Dealing with hard surfaces to make Nature-based Solution Eco-gardens

Connecting Nature

Nov 2019

The 'Dealing with hard surfaces to make Nature-based Solution Eco-gardens' Guidebook was developed from the Connecting Nature identifying barriers research in partnership with Front Runner City Poznań. Connecting Nature is funded by the Horizon 2020 Framework Programme of the European Union Grant Agreement No 730222

Contents of this Guidebook

Introduction

Connecting Nature

Connecting Nature is a partnership of 31 organisations co-working with local authorities, communities, industry partners, NGOs and academics to implement nature–based solution projects in urban settings. Key to the Connecting Nature ethos is identifying examples of pre-existing good practice, capturing the learning from these examples, and working with cities to up-scale and out-scale their delivery across entire cities. Up-scaling and out-scaling of nature-based solutions represents a substantial challenge, with barriers preventing delivery associated with such diverse aspects as technical, governance, and financial challenges. Within the Connecting Nature project, we have been working with a number of cities to explore the barriers that are currently hindering this up-scaling and out-scaling process. Once these barriers were identified, we began a process of collaboratively investigating and trialling solutions. This document represents the results of a review presenting solutions to one such identified barrier.

Converting Grey Spaces into Eco-gardens

The Connecting Nature partnership includes three cities that are leading the way in terms of developing and implementing a Framework for city-wide nature-based solution delivery: Genk (Belgium), Glasgow (Scotland), and Poznań (Poland). Of these cities, Poznań's ambition is to supplement their existing 'green wedge' urban design by implementing a series of nature-based solution eco-gardens. The gardens will be designed to act as stepping-stones, providing connectivity between the existing green wedges, providing more equitable distribution of greenspace, and providing opportunities for experiencing and learning about nature. In collaboration with local kindergartens, the City of Poznań have already begun the roll-out of these gardens. Nature-based solution design principles are being used to convert grey spaces within the kindergartens into eco-gardens for the pupils and social gardens that provide accessibility for local communities. A key challenge in relation to out-scaling this initiative across the city is the high expense of demolishing and disposing of the hard surfaces that need to be removed in order to create the nature-based solution eco-gardens. Based on the experiences of the City of Poznań Connecting Nature team, this cost can take up most of the budget for the re-design. In order to help reduce/remove this barrier to delivery, a review how other projects globally have addressed this barrier was carried out. The review is presented as a series of case studies demonstrating the possibilities:

Solutions

1. BREAKING UP HARDSTANDING THEN PLANTING IN THE GAPS

Breaking up hardstanding and leaving it on site can be a way to create a nature-based solution by reusing hardstanding and avoiding waste disposal costs. Planting up the gaps in broken-up hardstanding creates an opportunity to introduce a diversity plant species into a previously barren environment. Furthermore, there are species which happily colonise gaps in concrete, for instance forget-me-nots and birches that can complement deliberately planted species. An additional benefit of such an approach is that the surface becomes permeable, reducing water run-off.

Breaking up a small section of asphalt can be done using a pickaxe or a jackhammer and a shovel. Larger areas would require an excavator. Drilling holes is another way to break open the surface.

This type of space would be suitable for an eco-garden rather than a play space, because the loose material may be a potential hazard for children. However, it could be incorporated into a play space if combined with, for example, the use of boardwalks.

CASE STUDY

Wagon-landscaping: The temporary garden "Jardin des Joyeux"

The area was an abandoned car park, next to social housing in the Paris surroundings. The site was viewed negatively by local residents and was attracting antisocial behaviour. A social transformation was initiated, by which the asphalt was broken up and dismantled in 2015 to prevent motorised vehicles accessing the site. It has been transformed into a garden on an extremely low budget. A rock garden was created, using the broken asphalt and concrete as a base for planting, without any costs for export and disposal of demolition materials.

"The project ambition was to transform a sterile, impermeable site into a biodiversity garden, recycling and reusing hardstanding on site and avoiding costs associated with traditional garden projects such as disposal of waste materials, enriching with topsoil, and importing various ornamental plants species. Instead, an 'extensive' gardening approach was used, and more than 200 plant species were chosen that were naturally adapted to the challenging conditions on site (e.g. drought, poor soils and shallow grounds, variations of temperatures, infrequent management…).

For more information see:
https://www.wagon-landscaping.fr/joyeux-1/

Benefits

- Helps to reduce water run-off.
- Supports biodiversity.
- Low costs and maintenance.
- Recycling/reusing site materials.

Trade-offs

- May not be appropriate/ safe for younger children.
- Not suitable for a play area, only for a garden.

2. INSTALLING A 'GREEN ROOF' STYLE SYSTEM ON HARDSTANDING

Another way of creating a nature-based solution on hardstanding that avoids the costs of breaking up and disposing of the impermeable layer is to install a green roof type system at ground level. There are different systems of green roofs, categorized into intensive and extensive green roofs. They differ primarily in terms of substrate depth, plant selection and maintenance requirements.

Extensive green roofs are typically installed to deliver ecological/environmental benefits and offers an option with a shallower build-up height. Suitable plants include native wildflowers adapted to shallow, nutrient-poor soils, and can include sedum species and grasses. After establishment of the vegetation, the maintenance requirement is minimal.

EXTENSIVE GREEN ROOF
- Water and nutrient supply mostly by natural means;
- Low loads and built-up heights
- Mainly substrates with layer depths of up to 120 mm
- Loads about 50–150 kg/m2;
- Reduces run-off;
- Undemanding, extensive and self-regenerating plant communities.

Intensive green roofs are usually accessible with a focus on aesthetics and recreational value. They require more weight and a deeper system build-up. The maintenance should be regular, depending on the landscape design and the chosen plant material. Anything is possible from lawns, shrubs, perennials, trees, as well as ponds, pergolas and patios.

INTENSIVE GREEN ROOF
- Regular maintenance required;
- Weight > 150 kg/ m3;
- Deeper substrate depth (> 200 mm)
- Ornamental lawn, summer flowers, demanding shrubs, bushes and trees.

https://zinco-greenroof.co.uk/green-roof-systems

STANDARD SYSTEM-BUILD-UP

1. Root Barrier (optional)
2. Moisture Retention / Protection Mat
3. Drainage Layer
4. Filter Sheet
5. Growing Layer
6. Plant Level

Benefits

- Reduces the costs by omitting break up/disposal of tarmac.
- Creating a new garden which can be easily adapted to the needs and various ideas.
- enhances biodiversity.

Trade-offs

- Costs of producing and installing an appropriate system might be higher than with other solutions.
- Does not directly unseal the soil.

According to information provided by leading companies installing green roofs, there are typically three main styles of green roof that would appropriate for this particular ground level application:

- Extensive green roof 'sedum' style
- Extensive green roof 'biodiverse' style
- Intensive green roof 'roof garden'

Choosing the best option would be driven by the particular needs of the project, for instance the desired level of biodiversity, and the required ecosystem service benefits and/or aesthetic/recreational aspirations for the site. Examples of the three types, including the benefits and trade-offs of each system are presented:

EXTENSIVE GREEN ROOF "SEDUM" STYLE

- Shallow, ground-covering extensive green roof type.
- Often applied when expenses for maintenance are restrictive.
- Cheapest option in relation to least substrate and maintenance required.
- Very drought tolerant and retains aesthetics year-round.
- Biodiverse system not suitable for recreation unless combined with boardwalks.
- Narrow plant diversity limiting for associated biodiversity

TECHNICAL DATA
Build-up height ca. 90 mm
Weight, saturated ca. 95 kg/m²
Water retention capacity ca. 25 l/m²

CASE STUDY

Terminal Building, Airport Ibiza

https://zinco-greenroof.co.uk/sites/default/files/2018-02/ZinCo_Ibiza_Airport%20Terminal%20Building_0.pdf

EXTENSIVE GREEN ROOF "BIODIVERSE" TYPE

- The substrate depth is typically varied to create structural diversity (average depth is 130 mm).
- Typically use varied low-nutrient substrates to enhance biodiversity.
- Vegetation typically native wildflower species of local provenance (seeded/plug plants);
- Can includes habitat features such as bare ground, log piles, rubble mounds, bee hotels, mini wetlands.
- Cheap option in relation to low substrate and maintenance requirement.
- Less drought tolerant than sedum roofs. Can require irrigation if there is a pressure to keep it looking green through summer. However, if biodiversity is the main aim, will recover if allowed to dry in mid-summer.
- Biodiverse system not suitable for recreation unless combined with boardwalks.

TECHNICAL DATA
Build-up height ca. 150 mm
Weight, saturated ca. 150 kg/m²
Water retention capacity varies

CASE STUDY
Here East, London Queen Elizabeth Olympic Park

https://oppla.eu/london-nbs-leading-sustainable-city

INTENSIVE GREEN ROOF "ROOF GARDEN"

- Aesthetic/recreational green roof system build-up with high water storage
- Lawn, perennials, shrubs or small trees can be planted;
- Various combinations are possible, e.g. with walkways, patios, playgrounds, water features or even driveways.
- Higher cost due to deeper substrate and more formal design.
- May require irrigation, but depends upon substrate depth, planting design and rainfall
- Greater options for recreation than extensive systems

TECHNICAL DATA
Build-up height from ca. 270 mm
Weight, saturated from ca. 370 kg/m²
Water retention capacity from ca. 136 l/m²

CASE STUDY
Jubilee Park, Canary Wharf, London

https://zinco-greenroof.co.uk/references/jubilee-park-canary-wharf-london

Further information https://livingroofs.org/introduction-types-green-roof/

3. RETAINING HARDSTANDING AND USING IT AS A SPACE TO BUILD RAISED GARDEN BEDS

Another option is to leave hardstanding in-situ. The space it takes up can still be used to enhance biodiversity and store stormwater. Structures like planting beds are a quick and increasingly common way of greening unused urban spaces. Placing raised beds on hardstanding can be a great way to grow plants and vegetables without needing to test the site for ground contamination. Such an approach generally reduces costs as the only infrastructure required is materials for constructing the raised beds, soil or other growing medium to fill the beds, and (usually) a source of water for irrigating. For the most sustainable approach, rainwater harvesting should be used for irrigation.

As well as providing growing space for plants, raised beds can be a part of playable structures and have educational value for children. They can, for instance, create opportunities to teach gardening skills and environmental responsibility. Minor trade-offs are the slightly higher maintenance demands, specifically in summer, as raised beds tend to require more frequent irrigation than beds in the ground. Also, the limited depth of soil can restrict the type and size of plants that can be grown (for example large trees are not advisable). In general, the method is affordable and low-cost. If unsealing is desirable, the hardstanding could be broken up beneath the raised beds to allow rooting into the sub-soil. Alternatively, holes could be drilled in the tarmac between planters to enable water to infiltrate into the ground.

CASE STUDY

What If: Lamlash Street

Lamlash Garden is a reclaimed road in the heart of the newly created West Square conservation area in London. In about two years, the local community, alongside architecture practice 'what if: projects' transformed this neglected road from an illegal dumping ground into a prosperous community garden. The new space includes an urban mini-orchard, plant beds, raised planters, and seating areas. Plant beds with meadow-type planting encourage pollinators, while raised planters enable the residents to grow seasonal fruits and vegetables.

Further information:
http://www.what-if.info/lamlash-street-2/
https://learn.eartheasy.com/articles/gardening-on-concrete-with-raised-beds-and-patio-containers/
http://nomadicgardens.weebly.com/

Benefits

- Reduces costs by avoiding break up/disposal of hardstanding.
- Educational opportunities.
- Quick and low-cost solution.
- Potential for enhancing biodiversity.

Trade-offs

- Slightly higher maintenance than ground beds.
- Restricts types and sizes of plants that can be used.
- Does not directly unseal the soil unless combined with drilling/breaking-up hard standing.

4. RUBBER CRUMB/ SAFETY SURFACING & RUBBER MULCH

A method that could be adopted that could make spaces more play-friendly, whilst avoiding the cost of removing hard surfaces, would be the use of rubber mulch to cover the hardstanding. This could be combined with an approach of either breaking up and planting the hard surface or using raised beds to create a nature-based solution approach that includes an element of creating permeable green surfaces. Use of rubber crumb would be most appropriate if the hard surface only comprises part of a larger site being converted into a nature-based solution eco-garden, so that the rest of the area could be 'greened'.

Rubber mulch was developed for use in playgrounds and landscape projects to replace conventional bark. It is a relatively environmentally friendly solution as it is manufactured from recycled waste. Depending on the company, recycled rubber chippings are granulated down to 1-4 mm, forming wet pour. Wet pour can be used over existing hard surfaces such as tarmac and concrete. The material is durable, low maintenance, long-lasting and easy to clean. Moreover, it is safe for children - it provides protection from slips, trips and falls.

CASE STUDY

Dee Point Primary School in Blacon, Chester, Safer Surfacing

The company Safer Surfacing was asked to replace play areas in Dee Point Primary School in Blacon with the recycled rubber bark. The two areas were using traditional wood bark which became very messy and difficult to use by children. Safer Surfacing cleared the site and applied their rubber mulch which resulted in natural looking all weather play surface.

http://www.publicspaceinnovationshow.co.uk/news/blog.asp?blog_id=12529

Benefits

- Reduces costs by avoiding break up/disposal of tarmac.
- Durable, low maintenance and safe for children.

Trade-offs

- Does not necessarily unseal the hard surface beneath, but hard surface could be unsealed first by breaking up or drilling.
- Does not deliver benefits for biodiversity, so would need to be combined with nature-based solution design.

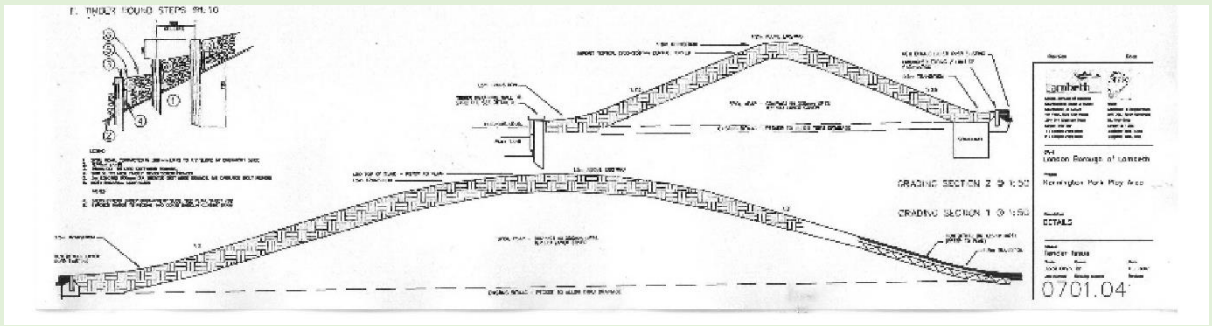
5. BURYING THE DEMOLISHED TARMAC IN A MOUND

To avoid disposal costs, hardstanding can be demolished, and the broken-up material can be buried in a mound. The mound can then be covered with grass to become a part of the playable structures. Alternatively, the mound can be planted to create a biodiverse feature. This avoids the cost of material disposal.

CASE STUDY

Shape: Kennington Park Play Area

Landscape practice 'Shape' converted a tarmac tennis court into a playable landscape. A mound was created by burying demolished tarmac. This allowed for embankment slides and separation between play for older and younger children.



Further information:
http://shape.eu.com/#/play-areas-1/

Benefits

- Reduces costs by avoiding break up/disposal of tarmac.
- Can be used to make interesting topography for play spaces or landscape design.
- Can form part of an interesting nature-based solution design.

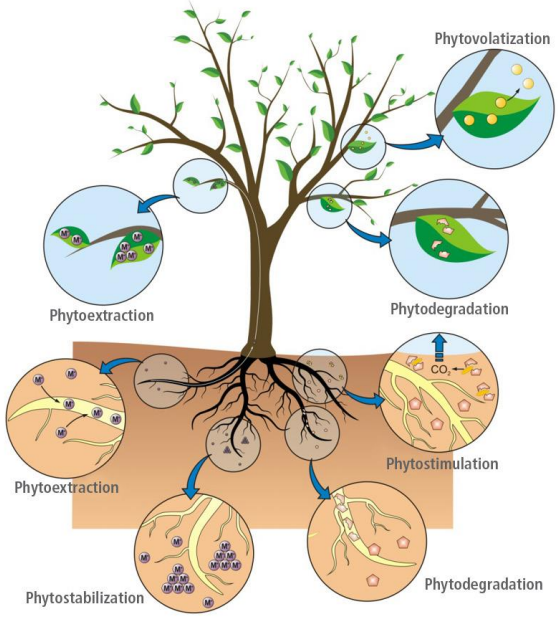
Trade-offs

- Still has the expense of breaking up and moving the materials.
- Does not remove contamination if present in the hard surface materials.

6. DECONTAMINATING THE SOIL THROUGH PLANT USE

Where tarmac was installed prior to the 1970s, there may be a requirement to conduct ground contamination tests on site. Older tarmac may contain coal tar, which could leach dangerous contaminants into the ground below. Similarly, surfaces beneath the tarmac could also contain contamination regardless of installation date.

If contamination is found, phytoremediation maybe a possible nature-based solution to implement. Phytoremediation utilizes the ability of certain plants to decontaminate the soil or water in which they are growing. Plants can achieve an acceptable level of decontamination at a reasonable cost with minimal environmental disruption. For soil clean-up, contaminated areas are cultivated with special plants capable of removing the contaminants or rendering them harmless. Because phytoremediation is similar to usual agricultural practices, it is particularly well suited to treat large expanses of moderately contaminated soil, on which excavation is not possible.



The various ways plants can decontaminate soil.

Source: http://bit.ly/2pIZfAz

Further information:
https://academic.oup.com/labmed/article-pdf/27/1/36/24954903/labmed27-0036.pdf
https://indianapublicmedia.org/amomentofscience/phytoremediation/