# Use Microclimates for Frost Protection

*by Joel Glanzberg and Ben Haggard*

High elevation deserts have the distinction of being hard places to live, both because they are dry and because they are cold. They have many of the same problems as other desert regions—alkalinity, prolonged periods of drought, and severe wind and water erosion. But, in the high desert, specific solutions to these problems may require special adaptations to accommodate low temperatures.

Here, species selection is not only limited by water needs, but also by cold temperatures. Frost and a short growing season are primary causes of frustration among gardeners in our region (northern New Mexico).

Cold can damage plants in several ways. Very cold temperatures will simply kill frost-intolerant plants. For example, mesquites and figs cannot survive the winter lows of the higher elevations. Other plants can survive the winter lows, but are damaged by freezing temperatures during the early growing season. Typically, an extended period of warm weather in the spring is followed by a hard frost which nips the blossoms or immature fruit of trees such as almonds or peaches. In our area, we are lucky to get fruit set on orchard crops in one year out of three. Similarly, late frosts can badly damage the new spring growth of root-hardy plants such as "hardy kiwis".

Plants which are normally killed by frost, as well as long-season annuals, should be grown in the warmest of microclimates. The best site for these plants is on a south-facing slope, with a large thermal mass immediately to the north to increase heat retention. The site should be more than halfway up the slope to be out of the frost pocket. (See Issue #8 for an explanation of the characteristic movement of cold air in relation to landform.)

Protection from the open night sky—whether overhanging roofs or trees, or the surrounding walls of a courtyard or forest—is helpful too. This is because heat absorbed during the day is radiated to the open sky at night. Reducing exposure to the night sky cuts down on this heat loss.

Black rocks, a wall, or a building can serve as thermal mass. Also, plant materials, particularly trees, can function as thermal mass to the north of the site. Think of trees as standing columns of water. They absorb solar heat during the day, and radiate it at night. Evergreen trees work best because their dark foliage absorbs more heat. However, deciduous trees which hold their leaves until late in the season also work well. The Russian olive *(Eleagnus angustifolia)* is an example; it has the additional benefit of fixing nitrogen in the soil.

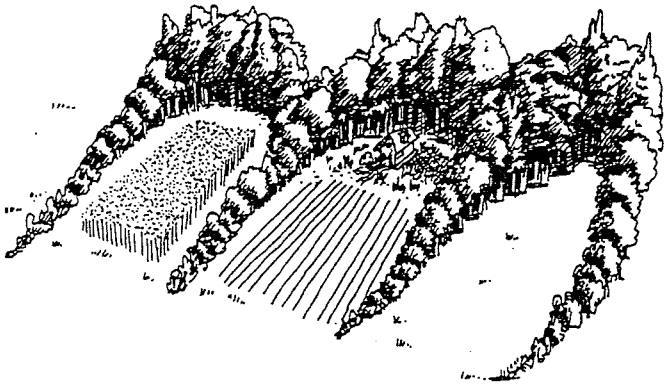
Warm microclimates can be created with plant covers, cloches, Wall 'o Waters, or other large or small greenhouse structures. But creating microclimate in this way is expensive, and requires products that consume energy in their production. These techniques should be reserved for plants far out of their normal range whose value and desirability justify the cost of such measures.

Plants like peaches, almonds, and hardy kiwis, which will bloom or leaf out in early warm spells, require a different approach. Warm microclimates may protect them from some frosts and freezes, but they will bloom and leaf out very early and be more susceptible to damage from late frosts. A better strategy is to keep these plants dormant for as long as possible, while providing good frost protection when they do bloom.

The microclimate formed by the east side of a building can satisfy both needs. Many old apricot trees in northern New Mexico are found on the east side of homes, where they are shaded from sun during the warmest part of the day, delaying bud break. Yet, the building limits heat radiation to the night sky and acts as a thermal mass, enhancing frost protection at night. The north side of a building also offers these advantages.

In nature, this type of microclimate exists at the forest edge. The tree canopy limits heat radiation to the night sky, while the trees act as a huge, standing thermal mass. Many of the plants which benefit from this treatment were originally native to forest edges, and can be introduced to these sites in existing forests.

Good varietal selection and planting practices can also contribute to assuring a fruit crop. Choose varieties with long



*An arc of evergreen trees open to the south creates a huge standing thermal mass and an abundance of microclimate for different plant needs.* *Illustration from* **Permaculture: A Designer's Manual.**

chilling hour requirements to avoid early blooming. And consider planting trees with large rocks among the roots, a custom still talked about by old-timers in this area. This keeps the roots cold, which promotes late blooming.

Every aspect of buildings, walls, water tanks, rocks, etc. can provide favorable microclimates for plants. The south and west sides are good for late bloomers, long-season annuals,

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and plants which are not root hardy. The east and north sides are good for winter hardy early bloomers. All sides provide night sky protection, temperature moderating thermal mass, trellis space for vines, and, in most cases, dew and rainwater harvesting possibilities.

Consider the courtyard oasis, brimming with bearing plants. Tomatoes, eggplants, and jujubes grow outside the courtyard against the south wall. Grapes climb up this south wall and shade it from the summer heat. Inside the courtyard, hardy figs droop from the south-facing wall, while peaches, almonds, and apricots ripen in the mid-garden. Hardy kiwis climb up the north-facing wall, their heads in the sun, their roots in the cool, moist earth.

The cold temperatures of the high desert present a challenge to the permaculture designer. Since one of our goals is to increase the diversity of plant life around us, we must design to extend the range of plants in fall, winter, and spring. Recognizing and taking advantage of existing microclimates, and deliberately creating microclimates for specific purposes, are important parts of that task.

The ideal tree for the high desert is drought tolerant, alkali tolerant, late blooming, and early ripening. *Zizyphus jujube* (Chinese date) comes close to this ideal. Like many good trees for the high desert, it is native to North Asia where it is as prized as apples are in the West. It is drought and alkali tolerant, and early blooming, but its fruit cannot always ripen above Zone 5. Its fruit is edible fresh and dried, and is a highly prized Oriental medicinal.

Its small defect of ripening late is much easier to deal with than the early blooming of the almond, peach and apricot. Like other non-hardy plants, it can be grown in very warm microclimates. It will never be fooled into blooming early, and can use the extra heat to ripen its fruit. South-facing walls are ideal.

—Joel Glanzberg