



William T. Kemper Center for Home Gardening

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Terrariums and Vivariums

History

Terrariums, vivariums, and aquariums are microenvironments under glass. Terrariums were popularized in the 19th century when a London surgeon, Dr. Daniel Ward, accidentally created a garden in a jar. A natural history hobbyist, Dr. Ward wanted to see an adult sphinx moth hatch from a chrysalis. He buried the cocoon in damp soil in a glass jar and covered the jar with a metal lid. Some grass and a fern sprouted from the soil, and Dr. Ward lost interest in the cocoon. The plants thrived in the jar without additional water and no influx of fresh air. After four years, while Dr. Ward was absent from his home, the metal lid rusted and rain entered the jar causing the plants to rot.

In 1832, Dr. Ward decided to ship some glass-contained plants to Sydney, Australia, by way of Cape Good Hope. The containers of ferns and grasses, lashed to the ship's deck during the eight-month voyage, arrived intact and healthy. Dr. Ward's Australian colleagues returned the glass containers to London with equal success.

After Dr. Ward published his findings the glass-contained planters became known as Wardian cases. The development of Wardian cases opened up intercontinental plant trade. Indian teas, Chinese bananas and Brazilian rubber trees were introduced in compatible climates around the world. Exotic, tropical plants became available in Europe and America. Dr. Ward's efforts provided a global selection of plant material for the indoor gardener, and an effective method for maintaining delicate plant species. Today, terrariums are used mostly by hobbyists who plant commercially propagated materials.

Terrariums can be used as a naturalistic environment for keeping small reptiles and amphibians, much like an aquarium is used for keeping fish. This type of modified terrarium is called a "vivarium."

Containers

A good way to recycle glass containers is to create a terrarium. Almost any type of clear glass container can be used for a terrarium, as long as it holds moisture and transmits light. Possible candidates include canning jars, fish bowls, juice pitchers, chemist flasks, light fixtures, curio cabinets, and wine bottles. Special tools are required for planting bottle terrariums.

Colored glass is inappropriate as it reduces light intensity and transmits its own color while absorbing other colors in the light spectrum. Red tinted glass will block blue light, and increase light in the red spectrum, causing plants to become leggy. Green glass should also be avoided because it blocks red and blue light, both necessary for healthy plant growth.

High quality plastics, such as Lucite or Plexiglas, are also suitable for terrarium containers. Plastics are generally cheaper and lighter in weight than glass; weight may be a determining factor for a hanging terrarium. The main drawback of plastic terrariums is that the material scratches easily and may be etched by the soil. Also, condensation tends to remain on the sides of plastic tanks longer than it does on glass.

Aquarium tanks make excellent terrariums, and they are ideal for vivariums. The tanks are available in several sizes, and their shape allows easy access for landscaping and maintenance. The tanks can be sealed or ventilated, and they can be fitted with a light fixture. Supplemental, full-spectrum light is vital for the wellbeing of captive reptiles and beneficial for most plants. A little extra light will help keep orchids and violets in bloom.

Soil

Soil texture is important for terrarium plants. Terrarium soil must retain moisture without becoming waterlogged. It should be porous enough to allow good drainage and air circulation while being firm enough to hold plants in place. Properly textured soil can be created by mixing a few materials from the following list.

Standard potting soil: tends to have fine particles and consequently, a heavy texture.

Sandy potting soil: standard potting soil with 50% sand added; sold as cactus soil.

Soil-less potting mix: dark; rough-textured organic material available in most garden centers.

Perlite: expanded volcanic rock particles used to improve soil drainage.

Peat moss: decomposed sphagnum moss; helps retain soil moisture while preventing compaction.

Grit, sharp sand: improves drainage and air circulation; grit particles are larger than sand.

Humus: decomposed vegetation; provides an organic source of nutrients.

Horticultural charcoal: absorbs sour odors of decomposing materials.

Three basic types of terrarium soil mixes are: tropical (T), desert (D), and bog (B).

(T)-mix #1

2 parts sandy potting soil

1 part peat moss

1 part perlite

(T)-mix #2

1 part soilless potting mix

1 part sand

2 parts standard potting soil

(D)-mix #1

3 parts sandy potting soil

2 parts humus

1 part perlite

1 part charcoal
1 part grit

(D)-mix #2
2 parts soilless potting mix
1 part sandy soil
1 part grit

(B)-mix
3 parts peat moss
2 parts standard potting soil
1 part charcoal
1 part sand

Plants

Plants selected for a terrarium will share the light, temperature, humidity and soil conditions. Light requirements can be divided into low, medium and high intensity.

Low light is enough natural sunlight to read a newspaper, such as the light received from a north window. Most plants will require supplemental light in a low-light area.

Medium light is strong daylight with some direct sun for part of the day. Morning light from east windows provides medium light. Plants that require medium light may also acclimate to lower or higher light locations. Supplemental light is recommended for orchids.

High-light areas receive direct sunlight for most of the day. Unobstructed south windows and skylights may provide adequate sunlight for high-light plants. A few compact-growing species of cacti and succulents are listed here.

Warm-temperature plants (W) do best in a minimum of 60-65 degrees F.

Intermediate-temperature plants (I) prefer a temperature range of 50 to 75 degrees.

Cool-temperature plants (C) can tolerate temperatures from 35 to 65 degrees.

Plants requiring **high humidity (H)** can be maintained in permanently closed containers. Most plants will benefit from occasional or **partial ventilation (V)**. Cacti and succulent terrariums should always be left **open (O)**.

Low Light Plants

I. Tropical Plants for Low-light Terrariums: These plants can be combined in a ventilated terrarium of intermediate temperature.

Botanical Name	Common Name	Temp	Humidity	Soil
<i>Aglaonema</i>	Chinese Evergreen	W	V-H	T
<i>Chanaedorea elegans</i> 'Bella'	Dwarf Parlor Palm	I	V-H	T
<i>Dracaena godseffiana</i>	Gold Dust Plant	I	V	T
<i>Philodendron</i>	Sweetheart Plant	I	V-H	T
<i>Pittosporum</i>	Mock Orange	I	V	T
<i>Sansevieria hahnii</i>	Bird's Nest	I	O-V	T

<i>Scindapsus</i>	Pothos	I	V	T
<i>Spathiphyllum</i>	Peace Lily	W	V-H	T
<i>Syngonium podophyllum</i>	Goosefoot Plant	I	V	T

Medium Light Plants

II. Bog Plants for a Cool Terrarium: These plants need plenty of moisture. *denotes carnivorous plant.

Botanical Name	Common Name	T	H	S
<i>Acorus</i>	Sweet Flag	C	V	B
<i>Azolla</i>	Floating Moss	I	H	B
<i>Darlingtonia*</i>	Cobra Plant	C	H	B
<i>Dionaea*</i>	Venus Fly Trap	C	H	B
<i>Drosera*</i>	Sundew	C	H	B
<i>Marsilea</i>	Water Clover	C	V-H	B
<i>Myriophyllum prosperpinacoides</i>	Parrot's Feather	I	V	T-B
<i>Nasturtium</i>	Watercress	C	H	T-B
<i>Sarracenia*</i>	Pitcher Plant	C	H	B
<i>Selaginella</i>	Club Moss	I	H	B

III. Tropical and Bog Plants for Warm, Humid Terrariums: These plants will live in the high humidity of a closed terrarium.

Botanical Name	Common Name	T	H	S
<i>Adiantum</i>	Maidenhair fem	W	H	T
<i>Caladium humboldtii</i>	Angel's Wings	W	H	T
<i>Calathea zebrina</i>	Zebra Plant	W	H	T
<i>Episcia</i>	Lace Flower	W	H	T
<i>Fittonia argyroneura nana</i>	Snakeskin Plant	W	H	T
<i>Hydrocleys</i>	Water Poppy	W	H	T
<i>Maranta leuconeura</i>	Prayer Plant	W	H	T
<i>Nepenthes*</i>	Pitcher Plant	W	H	B
<i>Pistia</i>	Water Lettuce	W	H	B

IV. Flowering Plants for a Warm, Ventilated Terrarium: Adequate warmth and fluorescent light will help to keep these plants in bloom. Foliage plants from group III may be used with group IV.

Botanical Name	Common Name	T	H	S
<i>Begonia</i>		W	V-H	T
Bromiliads				
<i>Billbergia 'Pixie'</i>	Vase Plant	W	V-H	T
<i>Guzmania lingulata minor</i>	Scarlet Star	W	V-H	T
<i>Tillandsia lindenii</i>	Blue-flowered Torch	W	V-H	T
Orchids				
<i>Ludesia discolor</i>	Jewel Orchid	W	V-H	T
<i>Phalaenopsis</i>	Moth Orchid	W	V-H	T
<i>Doritaenopsis</i>		W	V-H	T
<i>Vanilla planifolia</i>	Vanilla Vine	W	V-H	T
<i>Saintpaulia</i>	African Violet	W	V-H	T
<i>Sinningia</i>	Gloxinia	W	V-H	T
<i>Streptocarpus</i>	Cape Primrose	W	V-H	T

V. Foliage Plants for a Ventilated Terrarium: These plants are adaptable to different conditions. Plants with a humidity code V-H can be used with the flowering plants in group IV.

Botanical Name	Common Name	T	H	S
<i>Ajuga</i>	Bugleweed	I	V-H	T
<i>Aphelandra squarrosa</i>	Zebra Plant	I	V-H	T
<i>Ardisia</i>	Coral Berry	I	V-H	T
Bromeliads				
<i>Cryptanthus</i>	Earth Stars	W	V-H	T
<i>Tillandsia usneoides</i>	Spanish Moss	W	V-H	T
<i>Chlorophytum bichetii</i>	Dwarf Spider Plant	I	V	T
<i>Ficus</i>	Ornamental Fig	W	V	T
<i>Helxine</i>	Baby's Tears	I	V-H	T
<i>Iresine herbstii</i>	Bloodleaf	I	V	T
<i>Mimosa</i>	Sensitive Plant	W	V	T
<i>Myrtus communis microphylla</i>	Dwarf Myrtle	I	V-H	T
<i>Oxalis</i>	Shamrock Plant	I	H	T
<i>Pellea rotundifolia</i>	Button Fern	W	V-O	T
<i>Pilea microphylla</i>	Artillery Plant	I	V-H	T
<i>Polypodium</i>	Rabbit's Foot Fern	W	O-V	T
<i>Pteris</i>	Table Fern	W	V	T
<i>Stenotaphrum</i>	St Augustine's Grass	I	V	T
<i>Tradescantia</i>				
<i>Callisia cordifolia</i>	Inch Plant	I	V	T
<i>Setcreasea purpurea</i>	Purple Heart	I	V	T
<i>Zebrina</i>	Wandering Jew	I	V	T

VI. Plants for a Cool, Ventilated Terrarium: With medium light and good ventilation, these plants will tolerate cool conditions.

Botanical Name	Common Name	T	H	S
<i>Acorus</i>	Sweet Flag	C	V	T-B
<i>Buxus</i>	Boxwood	I	V	T
<i>Ceropegia woodii</i>	Rosary Vine	I	O-V	T
<i>Euonymus fortunei uncinatus</i>	Chinese Vining	C	V	T
<i>Hedera helix</i>	Ivy	C	V-H	T
<i>Pittosporum</i>	Mock Orange	I	V	T
<i>Podocarpus</i>	Buddhist Pine	I	V	T
<i>Sansevieria hahnii</i>	Bird's Nest	I	O-V	T
<i>Saxifraga</i>	Strawberry Begonia	C	V	T
<i>Trifolium repens minus</i>	Irish Shamrock	C	V	T

High Light Plants

VII. Plants for a Desert Terrarium: Many compact cacti and succulents will work in a desert terrarium. Only a few are listed here.

Botanical Name	Common Name	T	H	S
Cacti				
<i>Opuntia microdasys</i>	Bunny Ears	I	O	D
<i>Rebutia miniscula</i>	Mexican Sunball	I	O	D
<i>Lobivia famatimensis</i>	Sunset Cactus	I	O	D

<i>Mammillaria bocasana</i>	Powder Puff Cactus	I	0	D
Succulents				
<i>Graptopetalum</i>	Ghost Plant	I	0	D
<i>Faucaria tigrina</i>	Tiger Jaws	I	0	D
<i>Haworthia tessellata</i>	Star Window Plant	I	0	D

Assembly

The terrarium container should be cleaned before the materials are added. Cleaning the inside surface is very difficult after assembly. A non-abrasive bathroom cleanser will remove hard water stains. Vivarium containers should be thoroughly rinsed. Soap and water is best for general cleaning.

The growing medium can remain exposed or be concealed by lining the container with a sheet of sphagnum moss. A layer of drainage material, 3/4 gravel to 1/4 charcoal, should be evenly spread in the bottom of the container or on top of the sheet of moss. Aquarium gravel works well in small containers, pea gravel in larger ones. Charcoal should be rinsed so that the dust doesn't coat the sides of the container. The drainage layer should be about half the depth of the soil layer.

A soil separator is recommended to keep soil from washing into the drainage material. Fine-grade plastic screening, fine nylon netting, or even old nylon stockings will serve as a soil separator. A single layer of separator material is placed on top of the drainage material.

The soil mix should be moistened, but not soaked, before it is added to the terrarium. No water should drip out of a squeezed handful of soil. Dry soil may have to be used with bottle terrariums. A funnel can be constructed from a loosely rolled sheet of paper to put gravel and soil into containers with narrow openings. The total depth of the soil mix and the drainage material should be no more than one-fourth of the depth of the container. The soil can be sloped or terraced with rocks or pieces of brick to create a natural looking landscape.

Plants should be inspected for insects and disease. Infested plants should be discarded. It is helpful to arrange the plants as they will be placed in the terrarium before they are planted. Soil should be removed from the edge of the root ball near the base of the plant, and bottom roots carefully untangled. Nearly all of the soil should be removed for plants going into bottle terrariums. Large plants go in first, followed by progressively smaller ones. When all of the plants are in, the soil should be firmly tamped and covered with moss, orchid bark and/or pebbles. This prevents soil disturbance when watering and reduces evaporation later on.

Plants need to be watered slowly with room-temperature, distilled water, covering the soil surface evenly. The minerals in tap water can build up in the soil and leave residues on the terrarium walls. The soil is adequately saturated when it becomes dark all the way through. Excess water that gathers in the drainage layer should be siphoned off, sponged, or soaked up. The terrarium should never be tipped to let the water drain.

Maintenance

An average terrarium will require less maintenance than a collection of potted plants. Moisture is recycled in sealed terrariums, so these require only adequate light and temperature. However, plant selections for these are limited to slow growing, high-humidity tolerant species.

Light Exposure

Terrariums that depend on sunlight from windows should be turned occasionally, as the plants will grow toward the light source. Terrariums placed in direct sunlight need to be ventilated often and partially shaded during the heat of the day. An open desert terrarium will tolerate extended, direct sunlight.

Ordinary light bulbs (incandescent) may be used to supplement natural light, but full spectrum fluorescent lamps are the best substitute for natural light. A 24-inch, two lamp fixture is adequate for low light plants. More lamps or bigger fixtures produce enough light for medium to high-light plants. Fluorescent light can be placed within 2 inches and no farther than 18 inches away from the plants.

Actively growing plants need 14 to 16 hours of light each day, as well as a regular period of darkness. Artificial lights can be regulated with a timer to assure a consistent cycle of light and darkness.

Water

Terrariums should never be allowed to become completely dry. Larger containers can be checked for moisture by digging a finger down into the soil. It is common for bottle terrariums to have some condensation on the inside. Moisture content can be monitored by becoming familiar with the weight of the container. Like potted plants, terrariums become lighter as they dry out.

Overwatering a terrarium can create problems. When the drainage layer fills with water, the soil becomes waterlogged, eventually causing plants to rot. Water tends to stagnate quickly in a terrarium. Excess water in the drainage layer should be removed with minimal disturbance to the plants. A turkey baster can be eased through the soil near the edge of the terrarium to siphon away standing water.

Fertilizing

Fertilizer should be used sparingly in a terrarium where plant growth is limited by the confined space. Commercial fertilizers also contain salts which can build up in the soil of a terrarium. Soluble fertilizer can be applied half as often at 1/4 the strength of the manufacturer's recommendation, or small amounts of dried manure and bone meal can be added to the soil mix, usually once a year in the spring.

Carnivorous plants normally consume insects. If live flies or mosquitoes are not available, use a few very minute crumbs of lean hamburger. Feed sparingly once or twice a month. The plants cannot digest excess food, and overfeeding may kill them. A diluted solution of fish emulsion can be used on the soil.

Ventilation & Temperature

All terrariums, except desert types, should have some drops of moisture on the interior walls. The humidity in the terrarium is too low when condensation is absent, indicating that it's getting too much ventilation. The terrarium should be opened less often and occasionally sprayed with a fine mist of distilled water.

When the terrarium humidity is too high, condensation becomes heavier, plants may begin to rot and algae may begin to grow on the inside of the terrarium walls. In this case, the terrarium should be left open for a day or two, allowing extra moisture to evaporate.

Terrariums that are not in direct sunlight stay fairly close to room temperature. Most intermediate and warm-temperature plants need a 10-degree temperature drop at night, though not below 50 and 60 degrees respectively.

Insects and Disease

All plants should be carefully inspected before going into the terrarium. Insect-infested or diseased plants should be discarded. Insects and disease spread quickly in the protected environment of a closed container. When symptoms appear, they should be dealt with immediately.

Plant diseases in a terrarium are often related to the humidity. When rot or mildew becomes evident on plant parts, infected leaves or plants should be removed and ventilation should be gradually increased. Dead blooms and foliage increase the likelihood of fungal diseases; they should be removed as soon as they are noticed. Proper air circulation helps to prevent these and other problems. Overgrown plants should be replaced or pruned back if possible.

Animal Inhabitants

Vivariums resemble terrariums, but the microenvironment must be created in the best interest of the animal inhabitants.

Aquariums with a light fixture and a ventilated cover are the best containers for making a vivarium. Reptiles cannot generate their own body heat, and they need an exterior heat source in order to survive. Fluorescent light does not provide heat, so incandescent light bulbs, sunlight or another heat source is necessary. Creatures in the wild are accustomed to a 15-20 degree drop in temperatures at night, and they will need similar conditions in the vivarium.

A minimum 20-gallon capacity is recommended for vivariums because animals need adequate space to establish territories. Crowded animals may attack one another. Also, cleaning is easier when there is plenty of space between the plants.

Common vivarium animals include lizards, tree frogs, toads and turtles. Many of these animals are found in woodland or tropical areas, although different animal species, like different plant species, require particular habitats. Tree frogs and American chameleons like to have something to climb on, such as a small piece of driftwood or a branch. Some desert reptiles obtain water from their food, but most animals must have a water source. Toads, frogs, turtles and geckos need an area of shallow water in their vivariums.

Captive animals will not survive if their specific needs are not met. The vivarium habitat should be prepared before animals are brought home. Animals usually become confused when they are removed from familiar surroundings, and may refuse to take food when they are introduced into a new setting. A suitable habitat may help calm an animal that is frightened after a trip from the pet store.

The needs and characteristics of any animal should be fully understood before it is brought into the home. Turtles, for example, carry salmonella, and they should be handled as little as possible. Some lizards will lose their tail if they are picked up improperly. Chameleons will not drink water from a dish, but take their water from condensation that forms on plant foliage. Vivarium inhabitants depend upon the knowledge of their handler.

Pet shopkeepers should know the real, or Latin, name of the animal, where it comes from, what it normally eats, how warm it should be kept and what animals are compatible with it. If this information cannot be provided, animals should be purchased elsewhere. A few hours of research can prevent a lot of suffering and lead to an educational hobby.