ECONOMIC IMPACT OF PIERCE'S DISEASE ON THE CALIFORNIA GRAPE INDUSTRY

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This report provides estimates of the economic impact of Pierce's disease on the California grape industry. It is the result of a study funded by the California Department of Food and Agriculture (CDFA). The report reviews both the current situation and provides estimates of future economic impacts if a new vector, the glassy-winged sharpshooter (GWSS), becomes established.

BACKGROUND

Pierce's disease (PD) is not new to California. It was first observed and recorded in the 1880s when it was responsible for destroying more than 40,000 acres of grapevines in the Los Angeles basin.[1] Localized infections of the disease have occurred in the Napa Valley since the 1880s. There have also been periodic epidemics over the last century where the disease has reached a higher incidence and become more widespread in the grape growing regions of the state. In the early 1990s, growers in Napa and Sonoma counties again began reporting symptoms of PD. The spread of PD into North Coast vineyards, while widespread, is mostly confined to riparian areas and near irrigated landscapes. The blue-green sharpshooter (BGSS) is the principal insect vector spreading the disease from the riparian habitats. Under BGSS, vine-to-vine spread is minimal, even though the disease is present in the vineyard. This is due to the nature of BGSS, which does not travel far and has a limited ability to transmit the disease due to the small size of its mouth. In addition, much of PD infection is eliminated through the pruning process. Small vineyards planted next to BGSS habitat traditionally have had the highest risk due to infestations from the habitat. The disease basically has an edge effect of about 300 feet; hence, if the vineyard is 600x600 feet, then it is all edge.[2] Since 1994, more than 1,000 acres of Napa and Sonoma county grapevines have been pulled and replanted (total 1999 bearing acreage equaled 66,700 acres) due to Pierce's disease with an estimated cost to growers of over $30 million in lost income, production, and replanting expense.

Up until the late 1990s, PD was known as a disease mostly prevalent in the North Coast grape growing areas. However, according to Bill Peacock, University of California of California Farm Advisor, Tulare County has battled PD since the 1930s. He claims the outbreak has been as severe as that in Napa, but the problem doesn't receive as much attention since it doesn't have the high profile that Napa does. The problem would be exacerbated with the introduction of a more efficient vector than the traditional blue-green, green, and red-headed sharpshooters which are not aggressive in their travel and eating habits. Enter the glassy-winged sharpshooter (GWSS), which recently became established in California and is a serious threat to vineyards since it moves faster and farther into vineyards than other species.

Since the early 1990s, GWSS has been seen in high numbers in citrus along the Southern California coast. During the past few years, it has become more abundant farther inland in Riverside and San Diego counties. In 1998 and 1999, high populations on citrus and adjacent vineyards were seen in southern Kern County. GWSS is expected to spread north into the citrus belt of the Central Valley and become a permanent resident of various habitats throughout northern California.[3]

Temecula Experience

In the summer of 1999, wine grape growers in Temecula, Riverside County, experienced the sudden die-back of grapevines confirmed to be caused by PD. It has been reported that more than 200 acres (out of a total of over 2,100) were lost to PD.

The economic impact of the loss in production from 1998 to 1999 can be seen in Table 1. As can be seen from this table, 11,113 tons of wine grapes (not counting raisin or table grape varieties) from District 16 (Riverside and San Diego counties) were crushed in 1998. This amount had decreased to 7,255 in 1999, or 35 percent. The value of this tonnage had decreased from over $9.8 million in 1998 to $6.3 million in 1999, a loss of $3.5 million in gross agricultural income, or a decrease of 36 percent! This lost production also has an impact on other economic variables such as employment and regional and state income. The lost production, if realized, would have been made into wine, which would have been sold into retail channels. It is estimated that, on average, the wine valued at the producer level has a multiplier of 4.3 to convert it to a value at the winery level.[4] This calculation results in a value of this lost production of $15.2 million at the winery

level. The impact of this lost production on California state income, using a multiplier of 2.5[5], is estimated to be $37.9 million (Total California income in 1997, the latest data available, was $846 billion).

Table 1. Wine Grape Statistics for District 16, 1998-99.

	1998	1999	2000
Bearing Acres White Wine	1,578	1,598	1,280
Bearing Acres Red Wine	572	547	534
Total Bearing Acres	2,150	2,145	1,814
Tons Crushed White Wine	7,109	4,173	5,230
Tons Crushed Red Wine	4,004	2,543	3,820
Total Tons Crushed	11,113	7,255	9,050
Grower Return White Wine ($/ton)	961	860	1,005
Grower Return Red Wine ($/ton)	746	882	846
Gross Grower Return White ($)	6,833,740	4,051,846	5,256,150
Gross Grower Return Red ($)	2,988,225	2,242,826	3,231,720
Total Gross Grower Return ($)	9,821,965	6,294,672	8,487,870
Total CA Wine Tons Crushed	2,527,056	2,616,831	3,318,507

Source: Grape Crush Report, California Department of Food and Agriculture, Sacramento.

Comparisons of 2000 crush data for District 16 to 1998 data temper the impact from 1998 to 1999. Wine grape gross income for District 16 still decreases, but by $1.334 million, or 13.6 percent, still a significant amount. Much of this improvement can be attributed to increases in tonnage in 2000 over 1999 and increased wine grape prices. A comparison of bearing acreage from 1998 to 2000 reflects more of the actual situation. Bearing acreage has declined by 336 acres, or 15.6 percent. Growers are reluctant to plant additional acres or replace vines until some strategy for dealing with PD is found.

While Temecula is a relatively small grape growing area compared to the rest of California (District 16 wine grape production accounted for 0.3 percent of the total crush in 2000), the lessons to be learned from this situation are valuable in estimating the economic losses from the introduction of GWSS. Growers in Temecula have no plans to replant grapevines until a remedy is found for PD. A major problem in Temecula is the presence of large numbers of citrus in close proximity to vineyards. Before GWSS, this situation was not a serious threat. However, citrus serves as a host for GWSS, which moves from it to grapevines. In Southern California, the large numbers of GWSS coupled with their aggressive habits laid the groundwork for the current disaster.

Of concern is the large numbers of citrus in the Southern San Joaquin Valley that are in close proximity to vineyards. However, there are a large number of additional hosts that pose danger to grapevines if GWSS is established on them as well.[6] Data on the establishment of GWSS is speculative at this time (data on the incidence of PD throughout California is also not well documented and anecdotal in many cases). Estimation of potential impacts will have to rely on scenarios synthesized from observable occurrences where data exists (Temecula) or surveys such as the Napa Valley Pierce's Disease Task Force Report.

Overview of the California Grape Industry

Statistics on the California grape industry are contained in Table 2. This table provides acres harvested and gross farm value for raisin, table, and wine grapes for 2000. Table 2. Harvested Acres and Gross Farm Value, California Grapes, 2000.

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	Acres	Gross Farm Value
Raisin Grapes	280,000	$489,384,000
Table Grapes	89,000	$438,280,000
Wine Grapes	458,000	$1,908,649,000
Total California Grapes	827,000	$2,836,313,000
Total California Agriculture	8,306,200	$26,243,717,000

Source: California Agricultural Statistics Service.

As can be seen from Table 2, the California grape industry accounts for $2.8 billion in gross farm value (nearly 11 percent of the California state total and growing rapidly with wine grapes the leader). Wine grapes is the largest sector at $1.9 billion (68 percent) followed by raisin grapes (17 percent) and table grapes (15 percent). While not shown here, wine grapes have been the fastest growing sector over the past 10 years with a growth rate at the producer income level of over 15 percent per year. In addition, exports of California wines have grown at an impressive rate of over 10 percent per year since 1995 and now rank second in state exports at $498.5 million (1999 value).[7] In terms of acreage, the California grape industry accounts for 827,000 harvested acres, or ten percent of the state total. Grape acreage has increased over 10 percent from 1998 to 2000.

Statistics of grape acreage, gross farm value, and citrus/avocado acreage by county can be found in Table 3. Citrus and Avocado acreage is displayed with grape acreage to show which areas are at greatest risk from the presence of large citrus and avocado acreage. Also, counties are roughly grouped into geographical areas. First, grapes are grown in a large geographical area. However the top five counties in terms of acreage (Fresno, Madera, San Joaquin, Tulare, and Kern) account for nearly 71 percent of the total grape acreage in California and 63 percent of the grape gross farm value. Three of these counties (Fresno, Kern, and Tulare) have large concentrations of citrus and avocados.

Table 3. California County Grape Acreage, Grape Gross Farm Value, and Citrus/Avocado Acreage, 1999.

County	Acres, Grapes	Grape Farm Value	Acres, Citrus/Avocados
Alameda	2,018	8,523,000	
Contra Costa	1,580	6,978,000	
Glenn	835	2,273,000	714
Napa	30,506	221,852,000	
Sacramento	22,630	90,409,000	
San Joaquin	83,000	291,197,000	
San Mateo	40	130,000	
Solano	3,390	14,130,000	
Sonoma	42,227	269,271,000	
Yolo	8,704	35,431,000	
Fresno	228,430	605,214,000	28,737
Kern	88,283	491,269,000	43,531
Kings	5,178	20,523,000	
Madera	92,230	228,567,000	600
Merced	16,200	46,090,000	
Stanislaus	13,900	35,420,000	
Tulare	81,334	442,652,000	115,697
Monterey	34,187	157,926,000	1,020
San Benito	2,494	13,455,000	
Santa Clara	1,600	12,531,000	
Santa Cruz	200	1,513,000	
San Luis Obispo	16,272	83,601,000	2,536
Santa Barbara	14,064	60,117,792	10,186
Los Angeles	79	348,000	
Riverside	16,349	146,739,000	38,225
San Bernardino	1,210	2,726,000	6,139
San Diego	189	161,154	42,293

Source: California At A Glance, Published by California Farmer, August 1999. Data taken from County Agricultural Commissioners' Reports.

Economic Impacts

The economic impacts from PD take on different dimensions and will vary by location, age of vine, and variety. Impacts are derived from replanting entire vineyards, vineyard management which includes monitoring, replacement of diseased vines, and training new growth, vector management which includes monitoring vectors and application of vector controls (in many cases pesticides), and sharpshooter host and riparian management (where appropriate). All of these tasks involve costs; all substantial that will increase the cost structure of producing grapes in California. Appendix Table 1 contains an overview of

wine grape production cost estimates by University of California of California Farm Advisors. Table 4 below contains University of California Farm Advisor estimates of establishing a vineyard (minus land costs), amortized cost contribution to annual costs, and replanting costs.

Table 4. Vineyard Establishment and Replanting Cost Estimates

Area, Variety	Establish Cost/Acre	Cost per Vine	Amortized Cost/Acre	Vines per Acre	Replant Cost/%
San Joaquin Valley Wine	$4,105	$7.27	$621	565	$18/2%
Lodi Cabernet	$5,949	$9.56	$381	622	$31/2%
Sierra Nevada Zinfandel	$10,173	$17.22	$1,013	622	$105/5%
Sonoma Chardonnay	$13,369	$14.72	$1,227	908	$103/4%
Lake Sauvignon Blanc	$8,640	$15.27	$834	566	$47/2%
Santa Maria Chardonnay	$11,985	$11.01	$736	1,089	$256/5%
San Luis Obispo Cabernet Sauvignon	$9,526	$10.94	$585	871	$64/2%
San Joaquin Valley Thompson Seedless	$3,839	$7.40	$378	519	$22/5%

Source: University of California Farm Advisor Sample Costs to Establish A Vineyard and Produce Wine Grapes.

As can be seen from Table 4, costs vary widely by location and variety. However, they give a good guide on the costs of replacing a vineyard and replanting vines within a vineyard. The last column deserves explanation. It presents the cost of replanting a percentage of the vines in a vineyard; hence, for the San Joaquin Valley Wine estimates, the cost is $18 to replant 2 percent of the vineyard (which in the case presented is 2 percent of 565 vines per acre).

The replacement of a vineyard due to PD involves more than just the replacement cost. It also involves lost yield and revenue in addition to the cost. A hypothetical example using the costs for Sonoma Chardonnay is contained in Table 5 below. It is assumed that the vineyard will suffer a 50 percent loss in yield the year prior to removing the vines. It also assumes a 7-ton per acre yield at the vineyard's maturity and a price of $1,060/Ton.

Table 5. Hypothetical Cost and Revenue Scenario of Vineyard Replacement.

	Year 0	Year 1	Year 2	Year 3	Year 4
Yield (tons/acre)	3.5	0	0	3	7
Revenue	$3,710	0	0	$3,180	$7,420
Revenue w/o PD	$7,420	$7,420	$7,420	$7,420	$7,420
Revenue Difference	-$3,710	-$7,420	-$7,420	-$4,420	$0
Replant Cost		-$1,227	-$1,227	-$1,227	-$1,227

In this example, the establishment of a new vineyard would cost $13,369 but be amortized over 22 years; the yearly cost would be $1,227. Not reflected in this example is a case where the vineyard being replaced was not completely amortized resulting in additional cost than reflected here. In this case, the total cost plus lost revenue over a five-year period is $27,878 per acre, a substantial and significant cost. In addition, replanting a vineyard is no assurance that the vineyard will not be re-infected, especially since the scientific literature states that younger vines are more susceptible (giving credence to the argument that Napa is especially vulnerable since it has replanted a significant amount of acreage due to Phylloxera.

Other costs involve the replacement of vines infected by PD and training new growth. Table 4 provides some estimates of this cost, which varies widely by location, variety, and percentage of vines to be replaced. An accurate assessment of this cost on California vineyards is dependent on assumptions relating to the percentage of vines infected each year and needing to be replaced. At this time, more information is needed.

Another cost is controlling the vector. This cost will involve the placement of traps or sweeping the edges of a vineyard with a net to determine infestations of sharpshooters. Control of vectors is detailed in the University of California Pest Management Guidelines. A combination of trapping and monitoring is recommended. Information needs to be developed on the density and number of traps to be used, and labor cost of monitoring.

Three materials are recommended for an IPM program to control sharpshooters based on their usefulness taking into account their efficacy and impact on natural enemies. The first is IMIDACLOPRID, which is a foliar product that gives a fast kill of sharpshooters but lasts only about two weeks. It is applied at the rate of 0.75 ounces per acre, but is limited to 2 ounces per acre per year. The commercial cost of this product is $32 per ounce; hence the cost per application is about $44 per acre assuming a $20 cost to apply it.

Another material is a drip system variation of IMIDACLOPRID and is applied through the irrigation drip system at a rate of 16 ounces per acre. Cost is $4.80 per ounce resulting in a cost of $76,80 per acre per application. Another material is DIMETHOATE, which is suggested for BGSS in coastal areas. Use of this material is under a special needs registration and cost data has not been obtained on it.

Scenarios for Estimating PD Economic Impacts

Since the introduction of GWSS as a new vector for the transmission of PD, a whole new set of dynamics have been introduced into the estimation of the economic impacts of PD. Previously, the impact has been estimated through surveys (in the case of the North Coast wine grape industry). These surveys are based on actual experience with the disease. In the case of GWSS, a number of assumptions will have to be made. The following scenarios suggest themselves:

1. All of California will be infected uniformly and to the same degree. This scenario assumes the PD does not vary by location and variety. There is evidence to suggest otherwise and this scenario is, in all probability, not realistic.
2. Separate the geographical areas and make assumptions based on the likelihood of PD being spread by vectors. Assumptions can be drawn from survey information and data presented in the Temecula case. In this scenario, the southern San Joaquin Valley would be treated as the spread of the disease in Temecula due to its exposure to substantial amounts of citrus and the rest of the state treated according to other hosts such as riparian areas.

Other scenarios may suggest themselves. However, economic analysis probably will be more accurate under the second scenario. Under this scenario, a greater impact will likely take place in the Southern San Joaquin Valley due to the proximity of other hosts such as citrus and approach the levels seen in Temecula. Under any scenario, control costs will be escalated for all areas. Producers will need to develop strategies for detection, control, and management of the disease, all of which will add significantly to costs of production. Currently, returns to grape producers, especially in the Southern San Joaquin Valley, are under great pressure due to overproduction. It is likely that many producers will not be able to survive an intensive outbreak of PD, which will significantly add to production costs and capital costs of replanting vineyards. While some of these producers may have been forced out of production in any event, an outbreak of PD will hasten their decline and exit from the industry.

Appendix Table 1. Summary of Farm Advisor Cost Studies for Wine Grapes.

Cost Item	SJV Wine	Lodi Cabernet	SJV Thompson	Sierra/Nv Zinfandel	Sonoma Chardonnay	Lake Sauvignon Bl.	S.Maria/S.B. Chardonnay	S.L.Obispo Cabernet
Prune & Tie	130	185	209	141	486	314	261	392
Suckering		49			38	60	90	85
Leaf Removal					202	150	150	
Frost Protection					59	68	54	
Weed Control	96	56	51	46	78	41	29	21
Mildew Control	106	44	82	106	296	71	202	95
Pest Control-vertebrates	14			36		5	31	16
Pest Control-insect	28	73	85	53	37	59		56
Birds								82
Irrigate	207	40	190	33	161	61	78	143
Fertilize	16	31	39		327	7	48	26
Green Tie/Shoot Thin		102		141	141			
Move Wires					338	48		
Pickup	34	13	31	393	187	45	17	17
Miscellaneous	48	9	34		46	143	13	12
Total Cultural	679	602	721	949	2396	1072	973	945
Operating Capital Int.	34	30	38	40	91	53	42	46
Harvest	450	280	281	441	418	812	825	1425
Total Operating	1163	912	1040	1430	2905	1937	1840	2416
Cash Overhead	221	469	240	879	1635	603	749	771
Total Cash	1384	1381	1280	2309	4540	2540	2589	3187
Amortized Overhead	819	507	498	2247	2070	1436	1066	1359
Total Costs w/o land	2203	1888	1778	4556	6610	3976	3655	4546
Amortized Land	387	305	186	378	2590	669	392	289
Total Costs with Land	2590	2193	1964	4934	9200	4645	4047	4835
Land Value	10,500	8,000	4,500	5,000	35,000	7,500	10,000	7,000
Study Year	1997	1994	1997	1996	1999	1998	1996	1996
Farm Acreage	120	200	120	5	30	40	95	18

Source: University of California, Cooperative Extension. Sample Costs to Establish a Vineyard and Produce Wine Grapes.

[1] The material in this section is largely taken from the University of California's Pierce's Disease Research and Emergency Response Task Force Report.

[2] As reported by Professor of Entomology Alexander Purcell, University of California, Berkeley.

[3] Source: University of California Statewide Integrated Pest Management Project, UC Pest Management Guidelines, Grape, Pierce's Disease, Updated 12/99.

[4] This estimate is taken from data contained "Economic Impact of California Wine", An MKF Research Report, Sponsored by the Wine Institute and California Association of Wine Grape Growers, January 2000.

[5] Figure supplied by University of California sources using IMPLAN.

[6] For a list of sharpshooter hosts, see "Pierce's Disease in the North Coast", University of California Cooperative Extension and Statewide IPM Project.

[7] Source: California Department of Food and Agriculture.