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# TERRARIUMS

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## CONVERSION FACTORS

Metric units	Approximate conversion factors	Results in:
<b>LINEAR</b>		
millimetre (mm)	x 0.04	inch
centimetre (cm)	x 0.39	inch
metre (m)	x 3.28	feet
kilometre (km)	x 0.62	mile
<b>AREA</b>		
square centimetre (cm <sup>2</sup> )	x 0.15	square inch
square metre (m <sup>2</sup> )	x 1.2	square yard
square kilometre (km <sup>2</sup> )	x 0.39	square mile
hectare (ha)	x 2.5	acres
<b>VOLUME</b>		
cubic centimetre (cm <sup>3</sup> )	x 0.06	cubic inch
cubic metre (m <sup>3</sup> )	x 35.31	cubic feet
	x 1.31	cubic yard
<b>CAPACITY</b>		
litre (L)	x 0.035	cubic feet
hectolitre (hL)	x 22	gallons
	x 2.5	bushels
<b>WEIGHT</b>		
gram (g)	x 0.04	oz avdp
kilogram (kg)	x 2.2	lb avdp
tonne (t)	x 1.1	short ton
<b>AGRICULTURAL</b>		
litres per hectare (L/ha)	x 0.089	gallons per acre
	x 0.357	quarts per acre
	x 0.71	pints per acre
millilitres per hectare (mL/ha)	x 0.014	fl. oz per acre
tonnes per hectare (t/ha)	x 0.45	tons per acre
kilograms per hectare (kg/ha)	x 0.89	lb per acre
grams per hectare (g/ha)	x 0.014	oz avdp per acre
plants per hectare (plants/ha)	x 0.405	plants per acre

# TERRARIUMS

Credit for the development of terrariums goes to Nathaniel Bagshaw Ward (1791-1868), a physician of London, England, and Secretary-Treasurer of the Society of Apothecaries.

Dr. Ward was a keen botanist and plant collector. During a field trip in 1829, he found the chrysalis of a sphinx moth on a piece of mold, which he placed in a glass jar to watch the insect develop. Later, he noted the germination of two seedling plants among the mold. These turned out to be a grass and a fern which he kept alive for nearly 4 years.

This suggested to him the principle of what became known as the Wardian case, named in his honor. In 1883, after many experiments with different glass containers and light conditions, he sent two of his cases containing ferns and grasses to Sydney, Australia, and back. The voyage lasted a year and these plants survived, having been subjected to variations in temperature ranging from  $-7^{\circ}\text{C}$  to  $48^{\circ}\text{C}$ .

Those were the days of sailing ships. The transportation of tropical plant material for the botanical gardens of England had always presented problems and a high mortality rate among the specimens was normal. The Wardian case now made it possible to transport plants successfully over long distances.

The value of the invention was further demonstrated by Robert Fortune, curator of the Chelsea Botanical Garden and well-known botanist and plant collector of his time, who transported 20,000 tea plants from China to start the tea trade in India.

Today, a terrarium is a glass container in which a group of plants requiring the same environmental conditions and cultural care, are grown together. Terrariums are the obvious answer to the problems of growing plants in the overheated dry atmosphere of modern apartments. Their use as ornamental features in decorating hotel foyers and large office complexes is steadily increasing.



## REQUIREMENTS

When establishing a terrarium, the container, soil and drainage, light and temperature must be considered.

### CONTAINERS

Glass containers that can be used as terrariums range from brandy goblets to glass bottles and fish tanks. The glass should be clear, **not** tinted, and the container should be fitted with a lid. No cover is needed when a bottle having a small opening and narrow neck is used.

The size and the shape of the container determine the type of plants to be grown. A small goblet may hold only one plant such as an African violet (*Saintpaula ionantha*), whereas a large rectangular fish tank allows the creation of a miniature woodland scene — a real challenge to the gardener's artistic ability.

A terrarium provides a controlled atmosphere microclimate in which the plants are protected from dust, oil or gas fumes from the heating system, and sudden changes of temperature.

Once a terrarium has been planted and the growing medium watered, a continuing chain of events is set in motion, which is referred to as the "rain cycle". This process provides constant moisture. The plants absorb moisture from the soil through their root systems and pass it up through the stems to the leaves, where it is transpired as vapor.

If the lid is closed tightly, this buildup of moisture causes the container to cloud up and obscure the plants, defeating the whole purpose of the display. For this reason, the lid or covering should be removable to allow excess humidity to escape. A certain amount of condensation should always be evident as an indicator that the level of moisture is sufficient in the soil.

### LIGHT AND TEMPERATURE

The Wardian case became a popular feature in many Victorian drawing rooms. Despite the heavy window drapery in vogue at that time, and the general overfurnishing and lack of light, plants in terrariums thrived.

Today, with greater emphasis on window light, plus advances in fluorescent and wide spectrum lamps such as Gro-lux, terrariums can be placed almost anywhere in a modern building. However, do not place a terrarium in direct sunlight, or over a radiator or other source of heat. In either case, the interior temperatures would build up in a very short time to levels that would injure the plants. A north or northeast window is ideal. Where the only location is an unlighted corner, artificial lighting is necessary.

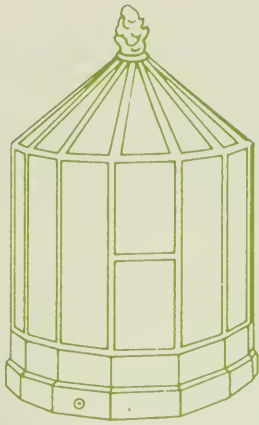
Chances of success are increased if the plants chosen belong to one grouping or category so that the cultural requirements are more or less similar. In short, do not mix tropical and cool woodland plants and expect them to thrive. (See lists of plants at end of pamphlet.)

### SOIL AND DRAINAGE

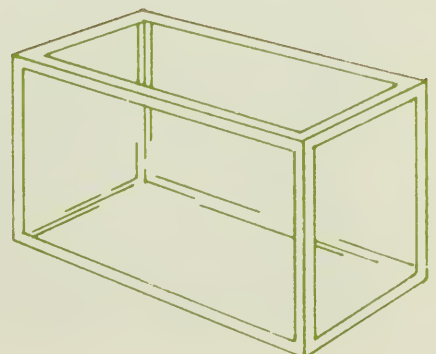
An open-textured soil with plenty of fibrous humus that drains readily is desirable. It must not be rich in nutrients as rapid, lush plant growth is to be avoided. It is essential that the soil mixture be sterilized to eliminate fungal disorders and harmful insects, both of which will build up very quickly in the high humidity of a terrarium.

Commercially sterilized soil, available at garden stores, is probably best to use as it saves the trouble of mixing and sterilizing soil at home. Home sterilization of soil involves baking it in the oven in shallow trays at 85°C for

## Types of containers



A Wardian case as designed by the inventor,  
Dr. Nathaniel Ward



about 1 hour. This produces a most unpleasant odor that permeates the whole house.

If you are determined to make up your own soil mix and sterilize it, use two parts of a fibrous loam (the sort of soil obtained by composting turf is ideal), an equal amount of vermiculite and one part of leaf mold. Mix this and rub it through a sieve. This is suitable for most plants. Where acidity is required, two parts of peat moss can be added.

A generous layer of drainage material under the soil mixture in which the plants are growing in a terrarium is absolutely essential.

The drainage layer should be at least half the depth of the soil layer. Drainage material can be anything that won't break down, such as fairly small particles of broken clay pots, small pebbles, crushed rock or coarse gravel. Pieces of charcoal should be added to keep the soil from going sour and developing bad odors from the breakdown of organic matter.

A layer of sphagnum moss laid over the drainage layer helps prevent the soil sifting down and clogging the drainage.

## ORNAMENTAL MATERIAL

Moss, lichen, colored or odd-shaped stones, pine cones, mirror glass to represent a pond, driftwood — all can give good effect if used with restraint. Ornamental material should be related to the natural setting.

Avoid figurines of birds, animals, gnomes, little cottages and similar ornaments, as these introduce a note of whimsy or fantasy and detract from the interest of the plants. Unfortunately, this feature is stressed in terrariums sold in garden centers.

## TOOLS AND EQUIPMENT

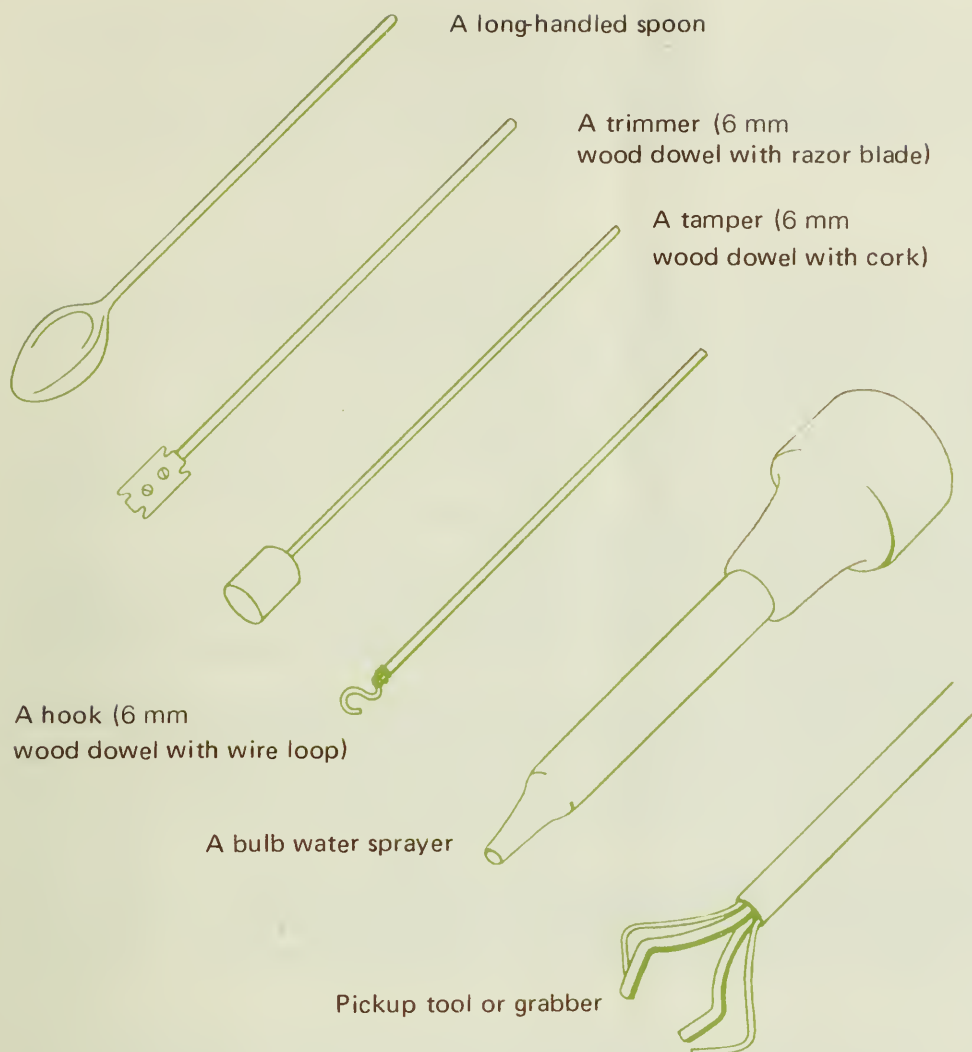
As terrariums have become more popular, an entire range of tools for planting and maintaining them has been developed. Most of these tools can be made at home with the exception of an item that does not have a popular single name, but is described as a "grabber" or "mechanical fingers." It consists of a small-diameter metal cylinder, with a handle at one end that can be pushed in and pulled out to open and close metal prongs at the other end.

Three tools are made from lengths of 6 mm dowel rod to which are attached: a razor blade for pruning; a cork as a soil tamper; and a short length of wire bent into a loop. Other useful equipment includes a "bulb-type water sprayer" with a long neck, a long-handled wooden spoon, and paper funnels to pour the soil into containers with narrow openings.

## ESTABLISHING A TERRARIUM

To gain experience, start with a container that has a wide opening, as bottles are more difficult to plant. Clean the container by washing it in warm soapy water and rinsing thoroughly to remove all soap, then set it aside for at least 24 hours to dry out completely. The inside glass must be dry, or soil and dust will stick to it and may be difficult to remove.

Depending on the container's shape, pour in or place a layer of drainage material at least 2.5 cm deep (deeper for large containers). To keep the soil from souring, mix pieces of charcoal with the drainage material and sprinkle charcoal chips on top, then cover with a layer of sphagnum moss to prevent the soil mix filtering down into the drainage layer and clogging it.



The depth of the soil layer depends on the size of the terrarium. Obviously, the soil has to be deep enough to take the root systems of the chosen plants. A good rule of thumb is to have the soil layer twice as thick as the drainage layer.

Shape the soil layer roughly into whatever plan has been decided, such as a slope, terrace or mound. If the terrarium is located where it is freestanding, then it should be attractive from all sides, but if it is backed against a wall, then the slope or terraces should be presented to the front view.

If your plan is for a natural woody landscape, have the soil surface irregular with a piece of mirror glass in a hollow to simulate a pond and miniature trees, such as conifer seedlings, planted around it. Include a twig chosen for its branch formation, stripped of its bark and laid down, to



represent a fallen tree. Irregular or colored pieces of rock are also pleasing in a landscape arrangement.

Whether or not the drainage layer should be hidden from view at the sides is up to the designer. Strips of moss or lichen can be inserted if desired, with the vegetative side next to the glass.

## PLANTING

Since a terrarium has a humid microclimate, be sure to choose plants that demand or tolerate such conditions. The plants should also be slow growing and low in height at maturity to keep maintenance, pruning or removal, and replacement to a minimum.

Many pet shops stock cacti, succulents and tropical plants in 5 or 7 cm pots. This is an ideal size of plant for terrariums. Select a number of plants and, before transplanting them, arrange the pots in different groupings to determine the most pleasing design. Use the tallest plant in the group as the key plant in the layout and plant it first.

When using a container with a narrow opening, reduce the ball of earth around the root system of the plant and squeeze it gently into a sausage shape to pass through the opening. Sometimes, as in a bottle planting, the soil has to be removed completely.

Scoop out a hole to take the plant and lower the plant into the container on the stick with the looped wire; or use the mechanical grabber tool. Be sure to support the plant while it is being planted. Use the cork stick to tamp the soil firmly, but gently, around the root system. Patience rather than skill is required in using these tools.

Generally speaking, tropical plants require more heat and humidity than natural woodland plants. Greater success is achieved if plants are chosen from within a category, to ensure uniformity of cultural requirements.

## WATERING

The amount of water needed depends on the ventilation; the tighter the lid, the less water required. Three or four waterings a year, using an atomizer, are usually sufficient. Excessive condensation on the inside of the glass indicates too much soil moisture and the cover should be removed. To ventilate a narrow-necked bottle, direct a flow of cool air into the bottle from a hair dryer or electric fan.

## UPKEEP AND PEST CONTROL

All plants intended for a terrarium should be quarantined for about 3 weeks and check them regularly for insects or diseases. To prevent fungal disorders from developing, apply a systemic fungicide such as Benomyl to plants before transplanting.

Check the terrarium periodically for diseased plants and cut off all leaves showing suspicious symptoms of fungal attack. Remove all plant debris.

If insects become established, spray with a dilution of rotenone or pyrethrum from a hand sprayer.

For additional information, write for a copy of publication 1543, *Insecticides for the Home and Garden*, available from Information Division, Agriculture Canada, Ottawa K1A 0C7



## PLANTS SUITABLE FOR TERRARIUMS

There are two main groups: woodland plants and tropical plants. Both require the same high humidity, but different temperatures. Some succulents also lend themselves to terrarium culture.

### TROPICAL AND SUB-TROPICAL

#### *Aglaonema* — Chinese evergreen

This plant is very adaptable and will survive in conditions of poor light and low moisture. It does best where warm and with humidity 50%. Prune back occasionally to keep in bounds.

#### *Codiaeum* — Croton

Crotons are tropical shrubs grown as house plants for their beautiful leaves, which have different forms, ranging from ovate to linear, entire or lobed, or spirally twisted. Young leaves are usually green with yellow markings and later the foliage turns to shades of red. There are literally dozens of crotons to choose from. All are attractive and eminently suitable for terrariums. However, it should be noted, they will outgrow the container and should be repotted into larger containers occasionally. Crotons need good light for development and retention of bright colors. They thrive in high humidity and temperatures over 21°C. Keep uniformly moist.

#### *Dracaena Godseffiana* — Gold-dust plant

Its glossy, deep-green, elliptical leaves are irregularly spotted with yellow dots. The plant is slow growing. The genera *Dracaena* and *Cordyline* are very much alike.

#### *D. Sanderiana*

Straplike leaves, white margins.

#### *Anthurium scherzerianum* — Flamingo flower

This popular greenhouse plant is grown for its showy, yellow flower cluster enclosed in a spathe, which may be red, yellow or white. It needs a high temperature 26 to 32°C and high humidity to do well. Keep uniformly moist.

*A. Forgetii* — a dwarf anthurium with distinctive olive green leaves with velvety texture and a trace of silvery veins.

#### *Episcia* — Flame violet

There are some 30 species of *episcia*. They are related to African violets. In nature, these plants are mostly epiphytes and, therefore, are excellent for use in hanging baskets. They do well in the high humidity of a terrarium, but need pruning. The plants send out runners, which root down new plantlets. The leaves are oval to round, with a velvety texture and beautiful markings ranging from chocolate brown to copper and silvery tones. *Episcia* does best in bright light and high humidity.

*E. cupreata* - copper-foliage with white markings; scarlet flowers.

***Selaginella kraussiana*** — Moss fern

The leaves are small, scalelike and different shades of green. This is a ground covering plant with creeping stems that take root at the joints.

***Peperomia***

This is a huge genus of fleshy-leaved plants which are tolerant of a wide range of conditions. The leaves are usually oval, thick and without marginal teeth.

***P. argyreia*** — Oval leaves with white markings.

***P. obtusifolia 'minima'*** somewhat prostrate in habit; roots down at joints of stems; round-oblong leaves.

***Pilea (Adicea)***

This includes some 500 species of mostly tropical herbs with fleshy stems. They thrive in the humid atmosphere of terrariums.

***P. cadierei*** - Aluminum plant - a small-leaved plant with silver and green foliage.

***P. microphylla*** - Artillery plant - small, fleshy green leaves; a creeping plant suitable as a ground cover.

***P. nummulariaefolia*** - Creeping Charlie - a ground-covering plant that takes root at the nodes.

***P. depressa*** - Baby's tears - a ground-covering plant with small leaves.

***Scindapsus*** (Pothos) - Pothos has dark-green leaves marked with yellow. It needs pruning.

***Maranta* or *Calathea*** — Prayer plant

There is a great deal of confusion about these two genera because they are so closely related. The most common name used in the trade is Maranta. Both have distinctive brown spots on the leaves.

***M. massangeana*** - smaller grey-green leaves with silver markings.

***Spathiphyllum cannaefolium*** - Spathe flower

The lance-shaped leaves are on slender stalks.

WOODLAND PLANTS

***Adiantum*** - Maidenhair fern

***Pteris ensiformis 'Victoriae'*** - Victoria fern

Ferns do best in semishade, high humidity and temperatures between 15 and 18°C. They require constant moisture in the soil, but drainage must be perfect. Ferns should be planted in containers with wide apertures that allow easy access, as they require pruning at regular intervals to remove dead fronds.

***Mitchella repens*** - Partridge berry

The partridge berry is a prostrate woody plant suitable as a ground cover. It roots easily at the joints and grows well in partial shade. Its round leaves are about 9.5 cm in diameter and the fruit is a scarlet berry.

***Hedera helix* var. *baltica*** - English ivy

This small-leaved variety can be used as a ground cover. It does well in partial shade, prefers temperatures under 18°C and requires ample moisture.

***Podocarpus macrophylla* Maki** - Shrubby yew pine

This narrow-leaved evergreen plant has an erect habit of growth. It is slow growing and needs to be pruned when young to keep compact. It prefers semishade and cool temperatures (under 21°C).

***Saxifraga sarmentosa*** - Strawberry geranium

Like the strawberry, this creeping plant sends out stolons or runners, which produce new plants. Its leaves are round, with a furry texture, white veins, and pink underside.

***Viola odorata*** - Sweet violet

Many species of violets are suitable for container growing. This tufted perennial produces runners that take root at the joints. Its flowers are white or violet, and sweet scented. It needs ample moisture, a cool temperature (18°C) and bright light for blossoming.

***Gaultheria procumbens*** - Wintergreen

This prostrate woody plant prefers a somewhat acid soil and partial shade. Its leaves are oval and fruit a scarlet pea-sized berry.

