Australian Plants for the
NORTHERN TABLELANDS
of New South Wales

The New England Group of the
Society for Growing Australian Plants

AUSTRALIAN PLANTS
for the
NORTHERN TABLELANDS
of
NEW SOUTH WALES

NEW ENGLAND GROUP
of the
SOCIETY FOR GROWING AUSTRALIAN PLANTS
1982

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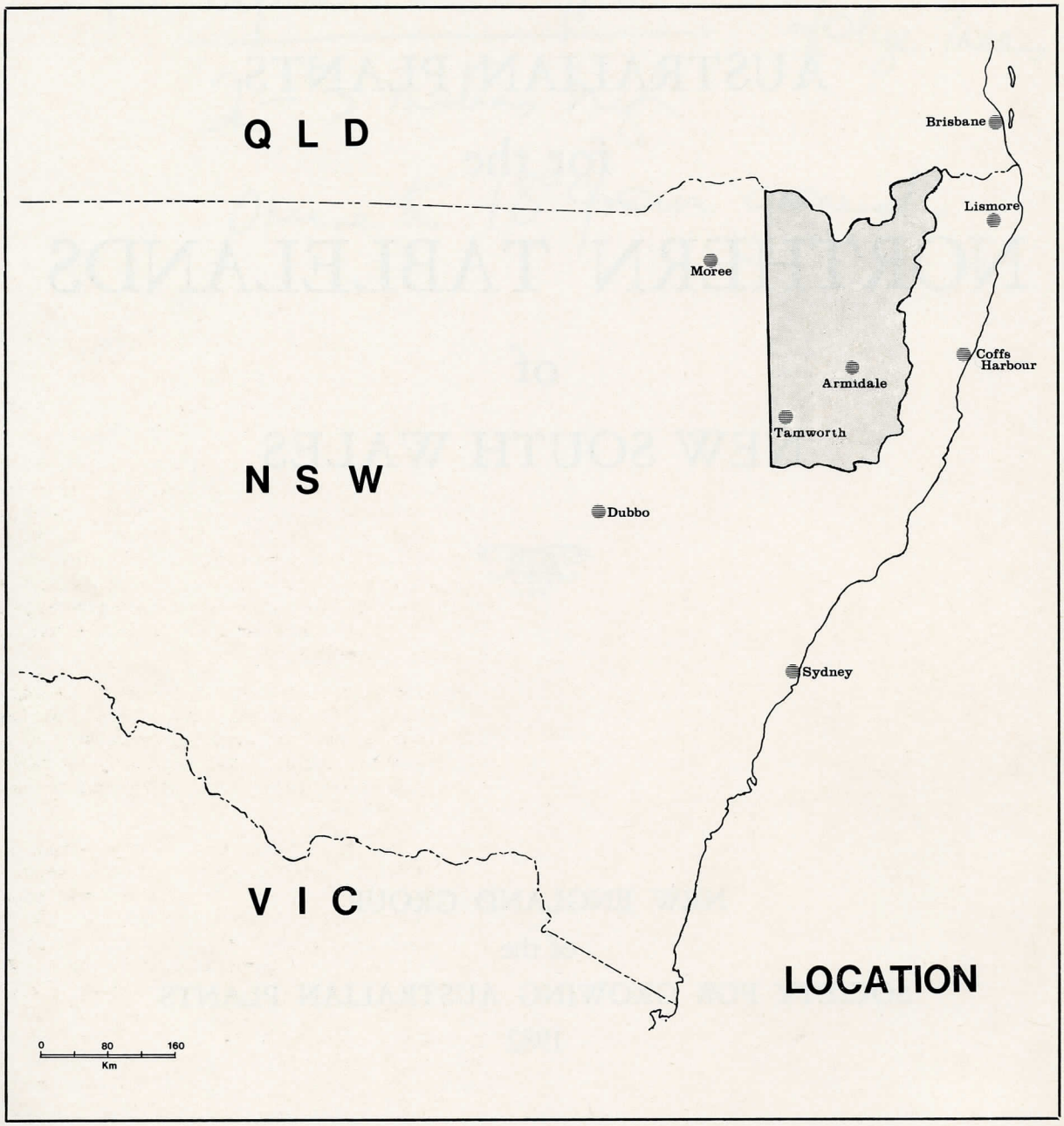

COVER PLATE:

Helichrysum bracteatum, "Golden Everlasting", an annual herb which is widespread on the Northern Tablelands and has been selected as the Group emblem.

Introduction

THE New England Group of the Society for Growing Australian Plants was formed in August, 1977, with a small number of enthusiastic members. At that time, little was known of the special techniques required for growing native plants on the Tablelands, or of the large number of species potentially suitable for this climate.

We are indebted to the pioneering work done by the late Toss Frazier, by Phil May, Bob Hardie and Hans Wissmann, whose gardens inspired us in those frustrating early days, and Mike Brennan, whose Protea Park Nursery provided us with many of our first plants. Gradually, our numbers increased, our techniques improved and we received new inspiration from Harry Bell, who set us on the path of successful propagation.

Despite a severe drought, during which we learnt a great deal about mulching and efficient watering, our numbers have increased dramatically, and we have made our mark on the community by staging successful Flower Shows and contributing to tree-planting projects.

This book has been in the planning stages for two years and is the culmination of many years of individual hard work. We have pooled our knowledge, gained through both successes and failures, to guide those of you living in cold climates towards the successful growing of native plants. We hope it will also be helpful to those of you gardening in areas of other climatic extremes. We intend this book to reach both the town gardener and the man on the land, including the large number of hobby farmers in rural areas. We have included a chapter on indigenous plants, as it is only through knowledge of our own flora that we can truly understand our environment and attempt to preserve the small areas still left in their natural state.

We hope that you will enjoy this book and use it often.

Maria Hitchcock,
President, 1982.

Acknowledgements

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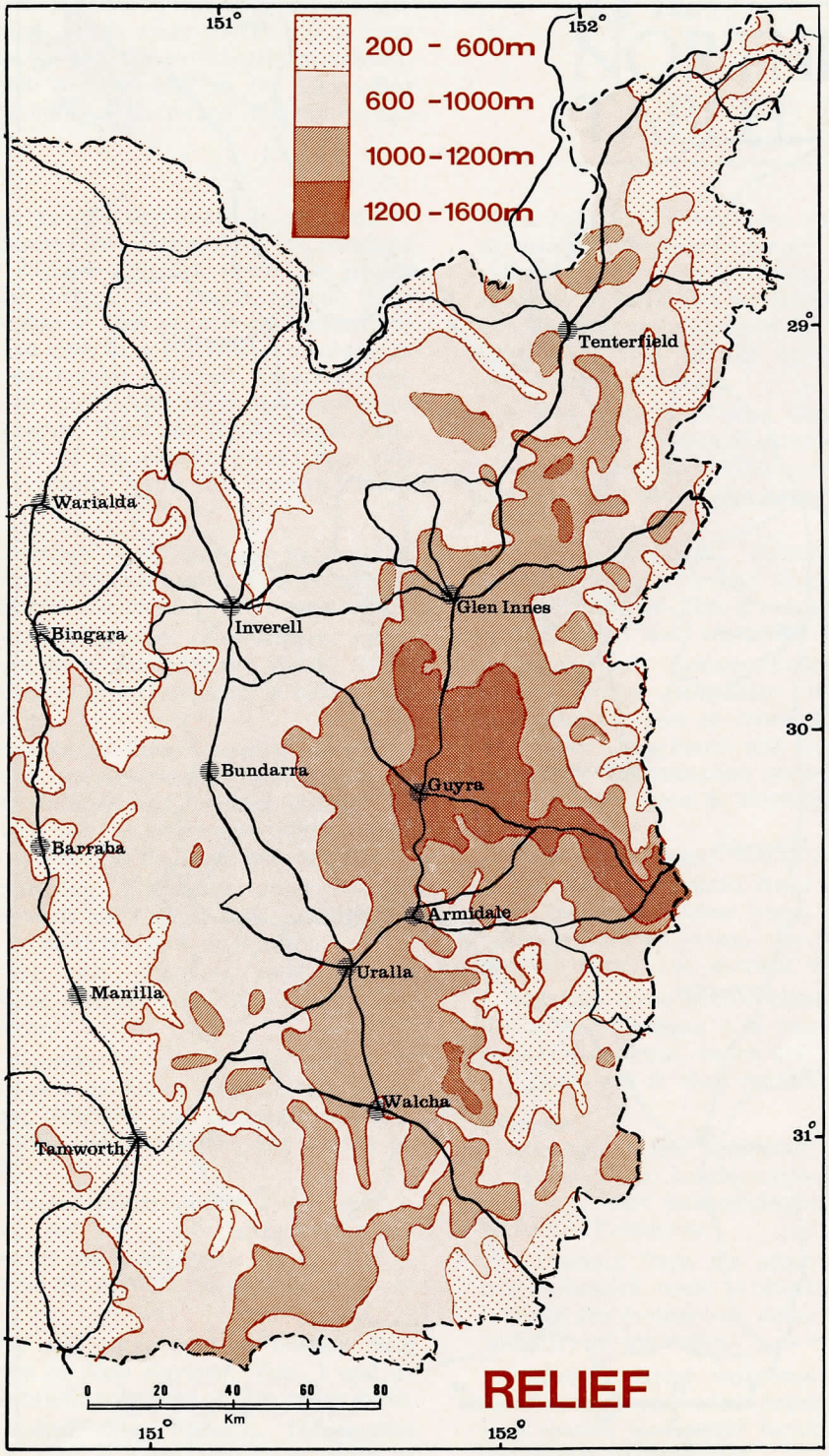
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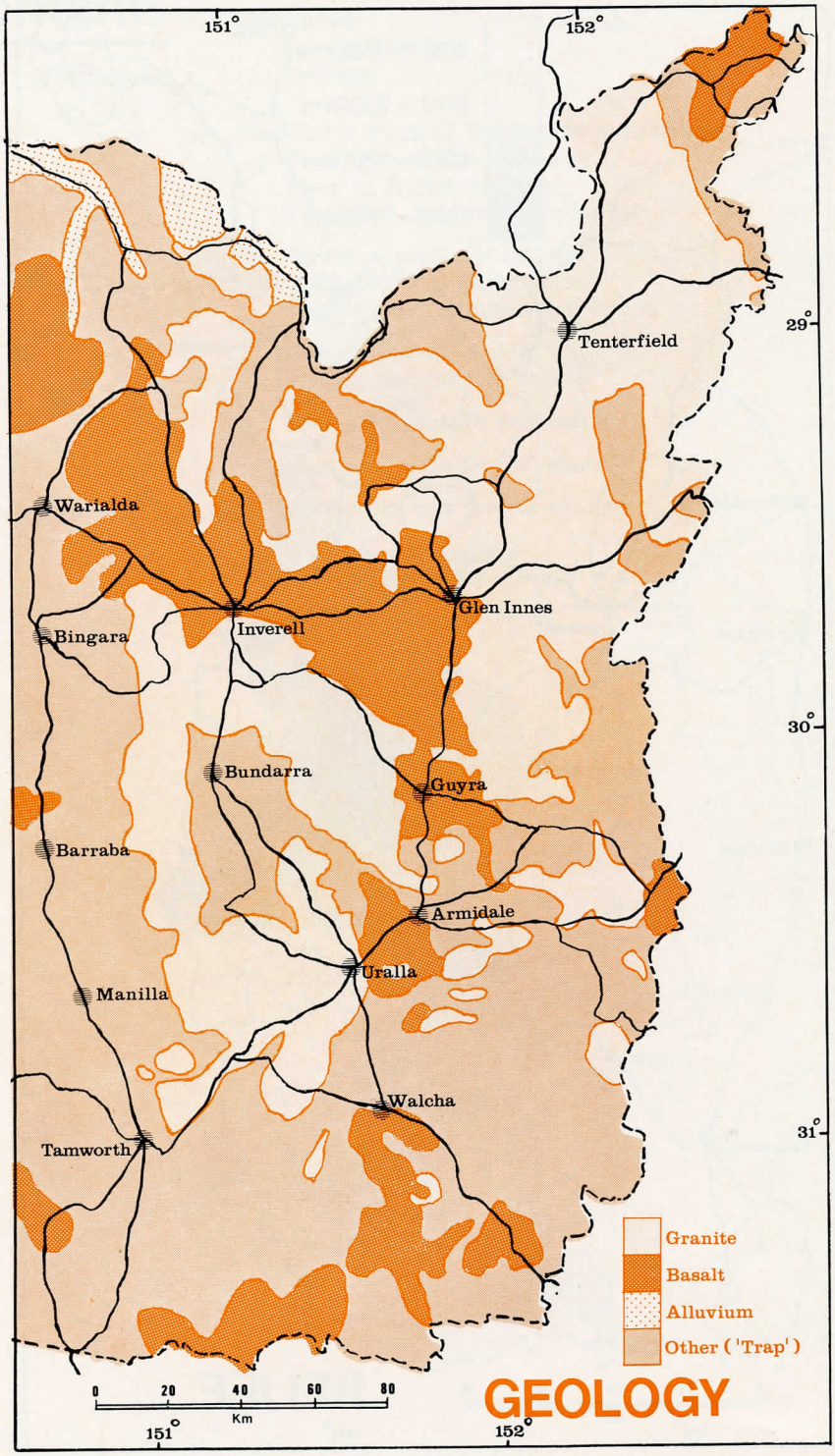
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Manilla
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Tamworth
Granite
Basalt
Alluvium
Other ('Trap')
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GEOLOGY

THE NORTHERN TABLELANDS

THE Great Dividing Range forms the backbone of the Northern Tablelands, and although the altitude of this range varies from 800 metres to over 1500 metres, peaks are not particularly prominent. Areas over 1200 metres occur in the Guyra-Ben Lomond region, between Deepwater and Bolivia and east of Walcha.

Relief

Relief of the region is dominated by the undulating upland country that forms the New England Plateau. The highest altitudes occur at Round Mountain (1583 metres) and Point Lookout (1562 metres). To the east this plateau is dissected by deep gorges, and ends in a precipitous escarpment. A number of spectacular waterfalls have been created in the gorge country, the most significant being the Apsley, Dangars, Ebor and Wollomombi Falls. The eastern edge of the plateau breaks into hilly country that eventually forms the Western Slopes.

Soil

Although a diversity of soil types can be identified in the Northern Tablelands region, it is possible to make some general comments.

- A considerable portion of Northern Tablelands soils have been derived from basalt. These soils are often heavy in texture, dark in colour, and of high fertility.
- The greywacke or "trap" country that rings the margins of the Northern Tablelands produce extremely variable and complex soils. Often the surface soil has a grey-brown sandy loam structure, but the subsoil is clayey and cohesive.
- The weathering of granite areas on the Northern Tablelands has formed light coloured soil that tends to be relatively low in fertility.
- There are also relatively small alluvial deposits associated with the rivers flowing out from the upland country.

Given the diversity of soils in this area it is desirable that native gardeners ascertain the depth, texture, fertility, friability and drainage capacities of their own soil, and if possible, the acidity or alkalinity (pH).

In general native plants prefer a soil that is slightly acid i.e. pH 5.5 to 7.0. In fact, it seems that as long as the soil is slightly acidic or close to neutral it should be possible to grow a range of native plants.

Although the soil types tend to overlap each other (*An Atlas of New England*, Vols. 1 and 2) it is possible to briefly comment on five major types.

- Yellow Podzolic-Gley Podzolic. This occurs around Tingha, east of Glen Innes and south of Tenterfield. This is an acidic, quite shallow, medium to coarse sandy loam of granite origin with a clayey subsoil over granite. Although flat areas have a tendency to form high watertables the soil dries out quickly. This prevents deep root growth and plants have to be very drought resistant yet tolerant to waterlogged conditions.
- Red Podzolic. Found chiefly around Walcha and along the Eastern Escarpment. This is an acid, moderately organic, friable, permeable soil which is, consequently, one of the better soils of the Tablelands.
- Yellow Podzolic. Found in some parts of North Armidale, around Rockvale and generally east of Armidale. This is a neutral to alkaline, hard setting, clayey soil, which can be difficult to work.
- Solodized Solonetz-Yellow Earth. Found around Uralla, Deepwater, Tenterfield, Bundarra and generally west of Armidale. This is a neutral to alkaline, deep loamy soil (from sandstone) overlying clay. Intermingling occurs as depth increases and the soil is poor in nutrients and moisture holding capacity.
- Chocolate-Prairie. Found in parts of Armidale, Kellys Plains, Bundarra Road area west of Armidale, Guyra and Glen Innes. This is generally a neutral, shallow, stoney, clay loam with moderate organic matter and nutrient elements.

Although some native plants grow on each of the above soil types it is frequently necessary for gardeners to drain, mulch and generally modify the soil conditions in their particular area.

Climate

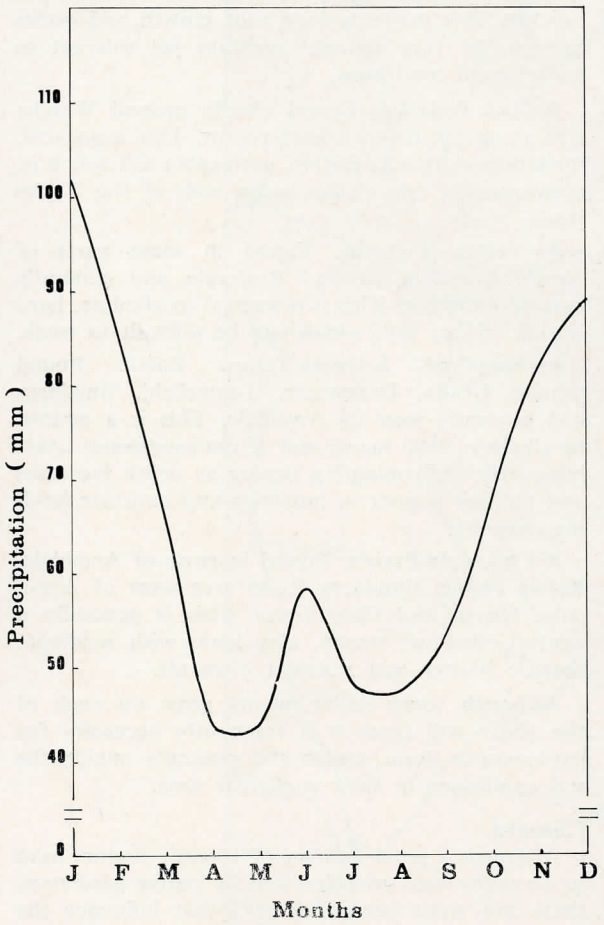
Although a great number of climatic factors have to be taken into consideration by native gardeners, there are some general factors that influence the Northern Tablelands.

- Distance from the coast and eastern escarpment: Rainfall tends to decrease and temperature increase the further you move towards the western boundary of the region.
- Relief: Great variations occur in temperature, rainfall and wind patterns that result from such specific local relief factors as slope, elevation and degree of protection.

• Altitude: Variations in altitude influence minimum and maximum temperatures. These in turn affect the number and severity of frosts and the daily temperature range.

Rainfall

Throughout the Northern Tablelands there is an expectation that some rain will occur each month, but with a strong tendency for a Summer maximum. The generalized pattern of rainfall for the region is presented in the following graph.



The average yearly rainfall for most centres on the Northern Tablelands is around 800mm. Highest falls occur in the Guyra area (880mm) and the lowest in the Inverell area (765mm).

There are two aspects of the region's rainfall that should be noted.

• Intensity of Summer storms — These storms may be short in duration, but there is a tendency for rapid "run off", and thus much of the water may not soak into the ground. Summer hailstorms can also create problems for young, unprotected and delicate native plants.

• Light snow falls — At higher altitudes of the region there is the possibility of light winter snow falls. Light snow or cold drizzle can damage the stem and leaves of even the hardy plants.

Temperature

The Northern Tablelands can generally be considered as a region of warm summer temperatures and cool to cold winters.

The following summary of mean maximum and minimum temperatures for six Northern Tablelands towns gives some indication of the temperatures that occur in the region.

MEAN MONTHLY TEMPERATURES

		Jan	Mar	Jun	Aug	Dec
Armidale	Max.	26.6	24.2	13.9	14.2	26.1
	Min.	13.5	11.5	1.7	1.4	12.7
Glen Innes	Max.	25.4	23.6	13.9	14.0	24.6
	Min.	13.2	11.6	1.8	1.5	11.8
Guyra	Max.	22.8	20.8	11.0	11.3	21.9
	Min.	11.4	9.5	0.9	0.7	10.5
Inverell	Max.	30.3	28.3	17.8	17.9	29.3
	Min.	15.3	12.4	1.6	1.4	13.7
Tenterfield	Max.	26.4	24.6	15.3	15.8	25.9
	Min.	14.5	11.9	2.2	2.0	13.0
Walcha	Max.	25.3	23.2	12.5	12.8	24.6
	Min.	11.7	9.4	-0.1	0.0	10.4

Perhaps the most important consideration with regard to temperature is the frequency and intensity of frosts. Frosts tend to occur between late April and mid October, with Tenterfield experiencing on average 39 frosts per year, Armidale 50 frosts, Glen Innes 57 frosts and Guyra 67 frosts.

COLD-CLIMATE GARDENING

ALTHOUGH the Northern Tablelands frequently suffer from other extremes of climate, such as drought, hail-storms, torrential rain, strong winds, heat-waves and snow-storms, the condition best known and most feared as a destructive influence in the garden is the regular occurrence of frost, sometimes quite severe, between May and September, but often earlier and later. Here we discuss frost resistance and cold hardiness, the concept of microclimate, which is very important for cold climate gardeners, and management practices that will help to avoid the disappointments caused by frost.

A hard look at frost

We are all familiar with the kinds of damage that occur after a frosty night, or a succession of frosts. With frost-tender species, such as some strains of the annual paper-daisy, *Helichrysum bracteatum*, the leaves and stems turn limp and dark-coloured: their tissues have ruptured beyond recovery and released all their vital fluids, as if an artery had been cut. Slightly more frost-resistant species may suffer from leaf-burn: the leaf-tips or whole leaves become brown and dried up, but unless a very large proportion of the leaves are affected such plants will probably survive. Woody stems of some young shrubs react to a sudden sharp frost by swelling and bursting their stem tissues, splitting the stem into several strands, all incapable of transporting water to the leaves; this results in all parts of the plant above the stem-burst dying, whether it be a single branch or the whole plant. Melaleucas and Callistemons sometimes react in this way, particularly if a spell of warm, moist weather has kept them growing in late autumn and there is sap in the stems. Such plants have not developed their cold-hardiness.

What do the terms frost-resistance and cold-hardiness mean?

Frost-resistance is an inbred characteristic; species described as "frost-resistant" are genetically capable of creating in themselves a condition which helps them to cope with low temperatures and frost.* This condition is known as "cold-hardiness", and it is developed each year, in autumn, in response to seasonal changes. As the length of daylight shortens, and temperatures begin to drop below about 10°C, plants gradually slow down their growth; bio-chemical changes may also occur at this time, so that a kind of anti-freeze is manufactured within the plant; and its membranes may be strengthened against the stresses of expansion and contraction entailed by freezing and thawing. In such ways, but very gradually, a frost-resistant plant develops its cold-hardiness, a process mainly controlled by the alternating warmth and coolness of autumn days and nights.

Sometimes a wet autumn followed by a spell of consistently warm weather upsets the process, for the plants put on a flush of new growth and are caught by the first frost that follows a cloudless, sunny autumn day. Sometimes frosts occur early in the season, before plants have had time to develop their cold-hardiness, and severe damage can then result. Sometimes gardeners, unaware of the natural process of cold-hardening, continue practices which promote growth such as frequent watering (the plant needs very little moisture when it is tuned to stopping growth), giving nitrogenous fertilisers, and pruning. All may give rise to new growth and subsequent frost damage or outright death, particularly of newly planted specimens. We have already seen that the presence of sap in the stems can lead to stemburst after frost.

In spring the acquired cold-hardiness of plants progressively weakens in response to increasing length of daylight and warmer temperatures; plants gradually get ready to begin growing. Gardeners must not try to hurry things along by watering or giving fertiliser in early spring, for this will break the cold-hardiness and promote new growth before the danger of a late frost is over. Cold-hardiness, once lost, cannot be developed again until the following autumn. A warm, wet spring may also bring on new growth too early in the season, and this is beyond our control. We can meet such a problem only by being on our guard against late spring frosts, watching for signs such as clear skies, still air, and low temperatures around sunset, being prepared to cover plants where practicable.

Microclimate

Before considering what steps we can take to minimise the damage caused by frost, we need to understand something about microclimate, because

* *Some species can only cope with two or three degrees of frost, while some can stand temperatures of -40°C. The term "frost resistant" is very relative, and we have to know* how *frost-resistant each species is to know whether it will be safe in a particular site.*

an early appreciation of the microclimates of our own gardens will suggest planting schemes that have a better chance of surviving frost damage.

Microclimates have been described as "little climates a few feet or a few hundred feet wide that are somewhat different from the general climate"; they are caused by differences in height, slope, aspect, the presence or absence of structures — fences, houses, sheds — and of vegetation — tall trees, dense hedges, etc. Two studies of microclimate made in and around Armidale in recent years have shown that quite surprising differences in temperature can occur, even within the confines of one garden.

Over a twelve month period in 1966-67 a climatologist, Russell D. Thompson of the University of New England, studied the differences in screen temperature* and other climatic data recorded at 18 small weather stations set up in and around Armidale — on the crests of North Hill and South Hill, on the north and south facing slopes below these crests, and in the valley between them, along the floodplain of Dumaresq Creek.

Results illustrated the following points:

- Cold air in winter and heat in summer both concentrate in relatively low-lying or flat land from which air drainage is slow. (Armidale floodplain experienced 73 frosts during the year, 36 of them being below –3.3°C, while the crest of North Hill had only 20 frosts and the upper slopes of South Hill only 38: none of these were as low as –3.3°C.)

- Structures in the environment (e.g. buildings) help to modify the severity of frosts. (Temperatures recorded in the rural floodplain outside the city were much lower than those recorded in the city floodplain, which benefited from the "heatbank" effect of city buildings, and probably also from the inversion layer caused by smoke and fumes from oil and wood-burning domestic heaters.)

- In winter, particularly, a north-facing slope is warmed by the sun's rays to a greater degree than a south-facing slope, since the angle of solar incidence is much less in the latter case, and southern slopes are in the shade for a greater part of the day. (In Armidale, the differences in temperature between north and south-facing slopes averaged 1.2°C in the winter months; frosts were slightly fewer and less severe on the north-facing slope than on the south-facing slope. But the coldness of the valley bottom extended quite high up the slopes on both sides).

Because of these local variations in temperature and the incidence and degree of frost, some parts of Armidale have a growing season longer by three to four weeks than other parts. Such variation is true of most localities.

This may not seem very helpful to those stuck with a garden in a frost hollow, or on a southern slope that is open to every sou'wester that blows; but even here the microclimate variations can be quite surprising.

In July of 1979 and late May of 1980, a S.G.A.P. member measured the ground temperature at night in various parts of his garden. Sites included close to the brick wall of his house; beside a rock wall several metres from the house; under a light canopy of young shrubs; and out in the open, down a slight decline from the house. The ground in down-sloping and open parts of the garden was found to be up to 5°C colder than ground within a metre of the house; ground close to the rock wall was warmer even than that near the house, since rocks store heat from the sun very efficiently during the day and release it at night, giving a heat-bank effect (the wall was built for this purpose). If the rock wall or the house had been at the lowest point of the garden their heat-bank effect would have seemed weaker because of the constant cold-air drainage in that direction; if the house had been of weatherboard instead of brick the heat storage would have been less, though high brick foundations would modify the difference at ground level.

In any block of land a large tree, a house or any other structure will afford some protection against wind and cold air, and will give shade at different times of the day and of the year; also structures of stone, concrete or brick will release some of their stored heat during the cold night following a winter day of clear skies and sunshine. When cold-air pooling has been observed, probably in parts of the garden away from the house and in depressions, it is sometimes possible to create gaps through which the cold air can drain away (but not into your neighbour's garden, please!). Overall warmth can sometimes be increased by judicious planting of wind-breaks (remembering the odd gap for drainage if appropriate) together with some tall shrubs and small trees to canopy the ground below; under these more tender species can later be planted. The full effects of vegetation growth and cover will not be felt for a few years. But some improvement in the microclimate can be accomplished fairly quickly, perhaps by using some of the larger stones,

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* *Screen temperature means temperature measured one metre above ground in a Stevenson screen, a louvred box in which instruments can be placed so as to give readings unaffected by strong wind and direct sun.*

lumps of concrete and odd bricks that builders would otherwise remove from a new site. If these are put round new plants they will modify the ground temperature a little — along with other measures suggested below, perhaps just enough to ensure survival over the first critical winter.

However clever we become at improving the microclimate, we must still face the basic fact that frosts are inevitable in this area, and that from time to time even the best site will suffer a relatively severe frost. In 1978, for example, the meteorological station at Armidale (which is not sited in the coldest situation) recorded a screen temperature of -6.7°C, and a grass temperature of -12°C was reported in one lower-slope garden. That particular night was said to have been the coldest for seven years in Armidale, and indeed centres all over the State experienced their lowest minimum for several years. Widespread damage was caused to many native plants throughout the Northern Tablelands, the damage perhaps being correlated with the well-watered state of the plants following a fall of 30-50 mm of rain the previous week. Even naturally occurring specimens suffered. Species normally considered frost resistant showed leaf scorch in young plants (e.g. *Acacia baileyana,* the Cootamundra wattle; *Casuarina cunninghamiana,* the river she-oak; *Acacia implexa,* or hickory wattle; *Acacia melanoxylon,* or blackwood; and *Eucalyptus bicostata,* or eurabbie) and some developed splitting of the bark, leading to death of the top growth later in the spring. Young plants of many species were killed outright by this one severe frost, though they had survived moderate frosts of the previous year, and earlier in this same winter. Others appeared to have survived this severe frost in July, but succumbed to a mid-August heavy frost (screen temperature -5.4°C).

Such harsh conditions must be expected in this area, and we must learn to live with them as best we can. The following is a list of practical suggestions for minimising the risks of frost-damage to our native species:

Reducing frost damage

Prevention is better than cure. Don't begin a native garden with species known to grow happily in Sydney or the coast (or even Tamworth) unless you have checked to discover if they have already been successfully grown in your local area. Some plants are very adaptable, but many are not. Supermarkets, shops and even local nurseries are not all sufficiently knowledgable about the degree of hardiness of all the species they sell. The terms "hardy" or "frost hardy" cannot be regarded as sufficient guarantee of success in our climate, but the lists given in this booklet should help you to decide whether a species has the right degree of frost hardiness for your situation.

Take into account the "provenance" factor when choosing seeds or plants, i.e. try to find out where the parent material grew and record it. Some species grow in a wide variety of climates, but individual populations of the species may become adapted to the locality they are found in and pass on their adaptations to seed or clones. If you have problems with a species despite the fact that it is known to grow well in your district, try again with seed or cuttings from the local ecotype.

Protect new plants in their first winter if you have any doubts about their hardiness. If the plant is big, surround it with hessian or cardboard fastened round three or four stakes. For smaller plants, milk or fruit juice cartons with their bottoms cut out give very satisfactory protection against both wind and frost, and will last the whole season; it is usually necessary to construct a hexagon from 1½ cartons (ordinary office staplers will join up the cartons provided strong staples are used); a stake is then driven into the ground very close the plant — preferably at the time of planting so that roots are not damaged — and the carton hexagon is put round both plant and stake, then fastened to the stake; a spring-loaded staple-gun is excellent for this job, but piercing large holes or splits with a penknife, through which string or raffia can be slotted to tie the carton to the stake, is quite easy. The box should touch the ground on all sides, and a large stone in the corner opposite the stake will help to stop it from moving. The plant should not be in contact with the box, or frost damage will occur at points of contact; however this minor damage does not severely affect the plant and some contact is inevitable as the plant grows. This method of protection may seem incomplete since the plant is open to the sky and to descending cold air, but there is a sheltered area inside the carton; stem burst is less likely, and leaf burn is less severe, partly because the plant is protected from the direct rays of the sun in the early morning and suffers less from sudden temperature changes.

If a plant is so frost tender that it is necessary to cover its top also, the cover should be removed and returned daily — a chore which only the very determined will undertake: it is done in the National Botanic Gardens at Canberra for some prized but tender species.

Remember that a shrub or tree will soon grow up above the cold air channels that affected it in its early years. Sometimes one is lucky with a susceptible plant, in that no heavy frosts occur during the first few years of its life, and by the time a bad year comes it may be tall enough not to suffer extensive frost damage. It may therefore be worth leaving even badly frosted plants in the ground, since new shoots frequently appear from the base next season; having a well established root system they often grow well and survive the next winter to live happily ever after!

Assess the microclimate of your garden. Choose and locate species with due respect for features of the microclimate that you cannot alter — e.g. the aspect, whether or not the whole garden receives maximum sunshine from dawn to sunset, or part or all of it is on a slope that faces east, west, or south; or whether it is in a frost hollow, with no possibility of improving the air drainage — such a site can also be very hot in summer which also limits choice of species.

Take positive steps to improve the microclimate by planting windbreaks (without blocking the cold air drainage channels); use quick-growing hardy species, such as acacias, as nurse plants to protect the more tender species that can be started a year or two later close to them. Eventually, when the more prized species are established, the nurse trees are cut down and removed, so that competition from their roots is not a problem.

Help your plants to increase their hardiness and preparedness for winter: reduce watering and avoid fertiliser as winter approaches.

Don't accelerate spring growth by giving water or fertilizer too early, and prune only in the warmer months, when frosts are not expected, so that the new growth that pruning stimulates is not destroyed by frost. If plants are damaged by frost, despite your care, don't prune off the damaged parts until frosts seem to be over.

Ensure that new plants are properly hardened off before planting out in the open. Don't plant out in the winter months — this practice is only safe for plants which go dormant in winter, such as deciduous exotics. The best times for planting native species in this area are late October and November, and late February and early March, with protection.

Remember the many useful native annuals that can be grown even in our short frost-free summer. Paper-daisies can be sown in autumn, under cover, and planted out in spring when frosts are over.

Many plants can be grown in containers and moved to sheltered sites under the eaves, or beside a north-facing wall for the winter months.

The aim should be to extend gradually over the years the range of native plants your garden can grow — not to try to reproduce what you see in a coastal nature reserve or a Sydney native garden or nursery.

TOWN GARDEN DESIGN

IN planning a house, the two elements of function and aesthetics are considered in order to provide comfortable, attractive and practical living areas. The same criteria apply to the design of a garden. All factors influencing the site and the projected activities of the garden-users must be considered if a functional and harmonious design is to be achieved.

Factors to be considered, which apply either to the development of an entirely new garden or the redevelopment of an existing garden, will include existing conditions or functional requirements.

Existing Conditions, either man-made or natural

Man-made Conditions

The usual town garden will be designed to fit onto a rectangular block of land, with straight boundaries defined by fences, and around a house and, perhaps, other buildings, with rigid rectangular lines. Driveways, too, are usually constructed as the shortest distance between two points: i.e. in straight lines. To offset the rigidity of these straight lines, which are rare in nature, use should be made of plant material — shrubs, ground covers and climbers — which will spill over and soften the stiffness of these lines. Curves may be used in planning paths, garden edges and driveways to introduce a more natural and less formal effect.

The first step, the drawing of a site plan, should show all existing structures and all other man-made constraints: for example, water and sewerage lines, site easements, underground telephone lines, power lines. The position of underground pipes is particularly important, as it is inadvisable to plant large trees and shrubs where their roots may interfere with such pipes. Similarly, tall trees should not be placed under overhead power lines. Eucalypts which may drop large branches (e.g., *Eucalyptus mannifera* ssp. *maculosa, E. viminalis, E. michaeliana*) should not be placed where falling limbs may cause damage.

Natural Conditions

Factors such as slope of ground, type of soil, aspect, existing rocks and trees and shrubs which are to be retained must also be considered. The location of such rocks and vegetation should be shown on the site plan, as they will provide the basis from which the ultimate design will be made.

The natural slope will determine the degree of drainage available and will indicate whether measures should be taken to improve drainage by installing a system of agricultural pipes or whether terracing or similar measures are necessary to prevent erosion. Minor erosion problems can sometimes be overcome by the use of soil-binding plants such as *Myoporum parvifolium*. Drainage may vary considerably on the one site: many gardens have both dry and moist areas, which will require different plant material. Wet areas can be drained by the use of Callistemons and certain Melaleuca species; drier areas are suitable for a wider range of plants.

Slope will also affect the degree of frost. Cold winter air flows downhill, and any interruption to this flow, such as buildings and fences, will cause frost pockets to occur. Only the most frost-hardy plants should be placed on the uphill side of a fence crossing a slope (see Plant List). Plants suspected of being marginally frost-hardy should always be placed on the down-hill side of some shelter, either plant or structure.

Soil type will dictate the selection of plant material. Plants which grow well in sandy soil (e.g. Banksias) may fail in heavy clay soils. New soil introduced to increase the range or to improve the growth of plants should have a high content of coarse sand. This will not only lighten heavy soils, but also give better drainage.

Aspect is another crucial factor. A quarter-acre block always includes a variety of aspects; one section with an eastern aspect will receive morning sun only and hence will suit such plants as Prostantheras which prefer semi-shade; another section may receive full sun throughout the day and hence would be too exposed for Prostantheras to succeed. Most gardens have an area with a southern aspect which receives very little sun throughout the year. Correas and Croweas could find such a site to their liking.

Functional Requirements

Ideally, a garden should be an outdoor living area designed to complement the indoor living area of the house. Areas must be set aside for driveways, clothes drying, wood storage and compost-making. Provision may also be required for children's playing areas, terraces, barbecues and swimming pools, either immediately or at some future date. Areas for such activities should be considered on the

original plan, so that the garden will not need massive redesigning when such features are incorporated. Terraces and barbecues should be placed to form a natural extension of the house, where their use will be most convenient. Outbuildings may be used to divide the garden and to give privacy to service and outdoor living spaces. Screens, which may consist of either structures or living plants, can be placed to provide wind or frost protection, to give privacy, to separate areas or to provide shade. Climbers such as *Clematis glycinoides* can be used to cover a screen and provide an attractive and functional division, while tall shrubs may give welcome afternoon shade to west-facing bedrooms.

A pleasant place for sitting out is an important requirement for any garden. It should be located to provide privacy, shelter from wind and temperature extremes, and easy access from the house.

Remember, too, that the garden should be planned to be pleasing when viewed from inside the house. Try to provide a feature that can be seen from the kitchen, living or family rooms. This may be a particular specimen tree or shrub, a small pool setting or a grouping of rocks with prostrate plants. During the planning stage, look out from the house and decide where such features could be placed to give an attractive focal point.

It is only after due consideration has been given to factors such as these, in order to determine the type of garden that you want and what is appropriate to your individual site and to your individual life style, that the selection of specific plants should be made. In making this selection, the ultimate size of trees and shrubs must be carefully noted.

Although time and money may not be available to put the whole design into immediate operation, an overall plan for the use of the site will enable you to develop a pleasing and functional garden and to avoid errors of placement which could be difficult and costly to rectify.

To clothe large bare spaces quickly in a new garden, a temporary planting of Acacias may be considered to provide background greenery, floral colour and perfume throughout the year, to attract birds and to improve the soil.

Your garden design will provide the framework for a constantly changing picture as plants develop and mature at varying rates and may be replaced by different species as garden conditions and gardener's tastes change.

LANDSCAPING OF RURAL PROPERTIES

THE growing of native plants on rural properties, be they large grazing concerns or five-acre hobby farms, is a much different proposition to growing them in town gardens. Here a distinction must be made between the house garden, where the plants are to be reasonably tended and given some water, and planting out in the open field which, after establishment, is left to its own devices. It is futile to plant such small gems as Boronias and Correas in a New England paddock and expect them to survive in a habitat so different from their original one. Moreover, such plants are quickly overwhelmed by exotic pasture grasses, if not by livestock.

The Rural House Garden

Very often the layout of house gardens on Australian properties verges on the ridiculous. Houses, on a prominent hill, surrounded by acres of open space, are often enclosed with a rectangular fence, inside which is grown the garden. While it is essential that the house garden be fenced off from stock, there is no necessity for the fence to be a perfect rectangle. Judicious use of contours and avoidance of straight lines can result in a garden which looks like a piece of bushland and not just a suburban allotment transplanted into an open paddock. (See Fig. 1.)

Avenues

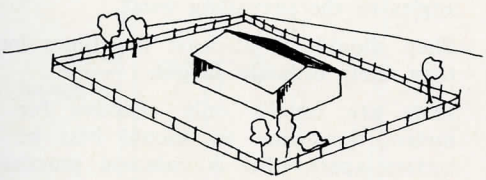
Another feature of many homesteads is the planted avenue along the driveway, reminiscent of the stately homes of England. It is true that some fine examples exist in our region, but too often the "avenue" is of irregular height, with numerous gaps, which merely advertises failure of the original concept. Avenues succeed only if the soil-type, drainage, nutrient level and watertable are all uniform for the whole length of the driveway, a rare occurrence indeed. If they are not, a row of plants, all of the same species, will not grow uniformly and some will not grow at all. A more successful concept is the avoidance of single-species plantings and avoidance of rows. If trees are planted in irregular clumps then the inevitable gaps caused by losses will appear to be merely part of the original grand design.

Shelter

Whatever the design of the house garden, a windbreak is necessary, particularly on the arc from south-west to north-west. Here it is best to use species which, if necessary, can survive on natural rainfall, keeping the choice small or rare species for positions close to the house (and water). Bushfires must always be kept in mind; it has been found that windbreaks with a large component of Acacias tend to dampen down a fire, even when the wattles themselves are killed. Melaleucas and Leptospermums are quick to ignite and are best

Fig. 1

not this---



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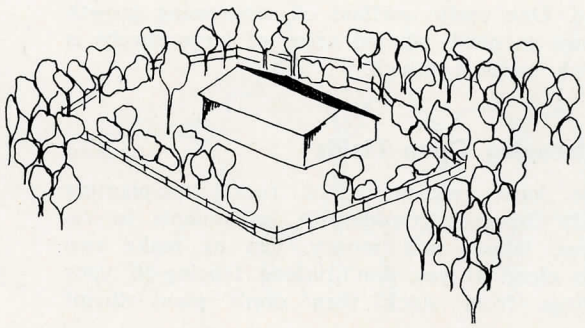


planted on the least vulnerable side of the house, on the east. Eucalypts are similarly volatile and it is recommended that the larger trees of a house windbreak be mainly Casuarinas, *Callitris* or *Banksia integrifolia.*

Planning the Garden

The principles of designing the house garden are much the same as for the urban situation. Large shrubs, being fire hazards, except perhaps for lush rainforest species, should not be grown against the house. A decision should be made at the outset as to which areas WILL be watered, even in drought (by watered we mean, say, once monthly), which areas will be watered if water is readily available but otherwise can be let go, and which areas will never be watered, after they have been established. This suggests an "inner belt" for so-called delicate plants, delicate only because they naturally occur in areas of reliable rainfall (e.g. Boronias, *Banksia ericifolia*). Round these there can be a middle belt of larger and hardier species, particularly wattles and Grevilleas. On the outside, possibly the house windbreak, should be those species that can be mostly left alone.

Where the smaller species are to be grown it is essential that the soil be well-drained but at the same time never dry out. The mixing of both coarse sand (NOT silt) and humus into the soil will assist water to enter the soil and the soil to retain it. If the bed is slightly raised excess water will drain off. Most small plants are shallow-rooted and will not survive either drying out of the soil or heating of soil by the sun. They should therefore be mulched and do very well if planted among large stones embedded in the soil. Where small plants are grown all grasses must be eradicated beforehand. Removal of grasses such as Couch is virtually impossible later without killing some of the shrubs. Further out, where large species are planted, grass will have to be controlled until the shrubs themselves inhibit the growth of grass, when the occasional rough mow between plants will suffice. One useful method of suppressing growth of grass in newly-planted areas of large shrubs is a thick sawdust mulch.

Landscaping Open Fields

The local renaissance of rural tree-planting already demands considerable investments in resources, labour and money. Let us make two points clear. If you don't intend fencing-off your plantings from stock then don't plant them! Secondly if you are not prepared to spend more on the hole than on the tree going into it, then don't waste your money. Unless plantings are to be fenced off, mulched, and protected against frost and encroaching weeds when young, then there is not much point in trying. Even plants native to our region originally grew, as seedlings, in the shelter of other plants, and even then only a tiny percentage reached maturity. They certainly did not flourish on exposed plains, among fertilized exotic grasses, on soil impacted by a century of sheep hooves.

Preferably, the ground should be ripped beforehand, or at least a substantial hole dug for each plant. Each plant must be mulched, well watered in, and preferably watered occasionally in its first year. One very successful method of weed suppression and water catchment combined is to place a circle of black plastic round the plant sloping slightly inwards towards it. The plastic may be used again once the plant is established. While still young, plants should be inspected to ensure that grasses do not smother them. For frost protection a milk carton makes an ideal shelter but many other waste materials may be used, so long as they are not tight against the stem of the plant.

Windbreaks

While the trees in a windbreak will themselves transpire much water it has been proved that the reduction in evaporation, caused by the windbreak, will result in considerable savings in ground moisture. Moreover, in winter the reduction in the chill-factor (i.e. low temperatures $\times$ wind speed) resulting from windbreaks has been shown to improve the condition and growth of livestock. On one experimental site in the USA a windbreak ten metres high increased the yield of unirrigated lucerne ninefold, and one windbreak near a farm dam in Western Australia reduced evaporation by the equivalent of 875 millimetres a year. Remember, ANY shelter is better than none at all. Some points to note are:

- Windbreaks should be roughly at right angles to the prevailing wind.
- They should be at least ten times longer than their ultimate height.
- They are usually only effective for 200 metres downwind so should best be 200 metres apart (this is common practice in New Zealand).
- They should not create frost hollows. If planted across a hill, the occasional gap will

permit the colder air to continue flowing down the slope.

- ABOVE ALL, they must be thick, made up of plants of different heights and have foliage down to the ground. Many people do not realise that the old-style "windbreak" of mature trees, with no low foliage, actually INCREASES the wind velocity. (See Fig. 2).

Shade

We all, in summer, see stock congregating under shady trees, yet many of our paddocks have not a single tree. Shade for stock represents money saved, because an animal without it will consume more fodder in order to get moisture, or waste energy in walking more frequently to drink at water holes. Shade trees should be planted in clumps, because often a single tree will be poisoned by the concentration of droppings at its base. Clumps should be distributed evenly throughout a field in order to encourage dispersion of stock. Many paddocks have existing groves of trees but these are often senile with no regeneration evident. Regrowth can be encouraged merely by fencing off part of the grove. Such fencing need not be elaborate; barbed wire nailed to tree trunks will often suffice.

Stock Feed

Many native plants are of value as stock-feed during droughts and can be lopped without killing the tree. Casuarinas are most suitable because they fix nitrogen — they are much used on the Western Slopes. Kurrajongs are also suitable, but only do well on the western fall of the tablelands.

Fence Posts and Firewood

Many properties are already devoid of sources for fencing and firewood timber. Both Eucalypts and Casuarinas are good firewood. Some of the faster-growing tree species, planted close together, will produce supplies of straight poles in a surprisingly quick time.

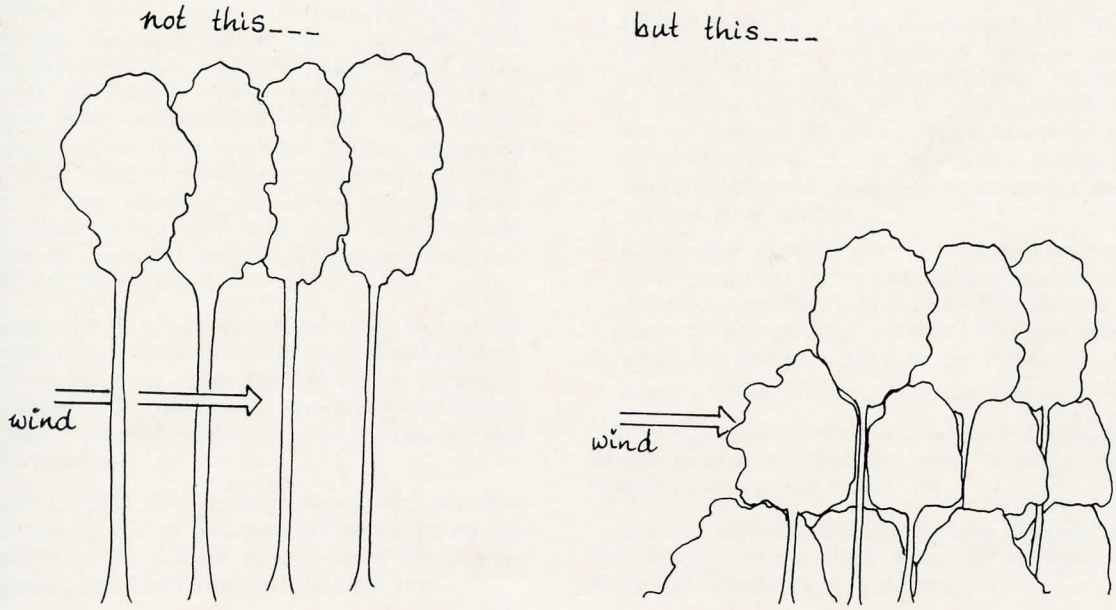
Erosion Control

Advice on this subject is readily available from the Soil Conservation Commission. One must remember that cold air drains downwards, so the replanting of bare erosion gullies can only be done with the very hardiest of species.

Ecological Diversity

The more an ecosystem is simplified by reducing the numbers of plant and animal species present, the greater the risk of disaster occurring. Not for

Fig. 2



nothing do the major outbreaks of pests and diseases occur mainly in crops of a single species, be they cotton farms or pine plantations. Often, when ecosystems are simplified, the habitat is improved for pest species but diminished for natural predators, with evil consequences. Increasing the diversity of plant species on a rural property will result in an increased diversity of the animals that live on it and will reduce the size and frequency of pest outbreaks. Therefore windbreaks and other plantings must contain a mixture of plant species. Also, small insectivorous birds will not remain without dense low undergrowth in which to feed, shelter and nest. Trees alone will not bring back these useful pest-destroyers in any numbers.

Dams

Windbreaks will help reduce the evaporation of water from dams, but unless they are planted well away from the dam itself (one hundred metres for preference) they may suck up more water than they save. On no account plant trees or large shrubs on a dam wall; they cause leaks. A planted island, even as small as one square metre, provided it has some hollow logs or boxes, will attract nesting waterfowl which will be safe from foxes.

Conclusion

The scope for growing Australian native plants on rural properties is almost limitless and already there are local holdings which are being transformed.

Despite the use of arable or grazing land for plantings, those land-holders who are obliged to run their properties as paying concerns will find that the planting of native trees and shrubs will result in improved overall productivity.

SITE PREPARATION AND MAINTENANCE

THE Tablelands have been grazed extensively for over a century but few people realise the impact of grazing on soils. Many homes in new estates, hobby farms and newer rural homesteads are built on ex-grazing land, which has been compacted to the extent of forming hardpans. In many areas there is little topsoil due to the erosive forces of water and wind. It is therefore important that gardens on these soils receive careful preparation.

Site preparation

Planting sites on rural holdings should be deep-ripped in order to break up any hardpans and to improve drainage. Town or homestead gardens should be dug to a spade's depth. Sites which are difficult to dig will benefit from the dumping of soil mixed with sand and organic matter on the top to create a raised bed. Such raised beds improve drainage and are generally favoured by gardeners of native plants. Most soils on the Tablelands will benefit from the addition of either coarse sand or organic matter or both, dug in well and blending with the existing topsoil. Beds need not be raised more than 30cm. New home owners should beware of the standard practice of burying rubble around house foundations, as this may inhibit growth in a site that offers the best frost protection for choice species.

Weed control

The extensive use of improved pastures has created a new problem for the country gardener. Many homestead gardens have a serious problem with weeds that vigorously invade cultivated soils. It is imperative that those weeds be suppressed if plantings are to flourish. Many native plants cannot compete with weeds which deprive them of soil moisture and nutrients. A weed barrier, composed of a thick layer of newspaper, magazines or cardboard, is very effective and allows water to penetrate. Black plastic over large areas is not recommended as it inhibits aeration and causes overheating of the soil in Summer.

Windbreak plantings may require the careful use of weedicide, if that is the most economical method. Weed control may mean the success or failure of a planting. The difference between weed-choked and weed-free plantings is immense during the first season alone.

Town gardens often have problems with invading weeds that spread by underground stems. These can be controlled by a thick paper barrier but it may be necessary to carefully weed the area first.

Planting out

Many trees on the Tablelands have been successfully planted using the following method.

- Dig a hole slightly deeper than the pot but TWICE as wide.
- Fill the hole with a bucket of water and allow it to drain away. This may take hours if the soil is compacted and will tell much about soil quality.
- When completely drained, drop a teaspoonful of 9-month Osmocote or Nutricote into the base of the hole and sprinkle some soil on top.
- Take the plant out of the pot carefully and position it in the hole. The soil around the plant should be level with the ground otherwise problems may develop such as collar rot (if too deep) or lack of moisture (if too high).
- Fill the space around the plant with excess soil and firm down well. At this point water may be trickled around the plant to help settle the fill. Water the plant in, making sure that there are no air pockets.
- Larger plants may need staking and it is best to drive stakes into one side of the hole before planting. If the stake is added later, be careful to position the stake outside the root-ball so as not to damage the plant. Nylon stockings make good ties. These should be applied loosely in a figure of eight to allow some movement and to prevent stem girdling.
- Plantings in exposed sites or frost hollows require frost protectors. A hollow milk or juice carton makes an excellent protector. Slip it over the plant to ground level so that the lower stem is protected. Staple or tie it to the stake.
- Apply a thick mulch around the carton.

It is advisable to plant out between October and March in order to allow the plant to become established before the first frost.

Another method used successfully involves planting directly into a thick layer of sawdust. (See illustrated examples of gardens).

Mulching

Most Australian plants grow naturally with a thick litter layer covering the ground. This layer, made up of fallen twigs, leaves, bark and other organic matter, has a number of functions.

It helps conserve soil moisture by reducing the evaporation rate, which can be very high during the Summer months. Soil temperature is kept relatively stable and a cool root-run is ensured for shallow-rooted species. It provides a habitat for insect predators, such as spiders, ensuring an ecological balance. The organic content improves soil structure and young seedlings can push through freely.

It is therefore important to mulch all plantings. As it is not feasible nor advisable to collect large amounts of leaf mould from the bush, a number of substitutes may be used. Hardwood sawdust makes an excellent permanent mulch when applied thickly. Softwood chips are also widely used but will break down faster. A combination of sawdust and woodchips is ideal as it will be permanent and the woodchips prevent crusting which often occurs on the top of sawdust. This may be used over newspaper for best results. Bark, collected on the property, stones, spoilt hay and other natural materials have all been used in various plantings and work well if applied thickly. It is important to keep the stem free of mulch to prevent stem rot. Any mulch should be dished slightly to allow rain water to drain towards the plant rather than away from it.

Maintenance

Watering

If plants are mulched well, they will not require frequent watering unless they are swamp species. A thorough watering regularly should be adequate and will encourage deep rooting. In the Armidale district, it is necessary to water thoroughly once a week in Summer (twice during hot spells). This can be minimised to once a month or not at all in winter, depending on the species and size of plant. Ground covers need more attention in winter. Plants will be more susceptible to frost damage if water-stressed. The use of indicator plants, such as Prostantheras, scattered through the garden is a helpful aid. Such plants wilt when water stressed but recover quickly after watering.

It is advisable to put plants that require frequent watering together so that none will be missed. Be careful with the use of waste water as many washing powders and detergents contain chemicals that may be toxic to plants if a build-up occurs in the soil. Bore water should be tested for salinity before use in the garden. New plantings require frequent watering for the first month, then gradually less frequently as new growth becomes visible.

Tree-ferns should be watered in the top of the trunk. A slow drip provided by a suspended bottle is excellent. Plants in tubs require special care to prevent drying out or over-watering, and should be assessed individually.

Pruning

During the growing season, many shrubs benefit by having the tips pruned. This technique encourages bushy growth as opposed to straggly branching and is important in the maintenance of vigorous growers such as Grevilleas and Callistemons. Tip-pruning will also encourage the production of more flowering stems and leads to a better shaped plant. Dead flowers or stems should also be removed to prevent the spread of disease and put maximum energy into healthy growth. Frosts are natural tip-pruners and this may be enough for some species. Take care not to prune terminal flower buds, or too hard so that the plant has a set-back. Healthy prunings may be added to the mulch layer beneath the plant. Avoid pruning during cold months or too late in Autumn when the resultant fresh growth will be cut by the first frost.

Fertilizer

The belief that native plants do not require applications of fertilizer is now generally discounted. However, all fertilizers should be used with restraint and caution. If your native plants appear to be in need of fertilizer the following points should be considered.

- Fertilizer can be used at planting time and on established plants. Mid to late spring seems to be the most appropriate time for use of fertilizers.
- Most authorities recommend the application of fertilizer to moist soil, and a light watering following the application. Gently raking the fertilizer into the surface soil is also a widely used practice.
- If in doubt use light applications of fertilizer and do not concentrate applications close to the stem or trunk of plants.
- Some plants are relatively sensitive to fertilizer and among these are such species as *Banksia, Boronia, Eucalyptus, Grevillea, Hakea* and *Isopogon.*
- Fertilizers can be broadly classified as "complete", organic, and slow release. "Complete" fertilizers are based on a mix of the components of nitrogen, phosphorous and potass-

ium. Most nurseries and garden suppliers have available fertilizers that contain N (nitrogen), P (phosphorous) and K (potassium). In general terms, native plants respond to a "complete" fertilizer that contains a relatively high proportion of N, a moderate proportion of K and a low proportion of P. Organic fertilizer in the form of animal manures and compost can be applied as a mulch. However, fresh poultry manure is generally considered as unsuitable. Blood and bone also comes under the heading of organic fertilizer but is currently not widely used for native plants. Pelleted slow-release fertilizers are beneficial for most native plants but, because of their cost, are not particularly feasible in an open garden. The placing of small amounts of pelleted slow-release fertilizer in the holes prepared for new plantings appears to be a very sound practice.

Pests and diseases of native plants

In the natural environment a very complex system of interdependence and coexistence between plants and animals has evolved. Plants are a food source and habitat for many animals, including birds and insects: in turn many plants are dependent on animals, particularly birds and insects, for pollination, seed dispersal and many other benefits.

In a garden, plants have been brought together in an artificial community in which such coexistence is hard to establish. Large populations of insects may suddenly appear to feed on a particular species of plant; often its newest shoots and buds are the target, and damage can be severe. This is especially common in gardens in new sub-divisions if the natural plant and animal communities have been destroyed.

The gardener will then be tempted to use insecticides. It is occasionally necessary to protect young plants (seedlings in particular) from pests such as snails and slugs, caterpillars, insect larvae, etc.; but wholesale and regular use of sprays and the like will in the end be counter-productive. All insects do not damage plants: many live solely on other insects, and gardeners call them "beneficial". Most insecticides kill a wide range of insects, beneficial and otherwise.

Controlling pests

In considering what action, if any, to take to control insect pests, the following ideas may be helpful:—

- Aim in the long-run to establish a balance between plants, birds, insects and other animals in your garden as far as this is possible.
- Be tolerant of some degree of damage to plants to achieve this balance.
- Get to know and protect "beneficial" creatures such as ladybirds, praying mantids, lacewings, spiders and parasitic wasps; when you see them around observe where they live, try not to destroy their habitat, and don't spray them.
- Learn all you can about the specific pests that damage your plants, and choose a method of control causing least damage to other animals. If caterpillars are a continuing problem, use "Dipel", a bacterial spray which is lethal to caterpillars but hurts nothing else; use a strong jet of water to disperse and drown aphids; snip off leaves and branchlets where large colonies of insect larvae are congregating and destroy them; prevent ants from climbing up the trunks of trees to farm and encourage scale and other sugar-producing insects — this can be done by tying round the trunk a wide band of cloth coated with a sticky substance such as vaseline, which traps the ants and other insects.
- Try spraying badly infested plants with a foliage fertilizer instead of an insecticide. Pests often attack plants that are under stress, perhaps from bad drainage, or too little water, or from some mineral deficiency in the soil; if so, a little fertilizer will give the plant a considerable boost and help it to become less attractive to the pest.
- Above all, encourage birds not only to visit but also to nest in your garden; offer them different flowers that will attract them throughout the year, safe nesting places, and refuges in fiercely thorny bushes that will deter cats and birds of prey. Birds, even honey-eaters, live mostly on insects, so provided they are not harmed by what they eat they will clean up many thousands of insect pests.
- Insecticides should be a last resort, and should be applied strictly in accordance with manufacturers' instructions and common sense health rules.

Further reading

It is impossible here to deal with individual pests and diseases and their remedies, but it is very important that gardeners learn to identify correctly specific pests before attempting to control them. Two recent publications by Elliot and Jones, and Hockings, are therefore recommended; borrow from libraries if you cannot afford to buy them.

ACACIA SPECTABILIS

PLATE 2

BANKSIA ERICIFOLIA

EUCALYPTUS LEUCOXYLON ROSEA

PLATE 4

ERIOSTEMON MYOPOROIDES

ACQUIRING PLANTS

PLANTS may be acquired either through buying from a nursery, propagation of your own or as a gift from a friend. Uprooting plants from the bush is not advisable as most native plants do not transplant readily and many species are protected. You may also inadvertently transfer pests and diseases either into the bush or into your garden.

Buying plants

Privately

Most nurseries and garden suppliers stock some Australian plants but care is necessary in selecting suitable plants for your garden. It is advisable to plan before you buy and not be tempted by that glorious-looking plant which may be extremely frost-tender. Local garden centres and retail outlets buy in bulk from larger nurseries and will be happy to take orders for you. As these plants often come from a warmer climate, it may be necessary for you to harden them off before planting.

Specialist nurseries usually advertise in S.G.A.P.'s journal, "Australian Plants" and in other gardening magazines. Some of the larger nurseries will supply free or low-cost catalogues and price lists for mail orders.

From Government sources

The Forestry Commission of N.S.W. sells a wide variety of native plants in tubes at low cost and will send orders by rail. They also have a comprehensive catalogue, available at your nearest Forestry Office. The nearest Amenities Nursery to the Northern Tablelands is at Muswellbrook.

From S.G.A.P.

The New England Group of S.G.A.P. holds a sale of plants once a year in Spring. Plants are grown by members and donated to the Group. Purchasers may be assured of buying frost-hardy plants which have been accurately labelled. Many of the plants on sale are not readily available in the horticultural trade. Some of these are local species, grown from seed collected on the Tablelands.

What to look for in purchasing

When buying plants, you may unknowingly be introducing insect pests, diseases, weeds, fungi (particularly root-rot) and nematodes into your garden. This risk may be minimised by buying from reputable nurseries, by careful examination of prospective purchases or by propagating plants yourself.

A common problem on the Northern Tablelands is the very soft plant which has been raised in glasshouse or coastal conditions, or which has been held under low light intensity for unduly long periods in supermarkets. Such plants are often sold without being hardened off and die soon after planting out as a result of either frost or wind damage. Even the hardiest of species needs acclimatization.

Avoid pot-bound plants such as advanced eucalypts. They may look desirable at first, but will soon be outstripped in growth by smaller specimens. Large plants in small pots suffer root-spiralling, resulting in poor anchorage and subsequent wind damage. Straight-sided containers such as plastic bags are preferable to tapered pots for larger plants. Plastic bags are easily removed at planting time resulting in minimum root disturbance.

Tube-stock should be planted out before the plants outgrow their tubes. Ideally, the plant should be roughly equal in size to the height of the container. Exceptions are prostrate plants and climbers.

Indications of root-bound plants are:

- woody, trimmed stems supporting young growth,
- large roots hanging from drainage holes,
- advanced plants over one metre tall in small pots (especially eucalypts which have long tap-roots).

The form of a species may vary considerably and it is wise to check on colour and habit. When selecting Mallee eucalypts, look for a multistemmed specimen. Common names can be misleading and often differ from one district to the next. All plants should therefore be labelled with their correct botanical names.

The ideal plant should then be:

- not too large for the pot,
- a vigorous grower with some semi-hard wood and some new growth,
- free of stem-girdling, insect pests on the leaves and weeds in the pot,
- of the form and colour desired; and
- correctly labelled.

Seed

Many Australian plants can be propagated without difficulty by the beginner using seed. It is wise to remember that plants raised from seed may not resemble the desirable parent due to pollination by a less desirable form or cross-pollination by another variety. The best seed comes from plants growing in extensive populations of consistent form.

Collecting seed, as well as plants, from Crown Lands and National Parks is illegal. Professional seed collectors are issued with permits. Experimenting with seed collected from your garden or private land may have interesting results. Many desirable hybrid cultivars, such as the "Poorinda" group of Grevilleas have originated from natural hybridization in a large garden.

Seed may be bought in small lots from a number of commercial suppliers who will issue a catalogue on request. The N.S.W. Forestry Commission does not furnish a list but invites enquiries to its Seed Bank at Coffs Harbour.

S.G.A.P. also offers seed free to members through the Seed Bank Officers. Each state publishes lists in its journals. This seed is collected and donated by members and the range of species offered is considerable. They also purchase in bulk and resell small lots of certain species at low cost. The New England Group collects seed locally and this is available at meetings.

Hardening Off

All plants grown outside of the Region need acclimatization before planting out. The period of "hardening-off" will depend on the size of plant, species and time of purchase.

Tube plants acquired in winter from either the Forestry Commission or the Soil Conservation Service should *not* be planted until late October, when the last frost has passed. Stand tubes on concrete or in a wooden box against an eastern wall and keep well watered. Prevent roots from spreading into the ground. Ideally, tube stock should be potted on into larger containers such as tall milk or juice cartons (with base corners cut away). A good potting mix is half sand plus a quarter each of soil and peatmoss or compost.

Plants bought at local nurseries or supermarkets are mostly grown in warmer conditions and are often very "soft". These plants should be placed in a sheltered spot outside and gradually exposed to increasing amounts of sunlight. Water well for two weeks to wash out excess nitrogenous fertilizer and slow down growth. Plants bought in winter should be treated the same as tube stock. Repotting should not be necessary if plants are in 15 cm. (or larger) pots, unless there are large roots hanging out of the base.

PROPAGATION

MENTION has already been made of one method of plant acquisition, namely buying plants from nurserymen. Another and more satisfying way of acquiring plants is by propagation. Plant propagation is not difficult and excellent results can be achieved without the use of expensive equipment.

The two most popular methods of plant propagation are:

- growing from seed
- striking cuttings.

A few species respond to other methods, namely plant division, layering and grafting.

Seed germination

As long as the seed is viable, propagation from seed is an easy way of raising numbers of plants. With some species of Australian plants, pre-treatment is necessary before sowing. All Acacias and most of the peaflowers have a hard, impervious coat (or testa), which prevents the seed taking up water and thus inhibits germination. It is necessary to break the testa in order for germination to take place.

There are three methods used to rupture the testa. Firstly, the seeds can be rubbed lightly between sheets of sandpaper. Secondly, the seeds may be nicked or cut with a sharp knife. The third method entails pouring boiling water over the seeds and leaving them to soak for 24 hours.

The use of boiling water appears to be the most satisfactory method of treating all hard-coated seeds. The seeds are simply placed in a cup and boiling water and thus inhibit germination. It is necessoak in the water for 24 hours.

The following are some genera which will require pre-treatment:

Acacia
Hardenbergia
Kennedia
Indigofera
Cassia
Boronia

Of course many Australian plant species have seeds which do not require any pre-treatment. Included amongst these are:

Banksia
Casuarina
Eucalyptus
Melaleuca
Callistemon
Hakea
Leptospermum

It is important to use a well-drained sandy medium for seed germination. A good general mixture for this purpose is:

1 part coarse washed river sand
1 part peatmoss

If peatmoss is not available then soil of open texture may be substituted. Vermiculite has also been used successfully.

Various containers are suitable for seed germination. Plastic margarine dishes are well suited. The containers should be washed and drainage holes punched in the bottom, then filled to within one centimetre of the top with the soil mixture. The seeds are then spread sparsely on the surface and covered uniformly to their own depth with soil mixture.

An alternative method of sowing fine seeds, such as Callistemon, is to mix the seed with fine sand and then sprinkle this mixture on the surface.

There are two methods of watering the containers. There is the conventional method of overhead watering. This tends to disturb the soil surface which could wash out fine seeds. The alternative method is to use capillary action. With capillary watering, the mixture is moistened from beneath (see illustration).

The seed containers should be placed in a sheltered position out of direct sunlight. For small numbers of containers, kitchen window sills have been found to be satisfactory.

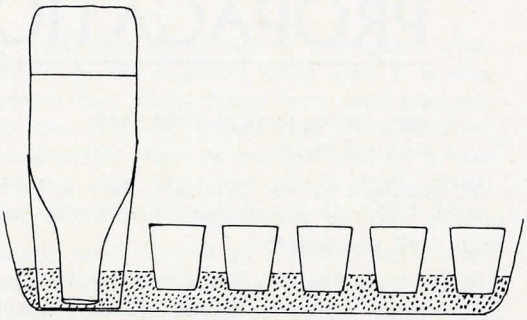
Once seed germinates, the seedlings should be pricked out into individual containers as soon as they are large enough to handle. Usually once the plants have their true leaves and are between 1 cm to 3 cm high, they can be transplanted. Many native plant species produce long tap roots soon after germination. If seedlings are left too long in the seed container, the roots may be damaged when transplanting takes place.

The medium into which the seedlings are transplanted should be free-draining. A successful mix is three parts coarse sand and two parts soil.

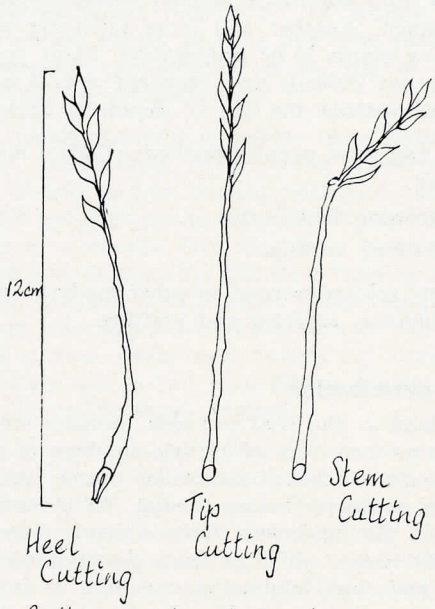
Cuttings

Many species of Australian plants can be grown from cuttings. Eucalypts and Acacias are exceptions and seed germination is the most satisfactory propagation method for them.

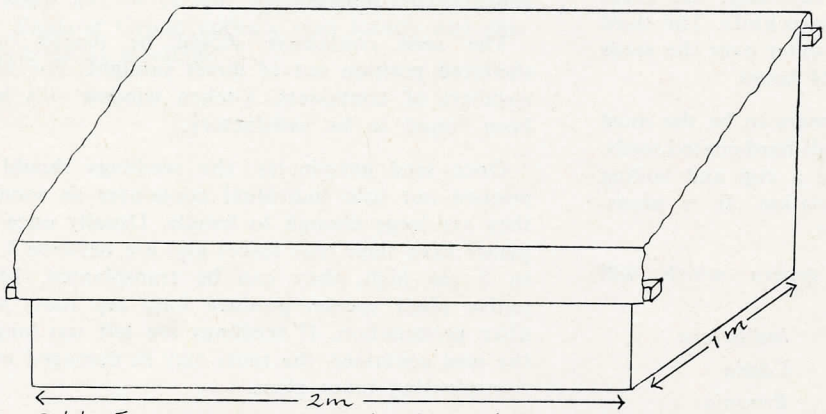
Certain points should be considered when cuttings are produced.



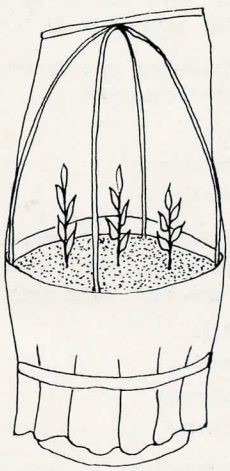
Bog Method: An inverted bottle filled with water is set in a pot which is imbedded in sand. Moisture rises by capillary action.



Cuttings should be trimmed of leaves for 2/3 length.



Cold Frame constructed of timber with a roll-up polythene cover.
A smaller version can be made with a large foam carton.



Plastic bag over wires set in pot and held with rubber band or string.

- Most plants will only produce roots from the area adjacent to the junction (node) of a leaf and the stem.
- Cuttings should not be allowed to dry out at any stage.
- Cuttings should only be taken from healthy, disease-free plants.

The usual cutting length is 10-12 cm. The cutting should be removed cleanly from the parent plant with secateurs. The leaves from the lower two-thirds of the cuttings should be removed at the stem with a razor-blade. The base of the cutting should then be cut cleanly just below a node. (See illustration).

After the cutting is prepared, the base may be dipped in hormone powder or fluid to promote root growth. An important part of cutting propagation is the selection of a suitable striking medium. A mixture of equal parts of coarse sand and peat moss is used by many growers. Excellent results may be obtained using just coarse "crusher" sand.

Plastic margarine containers are also suitable as containers for cutting propagation. Clear plastic drinking cups may also be used. Cups are useful because once the cuttings have struck the roots are visible through the sides of the cup.

The cutting medium should be watered before the cuttings are inserted. A stick is used to "dibble" a hole in the cutting medium. The cutting is placed in the hole so that the lower leaves are clear of the medium, and the medium firmed around the cutting. Cuttings should be spaced so that they do not touch. After insertion they should be watered with a fine spray.

A humid atmosphere is necessary for cuttings to strike successfully. A cold frame can be used if large numbers of cuttings are to be propagated. A smaller version consists of a 15 cm flower pot covered with a plastic bag. This is a useful set-up where small numbers of cuttings are grown (see illustration).

The cuttings should be placed in a sheltered position where they receive some sunlight. An easterly aspect is satisfactory. The cutting medium should be kept moist and cuttings inspected every day. They should be watered with a fine spray and dead cuttings removed. Water daily in summer. Less watering will be required in winter.

Once cuttings have struck they are potted on into individual containers. Three parts of sand and two parts of soil is a good mixture. Handle cuttings carefully to prevent root damage. Place contents of container in a basin of water. Cuttings can then be removed from the striking medium with minimum root damage.

A hole should be made in the potting-on soil large enough to accommodate the roots. Keep potted-on cuttings in a sheltered position until they have become established. New growth on the plant is a good sign that it has become established.

Cuttings will take varying times to strike. This is dependent on the plant species and weather conditions. Usually cuttings will strike sooner in warmer weather.

Initially, species which strike readily should be attempted. In this way, the grower gains both enthusiasm and confidence. *Brachycome multifida* is a species which strikes readily.

A great deal of pleasure can be derived from the propagation of your own plants. Species which are not readily available commercially can be grown and there is the added benefit of saving money by propagating your own plants.

THE NATIVE FLORA

of the Northern Tablelands Region

MUCH of the Tablelands area has been cleared for agriculture, but relatively undisturbed native vegetation still occurs in patches along roadsides and on uncleared hills in the settled areas as well as in more remote rough country. Several species of *Eucalyptus* and *Acacia* make up the typical tree cover, and a few common shrubs occur with them over much of the area. Some species are restricted to the drier, slightly warmer western parts of the area and others to the wetter, higher easterly parts. However, the richest diversity of species is found only in a few restricted localities, where there are coarse-grained low-nutrient soils derived from acid granite, trachyte or porphyry rocks. Fortunately these have generally remained uncleared, being of low value for agriculture, though often held under leasehold and subject to cattle grazing. In these areas we find the typically Australian flora represented by species of *Banksia, Grevillea, Hakea, Persoonia, Lomatia, Petrophile* (Proteaceae); *Boronia, Correa, Crowea, Eriostemon, Phebalium, Zieria* (Rutaceae); *Epacris, Leucopogon, Styphelia* (Epacridaceae); *Pomaderris, Cryptandra* (Rhamnaceae); *Leptospermum, Callistemon, Melaleuca, Baeckea, Kunzea, Homoranthus, Micromyrtus* (Myrtaceae); *Dillwynia, Pultenaea, Hovea, Mirbelia* (Papilionaceae); *Prostanthera* (Labiatae); and a range of wattles and eucalypts.

Some of these species are endemic (restricted to the area), and others reach the northerly or westerly limits of their distribution in one or other of these special localities in New England.

Trees at Moderate Altitudes

Between 1000 and 1200 metres on granite and trap soils, it is common to find a sequence of tree species from ridge-top to shallow valley: *Eucalyptus caliginosa* (Stringybark) on stony ridges, *E. melliodora* (Yellow Box), *E. blakelyi* (Red Gum), *E. bridgesiana* (Apple Box), and *Angophora floribunda* (Rough-barked Apple) in intermediate positions, and *E. viminalis* (Ribbon Gum) on deeper soils fringing the watercourses in trap or granite country, as well as on the richer soils of basalt-capped hills. *Casuarina cunninghamiana* occurs on streams in the western parts of the Tablelands, and *Casuarina littoralis* occurs with eucalypts around the gorge country and in more easterly parts of the area. Wattles such as *Acacia filicifolia, A. implexa* and *A. rubida* are widespread throughout the lower altitude Tablelands, but *Acacia ingramii* and *A. diphylla* occur only around the edge of the gorge country, and *Acacia melanoxylon* generally in the higher rainfall easterly parts of the region. *Banksia integrifolia* is a common understorey tree in the easterly parts of the Tablelands.

Trees at Higher Altitudes

Different eucalypts characterise the higher parts of the Tablelands above 1200 metres. *Eucalyptus pauciflora* (Snow Gum) and *E. viminalis* (Ribbon Gum), are the common trees on upper slopes and ridges; *E. acaciiformis* (Wattle-leaved Peppermint) occurs with them in some areas especially on granite and trap soils; *E. stellulata* (Black Sally) occupies the lower slopes and cold valleys on basalt soils, while *E. nova-anglica* (New England Peppermint) favours the lowest, flattest sites which are both cold and subject to occasional waterlogging, particularly on soils derived from granite. *Acacia dealbata* is the common tree wattle found at these higher elevations.

Trees with Restricted Distribution

Many other species of eucalypts occur in limited areas of the Tablelands where there are special soil or topographic conditions. An array of species can be found on stony hills, especially on granite or porphyry, and often towards the western edges of New England; such are *Eucalyptus nicholii, E. banksii, E. bancroftii, E. andrewsii, E. dealbata, E. caleyi* and *E. youmanii. E. macrorhyncha* and *E. melanophloia* are found towards the western margins of the Tablelands, as well as on the Western Slopes proper, along with *Callitris endlicheri* (Black Cypress Pine). On rather special poor white sandy soils without much of a shrub layer we find *E. mannifera* ssp. *elliptica* (Bendemeer White Gum) and *E. malacoxylon* (Moonbi Apple Box). Around the edges of the gorges of the upper Macleay River we find *E. michaeliana, E.* sp. *aff. cypellocarpa, E. baueriana* and *E. amplifolia.* On granite soils towards the eastern margin of the Tablelands we find *E. campanulata, E. dalrympleana, E. obliqua* and *E. caliginosa. E. approximans* (New England Mallee) is limited to a few sites on granite and trachyte.