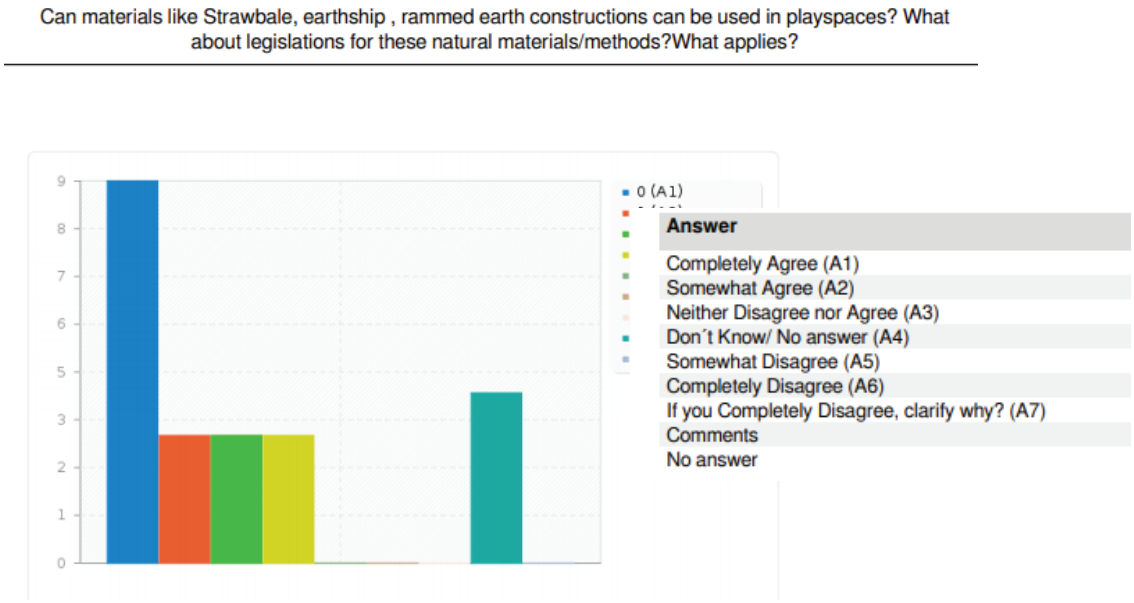


Chart 40: Natural Materials can be placed in a play area- the opinion of experts.

Equally, important question posed to participants is their interest in the choice of playground design.
They replied that :

- the basic reason is parenthood (there are also parents themselves)
- Acceptance and appreciation of the users
- The flexibility of space (creative/open-minded solutions)
- the invention of games through design.
- New experience and renewable materials

- New, sustainable playgrounds made of Natural materials and well-tried things such as swing, slide, and seesaw are more useful and have an increased game character
- Playgrounds are important social places
- Challenge and at the same time a big responsibility
- Rethink the typical models of playgrounds and design more Natural playgrounds so they can play free and create,
- Merging with the environment.

4.9 Maintenance

The replies we received as far Maintenance of the playgrounds are the following:

- Maintenance is really important to secure that playground will keep its quality, safety, and functionality.
- In cases of public playgrounds, responsible for the maintenance is the public sector (Municipalities)and it is not anymore a designer´s responsibility.
- Depending on the materials that have been used(an environment very susceptible to corrosion).
- Sand must be changed every 2 years from sandpit for hygiene purposes.
- Before starting the playground project should be a maintenance plan for the next 5 years.
- Surfaces and playground equipment should be checked occasionally for material destruction.
- Creating a contract between the Landscape architect and the municipal authority in order to preserve and control children's playgrounds.
- Playgrounds should be properly maintained by law registrations(TÜV)

4.10 The Safety Management in Playgrounds

As far Safety Management and what applies in playgrounds our participants replied that:

- Planners pay attention to this point
- Safety is the primary factor and should be monitored
- Special legislation as fas as Safety Management
- Scale and proportion, the efficiency of equipment
- Safety should be considered during the design and maintenance phase
- A *compromised* Safety management which offers security but at the same time is the aid of child development
- Useful Regulations, Legislation
- Legislations are strict as far using NaMa in playgrounds-this limits the options for space.

In the final question, it was asked to choose Natural Outdoor Play Activities that they find interesting and would gladly add in their Playground Design Project.
The Natural outdoor playspace activities are the following:

- *Rainwater usage for irrigation*. **77.78%** were positive with the idea.

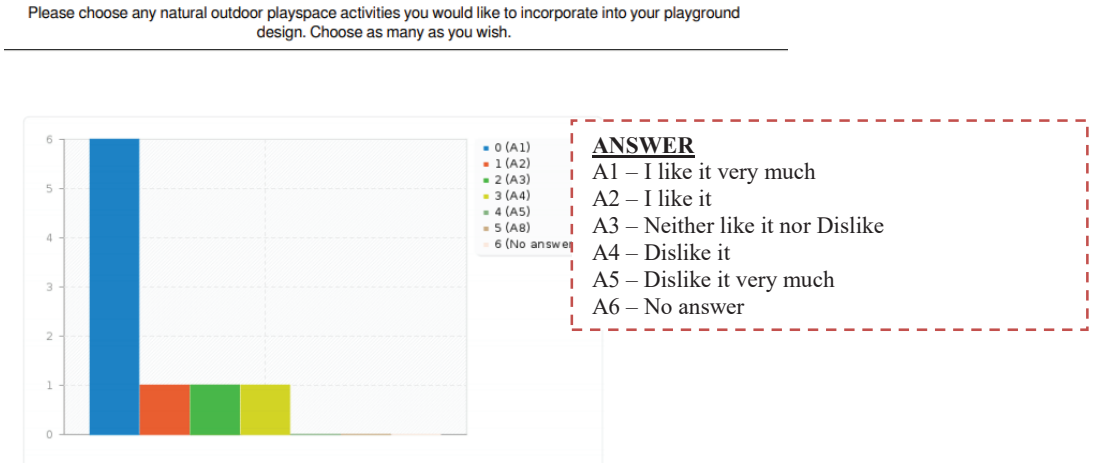


Chart 41: Rainwater usage for irrigation

- *Cob houses* **77.77%** in total agreed and were positive with the idea

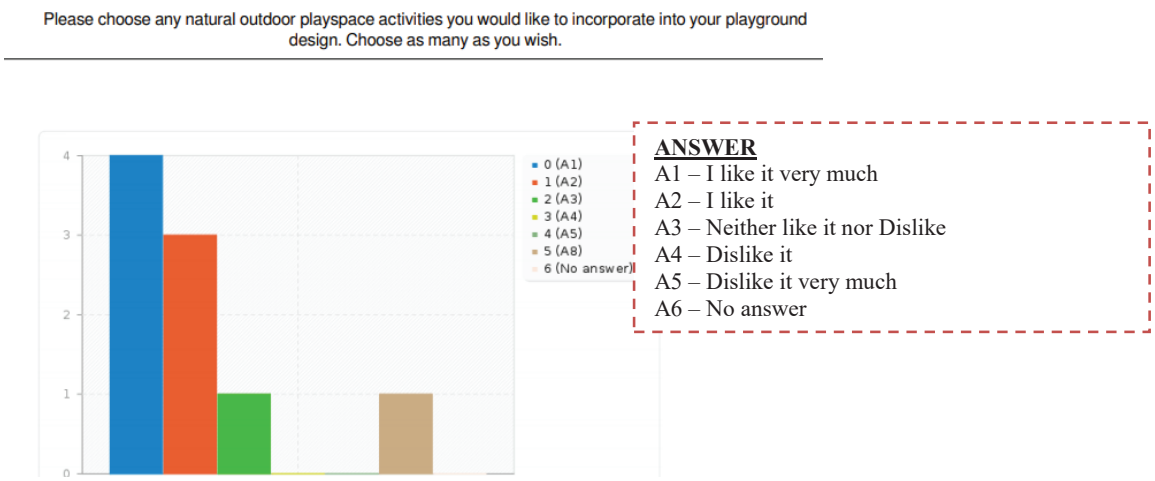


Chart 42: Cob houses as a Natural Play Activity

- *SBG* **77.77%** in total agreed and were positive with the idea

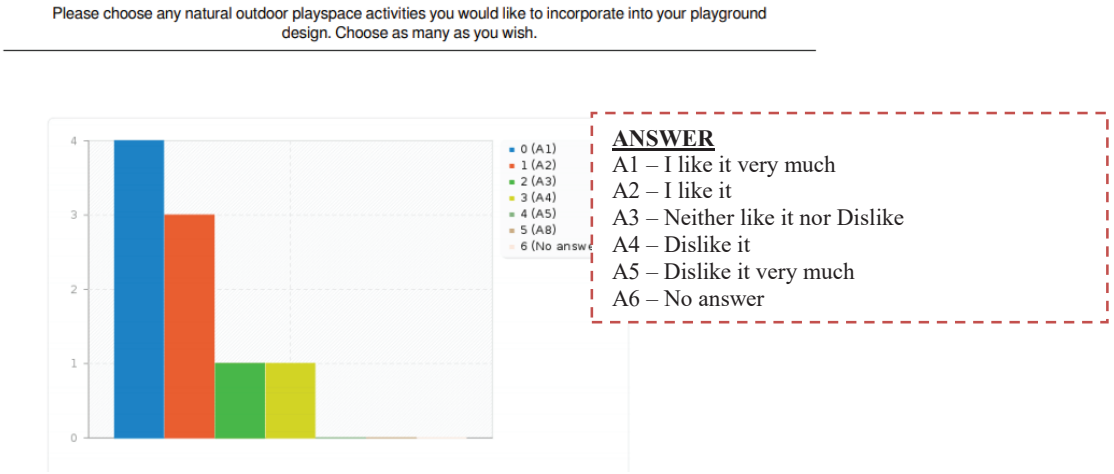


Chart 43: Straw Bale Gardening (SBG)

- *Earthbag slides* 88.89% in total agreed and were positive with the idea.

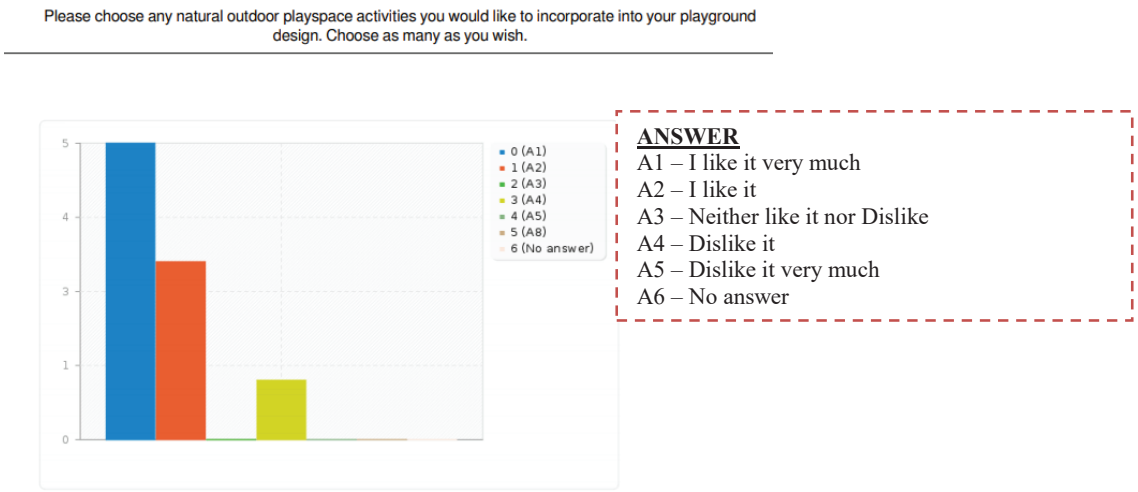


Chart 44: Earthbag slides as a Natural Play Activity

- Rammed earth climbing walls 88.89 % in total agreed and were positive with the idea.

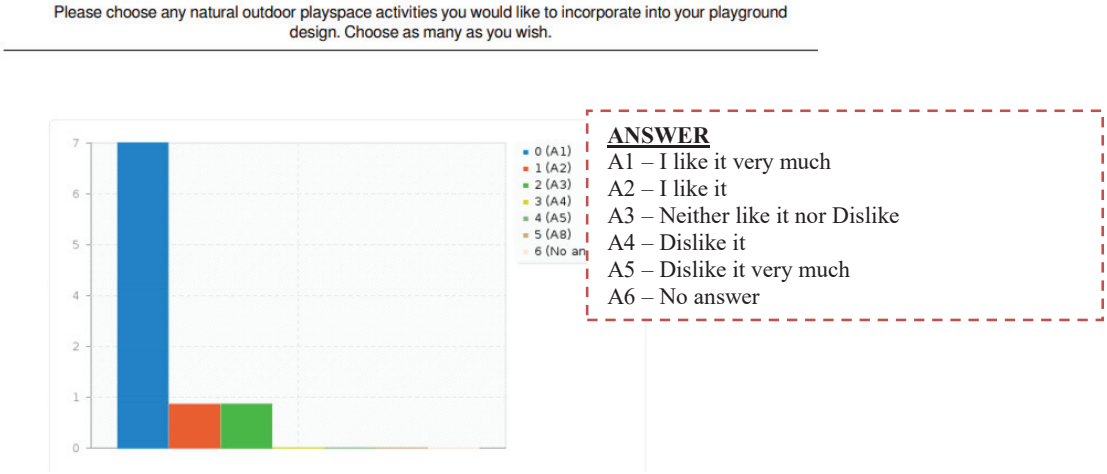


Chart 45 : Rammed Earth climbing walls as a Natural Play Activity

- Seasonal plants **100%** full agreement of participants with this Playspace activity.

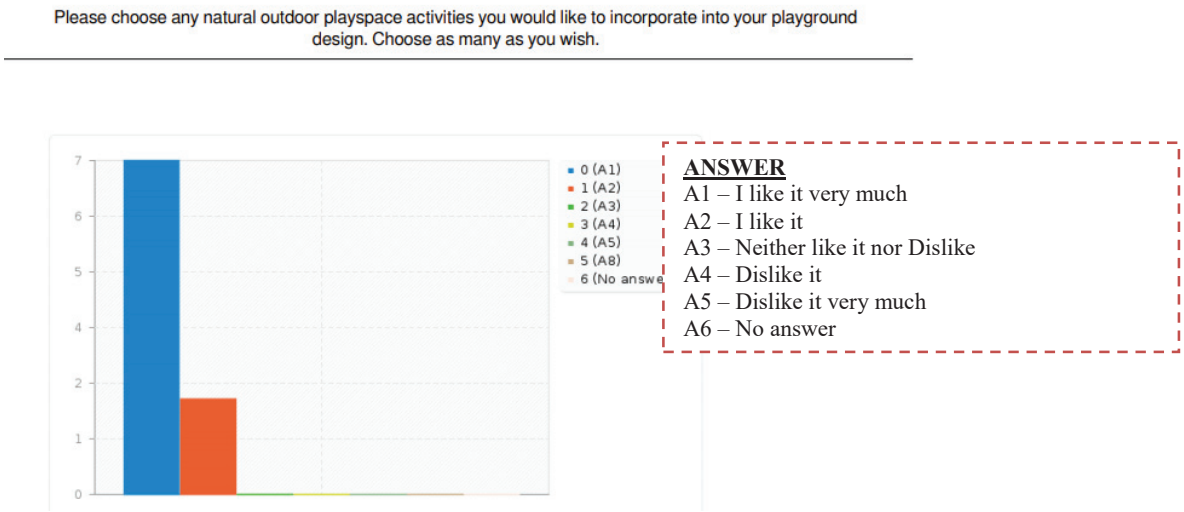


Chart 46: Seasonal plants

- Greenhouses for kids 88.89% were positive to build small greenhouses for the kids to learn how to maintain the space.

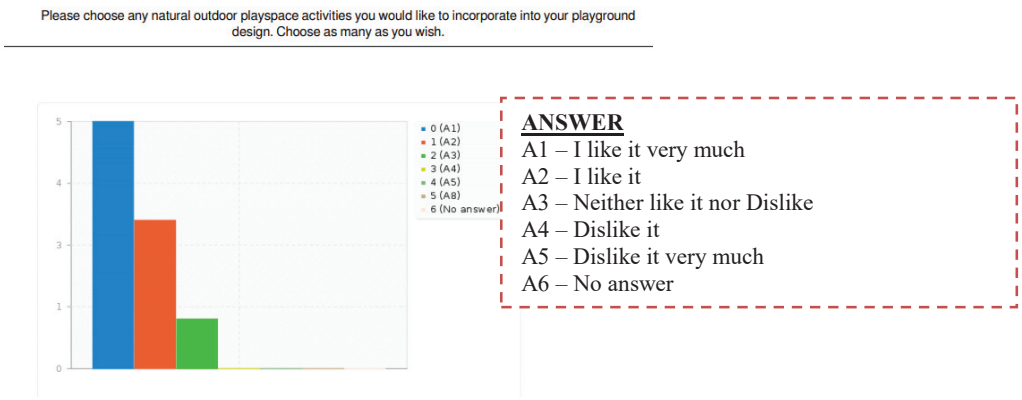


Chart 47 : Geenhouses for kids as a Natural Play Activity

- Sculptures made of straw and clay 55.55% were positive with the idea.

Imaginative and social play are one of the most important kinds of play.
33.33% were negative with the idea of building sculptures in play areas made of clay and straw.

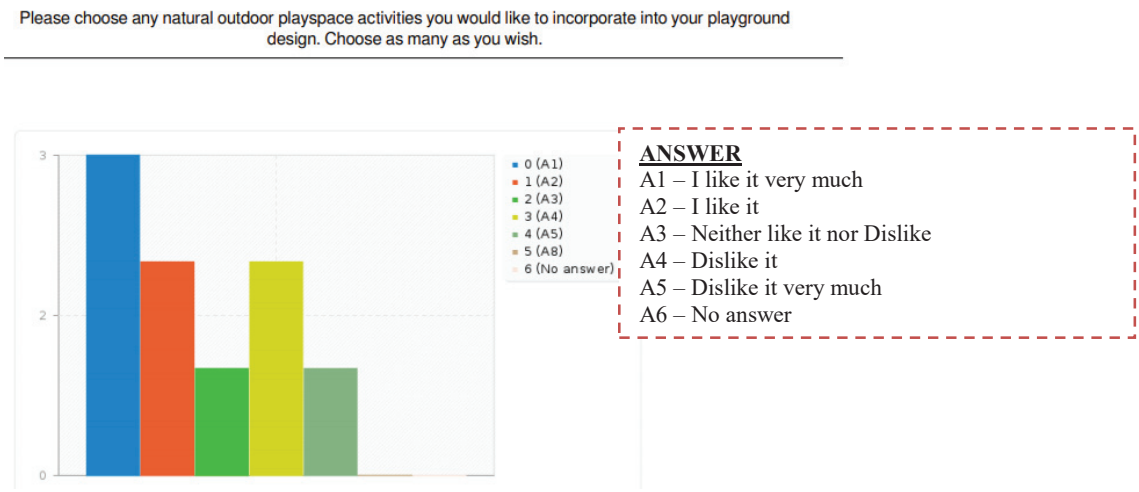
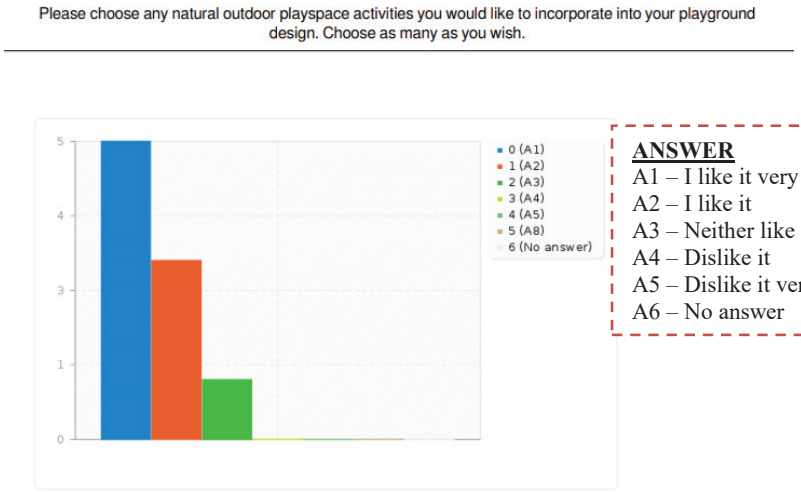


Chart 48 : Sculptures made of straw and clay as a Natural play Activity

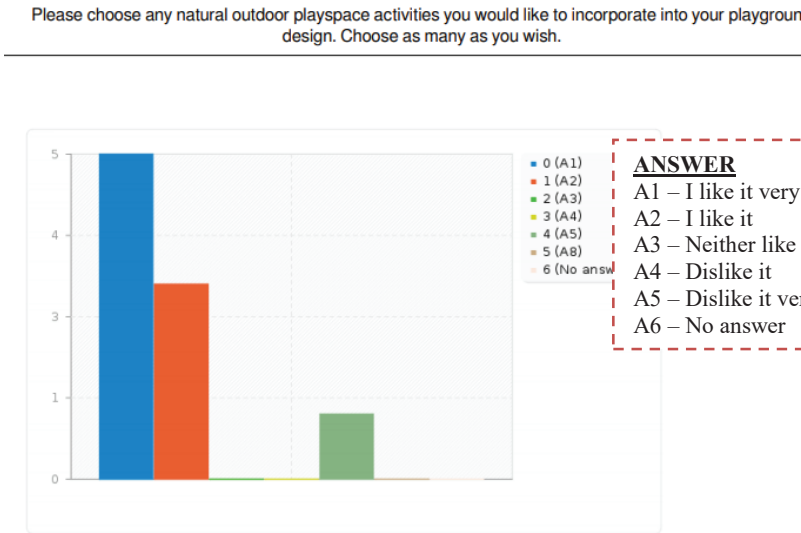
- Pavements/ pathways made of Natural materials 88.89% of the participants replied positively.



ANSWER
A1 – I like it very much
A2 – I like it
A3 – Neither like it nor Dislike
A4 – Dislike it
A5 – Dislike it very much
A6 – No answer

Chart 49 :Pavemetns made of Natural Materials

- Tire swings 88.89% of the participants replied positively.



ANSWER
A1 – I like it very much
A2 – I like it
A3 – Neither like it nor Dislike
A4 – Dislike it
A5 – Dislike it very much
A6 – No answer

Chart 50 :Tire swings as a Natural Play Activity

- Seating areas from straw and clay 77.77% answered positively. 11.11% were negative and the rest remained neutral.

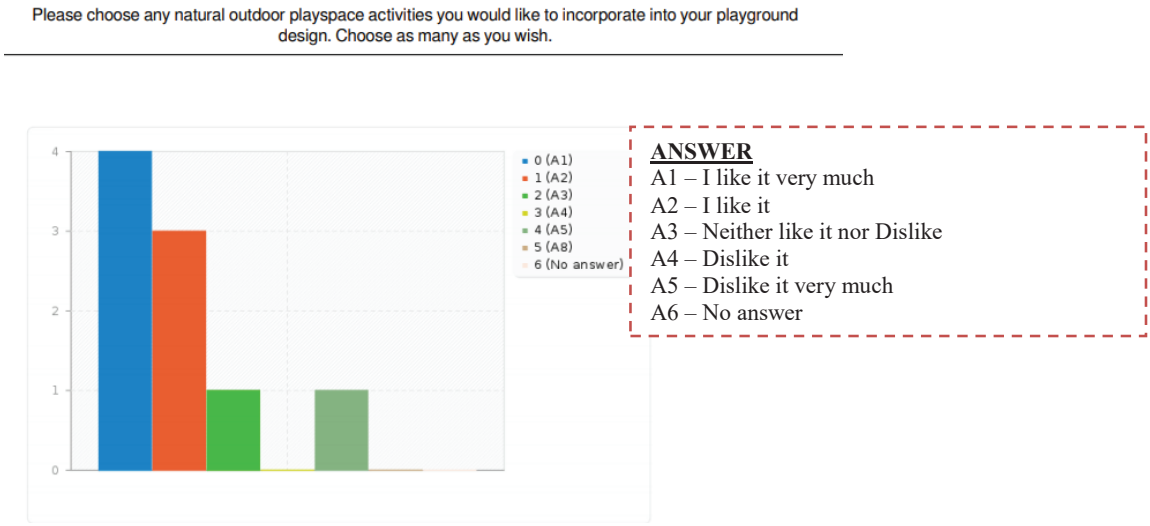


Chart 51: Seating areas of straw and clay

- Bamboo musical instruments 88.88% of the participants replied positively.

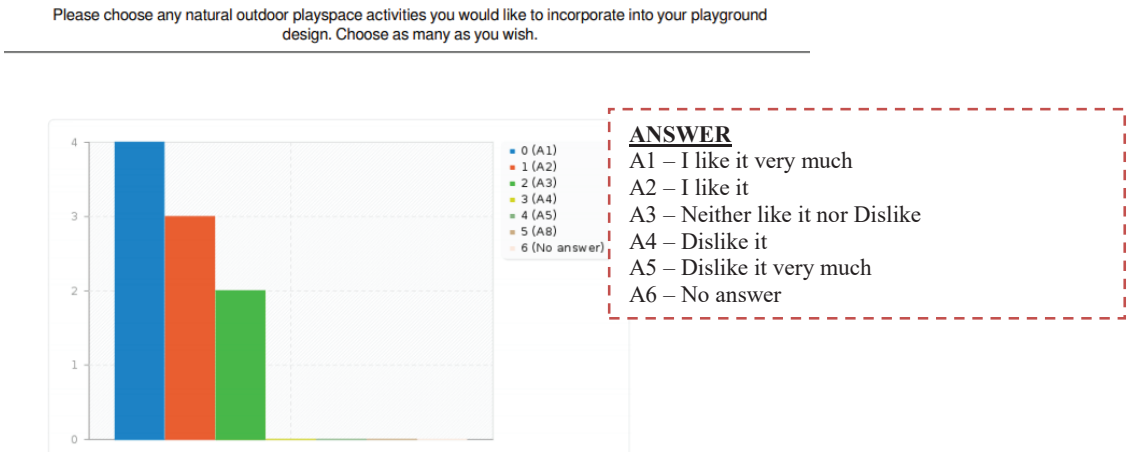


Chart 52 : Bamboo musical instruments

- Small ponds 66.67% of the participants replied positively. 11.11% were negative with this outdoor play activity

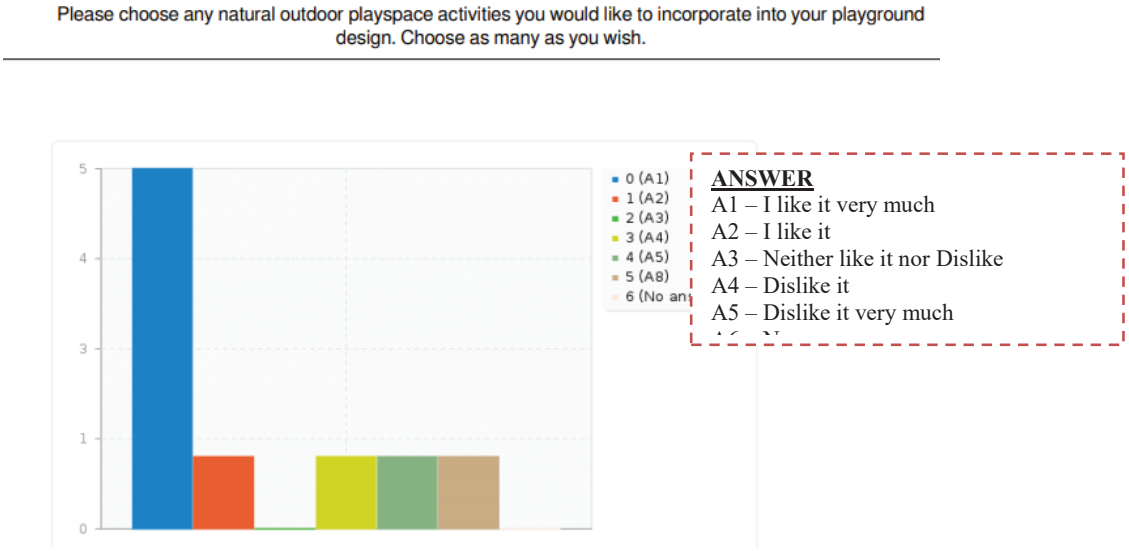


Chart 53 : Small ponds as a Natural play activity

- Strawbale fences used as borders 77.78% of participants replied positively.

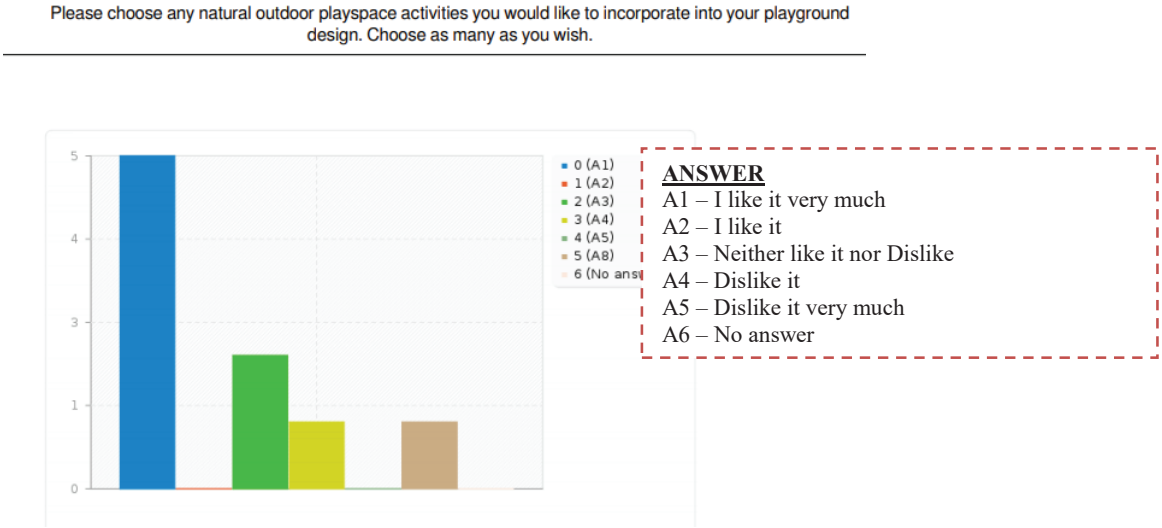


Chart 54 : Strawbale fences used as borders

- Climbing trees 77.77% of participants replied positively and a 11.11% were negative.

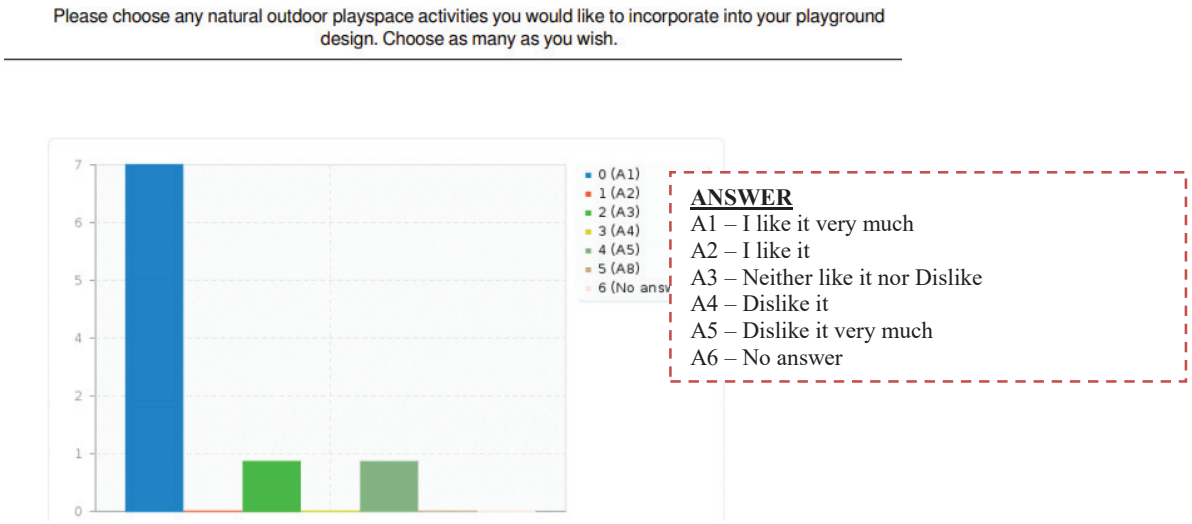


Chart 55 : Climbing trees as a Natural play Activity

- 3d Chess made of NaMa55.55% were positive with the idea but a 22.22% was negative.

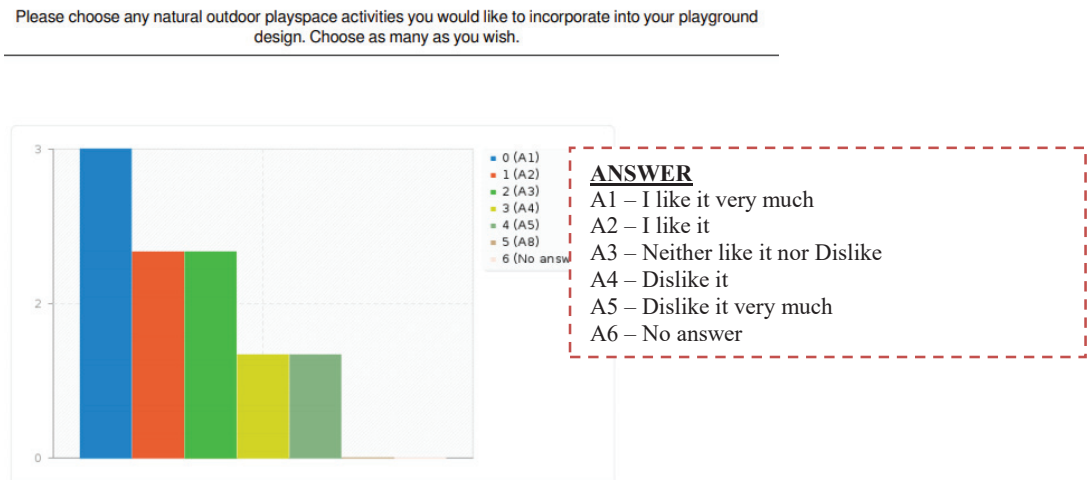


Chart 56 : 3d Chess made of NaMa as a Natural Play Activity

- Monthly educational workshops 66.66% of participants replied positively and a 111.11% were negative.

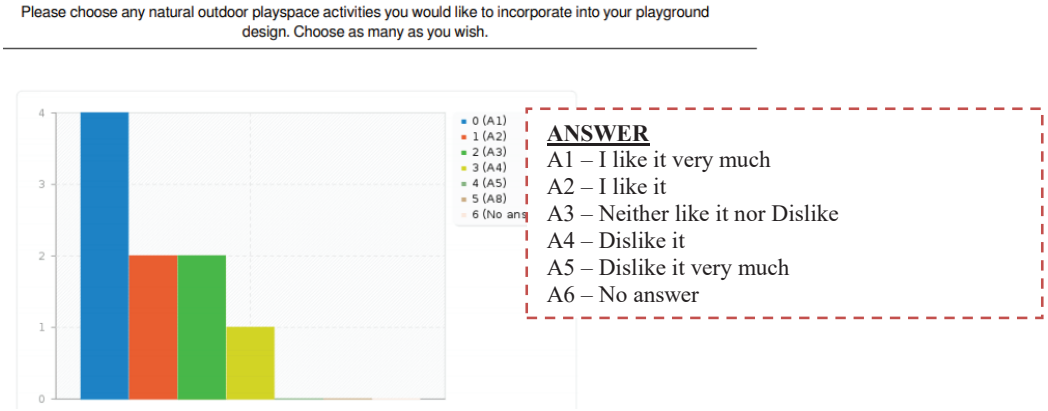


Chart 57: Mnthly education workshops

- Sandpit surrounded by blossomed flowers 88.89%

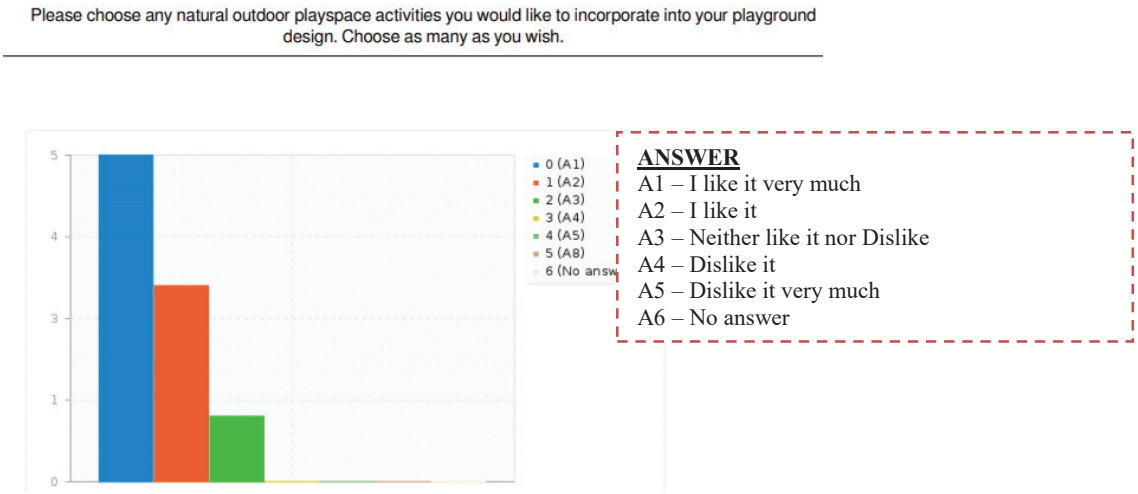


Chart 58 : Sandpit surrounded by blossomed flowers

- Wooden crawling structures 77.78%

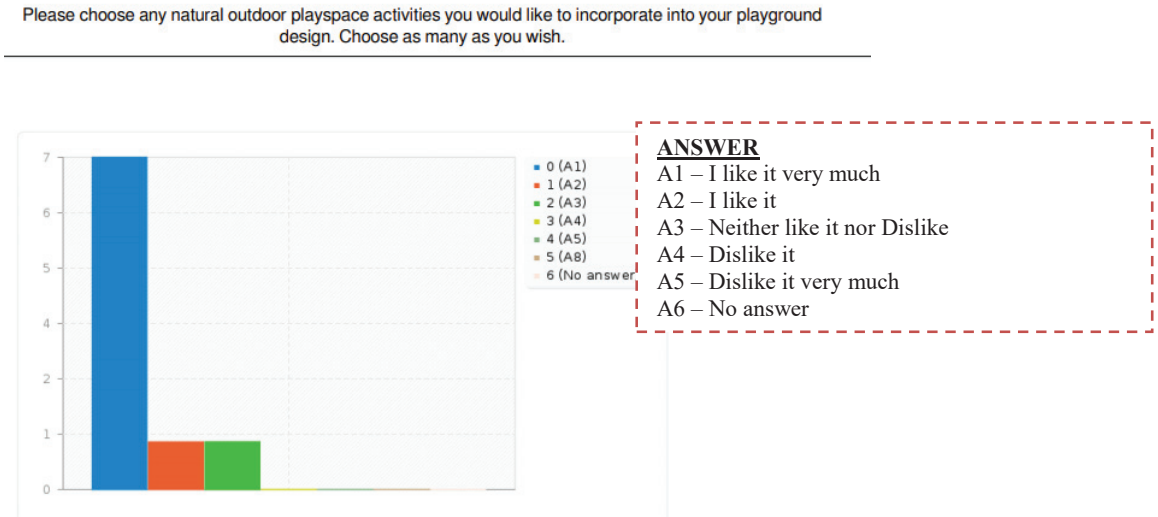


Chart 59 : Wooden crawling structures as a Natural play Activity

- Earthships 55.55%

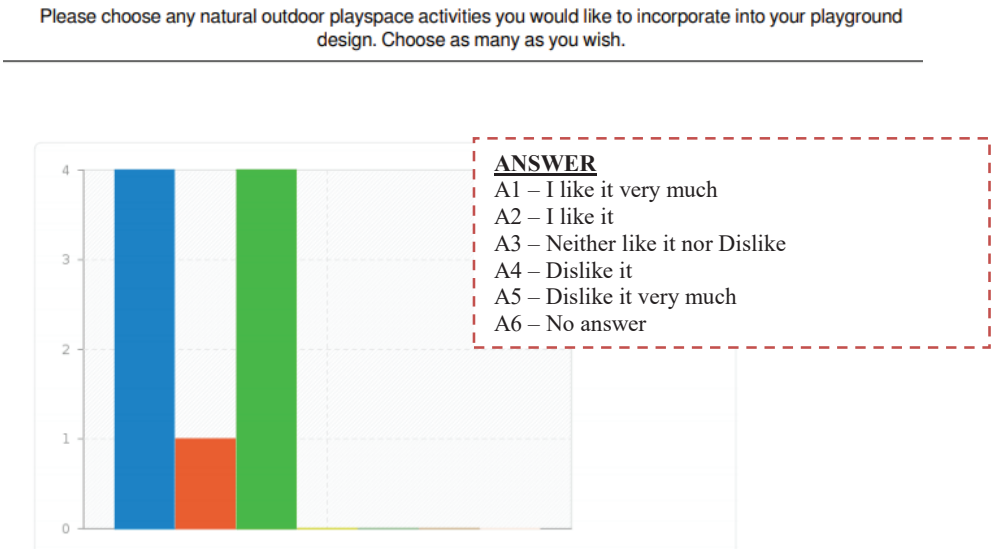


Chart 60: Earthships as a Natural play Activity

Survey Conclusion

From reviews provided by professionals as far as their in-depth view is concerned, their experience and knowledge of NaMa used in playgrounds, some notable conclusions are drawn.

Initially, the demographics of the individuals who participated in the Survey (Gender, Age, Occupation) were mostly women. With regard to age, the sample belongs to the 18-35 Age group, the most active, modern and up-to-date party of Landscape Architects/ Architects etc.

The period that the Questionnaire was active to the public (22.08-21.09.2018) is the main reason why we did not have enough participation, especially from Universities that it was sent since Academic year begins in early October. Another important fact is that out of the total of ***100*** Questionnaires sent, **25** were answered (a quarter of participation) which is a low percentage.

The results of the Research show that by 54.54% responsible for the playground design is Landscape Architect. But there could be a coalescing of Landscape Architects and all the specialized craftsmen, who are specified in the construction and creation of Natural constructions,for the design of playgrounds.The participation of craftsmen in the construction of the playspaces is required, so that there is an element of originality and locality.
But as far as it is concerned the Safety Requirements , the advisory service and the control by the competent body are needed so they can be done some changes or corrections or even additions to the existing Children´s playground Laws.

Influences of Landscape Architects for designing a play area are the Natural environment itself, needs of users, the culture, the location of where the playground is to be built.

A playground can thrive with the right selection of plants and materials.
Plant features help mental health and the proper development of children(effects on senses, creativity, social skills etc.).Something that makes it a very important factor in a playground area.

The functionality of the current playgrounds is 35.29% moderately useful through participants replies. That means, that improvements and changes should be taken into consideration.

In addition to, they were asked whether it would be preferable to have a training course or workshops at schools (88.88% were positive replies).
In this way, children and adults will be aware of the matter and be involved in its evolution.

At first glance of respondents replies to the Survey, were relatively positive in using /choosing NaMa for the construction of playgrounds. But there were also negative ones.
A 15% of participants (belonging to the solar group 50-75) pointed out that there are no suitable materials as we mention to our Questionnaire or you can not choose from a list what you will use. But in my humble opinion, if you take a look at today´s playgrounds you will notice that the only materials that are being chosen are steel, sand, cement, wood, and plaster for their construction. Materials that are more environmentally friendly, such as compressed earth(Rammed earth), clay, earthbags etc. are rarely selected for a playground construction. There are a lot of factors of course, involved before designing/planning a playground.

An open question for thoughts, is the reason for not choosing something purely from nature such as earth or straw, is it because of economic, safety, technical (experts in the field should be involved), lack of legislative frameworks(there is no specific Law about NaMa in playgrounds) , lack of knowledge of building methods or all of the above.

Either way, the intent and scope of Alternative Landscape Architecture is to create spaces for better Sustainable Open spaces that cause minimal environmental impacts and its use materials limit the exploitation of the Environment and the negative effects.

This represents a unique and incredibly great approach. However, the benefits are many and include long-term benefits.

Finally, it is important to note that the basic criteria of design a playground is the Location and the Budget of the project but taking into account the participation of the public.
So, we should consider more of the user's needs and judge and select what is good for them. Because there is always another solution for the greater good. Will you choose as a professional something *˝new˝* like that or will you design conservatively, it is up to you to change things.

SECTION 5: Final Conclusions

From the investigation that has been made, it becomes clear that the Natural Materials (NaMa) that were discussed in the process of our Research are not so widespread in the field of Landscape Architecture. Especially in the use of Playground construction, but movements has begun to change that. A primary step would be to introduce these NaMa and elements to the National/International Playground Association.

At the beginning of our research, it was analyzed thoroughly the History of Playgrounds, and more specifically, in the countries of Germany, the USA, and the U.K. It is extensively analyzed their evolution over the years with remarkable results.

Playgrounds are part of our history, legacy, culture, and their proper design should be taken into serious account.

Based on Researches, children when come into contact with Natural settings (straw, sand, clay, water, rocks, wood, and plants) enable them to shape their environment developing their physical, motor, creative and constructional cognitive abilities. In the most densely populated areas, this is impossible due to the lack of play environment(open urban areas), which makes it difficult for them to get to know their physical activity, which is the free improvised play.

Aim of our Research is to change the way of thinking as far Open Green Spaces (playgrounds, public parks etc.) is concerned by starting finding alternative ways of improving the way of children´s life in the big cities. To do that, it is necessary to reduce the Carbon Emissions and provide a healthier and friendlier environment for children to play to.

Nowadays, our need to find new materials/ new ways in the landscaping development site to partially replace the non-environmentally friendly materials is constantly increasing. Instead of using the main construction materials for play areas, it is suggested through our Investigation to consider using alternative solutions that can replace or coexist with the existing playground equipments.

During the development of our Research it was our duty for answering a variety of Questions that were raised.

It seems that there are no specific Regulations, Law involving NaMa to be used in Outdoor Play Spaces. Actions should be taken into account of having additional Guidelines and Laws for these Natural Materials and elements, that were discussed in the first Section of our Research.

Playgrounds can contain elements that are part of nature or are made from Natural Materials such as climbing trees, shrubs, grass, stones, sand, tree houses made of wood or bamboo, cob climbing houses, Straw Bale Gardening, Rammed Earth climbing walls and many more. Emphasis is given to develop a variety of skills so intellectual, cognitive, gross motor skills can be developed.

Another important factor in the development of playgrounds is vegetation which serves a unique and essential role in the child development. Natural Play environment encourage children to use their imagination through play while at the same time discovering the nature through the senses. Moreover, Natural Materials can be compared with the seasonal changes and so can vegetation with the senses to improve the developmental needs of the children. To illustrate, due to each material´s resistance to cold or warm conditions, should be placed in Play spaces each season different NaMa method structure so children can come into first contact with the nature and recognize the seasonal changes.

In addition,a Survey Questionnaire was developed to be given to Architects /Landscape Architects to record their point of view as far as it concerns the Materials/ appropriate vegetation

that is being used ,the major factors of Designing a playground and acknowledgement and awareness with regard to NaMa.

The results showed that the majority of Respondents answered positively to the use of NaMa in Outdoor Play Spaces but their level of knowledge and professional training was limited.

That means that there is a positive tendency for these Natural Methods to be applied in playgrounds.

If we were given the opportunity, it would have been done an Implementation of the Natural Materials in the play areas or a seminar with a collaboration of Natural Building Associations of the Region, to construct an experimental play space.

Finally, we hope that such materials, as well as other similar, derived from nature, will be in the Future the subject of a more extensive Research that will create the conditions for a more environmentally friendly outdour play environment for the children.

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APPENDICES

APPENDIX A

Survey Questionnaire

Survey Questionnaire of the Playgrounds made of Natural Materials

My name is Emmanouela Mygiaki, a postgraduate student in Landscape Architecture and Greenspace Management of Neubrandenburg University of Applied Sciences.

Along the way, the Master´s thesis explores how natural materials such as wood, straw, clay, rammed earth, but also rainwater management, Earthbags constructions, and Earthship models can coalesce with already existing (non-natural) materials on the playground spaces.

The purpose of the paperwork is to investigate the vital role of playgrounds in the field of Landscape Architecture, having a specific focus on the use of natural materials.

Note that It will be asked from you in case of participating in a Playground design to send 3 photos at low resolution before,after the construction and how it is maintained till today.

Due to the scientific approach of my Master's paper, the following survey questionnaire was developed to record the point of view of architects, landscape architects, civil engineers, carpenters, et cetera.

The evaluation questionnaire on the certain topic aims to be the primary material for the further quantification of the data. After its processing quantitative and qualitative characteristics will emerge, which will allow me to arrive and to draw conclusions, as far as the existing knowledge and the recording of quality data allows it.

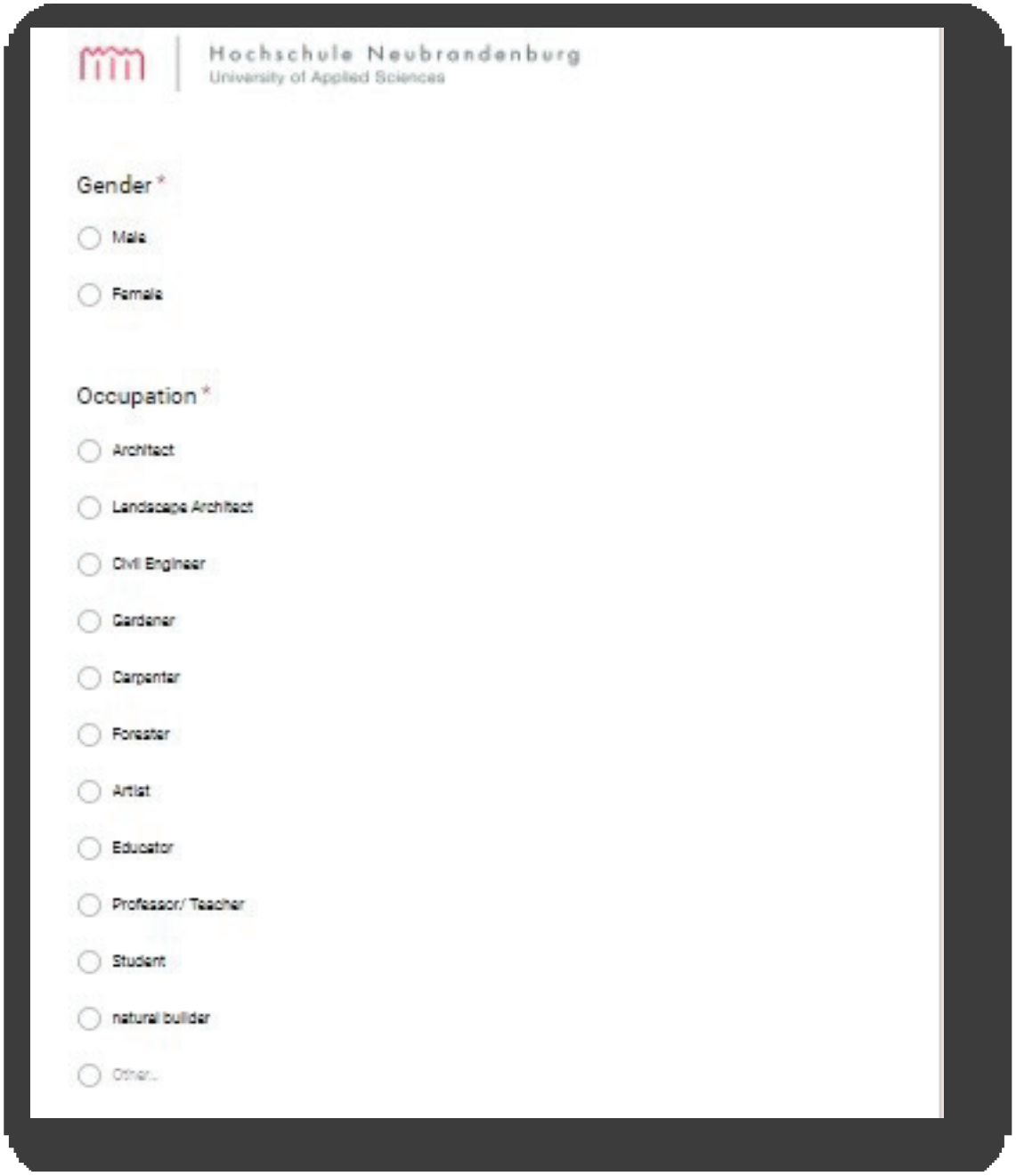
To participate, please click on the red button below.
The survey will take at most 20 minutes to complete.
The deadline is 1st October 2018.
Please forward this e-mail to all appropriate personnel.

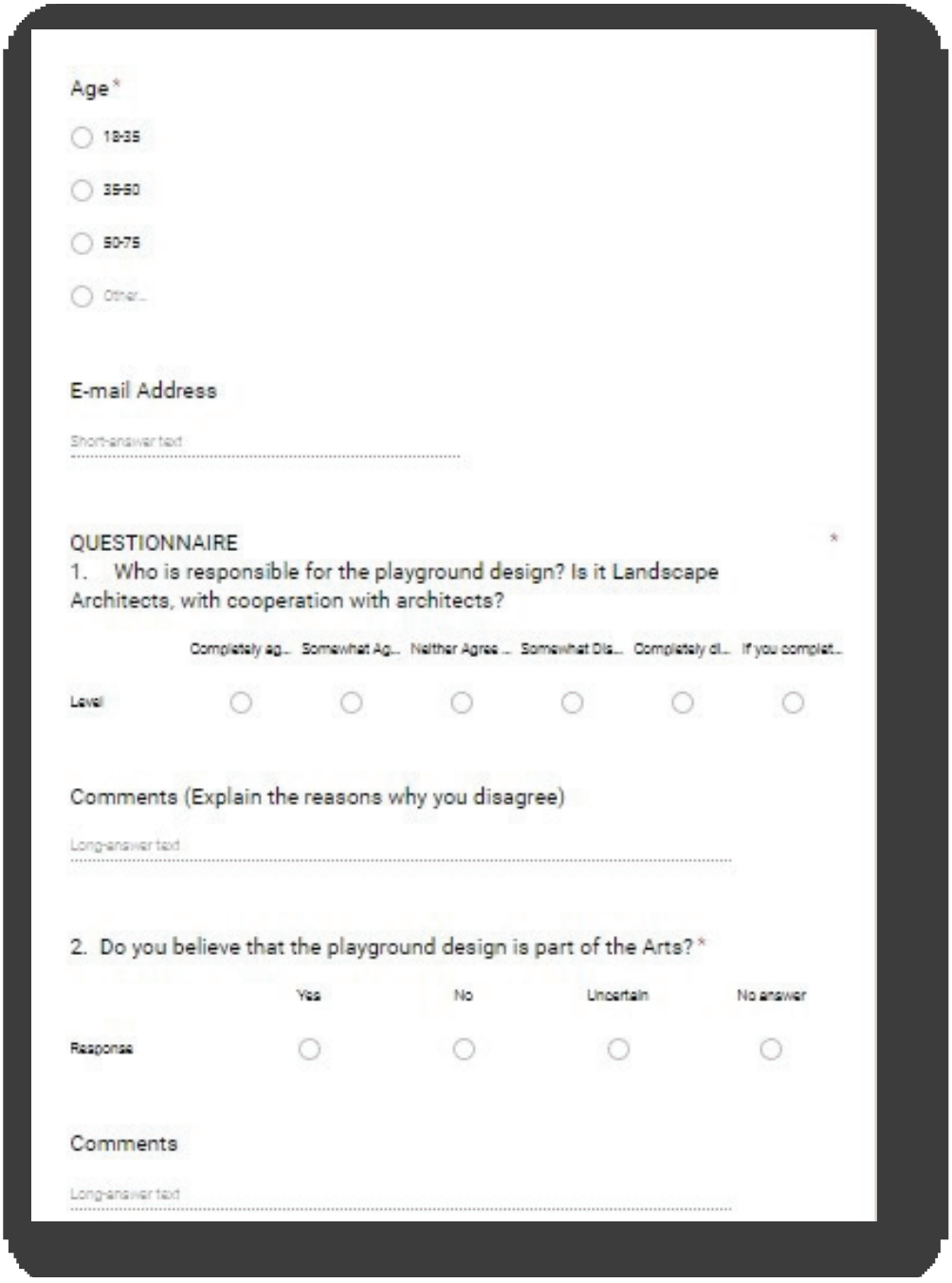
Thank you very much for contributing in my Master´s research.

If you are interested in the final results ,please send me an e-mail, so that I can contact you back as soon as the deliverables are at hand.

Sincerely Yours,

Emmanouela Mygiaki


Hochschule Neubrandenburg
University of Applied Sciences
Gender *
Male
Female
Occupation *
Architect
Landscape Architect
Civil Engineer
Gardener
Carpenter
Forester
Artist
Educator
Professor/ Teacher
Student
natural builder
Other...



Age *

- 18-35
- 35-50
- 50-75
- Other...

E-mail Address

Short-answer text

QUESTIONNAIRE *

1. Who is responsible for the playground design? Is it Landscape Architects, with cooperation with architects?

	Completely ag...	Somewhat Ag...	Neither Agree ...	Somewhat Dis...	Completely di...	If you complet...
Level						

Comments (Explain the reasons why you disagree)

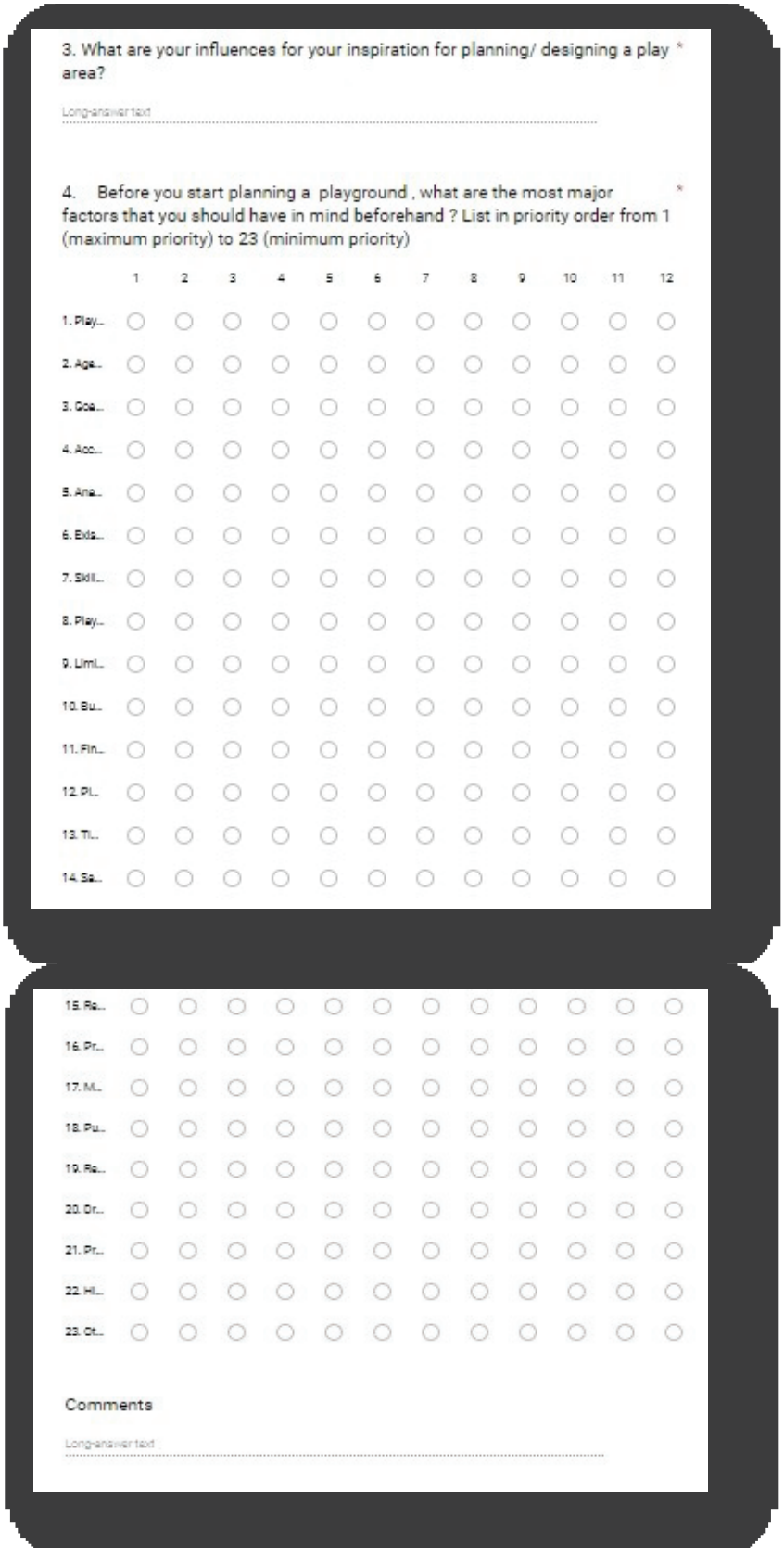
Long-answer text

2. Do you believe that the playground design is part of the Arts? *

	Yes	No	Uncertain	No answer
Response				

Comments

Long-answer text



3. What are your influences for your inspiration for planning/ designing a play area? *

Long-answer text

4. Before you start planning a playground , what are the most major factors that you should have in mind beforehand ? List in priority order from 1 (maximum priority) to 23 (minimum priority) *

	1	2	3	4	5	6	7	8	9	10	11	12
1. Play..	○	○	○	○	○	○	○	○	○	○	○	○
2. Age..	○	○	○	○	○	○	○	○	○	○	○	○
3. Coa..	○	○	○	○	○	○	○	○	○	○	○	○
4. Acc..	○	○	○	○	○	○	○	○	○	○	○	○
5. Ana..	○	○	○	○	○	○	○	○	○	○	○	○
6. Exis..	○	○	○	○	○	○	○	○	○	○	○	○
7. Skil..	○	○	○	○	○	○	○	○	○	○	○	○
8. Play..	○	○	○	○	○	○	○	○	○	○	○	○
9. Limi..	○	○	○	○	○	○	○	○	○	○	○	○
10. Bu..	○	○	○	○	○	○	○	○	○	○	○	○
11. Fin..	○	○	○	○	○	○	○	○	○	○	○	○
12. Pl..	○	○	○	○	○	○	○	○	○	○	○	○
13. Ti..	○	○	○	○	○	○	○	○	○	○	○	○
14. Sa..	○	○	○	○	○	○	○	○	○	○	○	○
15. Re..	○	○	○	○	○	○	○	○	○	○	○	○
16. Pr..	○	○	○	○	○	○	○	○	○	○	○	○
17. M..	○	○	○	○	○	○	○	○	○	○	○	○
18. Pu..	○	○	○	○	○	○	○	○	○	○	○	○
19. Re..	○	○	○	○	○	○	○	○	○	○	○	○
20. Dr..	○	○	○	○	○	○	○	○	○	○	○	○
21. Pr..	○	○	○	○	○	○	○	○	○	○	○	○
22. Hi..	○	○	○	○	○	○	○	○	○	○	○	○
23. Ot..	○	○	○	○	○	○	○	○	○	○	○	○

Comments

Long-answer text

5. By what criteria you select the appropriate plants and trees having in the playgrounds? *

Long-answer text

Comments

Long-answer text

6. What are the characteristics that plants / trees offer to playgrounds? *

Long-answer text

Comments

Long-answer text

7.Some of the plants are toxic. Will you put toxic plants in playgrounds only to educate the kids that it is forbidden to touch or taste these toxic plants/ trees? *

	Completely ag...	Somewhat Ag...	Neutral	Somewhat Dis...	Completely di...	If you complet...
Level	○	○	○	○	○	○

Comments

Long-answer text

8.By what criteria a landscape architect choose the materials that he will use at the playground ? *

Long-answer text

Comments

Long-answer text

9. What are the most suitable materials/ elements for a playground design /construction that a landscape architect choose?Is it wood ? Metal? Steel? Sand? Earth?Please justify your answer below. *

Long-answer text

Comments

Long-answer text

10. What natural materials/ elements have you used in your design for kindergardens,school playgrounds,public parks, playgrounds? *

Long-answer text

Comments

Long-answer text

11. Can materials like Strawbale, earthship , rammed earth constructions can be used in playspaces? What is applicable to the legislation on the use of natural materials/methods in playgrounds ? *

Long-answer text

12. During the years of your work you have focused on private gardens / parks but you have awakened an interest in playground design. What is the reason that you wanted to deal with the design of playgrounds?

Long-answer text

Comments

Long-answer text

13. What about maintenance of the playgrounds after the project is done? *

Long-answer text

Comments

Long-answer text

14. What is your opinion about the already existing playgrounds? Do they serve their original purpose or do they need to change/ be improved?

Long-answer text

Comments

Long-answer text

15.What do you have to point out about Safety in natural playgrounds? What applies?

Long-answer text

16.Please mention about playground projects that you have participated in or you were in charge. What materials were used for construction?.Analyse one case.

Long-answer text

Comments

Long-answer text

17. May I have the permission of using photos of playground structure(of the case you analyzed on question 16) in a low resolution of the stages before, after the construction and how it is maintained now (If the file size is bigger than 100 MB please send via email the file.)?

ADD FILE

Comments

Long-answer text

18. What is your opinion about natural playgrounds? Is it a new movement? *

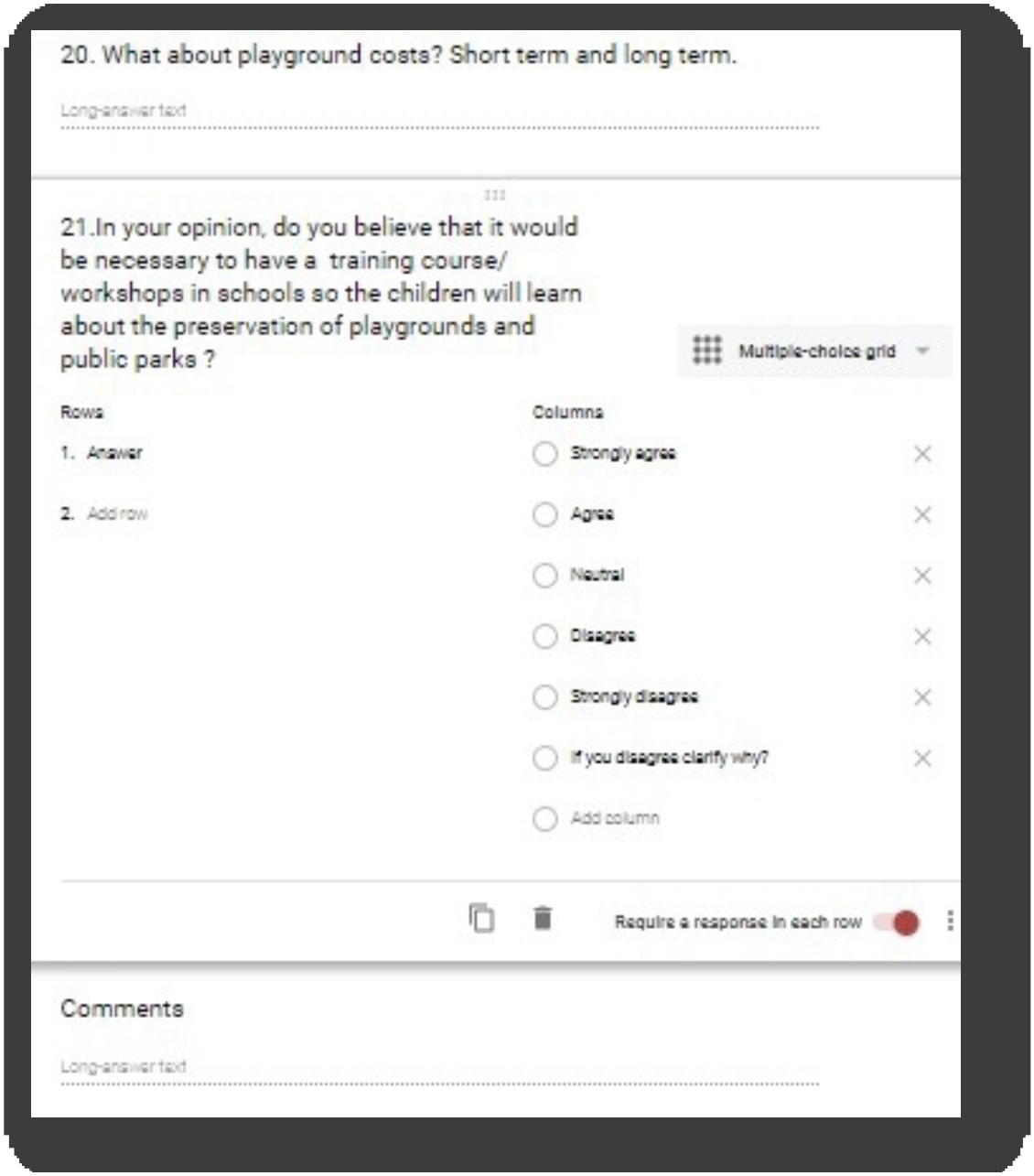
	Strongly agree	Agree	Neutral	Disagree	Strongly Disag...	If you disagree...
Level	○	○	○	○	○	○

Comments

Long-answer text

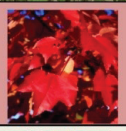
19.Please choose any natural outdoor playspace activities you would like to incorporate into your playground design .Choose as many as you wish. *

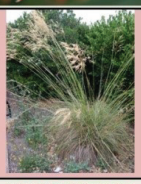
- [ ] Rain water usage for irrigation
- [ ] Cob houses
- [ ] Straw bale gardening
- [ ] Earthbag slides
- [ ] Rammed earth climbing walls
- [ ] Seasonal plants/trees
- [ ] Green houses for kids
- [ ] Sculptures of straw and clay
- [ ] pavements/pathways made of natural materials
- [ ] Tire swings
- [ ] Seating areas from straw and clay
- [ ] Bamboo musical instruments
- [ ] small ponds
- [ ] Strawbale fences
- [ ] Climbing trees
- [ ] 3d Chess made of natural materials
- [ ] weekly/monthly educational workshops for children to learn how to maintain their play area.
- [ ] wooden crawling structures
- [ ] sandpit surounded by blossomed flowers
- [ ] Earthships
- [ ] Other...


20. What about playground costs? Short term and long term.
Long-answer text
21.In your opinion, do you believe that it would be necessary to have a training course/ workshops in schools so the children will learn about the preservation of playgrounds and public parks ?
Multiple-choice grid
Rows
1. Answer
2. Add row
Columns
Strongly agree
Agree
Neutral
Disagree
Strongly disagree
If you disagree clarify why?
Add column
Require a response in each row
Comments
Long-answer text

APPENDIX B

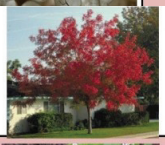
List of plants suitable for play areas

S No	Common Name	Image	Botanical Name	Height -Spread	Growth	Fruits
1	European Beech /Weeping beech		Fagus sylvatica Pendula	15-20 m tall,15-20 m wide	Hardiness Zones 4–7	Beechnuts Showy, Edible.Monoecious yellowish green Flowers inconspicuous.
2	American Beech		Fagus grandifolia	15-20 m tall,15-20 m wide	Hardiness Zones 3-9	Beechnuts Showy, Edible.Flowers inconspicuous
3	European Field Elm		Ulmus carpinifolia	25-40m tall ,12-20 m wide	Hardiness Zone 5	winged nutlet, 1.5 - 2 cm
4	Red maple, Scarlet maple, Swamp maple		Acer rubrum	7-20m tall ,4-7m wide	Hardiness Zone 4	winged nutlets, ca 2 cm / red, in small umbels, March/April, fragrant flowers
5	Common Oak,English Oak		Quercus robur	30-40m tall, 15-25m wide	Hardiness Zones 5 to 8	Showy fruits,Insignificant monoecious yellowish-green flowers
6	Japanese pagoda Tree. Styphnolobium japonicum		Sophora Japonica	15-20m tall , 12-15m wide	Hardiness Zone 6	Fleshy fruit
7	Stone pine		Pinus pinea	12-25m tall, 8m width	Hardiness Zone 8	edible pine nuts (pignolis)
8	European cranberry Bush		Viburnum opulus	2-5m tall and wide	Hardiness Zone 4	transparent,shiny,red stone berries,unpalatable.The fruit is edible in small quantities, with a very acidic taste; it can be used to make jelly. It is however very mildly toxic, and may cause vomiting or diarrhea if eaten in large amounts.
9	London planetree		Platanus acerifolia	25-30m tall,15-25m wide	Hardiness Zone 6	Persistent into spring in hanging capsules
10	Field /Hedge Maple		Acer campestre	3-15m tall,-m wide	Hardiness Zone 5	after pollination by insects, flowers develop into large, winged fruits, which are dispersed by wind.

S No	Common Name	Image	Botanical Name	Height -Spread	Growth	Fruits
11	Japanese Maple,Smouth Japanese Maple		Acer Palmatum	4-6m tall,2-5mwide	Hardiness Zone 6	Initially reddish,very atractive.The fruit is a pair of winged samaras (nutlets with stiff, fibrous, papery wings that aid in wind dispersal). Each samara 2–3 cm long with a 6–8 mm seed.
12	Giant feather or needle grass / Golden oats		Stipa Gigantea	1.8-2.4m tall, 0.6-0,.9 m wide	Hardiness Zone 6	seeds
13	Weeping Bottlebrush		Callistemon viminalis	3-4.5m tall, 1.5m wide	Hardiness Zone 8	-
14	Red cascade		Euonymus Europaeus	1.5-7m tall,2.5-4m wide	Hardiness Zone 4	Fruits bright rose-pink, 2cm across, opening to reveal orange seeds
15	American smoketree/ CHITTAMWOOD		Cotinus obovatus	3-10m tall,4-8 m wide	Hardiness Zone 4-8	Bizarre fuzzy inflorencesnces like wigs,persistent
16	Weeping Willow		Salix Babylonica	12-15m tall,	Hardiness Zones 6-8	-
17	Japanese pittosporum		Pittosporum tobira	2-10m tall,1.5-3m wide	Hardiness Zone 9	Round,woody,yellow-brown capsules,red seeds in sticky flesh,up to 1.5 cm long.
18	Platycladus orientalis-Pyramidalis Aurea-Chinese Arbor-vitae		Thuja orientalis	2-6m tall ,1-2m wide	Hardiness zone 6	-
19	Veitch's silver-fir		Abies veitchii	5-10m tall ,3-4m wide	Hardiness Zone 8	-
20	Eastern white pine, northern white pine, white		Pinus strobus	15-30m tall,6-10m wide	Hardiness Zone 5	up to 20cm long,slender,cylindrical,light brown cones,usually resinous.

S No	Common Name	Image	Botanical Name	Height -Spread	Growth	Fruits
21	White spruce		Picea glauca	15-40 m tall,	Hardiness Zone 4	Non-flowering
22	southern magnolia or bull bay,		Magnolia Grandiflora	3-4mtall,4-6m wide	Hardiness Zone 7	Cylindrical,red syncapy
23	Redbud, Eastern redbud, Mexican redbud,Texas redbud		Cercis canadensis	6-12 m tall,4-6m wide	Hardiness zones 4-8	light pink to pale red, in clusters, April/May, fragrant flowers
24	Judas Tree		Cercis siliquastrum	4-6 m tall and wide	Hardiness zone 7	Browish , leathery husks,lasting through winter
25	American plane tree, Western plane, Buttonwood, American sycamore		Platanus occidentalis	20-40m tall,1.5-2m wide	Hardiness zones 4-9	spherical, spiky, brown, usually single
26	fragrant sumach lemon sumac		Rhus aromatica	2 to 4 m tall with a rounded form	Hardiness zones 3-9	Showy
27	Goat Willow, Great Sallow		Salix Caprea	3-13m tall, 3-5m wide	Hardiness zone 4	none
28	Bloody cran´s bill or bloody geranium		Geranium sanguineum	2o-40cm tall layers up to 70cm	Hardiness Zones 3-9	the fruit is dry but does not split open when ripe
29	Snapdragon		Antirrhinum majus	0.5–1 m tall, rarely up to 2 m.	Hardiness Zones 7-9	The fruit is an ovoid capsule 10–14 mm diameter, containing numerous small seeds.

No	Common Name	Image	Botanical Name	Height -Spread	Growth	Fruits
30	August Lily, Corfu lily, fragrant plantain lily		Hosta plataginea	0.3-0.45 tall,0.45-0.6 wide	Hardiness Zones 3-9	none
31	Lemon thyme		Thymus x Citriodorus	0.10m tall ,0.3m wide	Hardiness Zones 5-8	none
32	Garden pnk,common pink		Dianthus plumarius	0.3-0.6m tall;0:45-0:6M WIDE	Hardiness Zones 3-9	none
33	English Hawthorn		Crataegus Laevigata	3-8 m tall ,3-6m wide	Hardiness zones 4-7	Showy,edible
34	Bayberry		Myrica Pensylvanica	1.5-3.00m tall,1.5-3m wide	Hardiness Zones 3-7	Showy,edible
35	ummer lilac, butterfly-bush, or orange eye		Buddleja davidii	1.8-2.5m tall,0.9-1.5m wide	Hardiness Zones 5-9	small capsules,not of ornamental importance.
36	chaste tree, chasteberry, Abraham's balm, lilac chastetree, or monk's pepper		Vitex agnus castus	1.5-2.5m tall,1.5-2.4m wide	Hardiness Zones 3-9	inconspicious, seeds slightly opening in dry areas
37	lavender cotton		Santolina chamaecyparissus	0.4-0.5m tall	Hardiness Zones 6 -9	none
38	Fringe tree		Chionanthus virginius	1-3 m tall, 1-3m wide	Hardiness Zone 5	Often no fruits, as dependent on foreignpollen, blue black berries from September
39	wall germander		Teucrium chamaedrys	1-3m tall, o.3 -0.6m wide	Hardiness Zones 5-9	none
40	Jasmine or common jasmine		Jasminum officinale	6-9m tall, 2.1-4.5 m wide	Hardiness Zones 7-9	none

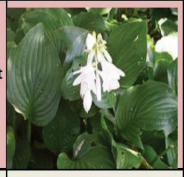
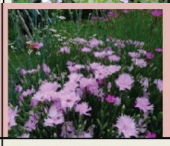
No	Common Name	Image	Botanical Name	Height -Spread	Growth	Fruits
41	Chinese juniper		Juniperus chinensis	1.5-2m tall ,varying in width	Hardiness Zones 4-9	globose, berry-like cones
42	Arctic birch		Betula nana	0.2-1.2m tall and wide	Hardiness zone 1	none
43	Fountain Grass		Pennisetum setaceum	0.9-1.5 tall,0.6-1.2m wide	Hrdiness Zones 9-10	none
44	Annual Honesty or silver dollar		Lunaria Annua	0.6-0.9m tall,0.3-0.6 wide	Hardiness Zones 5-9	showy
45	Chinese pistache		*Pistacia chinensis*	9-20m tall,6-9m wide	Hardiness Zones 6-9	Showy
46	Woodruff		Galium odoratum	0.15-0.30 tall,0.20-0.4m wide	Hardiness Zones 4-8	Showy
47	tatarian dogwood		Cornus alba	2-3m tall,3-5m wide	Hardiness zones 3-7	Showy
48	Golden bamboo		Phyllostachys aurea	3-5m tall and wide	Hardiness Zone 8	none
49	Dalmatian bellflower		Campanula portenschlagiana	0.1-0.15m tall	Hardiness Zones 4- 8	none
50	Flowering Ash		Fraxinus ornus	6-8m tall,4-6m wide	Hardiness zones 6-9	none

S No	Common Name	Image	Animals/ Insects	Fragrance	No fragrance	HABIT	Soil preference	Toxicity	
								mildly toxic	highly toxic
1	European Beech /Weeping beech		Beechnuts are eaten by birds and mammals, serving as an important food for chipmunks and squirrels.		No fragrance	Medium-size tree,Umbrella-shaped,overhanging,broad crown	acidic, loamy, moist, sandy, well-drained and clay soils.	X	
2	American Beech		over 100 species of butterflies and moths/leaf-footed bugs/ ants/ wild turkeys, foxes, and porcupines/ squirrels/ birds like wood thrushes and overbirds.		No fragran	Large,powerful tree with dense foliage.		X	
3	European Field Elm		valuable for butterflies		No fragrance	Large tree,fast-growing,initially conical,later to wide - ovoid, straight leader	moist and light, favours calcareous soils	X	
4	Red maple, Scarlet maple, Swamp maple		wild birds (woodpeckerss), host 300 caterpillar species,many species of moths.food source for numerous mammals, birds, and insects.	red flowers, in small umbels,plentiful ,fragrance of honey.		Small to medium size tree,large shrub,loose habit,crown assymetrical ,conical to broadly ovoid,lower branches overhanging,initially	moist, lime-free soil	X	
5	Common Oak,English Oak		Numerous insects live on the leaves, buds, and in the acorns,Squirrels, chipmunks and some birds, notably Eurasian jays Garrulus glandarius.		No fragran	Large tree,initially conical,then assymentrical and loosely round crown, main stem usually short, branches diagonically rising,slow-growing.	Dry to moist, not demanding,robust,on all nutritious, moderately tolerant to soil.	X	
6	Japanese pagoda Tree. Styphnolobium japonicum		Really helpful for bees as it flowers late in the summer	Small, fragrant, pea-like, creamy white flowers		Light,medium -size tree,round crown,somewhat umbrella-shaped when old,short sterm,main branches funnel-shaped	Slightly acidic to very alkaline, always well drained,sand-loamy substrates,not too heavy soil-it will not ripen.	X	
7	Stone pine		Seeds are nearly wingless and dispersed by birds (also eaten by rodents)	The familiar fresh pine fragrance given off by the tree is due to oil released from the		Medium-size,conical tree, with dense flat or umbrella-shaped ,domed crown,branches arranged in circles.	generally tolerant of a wide range of soils, including both sandy and clay soils.acid, neutral and basic (alkaline) soils.	X	
8	European cranberry Bush		Birds will eat the berries and insects like hoverflies feed on the nectar. The larvae of several moth species will feed on the leaves.Attracts butterflies.	small cream or pink -white fertile flowers in the middle.		A broadly upright,large shrub,often thicket-like,twigs horizontaal to arching,medium to strong-growing	Suitable for: light (sandy), medium (loamy) and heavy (clay) soils	X	

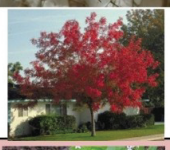
S No	Common Name	Image	Animals/ Insects	Fragrance	No fragrance	HABIT	Soil preference	Toxicity	
								mildly toxic	highly toxic
9	London planetree		Very little wildlife is associated with London plane, although the seeds may be eaten by grey squirrels.House finch also like eating London plane seeds.	Incospicuous		A majestic large tree, initiallz broadlz conical, then extensive and with round,branches diagonally extented ,twigs upright overhanging,fast-	light (sandy), medium (loamy) and heavy (clay) soils		X
10	Field /Hedge Maple		Field maple is attractive to aphids and therefore their predators, including many species of ladybird, hoverfly and bird. The leaves are eaten by the caterpillars of several species of moth, including the sycamore moth, the mocha, the maple pug, the small yellow wave, the prominent and	Incospicuous		Medium-size tree or shrub,broadly conical or ovoid to roand,moderately growing,25-40m per year, some solitaries have lower branches that hang down low.	light (sandy), medium (loamy) and heavy (clay) soils and can grow in heavy clay soil.	X	
11	Japanese Maple,Smouth Japanese Maple		Attracting birds and butterflies		No fragrance	Exquisite large shrub or small tree,often with stems ,broader than wide when old,loose crown,slow - growing,15-20cm per year.	light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in heavy clay soil. Suitable pH: acid, neutral and basic (alkaline) soils and can grow in very acid soils.	X	
12	Giant feather or needle grass / Golden oats		Attracting butterflies	The plant has prominent flower spikes emerging silver-laveneder in the late spring, aging to a radiant golden over the summer, and persisting in tan into winter.		has leaf blades that are narrow and gray-green, creating a bunchgrass foliage mass 2–3 feet (0.61–0.91 m) in diameter. It is evergreen to semi-evergreen, depending on the climate	light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil.	None known	
13	Weeping Bottlebrush		attract bees, birds and butterflies.	leaf is fragrant		It is a multi-trunked, large shrub or tree with hard bark, often pendulous foliage and large numbers of bright red bottlebrush flowers in spring and summer		X	
14	Red cascade			Flowers small, yellow-green.		Large shrub,loosely upright to overhanging,extended moderately,fast-growing.	light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil.	X	

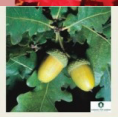
S No	Common Name	Image	Animals/ Insects	Fragrance	No fragrance	HABIT	Soil preference	Toxicity	
								mildly toxic	highly toxic
15	American smoketree/ CHITTAMWOOD		Attracts mammals	flower clusters (tiny, insignificant, dioecious, yellowish-green flowers) which bloom in June, but from the billowy hairs which turn a smoky pink to purplish pink in summer		It is a small, deciduous, rounded, Missouri native tree or large, upright shrub typically growing 20-30' tall and occurring on limestone glades, rocky limestone bluffs and bald knobs in the area of the White River in southeast Missouri	light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil.	×	
16	Weeping Willow		Produce pollen and nectar that feed bees. Attracts butterflies ,birds,moths and cattepillars		No fragrance	medium to large deciduous Tree,broad weeping, dark, dense crown, capricious growing , trunk greyish black, grooved, twigs green .	moist to wet, preferably calcareous. suitable for wet soil, withstand short flood, withstand long flood	×	
17	Japanese pittosporum		Attracts butterflies ,bees	White lateryellowish large bell-shaped ,up to 25cm wide ,very fragrant in terminal groups,spring to early summer		Large shrub or small tree ,dense habit,upright,string branches,slow-growing.	Fresh to moist,loamy,nutricious,well drained soil.dry in winter	×	
18	Platycladus orientalis-Pyramidalis Aurea-Chinese Arbor-vitae		Attracts birds	Insignificant		Initially columnar , later slenderly conical large shrub.Bark thin, red-brown, separating into papery scales.	Moderately dry to moist,slightly acidic to alkaline, in any garden soilthat is not to heavy.	×	
19	Veitch's silver-fir		Attracts birds.	fragrant flowers		Medium -sized tree, initially slenderly,conical,gradually wider,very symmetrical branches extended in layers to ascending loose, slow-growing 20-35 cm per	Fresh to moist, acidic, or neutral, avoids chalk, well-drained,sandy loamy.	None known	

S No	Common Name	Image	Animals/ Insects	Fragrance	No fragrance	HABIT	Soil preference	Toxicity	
								mildly toxic	highly toxic
20	Eastern white pine, northern white pine, white pine, Weymouth pine		It provides food and shelter for numerous forest birds, such as the red crossbill, and small mammals such as squirrels.	unremarkable, ♂ conical flowers, yellowish brown, fragrant flowers		Loose large tree, old specimen sometimes reaching 20m width ,conical when young, soon becoming assymetrically cylindrical,branches horizontalin	Moderately dry to moist ,very acidic to neutral,chlorotic on alkaline soil,good on well drained,poor or nutritious soil.	×	
21	White spruce		attracts forest birds		No fragrance	Usually conical ,medium -sized tree ,cultivats often cushion-like and slow-growing	Fresh to moist,occasionally damp,sensitive to heat and drought,very acidic to slightly alkaline,on all well-drained, not too nutricious substrates,sensitive to salt.	×	
22	southern magnolia or bull bay,		attracts butterflies,bees,birds	Before leaves shoot plentiful with radiant white ,wide-open flower stars,some 10 cm long,slightly fragrantflowers after the 15thyear only.		Conical small tree or shrub,with short stem,branches stiffy upright,horizontal to vertically ascending.	fresh to moist well drained rich in humus,acidic to neutral,evenly moist in summer,nutritious.tolerates alkaline loam	×	
23	Redbud, Eastern redbud, Mexican redbud,Texas redbud		valuable for bees (honey plant), valuable for butterflies	light pink to pale red, in clusters, April/May, fragrant flowers		crown is round to flat globular,bark dark in color smooth later scaly with ridges somewhat aparent sometimes with maroon patches.		×	
24	Judas Tree		valuable for bees (honey plant)	conspicious ,crimson-pink flower clusters directly on the stem and branches,before leaves shoot,soft fragrance		Large shrub to small tree with several stems, funnel - shaped becoming umbrella ,slow-growing.	calcareous sandy or loamy soils	×	
25	American plane tree, Western plane, Buttonwood, American sycamore		Attracts birds.		No fragrance	crown is round, half-open crown Bark and branches are light grey, flakes off, later grey-brown ,Fast-growing tree showing	rich, preferably humid soil	×	
26	fragrant sumach lemon sumac		attract birds and butterflies.	The leaves and stems of fragrant sumac have a citrus fragrance when crushed, hence the species name.		It is variable in size and branching habit. Fragrant Sumac can be an erect shrub with ascending branches, or it can be a low shrub with spreading	light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil.	×	
27	Goat Willow, Great Sallow		attracts butterflies	before leaves shoot ,attractive catkins,initially silvery, then yellow, honey scented.		Large shrub or small tree ,short,crooked stem,round crown,branches upright,twigs extended to rising,fast-growing	light (sandy), medium (loamy) and heavy (clay) soils and can grow in heavy clay soil.	X	

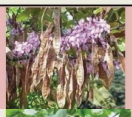
S No	Common Name	Image	Animals/ Insects	Fragrance	No fragrance	HABIT	Soil preference	Toxicity	
								mildly toxic	highly toxic
28	Bloody cran's bill or bloody geranium		Attracts butterflies	Bowl shaped ,carmine, May to June , second blossoms into August, many fragrant flowers		initially domed cushions growing into large, dense amts with ist many seedings, layers, and far-creeping runners.	Easily grown in average, medium moisture, well-drained soil	X	
29	Snapdragon		Attracts Hummingbirds, Butterflies and insects.	The flowers are produced on a tall spike, each flower is 3.5-4.5 cm long, zygomorphic, with two 'lips' closing the corolla tube.		It is an herbaceous perennial plant, leaves are spirally arranged, broadly lanceolate, 1–7 cm long and 2-2.5 cm broad.	well-drained soils since overly wet and heavy soils	X 0	
30	August Lily, Corfu lily, fragrant plantain lily		Attracts butterflies ,bees	Showy, Fragrant, Good Cut		It is an herbaceous perennial plant It is noted not only for its shiny, light green foliage, but also for its 6" long, deliciously fragrant, white	Easily grown in average, medium moisture, well-drained soils	X	
31	Lemon thyme		Attracts butterflies ,bees	fragrant leaves		It is an erect, bushy, woody-based perennial which typically grows 4-12" tall with upward branching stems.	Easily grown in average, dry to medium, well-drained soils	X	
32	Garden pnk,common pink		attract birds,bees and butterflies.	Showy, Fragrant, Good Cut		It is a ground cover evergreen, the stem is green ,erect,glabrous and branched on the top, the leaves are opposite, simple, linear and sessile, more or	Dianthus plumarius 'Itsaul White'	X	
33	English Hawthorn		valuable for bees (honey plant), valuable for butterflies, provides food for birds	white, flowers in May, fragrant flowers		It is a deciduous tree,rounded tree crown,slow growth rate,medium texture	loamy soil, sandy soil	X	
34	Bayberry		Attracts birds	The leaf is fragrant		It is a semievergreen to deciduous shrub,upright, spreading branching habit,shape is irregular to mounded,multi-stemmed, suckering and colony-forming	Easily grown in average, dry to medium, well-drained soils	X	
35	ummer lilac, butterfly-bush, or orange eye		Attracts butterflies	Showy, Fragrant, Good Cut		it is a vigorous shrub with an arching habit,produces large arching canes,a rather unkempt growth habit.	Easily grown in average, medium moisture, well-drained soils	X	

S No	Common Name	Image	Animals/ Insects	Fragrance	No fragrance	HABIT	Soil preference	Toxicity	
								mildly toxic	highly toxic
40	Jasmine or common jasmine		attracts butterflies,birds,moths	howy, Fragrant		is a vigorous, twining, bright, deciduous climber with sharply pointed pinnate leaves and clusters of starry, pure white flowers	They grow well in regular garden soil with moderate levels of soil fertility and moisture	X	
41	Chinese juniper		attracts birds		No fragran	evergreen,tree, shrub or groundcover, dependent on cultivar.species an erect, narrow, conical tree,slow to medium growth.	dry to fresh,in all moderately nutritous , well-drained substrates.	✖	
42	Arctic birch		attracts birds	showy		small shrub,prostrate to arching upright, slow growing.	bog soil or peat, also sandy loamy substrates	X	
43	Fountain Grass		attracts butterflies		No fragran	is a tender perennial fountain grass that is native to Africa,It is a rapid-growing, clump-forming grass that produces arching, linear, narrow green	Moderately dry to fresh, well-drained, sandy -loamy	✖	

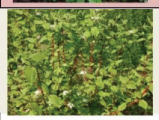
S No	Common Name	Image	Animals/ Insects	Fragrance	No fragrance	HABIT	Soil preference	Toxicity	
								mildly toxic	highly toxic
44	Annual Honesty or silver dollar		attracts bees, butterflies		No fragran	is a tall, hairy-stemmed biennial that is native to southeastern Europe and western Asia,Upper leaves	Easily grown in moist, organically rich, garden soils	X	
45	Chinese pistache		attracts birds	Foliage is aromatic when bruised.		It is a small deciduous tree ,tall with an oval rounded crown. Foliage consists of compound, even-pinnate, dark green leaves.	Grow in moist, organically rich, well-drained soils	✖	
46	Woodruff		attracts butterflies,bees,birds	Aromatic intensity of the foliage increases when dried, thus dried		Forms mats and creeps into large carpets,flatly extended runners.	Fresh to moist,sensitive to drought,well-drained, nutritious, loamy	✖	
47	tatarian dogwood		Attracts birds, butterflies		No fragran	Bnormal shrub,initially upright, later broad to broadly prostratw, twigs taking root on contact with the groand, like a thicket, fast-growing.	Moist or fresh soil preffered, but withstands moderate droughts, not demanding , allnot too poor substrates	✖	
48	Golden bamboo		Attracts birds		No fragran	Medium to tall bamboo,thichet -like	dry to moid, demands damp soil during growth period,acidic to strongly	✖	
49	Dalmatian bellflower		attracts birds,butterflies,bees	Showy		Dense cushions, excellent groundcover , short runners, vigorous growth	Moderately dry to fresh, sandy loam, grows well on mineral or substrate	✖	
50	Flowering Ash		Attracts birds	Showy, cream - white panicles,Fragrant,		broadly domed, later funnel-shaped	Best grown in moist, organically rich, well-drained loams in full sun	✖	

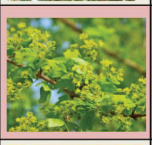
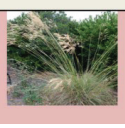
S No	Common Name	Image	Play activities	SENCES					SEASONS			
				color	fragrance	taste	texture	sound				
1	European Beech /Weeping beech		CLIMBING & HIDE AND SEAK PLAY						×			
2	American Beech		CLIMBING & SWINGING						×			
3	European Field Elm		CLIMBING ,hide and seek play & SWINGING						×			
4	Red maple, Scarlet maple, Swamp maple		CLIMBING ,hide and seek play & SWINGING						×			
5	Common Oak,English Oak		climbing & swinging						×		×	
6	Japanese pagoda Tree. Styphnolobium japonicum		climbing & swinging							×	×	
7	Stone pine		climbing ,play with the seeds & swinging						×	×		
8	European cranberry Bush		climbing ,play with the seeds & swinging						×	×	×	
9	London planetree		climbing, swinging,relaxing,picnic and hide and seek						×			×
10	Field /Hedge Maple		Hiding place							×	×	
11	Japanese Maple,Smouth Japanese Maple		hide and seek etc.						×	×	×	

S No	Common Name	Image	Play activities	SENCES					SEASONS			
				color	fragrance	taste	texture	sound				
12	Giant feather or needle grass / Golden oats		hide and seek ,play						×	×	×	
13	Weeping Bottlebrush		play props						×	×		×
14	Red cascade		play props ,hiding places						×	×	×	
15	American smoketree/ CHITTAMWOOD		Hide and seek , play props						×	×		
16	Weeping Willow		Hide and seek						×	×		
17	Japanese pittosporum		Hide and seek & play props							×		
18	Platycladus orientalis- Pyramidalis Aurea-Chinese Arbor-vitae		Hide and seek								×	
19	Veitch's silver-fir		Hide and seek							×	×	×
20	Eastern white pine, northern white pine, white pine, Weymouth pine		Hide and seek, play props						×			
21	White spruce		Hide and see ,play props,									×

S No	Common Name	Image	Play activities	SENCES					SEASONS			
				color	fragrance	taste	texture	sound				
22	southern magnolia or bull bay.		play props ,a play of sensations.crafts and culinary skills						×	×		
23	Redbud, Eastern redbud, Mexican redbud,Texas redbud		play props						×	×	×	
24	Judas Tree		imaginative play with the fruits of the tree, play props						×		×	
25	American plane tree, Western plane, Buttonwood, American sycamore		play props, hide and seek, imaginative play						×			
26	fragrant sumach lemon sumac		play props, hide and seek, imaginative play						×		×	
27	Goat Willow, Great Sallow		imaginative play, hide and seek,						×			
28	Bloody cran´s bill or bloody geranium		hide and seek						×	×		
29	Snapdragon		imaginative play							×	×	
30	August Lily, Corfu lily, fragrant plantain lily		Imaginative play							×	×	
31	Lemon thyme		imaginative play							×		

S No	Common Name	Image	Play activities	SENCES					SEASONS			
				color	fragrance	taste	texture	sound				
32	Garden pnk,common pink		exploration, imaginative play							×		
33	English Hawthorn		play props						×			
34	Bayberry		play props						×			
35	ummer lilac, butterfly-bush, or orange eye		play props,imaginative play							×	×	
36	chaste tree, chasteberry, Abraham's balm, lilac chastetree, or monk's pepper		play props, hide and seek							×		
37	lavender cotton		play props, exploration							×		
38	Fringe tree		hide and seek, play props						×	×		
39	wall germander		play props, imaginative play							×	×	
40	Jasmine or common jasmine		hide and seek, exploration, imaginative play						×	×	×	
41	Chinese juniper		hide and seek, play props						×	×	×	×
42	Arctic birch		exploration, imaginative play						×		×	

S No	Common Name	Image	Play activities	SENCES					SEASONS			
				color	fragrance	taste	texture	sound				
43	Fountain Grass		play props,imaginitive play with the leaves							×	×	
44	Annual Honesty or silver dollar		games with the leaves use them as money							×		×
45	Chinese pistache		climbing, hide and seek						×			
46	Woodruff		Play props, exploration games						×			
47	tatarian dogwood		hide and seek						×	×	×	×
48	Golden bamboo		hide and seek, play props						×	×	×	×
49	Dalmatian bellflower		imaginative play						×	×		
50	Flowering Ash		imaginative play, hide and seek,						×			

S No	Common Name	Image	COSTS (Height when received :1.20-1.50m)	Problems	Notes
1	European Beech /Weeping beech		≈ 30 euros	may be attacked by borers. Beech bark disease, canker and powdery mildew may occur. Leaves of beech are often not abscissed in the autumn and remain until the spring.	
2	American Beech		≈ 22 euros	VERSATILE TREE / DEFFICULT TO TRANSPLANT/SHADE TREE	
3	European Field Elm		≈ 220.00 euros	It is fairly badly sensitive to Dutch elm disease	
4	Red maple, Scarlet maple, Swamp maple		200.00 euros	can be somewhat weak wooded and may suffer storm damage because the species is so genetically diverse careful attention is needed to insure adequate cold hardiness and the desired red fall foliage manganese chlorosis tar spot, verticillium wilt leaf hoppers,red maple leaves are extremely toxic to horses.	
5	Common Oak,English Oak		41.00 euros	English oak is considered to be a low-maintenance tree with few problems. Oaks in general are susceptible to a large number of diseases, including oak wilt, chestnut blight, shoestring root rot, anthracnose, oak leaf blister, cankers, leaf spots and powdery mildew. Potential insect pests include scale, oak skeletonizer, leaf miner, galls, oak lace bugs, borers, caterpillars and nut weevils.	
6	Japanese pagoda Tree. Styphnolobium japonicum		150.00 euros	No serious insect or disease problems. Twig blight, verticillium wilt, canker, powdery mildew and rust may occur. Watch for leaf hoppers. the southern end of their range, the species may not be as long lived (30 to 40 years) as it is in colder regions, but it is still a worthy tree for the garden.	
7	Stone pine		84.00 euros	Mature trees have thick, fire-resistant bark and large cones, which open and release their seeds in response to heat. The wood, sawdust and resins from various species of pine can cause dermatitis in sensitive people.	
8	European cranberry Bush		45.00 euros	Not currently threatened although the larvae of the viburnum beetle Pyrrhalta viburni will eat the leaves.	
9	London planetree		220.00 euros	can be pollarded and pleached readily canker strains is a serious problem anthracnose, although generally not as bad as on P. occidentalis anthracnose-resistant cultivars should be used cold injury in harsh winters powdery mildew American plum borer	
10	Field /Hedge Maple		21.00 euros	No serious insect or disease problems. Leaf spots, tar spot, verticillium wilt, canker and root rots may occur. Potential insect pests include aphids, scale, borers and caterpillars. Mites may appear.	
11	Japanese Maple,Smouth Japanese Maple		150.00euros	No serious insect or disease problems. Potential disease problems include stem canker, leaf spots, fusarium, verticillium wilt, botrytis, anthracnose and root rots. Potential insect pests include aphids, scale, borers and root weevils. Mites may be troublesome. Foliage tends to leaf out early in spring and is subject to damage from late spring frosts. Chlorosis may occur in high pH soils.	
12	Giant feather or needle grass / Golden oats		3-5.00 euros	none known	

S No	Common Name	Image	COSTS (Height when received :1.20-1.50m)	Problems	Notes
13	Weeping Bottlebrush		25:00 euros	No serious insect or disease problems. Watch for spider mites and scale, particularly on indoor plants.	
14	Red cascade		61.00 euros	No serious insect or disease problems. Euonymus scale can be a significant problem and should be treated if it appears. Watch for aphids. Possible disease problems include twig blight, anthracnose, crown gall, leaf spot and mildew.	
15	American smoketree/ CHITTAMWOOD		100 euros	No serious insect or disease problems. Some susceptibility to leaf spots, rust and wilt.	
16	Weeping Willow		50-100.00 euros	Susceptible to numerous disease problems including blights, powdery mildew, leaf spots and cankers. It also is visited by many insect pests including aphids, scale, borers, lacebugs and caterpillars. Wood is weak and tends to crack. Branches may be damaged by ice and snow. Litter from leaves, twigs and branches may be a problem. Shallow roots may clog sewers or drains and make gardening underneath the trees difficult.	
17	Japanese pittosporum		120.00 euros	This plant contains saponins. Saponins are found in many foods, such as some beans, and although they are fairly toxic to people they are poorly absorbed by the body and most pass straight through without any problem.No serious insect or disease problems. Aphids, scale, mealybugs and root-knot nematodes and whiteflies may occur. Watch for leaf spot, bacterial blight and crown/root rot.	
18	Platycladus orientalis-Pyramidalis Aurea-Chinese Arbor-vitae		120.00 euros		
19	Veitch's silver-fir		130.00 euros	none known	
20	Eastern white pine, northern white pine, white pine, Weymouth pine		90.00 euros	The wood, sawdust and resins from various species of pine can cause dermatitis in sensitive people[222]. Avoid if allergies. Avoid internally if suffering from asthma or bronchitis. The astringent taste may cause stomach discomfort	
21	White spruce		21-64.00 euros	No serious insect or disease problems. Susceptible to needle and stem rust, canker, trunk and root rot. Yellow-headed spruce sawfly, spruce budworm and eastern spruce beetle are problems in some areas. Mites are common and repeated infestations can do serious injury to the plant. Intolerant of urban stresses (pollution, salt spray).	
22	southern magnolia or bull bay,		390.00 euros	No serious insect or disease problems	

S No	Common Name	Image	COSTS (Height when received :1.20-1.50m)	Problems	Notes
23	Redbud, Eastern redbud, Mexican redbud,Texas redbud		80.00 euros	Canker can be a significant disease problem. Verticillium wilt, dieback, leaf spots, mildew and blights may also occur. Insect pests include Japanese beetles, tree hoppers, leaf hoppers, caterpillars, borers, webworms and scale. Keeping the tree vigorous by regular watering and fertilization and by pruning out dead branches as needed will help keep the tree healthy.	
24	Judas Tree		220.00 euros	Canker can be a significant disease problem. Verticillium wilt, dieback, leaf spots, mildew and blights may also occur. Insect pests include Japanese beetles, tree hoppers, leaf hoppers, caterpillars, borers, webworms and scale. Keeping the tree vigorous by regular watering and fertilization and by pruning out dead branches as needed will help keep the tree healthy.	
25	American plane tree, Western plane, Buttonwood, American sycamore		200.00 euros	Sycamore anthracnose is a significant disease that can severely damage the foliage and twigs, often precipitating premature leaf drop. Canker, leaf spot and powdery mildew may also occur. Insect visitors include borers, scale, Japanese beetles, caterpillars and mites. When grown as a lawn tree, litter from twigs, large leaves, bark and fruiting balls can pose significant clean-up problems.	
26	fragrant sumach lemon sumac		150.00 euros	No serious insect or disease problems. Some susceptibility to leaf spot, rust, scale, aphids and mites. Nipple galls on foliage are a somewhat common, but generally cosmetic problem.	
27	Goat Willow, Great Sallow		75.00 euros	Susceptible to numerous disease problems including blights, powdery mildew, leaf spots and cankers. It also is visited by many insect pests including aphids, scale, borers, lacebugs and caterpillars. Wood is weak and may crack. Branches may be damaged by ice and snow. Litter from leaves, twigs and branches may be a problem. Shallow roots may clog sewers or drains and make gardening underneath the plants difficult.	
28	Bloody cran´s bill or bloody geranium		8-15.00 euros	No serious insect or disease problems. Some susceptibility to leaf spots and rusts.	
29	Snapdragon		3-10.00 euros	Rust can be a significant problem. If rust does appear in a planting, it is best to grow snapdragons in another part of the garden the following year. Also susceptible to mold, fungal leaf spots, downy mildew, wilt and root rots. Watch for aphids. Tall plants may need support when young until such time as they bush out.	
30	August Lily, Corfu lily, fragrant plantain lily		7-15.00 euros	Although slugs and snails can be serious problems, and leaf spot and crown rot lesser problems, hostas are otherwise virtually disease and pest-free, and are ideal, low-maintenance garden perennials.	
31	Lemon thyme		7.00 euros	No serious insect or disease problem. Susceptible to root rot, particularly in moist, poorly-drained soils.	
32	Garden pnk,common pink		8-10 euros	No serious insect or disease problems. Crown rot may attack plants grown in moist to wet, poorly drained soils. Chief pests are slugs, cutworms, aphids, caterpillars, thrips and red spider mites.	
33	English Hawthorn		70.00 euros	Hawthorns are susceptible to a large number of insect and disease problems. Cedar-apple rust and fungal leaf spot can be quite damaging to the foliage. Powdery mildew, fire blight, cankers and apple scab may also occur. Insect pests include borers, caterpillars, lacebugs, leafminers and scale.	

S No	Common Name	Image	COSTS (Height when received :1.20-1.50m)	Problems	Notes
34	Bayberry		45-60 euros	No serious insect or disease problems.	
35	ummer lilac, butterfly-bush, or orange eye		24.00 euros	No serious insect or disease problems. Watch for spider mites. Nematodes can be troublesome in the South.	
36	chaste tree, chasteberry, Abraham's balm, lilac chastetree, or monk's pepper		15-45 euros	No serious insect or disease problems. Leaf spot and root rot are occasional problems. Winter hardiness in the St. Louis area is a concern.	
37	lavender cotton		2-20.00euros	No serious insect or disease problems. Blight and root rot may occur.	
38	Fringe tree		33-115.00 euros	No serious insect or disease problems. Some susceptibility to scale and borers (particularly when grown in dry locations).	
39	wall germander		7-15 euros	No serious insect or disease problems. Susceptible to mildew, leaf spot, rust and mites. Cold temperature injury, die-back to the ground or death may occur in harsh winters.	
40	Jasmine or common jasmine		15.00 euros	*Jasminum officinale* is usually trouble free, but you should watch for mealybugs, scale and whitefly	
41	Chinese juniper		330.00 euros	No serious insect or disease problems. Junipers are generally susceptible to tip and needle blights. Cedar-apple rust and related rust diseases spend part of their life cycle on junipers. Root rot may occur, particularly in wet, poorly drained soils. Canker may attack bark or main stems. Occasional insect pests include aphids, bagworms, webworms and scale.	
42	Arctic birch		15-30 euros	none known	WIND RESISTENT
43	Fountain Grass		1.9-19.00 euros	No serious insect or disease problems.	

S No	Common Name	Image	COSTS (Height when received :1.20-1.50m)	Problems	Notes
44	Annual Honesty or silver dollar		7-15 euros	No known serious insect or disease problems. Leaf spot and stem canker may occur.	The leaves are transparent
45	Chinese pistache		150 euros	No serious insect or disease problems. Susceptible to verticillium wilt.	pistacius
46	Woodruff		1.9-19.5euros	No serious insect or disease problems.	
47	tatarian dogwood		60.00euros	Susceptible to leaf spot, twig and leaf blights and canker. Scale, leaf miner and borers are occasional insect pests.	
48	Golden bamboo		130.00euros	VERSATILE TREE / DEFFICULT TO TRANSPLANT/SHADE TREE	
49	Dalmatian bell		1.9-19.50 euros	No serious insect or disease problems. Snails and slugs may damage plants.	
50	Flowering Ash			Flowering ash trees are generally susceptible to a number of additional insect problems including ash borer, lilac borer, carpenter worm, oyster shell scale, leaf miners, fall webworms, ash sawflies and ash leaf curl aphid. Potential disease problems include fungal leaf spots, powdery mildew, rust, anthracnose, cankers and ash yellows. General ash decline is also a concern. Brittle branches are susceptible to damage from high winds and snow/i	