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Review paper

IMPORTANCE AND TYPES OF LANDSCAPE EDGING ON URBAN GREEN AREAS

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Abstract

Landscape edging (barriers) play a significant role in increasing the aesthetic value and functionality of entire green areas. They provide a way to solve the transition between two different surfaces, creating border and transitional zones between green areas and the surrounding spatial elements i.e. between structural elements within green areas. Different functional zones of the green space can be separated by using landscape edging and design of the barriers follow the stylistic arrangement of the green area. Barriers contribute to defining the spatial organization and composition of the green area and especially the lawn. The choice of material for the landscape edging affects both the decorative and functional aspects of the landscape design. Barriers made of natural materials or artificial origin influence the aesthetic characteristics of the space, directing the design in a rustic or modern direction. The modern trend towards ecological sustainability implies the use of permeable and semi-permeable materials, gives preference to barriers with joints (semi-permeable) and barriers made of loose material (permeable), as well as the use of natural and recycled materials. Plant material can be used to form barriers, involving different categories of plants. This creates a "softer" transition between the spatial elements. Different taxa of shrubs, flowering plants, ornamental grasses or combinations of these plant categories can be used for this purpose. Landscape edging is also a tool for enhancing the aesthetic, functional and ecological performance of the space. In an effort to create aesthetically appealing and sustainable solutions, the design of barriers emphasizes the importance of combining functionality with aesthetics, contributing to the overall aesthetic experience and ecological value of the entire green space, while reducing maintenance costs. Careful consideration of the materials from which the barriers will be made, their form, and their function enables the creation of stylistically different, visually attractive spaces focused on environmental sustainability.

Key words: *landscape edging, landscape design, urban green areas, plant material*

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1. INTRODUCTION

Defining boundaries within urban green spaces, which divide the area into smaller spaces or into zones of different function i.e. use, is essential. According to Wang et al. (2022) [1], such boundaries significantly influence landscape patterns, mechanisms for landscape change, and dynamic processes. In this context, landscape edging — also referred to as kerbs or edge barriers — can be used. Barriers can have a key role in shaping the landscape, from both an aesthetic and functional aspect. Not only do they help in defining the boundaries of urban green spaces, barriers provide for a better space management and protect greenery from mechanical damage. Properly placed kerbs can contribute to maintaining green spaces by preventing the spread of grass or other types of plants beyond designated zones.

Different functional zones within a green area can be separated using edging, which allows for a clear division of space and improves the overall functionality of the area. For example, edging can be used to separate pathways from lawns, lawns from flowerbeds, trees from shrubs, or other zones (such as recreational areas, children's playgrounds, restaurant gardens, and similar spaces). This delineation supports better use of space and improves user experience. From a design standpoint, edging enhances the overall composition by creating clear lines and contrasts between different surface treatments and vegetation types.

Beyond visual and spatial roles, edging can also have ecological functions. When properly designed and implemented, edging contributes to soil protection, reduces erosion, and can facilitate surface water drainage—an especially relevant aspect in urban environments facing challenges with stormwater management and climate change adaptation.

Despite its importance, the topic of landscape edging is still underrepresented in academic and professional literature. This paper aims to summarize practical knowledge and field experience related to edging in the greening of urban spaces. We emphasize the benefits of landscape edging as well as the multifunctionality of edging for plant protection, spatial organization, maintenance efficiency and investment optimization. We present and analyze different types of landscape edging according to a set of criteria we made through our empirical knowledge offering a deeper insight into it. Additionally, our aim is to put special focus on plant-based edging as a sustainable solution, bringing it closer to the wider scientific public and provide key design considerations as well as guidelines for plant selection. We address the following research questions: (1) Which are the main benefits of landscape edging? (2) What types of edging can be used in green spaces, including advantages and disadvantage of each type? (3) Why give priority to using plant-based edging?

2. METHODOLOGY

This paper is based on the theoretical and qualitative research, which includes collecting secondary data in the field of landscape architecture and horticulture to address the exploratory nature of the research questions. In the field of landscape architecture, not only in Serbia but also further afield, there is a lack of scientific data dealing with landscape edging and this topic is mostly based on practical knowledge and experience. Our focus was to collect, summarize and present available knowledge and experience related to landscape edging and offer it through this paper as an additional tool not only to landscape engineers but also to all interested groups. Different types of edging are analysed according to a set of criteria:

- type of material – it can be part of nature (i.e. a living material - plants), natural or artificial origin
- spatial forms – possibility to make linear or organic form in green ares, as well as edges in horizontal or vertical direction
- width and hight limitations – possibility to create edge with a different width or height in a green space (e.g. visual barriers which can be very high and wide) which depends of the landscape design, function of the edge, characteristics of the material and construction stability; no limitations in width but height limited to ground cover; narrow edges which stand verticaly but height limited to the ground level (typically for edges that serve as root barriers) or up to 25cm (low physical barrier)
- place/space of usage – possibility to be used in large semi-natural or natural landscapes (suburban or rural) with a significant ecological function (like shelterbelts or hedges) or in green areas which were or could be created under the higher human influence (e.g. green urban areas, parks, gardens etc.); type of landscape design (project design follows tendency to create modern or rustic/traditional green space)
- ecological benefits – contribution to the improvement of ecological factors such as increase air quality, noise and wind reductions etc., making healthier living conditions or contribution to the environmental protection.

3. BENEFITS OF LANDSCAPE EDGING

Landscape edging plays an important role in pulling the landscape together. Edging forms a clean line between planting areas and opened turf area or groundcovers, different types of planting areas, planting areas and paved areas etc. is not just about creating a visually appealing border; it serves several practical purposes that contribute to the overall health and longevity of green areas. Benefits of landscape edging can be summarized as:

- improvement of aesthetical quality of green areas (promoting tidy, well-managed space);
- defining spaces in green areas (creating sense of order and organization);
- increase the hygiene on green areas;
- effective addition to the green area and increasing its total value;
- weed prevention (ability to prevent unpleasant plants from encroaching into other designated areas);
- preventing dust, soil and mud to be transfer from the lawn to paved surfaces;
- preventing the penetration and spreading of roots from the lawn to other zones of the green areas;
- keeping soil and mulch in place, preventing erosion;
- cut down the green area maintenance costs;
- cut down the lawn maintenance costs (make some management tasks easier, some of them should be less frequently done or can be skipped).

4. RESULTS AND DISSCUSION

There are various types of landscape edging, each offering unique characteristics and gathering to different aesthetic preferences and functional needs. The general division of landscape edgings can be made according to the nature of materials, so primarily we can distinguish 2 groups: edges in which plants are used or those made of other materials. In the following text different types of landscape edging are presented and analysed taking into account the aforementioned criteria.

4.1. Landscape edging using plants

This type of edging involves the use of various categories of plants to form borders around or within green spaces. Vegetative barriers are an important element in landscape design—they help structure the green space, protect plants, and enable both visual and physical separation between different spatial zones. Beyond their functional and aesthetic value, plant-based barriers also provide significant ecological benefits.

According to Podhajska et al. (2020) [2], vegetative barriers can significantly enhance air quality, while Kafafy (2010) [3] emphasized their function as natural noise isolators. Plants within barriers help filter pollutants such as dust and harmful gases. This is particularly relevant when trees are included in the barrier. As noted by Mohd Noor et al. (2013) [4], a single tree can remove approximately 26 pounds of carbon dioxide annually, equivalent to emissions from 11,000 miles driven by a car. Additionally, green spaces can retain between 0.2 and 2 kg of dust particles per square meter annually, depending on the leaf type—directly contributing to healthier living conditions.

Trees and shrubs used in vegetative barriers serve as natural filters. To achieve rapid effects, fast-growing plant species are preferred. Vegetative edging can also be utilized in urban environments for the reduction of noise pollution. Since the 1970s and 1980s, studies have shown that plants can attenuate noise through reflection, refraction, scattering, and absorption of sound [5]. The degree of noise reduction depends on multiple factors, including the biological characteristics of foliage, plant capacity for sound absorption, as well as the type, spatial arrangement, size, and density of vegetation. These are all critical considerations for designers when planning vegetative edges in urban environments.

Urban vegetation provides both quantitative and qualitative benefits. These include financial returns through ecosystem services and qualitative improvements such as environmental sustainability, social wellbeing, and aesthetic enhancement. As Loh (2008) [6] argues, although these benefits are often discussed separately, they are in fact inseparable and must be valued collectively within the built environment.

Vegetative edges can be designed to create dynamic and appealing spatial forms both horizontally and vertically. Horizontally, they often take the shape of geometric lines, arcs, or spirals. Vertically, vegetative edging can be layered to form small or large visual barriers that serve as protection from wind or unwanted views. If they are used within densely built urban environments vegetation in vertically edges not only helps environment but also provides visual contrast and relief [7].

Shelterbelts are used to reduce wind speed and turbulence, enhancing comfort for both users and plants within the space. This type of plant-based barriers are common for large natural or semi-natural landscapes and it is advisable to use species that grow both vertically and laterally. Depending on the climate and habitat conditions various tree species or shrub

taxa can be used in forming shelterbelt, in a one-line or multi-line application, and a combination of trees and shrubs is preferred. Advantages of using this type of landscape edging include ecological, aesthetic and economic benefits. Ecological adventages include the support of biodiversity and variety of plants, contributing to bird, insect and animal habitats. Additionally, shelterbelts discrease or stop erosion processes which are caused by wind or water thereby having an economic significance. Edging landscape by using these type of barriers makes the planning and management of the landscape easier.

One of the modern trends in landscape architecture and horticulture are living walls, which provide vertical greening solutions with both aesthetic and functional benefits [6]. Living walls, formed in various ways and filled with plants, can serve as effective spatial barriers, offering privacy and enclosure in gardens, backyards, or terraces. Species such as ivy (Hedera helix L.), climbing vines, various shrubs, or bamboo (Bambusa vulgaris Nees) can be used to create a natural screen, offering visual protection while enhancing the ecological value of the space [8] (Figure 1).

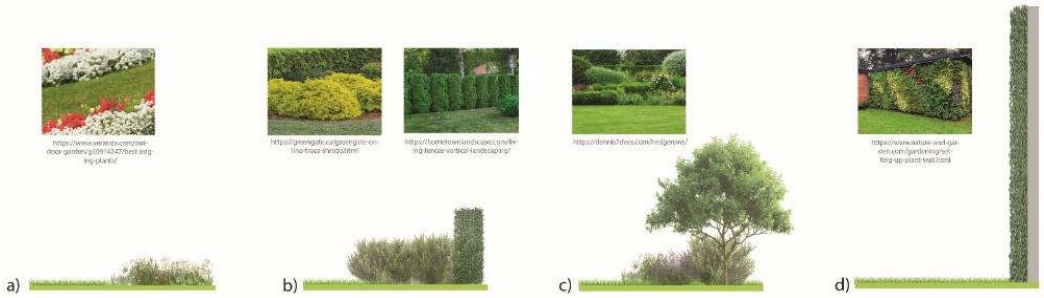

Figure 1. Landscape edging using different plant categories (a-herbaceous; b- woody; c- woody-herbaceous; d- green wall)

4.1.1. Selection of plants

Using plants in making barriers creates a "softer" transition between different zones in green spaces. In the process of plants selection the attention should be given to following [9]:

- the intended visual and functional effect of the barrier;
- the overall design of the green space, particularly lawn design;
- the purpose of the entire area and the usage patterns of specific zones as well as the whole space;
- environmental conditions, with an emphasis on climate factors;
- site-specific habitat conditions, including microclimatic factors such as light and shade exposure, wind shelter, air circulation, turbulence, and prevailing wind directions;
- soil type and quality.

Both herbaceous and woody species, including deciduous, coniferous, and evergreen plants, can be used in the construction of vegetative barriers. Various shrub taxa may be planted in groupings or shaped as formal hedges. Shrubs characterized by low height or slow growth are suitable for edging along pathways, while taller, fast-growing shrub species are ideal for forming elegant green hedges.

Aromatic woody species such as rosemary (*Rosmarinus officinalis* Linnaeus) and lavender (*Lavandula officinalis* Chaix ex Vill.) are particularly valued for their low maintenance and versatility in various design combinations. Among tree species, ornamental cultivars are

commonly used due to the wide range of decorative foliage and floral characteristics. Tree-based barriers may be formed through individual planting, planting in small groups, or through protective belts. In the category of conifers, species from the Thuja and Cupressus genera are most frequently used due to their dense and structured growth.

Among herbaceous species, a wide array of taxa is used for forming flower beds or ornamental grasses of various heights, typically planted in groupings or linear formations, depending on the size of the surface area. Particularly striking ornamental grasses include: pampas grass (*Cortaderia selloana* (Schult. & Schult.f.) Asch. & Graebn.), blue fescue (*Festuca glauca* L.), golden grass (*Hakonechloa macra* (Makino) Honda), fountain grass (*Pennisetum alopecuroides* ((L.) Spreng), chinese silver grass (*Miscanthus sinensis* Andersson) [9].

Culinary and medicinal herbs are increasingly being applied in landscape architecture [10], and they also have a role in the formation of vegetative barriers in urban green areas. Numerous species can be used, including: *Ocimum basilicum* L. (basil), *Laurus nobilis* L. (bay laurel), *Anethum graveolens* L. (dill), *Petroselinum crispum* var. neapolitanum and *Petroselinum sativum* Hoffm. (parsley), *Thymus vulgaris* L. (thyme), *Allium schoenoprasum* L. (chives), *Mentha piperita* L. (peppermint), and many others.

The inclusion of medicinal plants in barriers contributes to the aesthetic, sanitary, health-related, and nutritional functions of green spaces.

Perennials and rose gardens also have a place in the formation of vegetative barriers. Compared to herbaceous plants, they offer greater longevity, although their maintenance requirements differ.

Although plant-based edges are suitable for various places and every type of design certain limitations in the usage of plants in edging exist and are connected to width and height they can achive. Actually, plants' maximal height is connected to the biology of each species but can vary due to habitat condition, and often, especially in urban areas, it is significantly shorter than in natural or semi-natural landscapes. Plants need time for growing so the maximal effects of the greening and edging, especially using trees and shrubs, are often visible after 10 or more years. Thus, limitations which are common for using woody taxa can be avoided: (1) by using mature individuals of trees which can make the cost significantly higher, (2) woody taxa with initially lower height according to their biology, that is, cultivars of some trees whose heights are usually, at the moment of installation, close enough to their max biological height. Third solution is based on the usage of herbaceous species or perennals which achive the effect of immediately finished green area; however, there are some limitations in height and width. Actually, most of them, have maximal height of 25cm and even if they are used only in one line, for their optimum growth, require that the edge width must be 30-50 cm.

In contemporary discussions surrounding sustainability, diversity, and biodiversity, plant-based barriers are recognized for their broader ecological value. They provide habitat and food sources for birds, insects, and other organisms - especially when shrubs dominate the planting composition.

Using plants as a living material, with their specific morphological, structural, and textural properties, as well as dynamic variability over time, enables the creation of a wide range of spatial and visual options - many of which are not achievable through the use of conventional construction materials.

4.2. Landscape edging using other materials

Further division of this category of landscape edging can be related to the nature of materials so we can distinquish: edging using natural materials or edging using artificial materials. Divison of those two groups are present in the following text.

4.2.1. Natural materials

When constructed from natural materials, landscape barriers provide a rustic, ecologically sustainable appearance that blends harmoniously with the environment. The most commonly used natural materials include natural stone, wood, brick, mulch, sawdust, or bamboo stems/stalks. Natural materials in landscape edges don't bring high ecological benefits as usage of plants, but certain low benefits in the context of enviromental protection exist, as a better choice for the environment compared to the usage of artificial materials.

Stone is one of the most durable and resistant materials for constructing barriers in green spaces. It is typically used to edge paths, plazas, or to delineate boundaries between different planting zones. Stone barriers often separate two distinct vegetation types (for example, an open lawn from a flowerbed, or a lawn from a grouping of woody plants). When it is necessary to prevent surface encroachment by inert materials, stone proves to be a suitable solution. Both natural and processed stone are used, offering a long-lasting and rustic look. Stone is suitable for creating linear or organic forms as well as horizontal or vertical. When using stone barriers, there are no strict width or height limitations and it depends on the landscape design. This material can be used in various type of outdoor spaces and its usage alway is realted to traditional design tendencies. The most commonly used type is river pebbles, which are laid directly on the soil surface [9]. Stones may be laid lengthwise or crosswise, depending on the intended function and aesthetics of the barrier (Figure 2a). Low stone walls of varying height and width—either single-layered or multi-layered—are also used. The complexity of constructing stone walls depends on the stone dimensions, the purpose of the barrier, and the required foundation preparation, labor, and financial investment. Stone landscape edging can be used in large landscapes, as well as in the form of gabions. Gabions are mostly used in large semi-natural or natural landscapes with a primarily anti-erosion function, then aesthetic and low ecological function (as a material of a natural origin).

Wooden edging is popular for its natural appearance and versatility in shape, height, size, thickness, and color. Its use is common for urban green areas like parks, gardens, or other elements of green infrastructure connected to the higher human impact. Treated or impregnated wood is typically used due to its greater resistance to moisture and environmental factors. However, the use of treated wood may have negative effects on nearby insects and plant material. Wood can be used in the form of posts, planks, or logs, especially for rustic-style landscapes. If landscape project has the tendency to follow modern design, wood can be also suitable. In moden design projects wood elements used for edging are different in their form, appearance, shape and impregnated wood is always used. Limitations in width and height are related to the stability of the construction and landscape design. Wood is suitable for creating linear or organic form but certain limitations exist. In more complex landscape designs—especially those requiring curved lines, frequent directional changes, or sharp angles — wood may not be the optimal material choice for constructing barriers (Figure 2b).

Brick can be applied in various landscape architectural styles always with tendency to rustic design. It adds elegance and warmth, while in classical layouts, it can evoke a more

rural aesthetic. Brick edging is generally more stable and longer-lasting than wooden alternatives. When laid directly into the soil, bricks form surface-level barriers that can be easily moved or removed. Used that way, brick is suitable for creating not only linear but also organic forms of edge. Brick can be use in a forms of small walls where the vertical dimension of the edge is added. For improved stability, especially along paths or paved areas, a base foundation is often prepared prior to installation (Figure 2c). Brick doesn't have a usage in large landscape for creating edging. Ecological benefits are low and are limited to be safe for the environment compared to artificial material.

Mulch is a natural material made by shredding tree bark, typically from pine trees (*Pinus* sp.), and is laid directly onto prepared soil at the height of 3-5 cm. It is suitable for creating different horizontal forms with tendancy to make traditional design. Different linear or organic forms can be applied relatively easy with no limitations in width but height is limited to ground cover. Its use significantly enhances the aesthetic qualities of green spaces. Mulch is available in various granulations and colors, depending on the intended use and maintenance strategy, such as replenishment or replacement. It is resistant to wear and serves as an excellent drainage layer. Mulch can be applied to both large and small surfaces in various types of green areas but it doesn't have a purpose in natural or semi-natural landscapes. Its ecological benefits are medium and are connected to the benefits of plants and ground not directly to the improvement of ecological factors. The benefits include: preventing the spread of weeds between zones, retaining soil moisture, and moderating microclimatic extremes in the soil and near-surface layer—areas that are crucial for plant growth. Its use reduces both maintenance operations and costs associated with greenery management (Figure 2d).

Bamboo stalks are less commonly used than stone or brick, but they can serve as eco-friendly, lightweight barriers that preserve the natural character of the landscape. Tall bamboo stalks can be used as screens or dividers, providing both visual and physical separation between functional zones (for instance, seating or retreat areas from the rest of the space, or walking paths from other site features, including artistic or exhibition installations) (Figure 2e). They are suitable for creating linear or organic forms, both horizontal and vertical. Hights are limited to the bilogy of the species, availoability at the market and landscape design. Disadvantages are connected to the stability of the barriers, transparency or frequency of the replacement of stalks due to their decomposition. Compered to other natural elements, bamboo stalks are significaly less lasting with a high price of use. Mosty they are used in projects with tendency to follow modern design and better performace especially in the way of creating visual barriers can be achived by using multi-line application. Although bamboo is a apart of nature, its usage in landscape edging in a form of stalks leads to low ecological impact, the same like using of stone, brick or wood. In some cases live plants of bamboo can be used, when the ecological benefits are high but it demands specific climate and habitat conditions.

Gravel (pebble mix) is also less commomly used compared to stone or brick, probably because of the lack of a vertical form. It is often applied to differentiate zones with distinct planting schemes or as a supplementary material in green spaces, typically laid in front of plantings. Like mulch, gravel can be used to cover bare soil beneath trees and shrubs. Its texture and diameter variety offer an easy creation of various linear or organic forms but always horizontal with no limitations in width. Gravel can be used not only in traditional design projects but also in a modern ones. Its application can have both positive and negative effects

on plants, and it is widely used in landscape beds as a low-maintenance groundcover. In such cases, it is recommended that landscape bed edges be constructed from other materials, often artificial (e.g., rubber, plastic, metal, etc.) (Figure 2f). Due to the lack of a third dimension (height) it doesn't have an application in large landscapes.

All of these materials not only enable efficient spatial functionality but also contribute to urban ecological sustainability. Plant-based and natural barriers can prevent erosion, stabilize soil, and facilitate surface water drainage, supporting stormwater management. Furthermore, their application significantly reduces the need for intensive maintenance, thereby lowering the financial resources required for the upkeep of urban greenery.

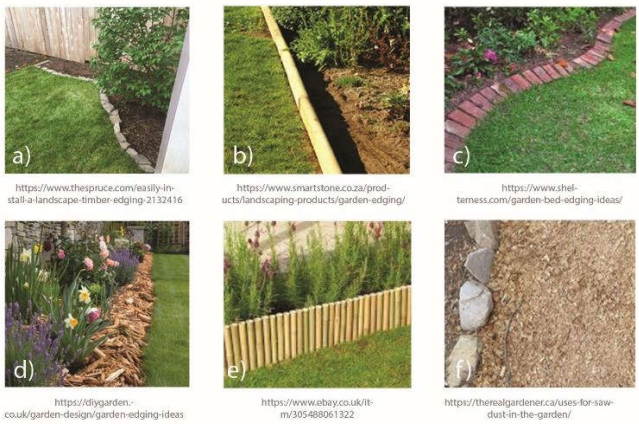

Figure 2. Natural materials (a- stone edge; b- wooden edge; c-brick edge; d-mulch edge, e-bamboo stalks edge, f-gravel edge)

4.2.2. Artificial materials

Artificial materials used for edging green spaces can enhance the aesthetics, functionality, and maintenance efficiency of urban greenery. The most commonly used artificial materials include plastic, concrete, metal, rubber, composite materials, and geotextiles. What is common for all of them is the absence of ecological benefits not even at a minimal level for the environment, plants or ground and they do not have a usage in large landscapes, natural or semi-natural.

Plastic edging is lightweight, durable, and easy to install. It typically comes in the form of a flexible roll, bundle or section with a different height and length suitable for placement along the edges of lawns, flowerbeds, or other zones within green spaces. Using plastic elements for edging can lead to limitations in landscape design. Actually, creating edges made of plastic elements with the specific organic forms is more demanding, especially high precise or complex project design which might be impossible due to the lack the variety of elements in terms of length, height or curviture that exist at the market. So the designs are limited to the possibility of fitting the elements available at the market and often changes to previous landscape designs have to be made or a decision needs to be made about picking another type of edging. Plastic edging enable forming only a very narrow edge with the function of separating two zones in the green areas. With a ground level height or above ground, up to 25 cm, plastic edges cannot be used as a visual barrier but can be used as a physical barrier of low impact (to prevent children or small animals to use some zone). Its usage is also related to preventing plant roots from growing from one zone to another. Plastic edges are not recommended to be used in projects with the tendency in rustic design. It is frequently used

in small-scale applications where flexibility and easy of handling are prioritized (Figure 3a). Compared to other artificial materials plastic edges are used most often due to their availability at the market, low price and costs of installation, as well as an easy installation process.

Concrete barriers are more durable and stable than plastic, making them suitable for creating clear and long-lasting boundaries. Edges made of concrete are suitable for making both, linear and organic forms as well as horizontal or vertical one. The limitation in forms, width or height depend on the stability of the construction and landscape design. They are commonly used for edging larger green spaces such as gardens, parks, or courtyards with the tendency to follow modern design. Concrete elements may be cast on-site or prefabricated, and can also be customized in color or pattern using stamped concrete techniques (Figure 3b). Concrete barriers are expensive and sometimes followed by demanding and long-lasting building works but, on the other hands they offer a high variety of possibilites in landscape design.

Metal edging gives a space a modern and clean appearance and is often used for precise line definition in landscape design. These edges are usually made of steel or aluminum, often treated to resist corrosion. Metal edging can be bent into various shapes (mostly linear but can be suitable for organic too) and provides a neat and professional finish to green spaces (Figure 3c). Metal edges are with a ground level height or above ground, up to only 8 cm, and cannot be used as visual or physical barrier to prevent small animals from using a part of green areas. Their main function is to be root barriers, an effective tool in minimizing structural damage from offending roots. Comparing metal edges to plastic edges or other artificial or natural materials, metal edging is more expensive but brings higher aestetic characteristics to green areas and has a long-lasting effect.

Rubber edging is flexible and a more environmentally friendly compare to other artificial materials, particularly when made from recycled materials. It is ideal for edging smaller areas or as a weed barrier, as it helps retain mulch or soil more effectively than harder materials (Figure 3d). Rubber edges are at the second place of usage among edges made of artificial materials due to their availability at the market, price and easy installing at the green area. However it should not be used in traditional landscape design as well as in large natural or semi-natural landscapes. Rubber and plastic edging have similar characteristics related to their usage but perhaps the important difference is in maximal height above the ground. Actually, rubber edges are present at the market with a maximal height of 15cm above the ground and, at the moment, there is significantly less variety at the market compare to plastic elements.

Composite edging combines plastic and wood fibers, offering both durability and sustainability. Composite materials often resemble wood visually but offer a longer lifespan and are resistant to rotting, making them a practical and ecological choice for various landscape designs (Figure 3e). It can be used as narrow borders with a function of root barrier or low physical barrier, in project with tendency to have modern design, with various spatial pattern (linear, organic, mostly horizontal or vertical up to 15cm high). Whenever one has to make a choice between using plastic, rubber or composite edging, the lead should be given to the composite edges. Although the price of these edges at the market is higher compared to those of plastic or rubber due to the production process, they enable the creation of clear, strong enough and nice low edges.

Geotextile mesh is primarily used to prevent weed spread across green spaces, but it can also serve as a subsurface edging solution. These barriers are not visible from the surface, as they are intended for underground soil stabilization and shaping. A major advantage of geotextile use—especially in combination with plant materials—is its water permeability in both directions, which helps maintain soil moisture balance. A subcategory of geotextiles includes herbicidal fabrics, which are also permeable to water. These contain slow-release herbicides, designed to inhibit root growth in targeted zones. According to manufacturer specifications, their herbicidal effect can last up to 10 years, eliminating the need for lawn edge trimming or weeding (Figure 3f). Geotextile meshes are suitable for every type of design but it should be known that creating proper form (linear or organic) demands some skills due to the fact that this material lays under the ground and it is not visible from the surface. If some stronger, clearer and stiffer edge is needed, a better choice is using some other type of barrier.

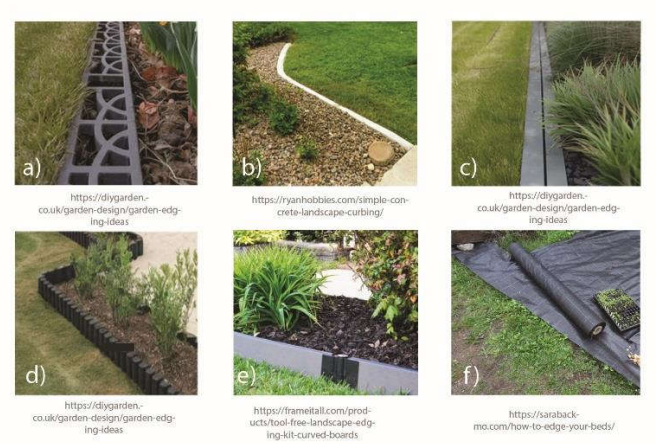

Figure 3. Artificial materials (a- plastic edge; b- concrete edge; c-metal edge; d-rubber edge, e- composite edge, f- geotextile)

Barriers made of artificial materials excluding concrete have a significant usage to prevent tree roots near sidewalks to penetrate pavement cracks, causing further damage or lifting of the pavement. The cost of this damage exceeds $100 million annually in the United States [11]. Vertical root barriers have proven effective in redirecting root growth to deeper soil layers, thus reducing damage to infrastructure [12, 13, 14]. However, it is important to emphasize that the use of artificial materials for forming edging can have adverse effects on plant material in the immediate area. These effects are due to the creation of specific microenvironmental conditions in the soil zone just below ground level, where the root system develops, and in the air layer just above the ground, where stems or rosettes of herbaceous species grow. Artificial materials can cause greater temperature fluctuations in these zones—higher heating in summer and cooler conditions in winter—which can indirectly harm the plants, initially affecting the roots and later other plant parts.

In this way, artificial edging materials may act similarly to urban heat islands, concentrating thermal stress on vegetation. Over time, this often results in plant dieback along the edges, which can then spread inward toward the center of the planted area. This phenomenon is particularly evident when lawns are edged using artificial materials.

A potential solution lies in combining plant material with natural materials in the construction of green space barriers. This hybrid approach can mitigate thermal stress and preserve ecological balance while maintaining structural definition in the landscape.

6. CONCLUSION

Barriers in green spaces are not merely structural elements but represent a tool for enhancing the aesthetic, functional, and ecological performance of the landscape. Careful consideration of the materials used for constructing these barriers, along with a clear definition of their form and function, allows the creation of stylistically diverse, visually appealing spaces focused on ecological sustainability.

Although each of the materials discussed has its own advantages depending on the specific needs and aesthetic preferences of users, plant-based barriers offer distinct advantages. Using plants in barrier construction creates a “softer” transition between different zones within green spaces and provides visual and psychological relief from the densely built urban environment. Plants can be used in landscape edging of every type of green area, from large natural or semi-natural landscapes to very small green spaces (urban pocket or business parks). Using plants in landscape edging enables the creation of a wide range of spatial and visual options - many of which are not achievable through the use of conventional construction materials. Careful plant selection can be crutial not only in forming desired edges and maximazing the benefits that plants bring, but also might significantly optimize the further maintenance of the entire green area. Certain disadvantage can be found in time needed to achieve maximal effects of the green edges. The formation of plant-based barriers requires the involvement of experts in landscape architecture and horticulture, who possess the necessary knowledge and skills for selecting and managing plant material, ensuring the durability and longevity of the barriers as well as the green space as a whole.

Landscape edging using natural materials leads to rustic, ecologically sustainable appearance that blends harmoniously with the environment. An exception is the usage of bamboo stalks which are connected to the projects with modern tendencies. All edges made of natural material are suitable for creating various forms, organic or linear, while some (mulch or gravel) have a limitation in the creation vertical forms and are limited to ground cover. However, the usage of mulch or gravel has no limitations in border width.

On the other hand, barriers made from artificial materials (except concrete) are generally less demanding to construct and maintain, but in the long term, they may have adverse effects on surrounding plant material. They are known to be without ecological benefits, do not have usage in natural or semi-natural landscapes and are connected to the projects with modern tendencies. Exclusing concrete, all other artificial material in landscape edging do not have usage in creating visual borders, particularly they enable the formation of very narrow edges with the only functions as separations of two zones in the green areas or as root barrier.

Careful consideration of the landscape edging enables the creation of stylistically different, visually attractive spaces focused on environmental sustainability and higer value of the entire green space.

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