

# Chapter 1. Ecosystem Management

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## Introduction

An **ecosystem** is the complex community of living organisms and their physical environment functioning as an ecological unit. Components of an ecosystem are inseparable and interrelated. An ecosystem management approach to growing winegrapes acknowledges that people are a part of and have a significant impact on ecosystem structures and processes, and that people depend on and must assume responsibility for the ecological, economic, and social systems where they live. Ecosystem management is currently being encouraged and implemented by communities, government agencies, businesses, academics and various conservation organizations throughout the world.

This chapter draws on the ecosystem management approach described and defined by the Keystone Center (1996), the Ecosystem Management Research Institute (2006), and the World Conservation Union (Shephard 2004); as well as other key publications on ecosystem management, agricultural ecology, and sustainable development provided in the reference and resource section of this workbook. Lodi winegrowers use the definition of Ecosystem Management described by the World Conservation Union Commission for Ecosystem Management (Shephard 2004):



Ecosystem management recognizes that the inter-connectivity of ecological, socio-cultural, economic and institutional systems is fundamental to our understanding of the factors which influence environmental objectives and outcomes. It is a holistic, multi-disciplinary and integrated approach, which requires a substantial shift in the way we perceive and approach the management of both our natural and modified environments.

The primary goals of an ecosystem management approach are to:

- Incorporate our distinct values in the design and implementation of ecosystem management initiatives
- Sustain vibrant, livable, and economically diverse human communities
- Maintain ecosystem integrity
- Sustain biodiversity at a watershed and regional scale

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Vineyard in Clements Hills AVA

## Defining your resource base

What is the foundation of your business? Your land, the people you interact with on a regular basis, and all available resources. Describing and writing down your resource base is a very valuable practice that lets you see not only what you are managing, but also provides you with additional insight about possibly how to manage your operation.

<b>1.1 Defining your resource base<sup>1</sup></b>			
<b>Category 4</b>	<b>Category 3</b>	<b>Category 2</b>	<b>Category 1</b>
<p>I know the <u>physical boundaries and physical conditions</u> of my property  <b>And</b>  I have identified the people <u>within and external</u> to my farm who should be involved in the process of defining its resource base  <b>And</b>  I have identified the available resources (financial, human, equipment) <u>within</u> my farming operation <u>and</u> the available <u>external</u> resources from participants to begin an ecosystem management approach to winegrape growing  <b>And</b>  I have a written record of all of the above.</p>	<p>I know the <u>physical boundaries and physical conditions</u> of my property  <b>And</b>  I have identified the people <u>within and external</u> to my farm who should be involved in the process of defining its resource base  <b>And</b>  I have identified the available resources (financial, human, equipment) <u>within</u> my farming operation <u>and</u> the available <u>external</u> resources from participants to begin an ecosystem management approach to winegrape growing.</p>	<p>I know the <u>physical boundaries</u> of my property  <b>And</b>  I have identified the people <u>within</u> the my farming operation who should be involved in the process of defining its resource base  <b>And</b>  I have identified the available resources (financial, human, equipment) <u>within</u> my farming operation to begin an ecosystem management approach to winegrape growing.</p>	<p>I know the <u>physical boundaries</u> of my property.</p>

<sup>1</sup>Modified from Reeves and Dlott 2002.

### Defining your resource base to be managed:

*Land Base:* Describe and map the physical boundaries of your farm. This is the actual land base in acres. In addition, it is important to survey your property for various physical characteristics, such as driveway and road systems, water access rights, streams and **riparian** corridors, vernal pools, wet **swales**, drainages, degree of slope, existing erosion, and the presence of animal and plant species including any as threatened or endangered species. All of these factors may affect how you

farm the site and also may be subject to local, state, or federal regulations.

**Participants:** List all participants who will be involved with your farming operations. This could include neighbors, community members, and other **stakeholders**. Think beyond your family and employees. What about your banker, farm advisor, and pest control advisor (PCA) or other consultants? Are you adjacent to any public land? What about regulatory agencies? Is there a local Audubon Chapter in your region? Interests at stake may change and additional participants may become part of the process.



**Available Resources:** List the resources you have available to manage your farm operations. This includes financial resources, human resources, capabilities of the external participants, and equipment.

<b>1.2 Developing a dynamic shared vision<sup>1</sup></b>			
<b>Category 4</b>	<b>Category 3</b>	<b>Category 2</b>	<b>Category 1</b>
I/we have attended a workshop <sup>1</sup> to develop a shared sustainability vision consisting of shared values, forms of production, and our desired future landscape <b>And</b> I/we have written our shared vision.	I/we attended a workshop <sup>1</sup> to develop a shared sustainability vision, but have not completed our vision.	I/we would like to attend a workshop <sup>1</sup> to develop a sustainability vision but have not done so.	I/we have no plans to develop a shared sustainability vision.

<sup>1</sup> It is not easy to develop a shared vision on your own if you have never done something like this before. Therefore the Lodi-Woodbridge Winegrape Commission periodically puts on a half day workshop to help growers start the process that is described in detail in this section.

## Develop a Dynamic Shared Vision

*"The landscape of any farm is the owner's portrait of himself. Conservation implies self-expression in that landscape, rather than blind compliance with economic dogma." - Aldo Leopold*

Developing a shared vision may be one of the most difficult tasks of ecosystem management. However, this approach within the context of ecosystem management is valuable for developing trust and respect among those people who are working together for the benefit of a defined area such as a farm, ranch, wildlife refuge, or watershed. This process is being used internationally to bring together diverse groups in Africa, Australia, North America, and South America (Rogers and Bestbier 1997, G limp et al. 1998, Rogers et al. 2000, Holt 2004, Nabben 2005, NRM South 2005, ECA 2006, Gadzia and Graham 2006, Nabben 2006, Rogers 2006) Different from any mission statement or business strategy, the shared vision is developed from the bottom up. It is inclusive of as many people as you feel comfortable with developing the future vision of your farm. This usually starts with all of the people described in your resource base above. However, availability of people should not stop you from beginning the process. The outcome of this exercise will be the destination you are moving towards throughout your lifetime. Remember, it is dynamic and as such should be revisited periodically as your family and community changes. There is never a final vision.

The vision you develop will be a shared view of the future stated in a positive manner (Maser 1996, G limp et al. 1998, Savory and Butterfield 1999, Wondolleck and Yaffee 2000, Gadzia and Graham 2006, Rogers 2006, Gadzia and Sayre 2007). It is what you want for that future, with an understanding of current perception, uncertainty, change, and endless possibilities. It is important to be positive and to welcome the various points of view from those you invite to help develop this vision. By developing a shared vision with others, you gain their personal commitment to your operation.

Remember, that as farmers and natural resource managers, what you are doing is not rocket science. It is harder than rocket science because of the dynamic nature of the natural world you work in. The next time an engineer tells you how hard their job is, tell them to predict next month's weather and to plan their work schedule accordingly.

### Three components of a dynamic shared vision:

1. *Shared Values (Social Equity Component)*: This is the foundation of the vision and consists of a quality of life statement articulated by the participants in the ecosystem management process. This relates to the social values and overall quality of life of the group. This is the “why” in what it is that you do.



2. *Forms of Production (Economic Component)*: This portion of the vision focuses on the economics of the land base you are managing and is what supports the shared values or quality of life for you and the other participants. This is profit as well as recreation, culture, aesthetics, meaningful work, environmental quality, some other products, or all of these combined.
3. *Desired Future Landscape (Ecological Component)*: This portion of the vision is about sustaining the forms of production on your farm and how the ecosystem processes should function. This is described in terms of what the landscape and ecosystem processes would look like in the future in order to sustain production and your quality of life. Historic knowledge may help in the development of the landscape description. It can be important to know what occurred historically in order to move forward.



#### An example of a shared vision:

Starting in 2003, LWWC began the process of developing a shared vision with its members. This was done in the context of the *Lodi Winegrower's Workbook* (Ohmart and Matthiasson 2000) and the sustainable certification standards of the *Lodi Rules for Sustainable Winegrowing* certification program (Ohmart et al. 2006; [www.lodirules.com](http://www.lodirules.com)). Over 10% of the LWWC membership has attended the half day workshop where, through facilitated discussion, participants begin the process of developing a sustainable vision for their farms. Below is a synopsis of the workshop discussions put into the form of a single dynamic shared vision statement that provides an example of what these statements contain. For the purpose of example the physical boundaries of California Crush District #11 were used to encompass the resource to be managed.



## An Example Dynamic Shared Vision for the Lodi-Woodbridge Winegrape Commission

### Whole to be Managed :

*Physical Boundaries* – The land delineated as Crush District 11 and the vineyards managed by Lodi-Woodbridge Winegrape Commission members.



*Decision Makers or the People Involved Who Influence the LWWC* – Winegrape Growers, Winery Owners, Suppliers, Retailers, Consumers, Politicians, Government Agencies, Educators, Advisors, Neighbors, Laborers, Financial Institutions, Foundations, Media, and Non-government organizations.

*Resource Base* – Operating budget for the LWWC and the capabilities of the Decision Makers and People involved who Influence Crush District 11. The capabilities of the people who influence the LWWC include Cooperation; Leadership; Education; Experience; Time; Research Involvement; Compassion; Energy; Understanding; Risk Takers; Knowledge of Opportunity; and Commitment.

### Three Part Vision:

*Quality of Life* – We value a life surrounded by family filled with companionship from them along with our friends. We feel good and secure in our homes and community. Our lives are filled with love, purpose, happiness, harmony, and peace. And because we strive to fill our lives in a positive way there is less chance for stress to creep in. We have time for fun and to enjoy the intrinsic worth of our lives with family and friends.

*Forms of Production* – In order to sustain our Quality of Life we will generate a profit from good quality winegrapes that produce good quality wine. This will create name recognition and demand for Lodi wine from thirsty buying customers. We will produce good relations with the local community. Our workforce will be content, viable and skilled. Our winegrape production will result in clean air and water, healthy soil, and an overall good environment.

*Future Resource Base* – For our Forms of Production to be truly sustainable our future land base will have a healthy and diverse soil with good populations of soil microbes. There will be an abundance of available nutrients for all plants and we will create an appreciation within the community for the importance of a healthy soil.

### Dynamic Shared Vision continued:

The water cycle will be healthy and beneficial to crops, land, people and nature. There will be an abundance of water from healthy rivers, streams, other surface water sources, and ground water. There will be greater availability and affordability of water with a balance of use between urban and rural communities.

Sufficient solar energy will be captured efficiently by healthy vigorous vines and native plants. Native vegetation communities will be thriving and biologically diverse. Renewable energy sources (e.g. solar) will be used by more people and businesses in the community. This will create more sources of sustainable energy. The air quality in our community will be good.

There will be adequate healthy and diverse biological communities. These communities will have ample vegetation of native plants that in combination with abiotic components provide good habitat for healthy wildlife populations. These healthy environments will also provide for diverse invertebrate populations beneficial to agriculture. Our community will understand and recognize the importance of a diverse, robust, and strong ecosystem.

There will be good rural and urban cooperation within our diverse community with participation in the continued development and pursuit of a shared vision. This will provide a balance of land use with protection of good agriculture land so it is available for use while encouraging sustainable economic growth. Urban centers are planned and clustered on non-arable land preserving our small town/farming atmosphere. Our community will value vineyards and sustainable agriculture.

## Ecosystem processes

Four fundamental ecosystem processes determine the dynamics and overall environmental quality of the land. These four processes are the water cycle, mineral cycle, energy flow, and community dynamics.

### The water cycle:

Water enters the landscape through rainfall and is stored in the soil profile, as surface water or as ground water in aquifers. Water cycles out of the landscape through runoff, evaporation, transpiration and deep percolation; these four components of the water cycle are strongly affected by the plants that cover the soil surface in natural and agricultural ecosystems. You can optimize your on-site water resources by reducing runoff, improving infiltration, and increasing soil water-holding capacity. Similarly, you can conserve water and protect water quality by minimizing off-site impacts, particularly the off-site movement of sediment (Reeves and Dlott 2002).



Be careful where you plant your vineyard, the water cycle can surprise you.

Photo: Kent Reeves

1.3 The water cycle <sup>1,2</sup>			
Category 4	Category 3	Category 2	Category 1
<p>I understand the amount of water that enters my property by monitoring and recording rainfall <b>And</b> I know the total water used by my vineyard operation by monitoring water use <b>And</b> I am knowledgeable about the total amount water resources in my watershed from surface and groundwater sources.</p>	<p>I understand the amount of water that enters my property by monitoring and recording rainfall <b>And</b> I know the total water used by my vineyard operation by monitoring water use.</p>	<p>I understand the amount of water that enters my property by monitoring and recording rainfall <b>And</b> I know the total water used by my vineyard operation by monitoring water use.</p>	<p>I do not monitor and record rainfall or keep track of the total water used by my vineyard operation.</p>

<sup>1</sup>The Water Management chapter will help you assess water use in managing your vineyard and wine quality.

<sup>2</sup> Modified from Reeves and Dlott 2002.

### The nutrient or mineral cycle:

The mineral or nutrient cycle is the process by which key elements necessary for living organisms, such as nitrogen, phosphorous, and potassium, move through the living (biotic) and nonliving (abiotic) components of the ecosystem. Ideally part of the mineral cycle should involve a biologically active soil with adequate aeration and energy flow below ground to sustain a variety of organisms in contact with carbon, nitrogen, and oxygen from the atmosphere. Implementing practices to prevent off-site nutrient losses (e.g., buffer strips, restored riparian areas, hedgerows, etc.) and increased nutrient cycling (e.g. cover cropping, adding compost, etc.) on your farm can help make it more efficient and environmentally sound (Reeves and Dlott 2002).

1.4 The nutrient or mineral cycle <sup>1,2</sup>			
Category 4	Category 3	Category 2	Category 1
<p>I have <u>written and implemented a comprehensive nutrition management plan</u> for my vineyard containing the following elements: field parameters, soil analysis, water analysis, tissue analysis, vineyard yield history, sources and forms of nutrients, sensitive areas, recommends rates and timing of nutrient applications, methods of application, and a review and update schedule</p> <p><b>And</b></p> <p>I implement practices to increase nutrient cycling (e.g. composting, cover cropping, use of treated water from ponds, etc.) and prevent the off-site loss of nutrients (e.g. use of buffer strips, vegetation along roads and ditches).</p>	<p>I have <u>created a nutrient budget</u> for my vineyard by calculating the amount of nutrients that enter it through irrigation water, cover crops and nutrient inputs such as fertilizer and compost and that exit the vineyard in the grapes harvested and I attempt to keep the budget balanced</p> <p><b>And</b></p> <p>I implement practices to increase nutrient cycling (e.g. composting, cover cropping, use of treated water from ponds, etc.) and prevent the off-site loss of nutrients (e.g. use of buffer strips, vegetation along roads and ditches).</p>	<p>I am in the process of developing a nutrient budget for my vineyard by calculating the amount of nutrients that enter it through irrigation water, cover crops and nutrient inputs, such as fertilizer and compost and that exit the vineyard in the grapes harvested.</p>	<p>I do not monitor nutrient inputs and outputs in an effort to develop nutrient budgets</p> <p><b>And</b></p> <p>I do not implement practices that prevent off-site loss of nutrients</p> <p><b>Or</b></p> <p>Hey, a little extra fertility in the river makes the bass grow larger.</p>

<sup>1</sup> The Soil Management Chapter will help you assess specific practices that affect mineral cycling and give suggestions on developing a nutrition management plan.

<sup>2</sup> Modified from Reeves and Dlott 2002.

### Energy flow:

Energy from the sun through plants is a one-way flow, so there is no energy cycle. Our natural living world runs on solar power and as an ecosystem process, energy flow shapes how ecosystems are structured and function. Our management decisions can affect how much energy is captured and put to use (Reeves and Dlott 2002). Plants capture light energy, and through the process of photosynthesis, convert that light energy into stored chemical energy that ultimately is utilized by animals and us. All life depends on this and therefore so does every economy, every nation, and every civilization (Savory and Butterfield 1999). Understanding energy flow and learning how to enhance it without large inputs of fossil fuel products will improve the other three ecosystem processes. Richard Smart's book *Sunlight into Wine* is an explicit recognition of the role sunlight plays in producing high quality wine (Smart and Robinson 1991). The Viticulture Chapter in this workbook deals directly with managing energy flow to produce quality grapes through canopy management in the vineyard.

<b>1.5 Energy flow<sup>1,2</sup></b>			
<b>Category 4</b>	<b>Category 3</b>	<b>Category 2</b>	<b>Category 1</b>
I work to optimize energy capture and flow in my vineyard through practices such as canopy, soil, and water management to achieve desired yields and fruit quality <b>And</b> I monitor energy used to manage my vineyard by tracking fuel consumption by tractors, harvesters, and ATVs as well as by irrigation pumps <b>And</b> I monitor energy use in my office and shop by tracking electricity consumption.	I work to optimize energy capture and flow in my vineyard through practices such as canopy, soil, and water management to achieve desired yields and fruit quality <b>And</b> I monitor energy used to manage my vineyard by tracking fuel consumption by tractors, harvesters, and ATVs as well as by irrigation pumps.	I work to optimize energy capture and flow in my vineyard through practices such as canopy, soil, and water management to achieve desired yields and fruit quality.	I do not consider energy flow in my farming operation.

<sup>1</sup> Modified from Reeves and Dlott 2002.

<sup>2</sup> The Shop and Yard Management Chapter will help you assess and manage energy use in your office and yard areas. Where energy use issues come into play in vineyard management, they are addressed on the appropriate worksheets in the Viticulture, Water Management and Soil Management Chapters.

## Community dynamics and succession

A **community** can be thought of as a subset of the living organisms in an ecosystem. For example, in your vineyard there is a plant community and an animal community. The animal community can be broken down further into the soil microbial community, the insect community, the bird community, and so forth. Community dynamics can be thought of as how the communities in the ecosystem interact and change over time. These interactions are the most vital of the four ecosystem processes. The other three processes cannot function unless plants of some form convert sunlight to useable energy for life and populate the environment. Biologically diverse communities are very dynamic, in other words they are in a constant state of flux. Species composition, numbers, and age structure are changing constantly along with a variety of other factors within the community. Biological diversity, or biodiversity, is a measure of the number/variety of species of plants and animals in an ecosystem. A biologically diverse assemblage of plants and animals enhances the functioning, stability, and productivity of our environment (Boyce and Haney 1997, Di Giulio et al. 2001). A high biodiversity is complimentary and essential to agriculture productivity and crop quality (Altieri 1999, Jackson and Jackson 2002, Imhoff 2003, Long and Pease 2005, Marshall et al. 2005, Blann 2006).



Red-tailed hawk

Succession is the term given to the process of changes a community and/or ecosystem go through over time. Biodiversity changes during the process of succession and is therefore an important element to monitor within not only vineyards, but adjacent natural areas on the farm. Relatively low biodiversity would indicate a stagnant successional process that could ultimately contribute to increased pest problems requiring more management and impact your bottom line.



The biological communities in an agricultural ecosystem provide benefits over and above the commercial crops they produce. These benefits are known as **ecosystem services**. They include removing carbon dioxide from the atmosphere (i.e. carbon sequestration), reducing greenhouse gases, the recycling of nutrients, regulation of microclimate and local hydrological processes. In some cases they result in the suppression of pest plants and animals through the production of pest natural enemies, and detoxification of noxious chemicals that enter the environment (Altieri 1999).

Human as well as animal communities are also subject to succession. The communities we live in shift and change on a daily basis. Family, friends, and colleagues come and go throughout our lives and we adjust accordingly to these changes. What we do, influences the length of time we are together in our communities. Developing a sense of community may take a lifetime or a week. It depends on the individual. Wondolleck and Yaffee (2000) surmise that sustainable community development often starts with groups that share a strong identification with a geographic location (Crush District 11), biophysical feature (winegrapes), and community (LWWC). Defining your

community beginning with your family and developing a shared vision provides the foundation to address the constant human community dynamics we face in our lives.

<b>1.6 Biodiversity and community dynamics (succession)</b>			
<b>Category 4</b>	<b>Category 3</b>	<b>Category 2</b>	<b>Category 1</b>
I work to optimize ecosystem services <sup>1</sup> in my vineyard by managing the vines, soil, vineyard floor and edges, headlands and buffer areas in ways that increase biodiversity <sup>2</sup> <b>And</b> I monitor and record indicators of plant and animal diversity in and around the vineyard <sup>3</sup> , including populations of pests and their natural enemies <sup>4</sup> .	I work to optimize ecosystem services <sup>1</sup> in my vineyard by managing the vines, soil, vineyard floor and edges, headlands and buffer areas in ways that increase biodiversity <sup>2</sup> <b>And</b> I monitor and record populations of pests and their natural enemies <sup>4</sup> .	I am aware that biodiversity and community dynamics are important in my vineyard and impacted by management of the vines, soil, vineyard floor and edges, headlands and buffer areas <b>And</b> I am working to understand the practices to implement to take advantage of the ecosystem services provided by biodiversity and community dynamics.	I am not aware of how biodiversity or community dynamics impact my vineyard.

<sup>1</sup> Benefits provided by the animal and plant communities in your vineyard over and above the grape crop.

<sup>2</sup> The number and variety of plant and animals in your vineyard.

<sup>3</sup> Are populations of birds such as quail, sparrows, or warblers increasing or decreasing on your property? Are native species nesting on your property? What species of mammals breed on your property? Are fish spawning in streams and rivers that may flow through your property? Knowing the answers will assist in determining the health of your land and ultimately the sustainability of your vineyard (Wrysinski 2001, Reeves and Dlott 2002). See Section 18 Monitoring Habitat and Wildlife below.

<sup>4</sup> Optimizing community dynamics means learning how to implement the type, timing, amount of farming practices to take advantage of ecological services such as increased numbers of pest natural enemies (Altieri 1999, Wrysinski 2001, Reeves and Dlott 2002).



Predacious mite that feeds on spider mites



Anagrus wasp, as parasite of leafhoppers

## Bioregions and American Viticulture Areas

The California Biodiversity Council recognizes 10 bioregions in the state and winegrapes are grown in virtually all of them (Fig. 1.1). They are based on natural assemblages of plants and animals with discernible but dynamic boundaries (Welsh 1994) which were developed in order to better manage and understand land use (Wheeler 1996). Each bioregion is unique with regard to physical, climatic, and biological characteristics. It is important to understand those features that make a bioregion unique because the same features contribute to making the fruit and wine from your area unique. Knowing about the area in the context of Bioregions also provides insight into how some state and federal agencies and many conservation groups think about important landscape, ecosystem, and sensitive species issues (Reeves and Dlott 2002). Crush District 11 encompasses three bioregions. The San Joaquin Valley, the Sacramento Valley, and the Bay-Delta Bioregions (Fig. 1.1). These bioregions are essentially the heart of California and as a whole are the state's top agricultural producing regions. Within these three bioregions is the Lodi Appellation and its seven sub-appellations.



Figure 1.1. California bioregions  
[\(\[http://gis.ca.gov/casil/legacy.ca.gov/Biology\\\_Terrestrial/regions/cbcregions.jpg\]\(http://gis.ca.gov/casil/legacy.ca.gov/Biology\_Terrestrial/regions/cbcregions.jpg\)\).](http://gis.ca.gov/casil/legacy.ca.gov/Biology_Terrestrial/regions/cbcregions.jpg)

The Lodi **Appellation** is a federally designated American Viticulture Area (AVA) recognized for the distinctive quality of its wines. Located directly east of San Francisco at the edge of the Sacramento River Delta, the Lodi appellation is noted for its classic Mediterranean climate and its distinctive sandy soils that provide the perfect environment for the production of world-class wines. These same characteristics also result in unique plant and animal communities.

The federal government first approved the Lodi AVA in 1986, and over the past two decades the number of "Lodi" labeled wines has skyrocketed. As the quality and recognition of Lodi wines spread, local winegrowers began to recognize the wide variety of ecological differences within the Lodi AVA - differences that began to show in the wines emerging from their vineyards.

These winegrowers sought to create sub-appellations that better reflect the diversity of the land. Their efforts resulted in the most extensive historical and science-based document outlining the diversity in climate, soil, topography, and elevation of any appellation ever to be submitted for federal approval. Their research concluded that seven distinct growing areas exist and deserve recognition as individual appellations.

In August 2006, the federal government granted recognition to the following seven appellations within the Lodi AVA (Fig. 1.2):

*Alta Mesa AVA* - Located in northern central Lodi, it is distinguished by its mesa-like elevation. The area is composed of dense heavy clay soils and gravel soils, and is the second warmest area in Lodi. Red grape varieties are typically planted in the AVA.

*Borden Ranch AVA* - Located in east central Lodi, it is the most topographically diverse area of the Lodi Appellation with elevations ranging from 73 feet in the west to 520 feet in the east. The region features well drained, stone-laden soils that tend to produce well-structured red wines.

*Clements Hills AVA* - Located in southeastern Lodi it is characterized by rolling hills at the base of the Sierra Foothills. It is generally warmer and wetter than western Lodi and it receives its cooling from the mountains. Red varieties are grown here.

*Cosumnes River AVA* - Noted for a relatively cool and windy growing season this appellation is located in the northwestern corner of Lodi. Relatively low-elevation and alluvial soils, the AVA is noted for its white wine varieties.

*Jahant AVA* - The smallest of the Lodi appellations it is uniquely defined by its pink Rocklin-Jahant loam soils. Jahant's climate is cool and dry due to its proximity to the Mokelumne River and Sacramento Delta, and relatively low elevations.

*Mokelumne River AVA* - The historical center of the Lodi wine growing region. Located in central Lodi it is noted for its fine sandy soils and boasts many of the regions famed Old Vine Zinfandel vineyards.

*Sloughouse AVA* - Located in the northeastern corner it is the warmest of the Lodi appellations.

Elevations rise to 590 feet and Sloughouse is noted for its diverse topography and low vigor soils. It receives the least cooling from San Francisco bay breezes that funnel up the Sacramento Delta.

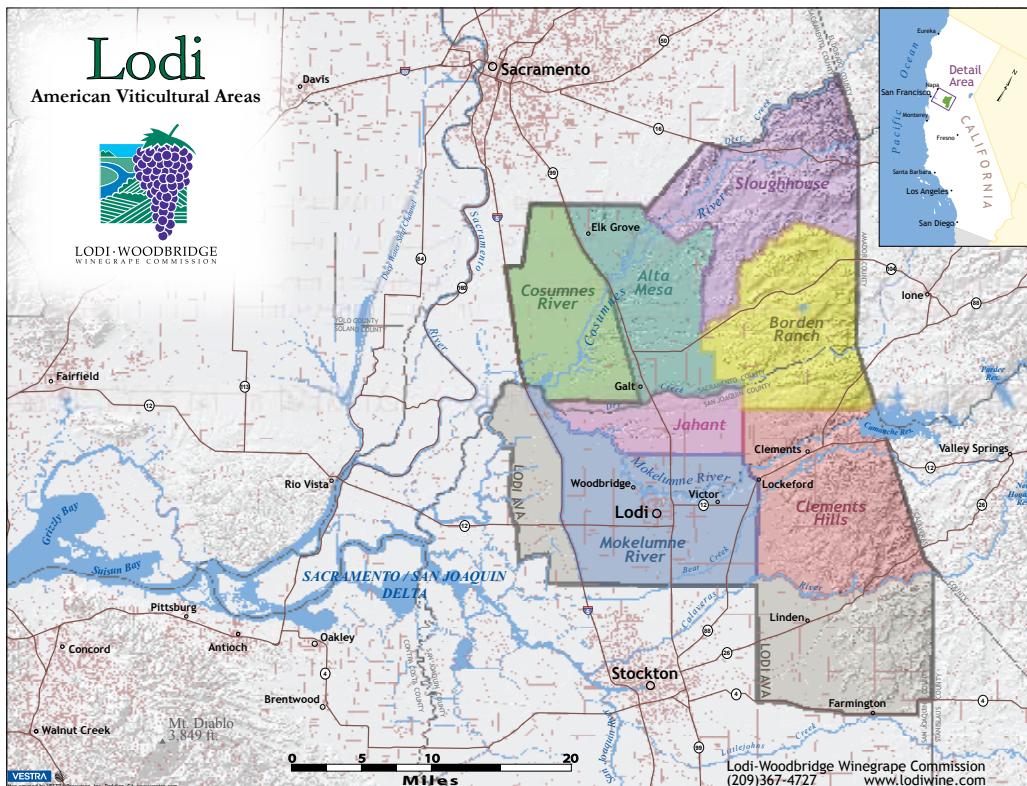


Fig. 1.3 Lodi American Viticulture Areas

### 1.7 Lodi appellations within the Lodi AVA

Category 4	Category 3	Category 2	Category 1
<p>I know the Lodi (sub) appellation in which my vineyard exists <b>And</b> The physical parameters such as soil type and weather that make it unique from other Lodi appellations <b>And</b> I know how it differs from the others in the plant and animal communities.</p>	<p>I know the Lodi (sub) appellation in which my vineyard exists <b>And</b> The physical parameters such as soil type and weather that make it unique from other Lodi appellations.</p>	<p>I know the Lodi (sub) appellation in which my vineyard exists.</p>	<p>I was not aware that the Lodi viticultural area was divided into several appellations.</p>

## Watershed management

The Frenchman, Joseph Nicollet, suggested in 1843, when surveying the upper Mississippi River basin, that the boundaries of new territories should follow river basin boundaries (Getches 1998). John Wesley Powell, scientist, geographer, and explorer, put it best when he said that a watershed is:

*"that area of land, a bounded hydrologic system, within which all living things are inextricably linked by their common water course and where, as humans settled, simple logic demanded that they become part of a community".*

Later in the 19<sup>th</sup> Century, Powell advised westerners to organize according to hydrologic regions for political decision-making (Getches 1998). We ignored him for too long and are just now beginning to heed that advice with the burgeoning movement to manage resources around watersheds (Reeves and Dlott 2002). There is a Watershed Program within the CalFed Bay-Delta Authority that was established in 1998 as an aid to achieving the overarching goal of this Program to restore ecological health and improve water management by working with the community at a watershed level. In California alone there are 109 unique watersheds that have been identified by this CalFed Program (CalFed 2006). These are primarily major watersheds and do not include the numerous smaller tributaries of these unique and valuable resources.

Agriculture is critical to the management of watersheds, from the participation of individual farmers in watershed stewardship efforts to the crops that are produced in watersheds. Five major rivers; the Sacramento, San Joaquin, Cosumnes, Mokelumne, and Calaveras along with their numerous tributaries flow through the boundaries of the Lodi District. These rivers also flow through the heartland of California agriculture. Healthy watersheds make for healthy working landscapes. "We all live in a watershed" is not just a catchy phrase repeated by watershed-based management advocates; it is the truth.

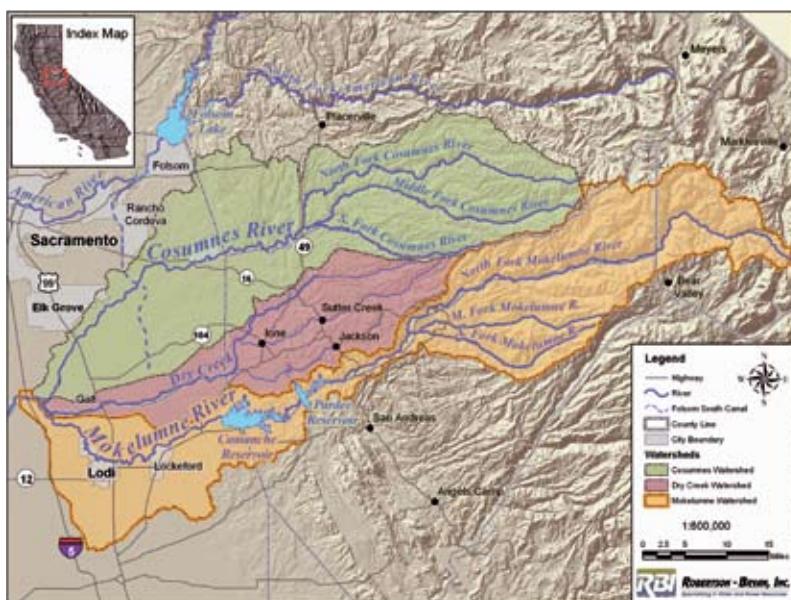


Figure 1.4. Map of the main watersheds in the Lodi region

<b>1.8 Watershed awareness</b>			
<b>Category 4</b>	<b>Category 3</b>	<b>Category 2</b>	<b>Category 1</b>
I am aware of the main watershed in which my vineyard is located <b>And</b> I am aware of the tributary watershed to which my vineyard is connected (if applicable) <b>And</b> I participate in a watershed stewardship planning group for my watershed if one exists <sup>1</sup> .	I am aware of the main watershed in which my vineyard is located <b>And</b> I am aware of the tributary watershed to which my vineyard is connected (if applicable).	I am aware of the main watershed in which my vineyard is located.	I am not aware of the watershed in which my vineyard is located.

<sup>1</sup>The Lower Mokelumne River Watershed Stewardship Committee meets regularly, usually in the Lodi Library Common Room. Contact the Watershed Coordinator for exact times and dates for meetings (Ph. 209-472-7127 x 125)

### Regional watersheds for the Lodi district

#### *The Lower Mokelumne River Watershed*

The Mokelumne River flows through the center of Crush District 11. Vineyards dominate the agricultural landscape and are approximately 40% of the lower Mokelumne River watershed comprising 28,174 acres (Fig. 1.5). Murphy Creek and Gill Creek are tributaries of this watershed below Camanche reservoir. The *Lower Mokelumne Watershed Stewardship Plan (Plan)* was funded by a CalFed Bay Delta program grant in 1998 and developed by a group of active watershed stakeholders between 1999 and 2002 through the San Joaquin County Resource Conservation District. Completed in 2002 the *Plan* provides a framework for stewardship of 10 key elements in the watershed. These elements are: Education; Recreation; Agriculture; Biological Resources; Water Quality; Flood Management; Cultural Resources; Economic Development; Emergency Services and Fire Management; and Ecological Restoration. The plan can be accessed online at [www.sjcrcc.org](http://www.sjcrcc.org), or by contacting the Watershed Coordinator, John Brodie at (209) 472-7127 EXT 125, [rvranglr@yahoo.com](mailto:rvranglr@yahoo.com), 3422 W. Hammer Lane, Suite A, Stockton, CA 95219. An informative video about the lower Mokelumne River watershed, *Reflections in the River*, was also produced by the RCD and is also available. Furthermore, the same CalFed grant that funded the writing of the watershed stewardship plan also help fund the writing of the first edition of the *Lodi Winegrower's Workbook*.

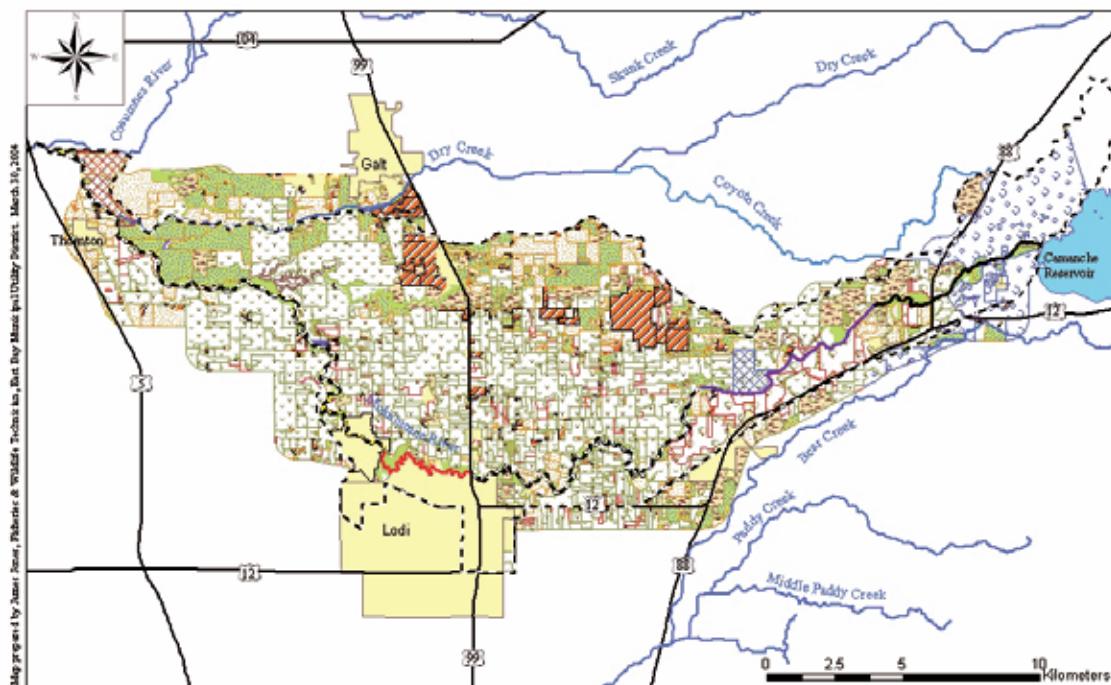


Fig 1. Lower Mokelumne River Watershed.

Watershed Boundary	Agricultural-Industrial	Deciduous Orchard	Urban	River Reach #
El Rio Farms	Agricultural-Urban	Freshwater Emergent Wetland	Valley Foothill Riparian	— 3
Ferreira Property	Annual Grassland	Irrigated Field Crops	Valley Oak Woodland	- - - 4
Mohr-Fry Property	Blue Oak Woodland	Irrigated Hayfield/Pasture	Vineyard	- - 5
				— 6

Figure 1.5. Map of the Lower Mokelumne River Watershed showing landuse

#### The Cosumnes River Watershed

The Cosumnes River is the only remaining unregulated (undamed) river on the western slope of the Sierra Nevada. Ultimately it flows into Crush District 11 in southern Sacramento County. A substantial portion of the watershed, known as the Cosumnes River Nature Preserve, is publicly owned and managed cooperatively by the Bureau of Land Management, US Fish and Wildlife Service, California State Parks, and The Nature Conservancy. This preserve is not only surrounded by agriculture, but includes it as a part of the overall management of the region. Dry Creek, a historic tributary of the Mokelumne River now flows into Bear and Grizzly sloughs which ultimately flow into the Cosumnes River. The Cosumnes flows into the Mokelumne River above the town of Thornton. An integrated resource management plan is being developed for the Cosumnes River watershed with more information available online at <http://www.cosumnes.org/index.html>.

#### The Lower Calaveras River Watershed

The Calaveras River Basin drains a total of 470 square miles above the foothill line in Calaveras and San Joaquin counties. The Calaveras River watershed is a tributary to the San Joaquin River Delta System and is located in Calaveras, Stanislaus, and San Joaquin counties. The lower Calaveras River watershed below New Hogan Dam encompasses approximately 115,000 acres and receives up to 90,000 acre feet of surface water. The four main tributaries below New Hogan are Cosgrove Creek, South Gulch, Indian Creek, and Duck Creek. Cosgrove Creek provides the largest run-off

contribution to the Calaveras River, as much as 8,500 acre-feet in some years.

The Calaveras River Watershed Stewardship Group (CRWSG) was started in 2004 to encourage preservation and proper management of the Calaveras River Watershed. This would be done through watershed-wide cooperation between landowners, water users, recreational users, conservation groups, and local, state, and federal agencies. The group is still in its infancy and is in the process of developing a Watershed Implementation Plan (WIP), which will serve as a guiding document for the CRWSG with long range goals for watershed management. More information about this group and the watershed can be found online at <http://www.calaverasriver.com/> or by contacting the Stockton East Water District at (209) 948-0333, 6767 E. Main St., Stockton, CA 95215, <http://sewd.net/index.htm>.

### Enhancing and protecting natural habitats

Often what is labeled as a “habitat” is really a vegetation community. However, because many people from different professions, agencies, and organizations talk about habitat, it is important to use an accurate and consistent definition to facilitate effective communication among different professions, agencies, and organizations. This workbook uses the standardized definition of habitat by Hall et al. (1997):

*“...We therefore define “habitat” as the resources and conditions present in an area that produce occupancy – including survival and reproduction – by a given organism. Habitat is organism-specific; it relates the presence of a species, population, or individual (animal or plant) to an area’s physical and biological characteristics. Habitat implies more than vegetation or vegetation structure; it is the sum of the specific resources that are needed by organisms. Wherever an organism is provided with resources that allow it to survive, that is habitat.”*

Within the California Wildlife Habitat Relationships (CWHR) classification system, there are 50 natural habitats and eight agricultural habitats recognized in the state (Mayer and Laudenslayer 1988, [http://www.dfg.ca.gov/whdab/html/wildlife\\_habitats.html](http://www.dfg.ca.gov/whdab/html/wildlife_habitats.html)). In *A Manual of California Vegetation* (Sawyer and Keeler-Wolf, 1995), the California Native Plant Society (CNPS) recognizes 275 vegetation stands, series, and habitats for the state. Vegetation communities can be managed, enhanced, and sometimes restored in order to benefit an organism’s overall habitat. East Bay Municipal Utility District (EBMUD) classified and mapped the vegetation along the lower Mokelumne River in San Joaquin County within the LWVC boundaries (Reeves and Jones 2004). Natural and Agricultural Habitats within the watershed were also defined and mapped (Reeves et al. 2006). You are encouraged to learn the habitats and vegetation communities on your property and how your activities may influence them.

This part of the chapter provides an overview of the general vegetation associations that are most often found in Crush District 11. These associations are broader than the habitats defined by the CWHR system and not as specific as the CNPS classification system. Carefully selecting new vineyard sites and using practices such as cover cropping, hedgerows, and buffer strips can significantly minimize adverse impacts to surrounding native habitat. These same winegrowing practices can also enhance the habitat quality of vineyards.

<b>1.9 Managing habitat in and around the vineyard<sup>1</sup></b>			
<b>Category 4</b>	<b>Category 3</b>	<b>Category 2</b>	<b>Category 1</b>
I maintain cover crops appropriate to each vineyard site <sup>2</sup> <b>And</b> I maintain hedgerows with <u>native</u> plants throughout our property <b>And</b> I use <u>native</u> grasses and shrubs along roadsides, on headlands, and ditch-banks.	I maintain cover crops appropriate to each vineyard site <sup>2</sup> <b>And</b> I maintain hedgerows throughout our property <b>And</b> We use grasses and shrubs along roadsides, headlands, and ditch-banks.	I maintain cover crops appropriate to each vineyard site <sup>2</sup> .	My vineyards are kept free and clean of any vegetation within and around their edges.

<sup>1</sup>Modified from Reeves and Dlott 2002.

<sup>2</sup>Cover crop and hedgerow plants can provide food (e.g., pollen, nectar, and prey) as well as refuge for beneficial insects, birds, and other animals. See the Soil Management chapter for relevant information on cover crops. An excellent source of information about cover cropping is *Cover cropping in Vineyards: A Grower's Handbook* (Ingles et al. 1998) and about hedgerows is *Hedgerows for California Agriculture* (Earnshaw 2004) and *Farmscaping with Native Perennial Grasses* (Long and Pease 2005).



Irrigation canal planted with native vegetation and which does not interfere with water transport or bank stabilization



Recently planted hedgerow between a road and the vineyard

### Benefits of Native Grasses for Agriculture

Hedgerows with a complex of **native** grasses and plants adjacent to vineyards in upland and non-farmed areas (e.g., roadsides, canal banks, levees, sloughs, drainage ditches, hard-to-farm corners, borders, and equipment yards) can eliminate many weed problems while providing permanent wildlife habitat (Strait 1999, Long and Pease 2005, O'Dell et al. 2007). A single plant may live 10-20 years, thus, once established, the grasses are easily managed by occasional mowing. Native grasses provide superior erosion control and are tolerant of drought, roadside traffic, and grazing. Although most native grasses are dormant during the summer, many species begin to green up well before winter rains because of their massive root systems that can reach deep ground moisture.

An established complex of native grasses sustains a wide variety of wildlife by providing excellent nesting cover in the spring. During the fall and winter, these grasses maintain their upright structure providing escape, loafing, and roosting cover for wildlife. The food value of native grasses for both seed and green forage is excellent. Many insect species also use the grasses and provide important food for pheasant, quail, and turkey chicks. Many of these insects are beneficial to the farmer because they provide biological control of agricultural pests (Di Giulio et al. 2001).



A native grass cover crop  
These grasses are allowed to set seed before mowing

Sources of information on habitat enhancement and restoration <sup>1</sup>			
California Society for Ecological Restoration 2701 20th St., Bakersfield, CA 93301 <a href="#">(661) 634-9228</a> <a href="http://www.sercal.org">http://www.sercal.org</a> email: smclark@lightspeed.net	University of California Sustainable Agriculture Research and Education Program One Shields Ave. Davis, CA 95616 <a href="#">(530) 752-7556</a> <a href="http://www.sarep.ucdavis.edu">http://www.sarep.ucdavis.edu</a> email: sarep@ucdavis.edu	Point Reyes Bird Observatory 3820 Cypress Drive #11 Petaluma, CA 94954 (707) 781-2555 <a href="http://www.prbo.org">http://www.prbo.org</a> email: prbo@prbo.org	Salmonid Restoration Federation P.O. Box 784 Redway, CA 95560 (707) 923-7501 <a href="http://www.calsalmon.org/about.html">http://www.calsalmon.org/about.html</a> email: srf@northcoast.com
Ducks Unlimited, Inc. Western Regional Office 9823 Old Winery Pl., #16 Sacramento, CA 95827 (916) 363-8257 <a href="http://www.ducks.org">http://www.ducks.org</a>	California Department of Fish and Game Native Anadromous Fish and Watershed Branch 1807 13th St., Suite 104 Sacramento, CA 95814 (916) 327-8840 <a href="http://www.dfg.ca.gov/nafwb/index.html">http://www.dfg.ca.gov/nafwb/index.html</a>	Grass to Grasslands P.O. Box 72405 Davis, CA 95617 <a href="#">(530) 759-8458</a> or <a href="#">(866) 456-CNGA</a> (toll-free) <a href="http://www.cnga.org">http://www.cnga.org</a> email: admin@cnga.org	Wild Farm Alliance 406 Main St., Suite 213 Watsonville, CA 95076 (831) 761-8408 <a href="http://www.wildfarmalliance.org">http://www.wildfarmalliance.org</a> email: wildfarms@earthlink.net
California Native Plant Society 1722 J St., Suite 17 Sacramento, CA 95814 (916) 447-2677 <a href="http://www.cnps.org">http://www.cnps.org</a> email: cnps@cnps.org	Yolo County Resource Conservation District 221 W. Court St., Suite 1 Woodland, CA 95695 (530) 662-2037 ext. 3 <a href="http://www.yolorcd.org">http://www.yolorcd.org</a>	Audubon California Landowner Stewardship Program 5265 Putah Creek Rd. Winters, CA 96694 (530) 795-2921 <a href="http://ca.audubon.org/LSP/html/contact.html">http://ca.audubon.org/LSP/html/contact.html</a>	Rivers Partners 806 14th Street Modesto CA 95354 (209) 521-1700 <a href="http://www.riverpartners.org/index.html">http://www.riverpartners.org/index.html</a>

<sup>1</sup>From Reeves and Dlott 2002.

## Vernal pools

**Vernal pools** occur only where a narrow range of favorable conditions exist. They are found only in a Mediterranean climate where most of the rainfall occurs from October to April followed by a hot, dry season when the pools completely dry out. A shallow depression is required, underlain by some soil substrate such as clay or basalt that is somewhat impervious to water percolation. In California, there are three geomorphological situations where these circumstances exist: coastal terraces, broad alluvial valleys such as the San Joaquin and Sacramento valleys, and ancient basaltic lava flows. Soils of vernal pools are typically very high in clay but can be derived from a variety of parent materials (Fig. 1.6).



**Figure 1.6. Distribution of Vernal Pools in California**  
Source: [http://ceres.ca.gov/wetlands/geo\\_info/vernal\\_pools\\_map.html](http://ceres.ca.gov/wetlands/geo_info/vernal_pools_map.html)

Hydrology is another key ingredient to the formation of a vernal pool. Specifically, water depth and duration of standing water play an important part in determining whether these areas can function as vernal pools. Water depths typically range from 10-60 cm (4 inches - 2 feet) deep. Pools need to remain inundated long enough to allow associated plants, invertebrates, and amphibians to complete their life cycles. Inundation can begin as early as November and go all the way until June in a very wet year. Shallow pools can fill with water, dry up, and then refill again several times during a season. Typically, a vernal pool is filled with water for only 3-4 months, from about

December through March. Vernal pools can be found from southern Oregon to just south of San Diego in Mexico, but the majority of vernal pools occur on California's coastal terraces and in the Great Central Valley.

Vernal pools are a unique habitat and therefore unique plants and animals have evolved to live in and around them. Because of the limited distribution of vernal pools some of these species are few in number qualifying them for the threatened or endangered species listings.

<b>1.10 Vernal pools habitat management<sup>1</sup></b>			
<b>Category 4</b>	<b>Category 3</b>	<b>Category 2</b>	<b>Category 1</b>
I preserve <u>vernal pools and swales</u> with adequate setbacks to reduce the probability of soil disturbance around them <b>And</b> Vegetated buffer strips of <u>native plants</u> are present to reduce sedimentation in the swales and vernal pools and introduction of pollutants.	I preserve <u>vernal pools</u> with adequate setbacks to reduce the probability of soil disturbance around them <b>And</b> Vegetated buffer strips are present to reduce sedimentation in the vernal pools and introduction of pollutants.	I preserve vernal pools with un-vegetated setbacks.	What's a vernal pool?

<sup>1</sup>Modified from Reeves and Dlott 2002.

### Vernal pools and San Joaquin and Sacramento Counties

Vernal pools are common in Sacramento and San Joaquin counties within Crush District 11. Several types are recognized including valley pools in basin areas which are typically alkaline or saline, terrace pools on ancient flood terraces of higher ground, and pools on volcanic soils. During wet springs, the rims of the pools are encircled by flowers that change in composition as the water recedes. Several aquatic invertebrates are restricted to these unique habitats including fairy and tadpole shrimp, spadefoot toads, and California tiger salamander.

On August 11, 2005, the U.S. Fish & Wildlife Service (USFWS) published a final critical habitat designation for 22 vernal pool ecosystem units in California and Oregon. Crush District 11 is located in Units 11 and 15 designated for critical vernal pool habitat. Within Sacramento and San Joaquin counties 53,648 acres have been designated critical vernal pool habitat<sup>2</sup>. Additional information can be obtained by contacting the Sacramento Fish and Wildlife Office, 2800 Cottage Way, Room W-2605, Sacramento, CA 95825, (916) 414-6600, fax (916) 414-6710, or e-mail: fwlsacweb@fws.gov. (<http://www.fws.gov/sacramento/es/protocol.htm>).

<sup>2</sup><http://a257.g.akamaitech.net/7/257/2422/01jan20051800/edocket.access.gpo.gov/2005/pdf/05-15569.pdf>

If you suspect you have vernal pools on your property, it is best to first contact the NRCS in Stockton at 3422 W. Hammer Lane, Suite A, Stockton, CA 95219, (209) 472-7127 x 127. As a non-regulatory agency the NRCS can provide information on what is appropriate for your farm along with what other agencies and organizations to contact to provide information. You can also contact the San Joaquin County Resource Conservation District (SJRCD) which has been conducting ongoing education and outreach to farmers and ranchers in an attempt to identify and encourage viable solutions between the needs of agriculture and requirements to protect vernal pools. The SJRCD is located in the same office with the NRCS in Stockton. The RCD has produced an on-line informational brochure, entitled: *Vernal Pools: Their History and Status in California's Central Valley*, [http://ceres.ca.gov/wetlands/what's new/vernal\\_sjq.html](http://ceres.ca.gov/wetlands/what's%20new/vernal_sjq.html).

## Oaks and oak woodlands

Eighteen species of oak enrich the California landscape. They occur throughout California and cover over a third of the state, ranging from the high desert slopes to the Pacific shoreline. The Mediterranean climate strongly associated with California oak woodlands is important for winegrowing. The Mediterranean region in the “old world” where many of the winegrape varieties originate is also associated with oaks (Reeves and Dlott 2002). Three species of oaks are found within our region: valley oak, *Quercus lobata*, blue oak, *Quercus douglasii*, and interior live oak, *Quercus wislizenii*. Plant and animals that share the oak woodland community are important influences for oaks. Oak woodlands in California provide breeding, nesting, foraging, and refugia habitat for 313 species of amphibians, reptiles, birds, and mammals (Mayer and Laudenslayer 1988).



Blue oaks in a vineyard in early spring with a ‘wall to wall’ cover crop. Note that vines start outside the canopy dripline. Photo by Kent Reeves

<b>1.11 Oak woodlands habitat management<sup>1,2,3</sup></b>			
<b>Category 4</b>	<b>Category 3</b>	<b>Category 2</b>	<b>Category 1</b>
<p>Oak trees were present before my vineyard was established, and the vineyard was laid out without removing them (unless they were sick and dying), farming is not done directly under the tree canopy, and native vegetation is maintained around the trees</p> <p><b>Or</b></p> <p>It was necessary to remove <u>some</u> oak trees and shrubs<sup>2</sup> before my vineyard was established but this was offset by mitigation banking or other permanent mitigation/protection of nearby oak woodland</p> <p><b>And</b></p> <p>I am working with conservation groups on landscape-level conservation planning of oak woodland ecosystems in the Lodi region.</p>	<p>Oak trees were present before my vineyard was established, and the vineyard was laid out without removing the trees (unless they were sick and dying), farming is done under the tree canopy</p> <p><b>Or</b></p> <p>It was necessary to remove <u>some</u> oak trees and shrubs<sup>2</sup> before my vineyard was established but this was offset through mitigation banking or other forms of permanent mitigation/protection of nearby oak woodland.</p>	<p>I removed <u>all</u> oak trees before I established my vineyard but replacement trees and shrubs were planted around the outside of the vineyard.</p>	<p>If oak trees were present before vineyard establishment, I removed them to make the most use of the land area for growing winegrapes .</p>

<sup>1</sup>Modified from Reeves and Dlott 2002.

<sup>2</sup>For additional information on oak woodland conservation, see the California Oak Foundation at <http://www.californiaoaks.org> and *California Agriculture* January-March 2007(61): 7-19 <http://CaliforniaAgriculture.ucop.edu>. For information on oak woodlands and bird conservation, see the Oak Woodland Bird Conservation Plan at <http://www.prbo.org/calpif/htmldocs/oaks.html>.

<sup>3</sup> See the Viticulture chapter for information about Armillaria root disease and California Woodlands.

### Vineyards in an oak landscape

The University of California's Integrated Hardwood Range Management Program (IHRMP) has published an educational brochure titled: *Vineyards in an Oak Landscape: Exploring the Physical, Biological and Social Benefits of Maintaining and Restoring Native Vegetation in and around the Vineyard*. It is a full-color, 15-page brochure intended for grape growers and those generally interested in agriculture and natural resource issues in California. It describes the unique values of the state's oak woodlands; the threats they face from fragmentation and conversion; and how landowners can care for them.

“Grape growers are increasingly looking to California’s oak woodlands as sites for new vineyards, so it is important that we provide them with as much information as possible on the impact of oak removal and conservation,” says Julia Crawford, coauthor of the brochure.

To order, contact University of California, DANR Communication Services, 6701 San Pablo Ave., Oakland, CA 94608-1239; Tel: (800) 994-8849 or (510) 642-2431; Fax: (510) 643-547. The price is \$4.50 (Calif. residents add 8.25% sales tax) plus shipping and handling.

### Riparian habitat

Riparian area refers to land and vegetation near water bodies such as streams, rivers, wetlands and lakes. The best available science indicates that healthy riparian areas generally include trees and shrubs that provide shade and stabilize banks around water bodies. Riparian habitat is important to ecosystem integrity and function across landscapes (Katibah 1984, Altieri 1999, Faber 2003, RHJV 2004). Studies indicate that trees and plants, wetlands, and floodplains all contribute to healthy riparian habitat. Riparian vegetation serves as a filter, preventing sediments and nutrients in surface runoff from entering waterways. The dense matrix of roots and organic surface litter can therefore improve water quality. Vegetation on the banks of waterways helps prevent bank erosion. Furthermore, vegetated riparian areas and floodplains act as a sponge by absorbing floodwater and then slowly releasing it over time, maintaining stream flows later in the summer. Shrubs and trees that shade the watercourse maintain cooler water temperatures, which are good for maintaining a diversity of aquatic life. Riparian vegetation also provides habitat for wildlife, especially bird species (RHJV 2004).



Riparian habitat adjacent to a 100+ year old Zinfandel vineyard

<b>1.12 Riparian habitat management<sup>1</sup></b>			
<b>Category 4</b>	<b>Category 3</b>	<b>Category 2</b>	<b>Category 1</b>
Banks of watercourses on my property have vegetated riparian area adjacent to the waterway <b>And</b> Vegetation is enhanced by weed management and supplemental plantings of native vegetation <b>And</b> I have removed some vines from production to increase the area of riparian vegetation and habitat for fisheries and wildlife.	Banks of watercourses on my property have vegetated riparian area adjacent to the waterway <b>And</b> Vegetation is enhanced by weed management and supplemental plantings of native vegetation.	I have not planted vines up to the edge of the watercourse <b>But</b> Riparian area (if it exists) is not enhanced or is managed to minimize vegetation.	I have planted the vineyard up to the edge of the watercourse to maximize the land area used for producing winegrapes (in accordance with legal requirements).

<sup>1</sup> Modified from Reeves and Dlott 2002.

### Riparian habitat and bird conservation

Riparian birds use every part of the habitat. Some birds prefer the canopy for nesting and foraging while others specialize on low shrubs. A healthy system needs diverse vegetative structure to best support birds. For more information, see the *Riparian Bird Conservation Plan: A Strategy for Reversing the Decline of Riparian Associated Bird Species in California 2.0* published by the California Partners in Flight and The Riparian Habitat Joint Venture (<http://www.prbo.org/calpif/htmldocs/riparian.html>).



Based on riparian bird monitoring conducted along the Mokelumne River in San Joaquin County between 1999 and 2006 there are 210 species of birds that have been observed to utilize the riparian area (Reeves et al. 2001, Yee et al. 2002, Pfeffer et al. 2006). Approximately 56% of these species feed on insects and can contribute to an overall integrated pest management program (Reeves et al. 2001, Pfeffer 2006).

### Economic values of riparian habitat

Riparian habitat provides many benefits to streamside landowners. For example a wide strip of riparian vegetation can offset flood damage to vineyards by acting as a “sieve” for trees and other debris that may wash in during large floods. Riparian vegetation also traps fine sediments and other pollutants, thereby preserving water quality. Because of their deep roots and dense growth habit, riparian trees, shrubs, and grasses provide excellent protection against bank erosion, helping to stabilize stream banks.

In addition to assisting with flood protection and erosion control, riparian vegetation may play a role in integrated pest management. Cavity nesting riparian bird species, such as kestrels and owls, prey on rodents in vineyards. Other cavity nesting birds, such as wrens, tree swallows, oak titmice, and bluebirds, may help reduce populations of pest insects. Bobcats, coyotes and foxes also use riparian areas to prey on rodents.

While Pierce’s Disease is currently not a problem in Lodi vineyards, this situation could change, particularly if Glassy-winged sharpshooter were to become established. Riparian vegetation management should foster a diverse, functioning natural plant community, while creating unfavorable conditions for the blue-green and Glassy-winged sharpshooters, thereby reducing the potential incidence of Pierce’s disease in nearby vineyards. While certain native and non-native plants may need to be removed, they should be replaced with other native species that will fill the ecological role of the removed plants. Studies conducted by researchers with the Agriculture Research Service in Napa County have shown that non-native invasive species (Himalayan blackberry and periwinkle) in proximity to vineyards is likely to increase the risk of Pierce’s disease. In contrast, the extremely low detection frequency of the Pierce’s disease pathogen in native species (California blackberry and elderberry) indicates that these hosts may add little risk of the disease in adjacent vineyards (Baumgartner and Warren 2005).

## Aquatic habitats

Aquatic habitats, such as streams, rivers and wetlands, are often overlooked in natural resource planning and management. These habitats can occur in association with many terrestrial habitats. Sometimes aquatic habitats are also found connected to one another, such as a wetland adjacent to a stream or river. Adjacent vegetated habitats such as riparian contribute to the overall quality of aquatic habitats. Besides providing important habitat for fish, aquatic habitats host a variety of wildlife species including amphibians, reptiles, birds, and mammals. Aquatic habitats are important to species such as Chinook salmon, steelhead, red-legged frog, California tiger salamander, giant garter snake, western pond turtle, waterfowl, herons, shorebirds, river otter, mink, and beaver.



Lower Mokelumne River

<b>1.13 Aquatic habitat management<sup>1</sup></b>			
<b>Category 4</b>	<b>Category 3</b>	<b>Category 2</b>	<b>Category 1</b>
I consider any nearby aquatic habitats in vineyard site selection, design, development and management (e.g., soil type and erosion ratings, slope of area, natural vegetation, and drainage are all considered to prevent off-site movement of sediments) <b>And</b> Buffer strips are left or created between vineyards and aquatic habitats <b>And</b> Roads are kept to a minimum around vineyards adjacent to aquatic habitats.	I consider any nearby aquatic habitats in vineyard site selection, design, development and management (e.g., soil type and erosion ratings, slope of area, natural vegetation, and drainage are all considered to prevent off-site movement of sediments) <b>And</b> Buffer strips are left or created between vineyards and aquatic habitats.	I consider any nearby aquatic habitats in vineyard site selection, design, development and management (e.g., soil type and erosion ratings, slope of area, natural vegetation, and drainage are all considered to prevent off-site movement of sediments).	If nearby aquatic habitats are present, I do not consider them in vineyard planning or management (except for complying with legal requirements).

<sup>1</sup> Modified from Reeves and Dlott 2002.

### Salmon and vineyards

Based on studies in the Pacific Northwest, it has been documented that Pacific salmon transfer large quantities of marine-derived nutrients to adjacent forest ecosystems with profound effects on plant and wildlife production. Biologists from UC Davis and EBMUD (Cederholm et al. 2000, Merz and Moyle 2006) investigated this process for two regulated rivers within Crush District 11, one with consistent salmon runs (Mokelumne River) and one without (Calaveras River). Mokelumne River Chinook salmon transported biomass and nitrogen comparable to Pacific Northwest salmon streams. Calaveras River levels were much less. Numbers of terrestrial scavengers, such as turkey vultures and coyotes, were correlated with salmon carcass counts over time on the Mokelumne River but not the Calaveras River. Likewise, salmon carcasses were consumed significantly faster on the Mokelumne River. Native riparian vegetation as well as cultivated wine grapes adjacent to Mokelumne River spawning sites received nitrogen from marine sources. This information suggests that robust salmon runs may provide important ecological services with high economic value within a working landscape.



## The vineyard as habitat



Vineyards provide habitat for a variety of wildlife. The ecosystem services provided by vineyards for vertebrate wildlife includes: nesting and foraging habitat for birds and raptors (Crase et al. 1976, DeHaven and Hothem 1979, Hothem and DeHaven 1982, Meunier et al. 2000, Somers and Morris 2002, Smallwood 1996, Van Duren et al. 1998, Reeves and Smith 2004, Ingels et al. 2005, Swolgaard 2005, Saxton 2006); cover, breeding and foraging habitat for rodents (Smallwood 1996, Van Duren et al. 1998, Ingels et al. 2005); and movement corridors for mammalian carnivores (Hilty and Merenlender 2004).

Because they can feed on grapes and damage vineyards, some wildlife species are considered pests and may be classed as undesirable species (see the Pest Management chapter for relevant information and practices on vertebrate pest management). However, pest species may attract valuable wildlife that prey on undesirable critters. Predators observed in and adjacent to vineyards include striped skunk, raccoon, gray fox, coyote, bobcat, and mountain lion.

Vineyards with cover crops surrounded by vineyards without them are islands for wildlife in California's agricultural landscapes. They are attractive to wildlife for the same reason that alfalfa in the Sacramento Valley is preferred by wildlife. Alfalfa and many cover crops are resource-rich and available to wildlife for many years. Pocket gophers proliferate in these environments, and



Bird nest in a grape vine canopy

they and their burrows are important resources for many animal species, most of which are beneficial to commercial crops. Preliminary research shows that gopher populations can thrive in cover crops without causing significant damage to vineyards (Smallwood 1996). Voles can coexist with productive vineyards so long as vine rows are kept bare (Smallwood 1996). Vineyards having both cover crops and bare rows appear to promote small mammals while also protecting the crop. Cover crops that provide habitat for wildlife also serve to connect remnant habitat patches on agricultural landscapes. In addition, numerous bird species found in vineyards provide benefits by feeding on insect pests.



Red-tailed hawk perched on grape stake

For additional information, see *Farming for Wildlife* (Clark and Rollins, 1996), *The Farm as Natural*

*Habitat* (Jackson and Jackson 2002), and *Farming with the Wild: Enhancing Biodiversity on Farms and Ranches* (Imhoff and Carra 2003).

### Enhancing habitat for raptors

Results from [raptor](#) surveys in the lower Mokelumne River watershed in San Joaquin County indicate that a variety of hawks hunt in vineyards, including red-tailed hawk, American kestrel, white-tailed kite, northern harrier, and Swainson's hawk (Reeves and Smith 2004, Swolgaard 2004, Swolgaard et al. *in press*). In addition a red-tailed hawk and kestrels select vineyards to hunt in during winter months (Reeves and Smith 2004). Maintaining, protecting, and enhancing habitat for raptors is valuable for sustainable viticulture.



Swainson's Hawk  
Photo Courtesy of Jim Dunn

#### 1.14 Enhancing habitat for raptors

Category 4	Category 3	Category 2	Category 1
<p>I have placed nesting boxes for owls, and perches for <i>raptors</i> (e.g., hawks, kestrels) in and/or around my vineyard</p> <p><b>And</b></p> <p>Natural nesting sites and perches for owls<sup>1</sup>, and raptors are maintained in and/or around the vineyard (e.g., leave oak trees in vineyard)</p> <p><b>And</b></p> <p>Nest sites and perches are monitored and maintained.</p>	<p>I have placed nesting boxes for owls and perches for raptors have been placed in and/or around my vineyard</p> <p><b>And</b></p> <p>Natural nesting sites and perches for raptors are maintained in and/or around the vineyard (e.g., leave oak trees in vineyard).</p>	<p>I have placed nesting boxes for owls in and/or around my property.</p>	<p>I have not placed nesting boxes anywhere on my property and no perches have been established for birds of prey.</p>

<sup>1</sup> Owl box occupancy rates may be lower where numerous nearby trees or other nesting structures exist. If owl boxes are positioned in trees, occupancy rates may be higher when placed in the upper third of the tree. Occupancy rates may also be lower where other species of owls, such as Great-horned owl, occur in high numbers. If that is the case, it is best to invest in natural habitat enhancement instead of artificial nest boxes and perches.

Some Lodi area raptors and the vineyard dwellers on which they prey



White-tailed kite



Vole



Northern Harrier



Pocket Gopher



Swaison's Hawk



Red-tailed Hawk



Ground Squirrel

## Enhancing habitat for other wildlife

Increasing the quantity and quality of habitat for wildlife on your property ultimately benefits the vineyard. This includes species such as waterfowl, songbirds, and bats among others.

<b>1.15 Enhancing habitat for other wildlife<sup>1</sup></b>			
<b>Category 4</b>	<b>Category 3</b>	<b>Category 2</b>	<b>Category 1</b>
I have placed <u>nesting boxes for bats, songbirds and other birds</u> in and/or around my property (for example western blue bird boxes, wood duck boxes near bodies of water) <b>And</b> Native plants have been established in or around the vineyard that provide shelter and/or food for wildlife (e.g., shrubs for quail).	I have placed <u>nesting boxes for multiple bird species</u> in and/or around my property (for example western blue bird boxes, and wood duck boxes near bodies of water).	I have placed <u>nest boxes or other nesting habitat</u> in and/or around my property for one bird species (for example western blue bird boxes, or wood duck boxes near bodies of water).	I have not placed nest boxes in and/or around my property nor done any habitat enhancement for other wildlife, such as songbirds or other birds, on my property.  Besides, I thought all birds ate grapes.

<sup>1</sup> Modified from Reeves and Dlott 2002.



Bat condo being put into place which can house 10,000 bats



Bat condo in place



Bluebird house with old nest

Photos by Kent Reeves

Nest box dimensions for common cavity-nesting birds							
Species	Floor (in)	Chips (2-3 in)	Depth (in)	Entrance above floor (in)	Diameter of Entrance (in)	Height (ft) above ground or water (W)	Preferred Habitat Codes
Wood duck	12x12	yes	22	17	4	10-20, 6W	3,5
American kestrel	8x8	yes	12-15	9-12	3	10-30	1,4
Barn owl	10x18	yes	15-18	0-4	6	12-18	4
Screech owl	8x8	yes	12-15	9-12	3	10-30	2
Hairy woodpecker	6x6	yes	12-15	9-12	1 5/8	12-20	2
Common flicker	7x7	yes	16-18	14-16	2 1/2	6-30	1,2
Ash-throated flycatcher	6x6	yes	8-10	6-8	1 1/2	8-20	1,6
Tree swallow	5x5	no	6-8	4-6	1 1/2	4-15	1
Violet-green swallow	5x5	no	6-8	4-6	1 1/2	4-15	1
Chickadees	4x4	yes	9	7	1 1/8	4-15	2
Plain titmouse	4x4	yes	9	7	1 1/4	5-15	2
White-breasted nuthatch	4x4	yes	9	7	1 3/8	5-15	2
House wren	4x4	no	6-8	4-6	1- 1 1/4	4-10	2,7
Bewick's wren	4x4	no	6-8	4-6	2- 2 1/4	5-10	2,7
Western bluebird	4x4	no	8-12	6-10	1 1/2	3-6	1

Source: Audubon Society Guide to Attracting Birds (Kress, 2006).

#### Habitat codes:

1. Open areas in the sun (not shaded permanently by trees), pastures, fields, or golf courses.
2. Woodland clearings or the edge of woods.
3. Above water, or if on land, the entrance should face the water.
4. On trunks of large trees, or high in little-frequented parts of barns, silos, water towers, or church steeples.
5. Moist forest bottomlands, flooded river valleys, swamps.
6. Semiarid country, deserts, dry open woods, and wood edges.
7. Backyards, near buildings.



## Federal programs for wildlife habitat restoration and conservation

U.S. Department of Agriculture, Natural Resource Conservation Service (NRCS)

### 1. Wildlife Habitat Incentives Program (WHIP)

The WHIP program provides incentive payments to landowners wishing to improve wildlife habitat on land they own or lease. Payments of up to 75% of the cost are available with a cap on the total cost. Payments are awarded on a priority basis and available funds may vary from year to year.

Priority projects are:

- Habitat development of unfarmed areas adjacent to farmed fields (ditches, levees, field borders, etc.).
- Riparian area and stream corridor enhancement or restoration.
- Wetland habitat creation or restoration.
- Upland habitat creation or restoration on rangelands.

Examples of cost-shared practices are:

- Low cross-levees (dikes) and water control structures for seasonal flooding of cropland.
- Planting trees, shrubs, and grass along drain ditches, streams and field borders.
- Nest boxes, raptor perches, brush piles, and water facilities (guzzlers).
- Livestock fencing to isolate waterways.

### 2. Environmental Quality Incentives Program (EQIP)

EQIP replaced the Agricultural Conservation Program and Long Term Agreement Program in 1997. One key goal of EQIP is to reduce sediment, nitrate, and pesticides from entering surface or ground water within designated geographic areas. For successful applications, NRCS will cost share the following practices: structural methods, such as pipelines, land leveling, return systems, and capping abandoned wells; vegetative methods, such as cover crops and windbreaks; and new technology, such as irrigation scheduling and pesticide and nutrient management. Payment is up to 75% of the project cost.

If you are interested in WHIP (<http://www.ca.nrcs.usda.gov/programs/whip>) or EQIP (<http://www.ca.nrcs.usda.gov/programs/eqip/>), contact the Stockton NRCS District Conservationist, Stockton Service Center, 3422 W Hammer Lane, Suite A, Stockton, CA 95219-5493 209.472.7127. For a complete list of California NRCS employees, get the directory at <http://www.ca.nrcs.usda.gov/contact/directory>. Another regional facility managed by NRCS that can provide assistance regarding native vegetation and wildlife habitat is the Plant Materials Center, 21001 N. Elliott Rd, Lockeford, CA 95237 209.727.5319 <http://plant-materials.nrcs.usda.gov/capmc/>.

## U.S. Department of Interior, U.S. Fish and Wildlife Service (USFWS)

### 1. Partners for Fish and Wildlife Program

Partners for Fish and Wildlife is the U.S. Fish and Wildlife Service's habitat restoration cost-sharing program for private landowners. It offers technical and financial assistance to landowners who wish to restore wildlife habitat on their property.

Projects include restoration of wildlife habitat on:

- degraded or converted wetlands
- riparian areas
- native grasslands
- streams
- endangered species habitat

The assistance provided by the U.S. Fish and Wildlife Service can range from giving informal advice on the design and location of potential restoration projects, to designing a project and funding up to 50% of the implementation cost under a formal cooperative agreement with the landowner.

Projects with the highest priorities are those that re-establish the natural historical communities and provide benefits to migratory birds, anadromous fish, and threatened and endangered species.

Projects include efforts such as, but not limited to:

- creating shallow water areas
- re-vegetating native plants
- erecting fences along riparian areas to create riparian pastures

If you are interested in participating in the Partners for Fish and Wildlife program, contact the program coordinators at (916) 414-6456. There is more information on the program at: <http://ceres.ca.gov/wetlands/introduction/partners.html>.

### 2. Private Stewardship Grant Program

The Private Stewardship Grant Program (PSGP) provides grants and other assistance on a competitive basis to individuals and groups engaged in local, private, and voluntary conservation efforts that benefit federally listed, proposed, or candidate species, or other at-risk species. Diverse panels of representatives from State and Federal Government, conservation organizations, agriculture and development interests, and the science community assess applications and make recommendations to the Secretary of the Interior, who awards the grants.

Excluding education and outreach, research, planning, and land acquisition, the PSGP is open to a wide variety of on-the-ground projects. Here are a few examples of previously selected projects:

- Stream restoration to increase overhanging vegetative cover and in-stream woody debris, restoring cool waters and improving habitat structure for trout species.
- Restoration of native plant communities through eradication of nonnative invasive plants.
- Habitat protection and restoration through modified grazing and timber management practices.
- Installation of exclosure fencing around sensitive habitats for imperiled species to prevent predation, trampling, and competition from nonnative species.
- Removal of fish migration barriers to enhance survival and reproduction of imperiled fish species.
- Implementation of effective management practices on existing suitable habitat for imperiled species.
- Restoration of wetland hydrology and vegetation to benefit imperiled waterfowl.
- Fire management activities to support rangeland/grassland habitat.

A ten percent (10%) match of cash or in-kind contributions is required. The program is available to private landowners and their partners. There is more information on this program at: <http://www.fws.gov/endangered/grants/private%5Fstewardship/>.

### **State programs for enhancement, restoration, and protection of wildlife on private lands**

The California Department of Fish and Game (CDFG) Private Lands Management (PLM) program offers ranchers and farmers an opportunity to increase their profits by improving habitat for wildlife. Through 1996, there were 52 PLM properties encompassing approximately 645,000 acres. The economic incentive provided is in the form of offering fishing and hunting opportunity to the public beyond the traditional seasons, and issuing tags or permits directly to individuals you allow to hunt or fish on your land. The landowner sets and collects whatever access and service fees they wish. The landowner pays a fee to be in the program, pays for the tags/permits, develops an approved management plan, and implements the agreed upon wildlife habitat improvements. The specific laws for the program are described in Sec 3400-3409 Fish and Game Code. Contact the Department of Fish and Game's PLM coordinator at (916) 653-7203 for more information and a brochure on the program.

The CDFG provides information (<http://www.dfg.ca.gov/habitats>) and recommendations to private landowners on programs and activities for the protection, management, and enhancement of native wildlife, fish, plants, and habitats. California Department of Fish and Game, 1416 Ninth Street, Sacramento, California 95814, Phone: (916) 445-0411.

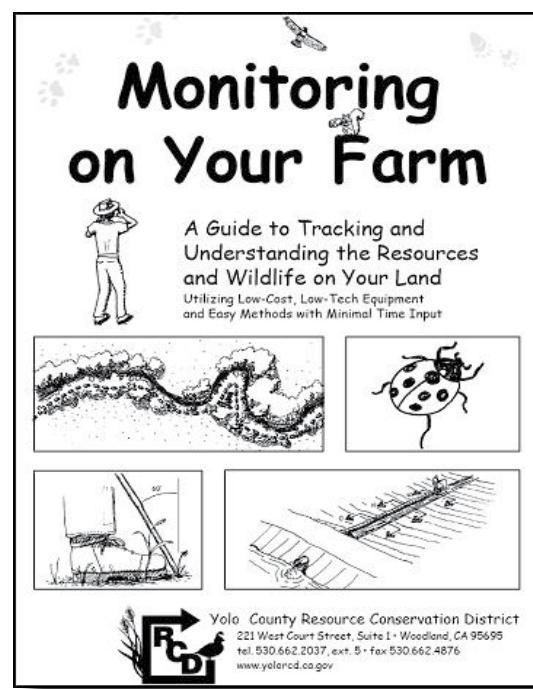
## Pesticides and wildlife

Improper and excessive use of certain **pesticides** during the 1950's and 1960's manifested itself in California wildlife populations (Carson 1963). Bioaccumulation of DDT and DDE up through the food chain had a pronounced effect on the brown pelican, peregrine falcon, and numerous species of songbirds (Carson 1963). With the ban on organochlorine pesticides, many of these species have bounced back and have been removed from the endangered species list. Many common pesticides can still impact wildlife populations and individuals, therefore careful use and reduction of pesticides in and around your vineyard can ultimately benefit wildlife.

Lodi growers recently contracted with Dr. Chuck Benbrook to develop a Pesticide Environmental Assessment System (PEAS) that calculates the environmental impact of a pesticide's active ingredient (Ohmart et al. 2006). PEAS assesses impact using 5 indices, three of which are related to wildlife: Toxicity to birds, toxicity to bees, and toxicity to *Daphnia*, which is the base of the food chain in aquatic habitats. The other indices are worker exposure and dietary exposure. The model can be used by Lodi growers to ensure that pesticides used in Lodi vineyards have minimal impact on wildlife and other ecosystem components. See page 68 in the Pest Management Chapter for a discussion of the PEAS model and a self assessment issue on reducing pesticide impacts on the environment, including wildlife.

### Monitoring habitat and wildlife

Monitoring is critical for feedback for management practices on your property and in your vineyard. Many of the issues in this workbook encourage monitoring, whether it is the moisture content of the vineyard soil, moisture stress in the vine, vine nutrient status, pest numbers, and so forth. It is also important to think of monitoring in relation to habitat and wildlife. As you manage for wildlife and habitat it is important to understand whether or not your practices are improving biological resources. Monitoring can be as simple as maintaining a photographic record over time or more involved collaborative research with an agency or educational institute. Regardless of what kind of monitoring you choose it is vital for making management decisions for your vineyard. Monitoring may allow you to: establish baselines of existing conditions, follow trends and fluctuation of biological resources, track individual species of plants or animals, follow changing use of resources by wildlife, improve your management, determine if you are moving away from or towards your vision (see Issue 1.2 above), measure economic success, avoid regulation, improve your knowledge of your property, and address personal or community issues (Wrysinski 2002).



<b>1.16 Monitoring habitat and wildlife</b>			
<b>Category 4</b>	<b>Category 3</b>	<b>Category 2</b>	<b>Category 1</b>
I keep a written or photographic record of vegetation and faunal (wildlife) changes on my property based on my management practices <b>And/Or</b> I collaborate with organizations and/or agencies to monitor biological resources on my property.	I keep a written or photographic record of vegetation and faunal changes on my property based on my management practices.	I drive around my property and mentally note any changes of plants and animals.	I monitor the amount of wildlife on my property by keeping track of the number of spent bullet shells on the floor board of my truck.

### Monitoring on your farm

The best resource for monitoring is the publication *Monitoring on Your Farm* published by the Yolo County RCD and written by Jeannette Wrysinski (2002). This publication provides excellent information for landowners who want to monitor natural resources on their property. Information can be obtained at [www.yolorcd.ca.gov](http://www.yolorcd.ca.gov), or by contacting the Yolo RCD at 221 West Court Street, Suite 1, Woodland, CA 95695, 530-662-2037, ext. 5.

Monitoring is more low-key than research, but just as legitimate for its intended purpose (Wrysinski 2002). It may not provide irrefutable answers with statistical confidence levels attached to them, but if done correctly, monitoring can accurately document changes in natural resource conditions, show trends in land use, measure differences between land areas, or measure qualitative changes that don't involve hard numbers, contributing to your management decisions (Wrysinski 2002).

It is important to be realistic and spend as little time monitoring as you can while still getting the information you will need to make decisions. Involve your family and staff in monitoring as well as community members. The local San Joaquin Audubon Society currently does volunteer monitoring on several public and private areas in the Lodi region. Monthly surveys of birds can provide invaluable information. Remember to pick what you want to monitor ahead of time based on your management. This may include a particular species of wildlife or plant. This may be a sensitive species or perhaps a game species such as California quail or cottontail. You may want to monitor a particular invasive weed species relative to native vegetation plantings. Remember to base your monitoring on what is important to you and some of your concerns.

### Monitoring methods

Photo monitoring is the most simple and striking kind of monitoring you can do for long-term change. It can also provide dramatic evidence of changes that can be accomplished (Wrysinski

2002). Below is an example of photo monitoring of a restoration site where a vineyard was removed and native vegetation re-established.



In this series of photos above the vineyard was removed in 2002. Restoration/enhancement began in 2004 and 2005. The same location was used to photograph the progress and will continue in order to monitor the site. Individual photos of specific plants such as the ones below can also be beneficial over time.



These 2006 photos were taken of Fremont cottonwoods that were planted as 2' saplings in the spring of 2005.

### Plant surveys and samples

Plant surveys and sampling can come in a variety of forms. What sampling techniques you choose depends on your goals and the type of information you want in the end (Wrysinski 2002). Are you monitoring native plants or are you interested in invasive weed species? Or both? Remember, invasive weed management should be done in combination with a restoration/enhancement plan (Bossard et al. 2000). For example, on the site in the above photos it was important to determine how many plants survived that were planted. Because all of the plants were marked, a simple “dead or alive” criteria was used to determine survivorship. This provided information on what species to use to not only replace the dead plants, but what to include that were successful for future plantings as the project proceeds.

### Animal monitoring

This is one of the most challenging, but rewarding forms of monitoring. It is important to decide what category of animals will give you the information you want to make management decisions. Besides the broad categories of insects, fish, amphibians, reptiles, birds, and mammals, it is important to pick which species might be of importance to you (also see sensitive species section below). General monitoring techniques may consist of an assessment of earthworms in your soil, sweep net samples of insects in pre-established quadrants of habitat, pit trap and cover board surveys for reptiles and amphibians, strip censuses or nest surveys for birds, and/or tracks and other sign surveys for mammals.



Swainson's hawk  
Photo courtesy of Jim Dunn

The important things to remember are: which category of animal is going to give you the information to manage your property and vineyard more effectively; monitor consistently over time; and use the information to make management decisions. The single most informative biodiversity monitoring guide for farmland is from the Yolo RCD as mentioned above (Wrysinski 2002). Agencies may be willing to conduct monitoring and/or provide baseline information about animals on your property. The Nature Conservancy, EBMUD, and the San Joaquin Audubon Society provide wildlife and plant lists that are relevant to landowners within Crush District II.

Information can be obtained at:

**Cosumnes River Preserve**, 13501 Franklin Blvd., Galt, CA 95632, Phone: 916.683.1700; FAX 916.683.1702; <http://www.cosumnes.org/specieslist.htm>.

**EBMUD**, Fisheries and Wildlife Division – Mokelumne Unit, 1 Winemaster Way, Suite K2, Lodi, CA 95240, Phone: 209.333.2095; FAX: 209.334.3795.

**San Joaquin Audubon Society**, PO Box 7755, Stockton, California 95267, <http://www.sanjoaquinaudubon.org/checklist.html>.

### Sensitive species

There are approximately 360 plants and animals listed under the Federal and State Endangered Species Acts in California. There are over 20 species of plants and animals listed as threatened, endangered, or species of special concern in Crush District II (Table 1.1). According to a 1993 study by the Association for Biodiversity Information and The Nature Conservancy, half of listed species have approximately 80% of their habitat on private lands. Because of listed species' dependence on private lands, private landowner participation in endangered species conservation is critical to successful species recovery and their eventual delisting. Several state and federal programs provide mechanisms to protect landowners' interests in their land, while providing them with incentives to manage lands in ways that benefit endangered species. Some will be discussed below.

<b>1.17 Sensitive species</b>			
<b>Category 4</b>	<b>Category 3</b>	<b>Category 2</b>	<b>Category 1</b>
I am aware of and know most of the threatened, endangered, and/or sensitive species that occur in the Lodi region <b>And</b> I know whether any of these species occur on my property <b>And</b> I manage my property to protect and/or enhance habitat for these species.	I am aware of and know most of the threatened, endangered, and/or sensitive species that occur in the Lodi region <b>And</b> I know whether any of these species occur on my property.	I am aware of and know most of the threatened, endangered, and/or sensitive species that occur in the Lodi region.	I am uninformed about sensitive species in my winegrowing operation. <b>Or</b> The three S's are my motto for managing endangered species on my farm (shoot, shovel and shutup).
<b><i>Finding endangered species on your farm is a sign that you are doing something right. It means that you have created on your farm conditions that are good for these species and that you are contributing to the increase in their numbers. If enough of these species can survive on farms, they will no longer be endangered, and can be taken off the list!</i></b>			

### The dilemma presented by endangered and sensitive species

Some may find it very difficult to agree with the two 'pearl of wisdom' statements above. Some environmental groups have used litigation based on the Endangered Species Act as a weapon against growers in many regions of California. They feel that the regulatory 'hammer' is the only way to bring endangered species back from the brink of extinction. This approach has alienated the grower community and ironically has led some landowners to practice the 3 S's mentioned above. The thought being if there are no endangered species on my property I cannot get into any legal trouble. However, since the bulk of the endangered species occur on private property it is the landowner who is in the best position to help endangered species recover if only given the chance. Most land owners want what is best for their land. Using this common ground between environmentalists and landowners, the organizations Environmental Defense and Sustainable Conservation are partnering with farmers, ranchers, private forest landowners and other private landowners. These organizations have developed positive relationships with private landowners throughout California to conserve and protect sensitive wildlife species and their habitat. If approached with respect the way these environmental organizations do, the grower can be a significant part of the answer to the recovery of endangered species rather than perceived as the cause of their decline.

Information on private landowner can be found at:

Environmental Defense - Center for Conservation Incentives, Sacramento Office, 1107 9th St. Suite 540, Sacramento, CA 95814, Ph. (916)-492-7070; <http://www.environmentaldefense.org>

Sustainable Conservation, 98 Battery St. Suite 302, San Francisco, CA 94111, Ph. (415)-977-0380, <http://suscon.org/index.asp>.

<b>Wildlife species in Crush District #11 that are threatened or of concern:</b>			
<b>Scientific Name</b>	<b>Common Name</b>	<b>Federal Status</b>	<b>State Status</b>
<b>Crustaceans:</b>			
<i>Branchinecta lynchi</i>	Vernal pool fairy shrimp	Threatened	None
<b>Beetles:</b>			
<i>Desmocerus californicus dimorpha</i>	Valley Elderberry Longhorn Beetle	Threatened	None
<b>Amphibians:</b>			
<i>Ambystoma californiense</i>	California Tiger Salamander	Candidate	Species of concern
<i>Scaphiopus hammondii</i>	Western Spadefoot	Species of concern	Species of concern
<b>Reptiles:</b>			
<i>Clemmys marmorata</i>	Western Pond Turtle	Species of concern	Species of concern
<i>Thamnophis gigas</i>	Giant Garter Snake	Threatened	Threatened
<b>Birds:</b>			
<i>Agelaius tricolor</i>	Tricolored Blackbird	Species of concern	Species of concern
<i>Athene cunicularia</i>	Burrowing Owl	Species of concern	Species of concern
<i>Buteo swainsoni</i>	Swainson's Hawk	None	Threatened
<b>Mammals:</b>			
<i>Perognathus inornatus inornatus</i>	San Joaquin Pocket Mouse	Species of concern	Species of concern

### Safe harbor agreements

Safe Harbor Agreements (SHA's) are voluntary arrangements between the U.S. Fish and Wildlife Service (USFWS) or the National Oceanic and Atmospheric Administration–Fisheries and cooperating non-Federal landowners. The SHA's main purpose is to promote voluntary management for listed species on non-Federal property while giving assurances to participating landowners that no additional future regulatory restrictions will be imposed. The agreements benefit endangered and threatened species while giving landowners assurances from additional restrictions.

Because many endangered and threatened species occur primarily or exclusively on privately owned property, we believe it is critical to their protection to involve private landowners in their conservation and recovery. Many property owners, however, are concerned about land use

restrictions that may occur if listed species colonize on their property or increase in numbers as a result of land management. Thus, they often avoid or limit land and water management practices that could enhance and maintain habitat.

<b>1.18 Safe Harbor Agreements</b>			
<b>Category 4</b>	<b>Category 3</b>	<b>Category 2</b>	<b>Category 1</b>
I participate in a Safe Harbor Agreement.	<p>I am aware of Safe Harbor Agreement programs</p> <p><b>And</b></p> <p>Know about the first programmatic SHA in California developed for the lower Mokelumne River in Crush District 11</p> <p><b>And</b></p> <p>I am evaluating whether or not this program would be beneficial to me within the context of land management on my farm.</p>	I am aware of Safe Harbor Agreement programs.	<p>I do not know about Safe Harbor Agreements</p> <p><b>Or</b></p> <p>Isn't a Safe Harbor a good place to dock your boat during a storm?</p>

#### The Lower Mokelumne River Programmatic Safe Harbor Agreement

The riparian forest ecosystem is vanishing from much of California. So it's welcome news that winegrape growers along with other farmers and ranchers are volunteering to restore and conserve these shaded

river corridors and the rich wildlife, fish, and songbird community that finds food and shelter there (Reeves et al. 2007). Along the Lower Mokelumne River, LWWC, Lange Twins Wine Estates, East Bay Municipal Utility District, and other landowners are working with the California Association of Resource Conservation Districts (CARDC) under a programmatic SHA. Environmental Defense, a national organization that has helped craft similar agreements in other states, also was extensively involved. The valley elderberry longhorned beetle (VELB) is the endangered species addressed by the SHA. With the assurances provided by the SHA, landowners are free to plant additional elderberry plants as part of their



Beetle exit holes in elderberry stems  
Photo Kent Reeves



Valley Elderberry Long-horned Beetle - Photo courtesy of USFWS

riparian habitat restoration projects, helping work toward delisting the beetle. But the habitat restoration is expected to benefit many other native species that live along the river (Reeves et al. 2007).

Like all SHA's, it encourages landowners to voluntarily restore and enhance wildlife habitat on their property without the fear of Endangered Species Act restrictions. In return for their beneficial stewardship, landowners receive legal assurances their good deeds will not result in new property restrictions and that they may continue normal business operations.

Landowners along a 40-mile stretch of the lower Mokelumne River are eligible to enroll a total of almost 15,000 acres under the agreement. Once enrolled, these landowners will plant and maintain elderberry bushes and restore native species typical of Valley Foothill Riparian habitats. Elderberry bushes are an important component of the riparian forest understory and the sole food source and shelter for VELB. Neotropical migrant songbirds, resident songbirds, raptors, and several mammal species also will benefit from restored Valley Foothill Riparian habitat.



Flowering elderberry bush  
Photo Kent Reeves

## Conservation easements

Conservation easements for protection of natural resources are legal agreements that allow landowners to donate or sell some "rights" on portions of their land to a public agency, land trust, or conservation organization. In exchange, the owner agrees to restrict development and farming in natural habitat, and assures the easement land remains protected in perpetuity. A 1996 study conducted by the National Wetlands Conservation Alliance indicated that the leading reasons landowners restored wetlands were to provide habitat for wildlife, to leave something to future generations, and to preserve natural beauty. Only 10% of landowners surveyed in the study restored wetlands solely for financial profit. This would also apply to other habitats besides wetlands. A conservation easement may provide you with financial benefits for the protection, enhancement, and restoration efforts for the natural environments on your property. Many easement programs include some sort of cash payment for a portion of the costs associated with habitat restoration and enhancement.

### 1.19 Conservation easements<sup>1</sup>

Category 4	Category 3	Category 2	Category 1
The natural areas on my property are protected by conservation easements.	I'm considering a conservation easement for natural areas on my property <i>And</i> I have conducted an assessment of my property and determined if it is appropriate for the future of my farm.	I am aware of conservation easement programs.	I do not know about conservation easements.

*Conservation easements may not be for everyone. Once signed and finalized, the easement lasts in perpetuity so it is important that you and your family are comfortable with the agreement, its benefits, and its implications before finalizing it.*

<sup>1</sup> Modified from Reeves and Dlott 2002.

#### An example conservation easement in Lodi

In order to meet the requirements of the San Joaquin Multi-Species Habitat Conservation and Open Space Plan (SJMSCP), the San Joaquin Council of Governments (SJCOC) staff is responsible for acquiring land to compensate for land consumed by development that contains habitat for any threatened and endangered species covered by the SJMSCP. In order to ensure the land is protected from development in perpetuity, staff use the preservation tool of the Conservation Easement. The Conservation Easement, publicly recorded by the County Assessors office, restricts any type of development on the preserve properties. A Preserve Management Plan (PMP) is created for each of the preserves through a collaboration of SJCOC and the willing landowner. The PMP meets the needs of the landowner while establishing a monitoring and enhancement plan for the preserve. Nestor Enterprises' Mokelumne River property, El Rio Farms, has a Conservation Easement held by SJCOC and is described here as an example.



El Rio site 2005 after vineyard removal and one disking

The El Rio Farms conservation easement is on approximately 24 acres of riparian habitat on property which is located north of Lockeford on the Mokelumne River. The main purpose of this easement was to meet the Valley Elderberry Longhorn Beetle jumpstart requirements of the SJMSCP. In 2005 Nestor Enterprises agreed to convert eight acres of vineyard back into riparian habitat while extending the riparian vegetation buffer between the river and vineyard. The easement was finalized in December 2005 and protects this important habitat while encouraging and continuing adjacent farming of winegrapes. The site is being restored through the cooperation of SJCOC, EBMUD, CDFG, USFWS, Center for Land Based

Learning, California Conservation Corps, and several area high schools.



El Rio site December 2006 (post-disking and planting)



High school students planting riparian vegetation

### Agriculture conservation easements

Agricultural conservation easements are for the explicit purpose of keeping farmland in production. They are similar to natural resource conservation easements, but, specifically protect farmland and maintain the practice of farming (Sokolow and Lemp 2002). In 1996, the state established the California Farmland Conservancy Program to protect farmland by buying easements. Based on a study conducted by UC Cooperative Extension and published in 2002, there were 34 local conservation organizations, land trusts, and open space districts that protect farmland through conservation easements (see Agricultural Easements: New Tool for Farmland Protection California Agriculture, *California Agriculture* January–February 2002, Volume 56:No. 1). Local opportunities may exist for one or both kinds of conservation easements on your property.

<b>1.20 Agriculture conservation easements<sup>1</sup></b>			
<b>Category 4</b>	<b>Category 3</b>	<b>Category 2</b>	<b>Category 1</b>
Some or all of my property is protected by an agricultural conservation easement.	I have identified where agriculture conservation easements are appropriate on my property <b>And</b> I am considering an agricultural conservation easement for my farmland.	I am aware of agricultural conservation easement programs, but based on careful research and understanding of easements have decided not to pursue them for my property at this time.	I do not know about agricultural conservation easements.

<sup>1</sup> Modified from Reeves and Dlott 2002.

### Central Valley Farmland Trust

The Central Valley Farmland Trust (CVFT) is a regional organization that protects farmland primarily in Merced, Stanislaus, San Joaquin, and Sacramento counties. In 2003 representatives from these counties began meeting to begin the process of creating a regional land trust dedicated to agriculture. The CVFT became a reality in May 2004 whose mission is to:

- Protect farmland through easements from willing sellers.
- Build support for the protection of Central Valley farmland, agricultural economy and heritage.
- Create an organization capable of protecting and managing lands in perpetuity.
- Obtain funding to acquire, hold and oversee conservation easements, and manage the trust.

Several landowners and agency staff from the area serve on the CVFT board of directors and advisory council. Information about agriculture conservation easements is available from the CVFT at 8788 Elk Grove Blvd, Bldg 1 – Suite 1, Elk Grove, California 95624, phone: (916)-687-3178. <http://www.valleyfarmland.org/easements.htm>

### Agricultural and conservation easement information sources

The Land Trust Alliance, <http://www.lta.org/>

American Farmland Trust, <http://www.farmland.org>, and <http://www.farmland.org/resources/reports/NationalView.asp>

California Farmland Conservancy Program, <http://www.consrv.ca.gov/DLRP/cfcp/index.htm>

Central Valley Farmland Trust, <http://www.valleyfarmland.org/index.htm>

Farmland Mapping and Monitoring Program, <http://www.consrv.ca.gov/DLRP/fmmp/index.htm>

Great Valley Center, <http://www.greatvalley.org>

Planning and Conservation League, [http://wwwpcl.org/pclf/pclf\\_plan\\_constrans.asp](http://wwwpcl.org/pclf/pclf_plan_constrans.asp)

UC Agricultural Issues Center/Land-Use and Farmland Conversion, <http://aic.ucdavis.edu/research1/land.html>

The Nature Conservancy, <http://www.nature.org>