In highly urbanised environments, such as metropolitan Melbourne, it is important to recognise the importance of maintaining and increasing the health of our urban ecosystems to improve living conditions not only for the fauna but also ourselves.

This fact sheet will explain ways to improve our urban ecosystem through the incorporation of vegetation through landscaping for both new and existing developments.

Why do we need to change our thinking regarding Urban Ecology?

Urbanisation in cities and suburbs has altered natural environments and processes such as soil drainage, overland and waterway flows, light availability and the habitat for birds and other wildlife. For example, removing areas of vegetation and replacing this with hard surfaces including roads, driveways and paving increases stormwater runoff and contributes to flash flooding. This damages our landscapes, waterways and buildings. There is much we can do in our metropolitan areas to overcome the loss of natural processes and improve liveability for people, flora and fauna.

One of the easiest actions involves decreasing the areas of hard or impervious surfaces and at the same time increasing vegetation and landscaping. In fact, research indicates that landscaping in metropolitan environments can reduce air conditioning costs by up to 50 percent, by shading the windows and walls of a home. Just one healthy tree can be the equivalent of ten room-size air conditioners operating 20 hours a day.

The benefits to our urban ecology include reducing overall temperature and noise, increasing air purification and providing habitat for local fauna.
Economic
The economic benefits of having trees in the proximity to buildings can be both direct and indirect:
• Air-conditioning costs for cooling can be up to 50 percent lower in a tree-shaded home as the home is provided with effective shading of windows and walls.
• Trees increase in value from the time they are planted until they mature. The housing market acknowledges that landscaped homes are more valuable than non-landscaped homes.

The savings in energy costs and the increase in property value directly benefit each home buyer.

Health and wellbeing
Studies show that green spaces (plants, trees, parks etc.) are good for human health and wellbeing. What’s more, green spaces in cities have been closely linked with improved physical, social, and mental well-being. Studies have found that hospital patients with a view of green space from their window, compared with a wall, needed less pain medication and recovered faster from surgery.

Environmental
Vegetation in cities assists in moderating ambient temperatures. This reduces the urban heat island effect which is caused by pavements and buildings absorbing heat. For example, effective shading of a window or home can negate the need to have air-conditioning.

Trees and shrubs can also be carefully selected to:
• reduce glare
• reduce penetrating winds
• control airflow
• improve air quality
• sustain a viable ecosystem for birds, small animals, and insects.

Communal
Metropolitan vegetation and landscaping often provides the following communal benefits:
• providing privacy
• emphasizing or screening out views
• reducing glare and reflection
• directing pedestrian traffic
• complementing and softening the built environment.

Incorporating vegetation and landscaping into urban developments provides many benefits to residents, developers and the community.

Make sure you carefully consider the selection and location of vegetation around your house to balance internal temperatures throughout the year.
Green roofs and walls are a great way to not only enhance the local urban ecology but also to improve the insulation of a building. This will keep internal spaces warmer in winter and cooler in summer. In urban areas, green roofs also help reducing the heat island effect, which describes the fact that metropolitan areas are generally warmer than rural areas. This is due to the extensive use of materials, such as concrete and bitumen, that retain heat.

There are three types of green roofs:
- Intensive roofs, which have a deeper substrate and can support a wider variety of plants but are heavier and require more maintenance.
- Extensive roofs, which have a shallower substrate, supporting a lighter layer of vegetation.
- Planter boxes on roofs, which can be installed on most accessible flat roofs and often represent a simple alternative to intensive and extensive green roofs.

There are two main types of green walls:
- Green facades, where a wall or structure is designed to allow for climbing plants to grow onto.
- Living walls, where modular systems of growing media are integrated into, or fixed onto, a wall.

The first step to improving local urban ecology is to conduct a site analysis. From there, a landscape design can be developed that will assist in determining the best location for vegetation and the greatest contribution it can make.

Landscaping for seasonal heat control
- It is best to protect north, east and west facing windows as this will help protect against hot summer sun.
- Deciduous vegetation will provide summer shade but allows winter sun to penetrate the building.
- Trees with dense foliage create more shade and therefore have greater cooling abilities.
- As space is often limited in urban developments, vegetating courtyards as much as possible is an effective way to reduce temperatures in your courtyard and internal living spaces.
- Vertical shading is most appropriate for east and west walls and windows to protect from hot summer sun at lower angles e.g. trees, shrubs and vines supported on a frame.
- Utilising plants that grow on walls (such as ivy) can act as thermal insulation for a building.
- Horizontal shading is best for north facing windows e.g. deciduous vines grown over a pergola.
- Tall evergreen trees should not be planted too close to north-facing windows as they create too much overshadowing in winter.

Landscaping to reduce glare and ground temperature
Glare occurs when intense sun reflects from surfaces such as paving, roofs and walls. Glare can be reduced by increasing ground cover, low growing shrubs, lawns and vegetated roofs and walls.

Ground cover planting not only reduces glare, it also decreases surface temperatures. For example, a vegetated courtyard can be 6°C cooler than a paved courtyard.

In addition, a vegetated surface allows stormwater runoff to be absorbed into the soil which reduces stormwater runoff, improves stormwater quality and increases soil moisture.

Green roofs are known to help lower urban air temperatures (heat island effect), provide building insulation and create a habitat for wildlife.

What can I do to improve Urban Ecology?

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Landscaping to reduce wind penetration and capture summer breezes

Vegetation can be selected and positioned to control the chilling effects of winter winds and also assist in capturing and harnessing cooling summer breezes.

Things to consider when landscaping to influence winds:

- Windbreaks are most effective when located at 90° to the direction of the wind.
- A windbreak with 50–60% density is generally more effective than a solid one, as a solid wall can create turbulence.
- Large dense shrubs can be used as windbreaks to the south-west to counter cold winter winds and channel cooling summer breezes.
- Medium to large-sized shrubs or trees clipped to form a hedge can provide useful still air insulation and shading when grown close to a wall.
- Careful positioning of windbreak planting can encourage the entry of desirable summer breezes through the building.
- Low shrubs, lawn and ponds to the north will help cool hot summer winds.

Landscaping to increase habitat

In addition to creating larger areas of habitat in local parks and reserves, sustainable gardening around dwellings and buildings can contribute to increasing habitat value and urban ecology.

Points to consider to achieve a sustainable habitat garden include:

- It is possible to have contemporary gardens, e.g. cottage or formal gardens, and still utilise indigenous plants.
- Select plants that are indigenous as they will best suit your local climate and soil. Research what plants will attract native birds and insects.
- Complete a site analysis focusing on soil quality, sun, shade and privacy before you choose your native plants.
- Get a copy of Council’s local plant guide.
- Avoid using plants that are known environmental weeds.
Green Roofs, Walls and Facades
Building design for a sustainable future

This fact sheet provides information about green roofs, walls and facades that can be designed to cool a building, help reduce stormwater runoff, increase biodiversity and provide more greenery in the city - which is known to reduce people’s stress levels and improve mental health. Incorporating vegetated roofs and vertical surfaces into existing and new developments can increase the appeal and marketability of properties. This fact sheet has been developed from the Growing Green Guide: A guide to green roofs, walls and facades in Melbourne and Victoria, Australia.

What are green roofs, walls and facades?
A green roof is a vegetated landscape that is installed on a roof surface, and is built up from a series of either loose-laid layers, or modules made of pre-prepared layers in trays. Vegetation on green roofs is planted in a growing substrate that can range from 50mm to over 1 metre in depth, depending on the weight-bearing capacity of the building’s roof and the design objectives.

Green facades are created by growing plants up and across the face of a building. Plants are either rooted in the ground or grown from containers installed at different levels on the face of the building.

Climbing plants can attach directly to the surface of a building or be supported on a structure independent of the building.

Green walls are plants grown in vertical systems that are usually attached to internal or external walls. Green walls differ from green facades in that plantings are made across the entire vertical structure, as opposed to planting at the base of the structure to enable vertical and horizontal growth. In a green wall, plants, growing medium, irrigation and drainage are incorporated into the system.
What are the benefits of green roofs, walls and facades?

A well designed and maintained green roof, wall or facade can provide:

- aesthetic improvements in highly visible locations
- protection of building materials leading to an increased lifespan of those materials
- reduced building heating and cooling costs due to increased insulation
- green spaces (and sometimes usable recreation spaces) in densely built environments
- increased property value
- food production areas for residents or commercial tenants
- rain water run-off management and water filtering/pollution reduction
- habitat creation and increased biodiversity
- cooling effect for the city – where there is a high density of green roofs, walls, facades and other types of greenery such as street trees
- cleaner air, with less pollutants.

The three key areas of development

Design

Well considered design is vital to realise the potential benefits of a green roof, wall or facade installation. If a green roof is intended to increase the permeable surface on a site, and to decrease stormwater run-off, a deep layer of growing substrate should be used. Design considerations also include understanding the site’s aspect and exposure so that suitable plants are selected. One of the most important design considerations lies in understanding the structural load that the wall or roof can take to determine what can be installed. If structural capacity is limited it may be possible to reinforce the walls or roofs to increase the weight loading capacity. Design must also take into account the project budget and a realistic assessment of the resources available for ongoing maintenance.

For shallower designed green roofs, also known as extensive green roofs, the benefits of reduced stormwater run-off is less in comparison to the deeper intensive green roofs.

Installation

Roofs, walls and facades can be installed on existing buildings, or built into new structures. In new builds it is important that the green roof, wall or facade installer is involved in discussions with the project team during the design phase, and not just brought in later to work around the existing conditions. Care must be taken where multiple contractors are involved in an installation that no damage is made to earlier work, for instance to the waterproofing membrane, and that warranties and insurance liabilities are clear.

Access for builders can be difficult and consideration must be given to OH&S requirements for working at heights. Irrigation systems are usually incorporated into green roof, wall and facade installations, and thought should be given to water collection and storage, and in some cases water re-use through the system.

Maintenance

Maintenance is critical to the success of a green roof, wall or facade. Maintenance will depend on:

- irrigation in particular must be maintained to ensure proper operation
- the vigour of the vegetation
- use of the roof or facade (e.g. if growing food versus creating a biodiversity space)
- aesthetic preferences for the roof, wall or facade
- number of likely weed seed sources around the site.

Cooling on a green roof

Solar radiation

Convection

Evapotranspiration

Vegetation layer

Growing Substrate

Filter Sheet

Drainage Layer

Protection Mat

Root Barrier

Waterproofing

Roof Deck

Heat transfer through roof

Heat transfer is reduced on a green roof because the growing medium has some insulating effect and the vegetation shades the building.

Stormwater management on a green roof

Foliage intercepts and uses water

Water is absorbed and stored by the growing substrate

Some water is taken up by plant roots and used

Drainage and water retention layer provides additional storage for water

To stormwater drain

Some water evaporates
We know the city can be 4 to 7 degrees hotter than surrounding suburbs due to the urban heat island effect. Green walls, facades and rooftops not only look good but help cool our city and retain stormwater which can help reduce flash flooding.

**Design goals and considerations**

The following tables provide some examples of different considerations for different design goals. This is not an exhaustive list, and is intended only to illustrate that different goals will require different inputs and system set ups. Discussions with professional green roof, wall and facade installers, landscape architects, structural engineers and a review of relevant research will be needed to make final decisions about the most appropriate approach.

### Green roofs

<table>
<thead>
<tr>
<th>Design goals</th>
<th>Design Considerations</th>
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</thead>
<tbody>
<tr>
<td>Reduced stormwater run-off</td>
<td>Increase depth and water-holding capacity of substrate, and include plants that can adapt their water use</td>
</tr>
<tr>
<td>Recreation and amenity use</td>
<td>Increase weight loading, ensure safe roof access, planning and safety requirements</td>
</tr>
<tr>
<td>Maximise thermal insulation</td>
<td>Increase substrate depth, provide irrigation, select species for leafy plant cover in summer (passive heat gain in winter may be increased if the roof is bare in winter but this strategy increases maintenance and reduces aesthetic benefit)</td>
</tr>
<tr>
<td>Provide biodiversity outcomes</td>
<td>Include habitat plants and features (such as water, food and shelter), and consider including small changes in topography and variation in substrates</td>
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### Green walls

<table>
<thead>
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<tr>
<td>A multi-storey green wall</td>
<td>Ensure access for maintenance is possible, consider a lightweight growing system if structural loading capacity is limited. Ensure species selection is appropriate for specific light and wind exposures at different heights</td>
</tr>
<tr>
<td>Low cost and easy to install on a residential building</td>
<td>Consider DIY installations, the size of the green wall systems that can recirculate irrigation runoff water, systems that can be easily maintained</td>
</tr>
<tr>
<td>Internal green wall</td>
<td>Ensure adequate light is available to support plant growth. This can also be achieved by installing a specialised artificial lighting system</td>
</tr>
<tr>
<td>Aesthetics and a design statement</td>
<td>Include a variety of species with extensive and different flowering times; consider planting in patterns and including different textures and colours or foliage</td>
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Design goals and considerations

**Green facades**

<table>
<thead>
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<tr>
<td>Low cost and easy to install</td>
<td>Use a climbing plant species that attach directly to the wall, grown in a planting bed at ground level. Seek advice to ensure the best selection of plant types for your building structure</td>
</tr>
<tr>
<td>A multi storey facade greening</td>
<td>Include containers at different heights, include cabling or lattice support structures for twining plants, ensure access for maintenance, provide irrigation, consider secondary protection of plants against stem damage (e.g. wind protection trellis)</td>
</tr>
<tr>
<td>Screening of an unsightly view</td>
<td>Use evergreen species to ensure year round screening, create a structure for the plants to grow on as the screen. Usually this is mesh or cabling, and twining species of plants are used</td>
</tr>
<tr>
<td>Maximise thermal benefits</td>
<td>Use deciduous species if heat gain is desired in winter; ensure very leafy plants, covering the entire wall for providing best shade in summer, particularly on north and west facing walls; provide a structure at least 100mm off the wall of a building for the plants to grow on, leaving an air gap between the building and green plants to maximise cooling effect</td>
</tr>
</tbody>
</table>

**Where can I find out more?**

The Growing Green Guide provides advice on how to design, construct and maintain green roofs, walls and facades in Victoria, Australia.
Growing Green Guide
www.growinggreenguide.org

Your Home Technical Manual
Your Home
www.yourhome.gov.au/technical

Landscaping Victoria
Ten things to consider
www.liav.com.au

Green Roofs Australasia
greenroofsaustralasia.com.au

Other Fact Sheets in this series are also available to provide guidance on the 10 Key Sustainable Building Categories. For further relevant information, consider the Fact Sheets entitled:

- Urban Ecology
- Stormwater Management
- Water Efficiency
- Energy Efficiency

**Mandatory Requirements and Council’s Design Advice**

**Environmental Sustainable Design (ESD) Principles**
There are two levels of compliance when it comes to ESD principles – mandatory and best practice.

**Mandatory Requirements**
The design, construction and installation of green roofs, walls and facades is subject to the normal planning and building permits, approvals and consenting processes. Specific information should therefore be obtained from planning authorities prior to the commencement of any such projects.

**Council’s Design Advice**
- Design the system to provide the maximum number of benefits
- Use non-potable water to supply any irrigation systems
- Enhance the ecological value of your site through inclusion of habitat features and plants
- Cover as much area as possible with vegetation to maximise thermal benefits; for green roofs, maximise the planting area for greatest stormwater benefits.

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