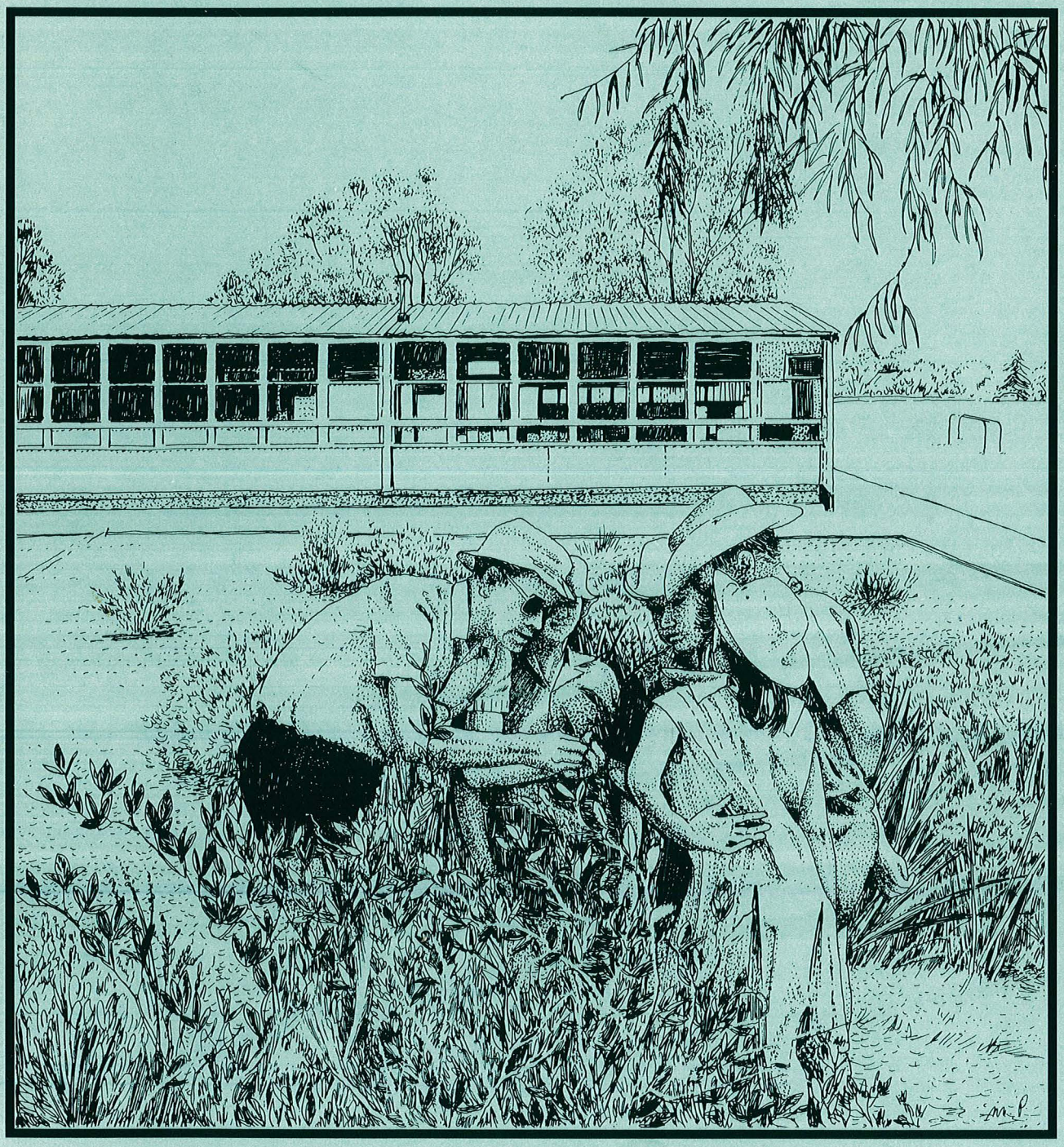
GROWING LOCAL PLANTS FOR EDUCATION

Robert Powell and Christina Lake

Department of Conservation and Land Management



GROWING LOCAL PLANTS FOR EDUCATION

Robert Powell and Christina Lake

1994

Published by:
Dr Syd Shea, Executive Director,
Department of Conservation and Land Management,
50 Hayman Road, Como, Western Australia 6152

Executive Editor:
Ron Kawalilak

Managing Editor:
Ray Bailey

Editor:
Grahame Rowland

Design:
Stacey Strickland

Printed in Western Australia by:
Lamb Print

Illustrations:
Margaret Pieroni

Written by:
Robert Powell and Christina Lake

ISBN:
0-7309-5915-5

About the Authors:

Robert Powell is a naturalist who has long been interested in Perth's vegetation. He is the author of *Leaf and Branch: Trees and Tall Shrubs of Perth* (Department of Conservation and Land Management, 1990).

Christina Lake is a parent whose children attended City Beach Primary School. She co-ordinated the school's award-winning bush garden from its inception in 1989 till the end of 1992.

CONTENTS

Acknowledgements:
The authors wish to thank the following:
City Beach Primary School, for making available materials used in the illustrations and appendices;
Alan Keane, Principal of City Beach Primary School, for his co-operation and support for the project;
Jane Emberson, Gil Field, David Kaesehagen, Bronwen Keighery, Fiona Marr and Boyd Wykes for comments on the text.

INTRODUCTION

Increasingly schools are growing local plants in their grounds. Such projects are often successful, providing a lasting resource from which students can learn about their natural environment. They can be used for many different activities, whereby students develop skills in mathematics, language, science and art.

This booklet was initiated in response to many enquiries from teachers about revegetation. It explains how a school, even without prior experience, can carry out such a project.

Why Local Plants?

By 'local plants' we mean the trees, shrubs and other plants that used to grow on the site before it was cleared. Most native plants grown in cultivation come from further afield, and are not local plants.

Local plants are especially valuable in helping us to learn about our natural environment, since they reflect the local conditions. For example, berry saltbush, which grows near the coast, has fleshy, succulent leaves to help it survive in a salty environment. Jarrah and pricklybark grow where the soil is less fertile than where marri or tuart predominates.

Local plants are also useful as environmental barometers. Before European settlement these plants thrived. Today, some of them are struggling; by considering why that is so one can better understand some of the ways in which human beings have, directly or indirectly, affected the environment.

Being the plants with which our fauna evolved, local plants are extremely important for conservation. They are the food-plants of the larvae of many different insects, which in turn are the food of many other animals, such as lizards, birds and bats. They are of further importance in needing no fertiliser and little or no watering.

Moreover, local plants have a special beauty. Because they are used by insect larvae, they develop interesting irregularities and detail. Their appearance is harmonious: they reflect the natural environment; and they look well together, being members of a natural plant community. This beauty is something that many of us will not appreciate straight away, because of our preconceived ideas. There is value in coming to realise that many of our attitudes and beliefs are narrow, conditioned ones, and in taking a broader view of things.

By using local plants, we can develop a different philosophy towards gardening, one that incorporates conservation, but also more. One by which the plants are not something to be nourished and controlled by the gardener, but free and independent. And by which the garden is not just for plants, where insects are 'pests' and the marks they make on a plant 'unsightly blemishes', but for animals as well.

Getting Interested

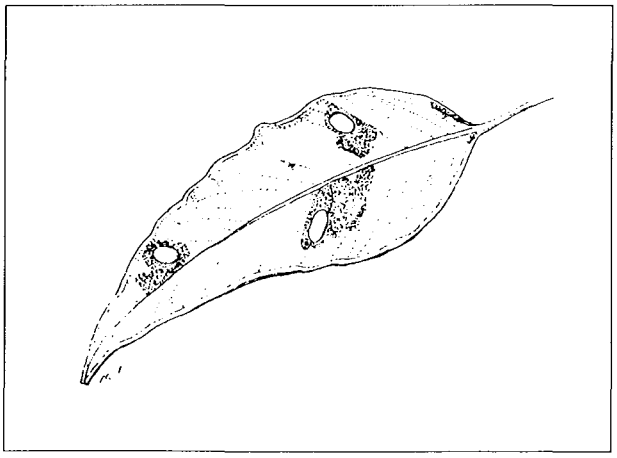
As a catalyst to excite enthusiasm, invite a botanist or naturalist (see Appendix 8) to the school to talk to staff, parents or students. The visit could include the identification of any specimens of the local flora still surviving in the school grounds or near by, and an excursion to bush near by. A naturalist can often tell some interesting stories about local plants, such as their relationships with various animals, or how they were used by the Aborigines.

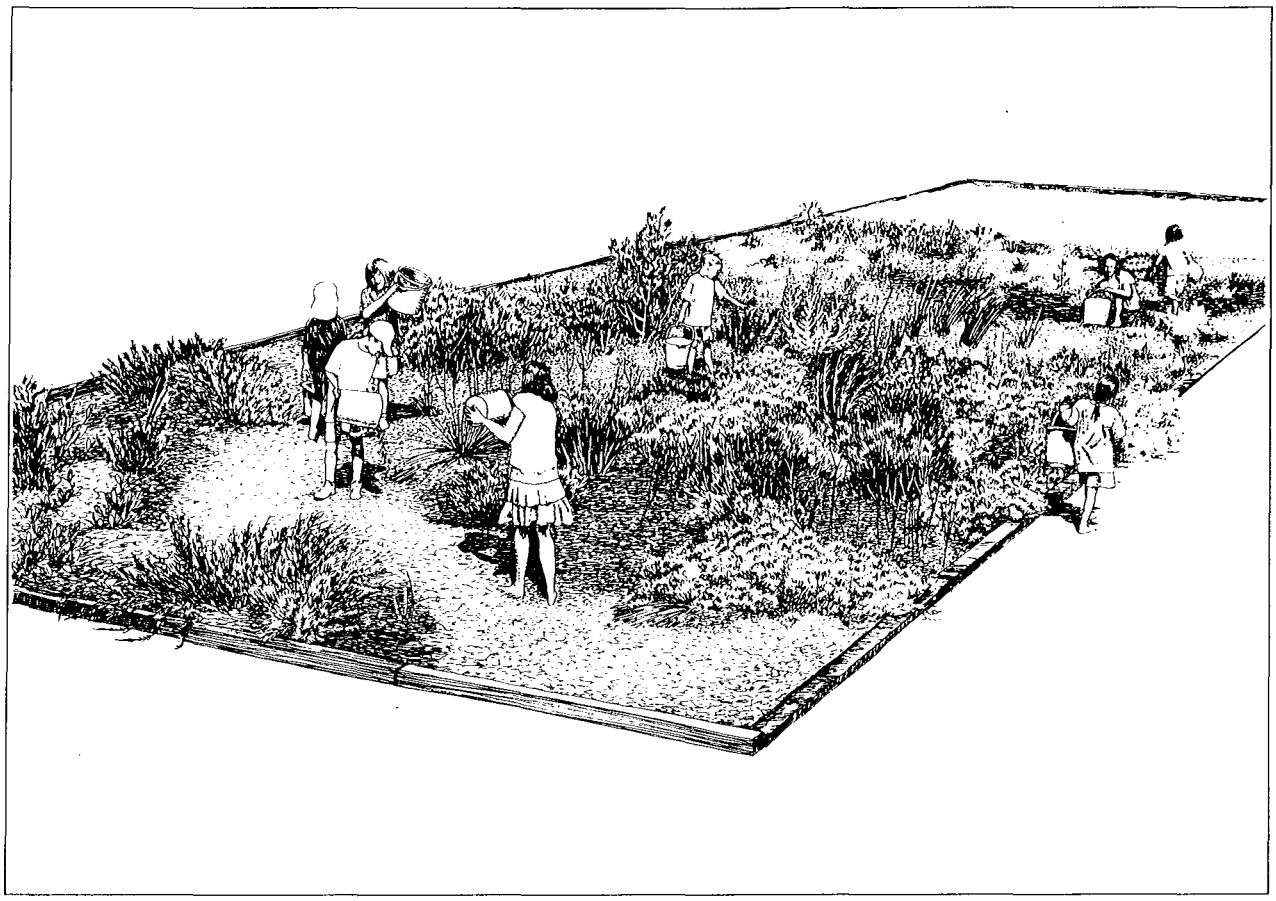
The identification of local species of eucalypt can be taught using a field key (see Appendix 1). This may be combined with drawing up a plant-list for the project (see 'Drawing up the Plant-List').

Another useful preliminary step is for students and staff to do a course in plant propagation at APACE nursery*.

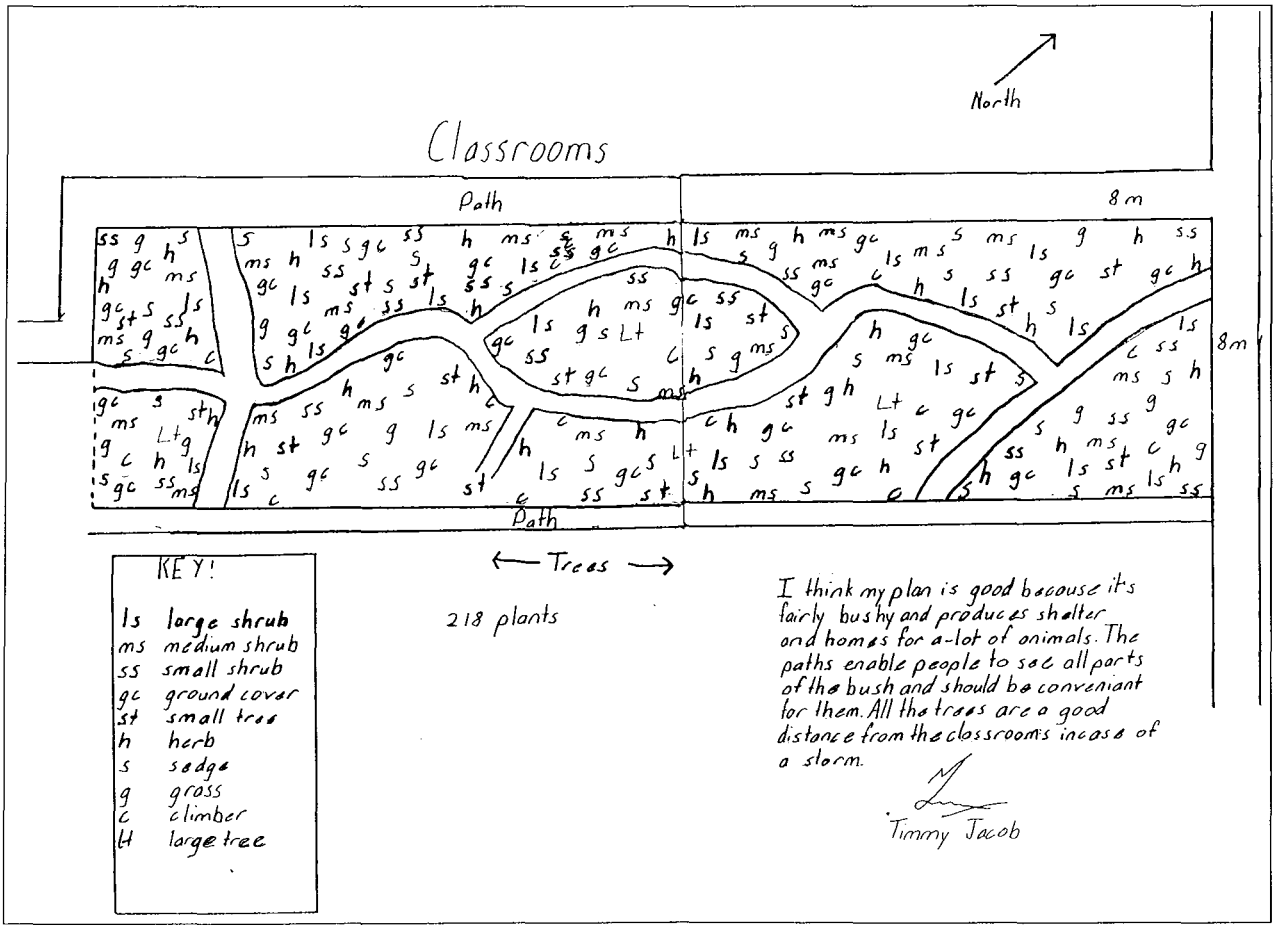
* APACE Aid (Inc.) (Appropriate Technology and Community Environment) is a non-profit, community-based organisation, located in North Fremantle. It has a nursery that specialises in plants of the Swan Coastal Plain, and also has permaculture gardens, community-allotment gardens, a seed orchard, seed-drying tunnels and a library. It provides services to schools that include teacher training and courses for students; courses in bush regeneration, plant propagation and seed collection; and assistance in helping schools assess and manage areas of remnant vegetation.

A jarrah leaf showing signs of the jarrah leaf-miner. Many of the insects that use a bush garden leave signs of their presence. These include scalloping of the edges of leaves, swellings on stems, and gum exuding from branches; many of these marks are distinctive enough to identify the insect concerned.
The dark patches on this leaf are where larvae of a tiny moth, the jarrah leaf-miner, have eaten the tissue between the leaf's outer layers. Each hole, oval and smooth in outline, is where a mature larva has cut out the outer leaf layers and cemented them together to form a sac, in which it drops to the ground to pupate.
From Leaf and Branch.





✣ *Bush garden, City Beach Primary School, showing development in stages. At the near end is stage 1, two years old; in the middle stage 2, one year old; and at the far end is stage 3, recently cleared of grass and ready for mulching and planting. The students are spreading bark chips over the pathways.*



✣ *A student's plan for bush garden, City Beach Primary School.*

PLANNING THE PROJECT

It is helpful and encouraging to learn as much as possible from similar projects done by other schools. Items on these sometimes appear in *Education News*. Greening Western Australia can provide a list of such schools, particularly those that have received recognition for their achievements. Examining these projects and talking to persons involved with them can make extra sure that, for example, the most suitable site and type of project are chosen.

School Development Plan

To provide for continuity, and for maximum support from the school community, the project should be incorporated in the School Development Plan. It will then be reviewed and discussed regularly, which will help ensure that it is kept in mind and budgeted for. There will be further benefit if the project can be designated as or associated with a school priority (e.g. within the science curriculum).

Co-ordinator

The project can be co-ordinated by either a person or a group. The person can be a teacher, a parent or an interested member of the community; previous experience, or knowledge of plants, is unnecessary if the guidelines in this booklet are followed. For a group, a combination of teachers and parents is ideal.

Support

Try to gain the support of teachers, parents, the school gardener and the general community. The project will succeed best if it can be a team effort. Do not expect to win everyone over to start with; more persons will come forward once the project starts to show results.

Type and Scale of Project

The project can be one of three types:

- local trees: establishing a group of one or more local species of tree, perhaps with some of the larger shrubs as well, in a grassed or surfaced area;
- a bush garden: developing a garden bed with both the dominant local species and also many of their associated undershrubs and herbs;
- bush regeneration: rehabilitating an existing, weed-infested remnant of bush to healthy bushland.

Bush regeneration is a highly rewarding and valuable project. It involves such things as defining the area's boundaries and pathways, weeding, and removing any non-local plants and garden refuse; and at the same time observing nature's response through natural regeneration and the increased vigour of the vegetation. It should also involve raising the community's awareness of the area's value. Planting should be undertaken only if the area is badly degraded and many species have been lost, and then great care should be given to selecting the right species, grown from local sources of seeds or cuttings. For further information, see *Managing Perth's Bushlands**.

This booklet, however, is chiefly about the second type, the bush garden. It also covers the first, local trees, which could be considered as a much simpler variant of a bush garden. Although less valuable than the other two types of project, re-establishing local trees is nonetheless very useful in helping students to recognise these species, and also to learn about some of the insects and other animals that use them.

The bush garden is so named because it is an attempt to recreate natural vegetation, or bush. Strictly speaking there is no such thing. Once bush has gone it is lost. It is unfortunately not possible to put back all the original plant species, since some are extremely hard to propagate or re-establish. Moreover, bush is more than just the plants: originally it was a whole ecosystem, including the mammals and other animals that lived there. Many of these animals can no longer survive in Perth's bush remnants, let alone in a small school plot. Nevertheless, good attempts at recreating bush can have something of the character and qualities of true bush, and allow one to make revealing comparisons with bush remnants. Needless to say, the closer the result to a complete community the more one can learn from it. But even if the bush garden contains, say, four or five species of local tree and a dozen or so of the shrubs and herbs that grew as part of the understorey, it can still teach us much.

The size of a bush garden will vary from, say, 50 m^2 to perhaps as large as 500 m^2. If it is to be well over 100 m^2, it is best developed in yearly stages of not more than 100 m^2 each stage; this will help keep it manageable for weeding and watering. Bear in mind that, the larger the garden, the more valuable it will be for insects, lizards and birds, and the more self-sustaining it is likely to be.

Choosing the Site

In choosing a site, the following need to be taken into account:

- the amount of space needed;
- the trees and shrubs already present;
- physical conditions;
- convenience; and
- visibility.

The *amount of space* available needs to be sufficient to allow a garden of the size planned.

The *trees and shrubs already present* in the school grounds will probably be a mixture of local and non-local species. The important thing is to know which are which; determining this is a useful task in itself, particularly since any remnant local species are potentially a valuable resource. A site where local species are present will, if suitable in other respects, be excellent for a bush garden: the site will then more quickly develop something of the structure of bush, and the young, newly established plants can provide an interesting contrast with the mature ones. The mature specimens may also supplement the garden by reproducing naturally. On the other hand, areas with existing specimens of non-local plants should be avoided in choosing the site for the bush garden. Any non-local trees or shrubs present on the site chosen should preferably be removed: if left there they will be visually discordant with the bush garden and will diminish the area's value for environmental education.

Considering *physical conditions*, an ideal site is one that receives a fair amount of light, is not connected to any watering system, does not receive too much incompatible human use, and whose soil has not been too modified.

**For full references of titles cited, see Appendix 1.*

A site will be more *convenient* if it is easily accessible for study and maintenance. If it is located near the school buildings, classes will be able to visit it readily to learn about the plants and animals present, and to maintain it by weeding and, where necessary, watering. The more *visible* the bush garden, the more readily staff and students will learn from it.

Drawing up the Plant-List

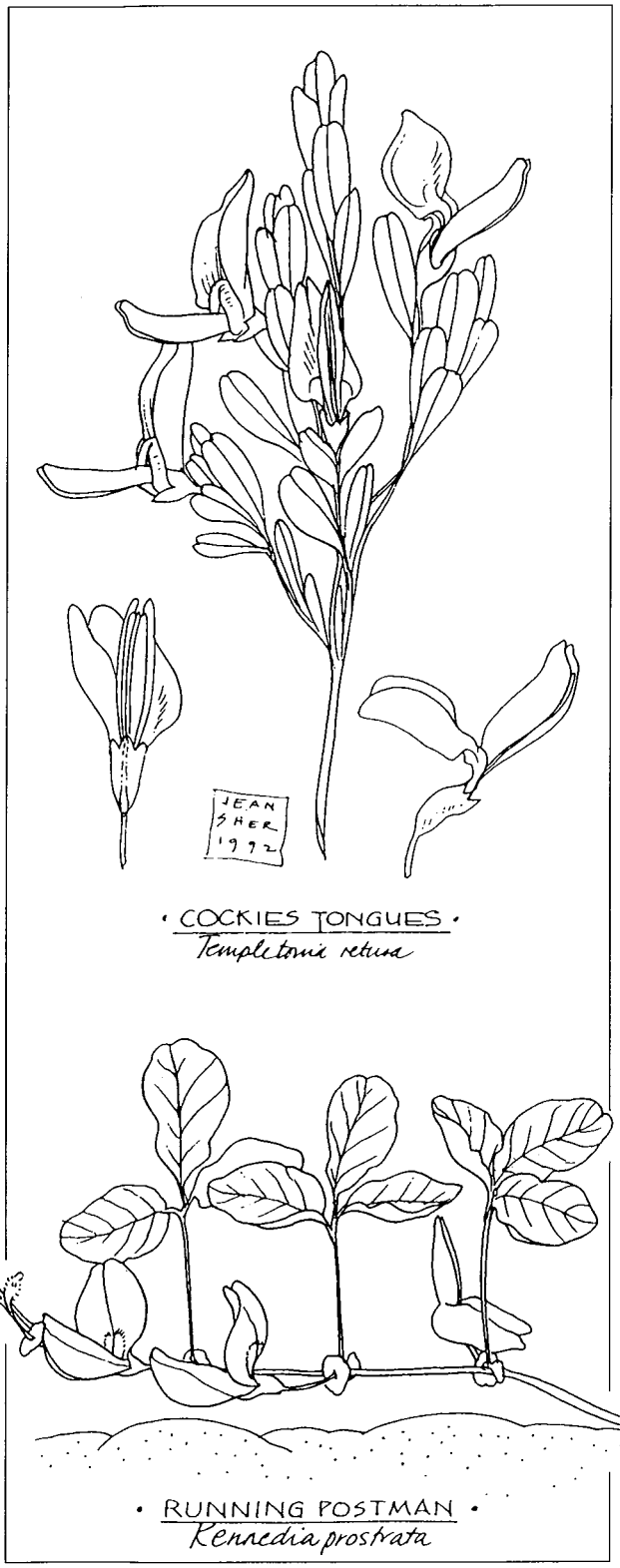
This is a crucial part of the project. It involves determining the plant community that used to exist on the site, and this needs some detective work. It is not sufficient simply to examine the nearest piece of bushland, because bush can vary considerably within a small distance. In the coastal limestone belt, for example, the vegetation at a given site may be forest, woodland or shrubland, depending on the depth of the soil and exposure to sea winds. In the grey, Bassendean sands, the plant community present will depend to a large degree on the water-table. Determining the plant community therefore involves firstly noting the soil and other conditions of the actual site of the bush garden as well as any local plant species that are present on or near the site. Then, to determine further plant species, remnants of vegetation near by that have the same soil and plant species as the school site can be examined. If adequate remnants do not exist, it is also necessary to rely to a degree on reference books, such as *The Self-effacing Gardener*.

Needless to say, this task needs specialised knowledge. Advice can be sought from the Wildflower Society of W.A. to arrange for a person (or group) to carry it out. In doing so, the person can show staff or parents involved with the project the remnants of vegetation and the soils on which the plant-list was based. Better still, students can be shown too, as a class excursion.

The list should be prepared in the form given in Appendix 6c. As many as possible of the species should be given common names, which most people find much easier to learn than botanical ones. (Besides, the aim is clearly for these local plants to become part of the ordinary experience of those involved with the project — and should not such objects have names that are part of our plain, everyday language?) A useful reference is *Common and Aboriginal Names of Western Australian Plants*. The life-forms of the plants are useful to know, particularly for the planting. The statement below the list gives a general idea of what that type of vegetation looks like. For terms to describe vegetation, see Appendix 4.

Timing

The best time for planting and sowing seeds is mid May to early June, so the young plants can take full advantage of the winter's rains in developing their root systems before they face the hot, dry summer. To make sure plants and seeds are ready for the initial planting, it is advisable to plan as far ahead of planting-time as possible. The plants should preferably be grown from seeds and cuttings collected by the students (see 'Obtaining Plants'), and the best times are spring (for cuttings) and early summer (for seeds). If the project is planned in the second half of the year, these activities can be carried out that year, and planting in the following year. If planned at the beginning of a year, there is the choice of leaving the planting until May of the following year, or planting the same year but with a limited number of plants bought from APACE nursery (see 'Obtaining Plants').



Outline drawings of plant species in bush garden, City Beach Primary School. By colouring in the drawings, students learn to recognise these species, and become more familiar with them. Drawn by Jean Sher.

Timetable of activities connected with bush garden, City Beach Primary School.

TIMETABLE

Month	Watering	Weeding	Planting/ Mulching	Butterfly Breeding/Ants	Meetings, Guest Speakers	Seeds/Cuttings, Excursions	Publicity, Graduation
JAN							
FEB					Meeting to discuss 1993 activities.	Harvest laceflower seeds and give to students and community.	
MAR		Weeding needed before planting.	Replace woodchips on path. Spread mulch.	Ant pit-trapping.	Guest speaker.	Field keys - Perry Lakes: identification of local eucalypts.	
APR			Assemble plants grown from cuttings. Dig out plants.		Discuss planting.		
MAY	Water new plants after planting.		Buy seeds and plants from APACE. Plant plants.				Publicity for planting - Arbor Day or World Environment Day.
JUN			Plant seeds.				
JUL				Use three cages for three species. Record observations.			
AUG		Weeding should not disturb new plants or seeds.			Meeting for last part of the year.	Renew licences and permissions if necessary.	
SEP					Guest speaker.	Collect cuttings/seeds - Trigg Res. (permission).	
OCT			Mulch if necessary.	Ant pit-trapping.			Compile graduation folder.
NOV	Identify plants needing water - to be watered once a week.						Photos for Year 7 graduation.
DEC						Collect seeds - Trigg Res. (permission).	

5.7.90

The nuts and pods we had collected at Trigg Reserve released their seeds within two weeks. The Harsh Hakea pods had split in two and released two winged seeds. The Dwarf Sheoak nuts opened to release about fifty small winged seeds each. The Coast Honey Myrtle nuts contained numerous minute red seeds. The red Berry Saltbush seeds and Coastal Daisybush became drier but looked similar to when they were picked.

Half of the seeds were planted in our garden by some students ranging from grades one to five during their lunch time.

The children sprinkled all of the seeds except for the Harsh Hakea in patches of the garden. A few mothers came down to help. We also planted some blue lace flower seeds which were purchased from APACE Nursery after the planting of the seeds they were raked lightly over by a parent.

The Harsh Hakea seeds were planted individually.

The other half of our seeds that were not planted will go to APACE Nursery to be grown for our garden.

Amanda Lake

22.

Diary Recording

	Height	Width	Flowering
ellow Jail Flower *	1m 65cm		
Harsh Hakea *	95cm		
rickle Lilly *	1m 08cm		
mptonia *	61cm		finished ✓
Daisy Bush *			caterpillar was seen. New Buds! ✓
Salt Bush *	1m 55cm		finished ✓
es *	64cm		male has flowers - female has berries
ful Rush *	80cm		170cm Buds
rush *	92cm		
	100cm		✓
Myrtle *	87cm		✓
wer *	82cm		✓
	7cm		Buds ✓
	18cm		x
	30cm		x
			x

Jodie Sarginson

22.10.90

Excursion To
Trigg Reserve

For collection of cuttings and seeds

At 1:30 pm Robert Powell, Chris Lake, Heather Taylor and Deanne Burman accompanied students, Rachel Jumper, Sam Greenwood, Darren Harper, Mireille Smith, Shelley McNab, Elwyn Moyser, Fiona Burman, Amanda Lake and Renae Taylor to several parts of Trigg Reserve.
Cuttings were collected of:
1. Snake Bush
2. Jar Bush
3. Fountain Leschenaultia
4. Boobialla
5. Stalked Guinea Flower
6. Thick-leaved Fan-Flower

and seeds from prickle lilly and yellow-tail-flower were also collected.
Robert Powell explained reasons for taking cuttings from several plants of one species i.e. each plants will show some slightly different characteristic - it may have a darker coloured flower, smaller leaves etc. He showed us several different characteristics of the thick-leaved fan-flower plants that were growing.
Cuttings collected were cut with a sharp blade or secateurs and then placed in a plastic bag with a small amount of water.

Fiona Burman

Dwarf Sheoak

Harsh Hakea

Coast Honey Myrtle

Steven Coneragan

✣ *Written work by students at City Beach Primary School.*

Before planting it is also necessary, of course, to prepare the garden-bed, by removing the lawn, weeds or bitumen (see 'GETTING THE GARDEN ESTABLISHED'). This should preferably take place a few weeks beforehand, to allow the earth to resettle before the planting is carried out.

Pathways

Pathways are an essential part of the bush garden. They allow access for studying and maintaining the garden, without trampling the plants or compacting the soil.

Obviously they need to be designed before planting begins. Include as pathways any routes that are already favoured. These may need to be fairly straight. Elsewhere, meandering pathways will make the bush garden a more attractive place to explore.

Preparing a Management Plan

A management plan is useful in defining the aims and scope of the project, particularly important when new parents and staff become involved. It is also useful in informing everyone what the project is about and in giving everyone an opportunity to contribute ideas towards it. Students and others should be involved in the plan's preparation. Parents can be kept informed about the plan by means of newsletters.

This booklet covers most of the things that will need to be included in the management plan, and the plan can be simplified to a large degree by referring to it. But there will of course be a number of choices and decisions to be made that pertain to your particular project. Students can contribute parts of it; for example, the system of pathways through the City Beach bush garden was chosen from those suggested by class members.

The plan should be prepared in stages. After consulting with advisers, staff and persons involved with the project, a draft plan should be drawn up. Staff, students and parents should then be invited to make submissions on it. The final plan should incorporate useful ideas received in the submissions, and should be freely available to anyone with an interest in the project.

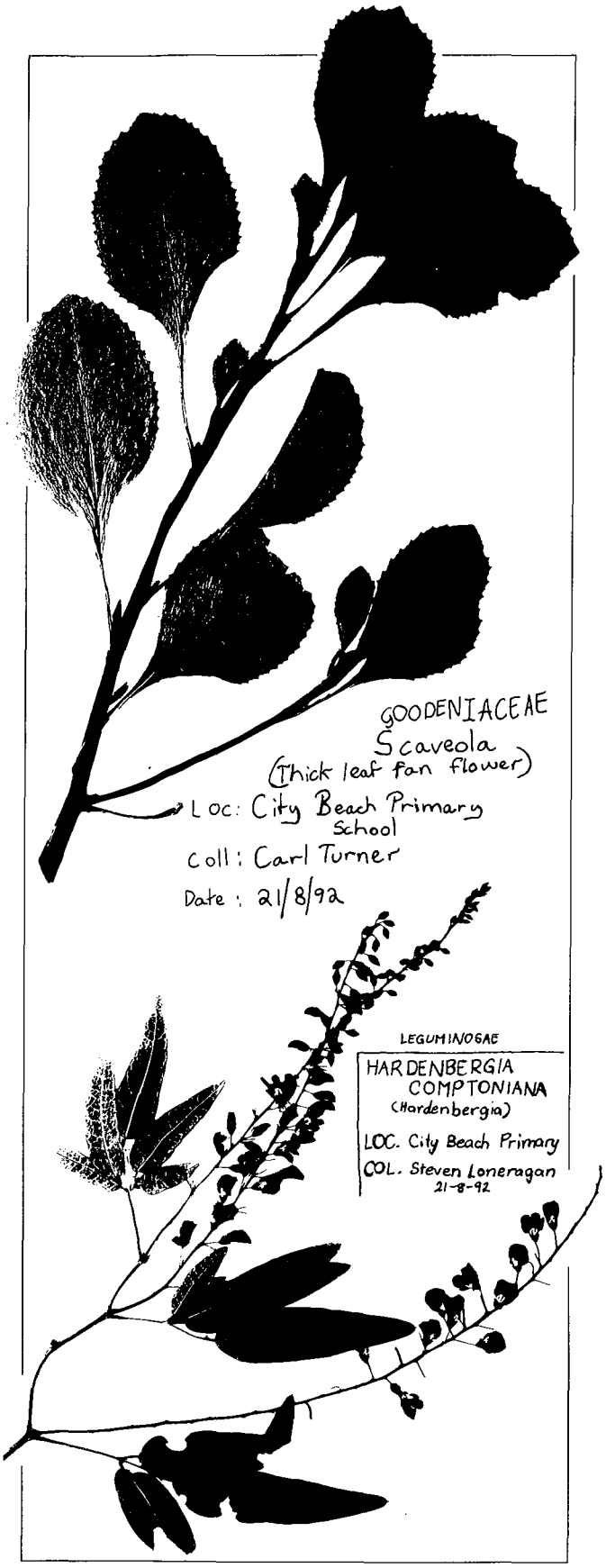
An extract from the management plan for City Beach Primary School is provided as an example (Appendix 6).

Integrity of Purpose

One of the important effects of the plan should be to ensure that the project remains one strictly for local plants, derived from local seeds and cuttings. It is easy to be careless and permit plants other than the above to be added. By doing so, many of the values of the project will be lost or diminished. It is therefore advisable to include in the plan a statement to the effect that any non-local plants, or local plants derived from non-local material, may be removed. Of course, many non-local plant species are colourful or otherwise appealing, and there may well be a considerable interest in growing some at the school. That is fine, as long as these plants are kept separate from the bush garden.

Term

The management plan should have a term of three to five years. By that time, sufficient experience will have been accumulated to produce an improved, revised version; this itself should have a term, perhaps a somewhat longer one.



Specimens from herbarium of plants in City Beach Primary School's bush garden, pressed and labelled by students.

GETTING THE GARDEN ESTABLISHED

Preparing the Site

The site chosen for the bush garden may be lawn, rough grass or weeds, or a hard surface such as bitumen or concrete.

A turfcutter or a bobcat can be hired to remove lawn, or it can be dug out manually by parents or other members of the community. Excess soil should be shaken out of the grass roots, so that the removal of topsoil from the site is minimised. Once the area is cleared, the soil should be raked over to remove any remaining grass roots or weeds, and finally should be raked smooth.

Rough grass or weeds can be dug out by parents. For large areas of weeds, another method is to kill them by slashing them and covering them with black plastic or old carpet for four to six weeks — but some weeds, such as couch, are difficult to kill in this way.

But before any sort of weed control is undertaken, identify any specimens of local plants that exist on the site. In order that these are not unduly disturbed when removing or treating the grass or weeds, stakes should be placed round them in order to exclude any digging or other disturbance within a metre of their bases. These areas round the individual plants can later be hand-weeded, taking care not to disturb the soil any more than is necessary.

The removal of bitumen or concrete may need the help of a community group or the local council.

Rather than leaving the soil bare, it is a good idea to spread mulch over the surface as an initial measure to limit the subsequent growth of weeds (see Mulch); weeds are likely to be a problem if the area contained weeds in the first place or if there are weeds near by. The area's boundaries and pathways should be clearly defined by materials that are heavy and stay in place; railway sleepers, which are available from garden shops, are good for this purpose.

Obtaining Plants

As far as possible involve the students: they can thus learn much about plants, and also appreciate that the plants in the bush garden are indeed being derived from local, wild ones. The students will also gain a feeling of ownership of and pride in the garden.

Licences and Permission

In order to collect seeds, cuttings or plants from any park or reserve, it is necessary to obtain a licence from the Department of Conservation and Land Management (contact the Administrative Officer, Flora), and also to get permission from the body in charge of the land.

To collect on private land it is necessary to get the owner's permission.

In addition to the above, approval from the Minister for the Environment is required if any of the plants concerned is declared as rare flora; this is not normally given.

Collecting Seeds and Cuttings

This is the best way of obtaining plants. The students can easily be involved, and can learn a great deal in the process. Different plants in different families have different sorts of fruit (see *Leaf and Branch*, pp. 210-11). Moreover, the remnant of vegetation visited can be examined, and compared and contrasted with the sort of vegetation to be re-created in the bush garden. To involve very young primary-school students, groups of students can be combined so that older students help the younger ones.

Information on collecting seed is given in *Native Seed Collection and Storage*. The best time for collecting seeds is in early summer, but seed of some species can be collected at any time of the year. The seeds will usually need to be stored before they are used, and it is important that this be done in such a way as to preserve them; the information sheet advises on methods.

Most of the seeds can be given to APACE Nursery to germinate, or germinated by the school if it has a nursery. Some of the seeds of each species should be kept for sowing direct into the garden-bed (see *Sowing Seeds*).

Cuttings are best taken in spring, when plants are making new growth. Determine who is to grow the cuttings (e.g. APACE) and seek advice from that organisation or person on the sort of cuttings needed and how to take them.

Rescuing Plants from Land about to be Cleared

The Local Plants Group (see Appendix 8) gets permission from land-developers to dig up small plants on land about to be cleared. This is a useful way to obtain many plant species that cannot readily be propagated. To be successful, some experience is needed in selecting plants of suitable size and age, and in digging them out with minimal disturbance to increase their chances of survival. The project co-ordinator should contact the Group and arrange for an adult and students to attend a suitable excursion to collect, with guidance from a Group member, species needed for the school.

Alternatively, the school may find its own site from which it can get permission to dig up plants (with guidance from someone with experience). Low-lying sites, however, should be avoided, since their soil may contain the dieback fungus. Even for elevated sites, it is advisable to have someone who can recognise plant diseases check the site first.

Buying Plants from a Nursery

APACE Nursery sells many plant species that occur naturally in different parts of the Perth Metropolitan Region. Some groups of specimens are from seeds or cuttings collected from known spots by nursery staff; others are from seeds of unknown origin collected by seed-suppliers. Since many species vary in form from one district to another, it is important to ensure when buying plants that the specimens planted are not only of the required local species but are also from seeds or cuttings collected in the general area.

As an example, suppose a school in the coastal limestone belt wanted spider-net grevillea for a bush garden. 'General area' would refer to seeds or cuttings taken from plants of this species growing naturally within the Perth Metropolitan Region in the same type of soil — that is, on limestone, and not in swampy areas on the eastern side of the coastal plain, where this species also grows.

Establishing the Plants

The plants can be established both by planting plants and by sowing seeds; a combination of the two methods is recommended.

Planting Plants

As a general rule, mix the different species together so that each is more or less randomly distributed through the garden. If, however, the physical conditions of the site are not uniform (e.g. the soil is shallower at one end of the bed than the other, or if the land is swampy at one end of the bed and higher and drier at the other), species should be planted in zones, based on examples of vegetation on similar non-uniform sites. This will give the garden more aesthetic and educational value.

In deciding where the individual plants should be placed, particular attention needs to be given to the trees and the larger, spreading shrubs. Firstly, they should be given enough room. Find out how large these species are likely to grow. They should not be placed too near buildings or underneath wires or other obstructions. Spreading shrubs should not be placed too close to pathways, although they can be placed near the edges of the bed if there is room for them to spread beyond the bed's boundaries.

Secondly, the number of these larger species to be planted should be in accordance with the structure of the vegetation on which the garden is modelled. For example, if the vegetation to be reconstructed is woodland of jarrah with a second storey of banksia, the number of jarrahs and banksias planted should be the number that would be found in an area the same size within the bush model. If in doubt, plant too few of the larger species rather than too many; these plants will have the opportunity later to increase their numbers by natural regeneration.

Finally, do not space these larger plants evenly. It is better to make the spacing exaggeratedly uneven. If, for example, three jarrah trees are to be planted in the bed, plant two of them within a metre of each other and the third well out by itself. Such uneven plantings will look more natural and will result in a greater variety of growth-habit.

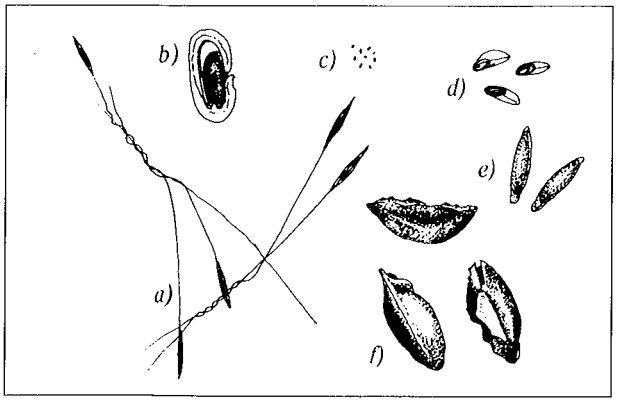
Students should be instructed in the method of planting. First make a shallow saucer-shaped depression 30 cm or more across, then in its centre dig a hole the depth of the soil in the pot but a bit wider — check by placing the pot in the hole. Remove the plant from the pot, taking care not to break the ball of earth round its roots, and transfer it to the hole. Push in soil firmly round the edges of the ball, then water the plant. Where the earth subsides, press in more.

Sowing Seeds

Seeds the size of a grape pip or larger should be sown so that they are just covered by soil; they may not germinate if they are planted deeper. Press them into the soil just far enough for them to be completely covered. Fine seeds should be mixed with a small quantity of sand, and the mixture sprinkled over the surface. The seeds of wattles and pea plants have a hard, impervious coat, and in nature may remain dormant for many years. Place these seeds into near-boiling water until they swell. This softens their coats, allowing water to penetrate; the seeds are then able to germinate when the soil becomes moist from rain.

Five yarris, near Gidgegannup.

The trees of Perth's woodlands occur in very uneven spacing, varying from isolated individuals to close pairs and groups. The spacing within a group is uneven too. This uneven spacing contributes greatly to the varied appearance of trees in nature. Nature's spacing and groupings should be copied in the bush garden. From Leaf and Branch .



Examples of seeds:*

a) tall spear-grass
b) red-eyed wattle
c) coast honey-myrtle
d) dune sheoak
e) spider-net grevillea
f) marri

**The sheoak's 'seeds' are, strictly speaking, nuts.*

Record where the different species of seed have been sown, so that checks can be made later on whether they have germinated. Many seedlings, particularly for species with small seeds, are tiny when they first germinate, and are best looked for by someone with experience, such as a botanist. Some types of seedling are illustrated in *Leaf and Branch*, p. 217.

Mulch

There are both advantages and disadvantages in laying down leaves, sticks and bark as a mulch. It conserves moisture in the summer, and it reduces the number of weeds that grow. On the other hand, it may look unnatural and, if spread thickly, may prevent seeds of local plants from germinating or developing.

Mulch is most desirable if the garden-bed has been created in an area that was weedy. If the area was originally lawn or a hard surface, weeds are unlikely to be a great problem in the first year, and mulch is less necessary.

The time to apply mulch is after planting and sowing have been completed. It can be obtained from some Councils, from their street-tree prunings. Before ordering it, however, the source of the prunings should be ascertained to ensure that they do not come from Cape lilac or other exotic trees likely to reproduce in the garden.

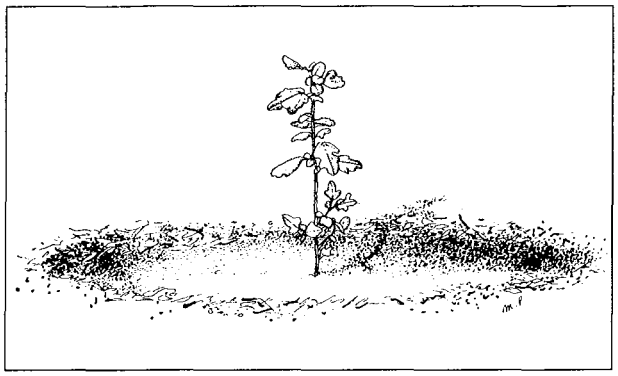
Bear in mind too that the mulch, when spread over the garden, should be dry, and not at all fresh or green. Most local plants are adapted to soils of low fertility; mulch that is fresh may harm them by supplying an excess of nutrients to the soil. The mulch should therefore be obtained some weeks in advance of when it is to be used, and stockpiled to allow it to dry out.

After the garden is a few years old, the leaves that the plants shed will build up into a natural mulch, and no more artificial mulch should be added.

Watering

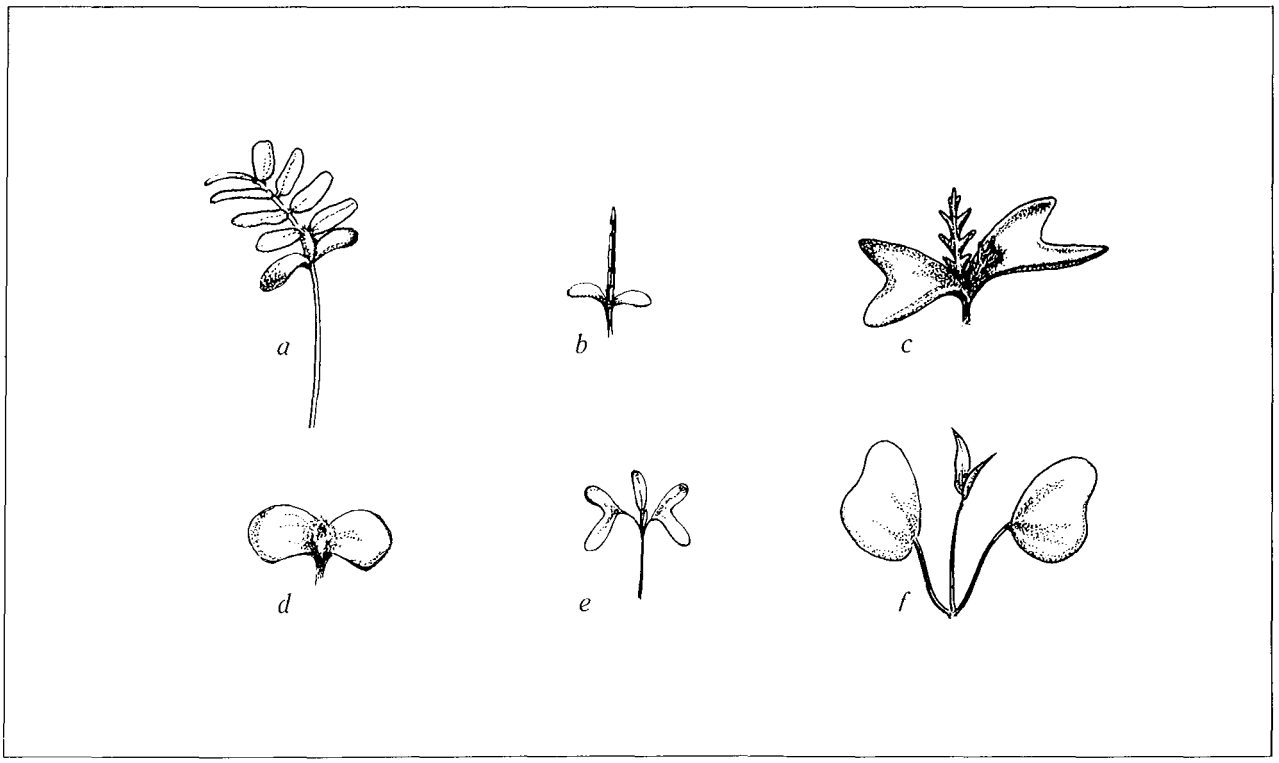
Watering should always be by hand, not by sprinklers or reticulation. It should serve one of only two purposes: to help the plants settle in after they have been planted; or to ensure that most of them survive their first summer.

During dry spells in the two or three weeks after the plants have been planted, they should be watered at least once every two or



Seedling of thomasia newly planted.
The shallow depression, about 30 cm across, is to facilitate watering, should that be necessary.

Newly germinated seedlings, with seed-leaves and young shoots. From Leaf and Branch
a) red-eyed wattle
b) common sheoak
c) candle banksia
d) saw-tooth banksia
e) tuart
f) jarrah



three days; after that they should be able to manage by themselves at least until the hot, dry weather begins, in November or December. From then until cool, moist weather returns, it is a matter of watering the plants that need it. Plants that do not look stressed can be left unwatered.

For the plants that need water in their first summer, water them once a week. Use a watering can to fill the saucer-shaped depression made during planting. Having been round to each such plant, it is a good idea to go back and water each plant once more, to make sure that each plant gets enough.

At the same time, take a look at the other plants less than a year old that have not needed water; any that are starting to look more dried out should be included among the plants that are watered. Continue the watering until the weather has become moist and cool to mild, generally in April or May.

Weeding

It will be virtually impossible to keep the garden entirely free of weeds, but the more thoroughly weeds are controlled the better the local plants will grow and reproduce. Conversely, the better the cover of native vegetation that develops, the less the work that will be needed to control the weeds.

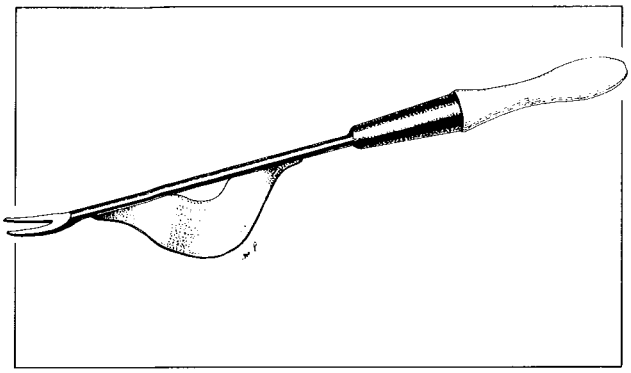
Most species of weed are annuals or annually renewable plants, which appear in winter and spring, but there are a few that appear in summer; the garden should ideally, therefore, be inspected and weeded regularly, throughout the year. Since many weeds flower in late winter to early spring, a concentrated effort should be made at that time in order to remove weeds before they have produced seeds, and thus reduce the number of weeds that appear the following year.

Before weeding is carried out, it is necessary to seek advice from a body such as APACE Nursery. Firstly, any poisonous species, such as Geraldton carnation weed, should be identified. Also, seedlings of local plants should be pointed out, so that they are not accidentally removed along with the weeds! Students while weeding should be given the exciting task of looking for further seedlings of local plants. Inexperienced students should concentrate on removing just one type of weed at a time.

If a mulch from tree-prunings has been used, seedlings of that tree species may come up from seed released from fruits contained in the mulch; these should be removed.

In removing weeds, the soil should be disturbed as little as possible; in pulling out the more robust weeds, hold down the soil with one hand or with a two-pronged weeder. Some weed species are easier to remove than others. The most difficult ones include bulbous species, such as soursob, gladiolus and freesia. Some species, such as couch, are difficult to remove manually but can be controlled chemically. APACE should be contacted for advice on the more difficult weeds and on techniques of chemical control; and the Australian Association of Bush Regenerators (W.A.) may be able to recommend a suitable operator for such work.

Weeds should be regarded as important plants to learn about. It is useful and satisfying to get to know the different species and their ways of life. For that purpose, specimens of the weed species should be taken to compile a herbarium of weeds. A useful reference on Perth's weed species and their control is *Managing Perth's Bushlands*.



Two-pronged weeder.

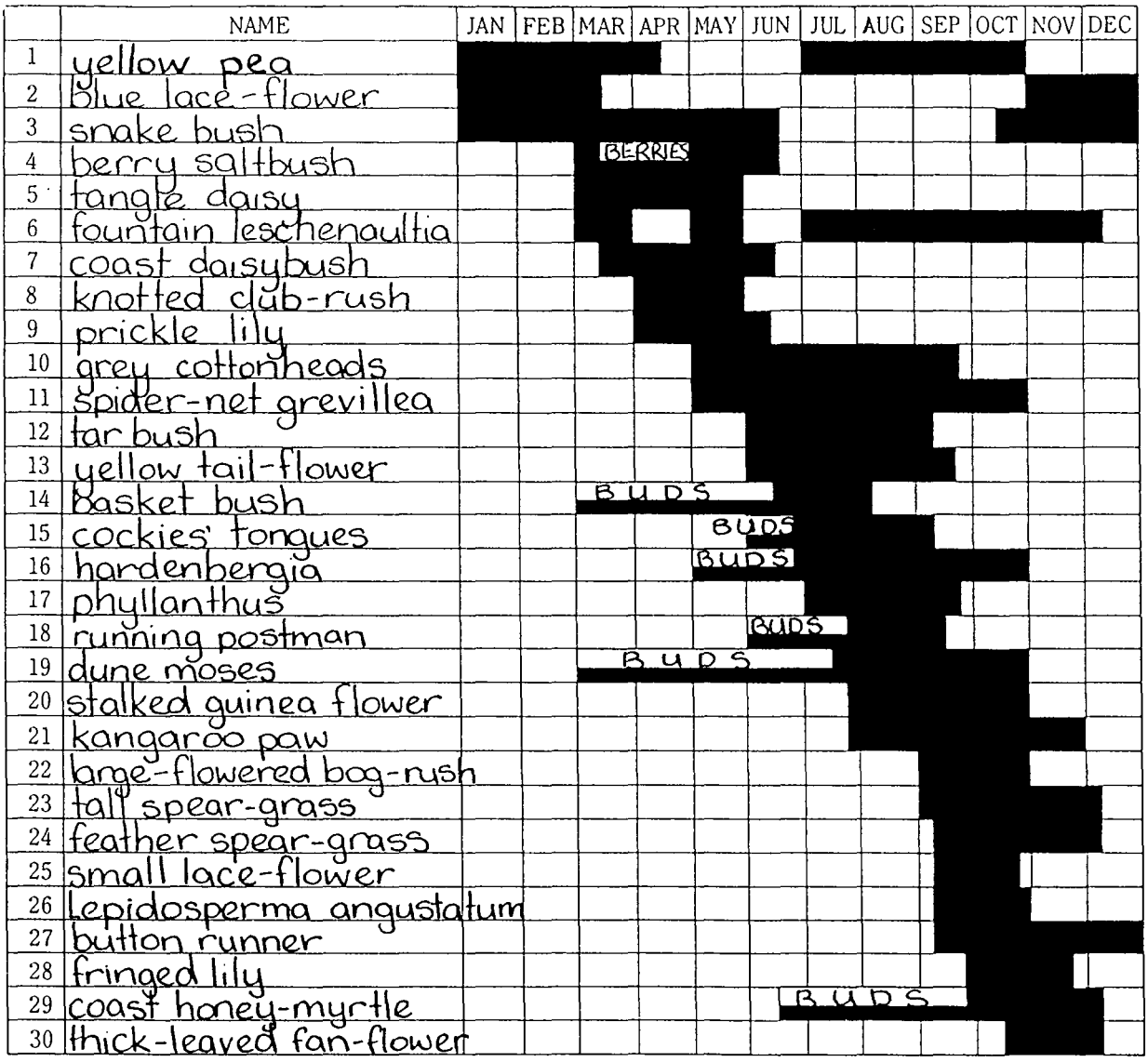
This implement is useful in digging out weeds without disturbing the soil too much, or in holding the soil in place when weeds are pulled up.

TEN STEPS TO SET UP A SCHOOL REVEGETATION PROJECT

- ***Discuss** project with staff, parents, students and other interested persons.*
- ***Appoint** a co-ordinator or committee.*
- ***Research** project by contacting people from resource list in Appendix 8.*
- ***Define** aims of project - e.g. to involve all students, staff and parents in preserving and re-establishing local plant species to provide a natural habitat for wildlife.*
- ***Plan** the type, size, location and duration of project, based on research carried out.*
- ***Prepare** site, obtain plants and seeds, and begin planting.*
- ***Publicise** start of project via media and newsletters.*
- ***Maintain** garden - e.g. weeding, watering, mulching.*
- ***Record** progress of garden - i.e. maintain diary, take photographs or make a video.*
- ***Draft** and finalise a management plan for the project.*

BUSH GARDEN

Flowering Plants Time Line



Mireille Smith

THE GARDEN ONCE ESTABLISHED

The garden can be considered established once all of its stages are a year old. After that it is to a large degree independent. The plants should not need watering, and certainly not fertilising or pruning. And being members of the same plant community, they will largely be in balance with one another.

Largely, but not entirely. Before European settlement there was a complete ecosystem, comprising not just the plants but also the animals. Native mammals grazed the understorey, favouring some plant species and avoiding others, and nearly every species was affected to some degree by its associated insects. Different types of fungi helped or suppressed different plant species. In a small plot of local plants, however, some of the plant species and many of the animal species are absent, and so the plants present can get somewhat out of balance.

Environmental factors have changed too. A change in the frequency of fire, either to more frequent fires, as in many small urban remnants of bush, or to the total absence of fire, as in a bush garden, will affect the balance between the plant species.

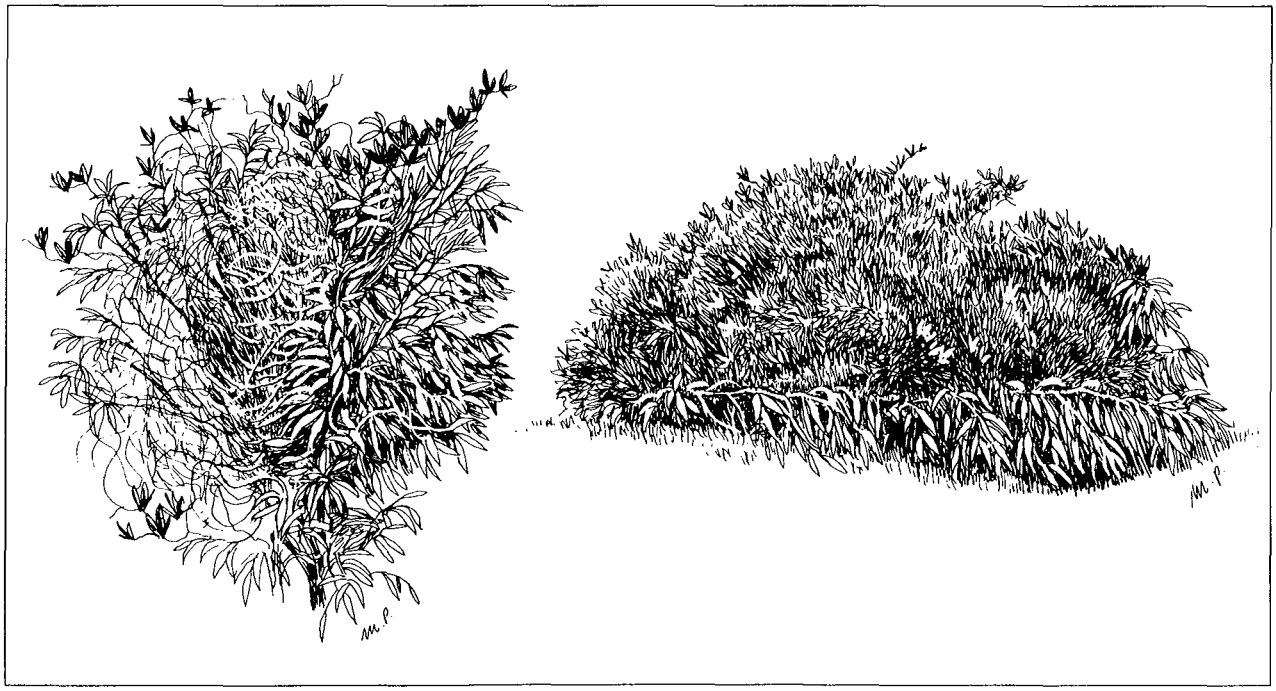
There are certain things we can do to help keep the bush garden as natural and balanced as possible. The main one is weeding. Weeds are not part of a natural ecosystem, and many compete strongly with the local species. Removing weeds improves the health of the local plants and increases their capacity to regenerate. One should also repair any disturbance to the garden, as soon as it is noticed. If the soil is disturbed, for example by the digging of dogs, it should be smoothed over again and the surface mulch put back in place. Any lawn clippings or other materials dumped in the garden should be promptly removed. Some help can be given to species that are not prospering in the garden, by planting additional specimens, or by helping more of their seedlings to survive their first summer by a bit of localised watering. Species that are prospering too much may need to be controlled, by removing many of their seedlings or by cutting some branches off mature specimens to allow other species more room.

It is important, however, that we avoid certain activities that, though beneficial to other types of garden, are harmful to a bush garden; obvious examples are digging and fertilising. Another is watering. Apart from possibly watering in isolated localised spots, as referred to above, there should be no watering once the garden is established. Extra water can make some plant species grow too much, or at the wrong season, and thereby weaken them or shorten their life-span. It may also encourage the growth of harmful fungi in the soil, killing plants such as banksias. If areas near the garden are under reticulation, care should be taken to ensure that none of the water enters the garden-bed.

Remember that the bush garden is, to a large degree, for observing nature, rather than nourishing and controlling the plants. The more independence we can allow the plants, the more we can learn from them.

✣ *Left: Records by students at City Beach Primary School of flowering times of plants in their bush garden.*

✣ *Below: Hardenbergia in nature (left), and in a watered garden (right).*
Avoiding watering in summer in a bush garden allows the plants to live together in a better balance. In nature, hardenbergia typically becomes dormant in summer to conserve moisture. By late summer it will appear as in the drawing on the left: it has shed most of its leaves,and the leaves it retains are held vertical to reduce the amount of sun they intercept. The quandong on which it is growing is not overburdened; the two have been living in harmony for many years.
In watered gardens (right), hardenbergia grows vigorously all through the summer and often swamps the plant to which it attaches itself. Here, after only a few years, it has smothered a eucalypt and bent it right over.



Using the Garden

A bush garden is a resource that is available every day for students to learn about nature from direct experience. It can be managed and documented largely by the students themselves.

The main limitation is the limits to the teachers' knowledge about our natural environment. However, the project can act as a catalyst for inviting to the school guest speakers who are knowledgeable in fields such as botany, ecology, entomology or ornithology. These persons can impart valuable knowledge and provide new understandings of why it is important to preserve our natural environment, and can thus generate much enthusiasm; written reports by students after such visits will often confirm this.

Things to Learn About

One simple, but very valuable, thing that the students can learn is to recognise some of the plants in the garden. By teaching students the common names of the plants (scientific names are harder to learn), they can learn to name these plants too.

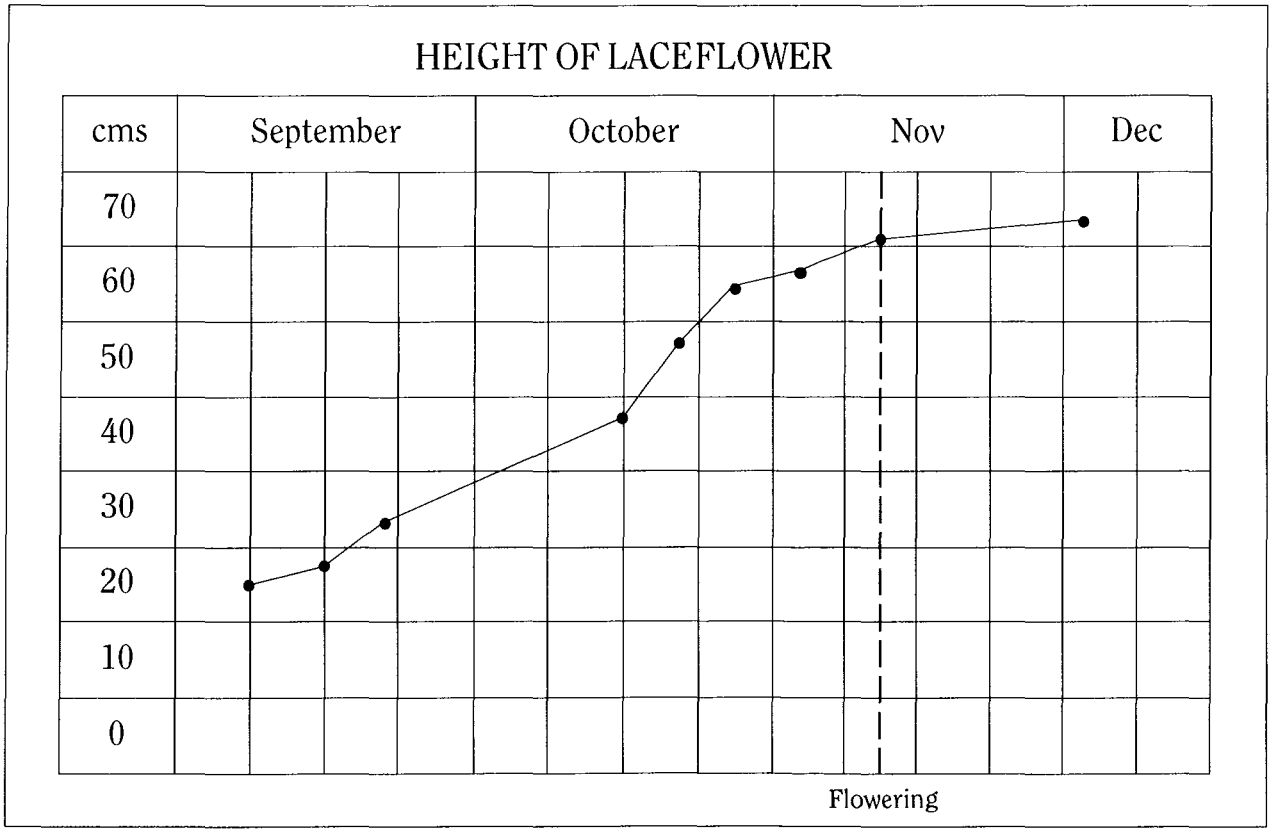
The Aborigines were familiar with a great many plant species in their environment, the bush. Moreover, in previous generations of Perth's white inhabitants, there were many who knew at least some of the natural plants. In today's vast spread of suburbs, whose parks and gardens are dominated by a confusing mixture of non-local trees and shrubs, few people can recognise local species.

To be able to recognise local species enables one to learn a lot more about our natural environment. By noticing where these species occur outside the school grounds and where they do not occur, and which ones are often found together, one can build up a picture of the different sorts of vegetation and environments in the Perth area and beyond. Bush reserves thus become much more meaningful and interesting. And anyone who can recognise some species is usually motivated to learn other species, and thus further increase his or her knowledge and enjoyment.

The local plants are not the only plant species one learns about from a bush garden, particularly if one is actively involved in looking after it; one also learns about the weeds. This is important in gaining an idea of the extreme threat that weeds pose to the survival of our bush remnants. In recent years, more and more 'friends' groups have been forming to help manage such areas, and some people are becoming trained in this work by doing courses in bush regeneration. It is only if many more people become active and informed in this way that Perth's remnants of bush may survive.

As we become more familiar with plant species, we can build up a knowledge of plant taxonomy. In the bush garden, one can examine the different parts of the plants (leaves, flowers, fruits, etc.) and observe similarities and differences between different species, and discover what are the characteristics of different plant genera and families.

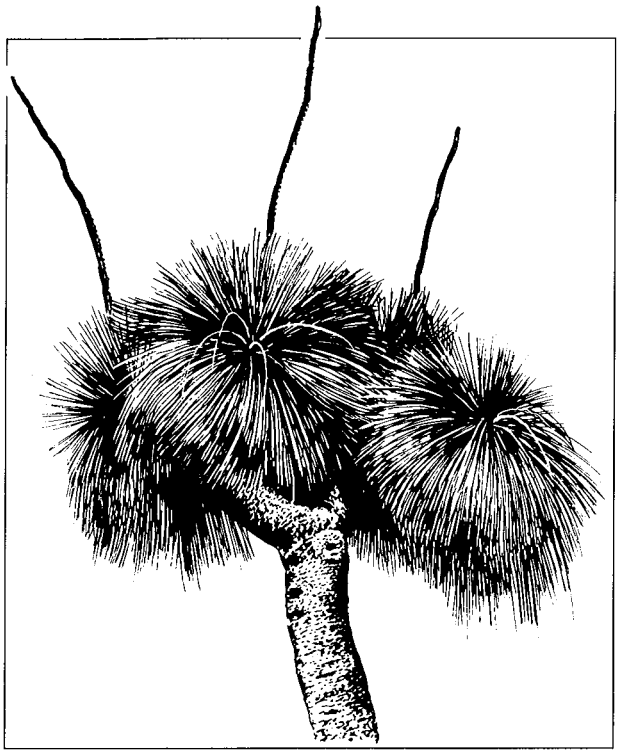
Growth of a laceflower, recorded by students at City Beach Primary School in their bush garden.
The graph shows that the growth accelerated in mid October, perhaps in response to rising temperatures, then slowed progressively as its flower-buds developed.
Flowering was recorded on 10 November, after which the plant grew very little if at all.



Some of these characteristics (e.g. small, prickly or hairy leaves, hard-coated or winged seeds) may be of great importance to the plant's survival. One can learn about how plants survive in the local environment also from the behaviour of plants in the bush garden. For example, they may withstand the summer drought by holding their leaves vertical in summer to avoid some of the sun's radiation.

The bush garden will also be a good place to study animals — particularly insects, which are fascinating for their immense variety of forms and ways of life. It can show many examples of the ways in which animals use plants, and also of the ways in which many plants use animals for pollination or the dispersal of their seeds.

A lot more about the ecology can be learnt by comparing the bush garden with a bushland area of the same plant community. The bushland will probably be a larger and more complete, and thus more balanced, ecosystem of plants and animals. Some

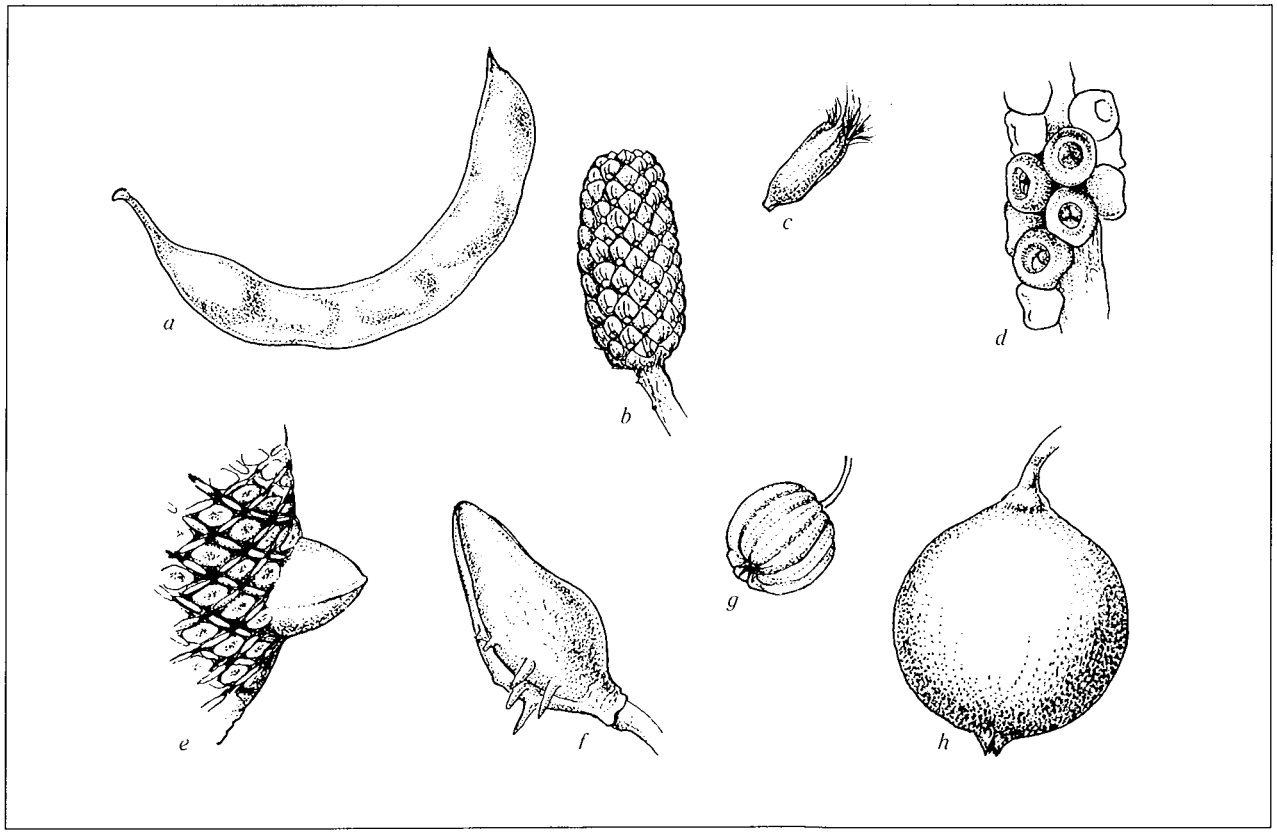


✣ *Many of Perth's plants were used by the Aborigines. The spears of blackboy were used as torches, useful for hunting fish at night. Bardi grubs in blackboy trunks were extracted and eaten, and the gum from blackboy was made into cakes.* *From* Leaf and Branch.

✣ *Examples of different types of fruit:*

a) POD of red-eyed wattle
b) CONE of dune sheoak
c) NUT of woollybush (x2)
d) cluster of CAPSULES of toobada
e) FOLLICLE (in cone) of firewood banksia
f) FOLLICLE of harsh hakea
g) SCHIZOCARP of corkybark
h) DRUPE of quandong

From Leaf and Branch



plant species that in the garden may grow vigorously and reproduce abundantly, and thus tend to outcompete other species, may in the bushland be held in check; it is interesting to learn, or at least consider, why this may be so. On the other hand, the garden may in some respects be more natural than the bushland, particularly if the bushland is not weeded or gets burnt too often. The garden may thus illustrate how bushland can suffer if abused and not looked after.

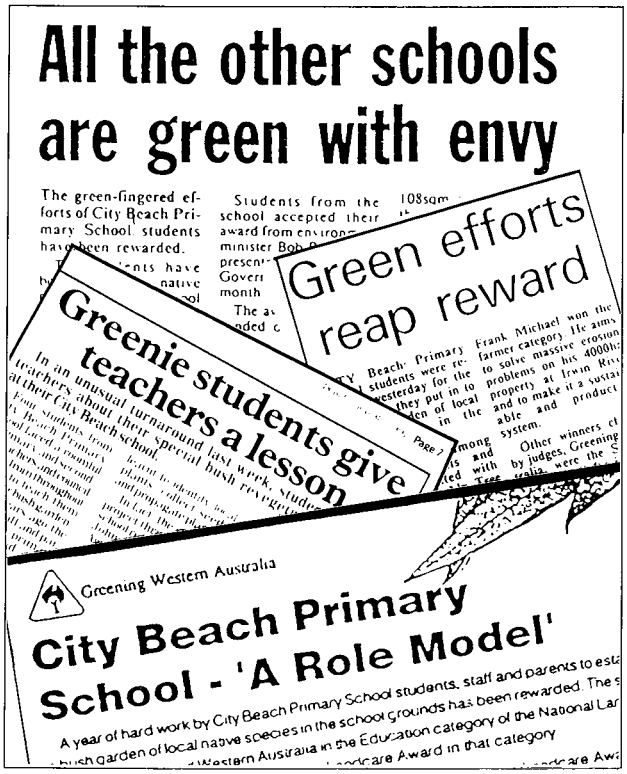
Bush gardens can show us that it is possible to adopt a way of gardening that is far more friendly towards our environment. They help conserve plants and animals. Moreover, they need no fertiliser, and so are no threat to our groundwater or wetlands; and they need little or no water, and thus help to conserve this valuable resource.

Things to Do

Student activities based on the bush garden can encompass a great variety; some of these are shown in Appendix 7.

A particularly useful activity is to maintain a diary of the garden, where observations on its plants and animals are recorded. For plants, these can include such things as the species and number of specimens planted; the planting and germination of seeds; times of flowering; the appearance of seedlings from natural reproduction; and the number of such seedlings that survive their first summer. For animals one can record bird species that visit the garden, and insects, spiders and lizards that are found there, with notes on any activities of these animals observed.

✣ *Newspaper clippings about City Beach Primary School's bush-garden project.*
Reproduced courtesy of Greening Western Australia, and the editors of Floreat Post, News Chronicle *and* The West Australian.


All the other schools are green with envy

The green-fingered efforts of City Beach Primary School students have been rewarded.

Students from the 108sqm school accepted their award from environ- minister Bob- presen- Govern month

Green efforts reap reward

Greenie students give teachers a lesson

In an unusual turnaround last week, Studen... teachers about their special bush re...

Greening Western Australia

City Beach Primary School - 'A Role Model'

A year of hard work by City Beach Primary School students, staff and parents to est... bush garden of local native species in the school grounds has been rewarded. The s... Western Australia in the Education category of the National Lan... Award in that category

Insect larvae, and adults of species that can easily be captured, can be drawn or photographed for later identification. Drawings can also include any indirect observations of animals (webs, nests, tracks, etc.). Make sure each entry includes the date. (For further advice on making observations on nature, consult the *Environmental Log Book*.)

By having such a record, it is easier to learn about seasonal patterns in the ways of life of plants and animals in the garden, and also about the garden's development and changing appearance as it matures. For this purpose it is useful to take photographs of the garden at intervals from the same point, for easy comparison. Or a video about the garden can be a good reminder of its beginnings.

The following are examples of other activities that students can carry out.

- The sizes of plants can be recorded at intervals, and their growth thus measured; the results can be plotted on a graph, to show how the rate of growth changes over time.
- A time-line can be made of the flowering periods of different plant species in the garden (see page 12).
- Many things can be drawn, for example the different fruits and seeds of different plant species, and the shapes of their leaves; the leaf shapes can be labelled with the names that botanists commonly give them.
- Parts of plants can be pressed to make a herbarium for reference.
- Each student can 'adopt' an individual plant to observe over a year, perhaps comparing it with another of the same species in a bush remnant.

Skills

The above activities will increase students' skills in observing, measuring, graphing and drawing, as well as in expressing themselves in writing. But perhaps more importantly, students develop a skill for life in learning how to plan, prepare and manage a bush garden.

Attitudes and Values

Having a bush garden, or involving students with remnant vegetation, encourages them to admire and value their local plants — species that are largely ignored, or even disliked, by the general community. It helps them understand a lot more about our natural environment and the impact on it of human beings, and develop a conservation ethic.

Publicity

Publicity in the media informs the community about the project, and increases interest in and support for it. It enhances the school's image, and can provide inspiration to other schools and to the general public. It helps the media to play a role in environmental education. The time to contact the media is *before* a student activity such as recording, collecting or planting: publicity needs to be planned in advance.

Entering competitions motivates the school to be even more committed, and the school can also benefit from the attendant publicity.

APPENDICES

APPENDIX 1: Further Reading

Bushland Plants of Kings Park, Western Australia (E.M. Bennett). Kings Park Board, 1988.

Common and Aboriginal Names of Western Australian Plants (E.M. Bennett). Eastern Hills Branch, Wildflower Society of Western Australia, 1991.

Environmental Log Book: For Keeping Notes on Nature in Australia (P. Mason and others). Gould League of Victoria, Second Edition, 1989.

Eucalypts of Perth: Field Keys (R. Powell and S. Hopper). Resource Note No. 21. Department of Conservation and Land Management, Second Edition, 1993.

Flora of the Perth Region: Parts One and Two (N.G. Marchant and others). Western Australian Herbarium, 1987.

Guide to the Coastal Flora of South-Western Australia (G.G. Smith). Handbook no. 10, Western Australian Naturalists' Club. Revised Edition, 1985.

Leaf and Branch: Trees and Tall Shrubs of Perth (R. Powell). Department of Conservation and Land Management, 1990.

Managing Perth's Bushlands: A Practical Manual Describing Perth's Bushlands and How to Manage Them (ed. M. Scheltema). Greening Western Australia, to be published in 1994.

Managing Your Bushland (B.M.J. Hussey and K.J. Wallace). Department of Conservation and Land Management, 1993.

Mapping Plants along a Transect (R. Powell and B. Wykes). Resource Note No. 22. Department of Conservation and Land Management, 1991.

Native Seed Collection and Storage: Information Sheet No. 5-87 (Conservation and Land Management Advisory Service). Department of Conservation and Land Management, 1987.

Our Wild Plants (Greening Western Australia). Greening Western Australia, to be published in 1994.

Potential of the Northern Swan Coastal Plain for Pinus pinaster Ait. *Plantations* (J.J. Havel). Forests Department (now the Department of Conservation and Land Management), 1968. Reprinted 1976 as Bulletin no. 76.

Self-effacing Gardener: A Natural Plant Community in the Garden (R. Powell and J. Emberson). C.& S. Genovese, 1979.

Sense of Place: A Response to an Environment: The Swan Coastal Plain, Western Australia (G. Seddon). University of W.A. Press, 1972.

Site-Vegetation Mapping in the Northern Jarrah Forest (Darling Range): 1. Definition of Site-Vegetation Types; 2. Location and Mapping of Site-Vegetation Types (J.J. Havel). Forests Department (now the Department of Conservation and Land Management), 1975.

Sowing the Seeds for Change: Plant Activities for Secondary Science Students (Greening Western Australia). Greening Western Australia, 1992.

'Vegetation' (R.L. Specht). In *The Australian Environment* (ed. G.W. Leeper). C.S.I.R.O. & M.U.P., 1970.

Western Australian Plant Names and their Meanings (F.A. Sharr). University of W.A. Press, 1978.

Woodman Point: A Relic of Perth's Coastal Vegetation (R. Powell and J. Emberson). Artlook, 1981.

APPENDIX 2: Botanical Names of Native Plant Species Mentioned in Text (excluding those in students' recordings)

red-eyed wattle	*Acacia cyclops*
woollybush	*Adenanthos cygnorum*
common sheoak	*Allocasuarina fraseriana*
dune sheoak	*Allocasuarina lehmanniana*
candle banksia	*Banksia attenuata*
firewood banksia	*Banksia menziesii*
saw-tooth banksia	*Banksia prionotes*
bossiaea	*Bossiaea eriocarpa*
toobada	*Callistemon phoeniceus*
marri	*Eucalyptus calophylla*
tuart	*Eucalyptus gomphocephala*
jarrah	*Eucalyptus marginata*
yarri	*Eucalyptus patens*
pricklybark	*Eucalyptus todtiana*
spider-net grevillea	*Grevillea thelemanniana*
corkybark	*Gyrostemon ramulosus*
harsh hakea	*Hakea prostrata*
hardenbergia	*Hardenbergia comptoniana*
coast honey-myrtle	*Melaleuca acerosa*
berry saltbush	*Rhagodia baccata*
quandong	*Santalum acuminatum*
tall spear-grass	*Stipa flavescens*
cockies' tongues	*Templetonia retusa*
thomasia	*Thomasia triphylla*
blue laceflower	*Trachymene coerulea*
blackboy	*Xanthorrhoea preissii*

APPENDIX 3: Terms for the Life-Forms of Plants

Tree: A plant more than 3 m tall, with a single stem that does not divide at the base into fairly equal stems.

Shrub: A bushy plant, usually less than 5 m tall, dividing at or near the base into several, fairly equal stems.

Climber/Creeper: A plant that twines over other plants or trails its stems along the ground.

Herb: A plant without a woody stem.

Sedge: A grass-like plant other than a grass, belonging to the family Cyperaceae.

Rush: A grass-like plant other than a grass, belonging to the family Restionaceae or Juncaceae.

Annually Renewable Plant: A plant that dies off above ground each summer and resprouts from underground parts each winter (e.g. orchids). (Such plants may also be called herbaceous perennials.)

APPENDIX 4: Terms to Describe the Structure of Vegetation

(These refer to the highest layer of the vegetation.)

Forest: Trees standing close enough together for their canopies to be overlapping or touching.

Woodland: Trees mostly standing apart, with gaps between their canopies.

Low forest or woodland: Forest or woodland less than 10 m high.

Shrubland: Shrubs dominant; trees absent or only occasional.

Grassland: Grasses dominant; trees and shrubs absent or only occasional.

Sedgeland: Sedges dominant; trees and shrubs absent or only occasional.

Herbland: Herbs (other than grasses or sedges) dominant; trees and shrubs absent or only occasional.

APPENDIX 5: Other Terms that Appear in the Text

Bassendean Soil: Deep, pale-grey sand (darker and more peaty round swamps), occurring in a belt through the middle of the Swan Coastal Plain (for other types of soil on the coastal plain, see *Sense of Place* or *Leaf and Branch).*

Bush: Natural vegetation (or vegetation that retains recognisable vestiges of natural character).

Bushland: An area containing a remnant of bush. The bush may be in a near-natural state; or degraded and infested with weeds, but retaining sufficient of the local plant species for it to be restored to a near-natural state by bush regeneration.

Bush regeneration: The practice of restoring weed-infested bushland to healthy bushland largely free of weeds, by concentrating on measures to enhance the ability of the local plants to regenerate naturally.

Ecosystem: A community of plants and animals interacting with one another, plus the environment in which they live and with which they also interact.

Groundwater: The water beneath the surface of the ground.

Life-form (of a plant): The form in which a particular species of plant typically grows (e.g. tree, sedge).

Local plant: A species of plant that used to grow naturally on the site concerned before it was cleared. (Note that most native plants are not local plants.)

Mulch: Plant (or other) materials spread over the ground to conserve moisture in the soil or protect the roots of plants.

Seed Orchard: An area where plants are grown so that seed may be collected from them.

Water-Table: The upper limit of the portion of ground saturated by water.

Weed: An unwanted plant, especially one that grows profusely. In bushland, a weed is an exotic or other non-local plant growing at the cost of the surrounding vegetation.

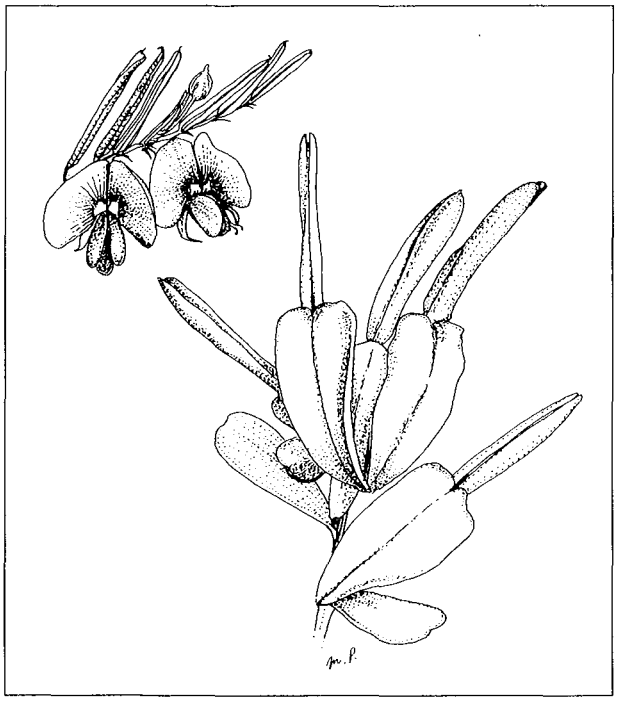
Wetland: An area where the soil is seasonally or permanently saturated with or under water.

Herbarium specimens prepared by students at City Beach Primary School (refer also p.7).

APPENDIX 6: Adapted Extracts from a Management Plan for a Bush Garden (City Beach Primary School)

(a) Contents

The flowers of bossiaea (above) and cockies' tongues (below). Despite their apparent dissimilarity, their petals are arranged in the same structure: a 'standard', two 'wings' and a 'keel' . All pea plants can be recognised by this structure.



(b) Summary

SUMMARY OF MANAGEMENT PLAN - PART I

1. RATIONALE FOR MANAGEMENT

The main aim for the management of the bush garden is to revegetate the proposed area with local plant species (i.e. those that occur, or used to occur, naturally on the site), which can then regenerate naturally. To convert the whole of the area from lawn to local plants will take another 4 years, requiring a continuing commitment by students, staff and parents.

2. MANAGEMENT OBJECTIVES

The bush garden will be managed so that it:

2.1 includes as many species as possible from the specified list of plants provided by adviser
2.2 provides a natural habitat for wildlife
2.3 is natural in appearance
2.3 is largely self-sustaining

3. PROJECT AIMS

This aims of the project are:

3.1 to provide an opportunity for students, staff, parents and the community to participate in revegetating an area that will resemble a natural plant community and will provide habitat for wildlife
3.2 to provide opportunities that develop the students' awareness of environmental issues
3.3 to provide students with basic information on collecting seeds of local plants and germinating them, as well as transplanting procedures
3.4 to provide students with a general knowledge of local native plants and wildlife
3.5 to encourage students to identify local plants and to observe new plants from natural reproduction
3.6 to encourage students to maintain individual botany/science books in which to record their own observations and drawings
3.7 to provide a natural stimulus to help students develop skills in maths, language, science and art
3.8 to provide community awareness of local native vegetation.

(c) List of Plant Species (Abbreviated)

(d) Animals Likely to Appear in Bush Garden

BIRDS

1. 28 parrot (Port Lincoln ringneck)
2. singing honeyeater
3. brown honeyeater
4. red wattlebird
5. silvereye
6. black-faced cuckoo-shrike
7. magpie
8. raven
9. kookaburra
10. galah
11. swallow
12. tree martin
13. sacred kingfisher
14. rainbow bee-eater
15. white-cheeked honeyeater
16. striated pardalote
17. little falcon
18. white-tailed black cockatoo

LIZARDS

1. fence skink
2. the skink *Lerista elegans*
3. yellow-bellied skink *(Hemiergis peronii)*
4. bobtail
5. spiny-tailed gecko *(Diplodactylus spinigerus)*

INSECTS

Very many species. Some examples:

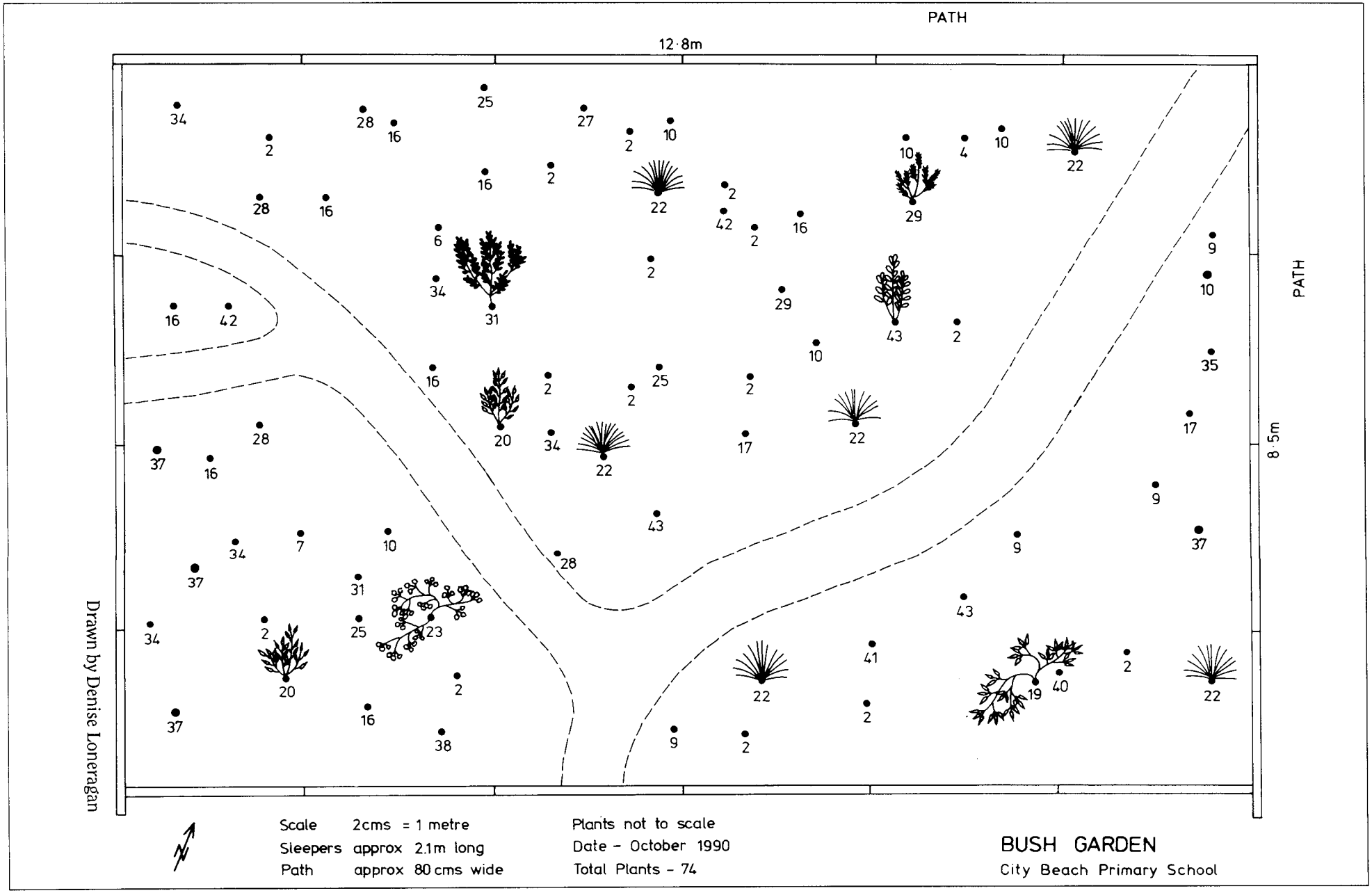
1. brown/fawn grasshopper
2. looper caterpillar
3. brown caterpillar (on basket bush)
4. pea-blue butterfly *(Lampedes boeticus)*
5. wedge skipper butterfly (April/May)

(e) Grid-Map for Stage 1 of Bush Garden (opposite page)

Numbers refer to plant species in list.

COMMON NAME	BOTANICAL NAME	LIFE FORM	STATUS
1. red-eyed wattle	Acacia cyclops	large shrub	on site
2. dune moses	Acacia lasiocarpa	small shrub	near by
3. summer-scented wattle	Acacia rostellifera	large shrub	near by
4. prickle lily	Acanthocarpus preissii	small shrub	near by
. . . .	. . . .	. .	. .
. . . .	. . . .	. .	. .
. . . .	. . . .	. .	. .
. . . .	. . . .	. .	. .
. . . .	. . . .	. .	. .
. . . .	. . . .	. .	. .
46. fringed lily	Thysanotus triandrus	small shrub	grew near by
47. blue laceflower	Trachymene coerulea	herb	very likely
48. small laceflower	Trachymene pilosa	herb	very likely

Structure of vegetation: shrubland with scattered tuart trees

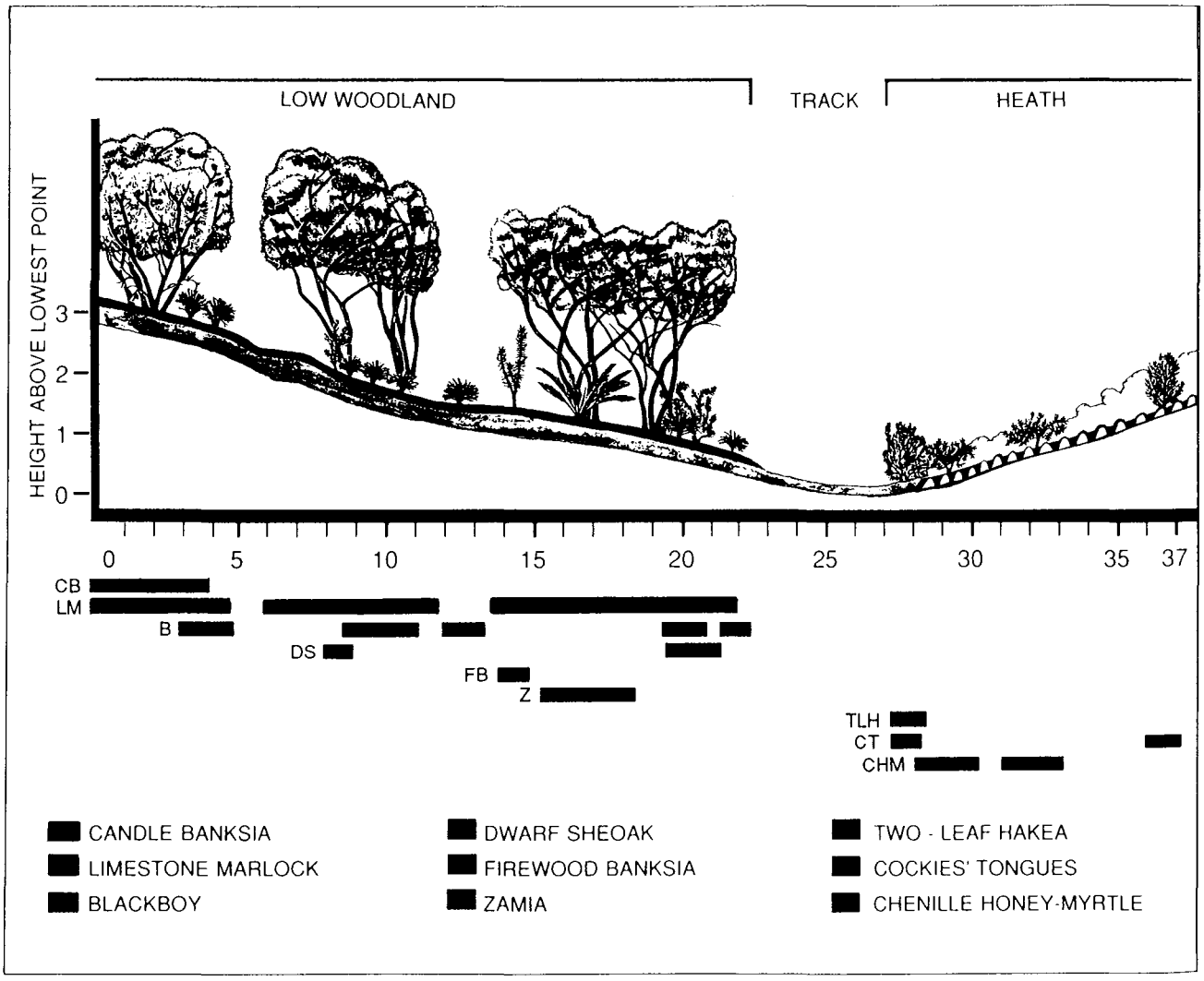

PATH
12·8m
PATH
8·5m
Drawn by Denise Loneragan
Scale 2cms = 1 metre
Sleepers approx 2.1m long
Path approx 80 cms wide
Plants not to scale
Date - October 1990
Total Plants - 74
BUSH GARDEN
City Beach Primary School

APPENDIX 7: Two Examples of Activities that can be carried out in Bushland near the School

(a) Identification of Local Eucalypts - see *Eucalypts of Perth: Field Keys*

(b) Mapping Plants along a Transect - see Resource Note *Mapping Plants along a Transect*

Below is an example, done by a class at City Beach Primary School.



APPENDIX 8: Useful Contacts

GROUP	TYPE OF ASSISTANCE	CONTACT NO.
1. Department of Conservation and Land Management (CALM)	Issue of licences to collect plant parts. Information and advice on local vegetation.	334 0333
2. Greening Western Australia	Curriculum materials. Supply of seedlings. John Tonkin Greening Awards.	481 2144
3. APACE Nursery	General advice. Plant propagation and bush-regeneration courses. Supply of local plants and seeds. Use of nursery facility. Help with drawing up plant-list.	335 5508
4. Kings Park Board	Advice on weeds, etc. 321 5065 Resource material. 321 5228	321 4801 321 7332
5. Wildflower Society	Introduction to guest speakers. Supply of seeds. Resource material.	383 7979
6. Local Plants Group	Excursions to obtain plants and visit sites of interest.	446 4719 448 6950
7. Local botanists	General assistance.	
8. Local Councils	Permission to obtain plants, seeds, etc., from land they control. Supply of materials (mulch, etc.).	
9. Local Community or organisations (Rotary, Apex)	Help with preparing site.	
10. Universities, museums, zoo, Gould League, the Water Authority	Source of guest speakers and advice.	
11. Landcare	Resource material.	
12. Schools with revegetation projects	Advice on school's own experience.	
13. Media	Creating awareness in the community. Recording progress.	

order 300625 2 06-JUL-93
Calm Corporate Relations
PLANTS FOR EDUCATION
1 pos film wr mag 1.000 pr J-L (bwr 0.03)

ISBN 0-7309-5915-5

9 780730 959151

3009-0294

LEIGH-MARDON GRAPHICS
15-31 Keys Road, Moorabbin, Australia, 3189
Tel: (03) 556 8111 Fax: (03) 553 1740