The Economic Roots of Solano County Agriculture

Report II
Solano Agricultural Futures Project

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Executive Summary

This report is an analysis of the diversity of Solano County agriculture, particularly its economic dimensions. This is the second written product of the Solano Agricultural Futures project conducted for county government by the Solano County Cooperative Extension office and the Agricultural Issues Center of the University of California. The first report in early 2007 summarized the findings of ten focus group conversations with Solano County farmers and ranchers. The third report in the series will compare the agricultural policies of Solano and eight other counties, while the fourth and final report will present a set of recommendations to the Board of Supervisors. Both are due later this year.

We focus here on the major factors that influence the economic well-being of the county's agricultural sector. This is much more than a static analysis of current conditions; Solano County agriculture is in continual flux, so the report looks at past and ongoing trends and future prospects. It also dips below the surface of aggregate countywide conditions to examine the detailed components of Solano County agriculture, particularly the individual crop and animal commodities that are grown here and the agricultural systems that characterize different regions of the county. Appendices I and II present detailed profiles of 17 different commodities and the nine agricultural regions of the county.

Describing the local agricultural economy, the key findings are:

- Agriculture is a major part of both the economy and landscape of Solano County. It generates about $370 million (commodity sales and related activities) annually and occupies 362,000 acres, 62 percent of the county's total area.

- Most farm parcels (as identified by the Census of Agriculture) are primarily rural homesites, located on small acreages and producing commodities of little, if any, commercial value.

- Total sales of crop and animal commodities in the county has gradually declined in value in recent decades in inflation-adjusted terms.

- Countywide market values, however, mask individual commodity trends, which change independently of each other. Among the top commodities in Solano County in recent years, sales of vegetables, walnuts, milk, and almonds have shot up in value while wheat, corn, sheep, beans, and tomatoes have declined. Grown locally a few years ago, sugar beets and fruit for canning are no longer produced in the county.

- The county has nine distinct agricultural regions, each characterized as a separate farming system according to commodities grown, soil conditions, cultivation practices and water conditions. Most important in commodity sales value are the Dixon Ridge, Winters, and Suisun Valley regions.

- Every dollar in agricultural commodity sales leads to an estimated additional 58 cents in off-farm income in the county through processing, farm supplies, machinery sales and other related economic activity. Similarly, each job on the farm or ranch generates an estimated 0.47 of a job elsewhere in the local economy.

- Besides commodity sales, Solano County producers earn income or other economic benefits from conservation payments, energy production, property tax reductions, and other uses of agricultural land and agricultural practices.

- Pushed by the demand for rural homesites from affluent buyers, prices of farmland in the county have escalated in recent years, making land unaffordable for farmers and ranchers seeking to expand. The minimum parcel size requirements under agricultural zoning do little to discourage residential purchases of farmland.

- The continued operation of local farms and ranches as largely family enterprises is limited by the aging of principal operators and the reluctance of younger generation members to take over these businesses.

- Local farms and ranches depend on elaborate systems of irrigation and drainage to grow crops and animals. Designed to move water to and through large parcels, these systems are upset by land divisions that create rural homesites.

- The history of modern Solano County agriculture covers a century and a half of evolving commodities and practices, with major changes brought about by shifts in global prices, irrigation, shipping, environmental conditions, competition from other regions, and new technologies.

What mainly drives the local agricultural economy are influences external to Solano County. The commodities produced by farms and ranches and their profitability is largely determined by global demand and prices for commodities, by corporate decisions about the location and availability of processing facilities and other commodity outlets, by competition from other regions of California, and by state and federal regulations.

Yet there are significant opportunities for local actions to reduce negative outside impacts and enhance the county's agricultural economy. Agricultural producers themselves are the most important agents in this arena in how well they can adapt to external changes. Needless to say, some Solano County producers are more successful than others in maintaining efficient and profitable operations.

Solano County government also has a role to play in contributing to the prosperity of farms and ranches. Most of this involves the county's policies and practices in land use and agricultural business regulations. Two examples drawn from the details of this report stand out:

- Zoning and other policies that control the placement of rural residences on agricultural parcels, with a view to limiting parcelization and urban impacts on farms and ranches.

- County government actions encouraging the location and retention of processing facilities and other outlets in the county for agricultural commodities.

The project's remaining reports will examine these issues in further detail.

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The Economic Roots of Solano County Agriculture

Solano Ag Futures Project

1. Introduction: Overview of Local Agriculture

Solano County has a diverse agricultural landscape. It combines parts of the Bay Area, Delta, Coastal Range and Sacramento Valley. The blending of these regions across the county creates a number of distinct agricultural production areas, each with different commodity mixes and cultivation characteristics.

For travelers passing through the County, the cropping and grazing patterns they see along the roads and in the hills are formed by individual farmers and ranchers trying to maintain profitable agricultural businesses. Some growers operate large row crop or livestock enterprises of hundreds or thousands of acres, selling in national and international markets, often using both owned and rented land. Other producers operate at a much smaller scale, some growing produce for nearby urban niche markets. There is no one particular type of farming operation—or even two or three—that typifies Solano County agriculture.

This Report.
We highlight here the major factors that influence the economic health of Solano County farms and ranches. Included are trends in farm number and size, agricultural impacts on the broader economy, support services and the processing industry, the human dimensions of local farming, the multiple income sources supporting agriculture, land market patterns, and the ups and downs of Solano County agriculture over time. Furthermore, to truly appreciate the diversity of the local farm sector, the report profiles 17 different locally produced commodities and nine distinct agricultural regions in the county. Appendices I and II present these details.

At the request of Solano County government, the University of California is conducting the Solano Agricultural Futures project, an 18-month comprehensive examination of the county's farm and ranch sector. Our focus is on the problems and future prospects of the economic base of local agriculture, with particular attention to the production and marketing of specific commodities. Two UC programs are involved in the project—the Agricultural Issues Center at UC Davis and the Cooperative Extension office in Solano County.

The project began in April, 2006, and has four major phases:

- ***Farmer and Rancher Perceptions and Projections*—**as captured in focus group interviews and individual questionnaires.
- ***A Detailed Profile of Agriculture in Solano County*—**covering production patterns, commodity markets, land ownership and leasing arrangements, agricultural land markets, operator and farm family characteristics, and the sources of agricultural income.
- ***Lessons from Other Areas*—**a comparison of agricultural patterns and county programs in a half dozen other California counties.
- ***Future Scenarios and Recommendations*—**economic options for Solano County agriculture focused on commodity markets, the services provided by agricultural land, and the role of county government.

The report is both descriptive and interpretative. It is based on information from three major types of sources:

(1) Published quantitative material such as the Census of Agriculture and the annual crop reports of the Solano County Agricultural Commissioner.

(2) Numerous structured and unstructured interviews with county officials, leaders in the local agricultural committee, other farmers and ranchers, and local experts in such agriculture-related areas as conservation programs, land markets, farm finance, and water.

(3) The results of our earlier focus group sessions with Solano County agricultural producers, including the individual questionnaires they completed.

The Significance of Local Agriculture.
How important is agriculture to Solano County? Agriculture has enormous significance to the county in land use terms. Farms and ranches are the dominant landscape features of the county, covering more than 60 percent of the county as noted in the accompanying Snapshot. Thus agriculture provides the bulk of the open space—scenery, habitat, vegetation, and other environmental resources. In effect, private landowners maintain the public amenities enjoyed by all residents and visitors to the county, buffering urban pressures and enhancing the quality of life.

Agriculture also contributes to the local economy, although it is no longer the dominant industry of many years ago. Greatly increased population, urbanization, and business growth in recent decades have expanded and diversified the economy, reducing the relative role of farms and ranches in the total picture. Still, the production of crops and animals and support businesses are important contributors to a balanced local economy. As the Snapshot shows, several hundred million dollars in commodity sales generate additional dollars through support and processing activities. Several thousand persons (including farm family members) either work on farms and ranches or in the dozens of allied businesses.

The landscape and economic dimensions of Solano County agriculture are interconnected. Farmers and ranchers are both business people and land stewards. In order to stay on the land and provide the open space resources so valued by others, they need a modicum of profitability. However, agricultural enterprises face challenges not experienced by other industries. On a yearly basis, producers confront weather and price fluctuations, governmental regulations, and other factors which directly affect their productivity and profitability, but are beyond their control. As a result, Solano County agriculture continually evolves as farmers and ranchers search for profitability by adapting to changing markets, technologies, urban pressures and other circumstances.

2. Farms and Farm Size

In 2002, the most recent year counted by the Census of Agriculture, Solano County had 915 farms representing 351,000 acres in production. The average farm size was 384 acres.

The average, of course, masks a great deal of variation—farms range in size from parcels of a few acres to ranches spread over several thousand acres. As Table 1 shows, more than 60 percent of all farms in 2002 were in the smallest size category—less than 50 acres each. (A quarter of all farms were under 10 acres each.) Only 12 percent of all farms were in the largest category, 500 acres or more.

The relative significance of the largest farms obviously changes when acre totals by size category are considered. With an accumulated total of 301,000 acres, the 113 largest farms together contained more than 85 percent of all agricultural land in the county. By contrast, the 552 farms in the under 50-acre category accounted for only 8,364 acres in 2002, 2.5 percent of the county's agricultural total.

A snapshot of Solano county agriculture

- **Land** 362,000 agricultural acres, 62% of county's total area (2004)
- **Soils and Typology:** Considerable variation, with flat to gently sloping terrain on prime soils in the northeastern and northwestern (Suisun and Green Valleys) sectors, moderate slopes on less prime land south of Dixon, and significant slopes on poorer soils in the Montezuma Hills and Vaca Hills areas. Prime soils (141,000 acres) account for 39% of total ag land in Solano County. Other cropland (19,000 acres) is 5% and grazing land (201,000 acres) is 56%.
- **Market Value of Agricultural Products:** $233 million (2006) 30th in California
- **Farms:** 915, average 384 acres (2002)
- **Commodities:** 75 different crop and animal products; at least 21 have annual market values of $1 million or more. Major commodity groups in annual market value are: (1) Nursery Stock: $50 million; (2) Cattle and Calves: $ 27 million; (3) Alfalfa: $26 million; (4) Processing Tomatoes: $19 million; (5) Walnuts: $16 million (2005)
- **Irrigated Farmland:** 124,000 acres on 553 farms (2002)
- **Agricultural Animals:** Inventory: 14,500 beef cows; 3,900 milk cows; 58,800 sheep and lambs; 81,000 chickens (2002)
- **The Agricultural Landscape:** 56% in animal grazing; 28% in field crops; 5 % in orchards (fruits and nuts); 3.% in vegetable crops; 8% in other (2005)
- **Local Economic Impacts of Agriculture:** At least $370 million in total economic activity, assuming an average 1. multiplier for the $238 million in market value of products (2002)

Sources: Annual Report of Agriculture, 2005; Solano County Agricultural Commissioner; U.S. Census of Agriculture, 2002.

Table 1 also details changes in farm numbers and size over a recent 15-year period, between the Agricultural Census years of 1987-2002. The recent trends include the following:

- Farm numbers in Solano County fluctuated during the 15-year period, first declining from 531 farms in 1987, then increasing to the most recent total of 552 in 2002.

- Most of the large increase in farm numbers between 1997 and 2002, from 795 to 915, was due to the sharp rise in the number of small farms—from 459 to 552, a 20 percent increase, in the 1-49 acre category. In part, this may have reflected the splitting off of individual lots from agricultural parcels to satisfy the demand for rural residences on large lots, combined with some continued agricultural activity on the new parcels. It also may have been the result of an increase in agriculture operations that meet the minimum $1,000 annual income minimum for the U.S. Census of Agriculture definition of a "farm."

- The dominant position of the largest farms in combined acres remained unchanged during the 15-year period, holding at 85-87 percent of all agricultural land. But the number of the largest operations steadily decreased during the period from 143 to 113, largely as a result of ranch mergers.

Table 1. **Farms and Farm Size, Solano County and California, 1987-2002**

SOLANO	**2002**		**1997**		**1992**		**1987**	
No. of Farms	915		795		850		895	
Average Acres	384		455		400		359	
Farms by Size Group		percent		percent		percent		percent
1-49 acres	552	60.3	459	57.7	485	57.1	531	59.3
50-499	250	27.3	213	26.7	246	28.9	221	24.7
500 +	113	12.3	123	15.4	119	14.0	143	16.0
Acres by Size Group								
1-49 acres	8,364	2.3	7,052	1.9	7,318	2.1	8,209	2.5
50-499	41,254	11.7	36,757	10.7	41,788	12.3	39,574	12.3
500 +	301,835	85.8	316,293	87.3	291,222	85.5	237,653	85.1

CALIFORNIA	**2002**		**1997**		**1992**		**1987**	
No. of Farms	79,631		74,126		77,669		83.217	
Average Acres	346		374		373		368	
Acres by Size Group								
1-49 acres	49,134	61.7	44,912	60.6	47,574	61.2	51,195	61.5
50-500	22,097	27.7	20,558	27.7	21,395	27.5	23,045	27.7
500 +	8,400	10.5	8,656	11.7	8,700	11.2	8,977	10.8

Source: Census of Agriculture, 2002, and earlier years

3. Farms as Economic Units: Does Size Make a Difference?

The many small Solano County farms (552 in 2002 under 50 acres) are a mixed bag economically. Including are a few commercially viable farms managed by full-time and other serious farmers. But the great majority of small agricultural parcels serve primarily as rural homesites with little, if any, commercial production. They are included in this tabulation because the Census of Agriculture uses an economically minimal definition of a "farm"—one that generates at least $1,000 in annual commodity sales.

In fact, the $1,000 minimum is not rigorously applied by the Census when it reports the number of farms per county every five years. The formal definition includes the potential for reaching the minimum; a farm is an enterprise "that produces and sells, or would normally sell, $1,000 or more of agricultural products." (Appendix A, 2002 Census of Agriculture.) Thus 253 of the farms--a little more than a quarter of all farms in the county—actually reported income of less than $1,000 in 2002; most probably had no commodity sales in that year.

Farm size obviously has some relationship to the economic health of a community's agricultural sector, and especially to the viability of individual farm operations. Viability can be defined in different ways. The strictest standard refers to the ability of an agricultural operation, an "economic unit," to totally support the income needs of a household. A less severe threshold is a "farmable unit," referring to a parcel size that can be efficiently managed as part of a larger farming operation.

Various factors affect the potential for operating a particular agricultural parcel as a viable enterprise. For example, some landowners accept a relatively low return from commodity production on a small farm if they have income from other sources and value the life style and other non-economic aspects of engaging in agriculture. An additional consideration is whether a small parcel as a farmable unit can be efficiently integrated into a larger operation; this is often a matter of location and the ease of moving equipment and labor between parcels.

Generally, the larger the total size of the farm the higher its productivity and profitability. Common belief asserts that most individual farm enterprises, to be efficient and profitable, require large parcels dedicated to commodity production of either plants or animals.

However, it is impossible to identify a minimum acre threshold for a productive agricultural operation throughout Solano County. The principal reasons that farm commodities differ greatly in their land requirements, market price and other factors. Producing field crops and livestock, for example, demands far more acres per individual farm than growing vegetable or orchard crops.

Table 1a. **Average Acres by Farm in Solano County Devoted to Particular Commodities (in descending order by acreage)**

Commodity	Acres	Farms
Processing Tomatoes	509.6	21
Wheat	391.6	62
Corn	295.0	12
Forage	264.8	192
All Orchard Crops	58.5	339
Pears	57.9	14
English Walnuts	56.4	170
Grapes	45.9	79
Plums and Prunes	30.1	71
Bell Peppers	27.0	14

Source: 2002 Census of Agriculture

Size obviously influences farm income. Table 2 shows the extent to which small and large farms in Solano County differ in commodity income. It compares farm size categories according to market sales of over and under $10,000 year (which divides local farms into two groups roughly equal in size) for 1997, the last year the Census of Agriculture reported data for this statistic. Clearly, market sales increased with larger farm size. Only 28 percent of all farms less than 50 acres had sales of more than $10,000 in that year, while 77 percent of all farms of 50 or more acres exceeded that threshold. The differences are greatest at the two size extremes—19 percent for farms under 10 acres and 100 percent for farms of 2,000 or more acres.

Table 2. **Farm Size and Commodity Sales, 1997**

	Farms with Sales of More than $10,000		Farms with Sales of Less than $ 10,000	
Size by Acres	No. of Farms	% of Total in Size Group	No. of Farms	% of Total in Size Group
		percent		percent
1 - 9	37	19.4	153	80.5
10 - 49	93	34.5	176	65.4
50 - 99	45	65.2	24	34.7
100 - 259	57	62.6	34	37.3
260 - 499	47	88.6	6	11.3
500 - 999	31	91.1	3	8.8
1,000 - 1,999	40	85.1	7	14.8
2,000 +	42	100.0	0	-----
Total	392	49.3	403	50.7
		percent of 795 farms		percent of 795 farms

Source: Census of Agriculture, 1997

This analysis suggests that very few small farms in Solano County earn significant income from commodity sales. However, the $10,000 threshold is an arbitrary one and also limited in its economic significance. Referring only to the gross cash income of farm enterprises from commodity sales, it ignores net revenue—or profitability--after costs are considered.

A rough measure of profitability that counts farms according to “net gains and net losses” is also provided by the 1997 Census of Agriculture. While unfortunately not reported by different farm size categories, it confirms that the great majority of small farms in the county are not economically profitable. Only about a quarter (25.3 percent) of all local farms that had sales under $10,000 (a rough surrogate for small size) also reported net gains in 1997, as compared to three-fourths (74.7 percent) of all farms with sales of $10,000 or more.

We lack solid information on the number and distribution of economically successful small farms in Solano County. However, according to anecdotal indications from the focus groups and informal interviews, a few farms on 50, 20, 10 acre or even smaller agricultural parcels are enjoying substantial incomes. As exceptions, they highlight the challenges of such operations. To be profitable on a small parcel demands intensive labor from family members and low reliance on hired employees, a business plan, both management and cultivation expertise and skill, efficient use of machinery and water, access to reliable markets, convenient location if on-farm sales are part of the plan and protection from urban intrusions. It is unlikely that that most owners of small agricultural parcels in the county have these necessary qualities to operate their farms at the level of intensity indicated by the few successful small farmers.

Such aspects of farm parcel size should be considered in county land use policy and practices, especially in responding to the continuing demand for homesites in rural areas. A common argument offered by land owners and realtors, presented to county governments to justify lot splits for residential sales in agriculturally-zoned areas, is that splitting larger parcels down to 20-, 40-, or 80- acre lots (the minimum parcel sizes in the major agricultural zones of Solano County) does not preclude the profitable production of certain commodities on these downsized properties. In theory, they may be right. In practice, the successful operation of small farms is seldom accomplished without the intensive application of the human energy and natural resources suggested above.

Information Sources

- Census of Agriculture
- Producer interviews
- Focus group sessions

4. Market Value Trends

A simple measure of the economic activity of Solano County agriculture is the market value of farm and ranch production—the total prices received by operators for the commodities they sold. Total market value was $233 million in 2006, the last year reported in the annual crop information collected by the county's Agriculture Commissioner. Raw market value numbers usually increase from year to year, but when adjusted for inflation they have declined over the years in Solano County, as noted in Table 3. Between 1981 and 2006, the inflation-adjusted value dropped from $255 to $199 million. Also Solano County market values in this two decade-plus period did not keep up with statewide increases, with the county's statewide rank dropping from 26th in 1981 to 29th in 2004.

Table 3. **Market Value of Agricultural Commodities in Solano County, 1981-2006**

	2006	2000	1995	1990	1985	1981
			$ Million			
Total	$233.0	$185.1	$180.3	$175.2	$153.1	$151.0
Inflation Adjusted	$199.0	$185.1	$195.8	$214.8	$219.7	$255.5
Solano State Rank	29[a]	30	28	30	26	26
			Percent			
Solano % of California Total	56[a]	62	72	74	92	94

[a]This is 2004 data, 2006 was not available.
Source: Annual reports, Solano County Agricultural Commissioner

Examining just these aggregate trends ignores fluctuations in the relative value of particular plant and animal commodities, the components of overall market value for the county. Table 4 traces changes in the top ten commodities by market value, at mostly five-year intervals between 1981 and 2006. Only four commodities (nursery products, cattle, hay, tomatoes) were included in the top ten at both the beginning and end of the period. Commodities that were added to the top ranks by 2006 or moved up significantly in place were vegetables (especially bell peppers), walnuts, milk, wine grapes, and almonds. Nursery products have been the number 1 commodity in value since 2000. On the other hand, the commodities that dropped out of the top ranks during the 25-year period were sugar beets (no longer grown in Solano County), wheat, corn, beans, sheep, and pears.

The top ten commodities in any one year represent between two-thirds and three-quarters of the total market value of local agricultural production. However, they do not constitute a complete list of economically important commodities in Solano County; the Agricultural Commissioner reports more than 20 crops and animal products that individually generate at least $1 million in sales per year.

Table 4. **Top 10 Agricultural Commodities in Solano County, By Market Value, 1981-2004**

	2006	2000	1995
1	Nursery products	Nursery products	Tomatoes
2	Cattle, calves	Tomatoes	Nursery products
3	Hay, alfalfa	Grapes, wine	Hay, alfalfa
4	Tomatoes	Cattle, calves	Wheat
5	Vegetables	Hay, alfalfa	Sugar beets
6	Walnuts	Corn, grain	Corn, grain
7	Milk, market fluid	Sheep, lambs	Cattle, calves
8	Grapes, wine	Vegetables	Grapes, wine
9	Almonds	Wheat	Sheep, lambs
10	Plumbs, dried	Milk, market fluid	Walnuts, English

	1990	1985	1981
1	Tomatoes	Tomatoes	Sugar beets
2	Sugar beets	Corn, grain	Tomatoes
3	Nursery products	Sugar beets	Wheat
4	Cattle, calves	Wheat	Corn, grain
5	Corn, grain	Cattle, calves	Cattle, calves
6	Wheat	Nursery products	Beans: dry, edible
7	Hay alfalfa	Sheep, lambs	Nursery products.
8	Sheep, lambs	Hay, alfalfa	Hay, alfalfa
9	Beans: dry, edible	Sunflower seed	Sheep, lambs
10	Beans, seed	Plumbs, dried	Pears

Source: Annual reports, Solano County Agricultural Commissioner

Information Sources

- Solano County Agricultural Commissioner
- Producer interviews

5. Profiles of Commodities and Agricultural Regions

Digging further into the details of individual commodities gives us a more complete understanding of the diversity of Solano County agriculture than is possible by viewing just countywide market value. Each of the 75 different crop and animal products grown in the county is distinctive in its combination of production practices, markets, location, and economic prospects. These conditions change over time, affecting profits and production. In any one year, some Solano-produced commodities generate profits for their growers, while others are money-losers. Farmers and ranchers consider these factors when making decisions about what and how much to grow.

While individually distinctive, commodities are also often linked to each other. For example, alfalfa hay produced in the county is sold as feed for milk cows and other farm animals. Many farmers grow more than one commodity on their owned and leased parcels, thus spreading out market and price risks. Also producers in certain regions of the county rotate the field crops they grow from year to year because of soil and other resource requirements.

Appendix I presents detailed profiles for 17 Solano County commodities. While most of the top ten commodities (cattle, alfalfa, processing tomatoes, walnuts, etc.) in market value are included on the list, some lower value commodities (prunes, fresh fruit, olive oil, etc.) are also profiled to present a broadly representative view of the county's agricultural production. Supplemented by maps and charts, the profiles follow a common topical outline.

Drawing from the profiles, here is a comparative summary of commodity differences and similarities:

- Current Status and Issues. Considering recent price trends, increasing production and anticipated continuing market demand, the economic futures of walnuts, almonds, alfalfa, several niche crops, and bell peppers seem bright. On the other hand, sheep, prunes, processing tomatoes, and wine grapes are on the decline in Solano County, although they are still important parts of local agriculture. Other crops, notably stone fruits and small grains, have an even more dismal future in the county's agriculture picture. Key current issues identified in the profiles include possible overproduction, the status of processors, and consumer preferences.

- Marketing System. There are diverse markets for Solano County products--global (processing tomatoes, almonds, walnuts), regional (alfalfa, milk), and local (niche fruit and vegetables). Some local commodities have shipped to one or two processors or other outlets (sheep, processing tomatoes, almonds, prunes), while others (niche fruit and vegetables, walnuts) have access to multiple markets. Grapes, processing tomatoes, sunflower seeds and some other products are sold through annual contracts.

- Market Value and Acreage Trends. Changes in the last 25 years are tracked and explanations for particular shifts in value and acreage are offered.

- Location and Cultivation Requirements. Most commodities grown in Solano County are location specific, benefiting from particular soil, climatic and other environmental conditions. For example, nut crops do well in the alluvial soils along Putah Creek in the Winters area, wine grape production is concentrated in the Suisun and Green Valleys,

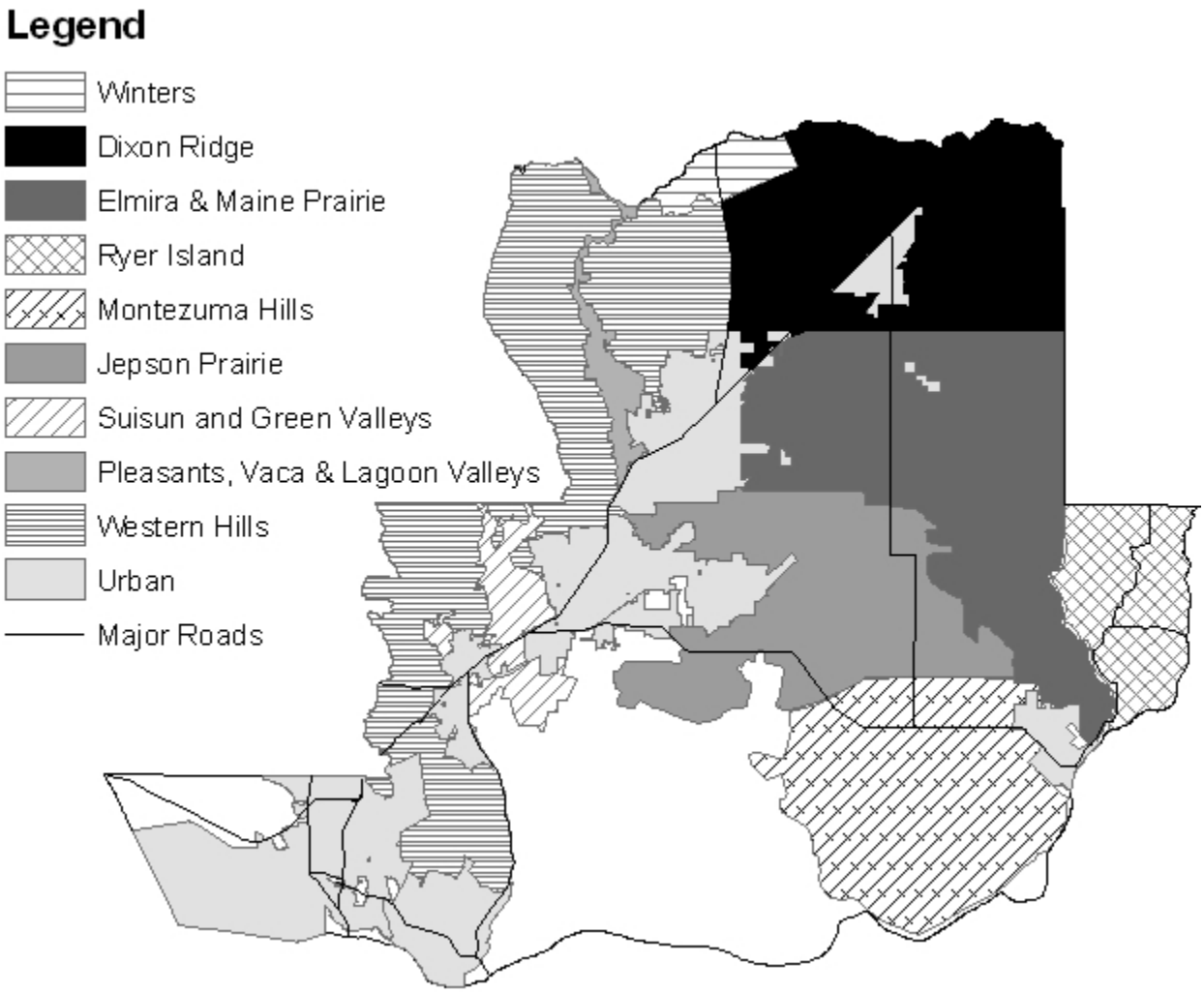
while the open spaces of the Montezuma Hills region are suitable for sheep, cattle and grain production.

Going further to sort out commodities according to location, Appendix II profiles the characteristics of Solano County's nine agricultural regions. While some crops and animals can be produced in more than one area, each region is characterized by a particular set of commodities, soil and other environmental conditions, topography, urban pressure, history and agricultural infrastructure. The profiles identify a unique agricultural "system" for each region which includes cultivation practices and market arrangements.

The profiles cover these regions:

1. Dixon Ridge
2. Elmira and Maine Prairie
3. Montezuma Hills
4. Ryer Island
5. Suisun and Green Valleys
6. Winters
7. Jepson Prairie
8. Pleasants, Vaca and Lagoon Valleys
9. Western Hills

Figure 1: Agricultural Regions of Solano County



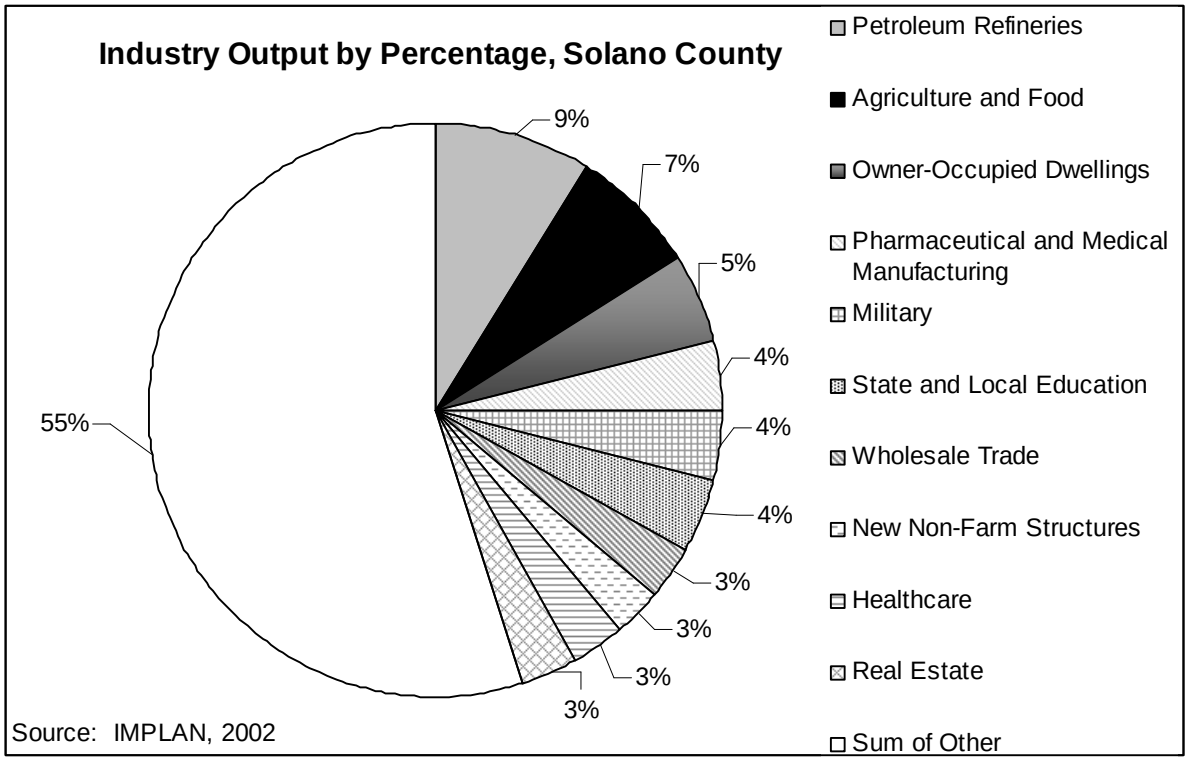
6. Agriculture and the Local Economy

Agriculture is a major part of the Solano County economy, in both the value of the direct production of crops and animals and the impacts of such activities on other local businesses and individuals. Farms and ranches directly generate these economic benefits:

- $233 million (2006) annually in commodity sales
- Additional millions every year in other services provided by farmland, including conservation payments and energy production.
- Employment of 558 full-time and 357 part-time farmers (among principal operators in 2002), additional farm family members, and hundreds of hired workers.
- Agriculture accounts for 7 percent of the total economic output in Solano County

By these measures, agriculture is one of the leading industries in Solano County. It ranks 2nd in percentage of industry output according to our research. Chart 1 presents how individual industries contribute to the total output of Solano County. It should not be surprising that Agriculture ranks second in Solano County. The industry is clearly an important part of the economic health of the County.

Figure 2: Industry Output by Percentage



These numbers tell only part of the story. Agriculture is closely linked to other sectors of the local economy. The production of crops and animals has a ripple effect throughout the economy, stimulating jobs, services and other forms of economic value in a variety of

businesses. These transfers flow in both directions, both from and to the farm. Agricultural products create off-farm benefits through processing, transportation, storage, and marketing to consumers,. At the same time, farms and ranches depend on the services and products provided by other businesses, including machinery, finance, fertilizer, and other supplies.

These connections extend across county boundaries. Neighboring or other counties in the region benefit when Solano grown commodities are shipped to them for processing or marketing or when Solano producers purchase farm supplies or other services in the other counties. To a lesser extent, commodities grown elsewhere are transported to Solano County for processing or farmers in other areas seek supplies here.

Impacts on the Local Economy: The Multiplier Effect

One widely used measure of the economic impact of agriculture is the so-called "multiplier", an estimated ratio of what a dollar value of commodity production on the farm generates in additional dollars in other sectors of a community or region. The conservatively-estimated industry multiplier for agricultural activity overall in Solano County is 1.58. For every $1 earned by farm products, another $.58 in income is created elsewhere in the county's economy. So the $233 million in farm and ranch sales reported for 2006 became almost $379 million in total local economic impact.

There is a separate multiplier for job creation—1.7 in Solano County. Thus for every full-time person working on the farm another .7 of a job is created elsewhere in the local workforce.

These multipliers vary by type of commodity, as Table 5 shows. Vegetables, fruits and nuts tend to have higher industry and employment multipliers than grain production, for example. The reason for such variations is that Solano County has more support and processing firms for vegetable, fruit and nut production than for grain farming.

Multiplier estimates are provided by a standard statistical model called IMPLAN, a type of input-output analysis that tracks product flows from producer to intermediary to final consumer. IMPLAN combines a database of firm activity by counties across the United States with a mathematical program that computes the regional multipliers. Each year, IMPLAN updates the database information inside the IMPLAN program. For this analysis of Solano County, we used the 2002 database of firm activity.

A summary of the IMPLAN results for Solano County are presented in Table 5. (A more detailed explanation of the IMPLAN output is found in Appendix III.) Table 5 shows that agriculture accounts for 7 percent of the economic output of Solano County and more than 8 percent of the value added in the county. This shows while agriculture is 7 percent of the economy, the added economic activity created from agriculture accounts for 8 percent of the economy. As to jobs, Table 5 notes that local agriculture employs 3.9 percent of all private sector workers in the county and accounts for 3.5 percent of total labor income.

Table 5. **Solano County IMPLAN Results**

	Multipliers		Percent of County Economy	
	Employment	Industry	Industry Output	Multiplied Output
			percent	
Agricultural Processing and Production	1.70	1.58	7.00	8.23
Agricultural Processing	2.62	1.68	5.45	6.20
Agricultural Production	1.40	1.58	1.55	2.38
Forestry, Fishing, Hunting	1.81	0.16	0.23	0.23
Ag-support Activities	2.62	0.18	0.38	0.38
Farming	1.47	1.20	1.78	1.78
Grains, Oilseeds, Cotton	1.28	0.07	0.09	0.09
Vegetables, Fruit and Nuts	1.62	0.57	0.93	0.93
Greenhouse and Nursery	1.47	0.24	0.46	0.46
Other Crops	1.75	0.07	0.12	0.12
Beef, Dairy Cattle	1.21	0.19	0.14	0.14
Other Animals	1.22	0.05	0.04	0.04

Source: IMPLAN, 2002

Agricultural Support Industries

Much of the agriculture-related economic activity measured by multipliers covers the large variety of services and products (inputs) that farms and ranches need to produce their commodities. Solano County producers depend on an extensive support network. There are fewer local providers in that network, however, as businesses have consolidated in recent decades because of national changes in their industries and in their clientele. Solano County producers thus have fewer choices in where they purchase goods and services, turning more to sources outside the county—whether in adjacent counties, elsewhere in the region, or through the internet.

The support requirements of local agriculture are extensive and include finance, trucking, tractors, other mechanical implements, fencing, irrigation equipment, fertilizer, feed, seeds, etc. Table 6 presents an illustrative list of major support businesses in three sectors --agricultural credit, input suppliers, and farm implements. Following is a synopsis of trends in these support sectors.

Agricultural Credit Sources

Solano County farmers now have access to three major agricultural lenders, after considerable consolidation in the banking industry in the 1980s and 1990s. Two are local commercial banks which specialize in agricultural business; the third, with its nearest office in adjacent Yolo County, is a part of the national farm credit system originally developed through federal action. Farmers require credit either for annual operational needs (to pay for production expenses before commodity income is received) or for capital needs such as land purchases. As indicated in our focus group sessions and survey, Solano producers do not see the recent decrease in credit sources as limiting their options.

Input Suppliers

Providing a wide range of specialized products and services to farmers and ranchers (and also gardeners and “hobby” farmers), these businesses operate in a highly competitive environment. Local suppliers in some product areas compete with national retailers, such as Lowe’s and Home Depot. In other cases, some local suppliers cater to particular agricultural segments. For example, the Suisun Valley Fruit Growers Co-op specializes in orchard and vineyard products, while Grower Ag Services and John Taylor Fertilizers serve row crop producers in the Dixon Ridge and Montezuma Hills areas. For bulk products such as fertilizer, close proximity to local suppliers is an economic advantage by minimizing transportation costs.

Farm Implements

Solano County farmers and ranchers currently have access to only three local implement dealers, each specializing in the types of equipment used in a particular agricultural region of the county. More than selling tractors, combines and other equipment, the dealers are also a source for replacement parts—often needed on an emergency basis by producers.

Table 6**. Illustrative Agricultural Support Sectors and Firms**

Agricultural Credit	
	Bank of Rio Vista
	First Northern Bank, Dixon
	Sacramento Valley Farm Credit, Woodland
Input Suppliers	
	Dixon Aviation, Dixon
	Growers Ag Service, Dixon
	John Taylor Fertilizers, Dixon
	Suisun Valley Fruit Growers, Fairfield
	Valley Farm Transport, Dixon
Farm Implements	
	Dolk Tractor Company, Rio Vista
	Green Valley Tractor, Fairfield
	Valley Truck and Tractor Company, Dixon

Agricultural Processors

For many Solano County farmers and ranchers, processing facilities provide the sole or principal market for their commodities. Some growers are still able to ship to local plants, an economic advantage in transportation costs and perishability. Most notable are two Dixon plants-- Superior Farms for lamb processing (the only lamb slaughter house west of the Rockies) and Campbell Soup (the only outlet for local tomato producers). Walnuts and wheat are other commodities that have access to local plants or in adjacent counties. Whether or not a processing facility is conveniently available can determine what is produced locally. Thus sugar beets and fruit for canning are no longer grown in Solano County because of plant closings in recent decades.

The Bottom Line

As measured by dollar value and labor multipliers, the benefits of local agriculture for the overall Solano County economy are less than they could be, as compared with many other agricultural counties in California. The industry multiplier for Solano was reported as 1.58, however for the entire state of California, the industry multiplier was 2.27. The Solano industry multiplier is lower than that for California as a whole because the number and diversity of agricultural support businesses and processing facilities are relatively limited in Solono. Indeed, they have declined in recent decades. The two major exceptions are the tomato cannery and sheep slaughter house located in the Dixon area. The county benefits from having these two processors which provide employment to county residents, local government revenue, and benefits to other businesses Most other farm commodity sectors—including wine grapes, beef cattle, dried plums, small grains, wheat and corn-- are not similarly advantaged. As well as limiting economic value for the county as a whole, this means that producers have to travel further to get services or process and market their commodities--directly increasing transportation costs and hence diminishing profits.

Information Sources

- IMPLAN results for Solano County
- IMPLAN results for the State of California
- Producer and other interviews

7. Farm Income: Multiple Sources

The earnings made directly from commodity sales by Solano County farmers --$233 million in 2006—are the top income source from their businesses. Farmers also receive other forms of income linked to agricultural operations or ownership of farmland. Some are found in the entrepreneurial opportunities for adding value to crop and animal production. Others are inherent in the environmental and other public benefits of keeping land in agricultural use or at least preventing its conversion to urban uses. Table 7 identifies several distinct income sources and other economic benefits for Solano County farm operators and farmland owners, with information presented for dollar amounts and affected acres where available.

The non-commodity revenue sources are relatively minor additions to the overall income of local farmers. They are received by just a few of Solano County's more than 900 farms, with the exception of the property tax benefits of the Williamson Act which covers most agricultural land in the county. Nevertheless, these forms of income are important to some farmland owners and operators and are options that others can use in future years. Some of these income sources have considerable future growth potential, especially the "green payments" that come from participation in federal conservation programs and the sale of agricultural easements.

A much larger source of income, not included in Table 7 because it is not linked directly to agricultural operations or land ownership, is the off-farm income that many operators and landowners earn from other employment or retirement payments. We have no estimate of the dollar amount involved, but it is considerable judging from the number of farmland owners in Solano County who have such non-farm income. The Census of Agriculture reported these employment patterns for principal farm operators in Solano County in 2002:

- 39% (357operators) identified their "primary" occupation as other than farming.
- Almost half (457 operators) had off-farm employment at some time during the year.
- 32% (300 operators) worked 200 or more days off the farm.

As mentioned in our focus group interviews, a major significance of non-farm income—including retirement pensions and investment returns not reported by the Census of Agriculture—is that it provides important income for some rural families that allows them to keep their land in agricultural use. In effect, the non-farm income helps to subsidize farm operations, especially when commodity production is not profitable.

Table 7. **Sources of Income from Agricultural Operations and Farmland in Solano County**

Source	Activities	Income Earned or other Economic Benefits/Period Covered	Acres Represented
Commodity Sales	Market Value of Crops and Animals Produced	$238 million/ 2005.	All farmland, 362,000 acres
Farm-Related Sources	Custom work for other farmers, rental payments, recreational services, etc.	$4.7 million/ 2002.	NA
Federal Conservation Pyments	USDA-administered programs that compensate farmland owners for conservation efforts, including wetland reserves, prevention of soil erosion, water quality, etc.	Approximately $5 million in payments/ 2000-2006.	NA
Other Government Payments	Other direct cash payments from Federal programs including disaster relief and crop support.	$2.2 million/2002.	NA
Sale of Conservation Easements	Compensation for elimination of development rights through perpetual easements held by the Solano Land Trust and other agencies.	Approximately $10.5 million from Solano Land Trust in 1988-2007.	3,700 acres in 12 farm parcels as of March, 2007.
Williamson Act Contracts	Property tax benefits for agricultural landowners who voluntarily sign contracts restricting development for 10-year renewable periods.	Approximately $3.48 million in 2006-07, an average of $13 per contracted acre.	264,461 acres in 2005
Energy resources	Income from natural gas sales and wind turbines on agricultural properties.	At least several million $ annually.	Unknown totals in Rio Vista and Montezuma Hills areas

Sources: Solano County Agricultural Commissioner, Assessor, Solano Land Trust, U.S. Census of Agriculture, California Department of Conservation, personal interviews.

Following are further details about the non-commodity income sources identified in Table 7.

Farm-Related Sources

Included in this category are a variety of forms of income that the Census of Agriculture identifies as “sales and services closely related to the principal functions of the farm business.” The largest specific portions of the $4.7 million total for Solano County farms in 2002 were for custom work in which farmers provided other farmers with services such as

planting, plowing, spraying and harvesting ($1.4 million for 42 farms) and income received by landowners for the rental of their land for agricultural production ($1.3 million for 73 farms). (Rental income may be underreported in the Census numbers considering the large volume of acres that are under lease.) Lesser amounts were earned for insurance payments for crop and livestock losses, recreational services on farmland such as hunting, and animal boarding.

Federal Conservation Payments

Close to $1 million annually is paid to Solano County agricultural landowners for conservation practices under several programs administered by two U.S, Department Agencies, the Natural Resources Conservation Service and the Farm Services Agency. The two most used programs in the county are:

- The Environmental Quality Incentive Program (EQIP), which funds cost-share arrangements in which landowners or operators engage in conservation practices that lead to such environmental benefits as erosion control, water and soil quality improvements, and reduced grazing impacts. In 2001-06, 82 EQIP contracts totaling $1.8 million were signed with Solano County farmers representing 26,000 acres.

- The Conservation Reserve Enhancement Program (CREP), which retires land from production for 10 years to allow for the restoration of wildlife habitat. Eleven contracts for 2,588 acres were funded in the southeastern part of the county in 2001-06 for a total of $2.7 million in landowner payments.

Typically more farmers apply for these programs than can be supported through available funding. Funding for such “green” payments is determined by the federal farm bill approved every five years and annual appropriations passed by Congress. Indications are that the next farm bill, scheduled for passage in 2007 will boost spending on conservation programs.

Other Government Payments

Besides conservation payments, other federal government funds directly received by agricultural landowners in Solano County include payments for disaster relief and commodity support. These programs have limited applicability in Solano County. Local growers are not major participants in the largest federal assistance program, commodity support payments primarily for corn, wheat, soybeans, rice, and cotton.

Conservation Easements

Placing a conservation easement on a farm permanently restricts the urban development of the property. The incentive for individual landowners to voluntarily give up their development rights is largely economic— one-time cash payments. There is also the personal satisfaction of acting to maintain the land in agriculture or open space for the long term.

Since 1998 a dozen local landowners have sold the development rights on their farm properties, representing about 3,700 acres, to the Solano Land Trust. They received a total of $10.4 million in one-time cash payments, averaging about $ 2,800 per acre. Three of the sellers also received federal tax benefits totaling $1.9 million for donating portions of the value of their easements. The total economic returns from these two sources approximated

the value of the rights voluntarily abandoned, or the difference between the full-market and agricultural values of the parcels. The highest values for easement purchase are in areas with the greatest urban pressures, especially along or near the I80 corridor in the Dixon and Suisun Valley areas. Landowners typically use their cash payments from easement sales to pay down farm debt, improve or expand their agricultural operations, or for personal purposes such as retirement.

The easements on agricultural land currently held by SLT are scattered throughout the county, although a significant block of contiguous easements has emerged recently around the I80 interchange at Pedrick Road, forming a greenbelt between the cities of Dixon (Solano County) and Davis (Yolo County). Easements are held on both cropland and grazing land. However, the SLT proposes a more focused 20-year strategy for future acquisitions under its "Agricultural Conservation Easement Plan" adopted in 2002. Priority is to be given to cropland on Class I soils in the Dixon Ridge, Winters, Vaca Lagoon, and Green/Suisun Valley regions. The plan calls for spending $3 – 5 million a year to put another 20 – 40,000 acres under easement during the 20-year plan period. The major obstacles to achieving these outcomes are limited funding sources and the availability of interested landowners in the pertinent areas.

The land trust administers the most active agricultural easement program in the county. There are others, including the joint powers arrangement between the cities of Dixon and Vacaville which maintains a "greenbelt" easement between the two cities along Interstate 80, covering 1,000 acres intensely farmed in high value crops.

Williamson Act Contracts

Instead of direct cash payments, a different kind of economic benefit is received by landowners with agricultural properties enrolled in the Williamson Act—reduced property tax payments. Owners of almost three-quarters of all Solano County agricultural land share $3.4 million a year in reduced taxes—about a 47 percent reduction-- through this 40 year-old state program that is administered by the county. The annual tax benefits average $13 an acre. Cropland generally earns higher per-acre savings, although percentage reductions are higher for grazing land.

Landowners voluntarily enroll in the program and obtain tax benefits in exchange for signing contracts with county government that restrict urban development. The 10-year contracts are automatically renewed every year, unless they are non-renewed (resulting in a nine-year phase-out) or cancelled (immediate termination with landowner penalty). As partial compensation for the lost property taxes, Solano County government receives about $700,000 a year in subvention payments from the state—only about a fifth of tax losses (shared by the county with other local governments in agricultural areas). The county does not participate in the Farmland Security Zone program, a relatively new version of the Williamson Act that provides larger property tax reductions to farmland owners in return for 20-year renewable contracts.

Energy Resources

Geological and geographical conditions provide a small number of Solano agricultural landowners with another form of non-commodity income—receipts from the generation of energy. Landowners in the Rio Vista and Montezuma Hills areas, along the Sacramento River in the county's southeastern section, reap the unique benefits of having natural gas deposits or high wind flows on their properties. As this information is closely guarded, neither individual nor aggregate revenue amounts from these sources are publicly available. Anecdotal accounts suggest that the income to a few landowners is considerable, with a rough estimate of several million dollars a year for the two energy sources combined.

The properties with these resources are largely ranches that produce grain, cattle and sheep. Their large size permits the equipment placement and access routes that the installation of natural gas wells and wind turbines requires, while allowing continued agricultural operations around the facilities. Landowner income from energy companies is based on two factors—an annual base rent for use of the property and a larger but fluctuating amount linked to the value of the energy produced.

Natural gas has been extracted in Solano County since the 1930s and is produced by companies that sell the gas to PG&E. Wind power for the generation of electricity is a more recent development in Solano County, with the first turbines constructed in the 1980s. The wind turbines are confined to the "Collinsville-Montezuma Hills High Wind Resources Area", a county general plan designation. About 700 turbines are currently in operation, developed and operated by energy companies that sell the power produced to PG&E. SMUD (the Sacramento Municipal Utility District) also obtains electrical power from wind turbines in the area on parcels it owns

Information Sources

- Solano County Agricultural Commissioner
- Census of Agriculture
- Solano County Assessor
- USDA, Natural Resource Conservation Service, Solano County Office
- Solano Land Trust
- Solano County Department of Resource Management
- California Department of Conservation
- Interviews

8. Agricultural Land Markets

Agricultural parcels in Solano County are regularly bought and sold, establishing a market that is measured by land prices and availability. Land market trends affect agricultural operations in two significant ways:

- In enhancing or restricting the ability of farmers to acquire land for agricultural purposes.

- In leading to the purchase of farmland by non-farmers for residences, often fragmenting the agricultural landscape and cutting into farm efficiency and productivity.

Land availability is a major economic resource for farmers. Affordable prices allow established operators to expand their production and become more profitable by efficiently using equipment and labor. Land affordability may also allow new farmers, typically younger individuals and families, to enter the business. Such agriculture-related purposes compete directly with the residential demand for country property. It is a competition in which home seekers who can afford higher land prices usually set the market, outbidding farmers and ranchers.

In fact, very few purchasers of Solano County farmland are agricultural operators; the overwhelming majority are homesite purchasers and investors, a situation that has been prevalent for many years. This is strongly confirmed by our interviews in May and June of 2007 with three professional land appraisers who work with rural properties in Solano County.

Land affordability has been an issue for local farmers for two decades and more. Before, agricultural land values were largely influenced by farmers' income streams--the prices they received from commodity sales. Affordability became a more serious problem in 2001 when land values—and especially rural property prices—began to escalate in Solano County, as in other parts of California centered on the Bay Area. Values almost doubled in 2001-06, the sharpest increase for any comparable period since Word War II. Contributing factors were low interest rates, high profits from investments, and the lure of cheap land in urban fringe places like Solano County as compared to more urbanized parts of the Bay Area. By fall of 2006, the local real estate boom ceased and values stabilized but did not start to decline.

Current Values and Affordability

Agricultural land market values vary by region of the county, as Table 8 shows. The three different agricultural areas listed together represent most of the market value of agricultural production in Solano County. The Dixon Ridge region has the most varied commodity mix, with orchards, tomato production, and other field crops. The Suisun Valley is noted for its vineyards and fruit production.

The demand for country properties for residential use is strong in the Dixon Ridge and Suisun Valley areas, and less intense in the Montezuma Hills. Interstate 80, with its commuter connections to the Bay and Sacramento employment centers, cuts through the Dixon Ridge area and is adjacent to the Suisun Valley, boosting housing values in both areas. Because of its aesthetic assets, as a small valley with vineyards and orchards

rimmed by hillsides, parcels in the Suisun Valley are sought for large and expensive homesites and thus bring higher prices than in the Dixon Ridge area, as Table 8 notes. By comparison, the residential demand is less intense in the Montezuma Hills because of the area's relatively remote location, its less green landscape, and large ranch parcels. A few sales of 100-acre and larger parcels for homesites have been recorded in this area in recent years.

As justified by commodity income, what is an affordable level of market value for agricultural use in Solano County? Our appraiser informants cite a range of between $1,000 and $4,000 per acre, far below the current and recent land values listed in Table 8 for the Suisun Valley and the Dixon Ridge areas. In the Montezuma Hills, the income from grain and animal production would justify land prices at the low end of the affordability scale, at or slightly higher than $1,000 an acre.

In individual cases, agricultural operators may pay higher prices for farmland. For example, the potential for wind energy production drives up the value for some ranch parcels in the Montezuma Hills. Other agricultural purchasers are willing to pay higher prices for certain parcels because of a good fit with their overall operations or can take on a large loan because of little or no existing debt. Some farmers and ranchers also participate in the market as speculators, buying parcels for investment in anticipation of future development options.

Table 8. **Representative Market Values for Agricultural Land in Solano County, Spring, 2007**

Agricultural Region	Market Value Per Acre	Market Value Per Parcel
Dixon Ridge—Dixon/Winters Area	$8,000 per acre for larger parcels, 80-acres plus. Over $12,000 per acre for 40-acre parcels.	$900,000 for a 40-acre parcel.
Suisun Valley	$30,000 per acre for 40-acre parcel.	$1.25 million for 40-acre parcel.
Montezuma Hills	$3,000 per acre for large ranches.	NA

Source: Estimates provided by three rural land appraisers.

Leased Farmland

Even if additional acreage is too expensive to purchase directly, farmers seeking to expand their agricultural operations can get access to more land by leasing from other landowners who are not active operators. Indeed, there is an active market for leasing farmland in Solano County, with both landowners and operators looking for such connections. Most lessors are retired farmers or absentee landlords.

Two types of lease arrangements are prevalent in Solano County. Share arrangements are common for grapes and row crops, in which the operator pays a percentage of gross income on commodity sales to the landowner. The current range is 15 – 20 percent. In the second type, operators make an annual per acre payment to the landowners, with higher quality soils generating higher compensation—currently up to $200 per acre.

Most leases involve written agreements, although some arrangements among parties who know each other well are confirmed simply by handshake. Most leases are for three to five years, although permanent plantings such as orchards are for longer periods, especially if the operator provides development costs.

Agricultural Zoning

In Solano County and elsewhere, agricultural zoning is intended to protect agricultural operations from incompatible land uses, primarily residential development. Agricultural zones carry out this purpose in several different ways—primarily by designating the minimum acres required for one residence, and also by limiting allowable land uses to farm-related activities. In theory, the larger the minimum parcel size the more the sale of agricultural property for residential purposes is discouraged; the assumption is that potential

homebuyers are put off by the high relative cost and maintenance obligations of purchasing large parcels. In practice, in recent years the minimum parcel size requirement has had little effect on the sale of agricultural land for residential use in Solano County.

Solano County has four exclusive agricultural zones, with minimum parcel sizes of 20-, 40-, 80-, and 160 acres. The 40 and 80 categories are focused on the best and most productive agricultural soils for growing crops ("intensive agriculture"), while the 20 and 160 categories ("extensive agriculture") are generally designated for lesser quality soils used for dry land farming and animal production (*Zoning Regulations,* Solano County Department of Resource Management).

The county's parcel size requirements have become less effective over the years in restraining the purchase of farmland for non-agricultural uses, according to the land appraisers we interviewed and anecdotal information. Even larger farms and ranches subject to the 80- and 160-acre minimums are being purchased in greater numbers for homesites, the appraisers report.

We have some evidence of this in the steady pattern of lot splits in Solano County's agriculturally-zoned areas. Under California law, an individual parcel of undeveloped land can be divided into as many as four smaller lots (a "minor" subdivision) without going through the extensive review and general plan change that a formal ("major") subdivision requires. Each of the smaller lots is subject to the minimum parcel size requirement in that zone.

County records show 136 such lot splits in agricultural zones in the 19 years between 1987-2005 covering a total of 32,971 acres, a little more than eight percent of Solano's agricultural land. The 136 original parcels were split into 397 smaller parcels, with the average size dropping from 255 to 82 acres. Table 9 details the lot split activity according to the zone category.

Table 9. **Lot Splits (Minor Subdivisions) in Solano County Agricultural Zones, 1987 – 2005, By Minimum Parcel Size Requirement**

Minimum Parcel Size	Total Acres	Before Lot Split		After Lot Split	
		Number of Parcels	Average Size in Acres	Number of Parcels	Average Size in Acres
20 acres	8,109	51	159	165	45
40 acres	9,261	61	171	168	70
80 acres	2,332	8	291	21	111
160 acres	13,267	16	677	43	270
Total	32,969	136		397	

Source: Solano County Department of Resource Management

We lack firm data to pin down the causes of this activity and the degree to which smaller parcels remain in agriculture after the split. Perhaps some lot splits were the result of property divisions within farm families and other factors unrelated to residential demand. Anecdotal evidence, however, suggests that homesite sales accounted for the majority of the lot splits detailed in Table 9 .

Information Sources

- Interviews with land appraisers
- Solano County Department of Resource Management

9. The Human Dimension: Farm Operators and Families

Solano County farms and ranches are not just economic enterprises; they also have social meaning as places where families reside and maintain a rural way of life. It is difficult to separate the human aspect of local farming from its economic and land use characteristics. Many agricultural operators place high value on the intangible rewards of working with the land, raising their families in the country, and retaining land with a long history of family ownership. They see themselves as land stewards and preservationists, as well as business people and equity holders. Personal and family considerations offset to some degree the economic risks involved in growing crops and animals. Thus decisions to sell or not sell farmland for monetary gain require that farm families weigh economic and non-economic factors, a deliberation that is complicated by intergenerational relations.

We get a glimpse of the personal and family dimensions of Solano County agriculture from the Census of Agriculture information displayed in Table 10, supplemented by comments volunteered by participants in our focus group sessions and the results of the individual questionnaires they completed.

Table 10. **Farm Operator Characteristics, Solano County and California, 2002**

	Solano County	California
Total Principal Operators	915	79,631
Total All Operators	1,456	125,095
Farms with Multiple Operators	438	33,962
Mean Age of Principal Operators	56.2	56.8
Percent under 45	15.3%	17.7%
Percent 65 and over	24.1%	27.8%
Primary Occupation Farming as % of Principal Operators	60.9%	61.6%
100+ Days Worked Off Farm for Principal Operators	42.5%	39.6%
Average Years on Present Farm	17.5	18.4
Percent 10 Years +	67.6%	69.5%
Place of Residence on Farm as Percent of Principal Operators	73.7%	72.5%
Women as % of Principal Operators	20.4%	15.8%
Women as % of All Operators	34.6%	29.5%

Source: Census of Agriculture

About 90 percent of Solano County farms are legally organized as family-type businesses—either as family or individual units, partnerships among family members, or family-held corporations. Even more significantly, the family characteristics of local farms are indicated by the following:

- More than 73 percent of the county's farms were the places of residence of the principal operators in 2002 (Table 10).
- Almost half of all farms had multiple operators in 2002, typically family members (Table 10).
- Family members constitute much, if not most, of the workforce for individual farms and ranches. About two-thirds of the 69 respondents who replied to this item on the questionnaire for focus group participants noted that relatives were

involved in their agricultural operations—including spouses, children, siblings, parents, uncles, nieces, and nephews

- Also according to the questionnaire, respondents reported that their families had owned farmland in Solano County (not necessarily the current farm) for an average of 63 years. Individual operators surveyed by the Census of Agriculture in 2002 had worked their present farms for an average of 17.5 years each, with 67 percent reporting 10 or more years on the same farm (Table 10).

As elsewhere in California, Solano County farmers are an aging group. Between 1987 and 2002, the average age of local farmers increased from 52.5 to 56.2 years, a trend that began some years before. A quarter of the principal operators in 2002 were 65 or older; only 15 percent were under 45.

This aging trend suggests that fewer young people are engaged in agriculture in Solano County. As older operators retire there will be fewer natural successors, possibly forcing the sale of their farmland to non-farmers. A number of focus group participants noted the increasing tendency of sons and daughters to look for occupations away from farming. Asked in the questionnaire whether "family members were likely to take over the operation in future years?", a bare majority of the respondents—32 of 69—gave a negative answer.

Information Sources

- Census of Agriculture
- Summary of Focus Group Sessions
- Questionnaire for Focus Group Participants

10. Irrigation and Drainage

The one input the great majority of Solano County producers require for their production is water. Because of the Mediterranean rain cycle of wet winters and dry summers, Solano producers rely on local services to provide water during the dry summer months and remove the water during the rainy winter. These organizations deliver their services through a system of canals and ditches that function as a local plumbing network. The Montezuma Hills, a portion of the Jepson Prairie and the hilly watershed lands of the Coastal Mountains are the only regions where Solano County producers farm with only natural rainfall.

Solano County has two distinct plumbing systems for agriculture. The major irrigation system moves from Lake Berryessa to an area ranging to the west in Suisun and Green Valley and over to Yolano in the Southeast. The natural and built drainage system moves winter rainfall off farmland into the Delta. Both systems are vital to the economic health of Solano County agriculture.

Like any plumbing, the irrigation and drainage systems servicing Solano County falter when blockage prevents water from flowing or the system is pushed beyond its capacity or purposes. The county has three public water agencies originally established to serve agricultural lands. They are the Solano Irrigation District, Main Prairie Water Agency, and Reclamation District 2068. Their ability to deliver water to farmland is restricted when agricultural land is divided into residential parcels. An irrigation system is designed to deliver water to an entire farm parcel. When a home is built on a portion of that parcel, the irrigation system must be redesigned to allow water to flow over and in some cases through this parcel to the next parcel down the line.

Water drainage is also complicated by rural land parcelization. Drainage systems usually divert rainwater through parcels in flowing to the Delta. This diversion is designed to occur over large areas. With residential development—even single homes-- on such parcels, construction is needed to direct the flow of rainwater away from homesites.

Information Sources

- Summary of Focus Group Sessions
- Interviews with irrigation district managers

11. A Brief History of Solano County Agriculture

Solano County's geography and natural resources create a diverse agricultural landscape. Local agricultural industries have a history in the county that originated with the first Spanish settlers. These 19th Century (18th?) settlers brought cattle, grain and grape production to the fertile valleys and hillsides of the county. While some of the original commodities of Solano County are still grown locally, other agricultural products have been added to the mix over the years.

Early Settlement Until 1880

Attracted by lush hillsides and valleys, the first European settlers in the county came to establish cattle ranches. In the 1850s former gold miners and early pioneers who came across the plains in wagon trains began raising cattle and sheep all over the county. By the 1860s, Solano County was ranked as the top wheat-producing area in the state. Wheat, cattle and sheep remained the top local commodities for many years.

But international conditions in the late 1870s abruptly changed the local agricultural system. A steep decline in world wheat prices, stimulated by production increases, forced local farmers to shift crops. Much of the shift also was dictated by variations in soil and cultivation conditions in different regions of the county and by market access. Farmers in the flat open areas east of the Vaca Mountains continued to produce primarily livestock and wheat. Those who settled in the more confined Suisun, Green, Pleasants and Lagoon Valleys began to switch from wheat and livestock to grape and orchard crops.

The Tree Fruit Industry, 1870s through 1920s

Many early settlers planted small acreages of fruit trees around their homes for family and local consumption. The combination of soil quality, warm days, cool nights and protection from wind on valley floors created an environment that gave Solano County fruit an early ripening advantage in the nation. Because of the lack of irrigation at this time, the dry farmed orchards produced a fruit small in size, high in sugar and low in moisture, assets for shipping and canning. Early settlers tried to capitalize on these traits but transportation limitations restricted the fruit from reaching markets outside of California.

When Solano County was linked into the national railroad system in 1868, the valleys around Vacaville and Fairfield became the center of the orchard industry that would make the county known in fruit markets all over the US. Within a few years, arrivals from two Asian nations helped advance the local fruit industry. Chinese settlers were the first to come to the county, following work on the railroads. Japanese settlers arrived in the 1890s. The two groups provided the labor and farming skills, sharing the knowledge with local producers that earned Solano County the title of "The Orchard of America". The improved production knowledge occurred almost simultaneously with improvements in refrigerated railcars and fruit canning technology. Vacaville became the center of the county's fresh fruit canning, drying and shipping, an industry that reached reach markets all over the world.

Solano County-raised fruit was able to access three distinct markets at profitable times during the year. The early producing fruit was shipped via train to outlets on the East Coast,

fetching early and very high prices. A second market involved the sale of canned and preserved fruit during winter months, make possible by the high sugar content from dry land farming. Finally, the low moisture content of Solano fruit meant efficiency in drying. Tapping these separate markets, Vacaville had numerous fruit shippers, canners and dry yards at the peak of the fruit industry around the turn of the century.

While orchard production supported a number of small family farm operations in the valleys of the county, areas not suited for fruit production continued to specialize in dry land livestock and grain production. Dixon became the center for sheep production and marketing in the county.

The Great Depression, Irrigation and World War II

The boom years of the early 1900s were followed by the Great Depression, which nearly eliminated fruit production in Solano County. Between 1925 and 1939, local fruit shipments decreased by over 90 percent. The decline was caused by skyrocketing consumer prices, a virulent cherry disease and erosion problems caused by poor soil management practices.

Orchard owners in Solano quickly switched to prune production because plums were inexpensive to dry and required less labor to harvest than other fruit tree crops. The days of small-scale orchards producing multiple fruit tree crops ended as farms converted to dried plum production.

The introduction of irrigation into the San Joaquin Valley in the early 1900s forever created agricultural competitors for Solano County. Large sections of the San Joaquin Valley were converted from dry land livestock and grain farming into orchard and tree crop production, a trend that continued through the post World War II period. As a result, Solano County's lost its eminence in the statewide fruit canning industry.

Irrigation, Field Crops and Development

The largest crop shift in the history of Solano County agriculture was still to come. The completion of Monticello Dam in 1957, a U.S. Bureau of Reclamation project, brought irrigation to the fertile lands east of the Vaca Mountains. As irrigation went in, livestock production was pushed into the hills and the fertile soil on the valley floor was converted to field crops, mainly sugar beets, processing tomatoes and irrigated corn and wheat. This shift in the local crop mix boosted the county's agricultural market value from an estimated $12.7 million in 1957 to $133.9 million in 1986.

Information Sources

- Producer Interviews
- Solano County Historical Society books and documents

Appendix I

Commodity Profiles

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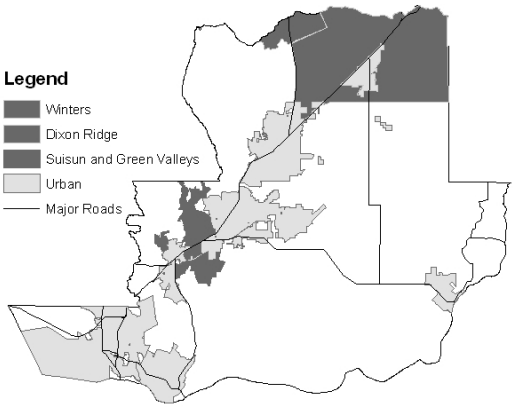
Walnuts



Current Status and Issues

Pushed by rising global demand, walnuts are an expanding Solano County commodity in acreage and market value. In 2006 and 2005, walnuts ranked fifth among all commodities in the county in market value, up from sixth in 2004. In contrast, in the years before 2000 the crop rarely appeared in the top 10 in market value of all local commodities.

As elsewhere in California, the local walnut industry has benefited from the growing reputation of the nut as a healthy food. Medical and nutritional research highlights the health benefits of eating walnuts, which are high in omega-3 fatty acids, vitamin E and antioxidants. As a result, both market demand and prices for the commodity have steadily increased in recent years.

Plantings of new trees, both because of the expansion of existing walnut orchards and the development of new orchards, have proliferated in recent years. As of 2006, Solano County had 1,109 acres in newly-planted trees, about one-sixth of the bearing acres in the County. Solano is not the only county in California to see an increase in walnut acreage, however, and the statewide increases may result in a lower market price for walnuts in the future if production exceeds demand. Nevertheless, the walnut market is not expected to decline for at least the next few years, as the recently planted trees will require another two or three years before coming into full production.

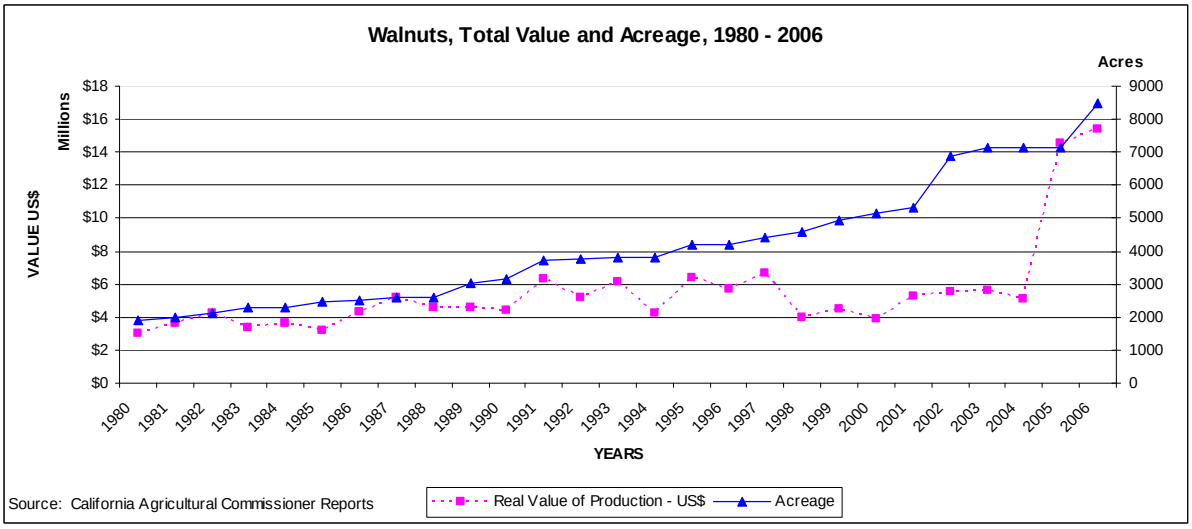
Marketing System

English walnuts are used as a snack item or as an ingredient in candy, cereal or baked goods. Manufacturers of these food items generally purchase walnuts that have already been dried and shelled by processors. Walnuts are typically produced on small family farms of less than 200 acres that vary in their on-farm processing capacities. Some producers perform no processing and only sell the raw nut in the shell to processors. Other walnut producers have on-farm driers that allow them to market their products for a slightly higher price. Solano County also boasts a number of organic walnut orchards. However, most of the local crop is sold to processors in Yolo and Sacramento and other nearby counties

Market Value and Acreage Trends

Solano County walnuts in 2006 were grown on 8,484 acres and generated a market value of $18.1 million. The 2006 numbers showed a slight increase over the figures from 2005, when Solano County ranked 11th in walnut production in California and produced 3% of the state total walnut value. In 2005, local orchards produced 10.9 tons of walnuts at an average of 2.5 tons per acre. The average price then was $1,507 per ton for walnuts in the shell or $0.75 per pound. The statewide average price for whole walnuts was around $0.73 per pound.

The price for shelled walnuts has varied since the 1980s from a low of $1.08 to a high of $2 per pound. The price appears to have stabilized at around $1.50 in recent years. While accurate price information for organic walnuts is harder to come by, organic producers report there is a strong market for their crop as an ingredient in organic food.



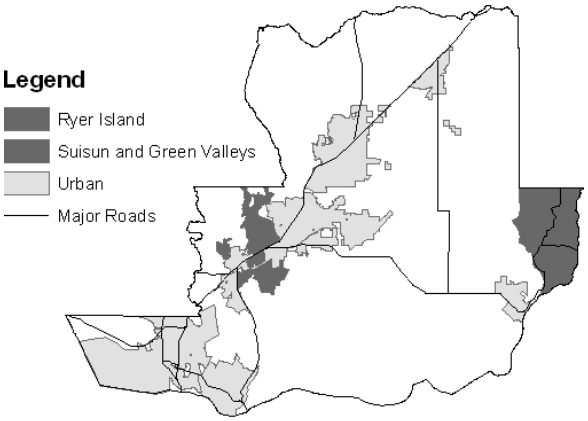
Location and Cultivation Requirements

Putah Creek plays a special role in making the Winters region a prime walnut production area. Alongside the creek run deep alluvial soils, rich and low in clay, enabling walnut trees to sink deep roots. Putah Creek also slowly leaks water into the surrounding soil. Most of this water is leached deeply into the soil and the long roots of the walnut tree allow it to tap into that water source.

The decision to plant a walnut orchard is a long-term commitment that begins with large, up-front investment in the trees with four to five years without income, followed by 35 years of production for a total of 40 years dedicated to this one commodity.

Walnuts are harvested annually beginning in October and through late November.

Wine Grapes



Current Status and Forecast

Although grapes for wine production have a long history in Solano County, their value and tonnage have sharply increased in the past 10-15 years. One reason is that many growers converted their fruit orchards into higher value vineyards, as local peaches, plums, pears and other fruit lost traditional cannery markets. Conversion to grape production also has been influenced by the success of wines produced in other northern California areas, notably nearby Napa and Sonoma counties. As plantings and local production increased in the 1990s, a few small wineries opened in the Suisun Valley, though most grapes harvested in the county are shipped to processors elsewhere.

Since the early 2000s, however, the profitability of the wine grape industry in Solano has dropped as a result of price decreases and the loss of annual contracts between growers and major wineries. Global market forces, marked by a boom and bust cycle in recent years in the supply and prices of grapes, have been the underlying factor. Lacking the popularity and reputation of Napa wines, Solano-grown grapes are more vulnerable to market fluctuations. Some advocates for the industry suggest that local production can avoid some of these fluctuations through collective promotion and marketing to identify the county as a source of high-quality wine.

A different challenge for local grape production is the attractiveness of vineyard properties for large rural residences, which drives up the market values for such land to levels unaffordable for agriculture. The large profits involved motivate some landowners to sell all or a portion of their wine grape acreage to wealthy individuals who want to own “wine estate”. Such properties often continue in grape production, with the new owners contracting with others to manage the vineyards.

Marketing System

Most wine grapes produced in Solano County are sold via contract to wineries elsewhere, mainly in Napa County and the Central Valley. Only about 3% percent of the local grape tonnage goes to wineries in Solano County. While in the 1970s and 1980s, local growers were able to sell their grapes “on a handshake” with established Napa County wineries, relations became more formal in later years as the wine industry underwent a wave of consolidations and many of the medium to large scale local wineries were purchased by multinational corporations. This change coincided with a downturn in market prices forcing some producers to let their grapes go unharvested to save costs. Finding a market for all local grapes has continued to be a challenge for Solano County wine grape producers.

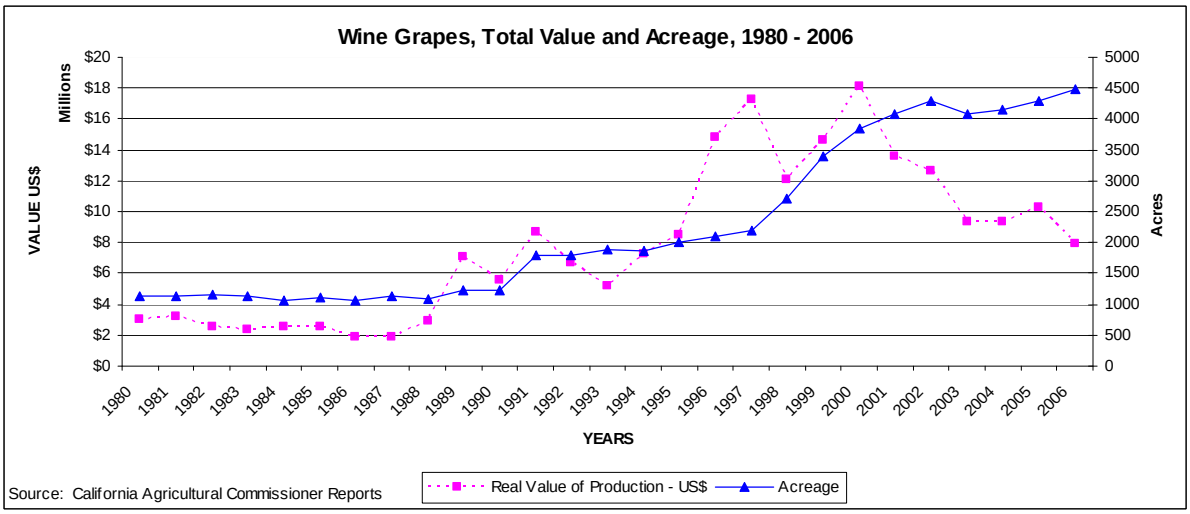
Many producers try to market their grapes to home winemakers, small wineries and other markets that were unheard of a few years ago.

Market Value and Acreage Trends

Wine grapes ranked seventh in market value among Solano County commodities in 2006, generating $9.3 million in sales. This was a decline from 2000, when grapes ranked third and earned producers $18 million. As the table shows, market values for grapes peaked in the mid 1990s and again in 2000, but have declined since then. Acreage devoted to the commodity has been stable since 2000 despite generally lower prices, reflecting the difficulty of changing permanent plantings. In response to the market problems, some growers in 2003 began to pull their vineyards, leaving the land fallow.

Most local production is used as a blending grape by wineries located outside of Solano County. A wine can be labeled and marketed with a specific geographical region if 75 percent of the grapes in the wine were produced in the geographical region listed on the label. Wine grapes from other regions of California are then used for the other 25 percent in the bottle.

Solano County has three distinct American Viticultural Areas (AVA), allowing labels and marketing with geographical designations. The northwest corner of the county is a part of the North Coast AVA. Suisun Valley, Green Valley and Wild Horse Valley each have their own AVAs. Currently there are only six Suisun Valley labeled wines, with three of them bottled outside of Solano County.



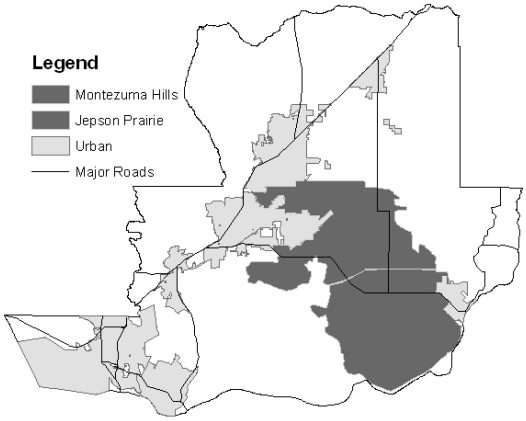
Location and Cultivation Requirements

Solano County is home to about 20 wine grape producers. Most of the local grapes are grown in Suisun Valley, with the remaining production in Green Valley, Wild Horse Valley, Ryer Island along the Sacramento River in the Delta and scattered around Dixon. Wine grape producers range in size from more than 200 acres to less than five.

The Suisun Valley is uniquely suited for wine grape production because of the numerous microclimates created by the geography of the valley. The cool air and fog from the Bay help create an ideal combination of cool nights and hot days that is conducive to high quality production.

Wine grapes are typically harvested beginning in late September through mid November.

Sheep



Current Status and Issues

The markets for sheep and wool have not been good to Solano County sheep growers for some years. Sheep have been raised in the county since the dawn of local agriculture in the 19th century. The plentiful rain and grass seen primarily in eastern parts of the county encouraged sheep raising, though this was diminished somewhat when organized irrigation systems arrived in the 1950s and popularized crop farming.

Sheep products are still a major part of Solano County agriculture, ranking 10th in market value among all local farm commodities in 2005. Solano has been a significant sheep production region on the state and national levels, ranking third and tenth, respectively, among California and U.S. counties in market value in 2002, according to the Census of Agriculture. However, prices earned by producers, overall sales volume, and production have fallen in recent years because of competition from importers and changes in consumer preferences. Particularly troublesome for local producers has been the decrease in the number of slaughterhouses throughout the western states as a result of industry consolidation.

Currently, raising sheep is barely or not profitable for most local growers. Although prices have stabilized in recent years, the economic future of this sector of Solano County agriculture is problematic. A major asset for local growers is the Superior Farms Processors in Dixon, which is the only sheep processing facility west of the Rocky Mountains.

Marketing System

Sheep producers market three products: wool, lamb and mutton. Lamb is the meat of animals less than 12 months old and is typically the meat preferred by U.S. consumers. Mutton and yearly mutton are the meat from sheep over 12 months in age. Mutton demand is currently increasing in the U.S. with increased levels of immigration from Latin America, where mutton is preferred over lamb.

Regardless of the recent increase in demand for mutton, the sheep industry is plagued with oversupply and low per capita levels of consumption. The U.S. does not have a history of high levels of per capita lamb or mutton consumption, especially when compared to beef, chicken or pork.

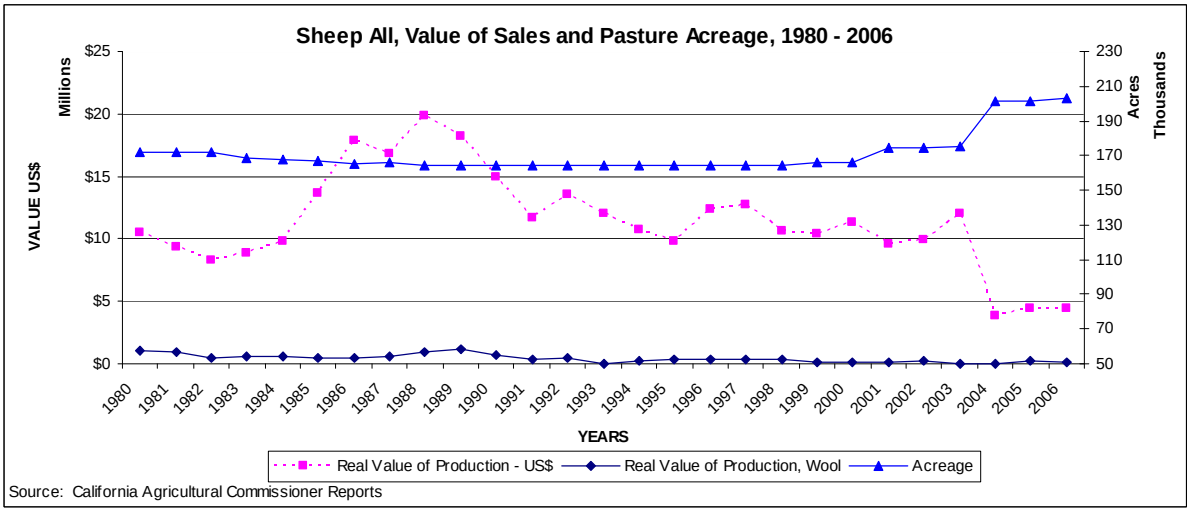
Historically, sheep producers relied on high wool prices to offset low meat prices, but in recent years wool marketing has almost come to a halt in Solano County because the cost of removing the wool can be more than the value of the wool. The wool market has

decreased considerably because of the wide variety of poly fibers currently used to make clothing. This has left sheep producers dependent only on the lamb and mutton markets for revenues.

A few Solano County sheep producers have found a unique market for their sheep through Niman Ranch, A major national niche seller of high quality meat. This relationship began in 1991 when producers agree to raise their lamb according to the natural standards of Niman Ranch. Central to the success of this relationship with Niman Ranch is the Superior Farms processing facility in Dixon.

Market Value and Acreage Trends

In 2006, 43,269 head of sheep and lambs were marketed for a total value to producers of $4.2 million while 308,083 pounds of wool brought $200,300. The value of wool production in Solano has not surpassed $1 million since 1980 and was practically nil in 2003 and 2004.

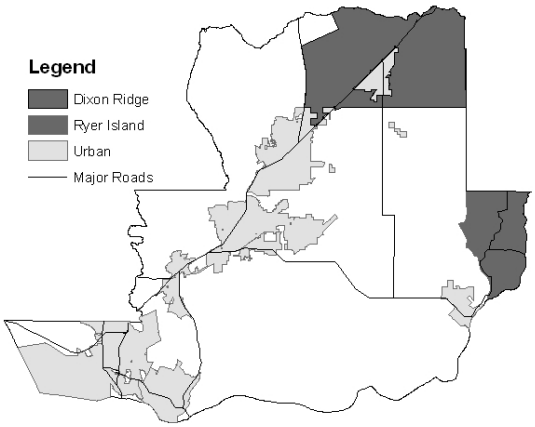


Location and Cultivation Requirements:

About 60 Solano County (Census 2002) ranchers are active sheep producers, who typically also produce small grains and wheat in a rotational system on non-irrigated land. The Montezuma Hills region is the center of sheep production in the county, because of favorable soil, climate and geography. The ground in the Montezuma Hills is typically used for sheep grazing the year after it is planted to small grains. The ground is then left fallow in the third year.

Processing Tomatoes

Current Status and Issues



Processing tomatoes are one of the top commodities in Solano County, ranking fourth in market value in 2006. Yet the local crop has declined in the past ten years in value, acres, and production, because of shifts in the overall industry largely external to Solano.

The closure in the 1990s of several canneries in the region was a major part of this trend. Tomato processors moved facilities south from the Sacramento Valley to the San Joaquin Valley to be closer to the farmland increasingly being devoted to tomatoes. There are more favorable growing conditions in the southern region, leading to the production of tomatoes with a higher percentage of soluble solids and decreasing the cost of separating the solids from the water within the fruit.

Fortunately for local growers, Solano County retains one tomato processing plant, the Campbell's Soup facility outside Dixon, which takes virtually all the Solano crop. Future local production of tomatoes is dependent on the continued operation of the Dixon plant.

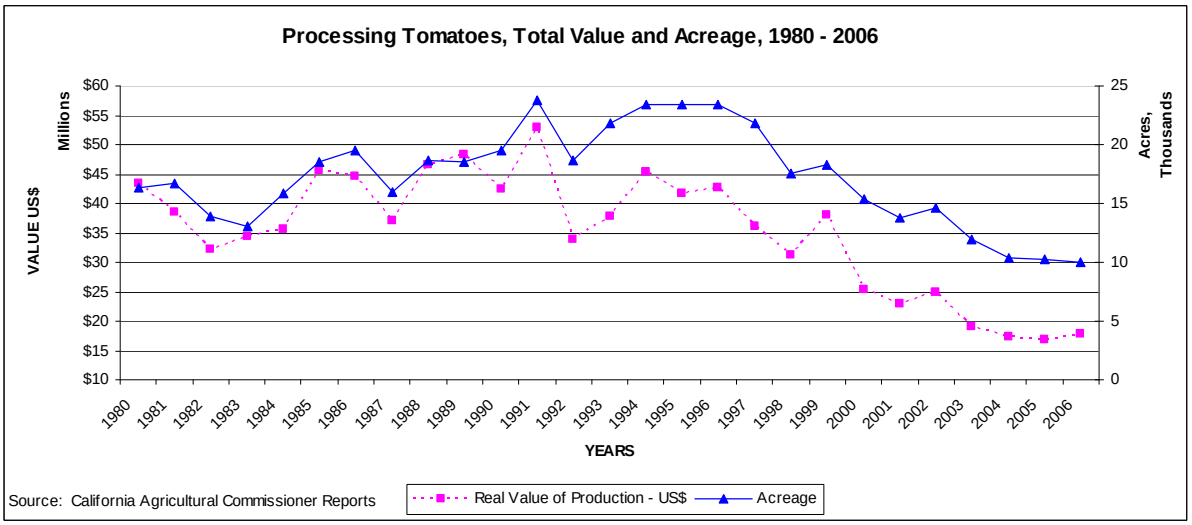
Marketing System

Processing tomatoes are the basis for tomato soup, salsa, spaghetti sauce and ketchup. Raw tomatoes are highly perishable and must be accepted for processing within six hours of harvesting. Like most tomato processing plants in California, the Dixon facility produces a basic tomato sauce or paste that is sold to other plants which combine other products into the final consumer product. All processing tomatoes are marketed via a contract with a processor, and producers do not plant tomatoes without a contract. Processing plants operate around the clock during the harvest period and the contracts assure a constant supply to feed the production line. Most processors source their tomatoes within a 45 mile radius to limit the perishability problem. The crop is mechanically harvested and delivered to the processor in tandem bulk trailers holding approximately 12 tons each.

Prior to being unloaded into the plant, each tomato load is sampled and graded based upon the percentages of mold, color, worm and solids. Grades are used in determining payment to the producer. Grading is done by a third party to ensure neutrality. Tomatoes are then manufactured into paste or diced and shipped to other food processing facilities for finishing.

Market Value and Acreage Trends

In 2006 about a dozen Solano County tomato farmers earned $20.8 million from the crop grown on 10,000 acres. As the chart indicates, market value and acreage for tomatoes in the county peaked in the mid 1990s. The expansion of the industry in earlier years, starting in the 1960s, was stimulated by the locally developed mechanical harvester, which replaced farmers' reliance on hand labor, and increases in the demand for tomato products aided by the growing popularity of pizza.

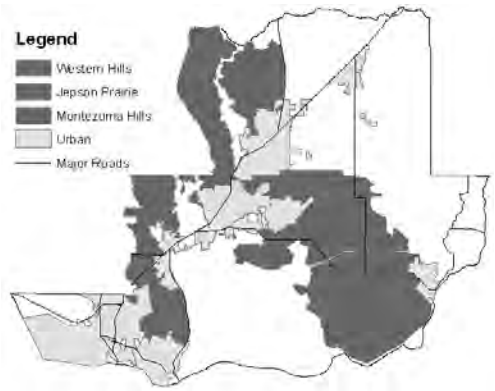


Location and Cultivation Requirements.

Solano County tomato growers are clustered around Dixon in close proximity to the local processing plant. Tomatoes are a warm-season crop, sensitive to frost at any growth stage. Optimal soil temperature for seed germination is 68°F (20°C). The Mediterranean weather conditions prevalent in Solano County—average summer air temperatures between 77° F (25°C) and 95°F (35°C) and low to non-existent summer rainfall—are ideal for growth and development of the fruit and limit disease problems. Well-irrigated plants can tolerate temperatures in excess of 100° F (38°C). Fruit development and quality are severely reduced when day and night temperatures drop below 68°F (20°C) and 50°F (10°C).

Processing tomatoes are planted from late January until May. The crop is harvested and delivered to the plant from July to October. In years with unseasonable weather, the harvest may start later and extend past mid-October. The occurrence of rain during the harvest season can be very detrimental; damage can vary from mild mold to total crop loss. Processor contracts require growers to deliver a definite tonnage at agreed-upon delivery times and prices.

Beef Cattle



Current Status and Issues

Cattle and calves consistently rank among the top agricultural commodities in Solano County in both market value and land used. They were the second top commodity in market value in 2006, 2005 and 2004, as local growers received favorable prices because of general market conditions. About 200,000 acres or 55 percent of all agricultural land in the county is devoted to pasture and grazing land. The majority of this land is used for beef cattle production, with the remaining going for sheep grazing.

Most beef grazing occurs on hillsides and on less than prime soils. The cost of expansion, augmented by high land values throughout the county, is a critical issue for local cattle operations. This problem limits economies of scale in the industry. Furthermore, cattle operations at times experience conflicts with urban neighbors over the impacts of large herds, leading to high costs for local operators and some relocation of grazing areas.

Cattle have been grazed in Solano County since the 19th century. Since that time, beef producers have experienced economic fluctuations, with alternating periods of profitability and loss depending on market conditions. Proximity to livestock auctions in Galt and Petaluma has granted Solano County beef producers good access to the commodity market. However, producers have been hindered in value-added marketing due to the lack of USDA-inspected beef slaughterhouses close to Solano County.

Marketing System

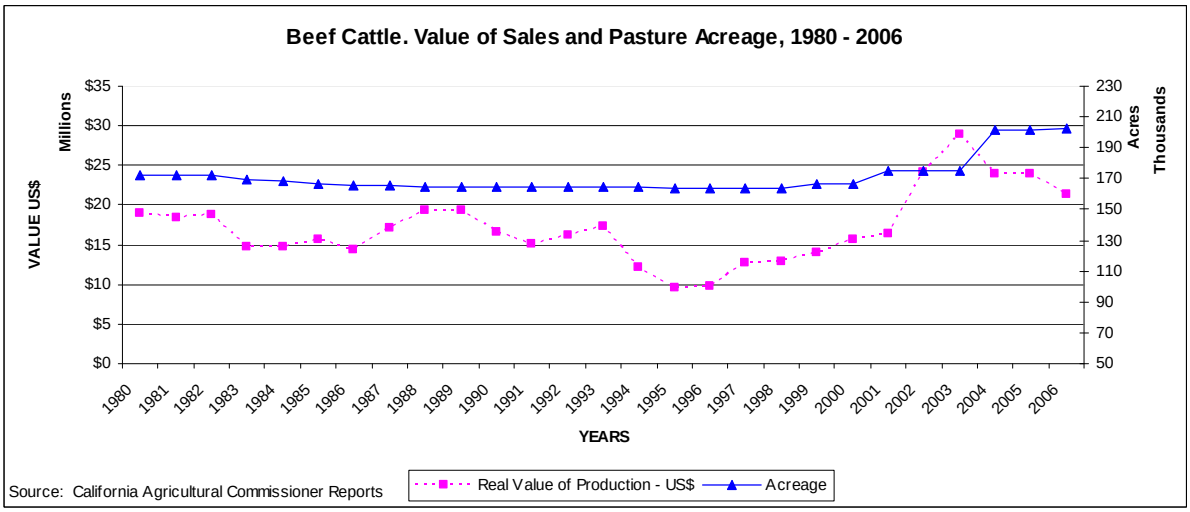
Solano County cattle production is part of the national beef cattle industry that delivers animals to large scale livestock processors in the Great Plains. Regional outlets for receiving the animals, such as auction houses, are also part of the market system. The closest livestock auction to Solano County is in Galt, about 20 miles away in southern Sacramento County. Without this auction in Galt, the beef industry in Solano County would have a much more difficult time marketing its calves. Currently, the closest USDA inspected livestock processing plant is in Oroville, and until there is a closer option for producers to process their cattle into cuts of beef, a value-added beef product will be very difficult to establish. The Galt auction has served as the primary livestock market for several years since the closure of the Dixon market in 1989.

Most Solano County beef producers are commercial cow-calf operations. These producers have their cows give birth to one calf per year, and the calf is either sold when weaned from the cow or added back into the herd. Cow calf producers typically sell their calves once or twice a year. There are a handful of purebred beef producers who also run cow-calf herds and have the option of marketing their calves as purebred to other producers as well as to the open market.

Market Value and Acreage Trends

As the chart shows, the market value of beef production in Solano County has increased since 1996, as prices have gone up. Economists attribute this increase to a cyclical period in which demand is greater than supply for numerous reasons.

Solano cattlemen generated $25.1 million in sales in 2006, slightly less than the $27.2 million the year before. They sold 36,000 cattle and calves in 2006 at an average price of $86.21 per hundredweight.



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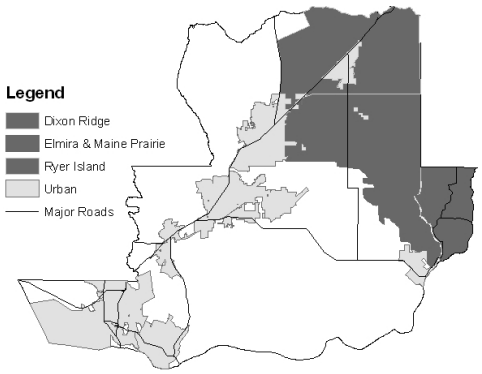
Location and Cultivation Requirements

Cattle ranches are scattered throughout the county, on hillsides and grassy areas not suitable for growing high value crops that require irrigation. Generally, these areas also produce dry land wheat and other grains in a rotational system. Most beef cattle operations are located in hills and lowlands around Vacaville, Fairfield and Vallejo. Prior to the creation of the Solano Irrigation District in 1956, the majority of land around Dixon was in a combination of sheep and beef cattle production, along with orchards. The delivery of water to this area quickly moved livestock production to the lower quality soils, where it remains to this day.

Almonds



Current Status and Issues

Almonds are currently one of the biggest success stories in California agriculture, having generated record yields and prices in the last four years and thus major profits for producers. Solano growers certainly have shared in this run-up of production and earnings, although the increase here has not been as rapid as in other counties where almonds are a more dominant commodity. Almonds were the 8th most valuable crop in market value in Solano County in 2006, rising from 23rd as recently as 2000. Statewide, the commodity is ranked fourth in market value, with 14 other counties leading Solano in sales.

The industry has been very successful at increasing the demand for almonds in both domestic and international markets. This unprecedented growth in a tree nut market has industry experts and economists wondering when almonds will become oversupplied. Statewide in 2005, a total of 611,723 acres were in almond production. This was a significant increase from the 516,767 acres in production in 2000.

Marketing System

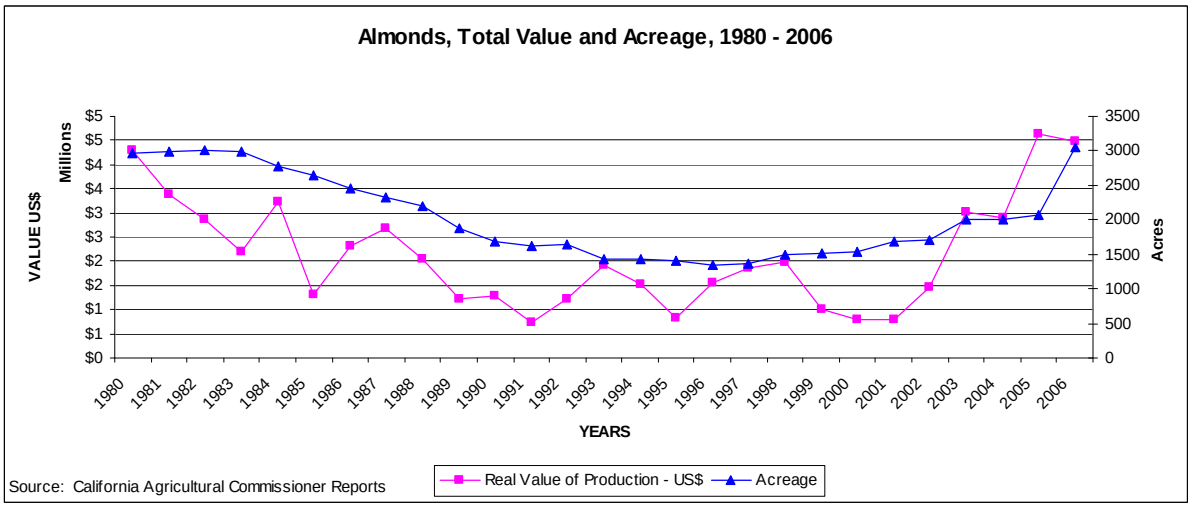
After the harvest, the nuts are delivered to handlers and marketers. Farmers who have invested in shelling equipment and can deliver their almonds already shelled receive a higher market price. In Solano County, most growers sell their almonds through Blue Diamond®, the private almond processing and marketing firm that was once a large statewide grower's cooperative and is headquartered in Sacramento. There are also a few small, independent buyer/handlers who purchase local almonds.

Prices are paid to the grower based on the shelled product that is delivered minus a penalty for losses due to pests, blanks, gummed nuts, and off-grade type kernels. Growers can sell the hulls left over after shelling, primarily as a soil amendment, although the earnings of this byproduct are minimal compared to the value of the nut meats. Prices paid by Blue Diamond®, shortly after delivery of the nuts, are usually a certain percentage of the anticipated price, with a later payment made after the nuts are sold. Independent buyers may pay for the almonds at the time of delivery or in several payments over a year. Growers selling to independent handlers may receive higher payments if they agree to be paid over a long period of time.

In 2006, according to Agricultural Commissioner data, local growers received $4,116 per ton, a decrease from the $5,375 received in 2005.

Market Value and Acreage Trends

Almond production in Solano County is clearly on the rebound. After a 15-year slide in acreage and value, production began to increase in 2000. In 2006, Solano County had 2,106 acres of bearing almond trees and produced just over $5 million in sales. Another 949 acres were non-bearing trees, newly planted and representing a continuing increase in production for the near future. Solano's sales are a very small part of the industry's statewide $2 billion in annual sales.

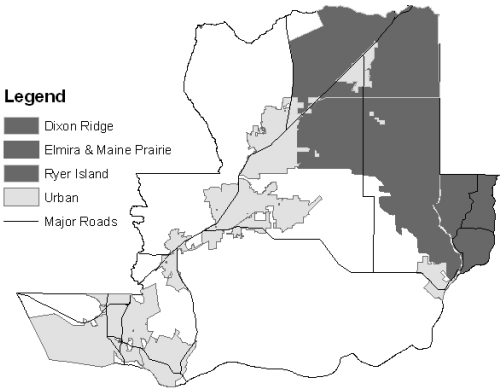


Location and Cultivation Requirements

Traditionally almond production in Solano County was based along Putah Creek south of Winters. However, over the past few years orchards have been established further south around Dixon. Almond production processes are intensive, including irrigation, nutrition, pollination, orchard floor management, tree training and pruning and pest management. Integrated pest management is widely practiced. Most of the almonds in Solano County are grown conventionally, although a few acres are devoted to organic production. The different cultivars grown are unique to California, many of them developed by local plant breeders. Rootstocks are needed to grow high quality nuts. Peach seedlings, peach-almond hybrid and Marianna 2624 plum are the rootstocks most commonly used. Most of the almonds grown in Solano County are mechanically harvested.

Alfalfa

Current Status and Issues



Because of favorable soil, irrigation and other growing conditions, Solano County growers produce high-quality alfalfa that is sought by large scale dairies. As a result, alfalfa is among the top local commodities in market value—ranking third in 2005.

In 2002, Solano ranked 10th among counties in the state and 43rd in the nation in the market value of alfalfa and other hay. Market values and production have steadily increased over the years. Many of the growers who abandoned sugar beet production in the late 1990s as the result of the loss of processing outlets converted their acres into alfalfa.

Although a low value crop, alfalfa produces good returns for growers who can keep their costs low. The economic health of the local alfalfa industry is tied directly to the health of the dairy industry. Solano County alfalfa producers see an increase in sales when milk prices are high and a decrease when milk prices are low. Prices usually do not fluctuate greatly from year to year, so alfalfa growers have had a steady and generally profitable crop. This is expected to continue into the near future.

Alfalfa producers believe that the Solano County confined animal ordinance adpted in 2005 limits their profitability. The ordinance limits the locations where a dairy can locate and generally increases the costs involved in permitting a large scale confinement animal operation. Producers argue that another large scale dairy in the county would create a valuable local market for their alfalfa. Silage, made from fresh chopped corn, and haylage, which is freshly chopped hay, are commonly blended with alfalfa to produce high quality feedstuffs for dairy cows. Alfalfa producers often plant corn as part of the crop rotation system. A new dairy would increase the local demand for both commodities produced in this rotational system. Alfalfa producers tell us that alfalfa production is more profitable and therefore preferred by local producers over silage and haylage.

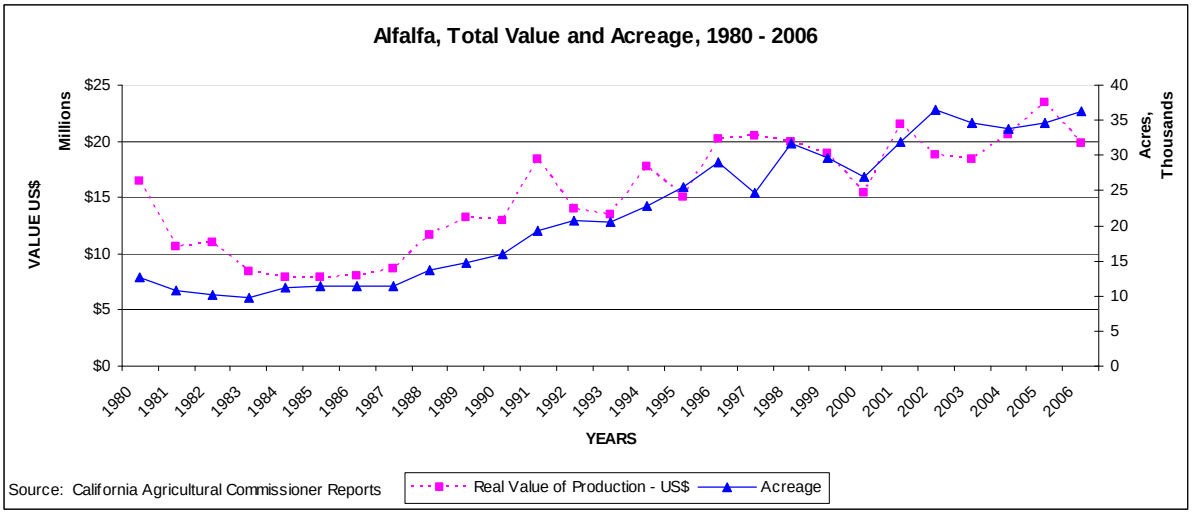
Marketing System

Most alfalfa produced in Solano County is sold to dairies elsewhere in northern California, particularly to large dairies in Fresno and Merced Counties where there is little alfalfa acreage. Local alfalfa production is generally marketed through a broker who handles the details of shipping and guarantees a quick payment to producers. Most alfalfa producers use a broker because they do not personally have the time to find a buyer and secure payment directly from individual dairies. The use of brokers also ensures that Solano County alfalfa is shipped all over California. According to Solano alfalfa producers, local alfalfa is shipped to Marin and Sonoma Counties on the coast and to many Central Valley counties.

Alfalfa is harvested in the field into bales that range in weight from less than 100 pounds to more than one ton. Each load of alfalfa is tested for total digestible nutrients (TDN). The TDN is a measure of level of protein and moisture content which determines the quality of the alfalfa. The dairy industry has different TDN standards than the horse industry, with the lowest quality alfalfa being sold to beef producers. The price varies according to quality.

Market Value and Acreage Trends

As the chart shows, market value and acreage devoted to alfalfa production have steadily increased over the past 20 years. In 2006, the crop was grown on 36,304 acres and generated $23.3 million for producers. This represented a sixfold increase over the acres and market value of the mid 1980s. A boost in acres used for alfalfa production occurred around 2000 when many growers shifted from sugar beets to alfalfa as a result of the local termination of beet production. Both crops can be produced on Class II soils.



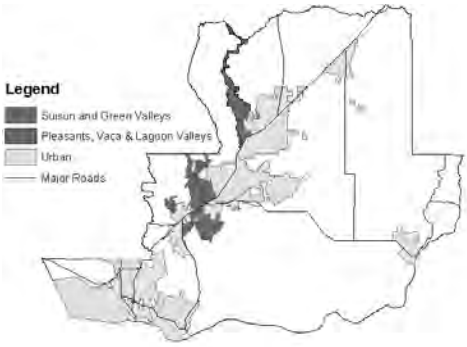
Location and Cultivation Requirements

About 140 Solano farmers (Census of Ag 2002) grow alfalfa on large plots that average about 240 acres each. Most production occurs around Dixon and south of Midway Road, an area with good soil, plentiful water and cool nights—conditions that combine to create a high quality crop. Affordable irrigation water is critical to producer profits, since alfalfa is a low value commodity.

A locational issue for many alfalfa growers is the proximity of nearby rural residences. Profitable alfalfa production requires the aerial application of pesticides, flood irrigation, and the operation of harvesting equipment sometimes at night—conditions that frequently lead to negative impacts on residences in the neighborhood. If growers lose the ability to engage in these practices because of local conflicts, their principal agricultural alternative is to convert their land to less profitable livestock production.

Niche Agricultural Production

Current Status and Issues



Solano County is home to numerous small-scale agricultural operations producing for niche markets. The type of goods produced range from fresh fruit to flowers and from eggs to olive oil. While not a major percentage of the total value of agricultural products in Solano County, such crops provide economic opportunities for a number of small scale farmers.

Fresh Fruit

In Suisun Valley, Green Valley and along Pleasants Valley Road, there are a few small producers growing cherries, pears, apricots and other fruit for the fresh fruit market. The majority of the production from these farms is sold either on-farm or to local markets. This type of fresh fruit production is a remnant of the Solano fresh fruit industry of the early 1900s, which grew some of the first California fruit bound for East Coast markets.

Olive Oil

Solano County has an excellent combination of soil and climate for olive oil production. A handful of local olive oil producers are trying to succeed in the competitive olive oil market. California production is a small player in the world market as only the 15th largest olive oil producer. . The U.S. domestic olive oil market is dominated by European Union imports. Since 1989, olive oil imports into the U.S. have increased more than 250 percent to meet the demand for olive oil created by the popular understanding of its health benefits as a cooking oil and salad dressing. Small scale olive oil companies specializing in hand picked, small batch and high quality olive oil , many of which are grower owned, have begun to thrive in recent years.

Organic Production

In 2005 Solano County was home to 27 registered organic producers who produced $2.8 million in value from 985 registered organic acres. The top organic commodities in terms of market value were walnuts, miscellaneous leaf vegetables, endive, fresh market tomatoes, and apples. In terms of acreage, the top organic commodities were walnuts, miscellaneous leaf vegetables, apples, almonds and kiwi fruit.

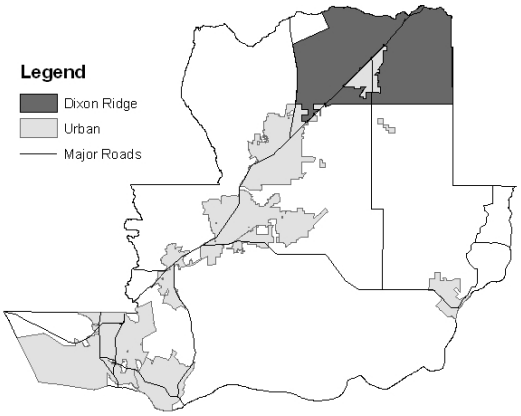
Solano County is a very small player in the overall California organic industry. It does not have any large scale multiple crop organic farms that are common in the Capay Valley of Yolo County.

Produce Stands

Suisun Valley is home to a thriving farm stand industry. The eight farm stands currently in operation include single crop stands-- specializing in kiwi, cherries or strawberries-- and stands open year-round which sell a variety of fruits and vegetables. County government regulations for the construction and operation of produce stands are a continuing problem for operators. One regulatory issue concerns the source of the produce sold; stands that sell only fruits and vegetables off-site are generally not allowed to operate in agricultural zones. However, it is difficult to monitor compliance with this requirement. Stands located on parcels enrolled in the Williamson Act face further use complications. Other issues involve the county's implementation of state and federal health, safety and other regulations. Produce stand operators assert that such rules conflict with their desire to provide an attractive shopping experience, including an open-air environment where customers can select fresh produce from wooden crates and bins.

Dairy

Current Status and Issues



Milk ranked sixth among Solano County agricultural commodities in 2006, producing $10.4 million in market value, although only three dairy farms were on record as operating in the county. One is a large dairy with more than 6,000 cows, while the other two are relatively small operations. The local production and sales of milk have increased greatly over the years, with the 2005 market value representing more than a fourfold increase since 1995.

However, the prospect of future expansion of this agricultural sector is constrained by county regulations which limit the location of new dairies. In 2005 the Solano County Board of Supervisors approved additions to the county code, which restrict the location of confined animal operations and define limits on their environmental effects. While not an outright moratorium on new large-scale dairies, the new regulations require proposed operations to undergo a strict review process and to adhere to stringent standards.

Enacted as the result of an outcry from urban residents against a proposed large-scale dairy, the new regulations reflect an ongoing conflict between urban and agricultural interests in the county. Urban groups are concerned about dairy impacts on residential lifestyles, while agricultural interests focus on the economic health of local farming. Agricultural leaders see lost opportunities for other sectors of the county's agriculture industry, since dairies typically purchase large quantities of feedstuffs such as alfalfa and corn from nearby suppliers to minimize their costs.

Marketing System

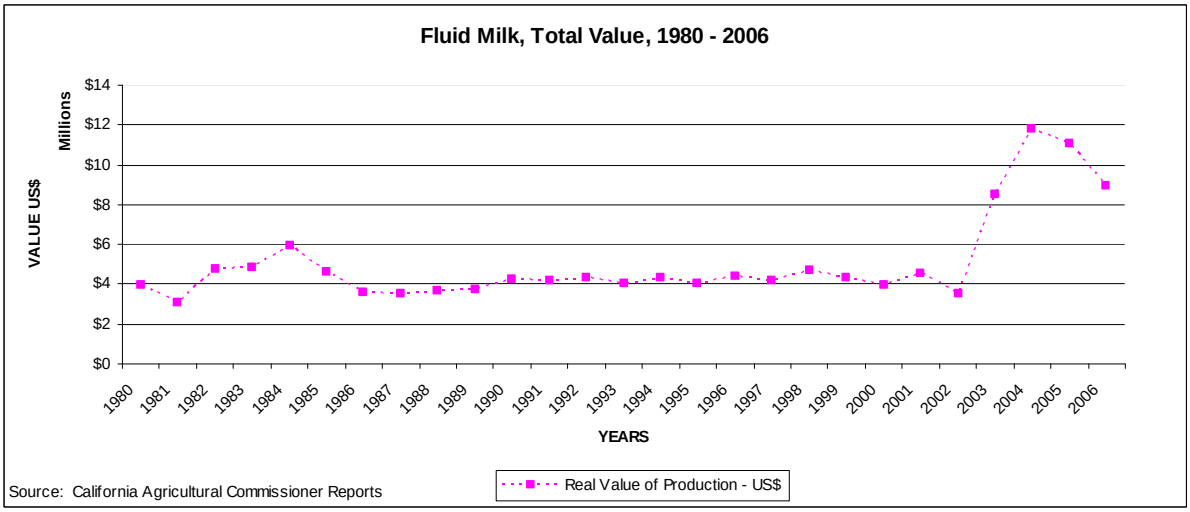
Typically, refrigerated trucks from the handler/processor arrive at the dairy farm at least once per day to pick up milk and haul it to the processing plant. The plant converts the milk into either a fluid or manufactured product and sells this product to retailers. Virtually all of the county's milk production goes into the fresh milk market, with less than one percent processed into other dairy products.

The prices producers receive are set by state and federal mechanisms. Under a California state marketing order, the state sets minimum prices which processors must pay dairy farmers for raw milk. These prices are based on national wholesale market prices for dairy products and differ by the end product produced. However, since the advent of pooling, all dairy producers receive the same "blend price" for their raw milk, regardless of how an individual producer's milk is utilized. The state oversees the pool and pays producers monthly, determining a blend price based on the average price of milk used across all products produced.

Market Value and Acreage Trends

In 2006, according to Agricultural Commissioner data, Solano County dairies produced 865,568 cwt of milk for the fresh market at an average sales price of $12.10 per cwt.

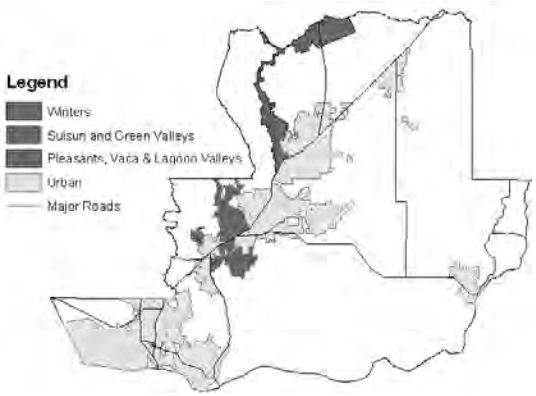
While Solano County has a long history of small scale dairies, the market value of milk produced in the county increased almost three-fold in 2003, as indicated in the chart, due to the addition of the large-scale dairy.



Location and Cultivation Requirements

The three Solano County dairies are located in and around Dixon. The new confined agricultural regulations have limited the possible locations of new diaries to an area south and east of Dixon and North of Rio Vista. While the new regulations limit where additional large scale dairies can be placed, they will be in close proximity to the feedstuffs grown in the area.

Dried Plums (Prunes)



Current Status and Issues

While Solano County produced $4 million in dried plums and ranked 9th in commodity value in 2006, the dried plum industry in Solano County, as in the entire nation, is in a precarious situation. The industry is facing increasing competition from Chilean and Argentinean plum production and decreased per capita consumption in the U.S. If U.S. consumers increase their consumption of dried plums for positive health benefits or as the Baby Boomer generation increases in age, then the dried plum industry in California will rebound. With no change in U.S. consumption, however, the industry will continue to shrink in the face of growing overseas competition.

Plums were first introduced into the Santa Clara Valley of California in 1856. By 1900, there were 90,000 acres of plums and drying houses spread throughout California. U.S. per capita dried plum consumption reached a peak in 1990, but has since decreased. In 2001, at the request of the California Dried Plum Board, the USDA officially renamed prunes to dried plums in order to improve the product's market image. In 2002, California acreage reached 80,000 acres for the first time since 1992, but declined to less than 72,000 acres by 2004. Increased competition on the world market has caused the price for dried plums to decline annually from 1993 to 2004.

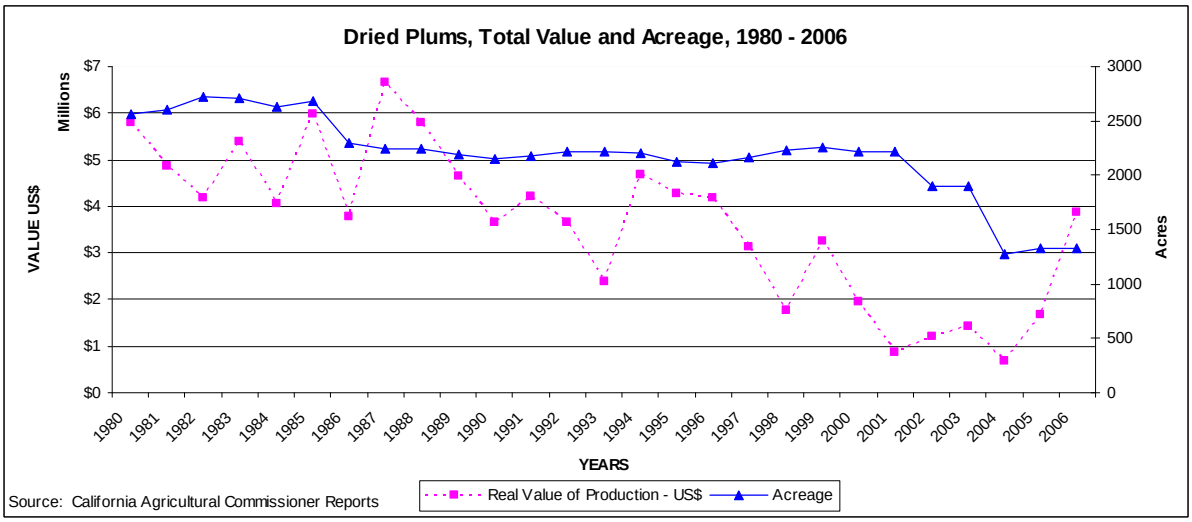
Marketing System

Lacking a local dried plum processor, Solano County producers must ship their plums to Yuba City to be dried. Local producers often complain that the cost of shipping the fresh plums 60 miles to Yuba City severely decreases their profits.

California produces nearly all of the dried plums grown in the U.S. and accounts for 70 percent of the world production. While the majority of dried plums produced in the U.S. are consumed domestically, the dried plum industry is currently focused on the international market. However, the U.S. has seen increased competition from Chile in the European market. Most U.S. dried plums are processed through the Sunsweet Growers cooperative based in Yuba City. An estimated 20 independent dried plum processors operated in the state in 2004.

Market Value and Acreage Trends

Dried plum acreage in Solano County began to decline in 2002. Almost 1,000 acres plum trees were pulled between 2001 and 2004. Since this decline in production, the total value of dried plums produced in Solano County has increased to almost $4.0 million in 2006. The $4.0 million in sales is large enough to rank dried plums 9th in total value generated by a commodity. The recent increase in dried plum production may result from an improvement in the quality of data collection and reporting by the Solano County Agricultural Commissioner.



Location and Cultivation Requirements:

Dried plums in Solano County are grown primarily in Suisun Valley and in the alluvial soils at the top of Pleasants Valley Road and around Winters. Plums grow best in areas with deep alluvial soils and wind protection

Sunflower Seed

Current Status and Issues

Over the past five years, sunflowers have emerged as a leading commodity in Solano County, ranking 8th in market value in 2005 and 12th in 2006. Solano County farmers grow sunflower seeds for two separate markets. In the first, seeds are sold on a commodity basis to be processed into oil and meal. The second market is for certified sunflower seeds, which are produced under contract for seed propagation companies. Sunflowers have been produced in Solano County for a long time, with considerable fluctuations in value and acreage over the years.

Marketing System

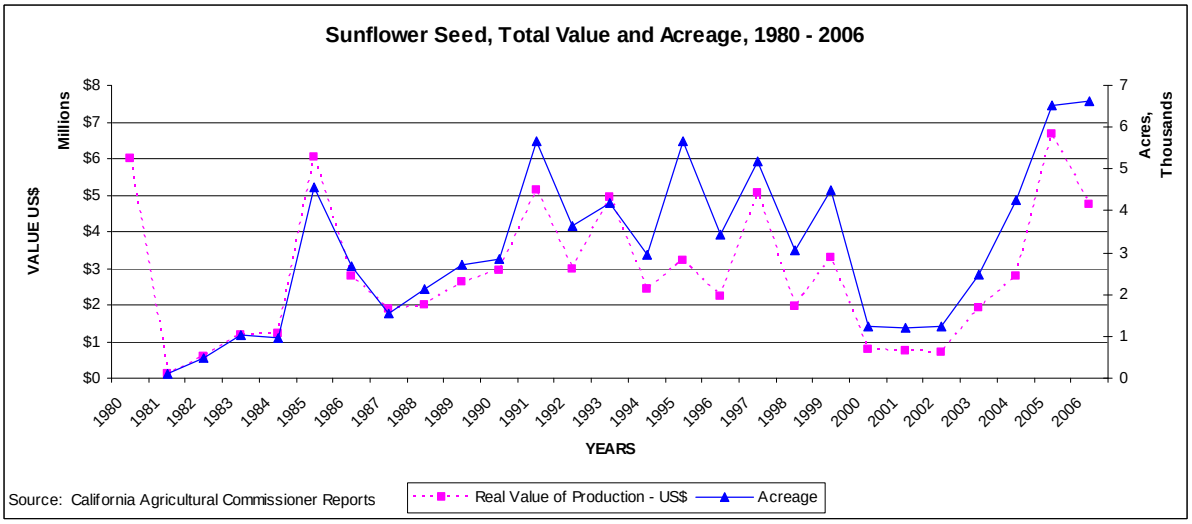
Planting certified sunflower seed under contract must be spatially coordinated because sunflowers are open pollinators. When two sunflower fields are planted next to each other, the harvested crop will have the genetics of both fields. In order to produce genetically pure certified seed, each field is required to be almost one mile from any other sunflower field. Harvested certified seed is delivered to a specific location determined by the contract. The seeds are cleaned and repackaged for delivery as seed for commodity production in the next season.

Commodity sunflower seeds are sold as a bulk commodity and processed into a wide array of products. Typically, the seeds are pressed to separate the oil from the rest of the seed. The residual is called meal and is processed into numerous products. Seed sold as a commodity receives the local commodity price determined by the world market.

The majority of sunflowers grown in the United States are produced in the Great Plains as part of a wheat and sunflower rotational system. The Great Plains production drives the world market price for sunflower seeds, and the relatively small Solano County production has no effect on market price.

Market Value and Acreage Trends

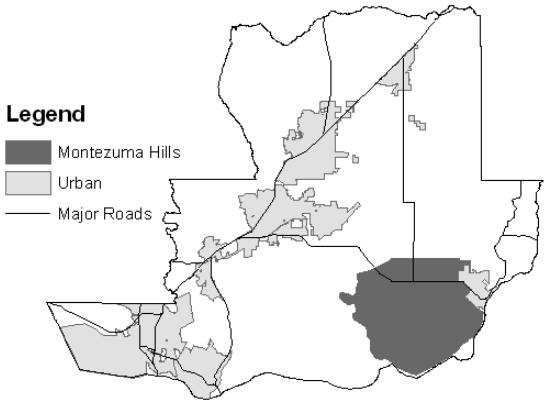
Sunflower seed production is on the rise in Solano County. In 2006 sunflowers were planted on almost 6,615 acres and generated almost $5.5 million in value. The seeds are produced as part of the tomato, alfalfa and wheat rotation system. Seed production in the Dixon Ridge area is preferred as a rotation crop over wheat or corn because of higher profits and a secure market price under contract.



Location and Cultivation Requirements

The deep alluvial soils of the Dixon Ridge area are perfect for sunflower production. Once the seeds are planted, weed control and irrigation are the major factors impacting production. Sunflowers are planted in May and harvested in August or September.

Montezuma Hills Grains – Oats, Barley



Current Status and Issues

The Montezuma Hills region is farmed in a crop rotation system that includes sheep, small grains and a fallow period. As part of this rotation, up to one third of this region can be in small grain production at any given year.

Historically, the small grains grown were limited to oats and barley. Recently some producers have been experimenting with safflower and canola. Small grain production in Solano County faces the challenges that come from producing a commodity on a small scale while receiving a globally determined market price. Montezuma Hills producers farm on a terrain that is too hilly for the kind of large scale production utilized in the upper Great Plains and Europe.

As part of the three-commodity rotation system, small grain production does not have to be profitable every year to make economic sense for producers also involved in the sheep industry. However, small grains can not be unprofitable every year for producers. As part of the rotation system, small grains are a leading income source for producers.

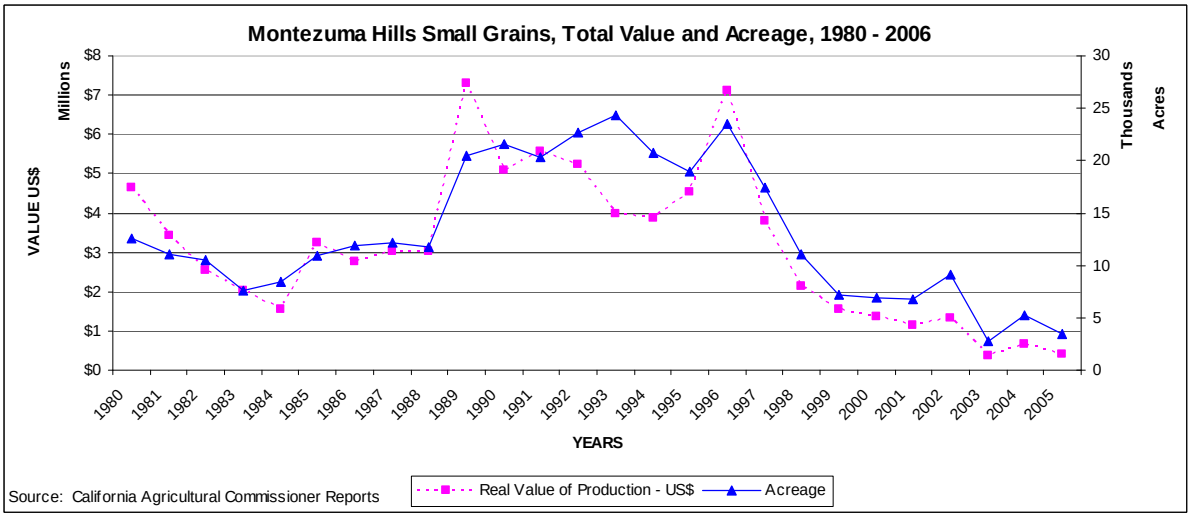
Marketing System

Small grains are harvested and shipped to a Woodland elevator, or to the Port of Stockton for export. Without these close outlets, small grain producers would have greater transportation costs. . The barley and oats produced in Solano County are usually marketed for animal feed. When there were multiple animal feeding operations in the Solano area, producers had several local markets. Now almost all of the production is shipped out of California.

Solano County is loosely connected to the world small grain industry. Profitable years are typically defined when the main small grain production regions experience a bad harvest. The more difficulty small grain producers in the Midwest have in harvesting their crops, the more profitable small grain production is in Solano County.

Market Value and Acreage Trends

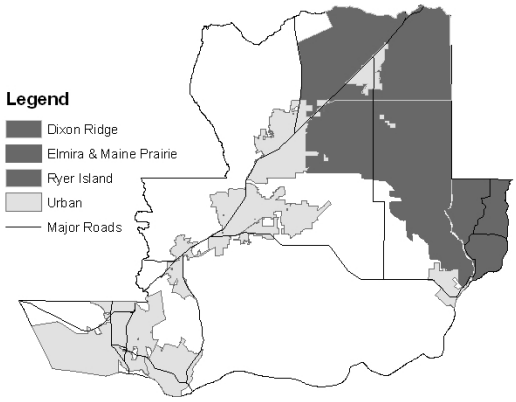
Small grain production is declining in value in Solano County because fewer acres are being planted in this crop and commodity prices have not kept pace with inflation



Location and Cultivation Requirements

The sheep, small grains and fallow crop rotational system may be the best agricultural use of the Montezuma Hills region in terms of working in conjunction with the environment. The Montezuma Hills are a natural grassland. Over the years producers have learned to farm here in a manner that allows them to cultivate a grain crop while utilizing the naturally occurring grass.

Wheat and Corn



Current Status and Issues

Today, wheat and corn are produced in Solano County to rest the land for processing tomatoes, green peppers or alfalfa which are all more profitable parts of the same crop rotation system. In the Dixon Ridge area wheat and corn are used to rest the land as part of the tomato, alfalfa or safflower rotation. The Montezuma Hills region uses wheat as part of the three year rotation between sheep, wheat or other small grains and fallow. Neither area has the economies of size necessary to compete with the Great Plains or Corn Belt where the majority of wheat and corn in North America are grown.

The corn grown in Solano County is planted for the same reason as wheat with the exception of sweet corn. Grown in a similar manner as field corn, sweet corn is separately marketed to area groceries stores as a vegetable crop. The Dixon area has a reputation for growing quality sweet corn. Detailed information on sweet corn production is no longer available in the annual crop reports published by the Solano County Agricultural Commissioner.

Higher market prices have increased the number of acres planted in corn in Solano County in recent years. .
.

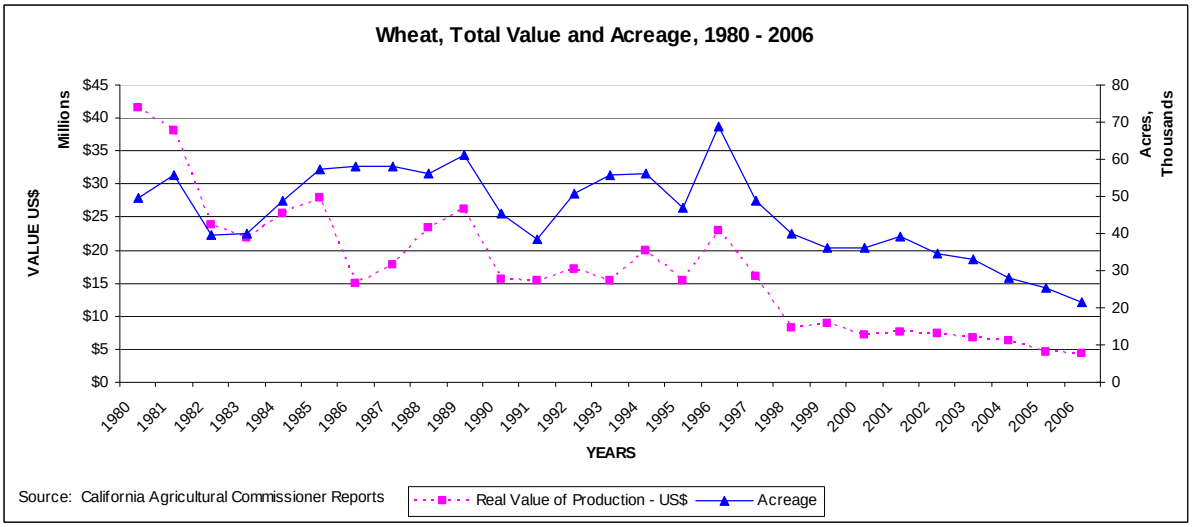
Marketing System

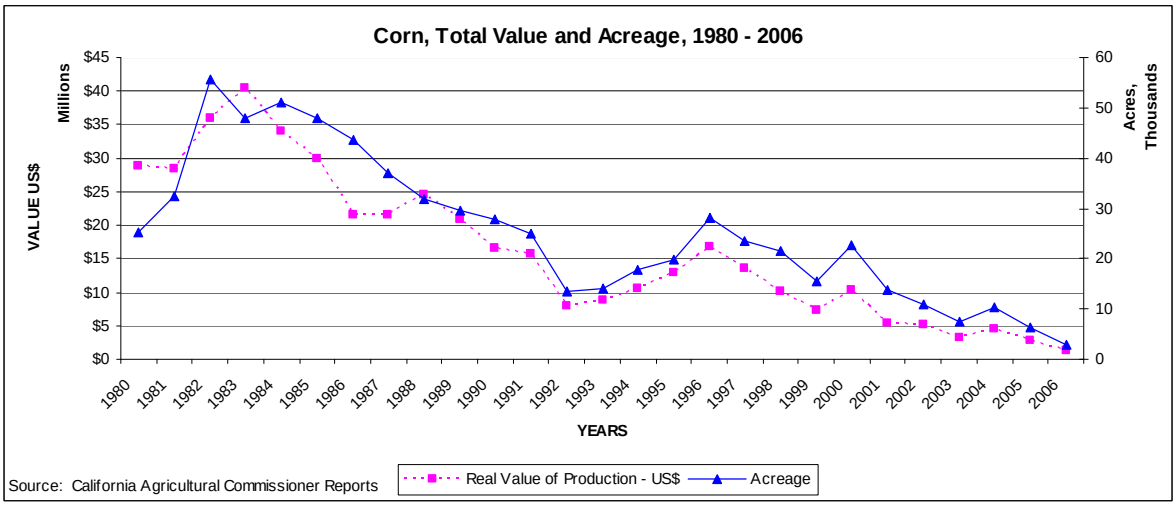
Wheat and field corn are harvested and immediately shipped to a grain elevator where producers receive a price per ton that is based on the world market. Because Solano County producers are small and inefficient in comparison to the large scale Midwestern producers, wheat and corn production are seldom profitable for most Solano County producers.

As grain production has declined in the area over the last 10 years, Solano County producers are losing their connection to the market. Since wheat production is not profitable in the Dixon area and only occasionally profitable in the Montezuma Hills region, both areas likely will experience declining profitability in the future.

Market Value and Acreage Trends

With some fluctuations, the overall Solano County trend in the past 25 years has been a steady decrease in wheat and corn market values and acreage, as the charts indicate.





Location and Cultivation Requirements

Wheat and corn are best grown in soils with low clay levels and high amounts of organic matter. The Dixon Ridge and most of the Elmira and Maine Prairie area are well suited for corn and wheat production. Wheat is planted in the late summer or early fall before the rainy season and is harvested in late June and early July. Corn is planted in the spring and harvested in August and September.

Wheat is a large scale commodity that requires large acreage and easy access to market. Any urbanization that keeps producers from using large scale implements, large acreage irrigation and drainage will harm the already low levels of profitability of Solano County producers.

Nursery Crops

Current Status and Issues

Solano County is home to a healthy nursery crop industry because of a combination of favorable growing conditions and transportation access. While there are a handful of nurseries in Solano County, local production is dominated by one operation. The smaller nurseries produce tree plantings, ornamental plants and other nursery crops to provide local producers and residential customers with new orchard plantings or ornamental plants.

By contrast, the leading nursery in Solano County does not market its production locally and depends on few suppliers in Solano County. The nursery located here a few years ago because of the availability of inexpensive land next to a major roadway and in a climate conducive to outdoor growing of nursery crops. This is large nursery is linked to suppliers and final consumers across the nation.

It is difficult to compare nursery production with other agricultural commodities in the county. Nursery crops are not planted in Solano County soil, but are grown in containers. Yet, especially the one large nursery is an important agricultural employer and its production is overseen by the Agricultural Commissioner as are other plant crops.

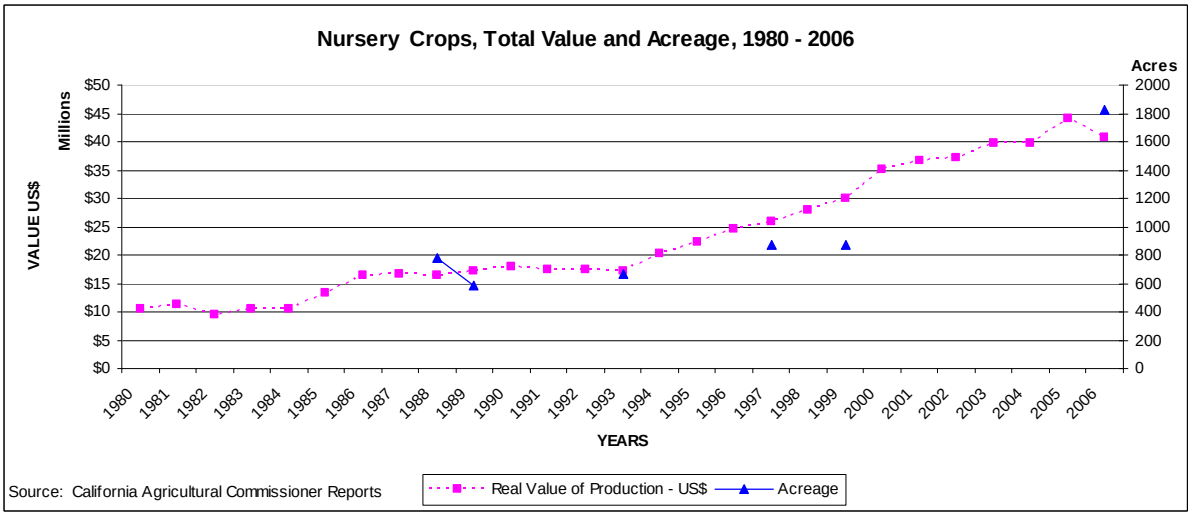
Marketing System

The small nurseries provide fruit and nut tree and vine crop starters for the orchard and wine industries in Solano County.

The one large nursery sells ornamental trees and shrubs throughout the United States. This nursery supplies trees and shrubs to retail nurseries and development projects. It has more in common with large scale nurseries in San Diego than neighboring smaller operations in Solano County.

Market Value and Acreage Trends

The large nursery dominates the total market value of nursery products grown in the county. Because nursery crops are generally planted into closely placed, they have a very high value per acre. Historically, the Agricultural Commissioner has not collected acreage information on nursery crops within Solano County.



Location and Cultivation Requirements:

The nursery industry is located in Solano County because of excellent climatic conditions and easy access to the interstate road system.

Appendix II

Agricultural Regions

DIXON RIDGE	**69**
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Agricultural Regions

It is nearly impossible to have a conversation with a Solano County producer without hearing a local geographical term—e.g. Dixon Ridge, Montezuma Hills, Suisun Valley—used to define an area. After completing several focus groups and and a number of interviews, we concluded that the designation of individual agricultural regions in Solano would help to present an accurate picture of local farming and ranching, one more meaningful than just a countywide perspective. Producers know the general location of these regions and the agricultural activities which take place there, although the exact boundaries defining the regions lack precision. Agricultural borders may be a quite a subjective interpretation of geographical data, but the visualization of these regions serves as a useful reference historically and economically.

Defining the Regions

The crops grown in various locales are a major factor in determining an agricultural region. Field crop regions-- Dixon Ridge, Elmira and Maine Prairie, Montezuma Hills and parts of the Suisun Valley--are defined by the crop rotational systems used by most producers in these areas. Other regions such as the Pleasants, Vaca and Lagoon Valleys are defined more by soil type and elevation. Areas primarily in livestock production, such as the Southwest Hills, are defined by a combination of soil type, slope and land use.

If agricultural regions are to be defined mainly by commodities produced, the county could easily be divided into 15 or 20 individual areas because of the diversity of crops grown locally. However, we developed our layout of the agricultural regions by grouping individual fields according to the rotational or permanent cropping system used and then applied natural resource elements to delineate their edges. Each agricultural region was defined by combining satellite images, soil survey information, county infrastructure, topography and producer interview information.

Multiple high resolution satellite photos of Solano County were stitched together and loaded into a Geographical Information System (GIS) file. Here the photos were combined with digital soil, road and elevation data to create a geographic model. Most producers interviewed were asked to verbally define the boundaries of their agricultural region and a few were asked to draw the boundaries on a map. The producer information was then used to guide the GIS based process to digitally define each production region.

Crop Rotation, Permanent Crops and Risk

No one single environmental characteristic**,** production practice, or trait of an area defines an agricultural production region. Agriculture is a risky business. Every year, producers plant crops or raise animals without knowing how the weather will impact their harvest or what market price they will receive for their production. Farmers utilize a battery of chemicals and farm implements and produce a variety of commodities to reduce risk. The visible results of this decision are the assortment of crops grown across Solano County.

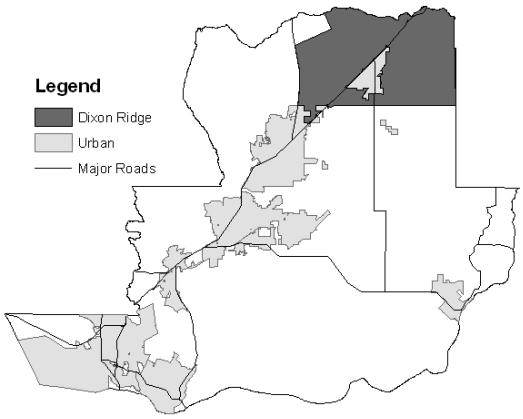
Each local producer selects a permanent or rotational cropping system based on the combination of crops perceived to return the highest level of profit in the long run. At times,

field crop producers will plant a crop (e.g. legumes) with the primary goal of soil improvement rather than profit; the recovered soil will then be planted the following year with a more lucrative crop. For farmers also involved in livestock production, pasture land management and livestock products serve as insurance against draught and poor crop market prices. The system is complex and every planting decision is weighed carefully. In the following sections, the basics of the crop rotational system are presented by the geographic region on which they are planted.

Dixon Ridge

Major Crops

Processing Tomatoes
Bell Peppers
Alfalfa
Sunflower
Wheat
Corn



Geographical Area

Total Number of Acres: 57,390
Total Value of Production: $64,205,584
Value per Acre of Production: $1,118
Percent of Region in Rural Residences: 11.9

Boundaries: Dixon Ridge is bounded on the north by Putah Creek and to the east by the Yolo County line. The southern boundary is defined by Midway Road. The western edge is marked by a combination of rural residential and cropping patterns which switch from field crops into ranchettes and tree crop-based production.

System overview

Dixon Ridge evolved from a sheep-producing area into a field crop system when irrigation was introduced to the area in the 1950s. Production in the region is more similar to patterns in nearby Yolo County than to other areas of Solano County. Several producers farm in both Solano and Yolo Counties. Dixon Ridge is essentially an extension of Sacramento Valley agriculture.

The rotational system here can include processing tomatoes, bell peppers, alfalfa, safflower, sunflowers, wheat, and corn. The most profitable crop is processing tomatoes. Every three or four years, a field is planted to processing tomatoes based upon a yearly contract with a tomato processing facility. In other years, another less profitable crop is planted to allow the soil to “rest” until tomatoes can be planted again. Dixon Ridge producers acknowledge their economic dependence on the tomato production contracts and are unsure of their ability to continue field crop production should the contracts be discontinued.

The majority of tomatoes grown in the Dixon Ridge are processed through the Dixon-based Campbell Soup plant. The tomato industry in the the past 15 years has experienced both a consolidation of of processing plants and a shift south to the San Joaquin Valley in in tomato production with plan relocation. Campbell Soup continues to operate the Dixon plant because the continued ability to produce high quality finished products.

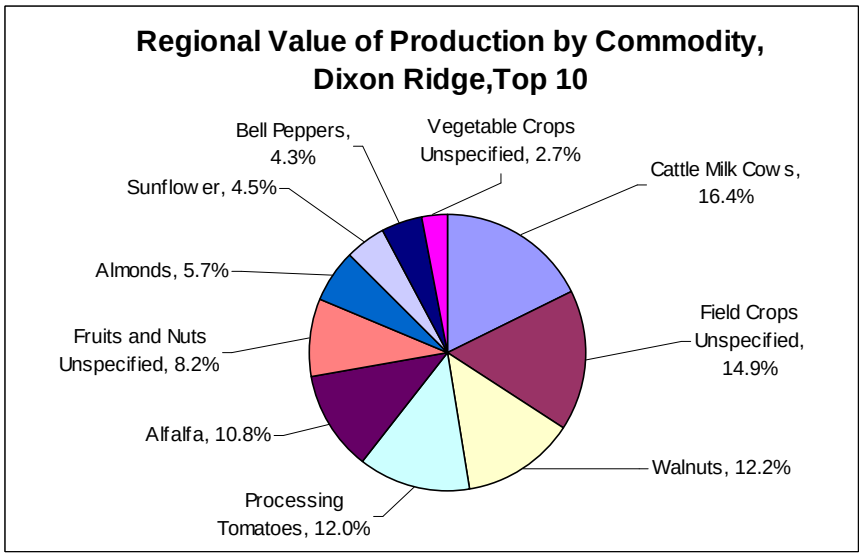
To ensure quality, tomatoes are brought to the plant as quickly as possible following their harvest. The location of all of Solano's tomato production within a few miles of the plant is a big advantage. Urban development, local road congestion, or other problems that inhibit transportation of the tomatoes from the field to the plant could be harmful to continued tomato production in the Dixon Ridge area.

Farms in the region are large operations. Dixon Ridge is the only agricultural region in the county in which most farmland is rented by operators from landowners. The exact percentage of rental land is not known, but most producers interviewed indicated that their landlords lived off the farm, many in San Francisco.

Continued land rental arrangements in the long-term are problematic, as local operators suggest, because a number of successor owners are unlikely to retain these connections. According to anecdotal accounts, most of the children of their landlord have nonagricultural occupations with relatively little interest in maintaining agriculture on farm properties they are likely to inherit.

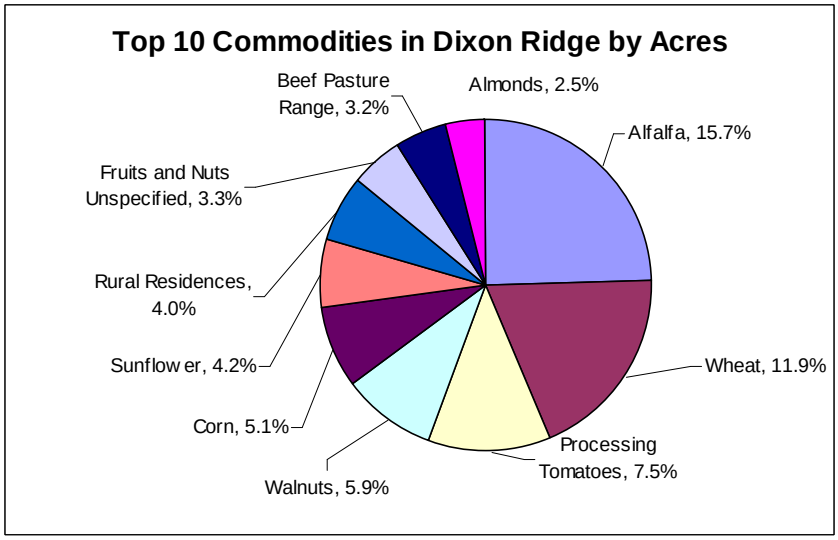
Agricultural Value by Commodity

The dairy industry is the largest agricultural value generator in the Dixon Ridge area. Because of the road layout in the region, there were enough unidentified fields which are known to be in field crop production, but we were unable to verify their production. Walnuts have surpassed all row crop production in the region. Almost 30 percent of the agricultural production in the Dixon Ridge comes from tree crop production. Processing tomatoes and alfalfa are the leading row crop value generators.



Agricultural Production by Area

Alfalfa covers almost 16 percent of the area in the Dixon Ridge. Wheat and processing tomatoes complete the top three. Processing tomatoes acreage totaled around 5,000 acres, which is down considerably from five years. We believe the decline is the result of regional economic pressures and tomato processing consolidation. Almost 4 percent of the Dixon Ridge area is covered by rural residents.



Soils and Slope

Most of the county's Type I and Type II prime agricultural soils are found in the Dixon Ridge area. The Solano County Soil Survey conducted in 1977 lists the dominant soil types as in the Yolo and Brentwood classifications. These soils were created from alluvial deposits and are very deep, with low levels of clay. Irrigated orchard and field crops are the prevailing commodities.

The slopes of the individual fields that comprise Dixon Ridge have been laser leveled to aid irrigation, drainage and large scale production.

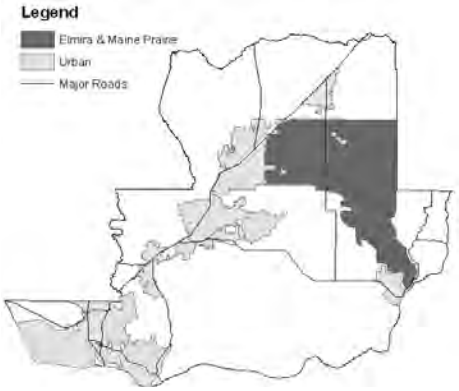
Regional Infrastructure

Driving along I-80, field crops are visible on both sides of the interstate in Dixon Ridge. The large-scale producers in the area rent land on both sides of the interstate. However, the freeweay is a difficult barrier for farmers who need to move their expensive equipment to and fro, increasing production costs. The small and poorly designed Pedrick Road overpass is the major route. Producers often have to assign two or three workers to the task of moving heavy and outsized equipment across the overpass to control traffic movements.

Irrigation and drainage infrastructure are critical elements of Dixon Ridge farming. Obstacles that block the flow of water to or from a parcel greatly increase the cost of

production. The water infrastructure is designed for fields no smaller than 40 and in some cases 80 acres. Thus, cutting up these properties for two- or three-acre residential sites can severely impede the flow of water to remaining farmland and to neighboring parcels.

Elmira and Maine Prairie



Major Crops

Alfalfa
Wheat
Corn
Pasture
Beef Cattle
Sheep

Geographical Area

Total Number of Acres: 74,812
Total Value of Production: $ 41,703,906
Value per Acre of Production: $ 557.45
Percent of Region in Rural Residences: 1.1%

Boundaries: The Elmira and Maine Prairie region is bounded to the north by Midway Road. The Yolo County line and Ryer Island form the eastern boundary. The southern edge is defined by a combination of changes in soil and a shift from row crop into pasture-based agricultural production. The western border is formed by the city of Vacaville.

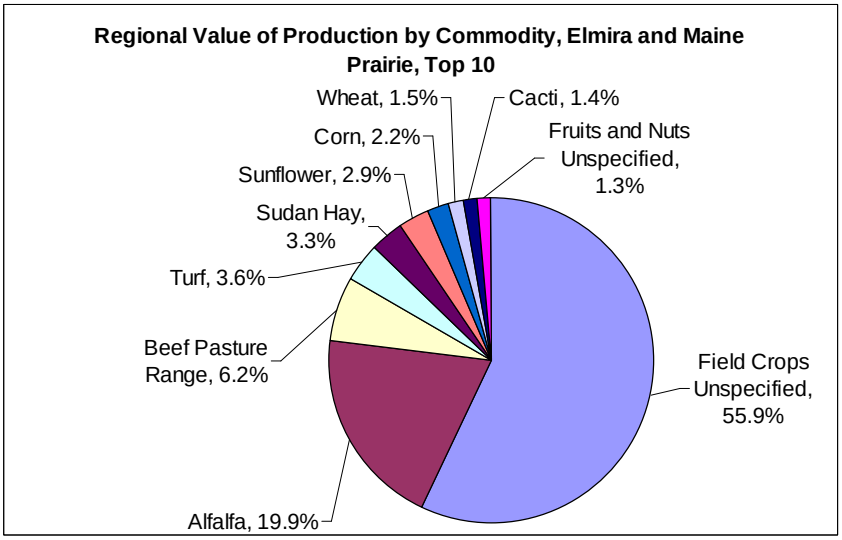
System overview

The area south of Midway Road and North of Jepson Prairie is primarily planted in a field crop rotation with lower value crops than the Dixon Ridge. Alfalfa serves as the most profitable crop in the rotation system. Wheat, corn and other grains are used as other parts of the rotation. Cattle and sheep are grazed on pasture on the remaining area. There is a clear north-to-south change in this area's cropping system based on soil type. In the north the field crop rotational system is dominant, while pasture slowly becomes a larger part of the farming system further south. The rotational system is based on the quality of soil and access to irrigated water. Over the past few years this area has seen an increase in irrigated pasture acreage as producers have shifted from field crops to livestock production. This region was home to the local sugar beet industry until the one accessible processing plant in northern California closed in the 1990s.

Economically, this region is connected to the agriculture of the Sacramento and San Joaquin Valleys because dairies there purchase most of the alfalfa, wheat, and corn grown in the Elmira and Maine Prairie area. Alfalfa produced in this section of Solano County is of high quality, aided by warm days and cool nights, access to irrigation and low to moderate slopes. However, producers in this region believe that the animal confinement regulations of Solano County limit selling to local markets and hence restrict profits. Most of the commodities produced in this area are sold to dairies and other animal operations in other counties.

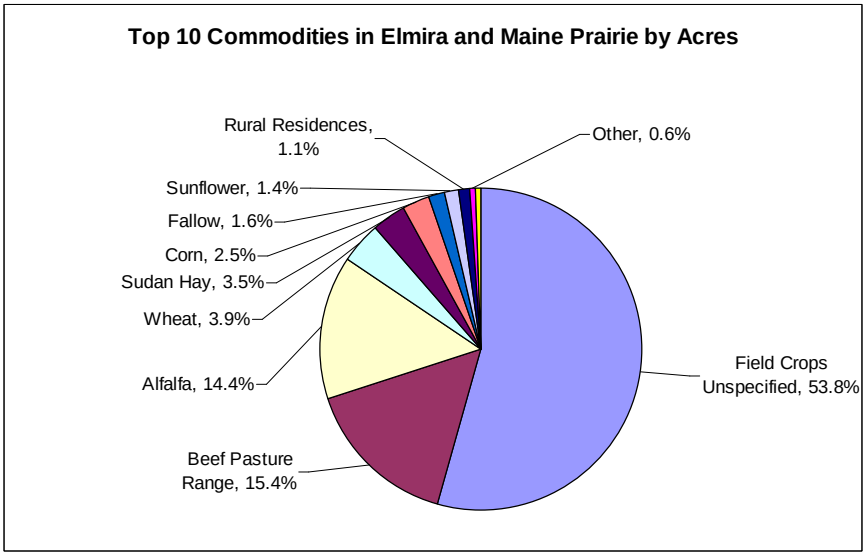
Agricultural Value by Commodity

Elmira and Maine Prairie is clearly a field crop production area. Alfalfa, pasture and turf are the three leading agricultural value generators for this region.



Agricultural Production by Area

Because of the remoteness of some fields, we were unable to confirm the type of row crop production on 54 percent of the region. Pasture, alfalfa and wheat cover 30 percent of the area where we confirmed agricultural production. Turf, which is a leading value generator does not rank in the top ten commodities in terms of acreage.



Soils and Slope

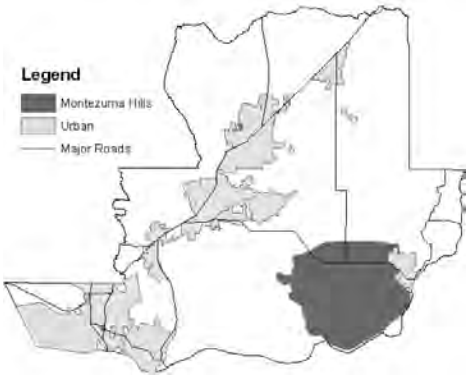
The Elmira and Maine Prairie region has mainly Class II and III soils. In the northern section. The higher percentage of Class II soils in northern parts of the region allows for more field crop production. In the south, the Class III soils make livestock grazing more prevalent.

Regional Infrastructure

Similar to the Dixon Ridge area, this region is dependent upon low cost water delivery and removal. The dense, heavy soils are not conducive to producing higher value processing tomatoes and bell pepper field crops.

The eastern side of the Elmira and Maine Prairie region is relatively free of urbanization pressure. The western side is under pressure as Vacaville grows and expands towards Dixon.

Montezuma Hills



Major Crops

Sheep
Small Grains
Fallow
Pasture

Geographical Area

Total Number of Acres: 54,995
Total Value of Production: $ 7,415,814
Value per Acre of Production: $ 134
Percent of Region in Rural Residences: 1%

Boundaries: The Sacramento River forms the southern border of the region. To the west, the Suisun Marsh edges the sheep, small grains and fallow cropping system. The northern boundary is formed by a combination of soil and cropping system changes and an increased occurrence of vernal pools. The city of Rio Vista is the eastern boundary of the region.

System overview

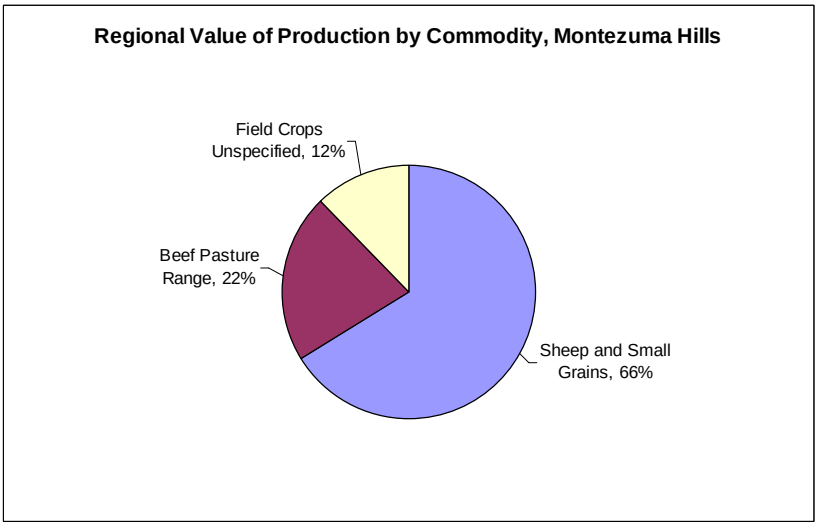
The current rotation of small grains, sheep and a fallow period is one of the oldest cropping systems in Solano County. It allows producers to spread the risks of poor harvests or low market prices across several different commodities. This mix is also a good environmental utilization of an area that is not well suited for field crop or cattle production. The Montezuma Hills are too hilly and the soil is too poor for large-scale field crop production, and cattle are too heavy for the steep hills and light soil.

The development of this farming system is partially the result of the region's proximity to the Delta. Historically, grain, lambs, and wool were easily transported through the Delta to San Francisco and points beyond. Rio Vista and the Delta were once the center of commerce in Solano County. Montezuma Hills growers recognized this and produced grains, fibers and meats that could be easily shipped to markets.

Agricultural landowners in the region are not completely dependent on income from agriculture. Gas wells and wind turbines also contribute to their income. The gas companies typically maintain the wells and access roads to the wells. Wind turbines are placed on rented land or on land owned by SMUD. On its properties SMUD rents grazing and pasture land to producers. Landowners who rent their land to other utility companies receive a small base rent plus a percentage of the price of the energy generated.

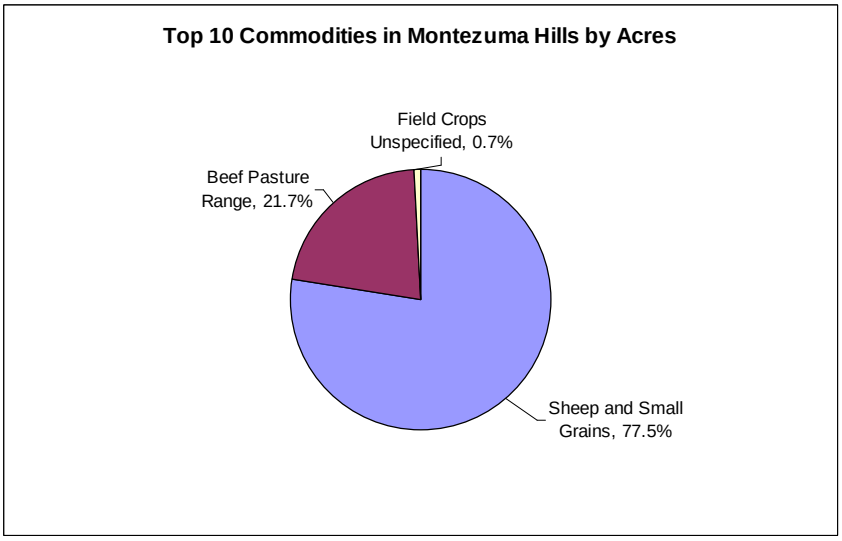
Agricultural Value by Commodity

The landscape of the Montezuma Hills is dominated by sheep and small grains production. The dominance is reflected in the sheep and small grain production accounting for 66 percent of the agricultural value generated in the region.



Agricultural Production by Area

Sheep and small grains, when combined with pasture cover 99 percent of the Montezuma Hills region.



Soils and Slope

The Montezuma Hills soils are associated with Altamont-Diablo soils, which are relatively deep but steeply sloped and less fertile than those in the Dixon Ridge. The clay content of these soils can be high, but the seasonal rain patterns allow the ground to be cultivated

during the dry season. If left uncultivated, the soils will support grass and small shrubs. Any trees in this area have been planted by settlers as wind breaks or shade.

Regional Infrastructure

The Montezuma Hills are farmed without irrigation and therefore do not have the water infrastructure of other areas.

The area is under urbanization pressure as Rio Vista continues to grow.

Ryer Island

Major Crops

Alfalfa
Wheat
Corn
Grapes
Pears
Tomatoes

Geographical Area

Total Number of Acres: 21,097
Total Value of Production: $ 15,253,351
Value per Acre of Production: $ 723
Percent of Region in Rural Residences: <1%

Boundaries: Ryer Island is defined on three sides by water and by the Yolo/Solano county line on the northern side.

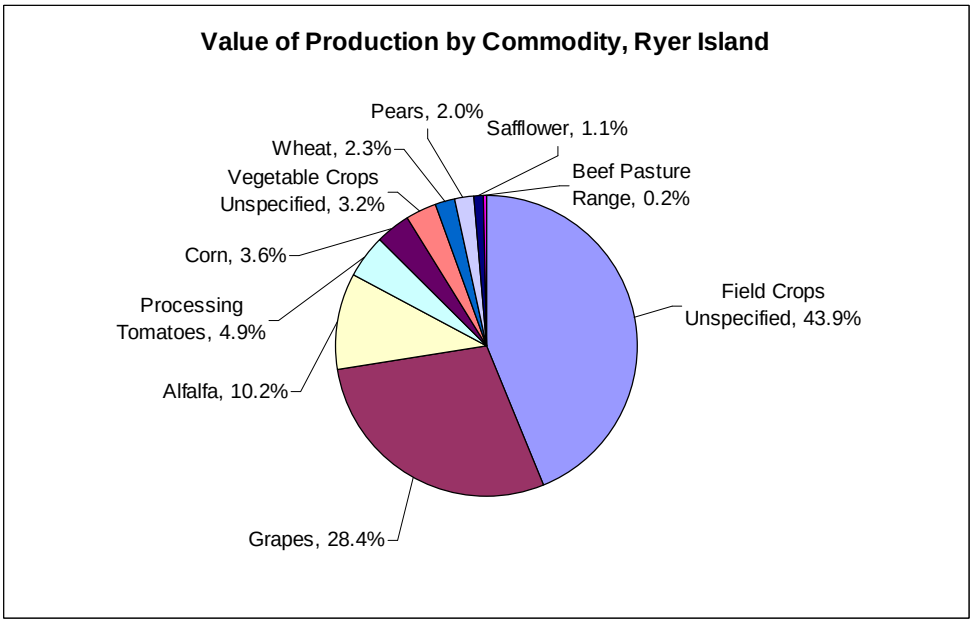
System overview

Ryer Island has more common with the farming system of Dixon Ridge and southeastern Yolo County than any other area in Solano County. The area contains fertile soils and very little development which make it ideal for row crop production. The island is remote and the only means to access the southern island is via a small narrow bridge or by ferry. Producers who farm Ryer Island enjoy their ability to farm without having to worry about the complaints of urban neighbors.

The majority of the island is planted in field crops where the ground can be left fallow during spring flooding. In the areas of the island that do not flood, producers have planted a few acres in wine grapes and tree fruit crops. Because of the proximity to San Joaquin, Sacramento and Yolo counties, the majority of the commodities produced in this area are shipped into these areas for processing.

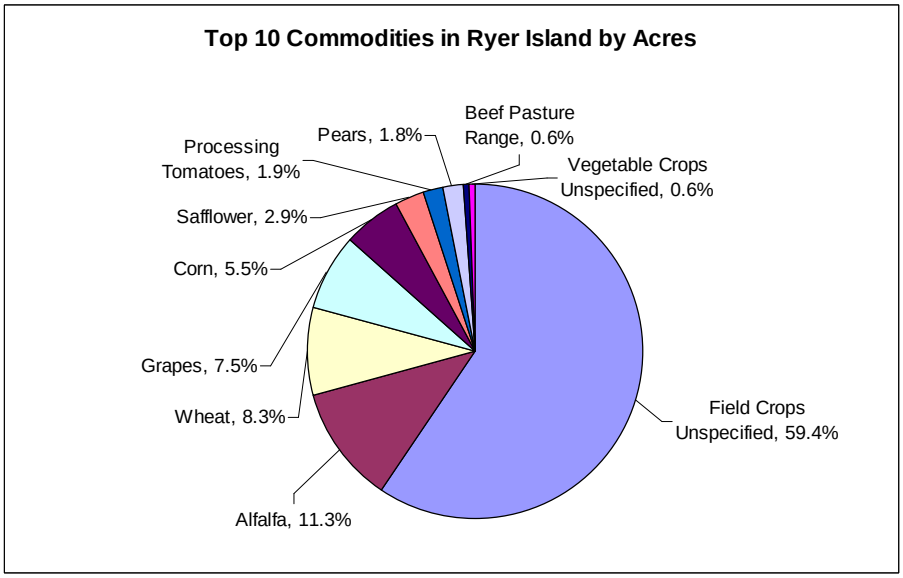
Agricultural Value by Commodity

The agricultural value created on Ryer Island is dominated by wine grapes, alfalfa and processing tomatoes. The lack of roads on the island forced us to classify almost 60 percent of the land as unspecified row crops.



Agricultural Production by Area

Ryer Island is used in a similar manner as the agricultural land found across the county boarder in Yolo County. The area is dominated by alfalfa, wheat and corn with parcels of wine grape production along the edge of the levies. There is little pasture land found on the Ryer Island.



Soils and Slope

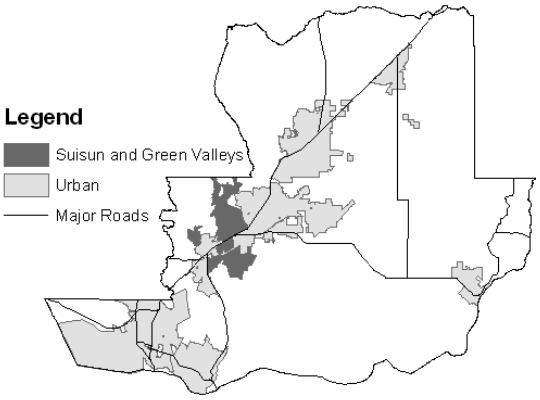
Ryer Island is composed of Class II, III and IV soils, which are poor in drainage but tend to contain excellent organic matter. The soil quality is complicated by frequent spring flooding during periods of heavy winter rainfall and spring snow melt. The poor soil drainage is partially offset by the gentle slope found in this area.

Regional Infrastructure

Ryer Island is not dependent on any Solano-based irrigation delivery service for water. The landowners have water rights associated with their land that allow them to draw water from the Delta for irrigation purposes.

The region lies in a remote corner of Solano County. Farmers who produce field crops face higher than average transportation costs to get their products to market. Producers mentioned during meetings that they have lost money on crops in the past because of high transportation costs.

Suisun Valley and Green Valley



Major Crops

Grapes
Tree Fruits
Vegetable Crops
Wheat
Beans

Geographical Area

Total Number of Acres: 11,631
Total Value of Production: $ 16,767,466
Value per Acre of Production: $ 1,441
Percent of Region in Rural Residences: 2.7%

Boundaries: Suisun Valley and Green Valley are defined by the rich deep alluvial soils that form the floor of each valley. Both are surrounded by steep hillsides which are part of the coastal range which runs along the Western edge of California. The southern boundary for both of valleys is the Suisun Marsh.

System overview

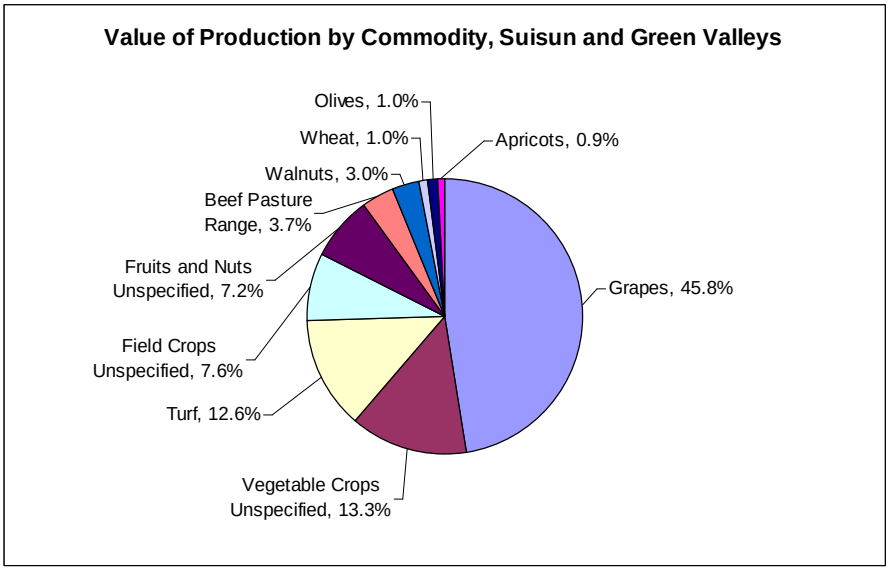
Suisun and Green Valleys are blessed with excellent soil, climate and slope. However, between 25 and 50% of the very fertile land in these valleys is currently not in agricultural production. Several landowners in the region leave their land fallow as a long-term business decision that avoids making large investments in orchard or vine crop production. Most agricultural producers in Suisun Valley are either wine grape growers, farmers interested in value-added or agricultural tourism activities, or producers who wish to continue commodity based farming.

Grape growers in the Suisun Valley are seeking to establish the Suisun Valley AVA as the designation of a high-quality wine region. They plan to increase the number of wineries in the valley and find small, high-quality, niche markets for wine with the Suisun Valley label. There is also a movement to establish Suisun Valley as an agricultural tourism destination. The goal is to capitalize on the high volume of traffic along I-80, local tourism and proximity to the Bay Area.

The valleys are an attractive area for rural residence seekers and hence urban encroachment is an ongoing problem for local farmers.

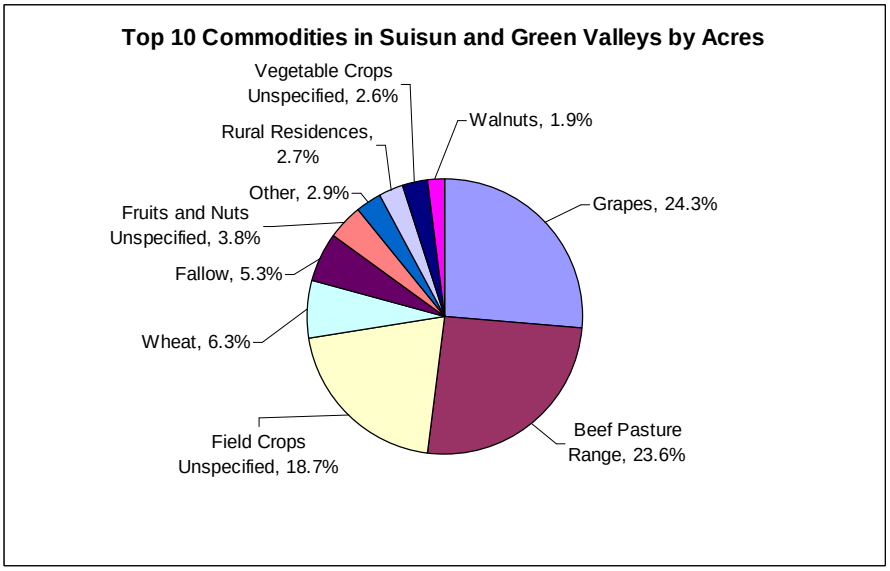
Agricultural Value by Commodity

Wine grape production is the clear leader in terms of agricultural value creation. Vegetable crops are the second largest contributor, followed by the turf grass production located on the southern edge of Suisun Valley. The small number of interior roads kept us from confirming production on 18 percent of Suisun Valley.



Agricultural Production by Area

Grapes rank as the leading land use in Suisun Valley. The pasture land in Suisun Valley is located along the edges, in the southern section of the Valley and is a dominate land use in Green Valley. Our estimation of fallow land is lower than we expected because in many cases we could not separate fallow land from recently harvested farmland.



Soils and Slope

Suisun and Green Valley have Class I Yolo-Sycamore associate soils that rival in fertility the soils found in the Dixon Ridge. These deep soils along gentle or zero slopes, wind protection and cool nights with warm days are excellent conditions for tree fruit and grape production. Low clay content and soft alluvial soils allow good drainage.

Regional Infrastructure

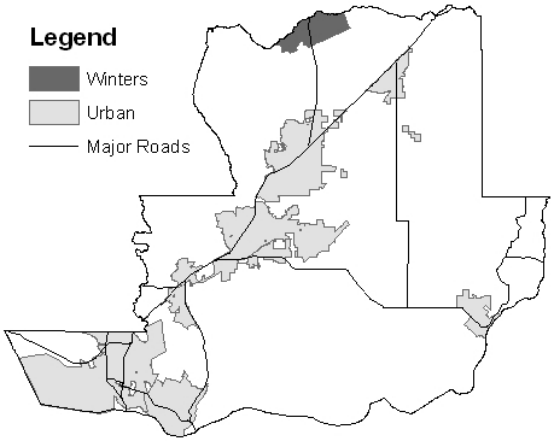
Suisun and Green Valleys are supplied with water through the Solano Irrigation District. The water delivery system to the valley is efficient and reasonably priced.

Impeded by the small scale of parcels in the region, Suisun and Green Valley landowners have struggled to find profitable commodities. Individual parcels here are much smaller then those found in the Dixon Ridge area.

The land parcels in this area are based on historical orchard production in which a family could be supported by 20 acres of high-value fruit crops. When international market forces forced the fruit processing industry to consolidate, producers in these valleys lost their connection to the canned fruit industry and were no longer able to market their fruit.

Some fruit orchards were converted to wine grape production in the 1980s and1990s, but the collapse of wine grape prices in the early 2000's was a blow to local producers.

Winters



Major Crops

Walnuts
Almonds
Dried Plums

Geographical Area

Total Number of Acres: 5,995
Total Value of Production: $ 13,156,983
Value per Acre of Production: $ 2,194.38
Percent of Region in Rural Residences: 1.2%

Boundaries: Boundaries: This region is essentially defined by the Solano County portion of the alluvial soils that run along Putah Creek. The creek forms the northern border of the region while the eastern edge is roughly defined by Stevenson Bridge and County Road 95A. Putah Creek Road and a shift in cropping patterns between tree crops and a field crop rotational system are to the south. The western edge is formed by a hillside that separates the Winters area from the Pleasants Valley Road area.

System overview

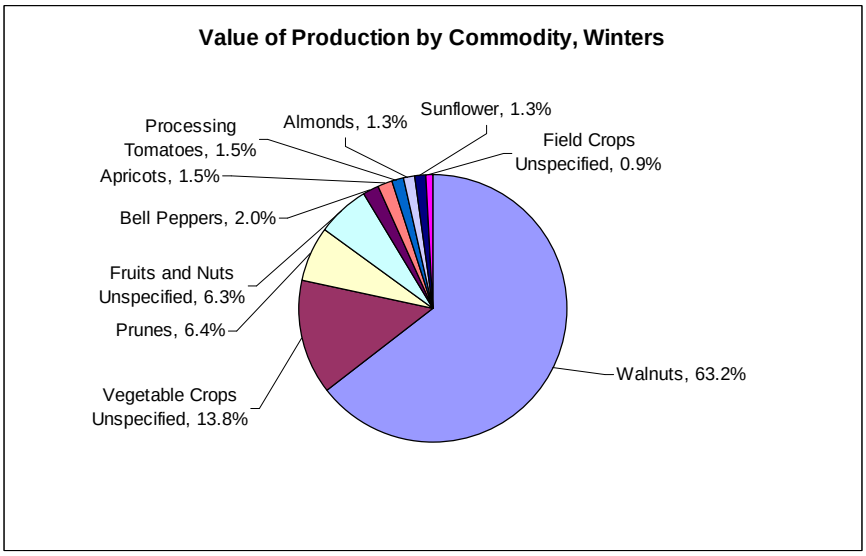
The Solano County fruit and tree crop industries are centered in the Winters region. The deep rich soil of the alluvial fan surrounding Putah Creek allows orchard crops to grow roots deep enough to tap into the underground water leached out of nearby Putah Creek. This area is named after the small Yolo city of Winters, adjacent to the county line.

Economically and socially, the Solano-based orchard owners associate with the Winters community. Many producers in the Winters region believe that the existence of Yolo County based processing is important to their continued success. Winters area producers believe that Solano County should help shield them from urbanization pressures coming out of the Bay Area so they can continue to function as part of the tree-based economic activity that spans the Solano/Yolo boundary.

Historically, this region was the second leading tree crop area in Solano County behind Suisun Valley. As the orchards in Suisun Valley were replaced with grapes, the Winters area overtook the Suisun Valley in terms of acreage and value generated from tree crops.

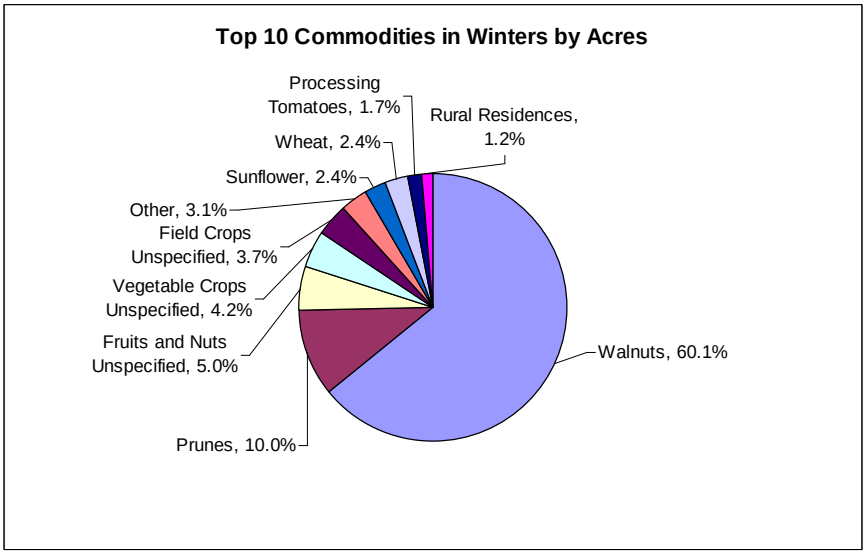
Agricultural Value by Commodity

Walnuts are the dominate crop in the winters area in terms of value creation and land use. The Winters area specializes in the production of high value tree and vegetable crops. The eastern and southern edges of the region are the locations for row crop production. The combination of high value commodities and row crop production combine to have the Winters region have the highest value per acre of production in Solano County.



Agricultural Production by Area

The agricultural land use in the Winters directly impact the agricultural value creation. Tree crops and vegetable crops lead the region. Rural residences account for 1.2 percent of the land use within the region. The low percentage of rural residences does not reflect the rural residential pressure on the boarder with the Western Grazing region.



Soils and Slope

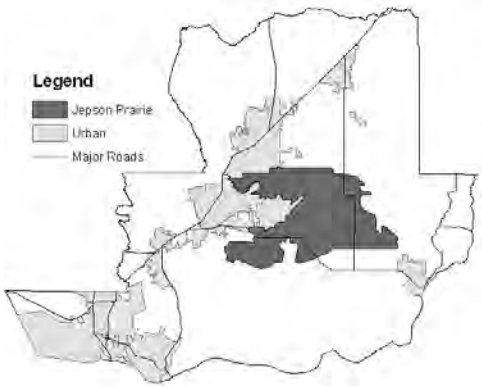
Most of the alluvial plane around Putah Creek is class I soil and is composed of Yolo-Brentwood loam soils. Generally the area gently slopes towards the creek. The soil is ideal for orchard and tree nut production.

Regional Infrastructure

Farms in the Winters area are well supplied with water through riparian water rights and ground water. The deep alluvial soils allow tree crops to tap into the groundwater leaching from Putah Creek.

Urbanization from the Bay Area that reaches up Interstate 505 is a concern for Winters area producers. The smaller parcels originally created for orchard production are highly sought after for rural residences. Residential purchasers in the area generally have little knowledge of orchard production and are interested in maintaining the orchard more for landscaping reasons than profitable commodity production. This has led to isolated disease and pest problems which could threaten neighboring commercial orchards.

Jepson Prairie



Major Crops

Cattle
Sheep
Pasture

Geographical Area

Total Number of Acres: 46,409
Total Value of Production: $11,196,483
Value per Acre of Production: $241
Percent of Region in Rural Residences: 1%

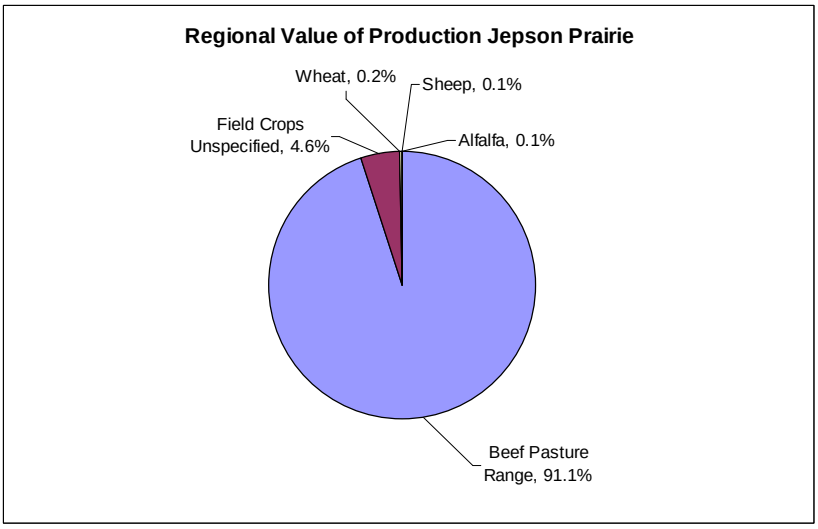
Boundaries: The bounds of Jepson Prairie are predominantly defined by changes in soil type and urbanization. The western edge is formed by Travis Air Force Base. The Suisun Marsh and a change in soil type together form the southern edge of this region. The eastern bound is defined by the Lindsey slough. The northern edge is based on crop patterns which show a shift from a field crop based system in the Elmira and Maine Prairie region to the pasture based system in Jepson Prairie.

System overview

Jepson Prairie is a very rural section of Solano County. The combination of poor soils, vernal pools and sloughs makes it impossible for this area to be used for any agricultural purposes besides livestock production. Stringent zoning and vernal pool protection policies, as well as the presence of landfills, have kept this area almost free of urbanization pressure.

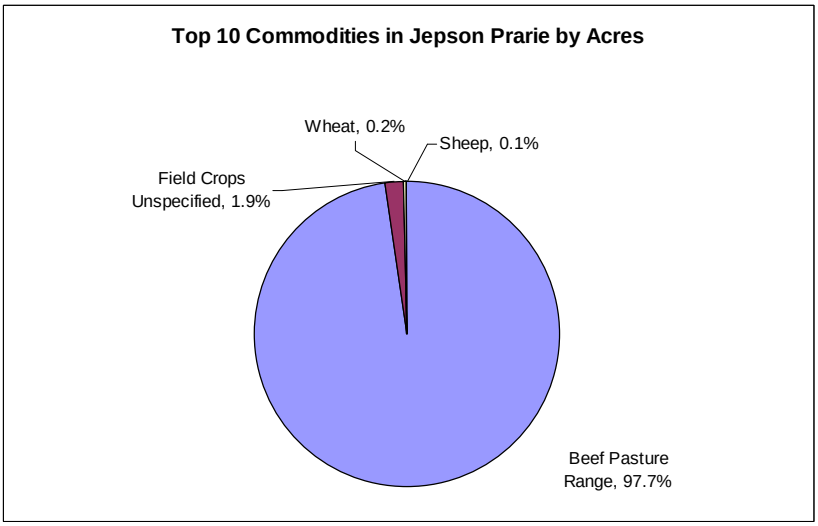
Agricultural Value by Commodity

Jepson Prairie can appear to be void of any economic activity to someone driving down Highway 113. Jepson Prairie is farmed almost exclusively as rangeland for beef and sheep production. The sensitive habitat of Jepson Prairie and low soil quality make livestock production the perfect agricultural activity for this region.



Agricultural Production by Area

The Jepson Prairie region is utilized almost 100 percent for livestock production.



Soils and Slope

The gently rolling hills, vernal pools and sloughs create a topography which can only support pasture based livestock production. Livestock production has little impact on the environment in this region. New research illustrates the important role cattle grazing plays in the long-term viability of the vernal pools, which serve as vital centers of biodiversity.

Regional Infrastructure

Low-intensity livestock production and a low level of urbanization are adequately supported by the small amount of infrastructure in this region.

Pleasants, Vaca and Lagoon Valleys Region

Major Crops

Small-Scale Commodity and Niche Agriculture

Geographical Area

Total Number of Acres: 6,304
Total Value of Production: $ 3,892,493
Value per Acre of Production: $ 645
Percent of Region in Rural Residences: 11.3%

Boundaries: A thin line of alluvial soils which runs through the Pleasants, Vaca and Lagoon Valleys region. The steep hills of the Vaca Mountains form the east and west boundaries. Putah Creek serves as the northern boundary.

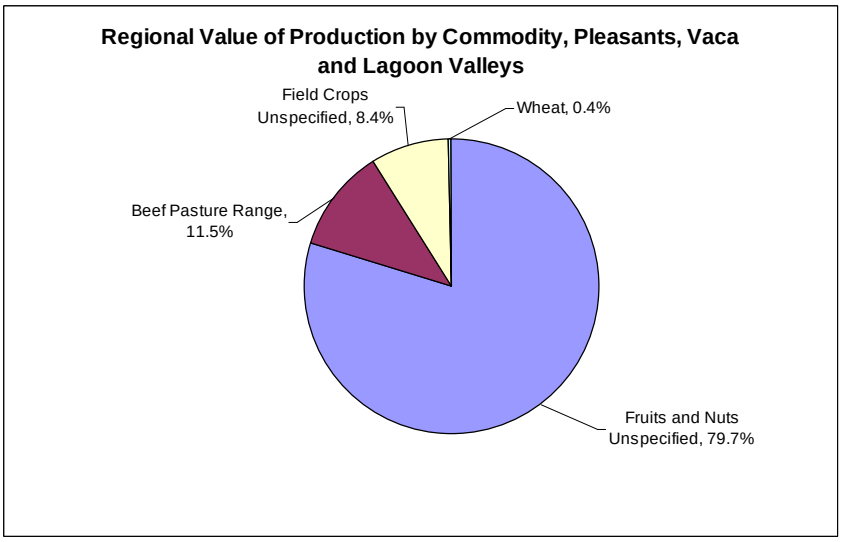
System overview

Starting along Putah Creek, there is a thin strip of alluvial soil that runs north to south through Solano County, terminating at I–80 and Vacaville. This thin valley is home to several agricultural operations that are individually smaller than those found in eastern Solano County and that comprise a much smaller total area than Suisun and Green Valleys to the west.

This region is difficult to define because of the variety of crops produced. Historically, this area was home to orchard and some grape production. As older farming families have sold their land in recent years to people without agricultural backgrounds, small scale horse and livestock operations have increased. Yet the region still supports a handful of high-value niche agricultural operations owned either by established operators who converted their commodity based farms into higher value operations, or by new residents with agricultural interests.

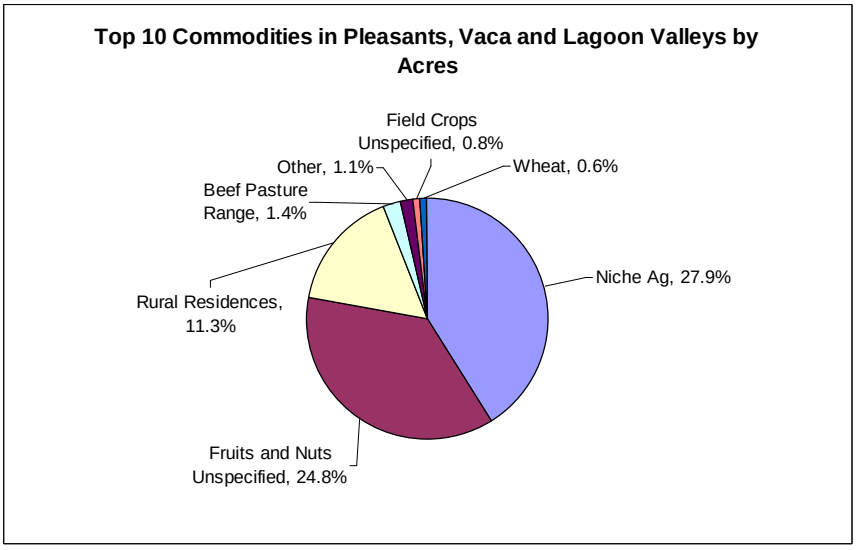
Agricultural Value by Commodity

The large number of small parcels and the diversity of commodities grown on these parcels made it very difficult to classify production in these interior valley regions. We had to rely on producer conversations to make most land use confirmations. Our interviews yielded production as varied as horses, organic eggs, tree crops to high value olive oil.



Agricultural Production by Area

The Pleasants, Vaca, and Lagoon valley region is home to numerous small scale producers and hobby farmers.



Soils and Slope

This region has high quality, alluvial soil along the valley floor that quickly gives way to lower quality soil on steep slopes. The valley floor is gently sloping and supports small scale crop production, while the hillsides are only suitable for pasture-based livestock production

Regional Infrastructure

This area is under constant pressure from urban growth moving to the north from Vacaville. Because of small parcel sizes the area cannot support large scale crop production**.**

Western Hills

Major Crops

Beef Cattle
Pasture

Geographical Area

Total Number of Acres: 79,741
Total Value of Production: $ 16,955,080
Value per Acre of Production: $ 212.63
Percent of Region in Rural Residences: 17.1%

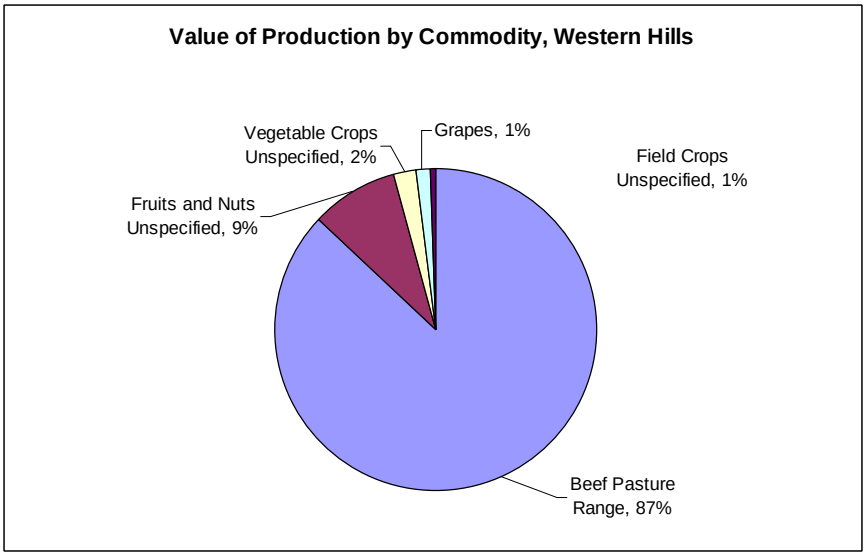
Boundaries: This region is framed on all sides by a combination of high-quality valley floor alluvial soils, county boundaries and urban areas.

System overview

The Western Hills are one of the beef production centers within Solano County.

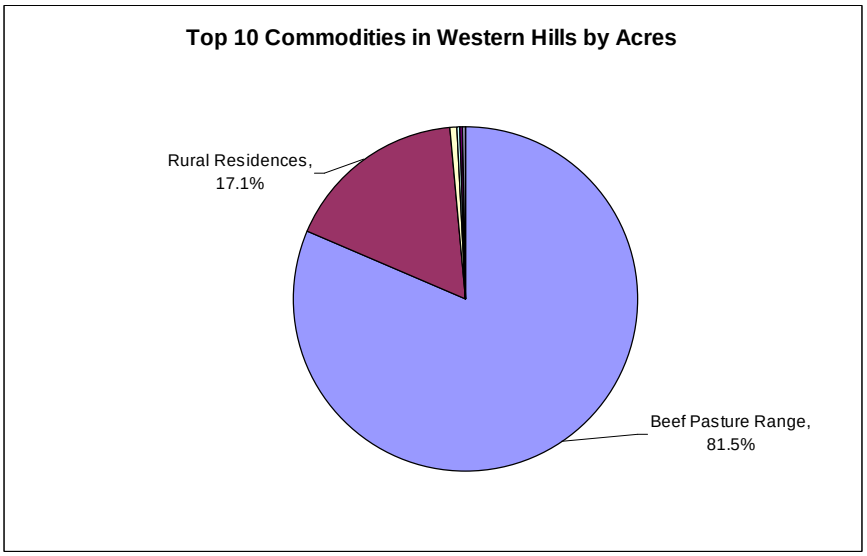
Agricultural Value by Commodity

Beef produced off of the grazing land is the dominate leader in agricultural value creation in the Western Hills. There are small pockets of tree crop and vegetable production found throughout the region.



Agricultural Production by Area

Range land is the dominate agricultural land use in the Western Hills. The Western Hills is also the location of the large rural residential area located north of Vacaville along Interstate 505.



Soils and Slope

Type IV soils and the steep slope of the hillsides in the Western Hills combine to limit the production in this region to pasture-based livestock.

Regional Infrastructure

Beef cattle production does not require high levels of infrastructure. The area is under threat from urbanization as the cities of Vallejo and Fairfield push their boundaries in all directions.

Solano County

Major Crops

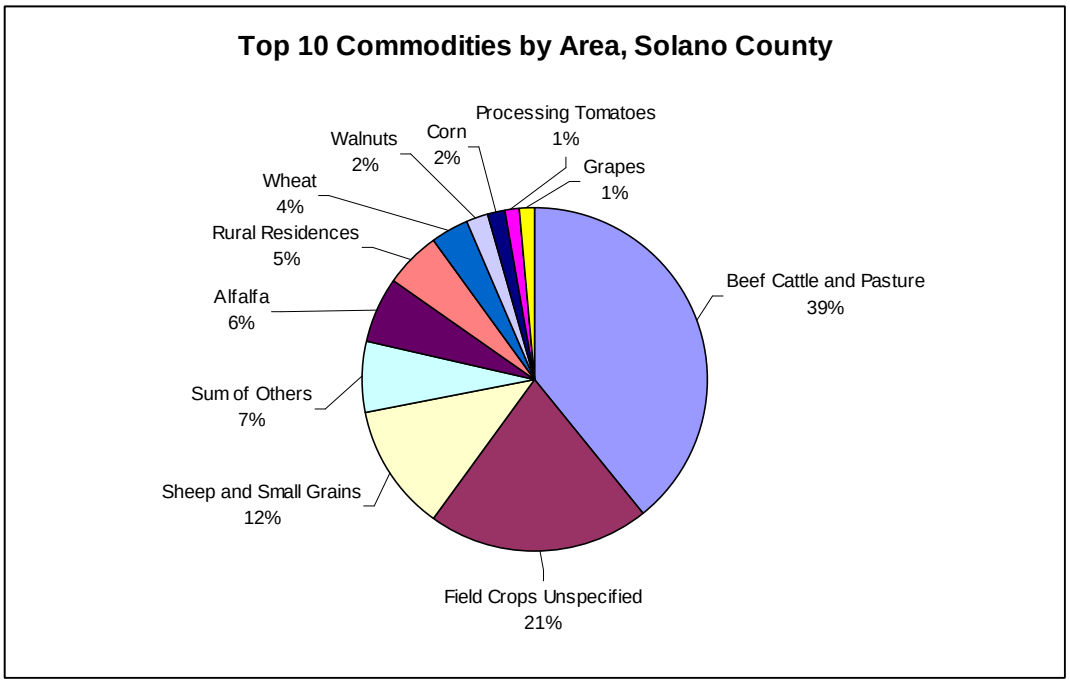
Nursery products
Cattle, calves
Hay, alfalfa
Tomatoes
Vegetables
Walnuts
Milk, market fluid
Grapes, wine
Almonds
Plumbs, dried

Geographical Area

Total Number of Acres: 359,892
Total Value of Production: $243,162,931
Average Value per Acre of Production: $675.65
Median Ag Parcel Size: 38.44 acres
Median Rural Resident Parcel: 4.8 acres

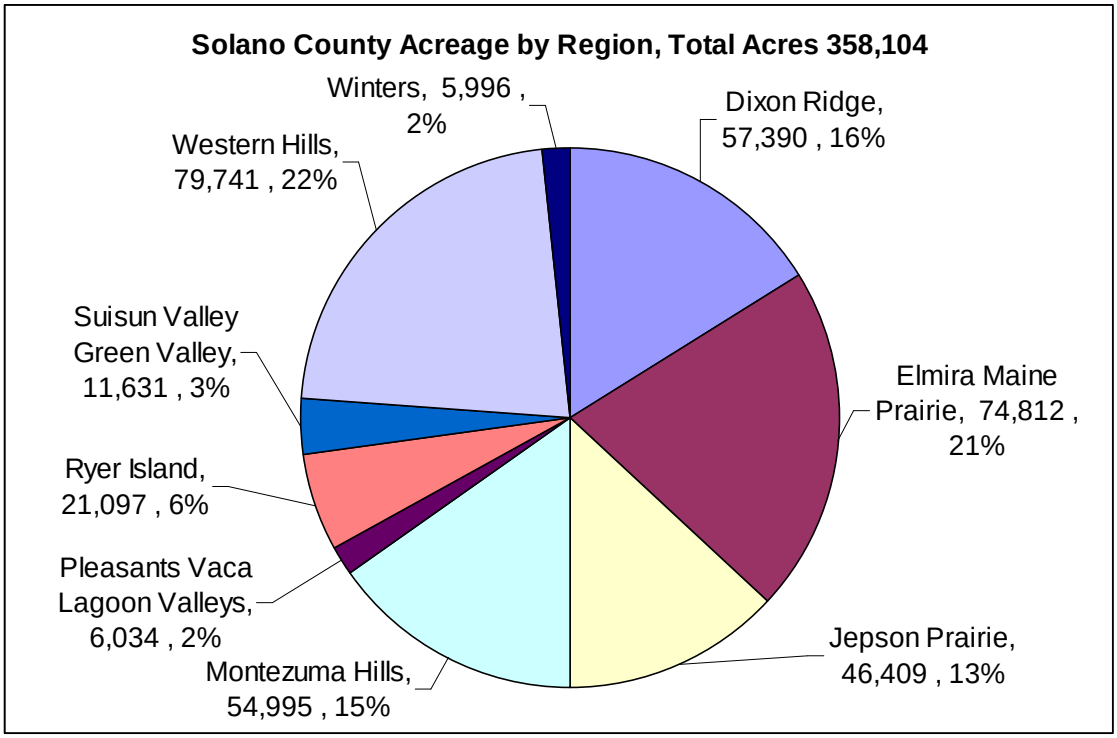
Agricultural commodities by acreage

The leading commodities in terms of number of acres used in production are Beef Cattle and Sheep which graze the pasture and rangeland found throughout the County. We estimate 50 percent of the agricultural land in Solano County is used as grazing and rangeland. Nursery crops lead Solano County production in terms of value, but are produced on less than 1 percent of the acreage. Other important commodities in terms of value are processing tomatoes and alfalfa and milk production.



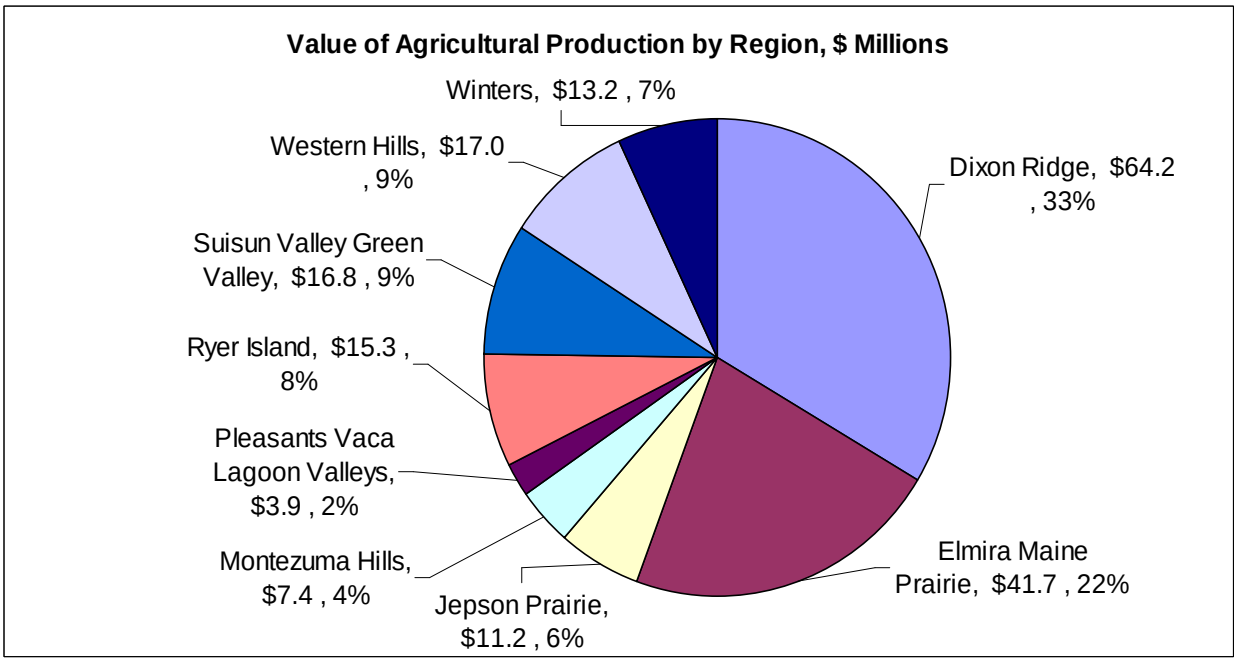
Agricultural regions by acreage

As defined by our agricultural regional boundaries, the Western Hills Account for 22 percent of the agricultural land in Solano County. While the Western Hill is the largest area, the Dixon Ridge, Winters and Suisun Valley are the leaders in terms of agricultural value creation.



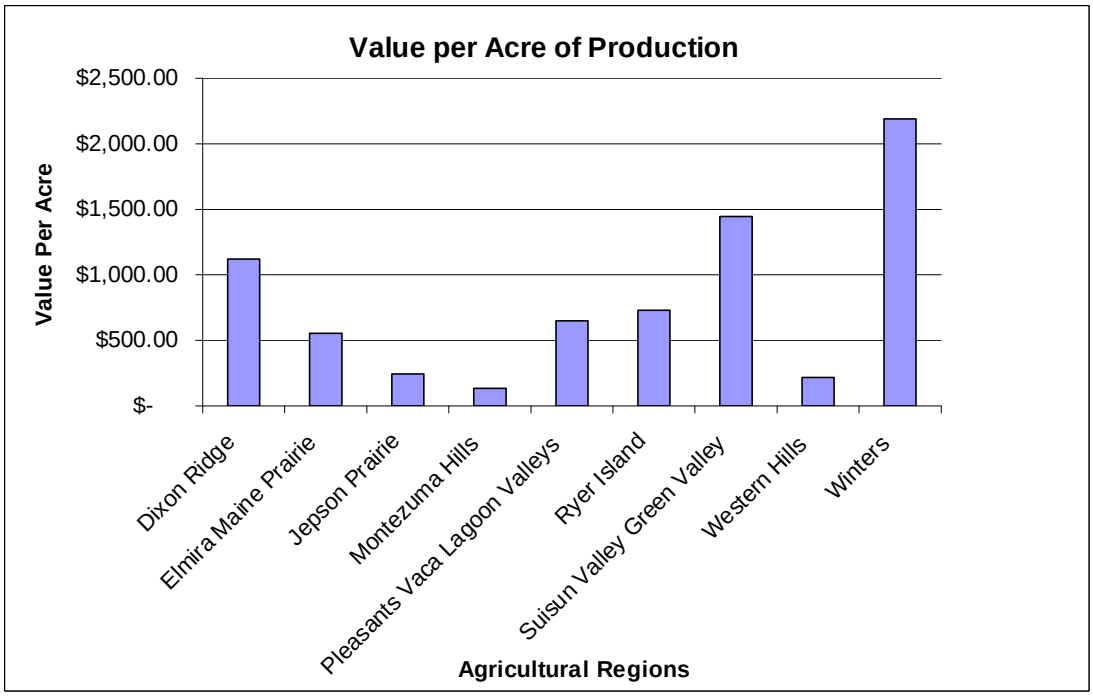
Agricultural regions by value

This graph highlights the importance of the Dixon Ridge, Winters and Suisun Valley. The Dixon Ridge and Winters combine to generate 40 percent of the agricultural value in Solano County. When the Suisun Valley is added to the Dixon Ridge and Winters area, 50 percent of the agricultural value generated in Solano County is accounted for. The Elmira and Maine prairie region is also important as it generates almost 22 percent of agricultural value while accounting for only 21 percent of the agricultural area.



Agricultural regions by average value per acre

An insightful measure of the important an area is to overall value creation within Solano County is a measure of value per acre of production. The Winters area is the clear leader in value per acre with an average of over $2,000 per acre. The Suisun Valley and Dixon are second and third with average value per acre of production of over $1,000. Areas with lower value per acre of production are typically used for livestock or field crop production that requires large acreages.



Appendix III

Solano County Multipliers

Agriculture creates significant ripple effects (i.e. multipliers) throughout the economy of Solano County. Each dollar earned within agriculture fuels a more vigorous economy by stimulating additional activity in the form of jobs, labor income and value added.

We utilized IMPLAN[1] Pro® version 2.0 software and accompanying 2002 dataset to determine multiplier effects. IMPLAN utilizes a model developed by the USDA Forest Service and designed to model the interrelationships between the economic sectors in the state and regional economies. The model employs input-output tables to show transactions among sectors. For any given industry, the model enables quantification of outputs (value of production), jobs, labor income and value added both before and after taking into account the ripple effects on the entire economy. These ripple effects are expressed as a dollar value and as an industry multiplier. Industry multipliers are typically a ratio close to 2. For the statewide agricultural production and processing industry there is a value added multiplier of 2.27. Thus for every dollar of value added in that sector, there is an additional $1.27 added to the state economy. Ripple effects may also be measured in terms of jobs added to the economy.

Ripple, or multiplier effects are composed of three types of effects—direct, indirect and induced. Direct effects measure the direct outputs of a particular industry and thus are determined directly by that industry's inputs. Indirect effects are the secondary inter-industry effects that one industry has on another. For example, increases in fertilizer purchase by the vegetables, fruits and nuts subgroup indirectly results in the production of additional fertilizer as well as usage of additional natural gas to produce the fertilizer and increased production and transport of the gas. These direct and indirect effects result in changes in population and income, which in turn affect household consumption. Induced effects are the changes in household consumption of goods and services measured in employment, income and value added.

The industry multipliers are essentially the ratio of total effects to direct effects for each industry. For example, in Table 1, the direct effect from Solano County agricultural production and processing is 6,432 jobs, the total effect (direct, indirect and induced) is 10,934 jobs and, in Table 2, the Solano County employment multiplier 1.70 (an additional 0.70 jobs created for every job in agricultural production and processing). Here we can see that the multiplier of 1.70 can be derived by dividing the total effect (10,934) by the direct effect (6,432).

There is an important caveat when interpreting the multiplier effects of particular industries. The total effects (direct, indirect and induced) and industry multipliers for aggregated subgroups are not equivalent to the sums of the individual subgroups. Agricultural activities are related in many ways, so when regional economic impacts of one industry are measured, effects associated with the production of other industries are also incorporated. Thus one industry's output becomes another industry's input. To avoid double counting, each industry must be separately analyzed to determine a unique "net effect" on the regional

[1] IMPLAN (IMpact Analysis for PLANning) developed by the U.S. Department of Agriculture Forest Service, together with the Federal Emergency Management Agency and U.S. Department of Interior Bureau of Land Management. IMPLAN's secondary database is derived from published sources including the U.S. Department of Commerce, Bureau of Economic Analysis, U.S. Department of Labor Bureau of Labor Statistics and U.S. Department of Agriculture.

economy. This is why the total economic effect of farming is not the sum of the effects of each of the subgroups—field crops, vegetables, fruits, dairy, etc.

Multiplier effects differ by commodity because the production of some commodities may be related to more input and processing industries located within the county or region than others. Multipliers may also differ by region due to geographic dispersion of industries related to agriculture, differences in aggregate size of agriculture and type of commodities produced in that region. In addition, county multiplier effects do not reflect interactions with industries located out of county. Some industries may have a greater impact at the county level, while other industries may have broader geographic impacts, which are not included in the IMPLAN analysis for Solano County.

Table1. **Solano County Direct and Indirect Effects**

		Direct Effects			Total Effects		
	Industry Output	Employment	Labor Income	Value Added	Employment	Labor Income	Value Added
	($millions)	(jobs)	($millions)		(jobs)	($millions)	
Agricultural Processing and Production	1,221	6,432	230	516	10,934	391	815
Agricultural Processing	951	2,619	145	366	6,861	281	614
Agricultural Production	270	3,813	83	149	5,338	127	235
Forestry, Fishing, Hunting	28	284	4	13	514	9	22
Ag-support Activities	32	1,086	27	22	1,368	35	37
Farming	210	2,443	51	114	3,615	85	176
Grains, Oilseeds, Cotton	12	314	2	5	401	4	9
Veg, Fruit and Nuts	99	1,080	26	60	1,749	45	91
Greenhouse and Nursery	42	379	16	36	557	21	46
Other Crops	13	118	2	7	206	4	11
Beef, Dairy Cattle	33	377	1	3	595	5	14
Other Animals	8	175	2	2	213	4	4
Total Solano Economy	17,436.00	166,961	6,661	9,911			

Solano farmers constitute an essential part of the county economy. As this report documents, farm production is itself large and dynamic. Furthermore, farm production is closely linked to many other industries: the production of farm inputs, the processing of food and beverages, the textile industry, transportation and financial services. Including multiplier effects, Solano farm and closely related processing industries account for 7 percent of the total Solano economy, employ 3.9 percent of the county's private sector labor force and account for 3.5 percent of the county labor income. Every dollar of value added—labor and property income and indirect business taxes—in agricultural processing and production generates an additional $0.58 in the county economy. For every 100 jobs in agriculture, including the food industry, there are 70 additional jobs created throughout the county.

Table 2. **Solano County Industry Multipliers**

	Employment	Labor Income	Value Added
Agricultural Processing and Production	1.70	1.70	1.58
Agricultural Processing	2.62	1.94	1.68
Agricultural Production	1.40	1.54	1.58
Forestry, Fishing, Hunting	1.81	2.25	1.75
Ag-support Activities	2.62	1.33	1.71
Farming	1.47	1.67	1.55
Grains, Oilseeds, Cotton	1.28	2.21	1.80
Veg, Fruit and Nuts	1.62	1.74	1.53
Greenhouse and Nursery	1.47	1.33	1.28
Other Crops	1.75	2.06	1.63
Beef, Dairy Cattle	1.21	5.05	4.70
Other Animals	1.22	2.15	2.12

Employment Multipliers

Employment multipliers represent the increase in number of jobs created throughout the economy as the result of one job in the agricultural sector as listed in column one of Table 2. For instance, for every job in the Agricultural Processing and Production industry, an additional 0.70 jobs are created within Solano County. An industry with a multiplier greater then 2.0 will create more than one job in the overall county economy for every one job created within the industry.

Labor Income Multipliers

This variable is a measure of net wages, salary, dividends and profits returned within the county. Unlike the employment multiplier which can be thought of in terms of jobs, the labor income and value added multipliers are estimations of financial increases in economic output. For every $1 dollar increase in labor income from an industry listed in the left column, the county economy will see an additional increase in labor income equal to the income multiplier minus one. For example, for every $1 million increase in labor income in Agricultural Production, Solano County receives additional increase of $540,000 in labor related income.

Value Added Multipliers

Value added multipliers provide a measure of the increase in overall economic activity when a specific industry has an increase in sales. IMPLAN uses data from employee compensation, taxes on production of inputs, and gross property tax information to create the estimate of value added. Similar to labor income multipliers, value added multipliers are estimations of financial increases resulting for economic output. For example, every $1 million increase in value added from Agricultural Production in Solano County creates $580,000 in other economic activity within the Solano County economy.

Table 3. **Solano County Direct and Total Effects as Share of County Economy**

		Direct Effects			Total Effects		
	Industry Output	Employ - ment	Labor Income	Value Added	Employ- ment	Labor Income	Value Added
				percent			
Agricultural Processing and Production	7	3.85	3.45	5.21	6.55	5.87	8.23
Agricultural Processing	5.45	1.57	2.18	3.69	4.11	4.22	6.2
Agricultural Production	1.55	2.28	1.25	1.5	3.2	1.92	2.38
Forestry, Fishing, Hunting	0.16	0.17	0.06	0.13	0.31	0.14	0.23
Ag-support Activities	0.18	0.65	0.41	0.22	0.82	0.54	0.38
Farming	1.2	1.46	0.77	1.15	2.17	1.28	1.78
Grains, Oilseeds, Cotton	0.07	0.19	0.03	0.05	0.24	0.07	0.09
Veg, Fruit and Nuts	0.57	0.65	0.39	0.61	1.05	0.68	0.93
Greenhouse and Nursery	0.24	0.23	0.24	0.36	0.33	0.32	0.46
Other Crops	0.07	0.07	0.03	0.07	0.12	0.06	0.12
Beef, Dairy Cattle	0.19	0.23	0.02	0.03	0.36	0.08	0.14
Other Animals	0.05	0.1	0.03	0.02	0.13	0.06	0.04