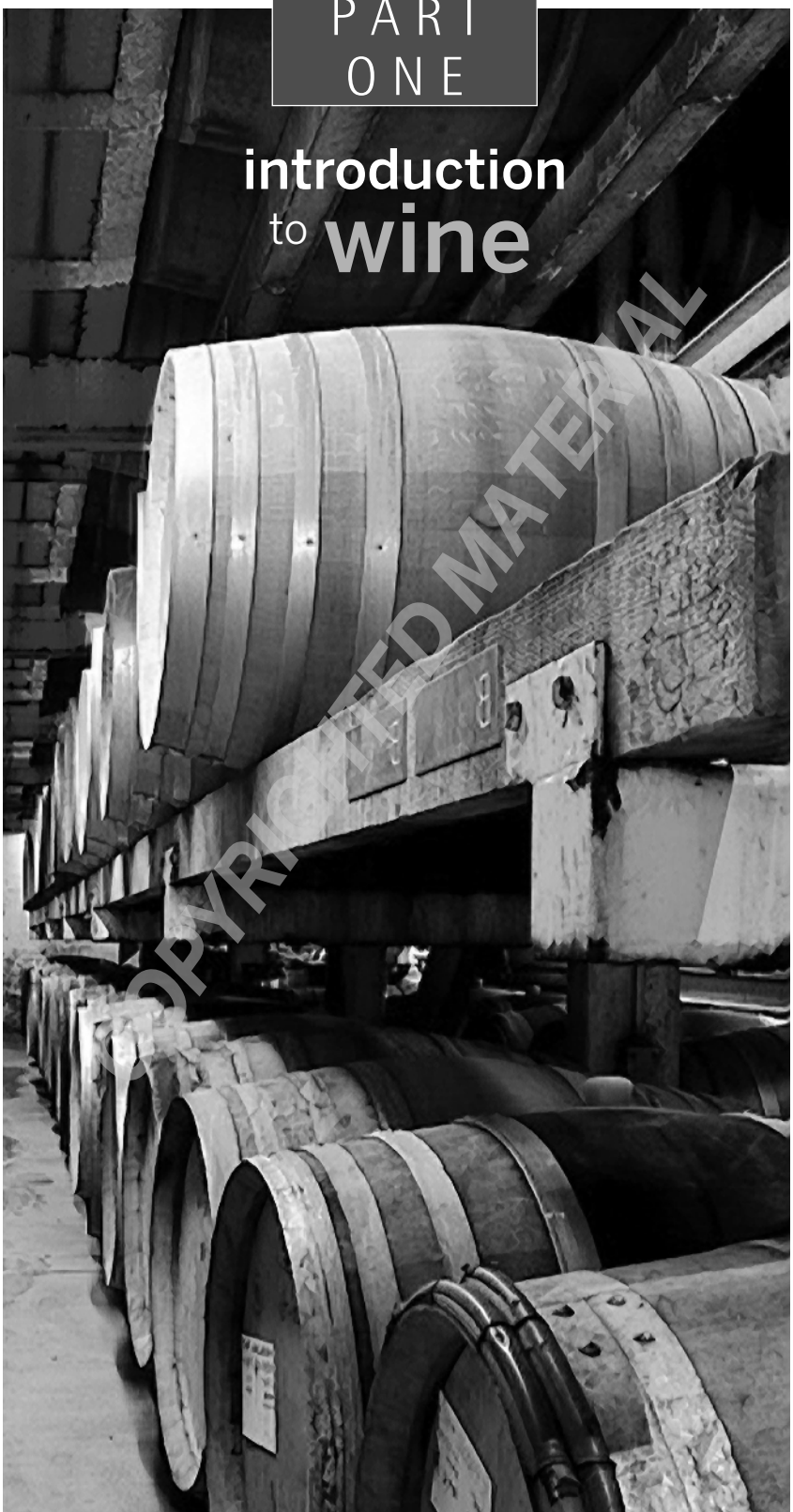
PART ONE

introduction to wine



While wine is simply the fermented juice of grapes, it has gained a place in our psyche as a religious or status symbol. All wine is the same, yet all wines are different. This section expands on the methods of growing grapes and making wine and why all wines do not taste the same. Other basic principles of storage, service, and the interaction of wine with food are also expanded upon, as well as the recent interest in wine's benefits for improving health.

chapter 1

What Makes Wines Taste Different?

Wine is a unique agricultural product. What other food product has aisles upon aisles in stores devoted to it, with so many different varieties and different producers? How can two bottles, labeled with the same grape and from the same region, taste so different? How do you tell the difference or try to decipher what is inside the bottle?

Many factors cause wines to taste different from one another. The most obvious and the most important variable is grape variety. Beside grape variety, grape quality and flavor are affected by the climate, the type of soil, and the agricultural practices (called viticulture) used for growing and harvesting grapes. The wine making process also creates distinctions between wines. All of these factors influence the quality and flavor of the final wine.

Upon completion of this chapter, the student should be able to:

Explain the botanical background of grape varieties
Discuss the life cycle of the vine
Describe when and how to harvest grapes
Discuss the types of climate and their influence on grape growing
Explain how topography influences grape growing
Discuss the influence of soil on grape growing

The Grape

Grape plants are part of the family of vining plants Ampelidaceae (or Vitaceae in some references) in the genus Vitis (grape). Within the genus Vitis are many species of grapes that developed around the world, including vinifera, labrusca, rotundafolia, and amurensis, to name a few. While wine can be made from any of these species, *Vitis vinifera* produces the majority of wine as consumers know it. Within vinifera there are several thousand subspecies, called varieties or varietals, which have individual characteristics. Just as a Granny Smith apple differs from a Red Delicious apple, so it is with grape varietals.

Each grape species evolved as woodland vines, climbing trees to reach the sun, and producing tasty, easily pickable fruit that enticed birds to transport the seeds. Depending on the conditions of the area, some vines mutated to better adapt to their surroundings. These mutations led to the differentiation of the grape varieties. As different varieties cross-pollinated, new varieties were created. Vines also propagated via layering, a process by which a vine coming in contact with the forest floor would sprout new roots. If the original branch was severed, then a new plant, identical to the first, would have been created.

NEW GRAPE VARIETIES

Modern nurseries use both the sexual and asexual propagation of grapevines to create new plants. If a nursery wants to create a new variety, it can sexually propagate new vines by physically controlling the pollination of the grape flowers. Pollinating a vinifera variety with a different vinifera variety produces a *cross.* Plant scientists often do this to create a new variety that will hopefully have certain desired characteristics from each parent. The best example of this process can be found in Germany, where many crosses between Rielsing and Sylvaner (referenced as Riesling x Sylvaner) have been created. Because each attempted cross produced a different mix of genes, each cross has different characteristics. In some cases, the cross was successful enough to be recognized as a new varietal, like Muller-Thurgau or Scheurebe.

If a plant scientist breeds vinifera with a different species (such as labrusca) the result is called a *hybrid*. Scientists hybridize grapes in an attempt to create a grape that has the great wine making characteristics of vinifera with the American grape plant resistance to phylloxera, mildew, and cold winters. Initial attempts resulted in poor-quality wines that tasted more like the labrusca than the vinifera (i.e., more like grape juice than wine). Further work has developed hybrids such as Vidal Blanc and Vignoles, which are commonly used for wine production in the eastern United States and Canada due to their increased cold tolerance.

GRAPE VARIATIONS

Whether it is a naturally occurring varietal, a cross, or a hybrid, variations develop within the group. Some plants may thrive better in wetter soil, some may like more sun exposure, or some may have a soil preference. A grower can take advantage of this by propagating the vines that do the best at that site. This asexual propagation produces plants called *clones.* The creation of clones is a controlled version of layering, which grapevines do naturally. Each plant is identical to the parent, so it is just as likely to thrive under the same vineyard conditions. The use of clones is not restricted to single, original sites, but is used by growers who have similar site conditions in other areas of the world. Growers looking to plant in new sites can compare the conditions of their site to those of the clone's origin. They can then order from their nursery the appropriate clone that is adapted to that environment. Not all varietals yield lots of choices. Some grape varieties (such as Pinot Noir) are more sensitive to site selection than others, and therefore yield more clones. If there are multiple clones to choose between, that choice becomes extremely important. A poor clonal selection will result in an inferior wine, while the correct clone can yield a top-quality wine.

GROWTH CYCLE

The growth cycle of the vine is very consistent from year to year. As the springtime temperature reaches about 50°F (10°C), the sap begins to rise in the branches and run through the dormant vine, and new buds begin to swell. These buds will become leaves and new *canes,* or woody stems, from which the fruit will be produced. Grapes are produced only on the new year's growth on a vine. As the temperature reaches 68°F (20°C), *inflorescence,* or flowering, occurs. The flowers are not big and showy, but rather small, typical of wind-pollinated or self-pollinated plants. When the flowers get pollinated, they begin to form berries that will become the grape cluster.

A grower is not concerned with the origin of the pollen so long as the pollination is complete. The seeds that develop will not be used to grow new plants, so their parentage is unimportant. If the weather during flowering is not calm and consistent, the vine has the potential to succumb to shatter or millerandage. *Shatter,* also called *coulure* in France, is the spontaneous dropping of flowers before they have a chance to get pollinated. This will result in a lower yield to the farmer. *Millerandage* is the incomplete pollination and development of the grape cluster. A cluster suffering from millerandage will have both seeded and seedless grapes developing side by side. These do not ripen at the same time and therefore will detrimentally affect the juice at harvest.

Grapevine inflorescence awaiting pollination.

Once pollination has occurred and the clusters have begun to form, the plant will focus on cane and leaf growth. Canes are the woody stems that will hold the developing grape clusters that year. The leaves are the engines producing the sugars that will eventually be transferred to the grapes. In midseason, a noticeable shift occurs and the ripening process, called *veraison,* begins. The beginning of color change that signals that veraison has begun. During the next four to six weeks, the grape clusters will change from small, hard green berries to plump, soft, sweet colored fruit. During this time, the sugar produced by the leaves is transferred to the fruit, the amount of acid in the fruit decreases, and the tannins begin to soften.

HARVEST

Harvest usually occurs four to six weeks after veraison begins, sometimes longer depending on the varietal. As the grapes approach harvest, several factors are analyzed to determine the optimal picking date. Foremost is sugar content, also known as *physiological ripeness.* As the grapes ripen, sugars produced by the leaves are transported to the grapes. Secondly, acid levels are monitored. While unripe, the acids in the grapes are extremely high, but as ripening progresses the acid level decreases. Acid is important in wine, so a grower is looking to balance the sugar level with the acid level. Finally, in the case of red wines, is *phenolic ripeness.* The compounds that characterize red wines, tannins, coloring compounds, and some flavor compounds are from a class of chemical substances called phenols. For some wineries, phenolic ripeness is more important than sugar/acid balance for determining harvest.

A grower, often in conjunction with a wine maker, will use a variety of methods to determine the optimal time to harvest the grapes. For many years, the indicator was taste. The grower would pick random grapes throughout the vineyard, tasting each to determine if the correct balance of flavors had been achieved for wine production. This is still the method to best determine phenolic ripeness. More scientific methods involve the use of pH meters and refractometers. A *refractometer* is a scaled prism attached to a viewing tube. By squeezing juice onto the prism and looking through the viewer, the grower can see how much sugar is in the juice by how the light is refracted. Several different scales are used to measure sugar concentration: Brix in the New World, Baumé in France, and Oechsle in Germany.

Determining Sugar Concentrations

Different scales are used to determine sugar concentration in grape juice. All are related to density—either by measuring specific gravity or concentration of dissolved solids. Below are the three main scales:

- Brix:
  - Most commonly used in North America and by scientists
  - Measures sugar concentration in solution by weight
- Baumé
  - Used in Europe and Australia
  - Measures percentage of concentration of a solution
  - Yields a direct measure of potential alcohol in juice

    °Baumé ~ % alcohol by volume after fermentation

    12.2 °Baumé juice can produce 12.2% alcohol
- Oechsle
  - Used in Germany
  - Measures specific gravity of a solution
  - Directly related to sugar content of juice

Brix and Baumé may be interconverted using:

°Brix = °Baumé * 1.8

After harvest and when the vines have fallen dormant for the winter, they are pruned to prepare the new growth for the next season. There are two main pruning methods, spur pruning and cane pruning. In spur pruning, the canes are removed and only a bud or two are left on the original trunk to form the fruiting canes next year. In cane pruning, all but one or two canes are removed, and these will bud to form the fruiting canes next year. These methods, combined with multiple types of trellising systems, control the quantity and quality of fruit produced by a vine each year. The method of pruning and training must be made when the vineyard is first planted, and will affect the method of harvest.

CONTROLLING GRAPE PRODUCTION

Why would a grape grower be interested in controlling the amount of grapes produced? Wouldn't the vintners want to produce as much as possible, in order to maximize the money they could make? Yes and no. One more factor comes into play when growing grapes, and that is the quality of the grapes produced. In most cases, quality is inversely proportional to quantity. In other words, the more grapes a vine produces, the lower in quality those grapes are. One could consider that a vine has only a set amount of energy, or quality, it can transfer to the grapes. This can be correlated to the amount of sugar the leaves produce via photosynthesis and how it is distributed amongst the grapes. The more grapes that hang on the vine, the more diluted that quality is per grape, the less energy is exerted per bunch to get those grapes ripe, or the less sugar gets placed in each berry. If a vine cannot expend enough energy to ripen a bunch, the grapes will possess vegetal flavors and will not develop the typical aromas needed for quality wine. With this in mind, some growers will conduct a "green harvest" around the time of veraison. A *green harvest* is the clipping of unripe clusters off a vine in order to decrease the yield and allow the vine to focus its energy on the remaining clusters. It is beneficial to the grower because higher-quality grapes will bring a higher price at market.

While all grapevines undergo the same cycle each year, each varietal will display unique physical characteristics. There are obvious differences like skin color (which can vary from pale green to peachy to bluish to almost black) and grape structure (skin thickness, amount of pulp, and size of pips all affect the resultant wine). Some varietals may have the potential to ripen with a lot of sugar content and little acidity, while others may retain high acidity levels. Some lose quality quickly if overcropped, while others can retain their quality at higher yields. As each grape variety is discussed in future chapters, the relationship between vine growth, grape characteristics, and wine flavor will be analyzed.

Phylloxera Vastatrix

The discussion so far has assumed that grapevines can be propagated and planted as any other plant. Unfortunately, in the majority of the wine regions of the world, that is not the case. The reason: a small root louse known as *phylloxera vastatrix*. Phylloxera is native to the eastern United States and Mississippi River Valley and has a very complicated life cycle. Phylloxera can live above ground or below ground, and does not have one distinct series of stages needed to reproduce. Because of the multiple life paths phylloxera can follow, insecticides are useless for eliminating an infestation. The form of phylloxera that destroys vines is a louse that chews on the roots of grapevines. The American vine species that are native to the eastern United States adapted over the years to form calluses around where phylloxera attacked the roots. This adaptation allowed the roots to continue transporting nutrients and water to the vine, and mitigated the damage done by phylloxera.

Initial attempts to plant vinifera in the eastern North American colonies resulted in failure. Most of the failures were blamed on mildew and mold, though the native phylloxera was more likely the culprit. In the middle of the nineteenth century, some American vines were brought to Europe. They carried with them phylloxera as a stowaway. The vitis vinifera, native to Europe, had never been exposed to phylloxera, let alone adapted to it. Instead of forming calluses on the roots, the roots became clogged as the vine tried to block the infestation. Eventually, all the roots would be useless at transporting nutrients to the vine and would die. Thus began a slow devastation of the vineyards of Europe. Several failed solutions were attempted, including flooding and spraying. Eventually the carrier was determined to be the cure. Vinifera cuttings (called scions) were grafted onto American roots (the rootstock). Thus the vineyards were able to be replanted. Much research in hybridization is focused on either developing resistance in vinifera stock or developing new rootstocks. Though is has taken many years to achieve acceptance, the majority of vineyards around the world are grafted vines planted on hybrid rootstocks.

Climate

Another key factor affecting how a wine tastes is the climate where the vineyard is located. The majority of wine growing regions in the world are located in two bands around the globe, between 30° and 50° latitudes north and south of the equator. In the Northern Hemisphere, this band covers most of Europe (southern Germany to North Africa), the United States, southern Canada, northern Mexico, and the Middle East, as well as parts of China. In the Southern Hemisphere, every landmass that falls in the band grows grapes: Australia, New Zealand, Chile, Argentina, and South Africa.

Why in these bands and not elsewhere? These are the temperate zones, with average annual temperatures between 50°F (10°C) and 68°F (20°C). For the most part, these bands also provide the vines with the 1500 hours of sunshine and 27 inches of rain they need each year. The true average temperature, plus the total amount of sunshine and the amount of rain will vary, as a band spanning 20° of latitude cannot have a consistent climate over the whole region. This band also provides a cool enough winter to allow the vines to enter dormancy and rest before the next year's growth.

Other factors affecting the local climate include proximity to water, elevation, and aspect (what direction the vineyard faces). Climate within the band can be broken down into different categories. One method is to classify areas as having maritime, continental, or Mediterranean climates.

MARITIME CLIMATE

A maritime climate occurs in areas within the sphere of influence of an ocean. More specifically, wine regions with the most significant maritime climate are influenced by weather patterns crossing from ocean to land, rather than the other way around. The rain and wind patterns originate over the ocean, and then influence vineyards as they make landfall. Typically, the weather conditions are moderated for the region, with mild winters and warm summers. Water takes longer to heat and longer to release that heat back to the atmosphere. During the summer, a maritime climate is cooler because the ocean is absorbing some of the sun's energy. In winter, that energy is released, making the surrounding area a little warmer than it would be typically. The amount of rainfall may be influenced, depending on the location. An increase in humidity is common due to the proximity to large bodies of water. As a result of the increased humidity, grapes grown in maritime climates often have mold, mildew, and rot issues. Examples of regions with a maritime climate are parts of California, Bordeaux, and parts of Spain and Portugal.

CONTINENTAL CLIMATE

Continental climates have no significant ocean influence, and are subject to the weather patterns as they cross the continent. They are characterized by four distinct seasons. Winter is typically bitterly cold, spring is warm and calm with some rain, summers are hot, and fall is best for the grapes if it is long and protracted. Grapevines growing in continental climates will be affected by frost in the spring (and sometimes fall), hail in the summer, and early rainfall in autumn. , If the winter is extremely cold, vines may be subjected to *winterkill,* or the death of the vine due to freezing. Conversely, hot summers may force the vines to shut down until the temperatures get cooler.

On a daily basis, during the growing season, there will be large fluctuations from the daytime high temperature to the nighttime low temperature. This is called *diurnal variation*. Diurnal variation mimics the weather of a cooler region and allows for a vine to ripen its grapes while still retaining acidity that may normally dissipate quickly, Examples of regions with a continental climate are Burgundy, most of Spain, Argentina, and Eastern Europe.

MEDITERRANEAN CLIMATE

Mediterranean climates are characterized by two apparent "seasons"—rainy and dry. Most of the rainfall occurs during the winter months, while sunlight is profuse in the summer months. There may be temperature moderation from large bodies of water, especially in the summer months. This effect is similar to that seen in a maritime climate, on a smaller scale. Also common is the diurnal variation seen in continental climates. For warmer Mediterranean regions, diurnal variation is important for properly balanced grape components. Examples of regions with a Mediterranean climate include Italy, Napa, the Jerez region of Spain, and parts of Chile.

Cool, Intermediate, and Warm Climates

A region's climate can also be categorized as cool, intermediate, or warm. This method is more directly related to the latitude of the region, and does not consider any influence from weather patterns. Bodies of water, such as lakes and rivers, or altitude may adjust a region's basic climate. This particular terminology is often used in discussing the style and flavor profile of a wine.

Scientists at the University of California-Davis developed a system known as heat summation or *degree days*. This method totals the degrees Fahrenheit above an average temperature of 50°F (10°C) between April 1 and October 31. If the average temperature on April 5 is 52°F (11°C), then 2 degrees are added to the sum. Zones are then classified based on the total number of degrees summed over the period. Zone 1 is any area whose sum is 2500 or below. The zones increase by 500 degree increments to Zone 5, at 4000 degrees or more. It is possible to assign grape varieties to a zone based how much heat the grapes need in order to ripen. This system is used mainly in California. The majority of vinifera grapes are best grown in zones 1 to 3. Zones 4 and 5 are specific to table grape and raisin production. Research is commencing on making degree days more specific to wine grape production, and looking at variations below the zone 1 designation.

Macroclimate, Microclimate, and Mesoclimate

Whether describing a region as cool or maritime, warm or Mediterranean, these descriptions classify the region's macroclimate. Two more specific terms,

mesoclimate and microclimate, have differing interpretations, depending on the source. A broad interpretation describes mesoclimate as the climate in a small geographic region, such as a village and its surrounding area. Microclimate is then the climate of a particular vineyard. This suggests that the conditions in a vineyard are uniform with no regard to aspect, slope, drainage, or other similar factors.

A narrower interpretation would state that the macroclimate referred to the village area, the mesoclimate to a particular vineyard, and the microclimate to the area contained within the leaves of a single vine. This interpretation suggests that the conditions at a vine may vary depending on location in the vineyard. It also suggests that the placement and growth of the leaves can influence the "climate" felt by the grapes. This interpretation is used in canopy management.

Canopy management is a method of leaf removal, shoot positioning, and trellising that improves the ripening and flavor of the grapes. Removal of leaves and shoot positioning allow for better air circulation in the vine (preventing mildew and mold issues) and expose the grapes to more sunlight. This aids development of flavor and color. The grower must be careful not to remove too many leaves, as this will adversely affect the amount of sugar produced and may result in sunburn or bleaching of the grapes.

If climate is the general conditions of an area, weather is what happens on a day-to-day basis. Weather can also be seen as the year-to-year variation. It is weather that creates *vintages* in wine. Every year, every growing season, is different. Some may be drier, others wetter. One year may have rain at harvest, while another has a heat wave that changes the flavor of the grapes. In some areas more than others, those annual differences are reflected by the wine in the bottle. Wine regions that are considered marginal (regions near the 50° latitude, or with challenging mesoclimates) often have large vintage variation. The most well known tracking of vintages could be in Bordeaux, where weather can determine if a vintage is considered mediocre or the crop of the century. Other regions, such as parts of Australia or Sicily, have relatively consistent weather and vintage variation is not as dramatic.

TOPOGRAPHICAL VARIATIONS

Topographical variation will also modify a region's climate, actually creating unique mesoclimates. Proximity to water is one feature that modifies the mesoclimate. Just as was seen in a maritime climate, water gains and releases heat more slowly than soil does. Therefore, vineyards near lakes or rivers may see cooler summers and warmer winters than the surrounding region. Anyone who likes to spend a day at the beach, lake, or riverfront is taking advantage of water's moderating effect. It is often cooler at the beach than it may be inland, because of the water's moderating effect. A second beneficial aspect derived from a vineyard's proximity to water

(if the vineyard is within sight of the water) is reflected light. Sunlight that falls on the water will be reflected back onto the vineyards, thereby almost doubling the amount of actual sunlight a vineyard would receive. Thus, northerly areas like Germany, which receive only 1300 hours of direct sunlight, can still ripen grapes due to the reflected light. Finally, water can moderate warm climate regions indirectly through the generation of fog. Cool water and warm, moist air combine in these regions to generate ground-level clouds, or fog. This keeps the vineyards cooler during the morning hours until the fog gets burned off.

Elevation has an effect on the mesoclimate, especially in warm regions. The average air temperature is cooler by 3.5°F (1.9°C) for every 1000-foot change in elevation. Planting grapevines at higher elevation not only cools the grapes more than if they were in the valley floor, but also provides for greater diurnal variation. This small temperature difference allows the grapes to ripen more slowly and to retain their acidity while ripening. It is altitude that allows fine wine grapes to be grown in warm regions like Argentina, Spain, and Portugal.

The aspect of a vineyard can also modify its mesoclimate. Many vineyards are planted on hillsides; among other influences, this raises the vines closer to the sun and maximizes the amount of light each vine can receive. Vines can be planted somewhat closer together, as the angle of the slope lifts each row of vines so they are not shaded by the ones below them. Vines on hillsides will be the first to feel the morning sun and the last to see the sun set, depending on which direction the hill faces. In cool climates, vines are planted on the southern- or southeast-facing slopes in order to maximize the amount of sunlight on the vines. In warmer climates, such as Tuscany, vines may be planted on the northern-facing slopes. These vines still get plenty of ambient light, but the north-facing slope is slightly cooler than those facing south, so ripening can be regulated.

Slope becomes particularly important in cool regions, because it acts as a cool air drain. Cool air is denser than warm air, so when the sun sets, the cool air on the vineyard drains to the valley floor. Meanwhile, warm air rises to the level of the vines, slightly warming them during the night. It is common to see frost in the valley regions, while the vines remain safe on the hillsides, avoiding winterkill.

Soil

The third component to wine flavor is the soil in which the grapevines grow. Some growers feel this is *the* factor in wine flavor, while others are not convinced it makes a difference at all. What can be said is that soil is very important to how the vines will grow. Vines, in general, prefer soils that are organically poor, but mineral rich. It is often said grapes grow where no other plant would flourish. The sites

for many vineyards are not conducive to highly productive agriculture. They are soils with little organic matter. They are usually, however, high in mineral content. Examples are chalk, iron-rich clays, gravel, and limestone.

In regard to soil, it is not the topsoil most growers are concerned with, but actually the subsoil and its mineral content. The next factor is the position of the water table. The optimum conditions for quality grapes would be deep, varied, mineral-rich subsoil with a deep water table. This forces the vines to send roots deep to find water, and thereby absorb minerals from the subsoil layers. It is believed that if a vine has to struggle to find water or nutrients, a type of survival mechanism activates. The vine then focuses its energy on producing seeds (i.e., grapes), in order to propagate itself on a better site. This is another way that the energy or quality in a vine can be focused on the grapes.

The ability of the soil to drain water well is extremely important. Grapevines do not like "wet feet," meaning that they do not like moist soils. Soils such as clay tend to be moist or heavy, because they retain a fair amount of water. Other soils, like chalk, can hold just enough water to be a humidifier for the vineyard without being too wet for the roots. Each varietal's tolerance for moist, or heavy, soils is different. In future chapters, the soil preference of each varietal will be discussed.

One additional characteristic for some soils is their ability to retain heat and release it back to the atmosphere at night. This follows the same principle as seen in water absorbing and releasing heat, except on a much shorter time scale. Typically, the soil will absorb the sun's energy during the day, and release it back to the atmosphere at night. Vines in cool regions may be trained low to the ground in an attempt to benefit from the heat radiation from the soil. This is seen especially in the galets of Chateauneuf-du-Pape. Galets (sometimes called pudding stones) are large river rocks, some the size of cantaloupes, which cover the ground in this French wine region. The rocks also serve as mulch for the soil, regulating the rate at which the soil dries out after rainfall.

The French have a term that sums up what makes wines taste different: *terroir*. Terroir has been defined by wine writer Matt Kramer as "somewhereness." It is the sense that the soil, the light, the amount of rain, the grapes planted in the next row, the aspect of the slope, the minerals—everything, including the winemaker—contributes to having only that wine able to come from that place. It is the backbone of European wine laws. Many New World winemakers contest there is no such thing as terroir, or that it is not important. They focus more on the expression of the grape itself: its flavor characteristics and how the vintner will express those characteristics in the bottle. In many cases, the specificity of place can be overridden by using grapes from many different areas, or by what could be the most important factor in a wine's flavor—the wine making process itself.

Harvest

Harvest is a very important time in the wine making process. Many factors go into determining the harvest date, and method. Earlier in the chapter, ripeness was discussed, in terms of both sugar and phenols. One corollary to sugar ripeness is acidity. In most fruits, as the sugar level increases, the natural acidity decreases. For wine, it is often not enough to make sure the sugar levels are high enough, but also that the acid levels have not dropped too low. The ratio of sugar to acid changes constantly, so the grapes are continually monitored. Should either the sugar level not be high enough, or the acidity too low, these will have to be treated in the winery.

Weather plays a part in determining harvest as well. The best weather for harvest is a long, warm autumn, which allows the grapes to develop flavor and ripeness slowly. However, that may not be an option if the weather turns bad. Grape growers will forgo perfect ripeness if a rainstorm is imminent. Excess water around harvest will be absorbed by the vine roots, and transported to the grapes. This dilutes the flavors and aromas the grower has struggled so hard to produce. Too much rain will also make the fields muddy—an inconvenience for pickers and an impossibility for machines.

HARVESTING BY HAND

Once the determination to harvest has been made, the grapes need to get from the vine to the winery. This can be a very minor step, or one of seemingly epic proportions. A grower will have decided long before the grapes are planted how they will be harvested. The choice is between hand harvesting and mechanical harvesting. Each has its pros and cons. Hand harvesting allows for individual inspection of each grape cluster, so only the best clusters, partial clusters, or even single grapes are picked. Most grapes are picked in whole clusters, which may or may not be desired for the fermentation process. The grapes are handled delicately, often in small baskets. This keeps the grapes from bruising, and prevents premature *oxidation* (browning of the grapes or juice) or loss of juice. There is also less extraneous stuff (leaves, bugs, stems, and the like) that get mixed in with the grape clusters. The downsides to hand harvesting are labor and time. Often a vineyard will need to be canvassed multiple times (known as *tries*) to get the grapes as they ripen best. This often requires many laborers, often migrant workers. The more acreage that ripens at the same time, the more workers are needed to pick before the grapes get overripe. The same holds for rain. Often, if rain is imminent, everyone available is sent to pick. In warm regions, picking may occur at night, under lights, in order to keep the grapes cool before they head to the winery.

HARVESTING BY MACHINE

Mechanical harvesting does not need the intense labor of hand harvesting. One man and a tractor can harvest an entire field, even at night when the grapes are coolest. Weather, labor, and time no longer are an issue. However, mechanical harvesting is indiscriminate in what it picks. If grapes on the vine are not ripe, they will be picked at the same time as ripe clusters. The grapes are not picked as clusters; the machine shakes the vines to separate the grape berries from their cluster formation. Grapes are now collected that may be bruised or the skin burst, allowing oxidation to commence. Also, there is some accumulation of extraneous materials, mainly leaves but sometimes bugs. Fields that will be harvested mechanically need to be designed as such before the first grapes are planted. The direction of the rows, as well as which trellising systems are to be used, needs to be determined. A great deal of planning and investment is needed to benefit from mechanical harvesting.

One can make some general assumptions about whether a grower has hand-picked or used a tractor. Top-echelon wines, which need high-quality grapes, will get the hand-harvest treatment. The same can be said for hillside vineyards. Mechanical harvesting is common with bulk production, and in vineyards on flat land. This does not mean that quality wines cannot be machine harvested. While harvesting method may affect the grapes at harvest, the real influence is the care taken in handling the grapes overall.

SUMMARY

The French term *terroir* suggests that a wine should taste of a place. Looking at the factors involved in terroir, they mimic all the characteristics that make each wine individual—grape varietal, soil, climate, aspect, weather. Old World winemakers use wine to express single locations, like a Grand Cru vineyard in Burgundy, or a hillside in Germany. While New World winemakers may not believe in "terroir" in the French definition, they make wines that are very reminiscent of place. For example, it is often apparent a wine is Australian because of the jamminess of the fruit. Sun, heat, climate, and weather—many are some of the things that make a wine individual, influencing how the fruit got that way. And while in the New World there may not be overt individual differences based on place, one can definitely determine a "family resemblance."

As with any product, the result is only as good as the ingredients. How the grapes are grown is crucial to the production of wine. Grape growing depends not only on location but also on how the vines are treated in the field. Canopy management, trellising, pruning, and harvesting can all contribute to the quality of the grapes. Perfect ingredients do not guarantee perfect wine, however. That

transformation is left in the hands of the winemaker. It is ultimately the wine making process, and the person who guides it, that influences what makes its way into the bottle.

KEY TERMS

Cross
Hybrid
Clone
Vitis vinifera
Cane
Inflorescence
Shatter/coulure
Millerandage
Veraison
Physiological ripeness
Phenolic ripeness
Refractometer
Green harvest
Winterkill
Diurnal variation
Degree days
Canopy management
Vintage
Oxidation
Terroir
Trie

QUESTIONS

1. What species of grape makes quality table wines?
2. Describe the growth cycle of a vine over one year.
3. Describe the two types of ripeness in grapes

4. What is phylloxera, and why is it significant?
5. Why are grapes best grown between 30° and 50° latitude?
6. What is a maritime climate?
7. What is a continental climate?
8. Describe a Mediterranean climate.
9. What does the term *microclimate* describe?
10. How does topography influence grape growing?
11. What type of soil do grapes prefer?
12. What are the advantages and disadvantages of harvesting by hand?
13. What are the advantages and disadvantages of harvesting by machine?