Considerations and Resources for Vineyard Establishment in the Inland Pacific Northwest

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Considerations and Resources for Vineyard Establishment in the Inland Pacific Northwest

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Introduction

Vineyard establishment requires careful planning and implementation. This guide is primarily designed to address factors and critical questions that potential owners need to consider before establishing a new vineyard in eastern Washington, eastern Oregon, or western Idaho. These initial decisions regarding land suitability, vineyard purchasing, vineyard establishment, and marketing are key to the future success of a business. While predominately focused on the vineyard and grape production aspects of the industry, essential information regarding winery establishment is also included where issues for the two overlap.

This publication provides online links throughout the text to reputable information from state and national Extension programs and other local, regional, and federal organizations. If you are reading this guide on electronic media, accessing these links will take you directly to the corresponding website. If you are using this manual in hard copy form, please see the appendix for a numeric listing (corresponding to the endnotes) of website addresses that can be consulted later.

Vineyard Economics

Vineyard establishment requires significant upfront investment, and it will take years before you will see a return on this investment. So that you are reasonably prepared for such an undertaking, it is important to create a thorough and well-defined business plan.

Developing a Business Plan

To develop a business plan, know the following: (i) the average sales price for the different grape cultivars at harvest, which may vary tremendously between different viticulture areas and over time with wine production trends (see the Status of the Washington, Oregon, and Idaho Wine Industries section); (ii) how the grapes will be marketed (see the Location and Marketing section); and (iii) whether value will be added to the grapes by producing wine or if they will simply be sold to a winery or processor. Consider establishing a contractual relationship to sell grapes before purchasing vines and beginning the establishment process. Often winemakers or purchasers will determine what variety to plant based on demand. The following resources are currently available to provide guidance in developing a vineyard business plan (see also the Financing section).

Vinewise[1] is an electronic, interactive tool designed by the Washington grape and wine industry to help growers through the business and viticulture-related issues associated with vineyard establishment. It can be used as a sustainability report card because it offers a series of checklists that allows growers to determine their environmental, economic, and social sustainability (see the Eco-labeling section for additional details). Vinewise covers topics such as business plans, marketing, human resources, vineyard establishment, and crop insurance.

There are several resources available to help you assess the development costs associated with starting a vineyard in the Inland Pacific Northwest. One great resource is AgTools[2]. AgTools is an electronic, interactive tool designed to help growers understand the establishment and production costs related to wine grapes as well as other crops. The AgTools suite of programs includes AgProfit, AgLease, AgFinance, and AgPlan, which make up a free software package that allows you to assess profit and financial feasibility over a 20-year period with standard inflate rates and equipment depreciation. You can access training materials online and attend training sessions held annually by Oregon State University (OSU) Extension if assistance is needed. Contact your local county Extension office for more information. Northwest Grapes Cost-of-Production Calculators[3] provide a quick assessment of production costs, require little to no training before they can be used, and can be modified using specific production cost numbers.

Enterprise budgets[4] for wine grapes in Oregon are available from OSU Extension; Washington State University (WSU) Extension has publications regarding the economics and costs of producing juice grapes[5] and wine grapes[6]; and University of Idaho (UI) Extension has a number of publications regarding the feasibility of growing wine grapes[7]. While these publications can provide state-specific information and explanations of what types of assumptions are made in determining profitability, they are dated.

These cost-of-production calculators and budgets can also provide valuable information on what management costs may be for a vineyard. However, costs associated with labor, vineyard maintenance (e.g., pesticide use, fertilizer use, irrigation, etc.), and final production will vary based on vineyard size, location, and chosen management strategy (e.g., conventional, organic, biodynamic), and the personal investment of time versus hiring consultants and/or managers.

Status of the Washington, Oregon, and Idaho Wine Industries

The US Department of Agriculture National Agricultural Statistics Service (NASS) maintains annual production statistics for grapes, including *Vitis vinifera* wine grapes. For information regarding grape cultivars being planted and harvested, current yields, prices per ton of harvested fruit, and winery production statistics, see the annual Grape Statistics Release for Washington State[8] and Grape Statistics Release for Oregon State[9]. Be sure to read reports from prior years to better understand trends in vineyard production. University of Idaho Extension has a publication on the value of the industry[10] to the state. State industry groups, such as those listed in the Location and Marketing section of this manual, also maintain data on their members' production statistics.

While national, regional, and local production statistics are a great way to see the current status of the grape industry, the key to a successful business is to have insight as to where the industry is going in the near and long term. Consult with potential buyers and statewide associations to understand future trends in production.

Financing

Research the availability of financing before making a commitment to buy land or establish a vineyard. The programs discussed below are designed to help find alternative funding sources; however, meeting with a local banker to discuss small business loan options is essential.

Small Farms Programs

When starting a business enterprise, there is great expense in establishment. For more information on finding funding sources, see the OSU Small Farms Program[11], WSU Small Farms Program[12], or the UI Small Farms Program[13].

United States Department of Agriculture Natural Resource and Conservation Services (USDA NRCS)

USDA NRCS provides leadership by partnering with private landowners and managers to conserve soil, water, and other natural resources. Of particular interest to prospective wine grape growers is the Environmental Quality Enhancement Program (EQIP), which is a voluntary conservation program for farmers that promotes agricultural production and environmental quality. The EQIP offers financial and technical assistance to eligible participants so that they may implement conservation management practices on eligible agricultural land. Participation in these programs is voluntary, but the use of a laboratory that is currently accredited by the North American Proficiency Testing Program[14] for soil and tissue analyses is required. More information can be obtained for your state program in Oregon[15], Washington[16], or Idaho[17].

Location and Marketing

American Viticultural Areas (AVAs) are geographically unique grape-growing regions recognized by the US Alcohol and Tobacco Tax and Trade Bureau (TTB) under the Code of Federal Regulations Title 27, Part 9. To determine AVA boundaries, search specific appellations on the TTB website[18]. Maps of AVAs are also available by contacting the US Geological Survey[19] (1-800-HELP-MAP). Each area is characterized by specific growing conditions that affect grape or wine quality and differentiate cultivars from those grown in other areas. Locating a vineyard within a given AVA can improve grape marketing to wineries and provide benefits when selling wine.

For additional information on marketing, status of the industry, connections to other state agencies of interest, fee structures associated with membership in regional grower groups, and state taxation, contact the following organizations:

- **Oregon Wine Board (OWB)**[20]

  The OWB is a semi-independent state agency that manages marketing, research, and education initiatives that support and advance the Oregon wine grape industry. The OWB is appointed by the governor and works on behalf of all Oregon wineries and independent growers throughout the state's diverse wine-growing regions. All industry members in the state are members of this organization based on their payment of tonnage and production volume taxes that support the OWB.

- **Oregon Winegrowers Association (OWA)**[21]

  The OWA is a voluntary membership-based organization that provides legislative and regulatory advocacy for the Oregon wine industry by presenting key issues for unified positive resolution before state and federal government agencies. The OWB serves a duplicate role as directors of OWA. To become an OWA member, individuals must have more than one acre of grapevines and/or serve as an owner, manager, or investor in a bonded winery in Oregon.

- **Washington Association of Wine Grape Growers (WAWGG)**[22]

  The WAWGG advocates for the Washington wine industry by educating, promoting, representing, and unifying wine grape growers. The most

important service to the membership is continuing education for a growing industry focused on premium quality. Membership includes vineyard and winery owners and suppliers.

- **Washington Wine Industry Foundation (WWIF)**[23]

  The WWIF is a nonprofit organization that funds scholarships, educational events, outreach, and research for the Washington wine grape industry. It is funded through contributions and grants from individuals, organizations, and companies.

- **Washington State Wine Commission (WSWC)**[24]

  The WSWC represents all licensed wineries and wine grape growers in the state of Washington. Funded almost entirely though grape and wine sales assessments, it is a government agency focused on raising awareness of Washington wines.

- **Washington State Grape Society**[25]

  The Washington State Grape Society is made up of growers, industry personnel, educators, and researchers whose goal is to promote the advancement of the grape industry in Washington. It provides scholarship opportunities for students in viticulture, workshops for growers, and advocacy for legislative activities related to the viticulture industry.

Growing quality grapes will not guarantee they are salable. Determine the market options before starting your vineyard.

- **Idaho Wine Commission (IWC)**[26]

  The IWC (also called the Idaho Grape Growers and Wine Producers Commission) is an industry organization that provides marketing, promotion, and information resources in support of a more productive wine business climate in Idaho. With a small and growing industry, this organization focuses on marketing events, education, and research. It is funded by wine and grape tax assessments, and all vineyard and winery owners in the state are members.

Permits and Regulations

There are numerous rules and regulations for vineyard and winery businesses administered by federal, state, and local governments such as building and selling permits, establishment locations, and particulars on sales. Various legal components of the wine business vary by state, including the following: definitions of what constitutes a commercial winery, where you can establish a winery, where you may undertake sales, bonding, labeling of wines, and transportation of wines. The time it takes to obtain a license can also vary drastically by state. Check with your state organization (OWB, WAWGG, or IWC) for details and assistance. For information about regulations that involve the farming aspects of vineyard establishment, such as water use and water rights, please see the Site Suitability section of this manual.

Federal

The US Department of the Interior Bureau of Land Management (BLM)[27] undertakes extensive land use planning through a collaborative approach with local, state, and tribal governments, the public, and stakeholder groups. They provide information on water laws and long-term use of public lands. The BLM is also responsible for managing all land status records. The Oregon and Washington[28] office is housed in Portland, Oregon, and the Idaho[29] office is in Boise, Idaho.

The US Department of Treasury's Alcohol and Tobacco Tax and Trade Bureau (TTB)[30] collects alcohol excise taxes and ensures that these products are labeled, advertised, and marketed in accordance with the law. Their focus is on protecting consumers and federal revenue. The TTB issues licenses and permits for bonding, deferments, transfers, transportation, and labeling that may take six months or more to be granted.

State and Local

Oregon

Oregon State Legislature. The rules and regulations governing the minimum size of land for building a winery are contained in Oregon Revised Statutes[31]. This

statute defines the size of a winery in terms of gallons of wine produced as a function of the minimum acreage of a vineyard.

County zoning codes. Each county in Oregon has its own ordinances governing land use and siting of a winery in unincorporated areas. Apply directly to the local county planning committee for a conditional use permit to site a winery or a vineyard with a potential future winery.

City ordinances. Cities may have ordinances governing land use development within incorporated areas. Often, certain locations are identified for new commercial use within the city limits. Permit applications are available from planning committees.

Washington

Washington State Legislature. The laws governing and defining wine business operation in Washington State are contained within the Revised Code of Washington[32] under Alcohol Beverage Control and administered by the Washington State Liquor Control Board (LCB)[33]. These rules and regulations define the following: what constitutes a domestic winery or a winery as a distributor and/or retailer of estate wine, off-premise samples, domestic wine made into sparkling wine, and sales at qualifying farmers markets.

County zoning ordinances[34]. Each county in Washington has rules and regulations governing local land use in unincorporated zones. Contact the county land use planning department directly, as counties have specific regulations that require a potential future winery outlet to apply for both a conditional use permit and a site plan review.

City ordinances[35]. Each city in Washington has ordinances governing their incorporated zones. Contact the city planning department for further information concerning siting of a prospective winery/sales outlet.

Idaho

Idaho State Legislature. The Idaho State Liquor Division[36] regulates alcohol sales in the state of Idaho. The Idaho State Police[37] regulate alcohol licensing for establishments and have information regarding direct shipping of wine in Idaho.

County ordinances[38]. The Idaho State Legislature, in Statutes, Title 23: Alcoholic Beverages, Chapter 13: County Option Kitchen and Take Wine Act[39], provides an outline for county law governing winery sales and sampling. In addition, each county has specific codes and ordinances which should be consulted before starting any winery or vineyard operation in Idaho.

City ordinances[40]. As with Oregon and Washington, understanding city ordinances in Idaho is critical if you plan to open a tasting room or operate a winery within city limits. Consult the city planning board for more information.

Eco-labeling Suitability and Requirements

Certifying a vineyard for "green" practices or eco-labeling wine may help distinguish a product and provide an increased market advantage. It is important to consider these approaches prior to vineyard establishment, as there are some basic farming principles that will differ based on the different certifications. Most eco-labels are based on marketing to the consumer and/or a winery that has increasing environmental awareness and interests towards sustainability.

Eco-labeling is generally based on one to three of the pillars of sustainability (see the Sustainability sidebar). To help you determine what is involved with each type of eco-labeling, the sections below include symbols that represent which pillars they address. The discussion is limited to the more common farm certifications and eco-labels used in the Inland Pacific Northwest.

Sustainability. Sustainability is typically defined by how a practice impacts three defined pillars: the environment, economics, and social equality. The 1990 Farm Bill passed by Congress defined sustainable agriculture as "an integrated system of plant and animal production practices having a site-specific application that will, over the long term:

- satisfy human food and fiber needs;
- enhance environmental quality and the natural resource base upon which the agricultural economy depends;
- make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls;
- sustain the economic viability of farm operations; and
- enhance the quality of life for farmers and society as a whole."

Sustainable symbols for this manual:

Environmental

$ Economic

Social Equality

Eco-labels. Also known as "green labels" for use on wines to inform consumers about associated environmentally friendly growing practices. The practices are usually backed by certification programs which focus on low-input, organic, or biodynamic production and/or environmental stewardship. The Global Ecolabelling Network (GEN)[41] offers extensive information about types of eco-labels, their credibility, and impacts.

Organic Certification

There are numerous organic certification bodies nationwide that certify and administer the process of growing grapes organically. Typically it will take three years to convert vineyards that have been farmed conventionally to organic. During the second year of transition, fruit may be marketed as "in transition." Examples of regional certification bodies include Oregon Tilth[42], Washington Tilth[43], the WSDA Organic Food Program[44], and the Idaho State Department of Agriculture[45]. While organizations may differ in their specific requirements for certification, all must adhere to the minimum standards set by the USDA National Organic Program[46].

International Organization for Biological and Integrated Control (IOBC)[47] $

The IOBC promotes the use of sustainable, environmentally safe, economically feasible, and socially acceptable control methods of pests and diseases of agricultural and forestry crops. This organization directs other certifying agencies throughout the United States and world, including LIVE (see below).

Water is a major limiting factor in crop production across the Pacific Northwest. Does your potential vineyard site have water access?

Salmon-Safe[48]

Salmon-Safe is a certifying organization dedicated to restoring and maintaining healthy watersheds in relationship to land use in both agricultural and urban settings throughout California, Oregon, Washington, and British Columbia. The certification requires management practices that reduce storm water runoff and non-point source pollution, helping to protect Pacific Northwest salmon watersheds. The Salmon-Safe eco-label can be found on many diverse products throughout the Pacific Northwest. Salmon-Safe is one of the eco-labels that partners with other farming organizations such as LIVE, VINEA (see below), and Oregon Tilth.

Low Input Viticulture & Enology, Inc. (LIVE)[49] $

LIVE is a nonprofit organization providing education and certification for vineyards using international standards of sustainable viticulture practices in wine grape production. They also certify wineries with standards in waste water management, carbon emissions, chemical use, and more. Vineyard and winery practices are based on a score system consisting of basic required practices, prohibited practices, and numerous ecological options. LIVE is an accredited member of the IOBC and Salmon-Safe.

Walla Walla VINEA (Winegrower's Sustainable Trust)[50] $

The Winegrowers' Sustainable Trust is a voluntary group of winegrowers dedicated to environmental, economic, and social sustainability concurrent with their production of grapes and wine. Walla Walla VINEA is an accredited member of LIVE.

Oregon Certified Sustainable Wines (OCSW)[51]

OCSW is a marketing program recently developed and administered by the Oregon Wine Board to enhance marketing by focusing on eco-friendly labeling. To be a part of OCSW, a vineyard or winery must be certified by either Oregon Tilth, LIVE, Salmon-Safe, Demeter[52], or a combination of these. For more information, contact the Oregon Wine Board. Because of this umbrella certification, OCSW may also address the social equality pillar of sustainability, depending on its partner organization.

Demeter USA (Biodynamic)[52]

Demeter is the only biodynamic farming certification organization in the United States, and is part of the international Demeter organization. This certification program views the farm as a single living entity, and seeks to maintain farm longevity and ecosystem health by working with the natural rhythms of the environment, people, and animals that make up the whole system.

Food Alliance[53]

This is a full system program that certifies farmers, processors, and distributers in North America. They focus

on providing guidelines by which agricultural and food industry businesses can follow sustainable farming practices, provide safe and fair working conditions, practice humane treatment of animals, and embody environmental stewardship. Certified members are distributed throughout the United States, Canada, and Mexico. They also encompass a wide array of producers who are organic to conventional. This program is the result of an initial collaboration between OSU, WSU, and the Washington State Department of Agriculture.

Global GAP (Good Agricultural Practice)[54]

Global GAP is a private sector group that sets voluntary standards for the certification of agricultural products, primarily in the fresh market. It provides a practical manual for good agricultural practices which can be used anywhere in the world, and is designed to reassure consumers that food products were produced with minimal environmental impacts and a high standard for worker safety. This program consists of an equal partnership of agricultural producers and retailers working to establish efficient certification standards and procedures.

Site Suitability

Whether developing existing farmland or purchasing new land, there are a number of critical issues that should be considered for the suitability of growing grapes, including climate, topography, soil characteristics, water availability, and environmental impacts.

Recently, many AVAs in the Pacific Northwest have undergone site suitability analyses to rank the land potential for grape production. These analyses are based on many of the features discussed in this section. The resulting reports are available through the regional marketing entities listed previously or university Extension specialists.

Climate

Growing degree days

Season length (duration of frost free days) and accumulation of heat units or growing degree days (GDD) should be considered in selecting a site or cultivars for that site. Growing degree days are a measure of heat accumulated during the growing season, which generally runs from April 1 to October 31. A single growing degree day is calculated using the average daily temperature subtracted from a threshold (or base) temperature of 50˚F using the equation $[(T_{max}–T_{min})/2]–50˚F$. Seasonal GDD is calculated by summing the daily GDD from 1 April to 31 October.

A GDD calculator is available from OSU's Integrated Plant Protection Center (IPPC)[55], and GDD accumulation on an exact weather station[56] can be accessed on the IPPC's US degree-day mapping calculator. Washington State University also has seasonal updates on long-term GDD accumulation and current season GDD accumulation[57]. These GDD reports are available for representative sites within all Washington AVAs. Station-specific GDD accumulations can be downloaded from AgWeatherNet (AWN)[58]. Further information regarding historical GDD, seasonal and daily temperatures, precipitation, weather extremes, and other weather data may be obtained from various weather networks and databases that serve the Pacific Northwest:

- Oregon Climate Summaries[59]
- Oregon Climate Service[60]
- AgWeatherNet (WSU)[58]
- Idaho Climate Service[61]
- Agrimet Weather InfoNet (Pacific Northwest Cooperative Agricultural Weather Network)[62]

Grape cultivars differ in their GDD and season length requirements. The basic guide presented in Table 1 provides an outline to assess whether the climate is suitable for cool, warm, or hot climate grape cultivars. Remember that cool-season and cold-hardy are not synonymous. Cold-hardiness is the plant's ability to withstand low winter temperatures, while cool-season (or cool-climate) cultivars refer to those that ripen with a lower GDD accumulation.

Spring frosts

Frost typically affects grapes in late spring and early fall. Spring frosts following budbreak can kill emerging shoots, whereas fall frosts can kill the vine canopy and completely stop fruit ripening. Depending on the site, some form of frost protection may be needed to avoid these problems.

Winter freezes

Deep freezes (in the single digits or lower) in winter can kill buds and other above-ground parts of grapevines. This damage can vary dramatically depending on a number of factors. For more information concerning freeze protection, consult the Extension publications *Protecting Grapevines from Winter Injury*[63] and *Assessing and Managing Cold Damage in Washington Vineyards*[64], and WSU's website on grapevine cold hardiness[65].

Topography

An assessment of site topography is vital for design and establishment of a successful vineyard. Slope and aspect determine sunlight exposure patterns, day length, heat accumulation, air drainage, frost and freeze susceptibility, the potential presence of a perched water table, and safe operation of equipment on hillsides.

Large bodies of water (e.g., lakes, reservoirs, rivers, etc.) can have a moderating influence on temperature fluc-

Table 1. Some examples of Vitis vinifera *suitable for cool, warm, or hot climate locations. Cultivars listed in multiple categories indicate that they are versatile in growing requirements, but different wine styles and profiles will likely result from growing in different climate classifications.**

Climate	GDD (˚F)	Cultivar
Cool Climate	1800–2000	Madeleine Angevine, Siegerrebe, Pinot Gris, Pinot Noir (rosé), Meunier (rosé), Chasselas, Muscat Ottonel
	2000–2200	Pinot Noir, Dolcetto, Gamay, Meunier, Chardonnay, Sauvignon Blanc, Verdelho, Green Veltliner, Riesling
Warm Climate	2200–3000	Cabernet Sauvignon, Merlot, Vigonier, Tempranillo, Petite Verdot, Malbec, Durif, Grenache, Cabernet Franc, Sangiovese
Hot Climate	>3000	raisin grapes, table grapes**

*Table modified from Gladstones, J. 1992. Maturity Groupings of Wine Grape Varieties. Chapter 7 in *Viticulture and Environment*, pp. 66-67. Adelaide, Australia: Wine Titles. Cultivars listed are not inclusive of all available varieties suitable for each climate category.

** Table grapes released from various US breeding programs are able to ripen in cooler climates. Examples include those from the University of Arkansas breeding program (Jupiter, Mars, Venus), American hybrid table grapes from Cornell University such as Himrod, and the Horticulture Research Institute of Ontario (Canada) variety Vanessa.

tuations. If extreme low temperatures are routinely experienced in an area, consider locating a vineyard near a large body of water to buffer temperature extremes. Both the size of, and proximity to, a body of water will influence these moderating effects.

Soils

While certain soil types are critical to vineyard success, they are only a fraction of the complete soils picture that should be considered during the establishment phase. When choosing a vineyard site, avoid (i) sites with a perched or high water table, (ii) shallow soils and/or soils with an impervious layer, (iii) soil depths less than 2 feet or greater than 3 feet (or areas with poor drainage), (iv) heavy clay soils with high nitrogen content, and (v) soils that receive a negative recommendation after being submitted for analysis to an accredited laboratory[14].

Soil types

The Natural Resources Conservation Services (NRCS) Web Soil Survey[66] website utilizes a comprehensive database of soils information to provide users with searchable, interactive soil maps. The website allows you to examine individual farms or parcels by address or GPS coordinates and obtain soil characteristics, slope, altitude, and more. While user manuals are provided within the online program, further assistance in using the website is available from your local or regional NRCS office. Printed soil maps may also be obtained from your local NRCS office.

Soil analysis

Before purchasing land for vineyard establishment, obtain a complete history of uses that may affect future plant growth and quality. Examples include crop production, pasture, USDA Conservation Reserve Enhancement Program (CREP) measures, and waste dumping. Pesticide (i.e., insecticides, fungicides, and herbicides) residues, heavy metal contamination, organic makeup, pH level, and nutrient content should all be assessed when you submit a soil sample for chemical analysis.

Planting grapes in soils before any remaining pesticide has broken down may result in debilitated plants or vine death. An OSU Extension publication called *Yesterday's Orchard…Today's Home: Legacy Pesticides on Former Orchard Properties*[67] highlights some of the dangers and challenges that are related to residual pesticides. Similarly, you need to be aware of any persistent herbicides (Table 2) that are likely to have been applied to fields used for wheat, peas, chickpeas, lima beans, soybeans, alfalfa, lentils, corn, clover, hay grass, ornamental horticulture crops, or rangeland.

Collecting a soil sample is relatively easy; you can find basic information on the process in *Soil Sampling for Home Gardens and Small Acreages*[68]. Once you collect a representative soil sample, submit it to your nearest analytical laboratory in Oregon[69], Washington[70], or Idaho[71] for chemical analysis.

Soil analysis reports and formats may vary from lab to lab; however, the *Soil Test Interpretation Guide*[72] will help you identify key components to manage. Soil pH is a common issue in vineyards, as wine grapes thrive in neutral soils. The Extension guide *Acidifying Soils for Crop Production East of the Cascades*[73] provides information on how to alter soil pH. The need to rectify a surplus or deficiency of specific nutrients is also common. For further information about a specific soil analysis result, contact your local Extension office.

Chemical analysis can be expensive and inadequate (i.e., not all chemicals are identified), so a bioassay may be more feasible. You can conduct a bioassay by planting a few vines into subsamples of the soil in question, monitoring their growth for a full season, and comparing vine growth to that of vines grown in uncontaminated soils.

Table 2. Active ingredients of herbicides with potential soil persistence. Some examples of common trade names registered for use on various crops in Oregon and Washington are given in parentheses. Caution: When in doubt, read the product label to determine the active ingredients.

Compound Class	Active Ingredients (Common Names)
Dinitroanilines	Benefin (Balan); Pendimethalin (Acumen, Pendant, Pendimax, Prowl, Pursuit, Stealth); Trifluralin (Buckle, Treflan, Trlap, Trust)
Imidazolines	Imazapyr (Arsenal, Lightning, Lineage); Imazaquin (Scepter); Imazethapyr (Pursuit)
Phenylureas	Diuron (Direx, Diuron, Karmex); Tebuthiuron (Spike)
Sulfonylureas	Chlorsulfuron (Chisum, Chlormet, Cimarron, Finesse, Glean, Report, Telar); Metsulfuron methyl (Accurate, Agility, Ally, Amtide, Canvas, Ciramet, Escort, Pasture, Plotter, Valuron) ; Nicosulfuron (Accent, Clarion, Nicosh, Primero, Steadfast, Stout); Primisulfuron (Beacon, Exceed, North Star, Spirit); Sulfometuron methyl (Oust)
Triazines	Atrazine (Bullet, Keystone); Hexazinone (Velpar) Simazine (Princep, Simazine)
Uracils	Terbacil (Sinbar)
Plant growth regulators	Clopyralid (Cody, Colt, Commando, Curtail, Cutback, Garrison, Prescott, Pyramid, Refute, Spur, Stinger, Widematch); Picloram (Grazon, Outpost, Tordon, Triumph, Trooper)
Others	Clomazone (Command, Strategy); Sodium borates (Prev-Am Ultra)

Testing for nematodes prior to planting is another important security measure, because these microscopic, soil-borne round worms can damage grapevines and transmit various grape diseases. For a fee, OSU Nematode Testing Service can perform a routine plant-parasitic nematode test[74]; their form includes general instructions on how to collect and submit your sample. Be certain to request that all nematodes in the sample be analyzed for population density in addition to type, as this may determine whether remediation is necessary; some nematodes are considered beneficial and can be used to control other pests. Submitting your soil sample in the fall is recommended.

Many areas of the Pacific Northwest have picturesque views that are attractive for winery tasting rooms, but they may not be suitable for grape production. Consider the suitability of the land for vineyard production before establishing a vineyard.

Water Availability and Water Rights

To establish and produce grapes in arid regions, you will need to irrigate and obtain legal water rights. To determine if a potential vineyard site has a legal water right, consult the Water Resource Department in Oregon[75], the Department of Ecology in Washington[76], or the Department of Water Resources in Idaho[77].

Certain regions within the Pacific Northwest can produce grapes without irrigation, termed "dryland farming." These areas include the Willamette Valley, western Washington, some parts of the Columbia Gorge, southern Oregon, and the upper foothills of the Blue Mountains in eastern Oregon. However, most of the precipitation that occurs throughout the Pacific Northwest is during the winter months, so vineyards in dryland farming areas may need supplemental irrigation during the spring and summer for the first two to three years of establishment. The total rainfall in an area is not always as important as when the rain occurs relative to specific growth stages of the plants.

In Oregon, it is legal to purchase water from a city or other entity that has a water right authorizing municipal use within their defined service area. Contact the operations superintendent of public works for your local municipality for further details. In Washington, it is possible to make a seasonal transfer of an existing water right to land in the beginning stages of establishment. Contact your local watermaster or the Department of Ecology in Washington for further details. In Idaho, water rights may be purchased or transferred. Contact the Department of Water Resources for more information.

For more information regarding the specifics of irrigation systems, refer to the following Extension publications and online resources:

- *Drip Irrigation–An Introduction* (OSU)[78]
- *Drip Irrigation* (WSU)[79]
- *Managing Irrigation Water Quality for Crop Production in the Pacific Northwest*[80]
- *Oregon Crop Water Use and Irrigation Requirements*[81]

Irrigation versus Well Water. If irrigation rights are not available for a potential vineyard site, well water may be an alternative. A common misconception, however, is that well water use is unlimited. The amount of water that can be legally removed from a well and applied to agricultural land may be severely restricted. Check your local ordinances for the use of well water to irrigate. Using well water is not equivalent to having water rights.

Environmental Impacts

The Oregon Department of Fish and Wildlife (ODFW) offers free consultation to landowners in the development process to avoid damage to wildlife habitats and aquatic life in waterways. The ODFW also helps landowners identify valuable species populations on their property, giving them the opportunity to preserve or restore a given habitat or organism. In some cases, identification of a species/habitat can give the location a higher property value. There are grants and tax incentives[82] for such projects as preservation and restoration. Check with your regional ODFW[83] office for more information. The Washington Department of Fish and Wildlife (WDFW) has similar grant programs[84], and more information is available through regional WDFW[85] offices. For Idaho residents, the Idaho Department of Fish and Game has grants available[86] for landowners willing to undertake wildlife preservation measures.

Other Considerations

Grapevines are extremely sensitive to herbicides containing phenoxy-type active ingredients (e.g., 2,4-D). Grapevines are most vulnerable from budbreak through bloom (early April through mid-July). Several Washington AVAs are within zones designated phenoxy-free or restricted use; however, if you choose a site outside of these areas, take the precautions described in the Extension publication *Preventing Herbicide Drift and Injury to Grapes*[87] and WSU's Leaf Index and Severity Rating[88] website.

Vineyard Establishment and Management Practices

The next step in determining whether to start a vineyard business is to learn as much as possible about vineyard establishment and management. Premier vineyards result only where exacting standards are met and maintained. By having a thorough understanding of wine grape production, you can avoid making many basic mistakes during vine establishment. The following resources are developed for the Pacific Northwest. See Table 3 for contact information for OSU, WSU, and UI Extension offices located in key grape-growing areas.

Table 3. Extension offices with a focus on grapes for the Inland Pacific Northwest.

Region	Extension Office	Location/Phone
Oregon statewide	Oregon Viticulture Extension	Corvallis, OR (541) 737-5480
North-Central Oregon	Hood River County Extension Service[89]	Hood River, OR (541) 386-3343
Eastern Oregon	Umatilla County Extension Service[90]	Milton-Freewater, OR (541) 938-5597
Southern Oregon	Douglas County Extension Service[91] Southern Oregon Research & Extension Center[92]	Roseburg, OR (541) 672-4461 Central Point, OR (541) 776-7371
Washington statewide	Washington Viticulture Extension	Prosser, WA (509) 786-2934
Eastern Washington	Irrigated Agriculture Research and Extension Center[93] Benton County Extension Service[94]	Prosser, WA (509) 786-9370 Kennewick, WA (509) 735-3551
Southwest Idaho	Parma Research and Extension Center[95]	Parma, ID (208) 722-6701

Even before the first plants are in the ground, there are several preparations and decisions that need to be made that can significantly impact your vineyard.

Oregon

OSU Oregon Wine Research Institute[96]

The Oregon Wine Research Institute (OWRI) website connects to various information resources at OSU, including research and Extension in viticulture and enology. Outreach includes Extension publications, newsletters, research updates, webinars, and upcoming events across the Pacific Northwest. New growers or those interested in establishing a vineyard are encouraged to use resources from this site and connect with local or regional Extension horticulturists and/or viticulturists.

Oregon State University Extension Service[97]

The OSU Extension Service provides outreach and information on agriculture for both commercial industries and the public. Many peer-reviewed publications authored by experts at OSU are available for free or a nominal fee in the OSU Extension Service Publications and Multi-media catalog. Please refer to the various county and regional Extension programs across the state for more information.

Oregon Production Guides

Oregon Viticulture[98]. This is a comprehensive book that provides information on many aspects of vineyard production in Oregon, including wine regions, soils, climate zones, vine physiology, and vineyard establishment and management.

Umatilla County Extension Wine Grape Website[99]. This website, developed by OSU Extension Umatilla County, is specific to the Walla Walla Valley which encompasses eastern Oregon and southeastern Washington. It contains a wealth of information regarding wine grape establishment and provides links to economics and production sites.

Washington

Washington State University Viticulture and Enology Program[100]

This website details current events and news on grape and wine production in Washington State, and provides information on educational programs, research, and Extension. In addition to accessing various newsletters for the Washington grape and wine industry, you can learn about the WSU Viticulture and Enology Certification Program[101], or how to pursue related undergraduate and graduate degrees.

Washington State University Extension Publications Catalog[102]

The WSU Extension Service engages people, organizations, and communities to advance knowledge, economic well-being, and quality of life by fostering inquiry, learning, and the application of research. This website is a clearinghouse for all approved WSU Extension publications, including those on grape production.

Washington Production Guides

Vine to Wine: Successfully Establishing a Vineyard and Winery[103]. This DVD is designed for anyone who has recently started a vineyard or winery, or is contemplating it. Topics covered include site selection, establishment, pest control, nutrient management, and basic winery equipment.

Growing Grapes in Maritime Western Washington[104]. While focused on production issues specific to western Washington, this guide provides insight and considerations into basic vineyard establishment.

Idaho

University of Idaho Extension Service[105]

The UI Extension Service works with the people of Idaho to address youth, community, family, environmental, natural resource, and agriculture issues. Various Extension publications, fact sheets, and bulletins are available at their website.

Idaho Production Guides

The University of Idaho's Fruit Research Program has an excellent website for the production of wine and table grapes[106].

Treasure Valley Community College[107]

While not affiliated with University Extension, the Treasure Valley Community College in Caldwell, Idaho, has a thriving viticulture and enology program and serves as an excellent starting point for Idaho producers.

Regional and National Resources

Northwest Berry and Grape Information Network[108]

Cooperation between OSU, WSU, UI, and USDA-ARS has resulted in a central website containing resources for small fruit growers. Resources include vineyard production guides, fact sheets, and other viticulture-related information.

eViticulture.org[109]

eViticulture.org is a portal website for a national initiative on grape production hosted by the eXtension Grape Community of Practice. Viticulture Extension experts and researchers from across the United States continually update the site with the most recent advancements in viticulture information.

Professional Guidance. While this guide provides general information needed to start a vineyard business, consider seeking help from a vineyard consultant and other growers in your area to help with the establishment process. There are many consultants throughout the Pacific Northwest that specialize in vineyard production systems. Contact your local Extension office for more information.

Identifying, Ordering, and Obtaining Plants

What to Purchase

Choosing the best cultivars and clones to grow in a vineyard depends on many factors. After determining what can grow and ripen at a specific site based on environmental suitability, soil type, and water availability, consider the market conditions (see the Understand Vineyard Economics section of this manual), determine which clones of the chosen cultivar have desirable characteristics, whether a rootstock is needed, and if so, what rootstocks are best suited for the vineyard.

Clones

Selecting specific clones within a cultivar can be difficult. A clone is simply the same grape cultivar that has a slightly different characteristic that can be propagated and maintained. Research on clones of several grape cultivars, including Chardonnay and Pinot Noir, is available at the Oregon Wine Research Institute[96] website. Very little scientific information exists regarding the performance of clonal materials of warm weather cultivars (e.g., Cabernet Sauvignon, Merlot, and Syrah). Many people choose to conduct on-farm trials of several different clones to determine the best one for a particular site.

Rootstocks (Grafted Vines)

One of the main reasons for the use of rootstocks is to prevent vine root damage and whole vine decline due to the insect phylloxera. Further information on phylloxera may be found in the Extension publication Grape Phylloxera: Biology and Management in the Pacific Northwest[110].

Other reasons for using a rootstock include resistance to nematodes, *Phytophthora*, and drought, and increased vine performance under suboptimal conditions such as water-logged and poorly drained soils, saline soils, and soils with low or high pH. Rootstocks may also improve grape quality by reducing vigor, enhancing (i.e., shortening) the time to fruit ripening, and reducing potassium content in the berries. For more information on rootstock cultivars, consult the Extension publication *Grapevine Rootstocks for Oregon Vineyards*[111]. Research at Washington State University has shown that in arid climates such as those east of the Cascade Mountains, rootstocks do not have an effect on vigor, wine quality, or ripening time of the scion. While this is good news for pest control (i.e., phylloxera resistance without a negative impact on quality), most of the vineyard acreage continues to be own-rooted (see the Rootstock Caution sidebar).

Rootstock Caution. In most grape-growing regions worldwide, grapevines are grafted to rootstocks. Much of the Oregon industry is planted to rootstock. However, some grapevines in eastern Oregon and throughout Washington and Idaho are not grafted to rootstocks; this allows greater flexibility in managing winter cold damage, including retraining (see the Winter freezes section under Determine Site Suitability in this manual). The need and ability to deal with winter damage in these regions can outweigh the concerns about phylloxera, especially where there is no established population of the pest.

Where to Purchase

Importance of Clean Plants

New pests and diseases can be inadvertently introduced into vineyards through infested nursery material. Collecting bud wood from vineyards may be easy and inexpensive, but there is a risk for bringing unseen problems such as crown gall and viruses such as grape leafroll, corky bark, *Rupestris* stem pitting, and more into a vineyard site. It is therefore critical to obtain plants from reputable nurseries that have met all existing state certifications regarding diseases and pests.

Certified "clean" plants are considered free of harmful pests, diseases, and known viruses after undergoing a state-specific inspection and certification process. Unless vines are specifically tested and propagated from certified clean vines, they cannot be called certified for that state. In addition, not all cultivars or clones being sold may be certified. It is your responsibility to specifically request certified plants from a nursery. The certification is done at the nursery level, not by cultivar across nurseries.

Nurseries that sell certified stock obtain their plants from a foundation plant service and use them to develop "mother" vineyards from which they propagate stock that they sell to growers. The foundation block which serves Oregon, Washington, and Idaho is the Clean Plant Center–Northwest Grapes[112] at WSU's Irrigated Agriculture Research and Extension Center in Prosser, Washington. The Clean Plant Center–Northwest Grapes is dedicated to the distribution of properly identified and certified disease-free grape plant materials. They maintain a list of certified nurseries[113] for Oregon and Washington, as well as a list of clean material available to nurseries.

Grape Quarantines

To minimize the distribution of pests and diseases across state borders, Oregon, Washington, and Idaho have restrictions on the import of plant materials. Read and review the Oregon Department of Agriculture[114], Washington State Department of Agriculture[115], and Idaho State Department of Agriculture[116] rules and regulations for an explanation of the grape quarantines for each state. A comprehensive list of frequently asked questions[117] concerning quarantine, certification, the National Clonal Germplasm Repository, and related issues of importance are provided at the Clean Plant Center[112] website.

The National Grape Registry[118] is an online resource of plant materials for which import and quarantine procedures for introduction into the United States have been completed. The website also provides information about where specific cultivars can be purchased, their origins, and clones.

Once your soil and on-site infrastructure are prepared, the next step is ordering plants. It is critical that you order 8–12 months in advance of planting to ensure that you can purchase the materials you want and that the stock is certified.

Movement of Plant Materials. It is important to note that beyond state quarantines, the viticulture industry strongly encourages specific etiquette to mitigate further spread of pests within states as well. For example, plant materials from the western side of Oregon where phylloxera is a problem should not be brought to eastern Oregon or Washington where there are no established populations of this root louse. Restricting the spread of phylloxera must be a priority for the continued success of the wine industries in eastern Oregon and Washington, especially since the vast majority of these vineyards are planted to own-rooted cuttings (i.e., they are not grafted to a rootstock) and thus susceptible to phylloxera and subsequent decline.

Before importing a variety from outside the United States, check to see if it exists in the country. If not, the selection will be required to enter through a sanctioned foreign import site. Contact the Clean Plant Center to obtain an import license. All federal and state importation and phytosanitary requirements[119] must be met before the material will be released to the individual or organization importing the selection.

When to Purchase

When to Order Plant Materials

It takes time for nurseries to properly propagate, graft, and root vines for planting. Orders should be placed for new vines during the winter before planting is scheduled. By not pre-ordering, you run the risk of not finding available certified plant material, or may only have access to marginal stock. Plan ahead and place an order as soon possible.

Further Information and Clarification

There are many questions that arise when determining how to start a vineyard or winery. If you have exhausted the resources above or need further clarification, please contact your local county Extension office or statewide viticulture specialist. These university faculty members are available to answer questions regarding soil sampling, regional climate, or general viticulture. ***Planning before planting is the key to success!***

Appendix: Vineyard and Winery Internet Resources

Footnote	Title	Website Address
	Vineyard Economics	
1	Vinewise	http://www.vinewise.org/
2	AgTools	http://www.agtools.org/
3	Northwest Grapes Cost-of-Production Calculators	http://www.nwgrapecalculators.org/
4	Oregon Enterprise Budgets	http://oregonstate.edu/dept/EconInfo/ent_budget/PDF/EM8974-E.pdf
5	Establishment and Annual Production Costs for Washington Concord Grapes	http://cru.cahe.wsu.edu/CEPublications/eb1965/eb1965.pdf
6	Wine Grape Establishment and Production Costs in Washington, 2003	http://cru.cahe.wsu.edu/CEPublications/eb1955/eb1955.pdf
7	The Economic Feasibility of Growing Wine Grapes in Idaho	http://www.cals.uidaho.edu/edComm/pdf/BUL/BUL0828.pdf
8	Washington NASS Fruit Production Statistics	http://www.nass.usda.gov/Statistics_by_State/Washington/Publications/Fruit/index.asp
9	Oregon NASS Fruit Production Statistics	http://www.nass.usda.gov/Statistics_by_State/Oregon/Publications/Vineyard_and_Winery/index.asp
10	Contribution of the Grape and Wine Industry to Idaho's Economy	http://www.cals.uidaho.edu/edComm/pdf/RES/RES0162.pdf
11	OSU Small Farms Program	http://smallfarms.oregonstate.edu/
12	WSU Small Farms Program	http://smallfarms.wsu.edu/
13	UI Small Farms Program	http://www.cals.uidaho.edu/sustag/SmallFarms/index.htm
14	North American Proficiency Testing Program	http://www.naptprogram.org/pap/
15	Oregon Environmental Quality Enhancement Program	http://www.or.nrcs.usda.gov/programs/eqip/index.html
16	Washington Environmental Enhancement Program	http://www.wa.nrcs.usda.gov/programs/eqip/FY09/index.html
17	Idaho Environmental Enhancement Program	http://www.id.nrcs.usda.gov/programs/eqip/
18	Alcohol and Tobacco Tax and Trade Bureau-AVA Designations	http://www.ttb.gov/appellation/index.shtml
19	US Geological Survey	http://www.usgs.gov.
20	Oregon Wine Board	http://www.oregonwine.org
21	Oregon Wine Growers Association	http://industry.oregonwine.org/oregon-winegrowers-association/
22	Washington Association of Wine Grape Growers	http://www.wawgg.org/
23	Washington Wine Industry Foundation	http://www.washingtonwinefoundation.org/
24	Washington State Wine Commission	http://www.washingtonwine.org/
25	Washington State Grape Society	http://www.grapesociety.org/
26	Idaho Wine Commission	http://www.idahowines.org/default.aspx

Footnote	Title	Website Address
Permits and Regulations		
27	Bureau of Land Management	http://www.blm.gov/
28	Oregon and Washington Bureau of Land Management	http://www.blm.gov/or/index.php
29	Idaho Bureau of Land Management	http://www.blm.gov/id/st/en.html
30	Alcohol and Tobacco Tax and Trade Bureau	http://www.ttb.gov/
31	Oregon Revised Statutes	http://www.leg.state.or.us/ors/
32	Revised Code of Washington	http://apps.leg.wa.gov/RCW/
33	Washington State Liquor Control Board	http://www.liq.wa.gov/
34	Washington County Zoning Ordinances	http://www.mrsc.org/codes.aspx#county
35	Washington City Ordinances	http://www.mrsc.org/codes.aspx#city
36	Idaho State Liquor Division	http://liquor.idaho.gov/MainLev_Laws.html
37	Idaho State Police Alcohol Beverage Control	http://www.isp.idaho.gov/abc/
38	Idaho County Ordinances	http://www.isll.idaho.gov/cntycode.htm
39	Idaho Legislature County Wine Acts	http://www.legislature.idaho.gov/idstat/Title23/T23CH13.htm
40	Idaho City Ordinances	http://www.isll.idaho.gov/citycode.htm
Eco-labeling Suitability and Requirements		
41	Global Ecolabelling Network	http://globalecolabelling.net//
42	Oregon Tilth	http://www.tilth.org/
43	Washington Tilth	http://www.washingtontilth.org/structure.htm
44	Washington State Department of Agriculture Organic Food Program	http://agr.wa.gov/FoodAnimal/Organic/default.aspx
45	Idaho State Department of Agriculture—Organic Certification	http://www.idahoag.us/Categories/PlantsInsects/Organic/indexOrganicHome.php
46	USDA National Organic Program	http://www.ams.usda.gov/AMSv1.0/nop
47	International Organization for Biological and Integrated Control (IOBC)	http://www.iobc-wprs.org/
48	Salmon Safe	http://www.salmonsafe.org/index.cfm
49	Low Input Viticulture and Enology (LIVE)	http://www.liveinc.org/
50	Walla Walla VINEA	http://www.vineatrust.org/index.html
51	Oregon Certified Sustainable Wines (OCSW)	http://www.oregonwine.org/Industry/Oregon_Wine_Board/Education/OCSW/
52	Demeter	http://www.demeter-usa.org/
53	Food Alliance	http://foodalliance.org/
54	Global GAP	http://www.globalgap.org/

Footnote	Title	Website Address
Site Suitability		
55	OSU Integrated Plant Protection Center GDD Calculator	http://pnwpest.org/cgi-bin/ddmodel.pl
56	OSU IPPC Weather Stations	http://pnwpest.org/cgi-bin/usmapmaker.pl
57	WSU AVA GDD Calculations	http://wine.wsu.edu/research-extension/weather/growing-degree-days/
58	WSU AgWeatherNet	http://weather.wsu.edu
59	Oregon Climate Summaries	http://www.wrcc.dri.edu/summary/climsmor.html
60	Oregon Climate Service	http://www.ocs.orst.edu/
61	UI Climate Service	http://snow.cals.uidaho.edu/climate/default.htm
62	Agrimet Weather InfoNet	http://www.usbr.gov/pn/agrimet/webarcread.html
63	Protecting Grapevines from Winter Injury	http://extension.oregonstate.edu/umatilla/mf/sites/default/files/pnw603-e.pdf
64	Assessing and Managing Cold Damage in Washington Vineyards	https://pubs.wsu.edu/ListItems.aspx?Keyword=em042e
65	WSU Cold Hardiness Website	http://wine.wsu.edu/research-extension/weather/cold-hardiness/
66	Natural Resources Conservation Services Web Soil Survey	http://websoilsurvey.nrcs.usda.gov/app/
67	Yesterday's Orchard…Today's Home: Legacy Pesticides on Former Orchard Properties	http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/19238/ec1513-e_.pdf
68	Soil Sampling for Home Gardens and Small Acreages (OSU)	http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/18696/ec628.pdf
69	Oregon Soil Analytical Labs	http://extension.oregonstate.edu/catalog/html/em/em8677/
70	Washington Soil Analytical Labs	http://wsprs.wsu.edu/AnalyticalLabsEB1578E.pdf
71	UI Analytical Sciences Laboratory	http://www.agls.uidaho.edu/asl/
72	Soil Test Interpretation Guide (OSU)	http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/22023/ec1478.pdf
73	Acidifying Soils for Crop Production East of the Cascades (OSU)	http://extension.oregonstate.edu/umatilla/mf/sites/default/files/Acidifying_soils_EM8917-e.pdf
74	OSU Nematode Testing	http://www.bcc.orst.edu/bpp/Nematodes/Nematode_Testing_Service_Form.pdf
75	Oregon Water Resource Department	http://www.wrd.state.or.us/
76	Washington Department of Ecology	http://www.ecy.wa.gov/org.html
77	Idaho Department of Water Resources	http://www.idwr.idaho.gov/WaterManagement/default.htm
78	Drip Irrigation: An Introduction (OSU)	http://extension.oregonstate.edu/catalog/pdf/em/em8782-e.pdf
79	Drip Irrigation (WSU)	http://smallfarms.wsu.edu/crops/irrigation/
80	Managing Irrigation Water Quality for Crop Production in the Pacific Northwest	http://extension.oregonstate.edu/catalog/pdf/pnw/pnw597-e.pdf
81	Oregon Crop Water Use and Irrigation Requirements	http://extension.oregonstate.edu/catalog/pdf/em/em8530.pdf
82	Oregon Grants for Preservation and Restoration	http://www.dfw.state.or.us/wildlife/grants/
83	Regional Oregon Department of Fish and Wildlife Office Directory	http://www.dfw.state.or.us/agency/directory/local_offices.asp

Footnote	Title	Website Address
84	Washington Grants for Wildlife Preservation	http://wdfw.wa.gov/grants/
85	Regional Washington Department of Fish and Wildlife Office Directory	http://wdfw.wa.gov/about/regions/
86	Idaho Grants for Wildlife Preser-vation	http://fishandgame.idaho.gov/public/wildlife/?getPage=223
87	Preventing Herbicide Drift and Injury to Grapes	http://extension.oregonstate.edu/catalog/pdf/em/em8860.pdf
88	Leaf Indexing for Herbicide Damage (WSU)	http://feql.wsu.edu/eb/index.htm
Vineyard Establishment and Management Practices		
89	Hood River County Extension Service	http://extension.oregonstate.edu/hoodriver/
90	Umatilla County Extension Service	http://extension.oregonstate.edu/umatilla/mf/
91	Douglas County Extension Service	http://extension.oregonstate.edu/douglas/
92	Southern Oregon Research and Extension Center	http://extension.oregonstate.edu/sorec/
93	Irrigated Agriculture Research and Extension Center (WSU)	http://www.prosser.wsu.edu/
94	Benton County Extension Service	http://county.wsu.edu/benton-franklin/
95	UI Parma Research and Extension Center	http://www.cals.uidaho.edu/parma/
96	OSU Oregon Wine Research Institute	http://owri.oregonstate.edu
97	OSU Extension Service	http://extension.oregonstate.edu/
98	Oregon Viticulture	http://oregonstate.edu/dept/press/o-p/OregonViticulture.html
99	OSU Umatilla County Extension Winegrape Website	http://extension.oregonstate.edu/umatilla/mf/commercial_hort/wine_grapes
100	WSU Viticulture and Enology Website	http://wine.wsu.edu/
101	WSU Viticulture and Enology Certificate Program	http://wine.wsu.edu/education/certificate/
102	WSU Extension Publications Catalog	http://pubs.wsu.edu
103	Vine to Wine: Establishing a Vineyard or Winery	https://pubs.wsu.edu/ListItems.aspx?Keyword=DVD007
104	Growing Grapes in a Maritime Climate	https://pubs.wsu.edu/ListItems.aspx?Keyword=eb2001
105	UI Extension Service	http://www.extension.uidaho.edu/crops.asp
106	UI Grape Research Program	http://www.efallahi.com/fruitresearch.html
107	Treasure Valley Community College	http://www.tvcc.cc.or.us/Academics/Ag/viticulture2.cfm
108	Northwest Berry and Grape Information Network	http://berrygrape.oregonstate.edu/
109	eViticulture.org	http://eviticulture.org

Footnote	Title	Website Address
Identifying, Ordering, and Obtaining Plants		
110	Grape Phylloxera: Biology and Management in the Pacific Northwest	http://extension.oregonstate.edu/catalog/pdf/ec/ec1463.pdf
111	Grapevine Rootstocks for Oregon Vineyards	http://extension.oregonstate.edu/catalog/pdf/EM/EM8882.pdf
112	Clean Plant Center–Northwest Grapes	http://wine.wsu.edu/research-extension/nwgfs/
113	Certified Nurseries	http://nwgfs.wsu.edu/certified.html
114	Oregon Department of Agriculture: Quarantine Rules	http://egov.oregon.gov/ODA/PLANT/docs/pdf/quar_grape.pdf
115	Washington Department of Agriculture: Quarantine Rules	http://agr.wa.gov/plantsinsects/PlantQuarantines/PlantQuarantines.aspx
116	Idaho State Department of Agriculture: Quarantine Rules	http://www.agri.idaho.gov/Categories/PlantsInsects/Documents/Reports/QuarSumN-sy2009.pdf
117	CPC-NW Grapes Frequently Asked Questions	http://wine.wsu.edu/research-extension/nwgfs/faq/
118	National Grape Registry (UC-Davis)	http://ngr.ucdavis.edu/index.cfm
119	APHIS Phytosanitary Requirements	http://www.aphis.usda.gov/plant_health/permits/downloads/q37-1circular.pdf

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All images courtesy of Michelle Moyer.

Use pesticides with care. Apply them only to plants, animals, or sites as listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

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puborders@oregonstate.edu

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