

Bonsai is very rewarding; but getting started can be frustrating. It is hard to get enough specific information so you can begin when you can't even find out what kind of soil to plant in or where to get it. Bonsai experts are quite friendly and as helpful as possible; but bonsai is second nature to them, so they generally think beyond the basics. In addition, there are so many ways to do things and so much variety in tree styles, plant types, fertilizers, etc., that sometimes it is hard to get a straight answer about what is needed just to get started. This booklet is designed to help beginners get started before they get discouraged. They say you don't get good at bonsai until you've killed a hundred trees. That may be true; but no one kills the first hundred trees they own and stays in bonsai.

This booklet attempts to do three things. First, it will tell you how to grow successful bonsai in terms of choosing material, shaping it for bonsai, planting it and caring for it so it stays alive and grows properly. It is written with reference to a temperate climate such as Pittsburgh. Second, the book will give you explicit information so you can converse with experienced bonsaists in a common language, without being intimidated. Third, it will tell you what materials you need to get started.

How to gain confidence in bonsai early.

You will find members of the bonsai societies, clubs and other groups to be wonderful people. It must be something in the fertilizer they use! They will try to answer any questions you have. However, there is only so much time to talk to them; and you don't want to bore them to death talking about peat moss. The following suggestions will help you and obtain the information you need to get started:

1. Join the local Bonsai Society or club. These are not secret societies! Anyone can join, usually by going to a meeting. Dues are reasonable. Attend the meetings, listen to the demonstrations and pay particular attention to information about special events. As fascinating as the business meetings are, the workshops, demonstrations and special trips are even better. In return, if you meet someone in the course of your travels who could give a talk or demonstration to the club about bonsai or a related subject, notify the club President or Program Committee. For more about the Pittsburgh Bonsai Society, see our [home](#) page.
2. This booklet will get you started; but also consider buying one or two books. We will have some links on the web site
3. Subscribe to one of the bonsai magazines. The pictures can be inspiring, you will gradually increase your knowledge about particular trees and the advertisements give you lots of places to spend your money. Isn't that what a hobby is all about?! The Pittsburgh Bonsai Society maintains a library of books, journals and videotapes for members to borrow, and other clubs may do the same.
4. Take a class. You will hear about them at club meetings, and information is often posted on our web page. You will get an overview and have the opportunity to ask a lot of questions. After the first few classes, you can take some of your plants to the instructor for suggestions about styling and care.

5. Get a friend interested in bonsai. It's more fun working with someone else and you can critique each other without being intimidated by a bonsai master.
6. Keep more than one plant. Growing at least ten trees of different types and ages will hold your interest better. It takes someone more patient than most to start with all seedlings and have nothing of interest for five or more years. After you have some confidence and know what kind of plants you like, consider buying a nice bonsai in the \$50-\$150 range. That way you can get the feeling and emotional involvement from the art of bonsai while waiting for your creations to mature.
7. To find resources for supplies around Pittsburgh and elsewhere, check out our [bonsai links page](#) and our [Local Resources page](#).

A few facts about bonsai everyone should know:

1. Any woody perennial plant with small enough leaves can be bonsai, even herbs such as rosemary.
2. Bonsai is pronounced bone-SIGH, not banzaiiiiiiii. It is a Japanese word meaning, "tray-tree."
3. Bonsai originated in China about 2500 years ago and was taken to Japan about 1000 years ago. Americans became interested in bonsai from the Japanese after WWII; this is why most of our techniques and vocabulary are Japanese.
4. be in Oriental cultures. It is a living art form, a hobby combining horticulture and artistic technique. Nevertheless, it is a good opportunity to practice Zen meditation. You may be able to see a tree as it really is without all the cultural and artistic appurtenances surrounding it.
5. Bonsai range in size from a few inches to four feet tall.
6. Most bonsai are outdoor plants. Do not try to keep an outdoor plant in your living room, particularly during the winter; it will die (*juniperis mortalis*). Some tropical plants, however, such as ficus may be trained as bonsai and kept indoors. It's still better to take them outside when the temperature is above 50 degrees F to get more sunlight.
7. It doesn't matter how old a bonsai is; what matters is how old it looks. Years of dedicated care and training do, however, give a bonsai special character.
8. The wood, not the leaves, makes a bonsai look old and gives it character. Don't worry about the leaves; they will grow.
9. What you plant in is called "soil," not "dirt."
10. Bonsai are planted in clay bonsai pots, which are relatively plain (unpainted) and usually rectangular or oval in shape. They also have feet and drainage holes. They come in all sizes and range from \$2-\$600 or more. Sometimes, the pots are glazed, usually in a subdued tone.

First, go to a nursery and buy a few healthy plants in gallon pots and practice with them. Junipers such as San Jose juniper and shimpaku juniper are hardy and are easy to work with and keep alive. Green mound juniper (*juniper procumbens nana*) is easy to find, hardy and a good grower. It is sometimes difficult to grow as an upright tree, however, because of its mounding or

cascading nature. Japanese maples are good deciduous trees for bonsai. Take your plants home and simply look at them for a while. Think of how a tree looks, rather than a landscape plant or bush. Remember, the idea is to make idealized scale models of beautiful wild trees. Plants that are trimmed into perfectly symmetrical shapes are topiary, not bonsai.

Turning a nursery plant into a bonsai involves several steps. After the initial styling and potting, your creation is called "pre-bonsai" or "bonsai in training." It is considered presumptuous to think you can create instant bonsai. A plant is supposed to be trained in a pot for several years to earn the name "finished bonsai." Experts only consider a plant to be a bonsai when it has a thick trunk, a finished style with all the branches and foliage in the right place and the right size, leaves that are as small as they can get, and a pot which is perfectly matched to the style and color of the tree. This finishing process usually requires years of trimming and restyling to accomplish. However, bonsai in training are also very satisfying to their owners and give the same sense of artistic pleasure, although perhaps to a lesser degree.

The basic steps in creating bonsai are:

1. Selecting plant material;
2. Styling, including pruning and wiring;
3. Potting, including root pruning and aftercare;
4. Continuing care, including:
 - Water
 - Fertilizer
 - Sunlight
 - Control of plant diseases and pests
 - Trimming
 - Winter storage.

Although it is beyond the scope of this booklet, the bonsai hobby also includes:

1. Grafting;
2. Propagation;
3. Final pot selection;
4. Improving roots and branches;
5. Collecting wild trees;
6. Drastic pruning;
7. Wiring and bending techniques, even drastic bends;
8. Carving dead wood;
9. Displaying; and
10. Telling tall tales about "the one that got away."

A bonsai is a scale model of a tree in nature. Of course, any bonsai tree is somewhat like its larger counterpart. The trick is to make it look old, interesting and artistic while maintaining its

natural appearance. Nature does many strange things to trees. It twists their trunks, erodes their roots, prunes or breaks branches, strikes with lightning, or sweeps the branches one direction in the wind. In bonsai, we may create a story of what nature has done to a tree and how the tree has struggled back. Depending on prevailing conditions in nature, however, a tree may assume one of a variety of shapes. The main direction and configuration of the trunk of a bonsai tree gives the style its name. The five basic styles are:

- **Formal upright** - Straight trunk with the apex (the very top of the tree) directly above the base and with branches roughly the same on both sides;
- **Informal upright** - Curved trunk with apex over the base (most common);
- **Slanting** - Curved or straight trunk tilted so the apex is not over the base;
- **Semi-cascade** - The main part of the tree, which may be a large branch, is over the edge of the pot and at or slightly below the level of the base of the trunk; and
- **Cascade** - The main part of the tree cascades over the edge of the pot, often reaching below the bottom of a tall pot.

In addition to these five basic shapes, there are variations, which fall into several other main categories. These include:

- **Broom style** - Upright trunk with a fan of branches forming an umbrella of foliage;
- **Windswept** - Most of the branches are growing in one direction as though the wind forced them to grow that way. The trunk is often leaning in the same direction;
- **Literati (bunjin)** - A long, thin trunk with an interesting line and few branches with a small amount of foliage.
- There are also bonsai which have more than a single trunk, from twin trunk trees up to forest arrangements of many trees.

11. In the United States, there are no religious practices associated with bonsai as there might

Plants for bonsai are often purchased from nurseries. If your town is like Pittsburgh, there may be several nurseries that have acceptable plants, but there are no full-scale retail bonsai nurseries. There are full-scale bonsai nurseries in and around many cities, and many of them can be located either in bonsai magazine ads or in the links located elsewhere on the Pittsburgh Bonsai web page. These nurseries have more of the plants usually used for bonsai; and the plants are often pre-trained. For instance, you may find junipers that are staked upright to grow like trees. Some also sell finished bonsai. Every spring the Pittsburgh Bonsai Society has a weekend show during which good plant material is sold. Occasionally, vendors come to Society meetings with plants. We also have an auction every year in which members sell trees, pots, books, etc. Other sources include mail order nurseries or bonsai shows in other cities where vendors sell plants. You can also collect plants from the wild, perhaps like that azalea bush in your yard that doesn't quite belong there.

Look for plants with the following characteristics:

- **Trunk.** There should be a single trunk, at least 1/2 inch thick at the bottom. It is very important that the trunk taper evenly toward the top.
- **Roots.** Often good roots are below the soil level in nursery pots. Dig down in the soil with your finger. Good bonsai material should have large roots going off in more than one direction, which can be exposed to enhance the tree's style. Beware of nurseries (or non-nurseries such as department stores that sell plants) where the plants are dug out of a field and shoved into a pot of peat moss or sand. Sometimes these roots are tangled, crowded or growing upwards. These plants can be used, but they should be bought in the spring so they can be repotted immediately.
- **Branches.** There should be plenty so you can select the ones that fit your styling of the tree. They should be thicker at the bottom of the tree and gradually get smaller toward the top. Internodes (the spaces between branches, secondary branches or leaves) should be short so the foliage masses will have a compact, dense appearance.
- **Foliage.** The condition of the leaves usually tells you about the health of the tree. Also, look for varieties with small leaves. The foliage eventually should be small, and smaller bonsai need even smaller leaves or needles for balance. Some plants' foliage can be reduced with training, and some naturally have small leaves.

Here's a list of good bonsai candidates you might find in regular nurseries:

1. Junipers (*Juniperus*), especially *procumbens nana*, needle, or *shimpaku*. Rug junipers are harder to train as trees;
2. Japanese Maples (*Acer Palmatum* and its upright cultivars);
3. Trident Maple (*Acer Buergerianum*);
4. Scots pine (*Pinus sylvestris*)
5. Crabapple (*Malus sylvestris*);
6. False Cypress (*Chamaecyparis obtusa nana* [Hinoki cypress], *Chamaecyparis pisifera* - various varieties);
7. Larch (*Larix*);
8. Mugo Pine (*Pinus mugo mugo* or the dwarf form, *Pinus mugo pumilo*);
9. Azaleas;
10. Chinese elm (*Ulmus Parviflora*);
11. Other elms (*Ulmus carpinifolia*, etc.) and
12. Japanese Black Pine (*Pinus Thunbergii*).

There are many other possibilities, so don't be afraid to try whatever catches your eye.

Styling Bonsai

The artistry of bonsai is in the process of styling. Part of styling may be done according to specific rules, which help to create a finished product that looks pleasing. Without going into the

philosophy of bonsai here, the following are some esthetic goals you should try to achieve when styling your trees:

1. The tree should look old (no matter how old it really is).
2. The tree should look stable, not like it's falling out of the pot.
3. The tree should look like a natural tree, not a man-made topiary.
4. The tree should appear healthy even if it appears to have survived many storms and much adversity.
5. The tree should have a certain movement to it. That is, the eye should be drawn along the shape of the tree (or line of the trunk) in a pleasing fashion.
6. The top of the tree should come towards the front.
7. The pot should not draw attention away from the tree.

Following are some guidelines for styling that help achieve the above goals: (NOTE: Bonsai are always viewed from the "front." Therefore, select a front view of the tree; and all the styling considerations are made with that view in mind.)

1. To look old, the tree should appear to have undergone changes that trees do as they age, that is, the roots around the base are eroded and showing, the trunk gets thick at the base and tapers as it goes up, the branches bend down, the whole tree enlarges and growth slows. Therefore,
 - Look for the widest base and expose the heavy roots. Make the front of the tree the side that shows the best roots and base of the trunk. Visible roots should not cross each other or come straight out towards the front. About half the thickness of surface roots should be exposed; they should not be entirely above the soil.
 - The trunk should be big at the bottom and taper towards the top. The front view should show the part of the trunk that has the widest base and the most extreme taper.
 - Bend the branches down at the trunk, especially the lower branches. This is most important for evergreens or trees that are to show extreme age. In nature, branches bend down over the years from the weight of the branch and from snow. Lower branches bend down more because of their larger size and more years of snowfall. Evergreens bend down more than deciduous trees because the foliage holds more snow than bare branches.
 - Leaves should be as small as possible; this makes the tree look larger in comparison and thus older. The apex of a tree rounds off slightly in an older tree as it stops shooting toward the sun, so a slightly rounded apex makes the tree look older, as long as the rest of the tree goes along with the old appearance.
2. Stability. No matter what style, the tree should appear stable and balanced. Although your eye will tell you more, here are a few rules to help. Pot the tree near but not in the center of the pot. Upright trees should have the apex directly above the center of the base. Slanting trees are usually placed in the pot so that they slant toward the side with the larger area of soil. A broad base and prominent roots anchor the tree's image. The pot should be the right size and shape (see potting).
3. The tree should look like a natural tree, not a man-made topiary. Rules for this include:

- "Let the birds fly through," that is, leave spaces between layers or "clouds" of foliage.
 - Do not prune the foliage into perfect balls, triangles or other geometric shapes.
 - If you want to leave part of a dead branch, prune it by breaking or peeling the end off with pliers instead of leaving a flat cut stump.
 - The overall shape of the foliage mass should usually be approximately a triangle, but do not make the whole tree or the individual foliage masses perfectly symmetrical.
4. The tree should appear healthy, even if it appears to have survived many storms and much adversity. It may have dead wood on it; but the wood should look dry and weathered, not rotting. Sand or scrape dead wood so it doesn't look splintered or feathered; and (optionally) paint it with lime sulfur to preserve it. Foliage should be green. Fertilize for good color, especially a week or two before showing the tree. Control pests. Never cut leaves or needles in half because the ends will turn brown. Rather, remove the entire leaf when damaged and pinch out new growth with your fingers. Keep the trunk and exposed roots clean with a toothbrush. (You can use a mild soap solution, but do not let it soak into the soil.)
 5. The tree should have movement to it, that is, the eye should be drawn along the tree in a pleasing fashion. It is the wood, not the foliage that primarily determines the style. The foliage is a background or frame for the wood. So the most important styling concerns have to do with the trunk and branches. To get this effect follow these points:
 - The first branch should grow out from the trunk at about 1/3 of the tree's height.
 - Visible branches should never cross when viewed from the front.
 - Adjacent branches should never be exactly parallel to each other.
 - If branches are exactly opposite each other and have the appearance of a cross (bar branches), one or the other should be eliminated.
 - Two branches should not originate from the same place on the trunk.
 - Lower branches should be thickest, and should gradually be smaller toward the apex.
 - Branches should come off from the outside of the curves in the trunk, not from the inside (pocket branches).
 - Large branches should never come directly out toward the viewer (eye-poking branches).
 - Branches should not be "u-shaped;" sharper angles look better.
 - All the rules for main branches as they come off the trunk should also apply to secondary branches as they come off the main branches.
 - The lowest branch should come off the trunk starting on one side, then the next higher branch on the other side, and the third branch toward the back. (Alternatively, the height of the back branch could be between the first two side branches). Repeat this pattern to the top of the tree, with occasional small branches in front of the trunk near the top (a very flexible rule.)
 - For about the bottom 1/2 to 2/3 the height of the tree, the foliage should not completely hide the trunk or the origin of the main branches when viewed from the front.

- The secondary branches and the foliage masses (clouds) should be somewhat flattened by wiring and trimming instead of remaining ball-shaped or shapeless. Viewed from the top, each branch should basically be triangular-shaped (widest part near the trunk); and the branches should extend out in all directions from the trunk. No branch should completely shade the branch under it. There should be some foliage on top of the branch for “volume”, but take off secondary branches growing straight up or down.
 - Viewed from the front, the overall shape of the foliage mass should be somewhat triangular and balanced over the base. This does not mean a symmetrical triangle; rather, the foliage and the trunk together should suggest movement. A Christmas tree shape just sits there like a couch potato. It is more pleasing for the tree to appear moving but balanced, like a graceful dancer. To get this appearance requires overall asymmetry, irregular spaces between the foliage masses, flattened branches that draw the eye out from the trunk in a coordinated fashion, and a base that appears strong enough to anchor the tree.
6. A single trunk tree should have one top. It should come towards the front slightly in order to be “welcoming”. Often the aspect of the tree reminds us of people. This is one reason movement, balance, welcoming and gestures of the branches can be important.
 7. The pot should not draw attention away from the tree. As a picture frame matches a picture, pots should be the proper shape, size and color to match the style and color of the tree. Bonsai pots are unglazed clay or have a subdued earthtone glaze color. Fancy details, carvings and painting are usually avoided. The pot should be approximately 2/3 as wide as the tree is tall. The height of the pot should be 1 to 1 1/2 times the width of the tree's base. The shape of the pot, type of lip, feet, taper of the sides, etc. are also considerations when choosing a pot; but those are beyond the scope of this booklet. (NOTE: These rules are for the final pot. When the tree is in training and growing more vigorously, the pot should be larger, plainer and cheaper.)
 8. All rules can be broken.

Pruning is the removal of entire branches from previous years' growth, or even a large part of the trunk, for the purpose of creating or cleaning up the design of the tree. Because of the energy the tree uses to deal with the wounds, pruning is best done during the late winter (February) when the tree is inactive and before new buds sprout or in the summer when the tree is growing actively and producing energy.

In general, remove branches that grow straight up, straight down or parallel to nearby branches. Remove dead branches unless they are part of the design. For trees with thicker bark, it is best to remove branches at their base using a concave cutter that leaves a small depression at the cut. Later, when the callous forms, the cut will be flat and less noticeable. For trees with thin bark, make the cut flat or slightly rounded. For the best results, do not cut all the way into the trunk; leave some of the "callous collar," which is the slight bulge around the base of the branch. This will allow the cells in this area to wall off the wounded area to prevent rotting and dieback. If you make the cut properly, the tree can “compartmentalize” or wall off the wound so the tree

stays healthy. A wound sealant or “cut-paste” may be put on the wound to help “wound wood” to more quickly cover over the wound.

If you can avoid it, do not prune heavily during the spring when the tree needs its stored energy to bud. Cuts will not heal as well, and nearby branches (or the whole tree) might suffer or die. Do not prune in the fall because the branches are providing nutrients which are being stored for the whole tree. This process thickens the trunk and stores energy for spring growth. Prune in the late winter or after the new foliage is mature and actively growing.

Trimming is the removal of small branches or foliage. We trim bonsai for several reasons:

1. To keep the tree small and in the proper shape;
2. To remove parts of the foliage that are unattractive or in the wrong place;
3. To allow sunlight and air to reach other foliage;
4. To selectively retard the growth of the trimmed branch; and
5. To encourage sprouting of new buds in other places on the tree (back budding).

Trimming is one of the most important activities for shaping the tree and may be done throughout the late spring and summer. You can start trimming after the first spring growth has “hardened off”. This means when the leaves have enlarged and gotten waxy and thicker. To keep the shape you want, simply remove the new growth which develops outside the desired outline. Branchlets that grow straight up or down or cross other branches should be removed. If you want a branch to thicken, do not trim it; let the foliage grow wild on that branch all season and then prune it back when the branch has gotten as big as you want. To keep a branch thin, trim it repeatedly and thin out the foliage. In this way, you can balance the appearance of the different branches. Usually, the top of the tree needs to be thinned more because it grows faster; and you want to keep the top branches thinner than the lower ones.

Trim the end of a branch just past a bud. Buds are usually at the base of each leaf. Whichever bud you leave on the end of the branch will likely sprout, and then the branch will grow in that direction. Thus, if you want the branch to grow to the right, leave the end bud pointing to the right. Do not leave the end bud on top because the new branch will grow straight up. Trim a little past the bud, being careful not to damage it. Many trees will “bud back” after they are trimmed. This means they will sprout branches from older wood. These dormant buds are suppressed, however, by hormones called auxins produced in the growing tip of the branch. When you cut off the end of a branch, you remove these hormones; and the buds on the rest of the branch will be more likely to sprout. For best results, let the tip grow out for five or more leaves and then cut it off. If you already have enough branches and just want to keep the shape you have, simply pinch off the tips of the branches or the unwanted buds whenever they arise. However, do not remove all the new growth. On junipers and similar trees, do not pinch off the buds on the growing tips of the branchlets. This might kill the branch. Rather, cut out selected branches to keep the shape.

Wiring is the process of wrapping wire around the trunk or branches to bend the wood and have it stay there after it grows. Wiring modifies the shape of the tree, but it does not dwarf the tree.

Use annealed copper wire or copper colored aluminum wire, which can be purchased through bonsai vendors. Aluminum is often used on deciduous trees and azaleas, and copper on evergreens, especially if you are showing the tree. Basic wiring rules follow; but it would be best to read more in a good bonsai book and to practice wiring and bending branches on woody branches and twigs freshly cut from yard trees.

If you use copper wire, it should be about 1/3 the diameter of the branch. For the same strength, aluminum wire must be thicker than copper. The wire should be as long as the branches to be wired, plus 1/3 extra. Wire the trunk first, if necessary, then the larger branches, then the smaller. As you wire smaller branches, use smaller wire. The wire must be anchored. To do so, wrap the wire around the trunk or a larger branch at least two times. When wiring the trunk, first shove the wire into the soil to anchor it. When wiring branches, first wire the longest part of a branch and anchor it on the trunk or a large branch. Then work backwards. Anchor the wire on the branch you just wired, beyond the secondary branch closest to the trunk. Then wire that branch to its tip. With the other end of the wire, you can wire other parts of the branch you anchored on. Always work from the inside of the branch to the outside, anchoring on a branch you have already wired with a heavier wire, and wiring two branches if you can. Wire the two branches in opposite directions. If one is going clockwise, the other goes counter-clockwise. Any anchoring should be at least two turns around a sturdy branch or a wired branch. Do not wire two branches directly across from one another, because when you bend one branch you will bend or break the other. The loops of wire should be at about a 60 degree angle to the branch and should be evenly spaced. Try not to put more than three wires on the same branch. The wire should barely touch the branch but not press into it. As you are wrapping, hold the anchor or the part of the branch you have just wired to stabilize it, and do not use the branch as a fulcrum to bend the wire. Practice bending the wire around your finger, not pulling it against your finger. Only wrap woody branches, not green sprouts; and do not wire over leaves or needles. Do not cross wires; this takes some planning when you are anchoring wires to branches that are already wired. Wire should be applied so that when you move the branch into place the wire gets tighter instead of getting looser and creating gaps. Thus, you should wire the branch so that a loop of wire is on the outside of the planned bend. If you are lowering a branch, the first part of the wire where it touches the branch should be on top. If raising the branch, the wire should start underneath. If you want to twist a branch, make the wire spiral in the same direction as the twist so that it will get tighter when you twist.

After the wire is applied, move the branch into place. Do this by supporting both sides of the bend and then bending the wire. Use thumb pressure to stabilize the branch. Decide ahead of time where you want the branch, put it there and leave it. Do not bend it back and forth because you might damage the cambium layer all around and kill the branch. After you wire the tree, water it and protect it by keeping it out of the wind and direct sun for a couple days. Wiring may be done just about any time, but it is probably best to avoid wiring when the new leaf or flower buds are opening because it is easy to damage them. Also, do not wire if the tree isn't healthy because bending the branches will increase the stress to the tree. If you wire a tree in the fall, protect it from freezing in the winter. Wiring and bending branches causes stress that can kill the branch or the whole tree if it freezes before it heals. It's not the wire that kills the branch, it's the

fact that the tree is not moving water and nutrients around when it's frozen. Don't wire or otherwise work on a tree that is frozen.

Repotting

When should you repot? Generally, trees should be repotted in the spring. This includes taking plants from nursery pots and from the ground, as well as repotting in bonsai pots. Root pruning and then repotting in the same size pot will give the roots room to grow. Only new roots absorb water and nutrients; so when the roots have filled the pot, you have to prune out some of the old roots to make room for new growth. Young trees should be repotted once every year or two and older bonsai every three or four years, but this is flexible, depending on the type of tree, the root growth and the soil condition. Bonsai need repotting if the drainage is slow. This means there is not enough air space in the soil and the soil structure needs to be renewed. The air spaces may be filled with growing roots or from organic material from weed roots, fertilizer, dead tree roots, or from breakdown of organic materials in the soil(bark), etc. If it's not draining the air spaces are filled with water.

Trees that seem to be declining and growing too slowly may be invigorated by replenishing their soil. Repot deciduous trees in the early spring when buds start to swell but before leaves start to unfold. This indicates the tree is waking up and new roots will also be stimulated to grow. Before the leaves unfold, they won't lose water; as a result, the tree will not dry out when you disturb the roots. Repot conifers after deciduous trees, but still in the spring (before the end of May or earlier). Some hardy plants can be potted in June. Flowering plants, like azaleas should also be repotted in the spring. They should be allowed to flower until the flowers fade, and then should have their flowers with their seed pods removed. It is also possible to repot azaleas right after they bloom (usually near the end of May to mid June). If you cannot repot at the right time, wait until the following year, unless it's an emergency.

Soil Components

There is a confusing array of suggestions for the soil composition to use for bonsai. You can narrow this down quite a bit by considering what is going on in the soil that affects the bonsai. The roots need basically three things: water, oxygen and minerals. **Water** – the tree needs to transport water from the roots to the leaves. Water, carbon dioxide in the air and sunlight is what makes carbohydrates. This is the plant's food. The water that is absorbed is mainly from water vapor around the roots. Thus the soil has to hold water and release it continuously between waterings. **Oxygen** – Trees actually breathe or respire. That means they use oxygen for some of their functions, and they get it through the roots rather than from the top of the tree. There has to be oxygenated air around the roots. Between waterings the oxygen level in the air around the roots decreases as it's used. When you water you sort of push all the air out of the soil, and as the water drains out fresh air is sucked into the soil, and a higher level of oxygen is available to the roots. This means the soil has to have a lot of good air spaces where the oxygenated air will mix with water vapor and get used properly by the tree. **Minerals** – Trees use many chemicals which combine with the carbohydrates made by photosynthesis to produce complex organic

molecules. Many of these are proteins, which use a lot of nitrogen. Nitrogen is also used in chlorophyll and DNA. Proteins and other molecules (enzymes, hormones, etc.) use potassium, phosphorus, calcium, magnesium, sulphur and micronutrients including boron (B), zinc (Zn), manganese (Mn), iron (Fe), copper (Cu), molybdenum (Mo) and chlorine (Cl). In bonsai soil these minerals come from fertilizer or from organic material in the soil that can be broken down by soil bacteria to release the minerals. Some nitrogen comes from the air. The minerals that can be absorbed by the roots are usually ionized, which means they have a positive or negative charge, such as Nitrate (NO_3^-). In soils that do not have organic materials (such as bark), these ions can be held and exchanged by materials such as clay.

From the above you can see that the soil needs to have components that;

1. hold water,
2. maintain air spaces and provide drainage to replenish the air, and
3. hold and exchange chemical ions (cation exchange).

A good way to do these things is to use volcanic materials. Pumice holds a lot of water and releases it slowly. Lava rock sheds the water and maintains air spaces, and hard akadama clay provides some cation exchange. This is one of the best modern combinations. It can be mixed in equal parts for most trees. Some people use more akadama for deciduous trees. Akadama also holds and releases water, and the roots can grow into it.

Another mix is to use something that holds water and provides drainage and air spaces along with organic material that can provide cation exchange and be broken down for nutrients. Examples are Haydite and bark or pumice and bark. The hadite must be large enough to maintain air spaces. It holds water, but not as much as pumice. The organic material should be aged pine bark. It breaks down more slowly than other organic materials such as compost. It should be sifted before adding it to the soil mix to remove the fine particles that would block drainage. As the bark breaks down it will eventually block the drainage. You need to repot before this happens.

Other things can be used for soil components, but many have drawbacks. Turface is a clay product that used to be good when it was ¼ inch size, but now it is only made in a very fine size that blocks drainage and is very hard to get wet when it dries. Don't use it. Peat moss is useless for bonsai pots, as is potting soil which is hard to keep proper moisture content and air spaces. Perlite provides good cation exchange but it's too light to provide proper structure. It's good for cuttings.

Soil size. Bonsai in pots bigger than 5" should have medium size soil. Medium size pumice is 3/16"-3/8". Brown lava is a little bigger. The akadama comes a little smaller and tends to break down into smaller pieces and dust. With volcanic soil you can sift everything, but alternatively you can just flood the newly potted soil until the brown stuff (dust) all comes out and you're good to go. With bark, sift it first through 1/8" screen and throw away the dust. For very small pots you can use smaller soil, but it will clog up faster, as will pure akadama.

Drainage is necessary to allow space for fresh air. If the pot doesn't drain, the problem is either poor soil structure (inadequate air space and water release) or the drainage holes are clogged, or both. It is difficult or impossible to regulate your watering to compensate. Overwatering is not the problem. Rather, it's poor drainage and poor balance of air and water in the soil.

The pot should have good drainage holes, preferably two or more at least an inch in diameter, and they should be at the bottom of the pot, not perched on a hump. Bigger pots need bigger or more holes.

You can cover the holes with screen to hold the soil in, but the screen should have large enough spaces. ¼" galvanized steel hardware cloth works well, but eventually rusts. Plastic screen should have at most 7 spaces per inch. I've never found plastic screen with 4 spaces per inch, but that would be ideal. One option is called plastic burlap (for needlepoint craft). The largest I've found is 5 spaces/inch. Bark should be sifted to remove the dust, and it's best to sift through 1/8" hardware cloth. The particles larger than 3/8-1/2" or so should also be removed.

It is unnecessary and perhaps counterproductive to put a "drainage layer" of larger soil on the bottom of the pot. Larger particles actually slow the drainage. Just use one kind of soil for the whole pot in most cases.

Soil surface. Over time the surface of the soil gets mucked up. Organic material starts clogging up the soil and it won't allow water into the soil. It also blocks air exchange. The organic material may come from fragments of the tree, weed roots, dead moss, organic fertilizer, leaves, etc. Live moss on the soil is usually not a problem if the water drains through it quickly and there are clean soil particles underneath (except pines – a lot of moss may mean the soil is too wet for pines). When the surface is compacted like this, it can be scraped off. A favorite way is to scrape with a potting stick while sucking the compacted stuff up with a shop-vac. You should scrape down until you reach soil particles or "granular soil". When the muck is all scraped off, put some more soil back on the surface and make sure the pot takes water and drains well again.

POTTING

Before disturbing the tree roots, have the tree and pot ready. Select a pot with plenty of room for a tree in training, but not super large. Only use pots with drainage holes. They may be ceramic, plastic, wooden, etc. Put ¼" screen inside the pot over the holes, and secure it there with a piece of copper wire that goes through the screen in two places, out through the hole, and is bent over to hold the screen against the hole. Also put stainless steel or copper wires through the holes to tie the tree in the pot. You will later twist the ends of this wire around the root ball to hold the tree in the pot. You should probably not prune the top of the tree when you are repotting because new root growth uses auxins from the foliage tips. When the tree, the pot and the soil are ready you may work on the roots.

First potting from a nursery can. Take the tree out of the nursery container. If possible, use your fingers to loosen and spread the bottom of the root ball. If it is a very compacted and deep root ball, you may have to first cut off the bottom 1/3 to 1/2 with a knife or saw. Use a pointed stick to comb out the roots and remove the old soil, starting at the bottom outside rim of the root ball and working upward and inward. Leave the center portion of the root ball near the trunk intact without removing the soil unless it is all mud or clay that you can remove. Remove dead roots or larger roots that do not have a lot of fine roots on them. Trim the roots to fit in the pot you are going to use, leaving some space on the bottom and around the sides of the root ball.

This space varies with the first potting, but can be something like 1/3 of the distance from the side of the pot to the base of the tree.

The tree is now ready to pot. Put a layer of soil at least 1/2 inch thick in the bottom of the pot. Make a mound of soil where the trunk will be, so the tree will sit up a little bit and the roots will be aimed slightly downward from the trunk. The tree should be positioned off center and slightly behind the middle of the pot. Position the tree so it looks balanced the way you want it and so the front is facing the exact front of the pot. The exposed base of the tree should be just above the rim of the pot. Now put the wires which you threaded through the drainage holes around the root ball and twist them together. Use pliers to pull on this wire and twist until it is snug. Do not strangle the roots, just make it snug enough to hold the tree. Often two wires are used, one behind and one in front of the trunk. Cut the excess off and bend the twisted ends down into the soil. Add dry soil mixture over the roots. With a pointed chopstick, eliminate large air pockets in the soil. Do this by inserting the chopstick through the roots to the bottom of the pot and moving the top of the stick back and forth. The dry soil will flow down along the stick and fill the air pockets. Do this all around the pot, from the center outward. Mound the soil up slightly near the trunk leaving the top surface of the large roots exposed. The soil should be slightly below the rim at the edge of the pot.

Then water. With a volcanic mix, flood the soil with water until the water coming out of the holes is clear. If the new soil is partly shredded (and sifted) bark, it is perhaps best to soak the newly potted roots and soil in water to saturate the bark. After soaking for 10 minutes, take the pot out of the water bath and let it drain. Don't pack the soil. Tilt the pot to drain out some excess water.

Repotting a bonsai. It is easier to repot a tree that has already been in a bonsai pot. The root ball will be the right shape. To get the tree out of the pot, first remember to cut any wires holding it in. Then it might pop out, or you may have to cut around the inside of the pot sides with a long knife or a special bonsai tool to free up the root ball. Remove the tree and rake out the roots around the sides and bottom. For an established bonsai, don't disturb the soil right under the base of the tree. Trim the roots to fit back in the pot with some space under and around the root ball for root growth. Put a layer of soil in the pot and mound it up where the trunk will be placed. Place the tree on the mound and twist it back and forth a little to get soil distributed under the root ball. Tie it in with the wires. Fill the rest of the spaces with soil and use your chopstick to get the soil between the roots and into any large spaces. Tighten your tie-down wires and water the tree.

POTTING AFTERCARE

After potting a tree, it needs special care for two reasons. First, the fine roots growing into the new soil are very easily broken. Therefore, absolutely avoid moving the tree around in the soil. Don't touch it; don't try to work on it; don't even leave it where it might be bumped or disturbed until the roots grow and strengthen (about 2-4 weeks). Second, the tree will have trouble absorbing water until the roots recover and begin growing. In fact, after the initial soaking you should let the soil get relatively dry before the first watering to stimulate the roots to grow. The

main thing is to prevent the tree from losing too much water through transpiration. Some water is lost through evaporation from the leaf surface itself; but even more may be lost through the stomata, which are pores on the leaf surface. When these are open the tree can lose up to fifty times more water than when they are closed. What opens them? Sunlight. Therefore, after potting, keep the tree in a place that is shaded, humid and out of the wind. This will prevent much of the evaporation and transpiration so the tree will not wilt. There are two additional tips, especially if you are repotting late when there are leaves on the tree. One is to cut off most of the leaves so the tree won't lose water. This can be risky, however. The other method is to spray the leaves, top and bottom, with Wilt-Pruf, a waxy substance that prevents evaporation. This is probably safe for most trees. As mentioned before, it is better for deciduous trees to be potted before the leaves unfold in the spring, so they won't lose much water.

WATERING

All trees should be checked at least daily. They may need more frequent watering if:

1. The soil drains very well and therefore holds less water;
2. The pot is small or shallow;
3. The weather is hot, dry or windy
4. The plant uses a lot of water because of large leaves or stomata that transpire heavily, or because it is in the sun or wind.

The soil should be watered when the top layer is getting dry just under the surface. Until you are familiar with your plants, you may have to scratch through the top layer with your finger to see if the soil is moist underneath. Often, even if the surface appears dry, the pot will have plenty of water, especially if it is large or the soil is heavy. First wet the surface so it will take water; then go back and water thoroughly. Water until it starts coming out through the drainage holes. Excess watering will wash out the fertilizer faster, however. As long as the soil drains well, it is hard to “over-water”. If you have good soil with air spaces and water holding capacity, and if the pot drains well, you can usually just water once a day and not worry about over-watering. If the water just sits in the pot, the problem is the soil, not your watering technique. With bad soil, you will have a nightmare trying to guess how much water to give and if or when to withhold it. For most trees, you can spray the foliage on top and underneath in addition to watering the soil. This will unclog the stomata and discourage some pests. One easy way to water with a hose is to attach a bonsai nozzle (e.g. Masakuni, from bonsai vendors) to a brass shut-off valve or a plastic sprayer pistol to turn the water on and off. Water in the morning or early evening if you can. Do not water leaves late at night because they may not dry out and this will encourage fungus. Drip irrigation may be used, but hand watering encourages you to inspect each tree every day and is superior.

SUNLIGHT

It is best to place the bonsai so they get at least morning sun. Most evergreens, especially pines, need as many hours of direct sun as possible (in our climate.) Most other plants do well with morning sun through mid-afternoon. Some trees prefer light shade most of the day. These are thin leaf plants such as maples and plants that usually grow on the forest floor such as azaleas. Trees that get a lot of sun will produce more compact growth with shorter internodes and smaller foliage. If the plant is not getting enough sun, it will reach for it with longer internodes and gangly growth. It will also produce larger leaves to increase its sun exposure. Therefore, a balance should be reached so the plant gets enough sun for good bonsai proportions without burning the leaves. If you can, you may rotate the plants frequently (1/4 turn once a week) so each side gets the same amount of sun. Also make sure the trees are not so close together that they shade each other.

FERTILIZER

Like soil mixture, fertilizer application is controversial. Bonsai usually do well with fertilizing regularly from late spring to fall. Don't fertilize in the early spring because it will encourage long internodes and large leaves. Trees need the three basic components of fertilizer: nitrogen, phosphorous and potassium. In addition, they need minor nutrients and trace elements such as calcium, iron, magnesium, etc. There are two basic kinds of fertilizer, chemical and organic. Chemical fertilizers have the three basic elements in percentages indicated by three numbers, such as "12-8-8." They may also contain trace elements in varying amounts. Chemical fertilizers are available to the roots immediately when you water with a solution of the dissolved fertilizer. Some common chemical fertilizers are Peters (Jack's) 20-20-20, Miracid, Miracle Grow and Rapid-Gro. Water the soil with this mixture about once every two weeks during the growing season. As mentioned above, fertilizing is controversial; and there are many other schedules which may be used.

As an alternative to chemical fertilizers, you can use organic fertilizers which may be a liquid such as fish emulsion or may be slow-release fertilizers such as Biogold. These fertilizers release organic compounds into the soil gradually when you water. Some of these compounds are converted into ions or chemicals that the roots can use. This is done by microorganisms in the soil. You can make your own organic fertilizer cake mixtures from things such as rapeseed cake, bone meal, blood meal, cottonseed meal, fish emulsion, etc. Slow release fertilizers are placed on the soil surface and watered through, so the soil gets a small dose with each watering. I have recently been using Osmocote Plus (slow release pellets) for young trees that I want to grow like crazy, Gro-Power (12-8-8 slow release organic pellets) for intermediate trees and Biogold (about 5-3-3 organic nuggets) for finished trees that I want to maintain the current size and shape. Do not fertilize in the winter, just before repotting, for a month after repotting, or if the tree is sick. Trees almost never get sick from lack of fertilizer. If a tree wilts, turns yellow, drops leaves, etc., look for another cause rather than reaching for the fertilizer. You will only make a sick tree worse by fertilizing.

DISEASES AND PESTS

The most common diseases to attack bonsai are insects and fungus. Rarely they can be attacked by bacteria or viruses. Insects come in many varieties, most commonly, aphids, fly larvae, caterpillars, mites and scale insects. Aphids can often be washed off with a stream of water; and caterpillars are merely removed by hand (use gloves- they sting). Mites are discouraged by washing the foliage when watering the tree. Scale insects may be scraped from the leaves or needles. Insecticides will work for most pests but may be toxic to some trees. If you use insecticides, mix them as directed and spray the foliage with a spray bottle. Wear plastic gloves, glasses and perhaps a respirator when working with toxic chemicals, spray outside, and do not inhale or ingest the spray. Mix only what you need so you don't have to dump excess chemicals in the drain. There are many insecticides to choose from, but always try to use the least toxic one you can. Aphids can often be controlled with a soap based insecticide such as Safer soap. Malathion is a systemic insecticide that works on most insects that are on the plant. For scale insects you can use a Horticultural Oil mixed in water. This is a very refined petroleum oil (not the old dormant oil or Neem oil) that kills almost any pest that is present on the tree when you spray. It is relatively non-toxic, but should not be inhaled. On junipers or other trees with a bluish color, it may turn the foliage bright green. Sevin is very useful to prevent damage from Japanese beetles on any thin leafed plants. It is also useful for preventing Lace bug damage on azaleas. It should be used when you see the first Japanese beetle on things like elms and crabapples, and right after you remove the flowers from azaleas. It is not systemic and it may wash off in the rain, so spray it again after a rain. Pyrethrins (meant for spraying on vegetables) are very safe and work well on aphids, some scale and other insects. By the way, don't spray any insecticides on plants with flowers. This can kill bees. In general, avoid the toxic chemicals if you can because they may contribute to causing cancer or other diseases, as well as killing beneficial insects. Keep all chemicals in a locked cabinet away from children.

Fungus can attack the foliage or roots of a tree. It is discouraged by letting the foliage dry after watering (by not watering too late at night) and not over watering the tree if it's not draining well. Good drainage helps prevent root-rot. Fungus can be treated with various fungicides. My favorite is Cleary's 3333F, but you may want to try a more economical one first. Important practices are close inspection of the trees when watering and maintaining the tree's general health with proper soil, sunlight, fertilizer, watering and air circulation. If you have a sick tree and do not know what's wrong, it's best to ask an experienced bonsaist or nurseryman for advice rather than spraying chemicals indiscriminately.

WINTER CARE

Most of the bonsai we have are outdoor plants. They require a change of seasons and must go dormant in the winter. For this reason bonsai should not be kept at room temperature during the winter, unless it is a tropical tree, such as ficus. On the other hand, when a bonsai is outside in the winter it might die or lose branches when it is frozen. The main danger is having foliage that

is trying to grow and is therefore losing water, while the roots are frozen and unable to supply water. This can happen in the early spring or when the weather suddenly turns from very cold to warm. In this case, the roots will still be frozen solid, but the top of the tree may warm up and transpire (lose water). While it is alright for the roots of most hardy trees to freeze, you should prevent rapid swings of temperature that can damage the tree or kill it. Be particularly careful in the early spring. Ideally, if you have a room or a cold frame you can keep between 33-40 degrees all winter, the trees can be stored there. The roots will not freeze, but the tree will still go dormant. If you do keep the trees above freezing, however, you must be careful to check them and water them when needed.

More commonly, people use storage rooms or areas that freeze, such as unheated structures (a dirt floor is best) or special plastic shelters (poly house). This protection from wind and weather will keep the minimum temperature slightly higher and moderate the swings in temperature. In addition, shelter prevents some water loss from the foliage while the pot is frozen. This is done by keeping the light low, preventing wind and providing a moist atmosphere. In general, dormant trees in pots should be kept out of the direct sun and wind. Alternately, some people plant the tree, pot and all, in the ground and mulch over it. This may be combined with a poly house or other protection of the tree against wind, snow and breakage. In the spring, gradually move the trees into the sun by taking them out on moderate days (if the roots are not frozen) for a few hours each day, then increase the time in the sun and weather. Once the buds begin to open, protect the tiny thin new leaves from freezing. People have found many different solutions to the winter problem. You can start making plans in the summer or fall for how you will protect your plants, then go over your plans or options with an experienced bonsaist. This is one area in which it is best to have an experienced opinion to give your trees the best chance of breaking bud in the spring.

PINCHING PINES

There are several kinds of pines that we use for Bonsai in our area. There is often confusion about what to do with different kinds of pines, especially about pinching or cutting candles in the spring. This is a basic section on a few kinds of pines.

Pines are commonly divided into two kinds – single flush and double flush. This refers to whether the pines will put out a second complete growth of candles and needles if the first growth is removed. For instance, Japanese black pine naturally grows on the windy coastline, and they often have their first flush of tender growth ripped off by storms and wind. They have evolved to survive by budding a second time. Other pines, such as Japanese white pines, grow in forests or mountains where this doesn't happen, so they have evolved to put out one flush of growth.

Japanese Black Pines. A Japanese bonsai master, Saichi Suzuki, developed a new trick for black pines in the 1930s. He discovered that if you remove the entire first flush of foliage, the trees will put out a second growth with smaller candles and shorter needles than the first flush

would have. This, of course, can be very useful if you want the foliage to be in better proportion to a small tree. First, fertilize the tree heavily in the spring, then stop fertilizing in the middle of May or 3-4 weeks before you decandle. When the first growth of candles have extended fully and the needles have opened, around June 10th-15th, remove all of the new candles right down to the base of each candle. Cut all the candles at the same time. The tree will then put out many new buds over the next month or two. Don't pinch them, just let them bud out. The shoots will be smaller than the first growth, and there will be many new shoots at each branch tip. When these candles have stopped elongating and the needles have opened and hardened off, it's time for the next stage. Start fertilizing again. Remove unnecessary buds. In general, leave two healthy shoots on the end of each branch, growing laterally and at about a 45° angle to one another. You will also see that the tree may be more vigorous in some parts and weak in others. You can balance this by removing some of the foliage, including old needles and perhaps shoots in the strong areas. The top of the tree is generally the strongest area. You can reduce the needles from 5-10 inches long down to 1/2 inch. If you have a very small tree and you want the shortest needles possible decandle late, e.g., June 15-25 and leave multiple shoots on until they harden off. For a larger tree, in order to get secondary growth that is not that small, decandle in the earlier part of June to give the secondary growth a head start.

Japanese red pines are also double flush pines. You can treat them the same as JBP, but they are not as vigorous. You probably should decandle earlier, and be a little more liberal with the fertilizer. You may not be able to decandle them every year unless they keep putting out a very vigorous first flush.

Japanese white pines are single flush pines. When they're in a pot, many or most of the candles don't get too long. You only need to remove the ends of the candles that are getting too long. Depending on how much growth you want, pinch the long candles (before the needles come out) down to about ¾ inch. They will elongate at different times, so you may have to pinch a few every day in May or June. Do not remove the whole candle, because that branch won't bud again, and it may kill the branch.

Scots Pines are single flush pines. When they are newly potted or if they are in the ground or a large pot, they usually put out long (3-6 inch or more) candles all over the tree. When the candles are still tight, you can pinch them to whatever length you want. The candles are soft before they open and can be snapped off with the fingers easily. You can pinch them all at the same time, and make them all about the same length, somewhere around an inch long. You may find that you'll have to pinch them again in a couple weeks. Then just let them grow. What you leave will become the end branches, and they will form one or more buds on the ends for next year. In the late summer you can trim the tree. Remove extra shoots and leave two on each

branch. You can balance the tree and cut it back by cutting branches back to buds. The buds you leave will grow out next year. You will find that Scots pine needles and buds will get smaller and smaller the longer they are in a pot. Eventually you may not have to pinch the candles.

Other pines will not necessarily respond like the ones above. You can probably pinch extra long candles, but they might not bud at the ends. You can usually just trim them back to inside shoots, but make sure to leave branches that have buds on them.

SUMMARY

This booklet has been presented to help beginners in Pittsburgh or similar areas get a head start in bonsai. Remember, the information presented is just one way to do things, in most cases the most common or the simplest way. All of the rules, especially about styling bonsai are just the beginning. There are many variations and refinements possible after you get some hands-on experience with the basics. There are exceptions and special treatments with some plants. Bonsai is a rewarding and relaxing hobby. Have fun