CHAPTER 10

LANDSCAPE DESIGN

This chapter outlines how landscape design can be integrated with housing design to modify summer and winter temperatures, improve comfort and save energy.

How landscape design can help save energy

Landscaping is an easy and inexpensive way to improve the energy efficiency of the building, enhance the appearance and value of a property, and provide screening for privacy.

Selected types of plants can be strategically positioned to protect the building from the harsh extremes of summer sun and chilling winter winds, improve comfort both inside and outside the home, and reduce the need for supplementary heating and cooling.

Deciduous trees and vines can be 'designed' to shade exposed indoor and outdoor living areas in summer while still allowing the sun through in winter. Low shrubs and ground cover around the home can reduce reflected heat and glare. Dense trees and shrubs can be positioned to deflect strong winds and channel cooling summer breezes.

The landscaping of a site can be designed to modify temperatures in and around the home. Shade from trees to roofs and/or windows can reduce indoor temperatures by 6–12°C in summer. Conversely, ensuring winter sun penetration through windows can save a substantial amount of heating energy. External temperatures can be reduced up to 6°C by using ground cover or lawn instead of paving. These temperature differentials improve both comfort and the energy efficiency of the home so that heating and cooling requirements are reduced. The principles of landscape design for energy efficiency are illustrated in figure 10.1.

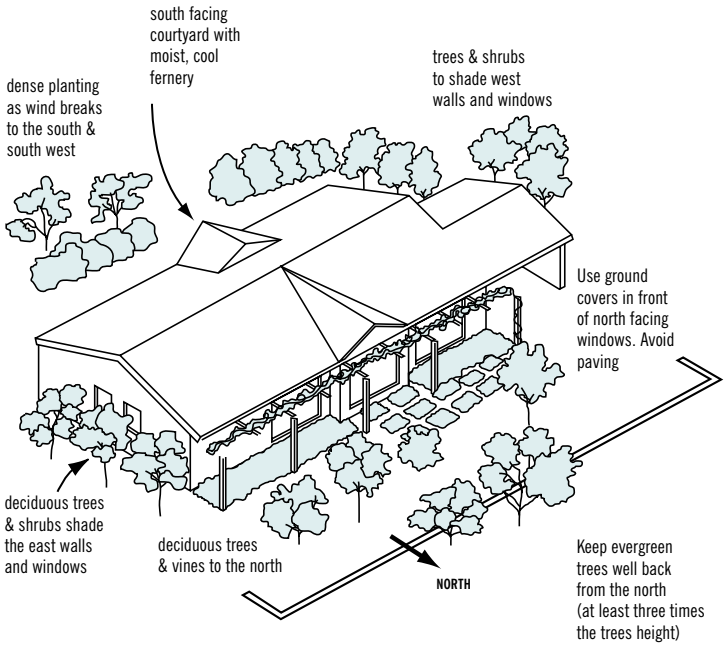

Figure 10.1: Effective landscaping can enhance energy efficiency

Integrating landscape with the building design

Too often the landscape is not considered until after a building is completed. Landscape design ideally is part of the wider design process, allowing interaction between the building orientation, building design, site conditions, and proposed landscape development. This presents the best opportunity for maximising the landscape benefits to the home and its occupants.

Once the desired performance characteristics of the proposed landscape have been identified, a local horticulturalist or nursery may be consulted about suitable plant species which meet the requirements, i.e. tall and deciduous trees, low and dense bushes, ground cover, etc. (see figures 10.1–10.7 for a guide to plant selection).

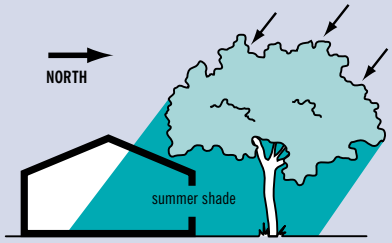

Figure 10.2: Deciduous trees on the north side provide summer shade

Site and microclimate analysis

While there are broad climate zones throughout the country, each site will have its own microclimate and conditions that will influence the house design and landscape development. A site and microclimate analysis provides information to assist the designer to decide on the best placement of the building on the site, and to identify what types of landscape protection are needed. The analysis need not be more complex than an annotated diagram. The analysis should consider:

- site size, topography, slope, soil and drainage;
- prevailing seasonal winds, temperature and humidity;
- relationship to sun and shade patterns in summer and winter;
- existing vegetation and any special features;
- location of other buildings and fences;
- location of vehicular and pedestrian access;
- views;
- any legal setbacks and building restrictions; and
- adjacent site conditions.

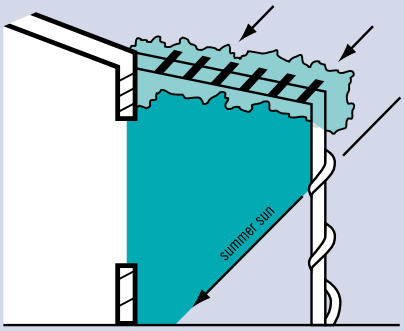

Figure 10.3: Use climbers on pergolas to shade walls and paving

Design response

Concept plans for the site can be developed working with the design brief and site analysis. The site analysis will help to determine the best location for plants and the best contribution they can make. For example, should a windbreak be used to give protection from unpleasant winds and where should it be located? Are there large areas of glass to be protected from glare? Are there large areas of paving that have to be shaded? The brief may have identified the need for a paved courtyard beside the building. The site analysis might have concluded that unpleasant winter winds blow across the courtyard from the south-west, and that reflected glare may be expected from the north-west during summer. The concept plans may indicate the location of a windbreak for winter wind protection and shade trees for glare control. The detailed plan would give the precise configuration of the planting barrier.

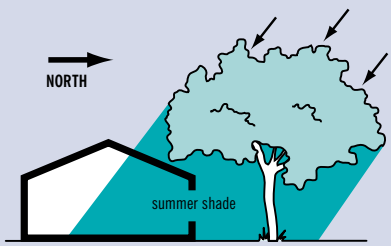

Figure 10.4: Provide summer shade to east and west aspects

Sun control

Modifying summer temperatures is a high priority in most climate zones. Windows facing north, east and west, will need protection from the hot summer sun. Landscaping can provide most of this protection economically and attractively. For example, a tree shading a window can reduce a room's temperature by up to 12°C.

SUMMER SHADING

The selection of suitable plants for shading depends on the part of the building (e.g. walls, outdoor living areas, windows) to be shaded. Different types of plants (trees, shrubs, vines) can be selected on the basis of their growth habit (tall, low, dense, light permeable) to provide the desired degree of shading for various window orientations and situations. Points to note include the following.

- Deciduous trees and shrubs provide summer shade yet allow winter access (see figure 10.2).
- Trees with heavy foliage such as planes and elms are very effective in obstructing the sun's rays and casting a dense shadow. Dense shade is cooler than filtered sunlight.
- Trees with light foliage, such as most eucalypts, honey locust and birch, filter the sunlight and produce a dappled shade.
- High branching canopy trees can be used to shade the roof, walls and windows.
- Horizontal shading is best for north-facing windows, e.g. deciduous vines such as ornamental grape or wisteria grown over a pergola (see figure 10.3).
- Vertical shading is best for east and west walls and windows in summer, to protect from intense sun at low angles, e.g. screening by dense shrubs, trees, deciduous vines supported on a frame, shrubs used in combination with trees (see figure 10.4).
- Shading and insulation for walls can be provided by plants that adhere to the wall, such as English ivy, or by plants supported by the wall, such as jasmine (see figure 10.5).

WINTER SUN PENETRATION

Shading the building from direct sun is essential for summer comfort, but care should be taken that winter solar gain to windows and outdoor living areas is not excluded. To protect solar access in winter, note the following points.

- Use deciduous trees and plants, particularly to the north of the building, to allow the access of winter sun to north windows (see figure 10.6).
- Tall, low-branching evergreen trees should be kept at sufficient distance from north-facing windows to avoid overshadowing in winter (refer to Chapter 4).
- Where evergreen trees are used for shading the home, they should have branches high enough to permit the entry of as much sunlight as possible in winter.

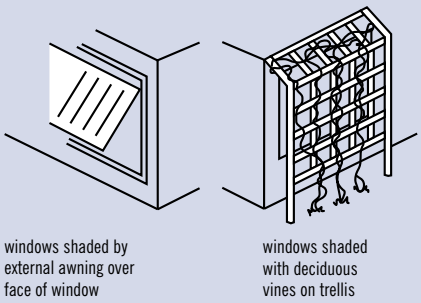

Figure 10.5: Awnings or deciduous vines on a trellis can shade windows

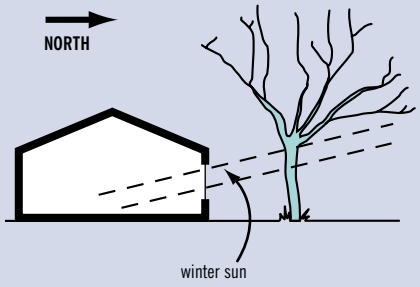

Figure 10.6: Deciduous trees on the north side allow winter sun entry

REDUCING GLARE AND GROUND TEMPERATURE

Glare is produced when strong sunshine is reflected from a surface such as light-coloured paving, walls, from water or a shiny object. Lawns, ground cover and low-growing shrubs absorb more sunlight and re-radiate less heat than a paved surface. Ground cover planting not only reduces glare but can lower the temperature near the ground by approximately 6°C. In summer, an asphalt surface can be twice as hot as grass. By increasing the proportion of non-paved areas, there is the added environmental benefit of increased stormwater absorption.

To reduce glare:

- use low-growing shrubs, ground cover or grass to absorb reflected glare (see figure 10.7);
- avoid large areas of paving near the home to reduce reflected glare and ground temperature, especially north-facing windows; and
- shade large areas of paving with trees or pergolas and planting (see figure 10.8).

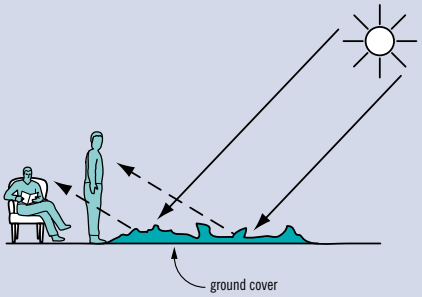

Figure 10.7: Low shrubs and ground covers can be used to reduce glare

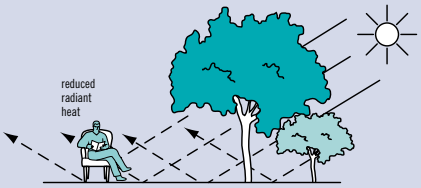

Figure 10.8: Glare control by interception

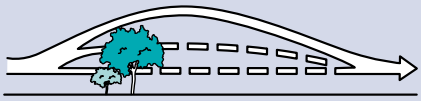

Figure 10.9: Permeable barrier reduces wind speed without turbulence

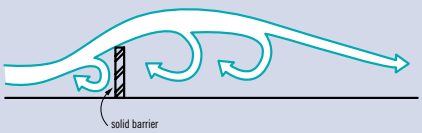

Figure 10.10: Non-permeable barrier creates turbulence

Wind control

Trees and shrubs can be selected and positioned to moderate the chilling effects of penetrating winter winds, particularly on large or exposed sites, and can also assist in capturing cooling summer breezes. In general, planting trees and shrubs as windbreaks, windscreens and breezeways may control airflow over, around and through buildings.

BLOCKING COLD WINDS

- Windbreaks are most effective when located at 90° to the direction of the wind.
- A vertical, somewhat permeable windbreak with 50–60% density is generally more effective than a solid one, such as a wall, which can create turbulence (see figures 10.9 and 10.10).
- Wind velocity can be reduced on both the windward and leeward side of a windbreak.
- Although wind velocity can be reduced by 50% for a distance of ten to 20 times the height, the maximum protection on the leeward side of a windbreak is provided for a distance of three to seven times the height (e.g. a windbreak of 6 m in height should be planted between 20–40 m from the area to be protected [see figure 10.11]).
- Earth mounds may be utilised to deflect winds.
- Large dense shrubs can be used as windbreaks to the south-west to counter cold winter winds, and channel cooling summer breezes (see figure 10.12).
- 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 (see figure 10.13).
- Planting can be utilised to promote natural ventilation by positioning to deflect air flow through the building (see figure 10.14).

CAPTURING SUMMER BREEZES

- Careful positioning of windbreak planting can encourage the entry of desirable summer breezes.
- Low shrubs, lawn and ponds to the north will help cool hot summer winds.

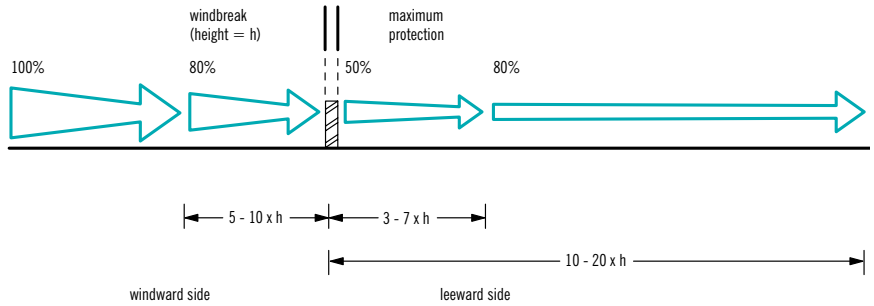

Figure 10.11: Wind velocity reduced by windbreaks

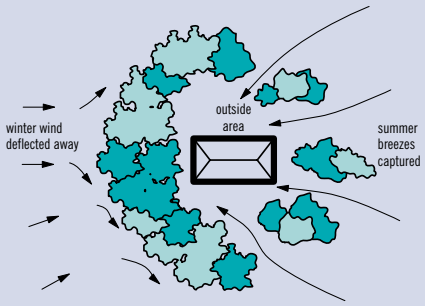

Figure 10.12: Use shrubs to deflect cold winds and channel summer breezes

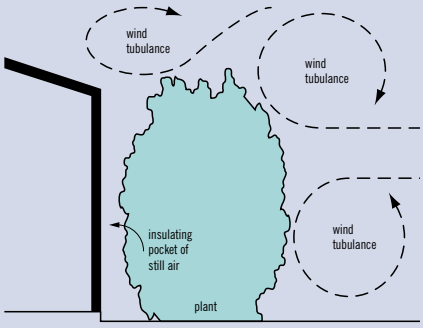

Figure 10.13: Planting can provide still air insulation beside walls

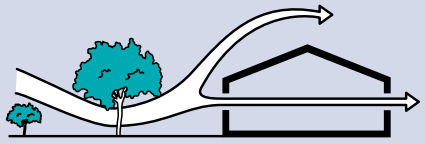

Figure 10.14: Planting to promote ventilation

Selection of plants

Different types of plants, ranging from tall trees to ground cover, can be used for different applications. Tables 10.1–10.6 provide some planting suggestions, selected primarily for Victoria. Care should be taken to check local conditions, and there are likely to be many more suitable plants to choose from.

Table 10.1: Canopy shade tree

SPECIES— LARGE TREES	DECIDUOUS (D) EVERGREEN (E)	HEIGHT X SPREAD (METRES)	GROWTH RATE	SHADE LIGHT (L)	LIMB DROP DENSE (D)	SUITABLE AREA
Angophora costata Smooth-barked Apple	E	15–20 x 10–15	Fast	L	✓	N S
Eucalyptus camaldulensis River Red Gum	E	20–30 x 15–25	Medium	L	✓	N S
Eucalyptus citriodora Lemon-scented Gum	E	15–20 x 8–15	Fast	L	✓	N S
Eucalyptus sideroxylon Red Ironbark	E	15–20 x 5–10	Fast	L		N S
Gleditsia triacanthos 'Shademaster' Shademaster Honey Locust	D	12–20 x 7–15	Fast	L		N S
Jacaranda mimosifolia Jacaranda	D	9–15 x 10–16	Slow	L		N S
Koelreuteria paniculata Golden Rain Tree	D	10 x 8	Medium	L		N S
Platanus x acerifolia London Plane	D	18–30 x 15–25	Medium	L–D		N S
Quercus robur English Oak	D	18–30 x 20–3	Slow	D		S
Tilia cordata Small-leaf Lime or Linden	D	15–20 x 10–15	Medium	D		S
Ulmus parvifolia **3** Chinese Elm	D	6–12 x 6–15	Medium	L		N S
Ulmus procera **4** English Elm	D	12–30 x 12–25	Medium	D		S
Zelkova serrata Zelkova	D	20 x 15	Medium	L		S

Footnotes

1. **N S** = Plants successfully grow both north and south of the Great Dividing Range, sometimes with supplementary irrigation.
   N = Plants will probably do best in warmer northern regions.
   S = Plants are only suited to cooler southern areas of the state.
2. Semi-deciduous in some climates, may be fully deciduous in cold climates.
3. It may not be advisable to plant this species in view of the potential threat of Dutch Elm Disease. *Zelkova serrata* would be a suitable substitute.

Table 10.2: Plants for low angle sun protection

SPECIES— SMALL TREES	DECIDUOUS (D) EVERGREEN (E)	HEIGHT X SPREAD (METRES)	GROWTH RATE	SUITABLE AREA
Abelia x grandiflora Glossy Abelia	E	1.5–2 x 2–3	Medium	N S
Banksia ericifolia Golden Banksia	E	2–4 x 2–3	Medium	N S
Choisya ternata Mexican Orange Blossom	E	1.5–2.5 x 1.5–2.5	Medium	N S
Grevillea 'Red Hooks' Toothbrush Grevillea	E	3–4 x 4–5	Fast	N S
Hibiscus rosa-sinensis Hibiscus	E	2–4 x 2–4	Medium	N S
Hibiscus syriacus	D	2–3 x 1–2	Medium	N S
Melaleuca hypericifolia	E	1.5–2.5 x 2–4 t	Medium	N S
Photinia glabra 'Rubens' Red-leaf Photinia	E	2–3 x 2–3	Medium	N S
Pyracantha angustifolia Narrow-leaf Firethorn	E	2–3 x 2–3	Medium	N S
Viburnum tinus Laurestinus	E	2–4 x 2–3	Medium	N S
Westringia fruticosa Coast Rosemary	E	1–1.5 x 1.5–2.5	Fast	N S

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Table 10.3: Climbers for pergolas

SPECIES— CLIMBER (TRELLIS)	DECIDUOUS (D) EVERGREEN (E)	GROWTH RATE	SUITABLE AREA
Clematis aristata Austral Clematis	E	Medium	S
Clematis microphylla Small-leafed Clematis	E	Medium	S
Clematis montana Clematis	D	Fast	S
Hardenbergia violacea False Sarsaparilla	E	Fast	N S
Hibbertia scandens Snake vine	E	Medium	N S
Jasminum azoricum	E	Medium	N S
Jasminum polyanthum Jasmine	E	Fast	N S
Kennedia rubicunda Dusky Coral Pea	E	Fast	N S
Mandevilla laxa Chilean Jasmine	E	Medium	S
Pandorea jasminoides Bower of Beauty	E	Fast	N S
Pandorea pandorana Wonga Wonga Vine	E	Fast	N S
Rosa banksiae Lady Banks' Rose	D	Medium	N S
Solanum jasminoides Potato Vine	E	Medium	N S
Trachelospermum jasminoides Star Jasmine	E	Medium	N S
Wisteria sinensis Wisteria	D	Medium	S
Vitis coignetiae	D	Medium	S

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Table 10.4. Low shrubs and ground covers for glare reduction

SPECIES— SHRUBS	FULL SUN	SEMI-SHADE	HEIGHT X SPREAD	GROWTH RATE	SUITABLE AREA
Cotoneaster dammeri	✓	✓	30–40 cm x 2 m	Medium	N S
Grevillea biternata Pronged Grevillea	✓		1.5 x 3 m	Fast	N S
Grevillea 'Poorinda Royal Mantle'	✓	✓	10–20 cm x 5 m	Medium	N S
Grevillea x gaudichaudii	✓	✓	15 cm x 2 m	Medium	N S
Juniperus sabina Savin Juniper	✓	✓	60 cm x 1.5–2 m	Slow	S
Myoporum parvifolium Creeping Boobialla	✓		5–15 cm x 3 m	Fast	N S
Rhagodia spinescens Herbaceous plants	✓		45 cm x 1.5 m	Fast	N S
HERBACEOUS PLANTS					
Ajuga reptans Carpet Bugle		✓	Indefinite	Medium	N S
Campanula porscharskyana Serbian Bell Flower		✓	Indefinite	Med–fast	S
Hedera helix **2** selected forms English Ivy	✓	✓	Indefinite	Medium	N S
Vinca minor **3** Lesser Periwinkle Ornamental Grape		✓	Indefinite	Medium	S

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2. Whilst regarded as an environmental weed in Victoria, cultivars such as Hedra helix 'Little Fingers' or H.h. 'Lvalace' are juvenile forms which do not flower, so will not be invasive to sensitive areas. They are also slower to climb walls. Retain the juvenile form by cutting back if mature foilage appears.
3. Do not use the Greater Periwinkle, Vinca major, in regions close to bushland as it is a serious weed in some areas.

Table 10.5: Climbers to cover walls

SPECIES— CLIMBER (WALL)	DECIDUOUS D EVERGREEN E	FLOWERS (SIGNIFICANT)	SELF SUPPORT	NEEDS SUPPORTING	COMPLETE COVER POSSIBLE	GROWTH RATE	SUITABLE AREA
Clematis montana Clematis	D	✓		✓		Fast	S
Ficus pumila Creeping Fig	E		✓	✓		Medium	N S
Hederta helix **2** English ivy	E		✓		✓	Medium	N S
Jasminum polyanthum Jasmine	E	✓		✓		Fast	N S
Parthenocissus quinquefolia Virginia Creeper	E		✓		✓	Medium	S
Parthenocissus tricuspidata	E		✓		✓	Medium	S

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   If in doubt as to the suitability of particular species, consult your local authority.

Table 10.6: Windbreak trees

SPECIES— WINDBREAK TREES	DECIDUOUS (D) EVERGREEN (E)	HEIGHT X SPREAD (METRES)	GROWTH RATE	SUITABLE AREA
Acacia boormanii Snowy River Wattle	E	3–4 x 2	Fast	N S
Acacia elata **2** Cedar Wattle	E	12–20 x 10–15	Fast	N S
Acacia longifolia **2** Sallow Wattle	E	4–6 x 6–8	Fast	N S
Acacia melanoxylon Blackwood	E	10–25 x 6–10	Medium	S
Acacia retinode Wirilda	E	6 x 3	Fast	N S
Allocasuarina torulosa Rose She-Oak	E	10–15 x 4–6	Fast	N S
Allocasuarina verticillata Drooping She-Oak	E	5–10 x 3–7	Medium	N S
Brachychiton populneus Kurrajong	E	6–15 x 4–7	Medium	N S
Casuarina cunninghamiana River She-Oak	E	15–30 x 8–12	Fast	N S
Eucalyptus cladocalyx **2** Sugar Gum	E	20–25 x 10–15	Fast	N S
Eucalyptus radiata Narrow-leaved Peppermint	E	10–30 x 6–20	Fast	N S
Eucalyptus melliodora Yellow Box	E	15 x 15	Medium	N S
Melaleuca armillaris **2** Bracelet Honey Myrtle	E	3–8 x 3–8	Fast	N S
Melaleuca linariifolia Flax-leaf Paperbark	E	6–12 x 5–15	Med–fast	N S
Pinus radiata **2** Monterey Pine	E	20–30 x 15–20	Fast	N S
Populus nigra 'Italica' Lombardy Poplar Boston Ivy	E	18–30 x 4–6	Fast	S

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