Healthy, Fair, and Profitable

A Win-Win Pesticide Policy

How Higher Pesticide Fees Can Improve Our Health, Environment, and Economy

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A Report from the  Green Watchdog

Prepared by the Pacific Institute as part of the California Green Scissors and Green Capitol Projects

This report is the second in a series that promotes more environmentally sensitive government spending and revenue decisions. Legislators need to recognize that the way revenue is raised has environmental and economic consequences that are as important as how it is spent. This series of reports advocates regulatory fees rather than taxes whenever the public costs of a regulated activity can be reasonably quantified, and elimination of subsidies or tax breaks that directly or indirectly cause harm to human health and the environment.

The following organizations support the policies set forth in this report and the principles of the Green Watchdog series. The Green Watchdog series aims to create policies for California that are fiscally responsible and environmentally sound.

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Executive Summary

Pesticide regulation in California is at a crossroads. The California Department of Pesticide Regulation (CDPR) is facing a significant shortfall in funding. California agriculture — which uses about 90 percent of the pesticides reported to the CDPR — is struggling financially. Many stakeholders are unhappy with the current system.

This report makes the case that we should increase the existing pesticide mill fee to both fully fund the CDPR and increase public investment in sustainable agriculture.

A review of the existing pesticide mill fee, required by Assembly Bill 780 (AB780) to take place in 2002, is an opportunity to discuss these issues and to create a "win-win" solution. Regulations that protect pesticide users and the public by establishing "safe standards" for pesticide use should continue. But a complementary policy of significant public investment in "clean" pest management practices, whenever economical, would benefit public health, the quality of our environment, and our economy.

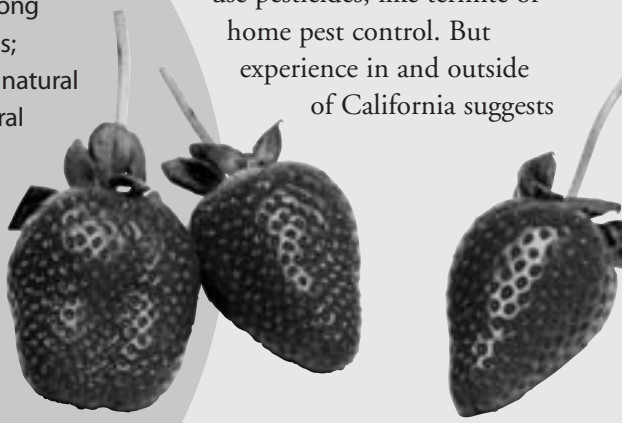
Complementary policies of this type are being implemented in other states and countries. Unfortunately, California has invested relatively little in this approach. For example, the three leading state-wide sustainable pest management programs have combined budgets of about $7 million per year; less than 1 percent of the more than $1 billion per year spent on pesticides by California's farmers. And less than 2 percent of the budget of the CDPR is for the development of reduced-pesticide use practices.

Those who have lived with the safe standards regulatory approach often perceive the promotion of alternatives to pesticide use as a competing policy. It is not. In fact, it complements existing efforts to reduce the impact from pesticides. Just as driving a well-built car will reduce the risk of injury from an automobile accident, driving fewer miles will also reduce that risk. Rather than arguing for one approach over the other, California can and should provide adequate funding for both.

Many stakeholders fear that reducing pesticide use will increase the cost of farming or services that use pesticides, like termite or home pest control. But experience in and outside of California suggests

Sustainable Agriculture

As defined by Congress in the 1990 Farm Bill, sustainable agriculture is "an integrated system of plant and animal production practices that will, over the long term: satisfy human food and fiber needs; enhance environmental quality and the natural resource base upon which the agricultural economy depends; … integrate where appropriate, natural biological cycles and controls; sustain the economic viability of farm operations; and enhance the quality of life for farmers and society as a whole."



that these fears are unfounded. The evidence presented in this report suggests that alternative pest management practices can increase, rather than decrease, farm profits.

California farmers specialize in high value commodities — wine grapes, strawberries, and almonds for instance. Rising land values and other long-term forces have pushed California's farmers in this direction, and will probably continue to do so for decades to come. Higher value commodities, on average, use more pesticide per acre than lower value products when they are produced using conventional farming systems. However, many higher value commodities can be produced using low input and organic farming systems.

Since demand for organic and other premium-quality commodities is increasing 4 to 5 times faster than demand for agricultural commodities in general, and because there are price premiums for such products, policies that encourage a transition to sustainable agriculture are consistent with, and reinforce, long-term trends in California agriculture.

Organic and low-input production systems are not always the most profitable. They are, however, more profitable than conventional systems in many instances. Some farmers and pest management businesses have already adopted sustainable pest management practices that increase profitability and are better for human health and the environment. Widespread and faster adoption of these practices, however, requires more public investment in knowledge, training, and incentives. [1]

But how can we significantly increase public investment in sustainable pest management when large shortfalls in state funding are coming our way? The fairest way to do this is to renew and increase the pesticide mill fee in California. This will not only help the CDPR, but will also give farmers an economic boost during hard times.

The high-technology sector of the California economy was supported with public investment during its infancy and eventually created many benefits for California. Sustainable agriculture and pest management is another long-term investment that will benefit the state. Pesticide use stakeholders in California need to recognize this win-win opportunity, and find common ground to move forward.

[1] This is true without accounting for the costs of pesticide use that are not borne by the user. When these costs (called "external costs" by economists) are included, the case for public investment is even stronger.

Introduction

Why Read This Report?

The future of the existing mill fees will undergo a legislatively mandated, broad stakeholder review process in 2002. This report presents two points. First, it argues that full funding of the California Department of Pesticide Regulation (CDPR) with revenue from increased pesticide mill fees would benefit taxpayers and the general public. Second, it argues that reducing pesticide use overall would benefit California farmers and the California farm sector, as well as the general public. To achieve a significant reduction, however, requires that we greatly increase public investment in sustainable pest management using revenue from increased pesticide mill fees.

Structure of This Report

This report has five primary sections including the introduction. Whenever possible, we provide references rather than repeat information that is presented elsewhere. Section two provides background information on the pesticide mill fee, pesticide regulation, and pesticide use in California. Section three describes the benefits to farmers, taxpayers, and the general public that would likely result from a reduction in pesticide use in California. A policy proposal — to encourage specific rather than ideological discussion of the issues — is presented in Section four. Finally, we recommend some specific next steps.

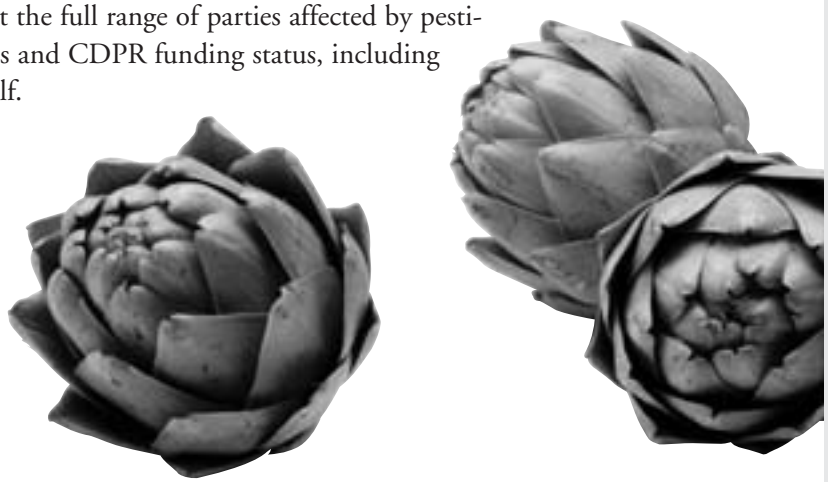
Background

Status of the Pesticide Mill Fee in California

Financing for the California Department of Pesticide Regulation (CDPR) has been, from creation of the Department in 1991, an uncertain mix of general funds and revenue from a temporary increase in a mill fee imposed on the sale of pesticides, over and above State and local sales taxes. The pesticide mill fee was enacted in 1971 at a level of 0.8 percent (8 mills), with County agricultural Commissioners receiving 62.5 percent of funds from the fee for local enforcement of pesticide laws. The state raised the rate to 0.9 percent (9 mills) in 1989, with increased revenue directed to the County level. The statewide budget crisis of 1990 caused CDPR to lose some General Fund support, which was replaced with a temporary increase of the mill fee to 18 mills, and a sunset clause to revert the mill fee to 9 mills on July 1, 1992. In 1992, the continuing state deficit prompted the legislature to reduce General Fund support further, and to increase the fee to 22 mills through July 1, 1997. The fee was renewed in 1997 — after a two-month lapse — until January 1, 2003, at the rate of 15.15 mills in 1998 and part of 1999, and 17.5 mills thereafter. (CDPR 2001)

The mill fee currently yields about $30 million of revenue each year, which amounts to about 1/2 of the FY01-02 CDPR budget of about $60 million. Another $9 million of support in FY01-02, however, is provided from unexpended mill fee revenues collected in previous years. The California General Fund provides about $15 million in FY01-02. Pesticide registration and licensing fees, the vehicle license plate fund, transfer payments from the Federal government, and other miscellaneous sources provide the remainder.

Assembly Bill 780 (AB780), passed in 2001, extends the fee at 17.5 mills until June 30 2004 and requires the DPR to submit a report evaluating funding needs and sources to the Legislature by January 1, 2003. The purpose of the analysis is to recommend a permanent funding solution for the CDPR. AB780 also requires the director of the DPR to perform this review via a subcommittee of the CDPR Pest Management Advisory Committee (PMAC), to be convened no later than January 1, 2002. The subcommittee must be composed of at least two representatives of nine categories of stakeholders listed in AB780. These categories represent the full range of parties affected by pesticide regulations and CDPR funding status, including the CDPR itself.



Box 1

The Origin and Current Priorities of the CDPR

CDPR was created in 1991 by transferring the pesticide regulatory division of the California Department of Food and Agriculture (CDFA) to the California Environmental Protection Agency (CalEPA). Its authority over pesticides in California is very broad, either pre-empting or having overlapping authority with regulation of pesticide pollution by the California Air Resources Board, the regional Air Quality Management Districts, the State and Regional Water Quality Control Boards, and local governments.

CDPR is the only regulatory agency within CalEPA that was once part of a Department (the CDFA) whose mission is to promote the sector that it regulates. This cultural history has not prevented DPR from being somewhat effective, but it has created mixed feelings about the value of the current activities and priorities of the CDPR. Public health and environmental advocates have criticized the Department for being too supportive of pesticide use and have been reluctant to support increases in its budget, in sharp contrast with their consistent support for more resources for other regulatory agencies.

For example, the Department's mission "… is to evaluate and mitigate impacts of pesticide use, maintain the safety of the pesticide workplace, ensure product effectiveness, and encourage the development and use of reduced risk pest control practices …" (www.cdpr.ca.gov/dprbranch.htm). The last component of the mission is also one of the four overall goals of the CDPR's Pest Management Strategy: "Advocate and assist with the adoption of economically viable reduced risk pest management practices" (CDPR 2001). But this part of the CDPR mission is funded at a very low level — perhaps 2 percent of the $60 million annual budget — and is therefore viewed by many in the environmental community as a nothing more than a public relations effort.

Box 2

Pesticide Use Reduction Experience Outside California

Denmark has a pesticide tax that is tiered from 3 percent to 35 percent of the retail sales price of the pesticide. Most categories of pesticides are subject to a 25 percent or 35 percent tax. Microbiological plant protection products are subject to the 3 percent tax. The Danish objective — established in the 1986 National Pesticide Action Plan — was to reduce pesticide use by half by 1997. Data through 1994 indicated that the program would indeed achieve a 50 percent reduction in total pesticide use. Interestingly, the property tax on agricultural and horticultural property was reduced at the time of adoption of the pesticide taxes, in an amount that was intended to completely "recycle" revenue from the pesticides taxes (Hansen 1999).

Sweden has specific taxes: that is, a specified "dollar" amount per kilogram of active ingredient. The equivalent percentage tax rate of the Swedish tax was about 30 percent of retail price in 1990. The relatively large Swedish pesticide tax reportedly reduced pesticide use by 50 percent between 1985 and 1990.

The State of Iowa made a commitment to sustainable agriculture starting with passage of the Iowa Groundwater Protection Act in 1987. There are two university centers and 22 programs supported by the pesticide and nitrogen fertilizer fees specified in the Act. Iowa's annual budget for this effort has been about $1.5 million (www.leopold.iastate.edu), a very modest amount for the size of its agricultural sector (about $12 billion in 1997). Total pesticide use on corn and soybeans was rising prior to 1985, but declined from 1985 to 1990 and from 1990 to 1995. Intensity of use per harvested acre of corn declined from 1.07 pounds of active ingredient in 1990 to 0.82 pounds in 1995 (Hartzler, Wintersteen, and Pringnitz 1997).

Massachusetts is considering adoption of an explicit pesticide use reduction policy. On July 17, 2001, the Joint Committee on Natural Resources and Agriculture approved a bill (S.1110) doing away with the current sales tax exemption for pesticides and dedicating new revenue to education, outreach, research, labeling, and creating and providing incentives for integrated pest management. The Massachusetts Department of Food and Agriculture would administer the new program (Center for a Sustainable Economy 2001).

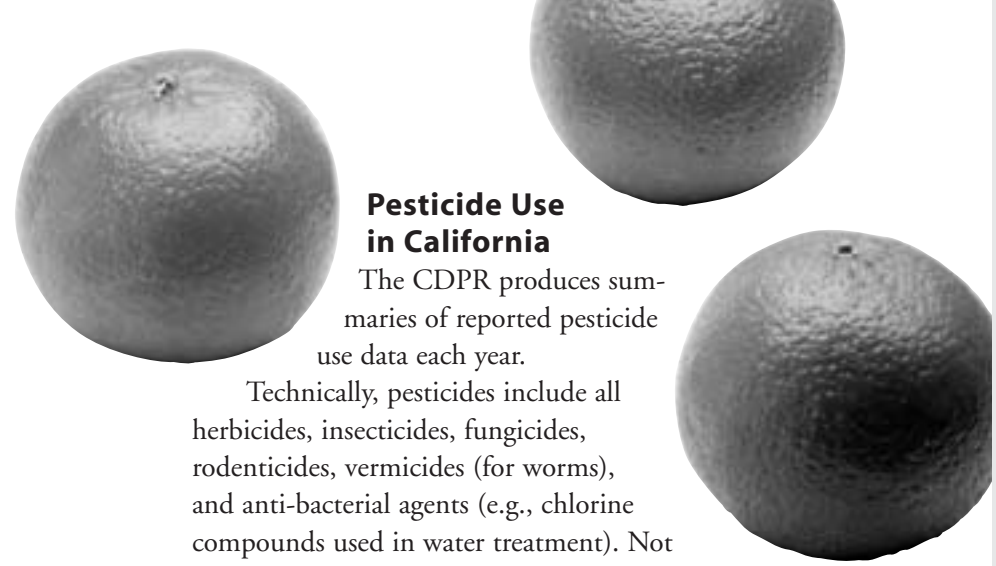
Governor Davis line item vetoed an additional $7 million of general fund money for the CDPR authorized by AB780 due to an anticipated fiscal shortfall in the coming fiscal year. The Governor called on farmers, the pesticide industry, environmental organizations, and other affected groups to begin talks on "a longer-term solution for support of the department."

Pesticide Regulation in California

The United States Environmental Protection Agency (USEPA) and the CDPR have historically regulated pesticides using the traditional "safe standards" approach. Some background information on the history and current priorities of the CDPR is provided in Box 1. The traditional approach to pesticide regulation has attempted to make the risks of damage to human health and the environment acceptable. Occupational and ambient exposure standards have been established, and specially licensed and trained contractors must make pesticide applications in a prescribed way. New pesticide products are reviewed for safety and registered for use only when they are believed to be safe when used as prescribed.

Decades of experience with the safe standards approach show that it has many limitations. Safe, scientifically based standards for occupational or ambient exposure are expensive and difficult to establish. The standards are often based on the short-term response of a few species in a laboratory to high levels of exposure, rather than studies of low levels of exposure over long periods of time to many species interacting in the complicated ways species interact in the real world. Cancer and adverse reproductive, neurological, and immune system impacts often result or are suspected to result from low-level exposure over longer periods of time. In at least a few cases (e.g., DDT and other persistent organic pollutants), adverse impacts and risks continue today from on-going exposure to substances that were banned from use in the U.S. several decades ago. In addition, the safe level of a substance outside the laboratory often depends on the presence or absence of a multitude of other substances or on the age or health condition of the most vulnerable members of a population (e.g., the elderly or children). For all of these reasons, safe standards have a demonstrated pattern of becoming more stringent over time.

Consequently, a supplementary approach to pesticide regulation has been developing worldwide: reduction in the use of potentially dangerous substances is encouraged whenever reasonably priced alternatives exist. Under this approach, research and dissemination of knowledge about "clean alternatives" is supported by public investment, and reduction in pesticide use becomes as important as the establishment of safe standards. The combination of traditional and more recent regulatory approaches recognizes that the attempt to establish safe standards is beneficial, but that some level of health or environmental risk is always associated with the use of substances that are toxic to pests. California has several programs that promote voluntary implementation of less-toxic pest control techniques. They are discussed later in this report. Pesticide use reduction experience in other states and countries are described briefly in Box 2.



Pesticide Use in California

The CDPR produces summaries of reported pesticide use data each year.

Technically, pesticides include all herbicides, insecticides, fungicides, rodenticides, vermicides (for worms), and anti-bacterial agents (e.g., chlorine compounds used in water treatment). Not all pesticide use must be reported to CDPR. Reporting requirements do not apply to home and garden and certain industrial and institutional uses (including chlorine used by water and wastewater treatment plants). Chlorine compounds used in water and wastewater treatment account for about 50 percent of total pesticide use in California, and about 20 percent of total pesticide use in California is estimated to be home and garden use (Templeton, Zilberman, and Yoo 1998). In this report, we discuss *only* reported pesticide use. The pesticide mill fee, however, applies to all pesticides registered for use in California.

Annual reports (CDPR 2001, CDPR 2000) present data from 1991 through 2000 in five use categories; production agriculture, post-harvest fumigation, structural pest control, landscape maintenance, and "all others." Production agriculture accounts for about 90 percent of reported use in 2000. Total reported pesticide use increased by about 22 percent from 1991 to 2000 (from about 153 million to about 187.5 million pounds of active ingredients). Use in production agriculture, however, increased by about 29 percent (from about 133 million to about 172 million pounds of active ingredients). The increase in production agriculture occurred prior to 1998; (preliminary) figures for 1999 and 2000 show a decline from the 1998 level of use. Trends, however, are difficult to assess over short periods because pesticide use in agriculture is highly variable from year-to-year, depending on demand for commodities, weather, and many other factors.

Some Pesticide Use Reduction Programs in California

There are and have been many governmental and non-governmental efforts to investigate the potential for, or to encourage, pesticide use reduction in California. FAWG (2001) describes many of these efforts. Substantial efforts have been made by some industry associations, including but not limited to the Almond Board, the Walnut Board, the Lodi-Woodbridge Winegrape Commission, and the California Association of Winegrape Growers.

Box 3
The UC SAREP Program

The Biologically Integrated Farming Systems (BIFS) Program of the University of California (UC) Sustainable Agricultural Research and Education Program (SAREP) was established in 1994 by Assembly bill 3383 (Bornstein, Brown, and Snyder). It was modeled on an almond project that SAREP participated in created by the Community Alliance with Family Farmers (CAFF). That project found that almond yields from organic orchards could be comparable with yields from conventional orchards. Nine BIFS projects in nine different farming systems have been funded since 1995.

The adoption of biologically integrated systems has created benefits for farmers such as improved soil fertility, decreased erosion and nitrogen leaching, reduced need to apply fertilizer and pesticides, and increased populations of beneficial insects, fishes, migrant birds, and game.

For example, a wine grape BIFS project involving 43 growers and 2,370 acres used intensive monitoring of weeds, pests, and beneficial insects to obtain a reduction in the proportion of BIFS vineyards sprayed for mites or leafhoppers from 54 percent in 1996 to 28 percent in 1998. The percentage of acreage treated with pre-emergence herbicides declined from 70 percent to 59 percent.

A BIFS prune project involving 877 experimental acres farmed by 33 prune growers demonstrated that growers could eliminate wintertime sprays of diazinon — an organophosphate insecticide that has contaminated California rivers — without adverse effects on their farming operations.

And a BIFS apple project found that pheromone mating disruption for coddling moth control on 311 acres in 11 apple orchards allowed a reduction in the use of organophosphates and carbamates of 59 and 92 percent, respectively.

SAREP is also a technical advisor to the CDPR's Pest Management Alliance (PMA) in winegrapes. Sulfur dust from vineyards has drifted, on occasion, into sensitive areas such as schools and public highways. Applying knowledge from the BIFS winegrape project may be a more effective way to solve this health and environmental problem than traditional "safe standards" regulation. The California Associate of Winegrape Growers (CAWG) is sharing more than 50 percent of the project cost, with the remainder funded by CDPR.

SAREP is also working in collaboration with the CAFF, the Lodi-Woodbridge Winegrape Commission, and UC researchers in a project supported by the USDA's Fund for Rural America. The project asks: "Why do farmers adopt sustainable agriculture practices and how can community links be strengthened to support adoption?" SAREP and its collaborators, and others like them, have successfully begun the transition to sustainable agriculture in California. But the end of the transition is not in sight, and SAREP is facing a possible reduction in funding in the near future.

Sources: personal communication with Marco Barzman, SAREP coordinator, and www.sarep.ucdavis.edu

Nonetheless, state-level funding for pesticide use reduction programs is small. The leading programs in this area are the University of California Integrated Pest Management Program (UCIPM), the UC Sustainable Agriculture Research Program (SAREP), and the Pest Management Alliance (PMA) program of the CDPR. Their combined budgets amounted to $6.4 million in 1999 (Kegley, Orme, and Neumeister 2000).

In comparison, the annual budget of University of California Cooperative Extension (which employs farm advisors in all 58 California Counties) is about $70 million, the annual budget of the CDPR is about $60 million, and the annual budget of the California Department of Food and Agriculture is about $250 million.

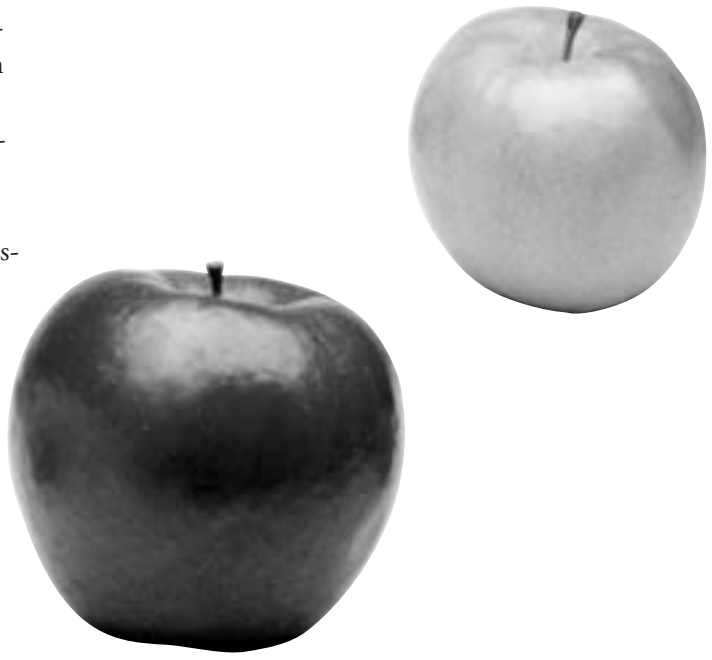
Federal-level funding for integrated pest management and bio-control projects is similarly quite small; less than 0.3 percent of the U.S. Department of Agriculture (USDA) budget in 1999 (Kegley, Orme, and Neumeister 2000).

The University of California Integrated Pest Management (UCIPM) Program, established in 1980, has successfully facilitated problem-solving research that shows how to manage pests with lower pesticide use (Klonsky, Shouse, and Zalom 2000). UCIPM provides extensive written documentation and some amount of training in the knowledge intensive techniques of integrated pest management. But its emphasis has been on development of new knowledge, not implementation. Although UCIPM includes a communication and outreach component, as do most University research programs, demonstration projects and seminars are not necessarily persuasive. A formal policy of rewarding pesticide use reduction using the "stick" of higher pesticide mill fees and the "carrot" of financial assistance during the transition to sustainable agriculture, is an implementation policy that complements research programs such as UCIPM.

The University of California Sustainable Agriculture Research and Education Program (SAREP) has also developed knowledge that needs to be implemented more widely. However, it has emphasized implementation from inception. It was established in 1986 in response to public concerns that California farming needed to be more ecologically sound, economically profitable, and socially responsible.

The Biologically Integrated Farming Systems (BIFS) projects have demonstrated, on numerous working farms, that pesticide use can be reduced or eliminated without reductions in yield. Whether these reductions also reduce costs varies from crop to crop and has not yet been evaluated systematically.

Some of the results of the SAREP effort are described in Box 3. With a state budget of only $600,000 or so per year, SAREP seems to have been remarkably effective at reducing the health and environmental risks from pesticide use by reducing use. Each additional dollar invested in SAREP would probably bring much greater risk reduction benefits to farmers, farmworkers, and Californians in general than investing that same additional dollar in increased funding for the "safe standards" regulatory approach.



Benefits From A Higher Mill Fee

Economic theory tells us that pesticides are being overused in California. Overuse occurs when a good or service is priced lower than it "should be." What price "should" apply to any good or service? The price that includes all costs of producing and using that good or service, whether incurred by the consumer or anyone else. A classic example is leaded gasoline, whose price did not include the significant health costs associated with emissions of airborne lead compounds from tailpipes. Leaded gasoline was eventually phased out in the U.S., as have been particularly dangerous pesticides (e.g., DDT).

In less extreme cases, however, complete phase-out of a chemical or product formulation is undesirable. There is broad agreement among economists that in those cases, the costs of a good or service that are not included in its market price and that can be reasonably quantified should be included in the market price via public policy of some type. The California Redemption Value (CRV) for recyclable beverage containers is an example. Manufacturers of beverage containers pay a fee that is spent supporting beverage container recycling infrastructure. Doing so reduces the cost to society of throwing away valuable resources after being used only once, and reduces the social cost of littering and landfill use.

The pesticide mill fee is another example: it causes about 1/2 of the current CDPR budget to be included in the price of pesticides in California. Not including reasonably quantifiable costs of pesticide use — such as the other half of the CDPR budget — causes the market price of pesticides to be too low, encouraging pesticide overuse.

We do not attempt to quantify the extent of pesticide overuse in California. So long as overuse exists, benefits can be achieved by reducing pesticide use from current levels. We describe those benefits in the next three subsections, beginning with financial benefits for California agriculture.

Sustainable Agriculture is a Financial Opportunity

A recent survey of long-term trends in California agriculture (Swezey and Broome 2000) concludes: "… shared knowledge of biological processes that determine pest dynamics, soil health, and microbial ecology will combine with the demonstrated ability of California growers and agricultural researchers to innovate, thereby maintaining the preeminence of California commodities." The survey authors also say, based on current trends, that, "alternative farming systems could comprise at least 20 percent and as much as 60 percent of all California cropland in production in 2025." *Where California agriculture ends up within this range — and how well it competes with other farm regions that are adopting alternative systems — depends on pesticide policy and agricultural investment choices being made today.*

In the short-term, the agricultural sector of the California economy is struggling. Prices of many commodities have declined. Cotton and rice are at half the price they were a year ago and would have fallen further without federal subsidies. Grape, almond, and walnut prices are also very low. Growers are switching to other crops or going out of business (personal communication, Steve Lyle, Director of Public Affairs, CDFA). Higher water and fuel prices, and water shortages, contribute to the problem, as does tough competition from foreign producers. But as demonstrated below, increased expenditures for pesticides and pest management are also significant financial burdens on farmers. A major challenge this report begins to address is the development of a majority opinion, supported by a broad range of stakeholders, that using pesticide fees as a revenue source for significant public investment in the transition to sustainable agriculture can help farmers overcome these adverse economic forces.

It is worth noting that some growers have independently taken significant steps toward lower pesticide use practices. For example, Tanimura and Antle (the nation's largest independent lettuce producer), Driscoll (strawberries), Dole (almonds), Paramont Farms (citrus), Pavitch family farms (table-grapes and raisins, and one of the largest organic farms in California), and Fetzer, Frog's Leap, and Frey Vineyards (wine) use all or some of their acreage for organic production of premium products (Holmes, et al, 2001). And Robert Mondavi and Gallo vineyards have reduced chemical inputs, to cut expenses and reduce liability. But the knowledge-intensive techniques of lower input agriculture are not easy to learn and may not be economical for the grower unless the

product can earn a market premium. Disseminating knowledge, rewarding innovation for a period of time (e.g., 10 years), and working with farm groups to create labeling and advertising campaigns that increase market share in rapidly growing markets, are activities that often require government action. The fact that some growers already understand and are taking action on the business opportunity we point out does not mean that California agriculture, as a whole, will change rapidly enough to take advantage of that opportunity.

Pesticide Use and Economics in California Agriculture

The most recently available data[2] show an average 4.7 percent nationwide increase in pesticide use in production agriculture for the 1992-1997 period. In comparison, CA agricultural pesticide use increased about 10 percent during that period. This suggests that California farmers in the 1990s were becoming more pesticide dependent than the average American farmer. CDPR (2001) provides *preliminary* pesticide use numbers for 1999 and 2000 that suggest pesticide use has declined since 1998.

Total pesticide use, however, is not the best measure of pesticide dependency. A better measure is the intensity of pesticide use: pounds of active ingredient per planted or harvested acre.[3] Intensification of pesticide use in agriculture in the U.S. increased from 1.26 pounds of active ingredient per harvested acre in 1964 to 2.56 pounds of active ingredient per harvested acre in 1978. From 1978 to 1997, however, U.S. pesticide use intensity has remained relatively constant at around 2.5 pounds per harvested acre.[4]

A detailed analysis of California use data by commodity from 1991 through 1998 (Kegley 2000) found that average pesticide intensity increased by about 50 percent in that time period. In California, intensity of use rose on a percentage basis most for vegetables and melons (around 100 percent), somewhat less for nuts and other fruits (around 65 percent), and very little for row crops (e.g., corn). Kegley also found that the intensity of pesticide use differs enormously between vegetables and melons, fruit and nut, and row crop categories. In 1998, for example, fruits and nuts were more than 7 times more intensive than row crops in their use of pesticides (51.25 vs. 7.13 pounds per planted acre), and vegetables and melons were about 3 times as intensive as row crops (21.24 vs. 7.13 pounds per planted acre).

Did the larger-than-national increase in pesticide use in California agriculture from 1991 through 1998 result from a shift by farmers toward production of higher-value-added commodities? This is a question for future research. It is certainly true that the California agricultural economy specializes in high value added commodities. The USDA categorizes California as part of the "Fruitful Rim" region; a region that produces 22 percent of U.S. agricultural production value on only 8 percent of the cropland.[5] But did California agriculture become dramatically more specialized in these commodities during the 1990s? If so, California farmers may be on a path toward even greater intensification of pesticide use since rising land values in California are (according to anecdotal evidence) making production of lower-value-added crops less feasible economically. Even if pesticide use or use intensity declined in 1999 and 2000, as the *preliminary* data from CDPR indicate, the long-term trend and driving forces in California agriculture seem to be toward greater pesticide use intensity.

The increase in pesticide use intensity in California agriculture has financial consequences for farmers. Table 1 presents some economic indicators related to agricultural pesticide use in CA from 1992 to 1998. The indicators suggest:

- pesticides, on average, have become more expensive per pound during the 1990s;
- pesticide expenditures are absorbing a rising share of crop value;
- pesticide expenditures are growing faster than net farm income; and
- the number of pounds of pesticides to get an additional dollar of net income is increasing (diminishing returns from pesticides).

All four indicators suggest that the opportunity to increase farm profits (by reducing pesticide expenditures and quantities used) is growing. The indicators also suggest that programs to help farmers control or reverse the growth in

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[2] www.epa.gov/oppbead1/pestsales/97/pestsales/table14.htm

[3] Use per planted acre is a better measure than use per harvested acre since the former includes all acres to which pesticides are applied each year while the latter includes only those acres that are harvested in a given year. Unfortunately, data on planted acres are often not available.

[4] Author's calculation using USEPA data for pesticide use and harvested cropland reported in Table 1 of (NASS 1997).

[5] Information from the economic research service of the USDA, available at: www.usda.gov/emphases/harmony/issues/resourceregions/resourceregions.htm

Table 1
Some Agricultural Economic Indicators for California

	'92	'93	'94	'95	'96	'97	'98
Agricultural Pesticide Use (mill. of lbs.)	156.6	172.5	175.4	187.6	182.4	198.6	186.4
Pesticide Expenditures (in millions)	$725	$755	$790	$900	$992	$1109	$1076
Net Farm Income (in billions)	$5.3	$5.9	$6.0	$4.9	$5.8	$6.4	$5.4
Crop Value (in billions)	$13.8	$15.1	$16.2	$17.1	$17.6	$19.8	$17.6
Indicator Ratio Derived from Data							
Pesticide Expenditure Per Pound of pesticide	$4.62	$4.37	$4.50	$4.80	$5.44	$5.58	$5.77
Expenditures/ Crop Value	5.25%	5.00%	4.88%	5.26%	5.64%	5.60%	6.11%
Expenditures/ Net Income	13.67%	12.79%	13.17%	18.37%	17.10%	17.33%	19.93%
Pesticide Used/ Net Income (lbs./dollar)	29.56	29.24	29.23	38.28	31.44	31.03	34.52

Sources: Economic data are from the California statistical atlas (DOF, 2000), and pesticide use data from the CDPR (1999).

pesticide expenditures and quantities used may be welcomed by the California farm community.

We underline the word suggest to emphasize that the pattern of the indicators over time could be caused by a variety of factors that we have not accounted for. But the suggestion in the California data is supported by pesticide expenditure and crop sales data for the U.S. as a whole, which show an upward trend in the percentage of crop sales revenue that is spent on pesticides. The suggestion is also supported by pesticide and pest management expenditure data at the commodity level in California over time ("time series data"), using cost and return[6] studies prepared by the University of California Agricultural Extension and historical costs in California available from the Economic Research Service of the U.S. Department of Agriculture.

Figure 1 presents these time series data. They are also provided in Table 1 and Tables A-1 through A-5 (appendix). Note that pest management expenses for strawberries and almonds are reported, rather than merely pesticide expenditures, because labor expenses for pesticide application and some other pest management activities (e.g., weeding) were identified in the cost and return studies for strawberries and almonds.

Strawberries and carrots were the 1st and 7th most pesticide intensive crops in California in 1998, and carrots, strawberries, and almonds were three of the five crops with the highest total use of "California Bad Actor" pesticides[7] in 1998 (Kegley, 2000). Carrots, strawberries, and almonds were also among California's top twenty commodities by value of sales in 1998, 1999, and 2000 (CDFA 2001).

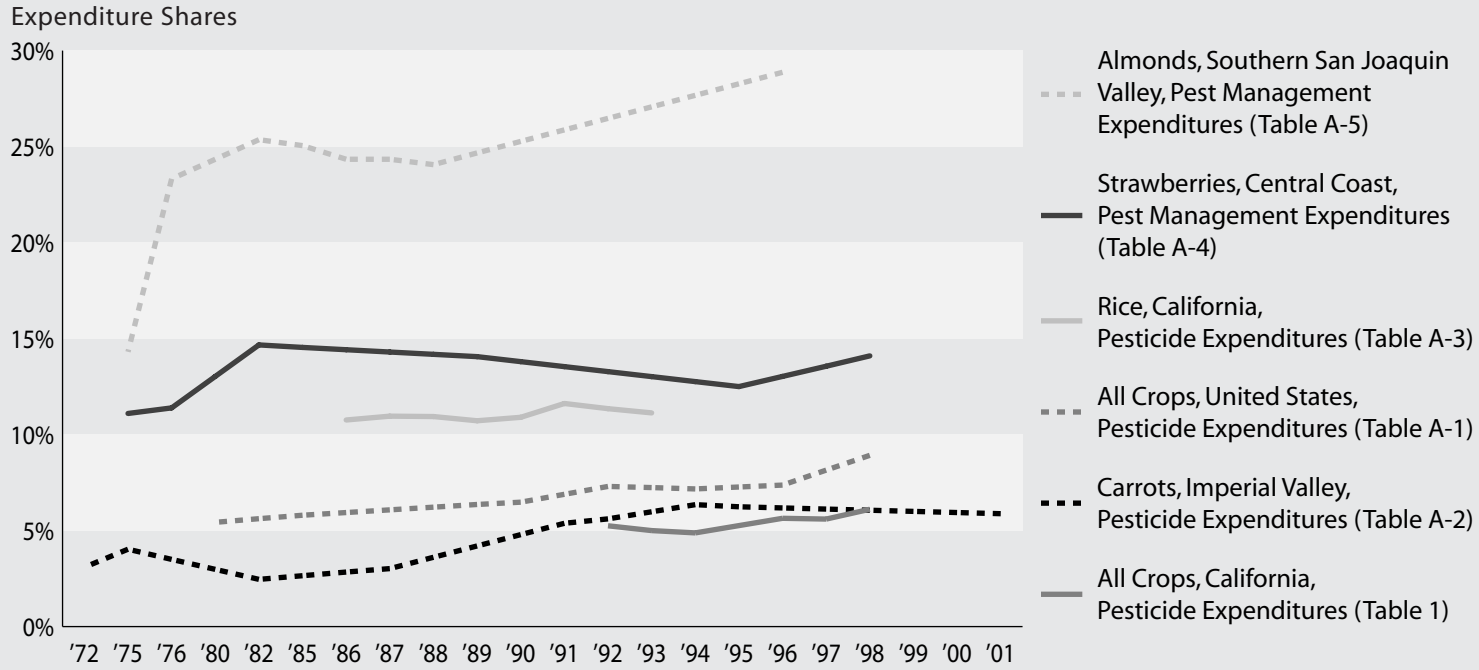
Direct Financial Benefits for Farmers

A research project at the University of California at Davis (Klonsky and Livingston 1994) provides a tangible example of how farmers can benefit financially from reducing pesticide use. Similar results have been obtained in other studies.[8] It also demonstrates that reductions in use do

[6] Cost and return studies present the best estimates of agricultural extension staff in specific locations around the State. The studies are forward looking (for the year following publication), rather than reports of actual expenses. Actual expenses in previous years, however, are used to prepare the reports.

[7] Californians for Pesticide Reform (CPR) define "California Bad Actor" pesticides as those that are both registered for use in California and are either acute poisons, known or probable carcinogens, neurotoxins, reproductive or developmental toxicants, or are known to have contaminated California groundwater.

Figure 1
Some Historical Data on Pesticide and Pest Management Costs



not always increase net returns, and that the relationship between net return and pesticide use differs greatly from commodity to commodity.

The UC Davis study compared four cropping systems over four years (1989-1992): a conventional four-year rotation, a conventional two-year rotation, a low-input system, and an organic system. Five crops were involved: tomatoes, safflower, corn, winter grains (e.g., wheat), and beans. Pesticide use in the conventional rotations was less than commonly used by farmers at that time (personal communication with Karen Klonsky). Profit (cash value of crops less operating expenses) for each system and commodity was estimated in dollars per acre for the four-year period. Profit for the organic system was estimated at both conventional prices and premium prices for organic commodities.

One way to increase farm profits by reducing pesticide use is to produce grades of commodities that command a market premium. At premium prices, the organic system was significantly more profitable for tomatoes, corn, and beans.[9] The Economic Research Service of the U.S. Department of Agriculture (Greene 2001) recently documented price premiums for organic products. Three sources of data — including supermarket scanner data — showed annual average premiums for organic fruits and vegetables of about 100 percent (double the price of conventional products) during the 1989-1996-time period. Organic milk prices averaged 60 percent over conventional milk brands in data for the 1997-1999-time period. Organic corn, soybeans, wheat, and oats enjoyed price premiums of more than 50 percent over conventionally grown varieties from 1993-1999. And retail clothing made from organic cotton earned a 34 percent price premium based on 1996 catalog data.

Price premiums fluctuate and may decline if many farmers begin to grow higher value grades of commodities. This is another important question for future research. A critical factor in maintaining price premiums is the rate of growth in demand for premium commodities in comparison with the rate of growth in

[8] See, for example Ikerd, Monson, and Van Dyne (1993); Diebel, Williams, and Llewelyn (1995); Hanson, Lichtenberg, and Peters (1997); Schillhorn van Veen et al, (1997); Srivastava, Smith, and Forno (1999) USDA (2001) and www.sustainablecotton.org/BASIC. Ikerd, et al, found that alternative systems for cotton production showed higher profits than conventional systems, and the BASIC project found that dramatic reductions in synthetic chemical use are possible in cotton production. Cotton was the 12th, 11th, and 7th most valuable crop produced in California in 1998, 1999, and 2000, respectively (CDFA 2000), and was the fourth highest user of California "Bad Actor" pesticides in 1998 (Kegley, et al, 2000).

[9] With price premiums, the organic system in the UC Davis Study, on a whole-farm basis, had profitability comparable with conventional systems (better than the four year rotation, worse than the two-year rotation). Without price premiums, the organic system in the UC Davis Study, on a whole-farm basis, was significantly less profitable than any of the other systems. However, profitability on a whole farm basis could be increased significantly by modifying the organic system in the UC Davis Study to exclude crops that have low or negative profits without price premiums.

supply of those commodities, and the willingness of consumers to pay more for quality commodities. So long as supply growth does not exceed demand growth, price premiums are likely to continue.

Sales from organic farms in California grew 15 percent per year from 1992 through 1998 (Klonsky 2000), far above the 4 percent per year sales growth rate of California agriculture in general during that same time period (DOF, 2000). Nationally, the organic trade association reports that organic product sales have grown by nearly 23 percent per year during the 1990s (www.ota.com/consumer). Continued growth in demand for organic and premium quality foods is expected as pesticide residue standards and public concern about subtle issues in food quality continue to grow.

California's organic farms are reported to have current annual sales revenue of about $200 million, a small fraction of the current U.S., European, and Japanese markets for organic products, which are about $6, $4.5, and $2 billion in 1999, respectively (Swezey and Broome 2000). There seems to be plenty of room for growth in production of premium commodities without glutting the market.

In addition, higher profits from lower pesticide use are possible even without price premiums. At conventional prices for organic produce, the UC Davis study found that tomatoes were most profitable when produced conventionally and corn was most profitable when produced in the low-input system. The organic system was still the most profitable for beans, even at conventional prices. These findings demonstrate that even without price premiums, low-pesticide-input or organic systems can be more profitable than conventional systems, if the right commodities are grown.

In contrast, safflower production was only profitable in the conventional four-year rotation system, and winter grains were only profitable in the low-input system. These results underscore the importance of detailed evaluation of the economics of pesticide use. In some cases, reducing pesticide use will not only reduce profit, but cause absolute dollar losses, even when price premiums exist (as they do for organic safflower and grains). This is why we include in our policy proposal transitional financial assistance to farmers who are willing to try sustainable agricultural practices. The most profitable and sustainable means of controlling pests for each commodity, each cropping system, each soil type, etc., will not be easy to determine.

The challenge to California farmers is nicely stated in a pamphlet prepared by Iowa State University: "Eight Ways to Reduce Pesticide Use" (Wintersteen, et al, 1999). The pamphlet provides examples of reductions in pesticide use that increased profits on Iowa farms, and neatly summarizes the theme that runs through the success stories:

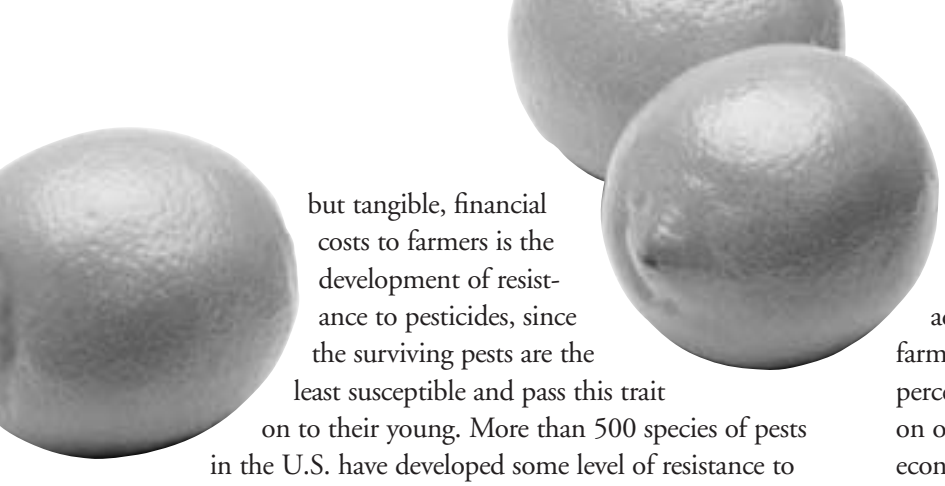
> Profit margins vary widely in farming. The key is to think in terms of net return, rather than maximizing yield. For example, a $5,000 insecticide application that results in a $3,500 increase in yield amounts to a $1,500 loss in profits. When commodity prices change, farm input use has to be reconsidered. Because prices vary over time, it is important to reevaluate pest management at least yearly. … Using a $50 sledgehammer when a $5 hammer will do is unnecessary and unprofitable. It takes an independent manager to use a hammer when the neighbors are using sledgehammers, but a profitable balance sheet is persuasive in the end. (p. 1)

Because farm profits depend on soil and crop types, tillage systems, climate, and many other situational factors, following the advice in the Iowa pamphlet — that is, taking advantage of the financial opportunity we highlight in this report — is difficult in practice. It requires monitoring crop status and pest levels closely, and applying the smallest hammer for the job. It also requires analysis of data from each farm and from groups of farms to determine the pest implications of various farming practices (e.g., timing or pattern of watering or fertilization).

Maximizing net return is far more information intensive than maximizing yield. Agriculture is a sector of the California economy that still has a long way to go to become part of the high-value-added "information economy." Smart farmers are already trying to maximize net return; but they could do a better job with increased public investment and financial assistance during the transition to sustainable agriculture.

Indirect Financial Benefits for Farmers and Farm Suppliers

Choosing the means of sustainable pest management that will maximize farm profits is also difficult because the choices and actions of neighboring farmers can indirectly affect the profitability of a farm. One cause of indirect,



but tangible, financial costs to farmers is the development of resistance to pesticides, since the surviving pests are the least susceptible and pass this trait on to their young. More than 500 species of pests in the U.S. have developed some level of resistance to broad-spectrum pesticides (Benbrook, et al, 1996). Failure to recognize this fact led to a situation in California in the late 1970s in which twenty-four of the twenty-five most important agricultural pests had been created by pesticide use (National Research Council 1989). This means that sustaining an initial increase in yield from pesticide applications may require steady increases in the amount or toxicity of pesticides that are used. This is one possible explanation for the historic increase in pesticide use intensity nationwide and in California.

A related source of indirect, but tangible, financial costs to farmers is the loss of beneficial insects that provide natural pest control and pollination services. Natural ecosystem controls were estimated to account for 99 percent of potential crop pest controls several decades ago (DeBach 1974). The value of natural pest control services at present is hard to estimate, but Naylor and Ehrlich (1997), correctly conclude: "Whatever the "precise" estimate, there is no question that the value of natural pest control services is … deserving of much more attention than it is currently receiving" (p. 167). Loss of natural pest control services is another possible explanation for the historic increase in pesticide use intensity nationwide and in California.

These forces, together, may be the explanation for a very troubling statistic: the percentage of crops lost to pests in 1989 was estimated to be greater than that in 1945 (13 percent versus 7 percent), despite a ten-fold increase in pesticide use in the U.S. over that time period (Quarles 1998). If this statistic is correct, and represents a long-term trend, current pesticide use is far greater than the level that would maximize farm profits.

Beneficial insects not only control pests, but also provide pollination services. A recent study of these services in Yolo County, California demonstrates the potential magnitude of their loss (Kremen, et al, 2001). Pollination "events" by native and domesticated honeybees were counted on organic and conventional farms with different types of neighboring land uses. Data from the study suggest that organic farms neighbored by conventional farms lose about 75 percent of the pollination services provided by native bees on organic farms that are adjacent to other organic farms, and that conventional farms neighbored by conventional farms lose about 87 percent of the pollination services provided by native bees on organic farms adjacent to other organic farms. The economic implications of this finding, or its applicability in general, are as yet unknown.[10] Yields may be lower due to less pollination, or pollination levels may be adequate because other native insects or rented honeybee colonies make up for lost native bee services. Nonetheless, it is reasonable to believe that California farmers are incurring some level of tangible financial pollination-related costs as an indirect consequence of excess pesticide use.

None of our analysis implies that pesticide use, of some types and at some levels, is economically undesirable. But farmers need to become more aware of the indirect financial benefits that would likely result from reduced pesticide use.

Farm suppliers should also become more aware of the opportunities that sustainable agricultural practices create. For example, the number of non-toxic, alternative pest control products available to growers increased eight-fold between 1986 and 1999, with more than 400 products now on the market. The number of companies marketing these products increased from 40 to 100 during that period.[11]

Pesticide manufacturers may argue that increased mill fees and reduced pesticide use will harm their business, but that is not necessarily the case. Those that innovate in the area of pest management may do very well under a combination of pesticide use reduction and safe standards policies. Pesticide manufacturers, however, will need to hire and invest in ecologists and biological knowledge, not just organic chemistry and genetic engineering. The knowledge-intensive character of low-pesticide use growing practices may also create more jobs than are lost in chemical production, distribution, and application. This is an important possibility that should be addressed in future policy research.

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[10] Estimates of the national economic value of crop pollination by native bees vary from $8.7 to $34.8 billion annually (Kremen, et al, 2000). See for example Southwick and Southwick Jr. (1992) and Robinson, Nowogrodzki, and Morse (1989).

[11] Analysis by Shawn King, Berkeley Integral Resource Center, cited in Holmes, et al, (2001).

Benefits for Taxpayers

Taxpayers also bear many of the costs of pesticide use that are not included in the price of pesticides. A simple example is the portion of the CDPR budget that is provided from the California General Fund (around $15 million). The budget of DPR would be zero if pesticides were not used at all. This is a simple test for reasonably quantifiable costs of pesticide use. Taxpayers would benefit from increasing the mill fee enough to fully fund the CDPR.

Similarly, under this test, some parts of the budgets of other state agencies are hidden costs of pesticide use. In particular, it is reasonable to believe that pesticide use is directly responsible for some part of the $1.6 billion budget for environmental protection and the $25 billion budget for MediCal in the 2001-2002 fiscal year budget. Such costs would include, for example, routine monitoring for pesticides in water sources, investments in pesticide removal treatment processes, costs incurred by the Attorney General's office when enforcing pesticide related environmental regulations, and emergency room or hospitalization services for persons with acute pesticide poisoning.[12]

Credible estimates of the "pesticide portion" of the California budget are not available. One study estimated that there are $2 of social costs for every $1 of pesticide spending on farms (Pimental 1993). Since pesticide expenditures in California agriculture were over $1 billion in 1998, unaccounted for but real social costs from pesticide use in California could be over $2 billion per year. If so, a 25 percent reduction in pesticide use would create social benefits of around $500 million in addition to the $250 million reduction in direct spending to purchase pesticides.

Since non-agricultural uses of pesticides also have hidden costs that are not included in pesticide prices, but would be (at least in part) if the mill fee were increased, potential benefits to taxpayers or the public are even larger. Realistically, state agencies could prepare estimates of reasonably quantifiable expenses they incur that are the direct result of pesticide use. *Even if reasonably quantifiable expenses amount to a small percentage of the potential total (i.e., 10 percent of $2 billion), a shift of funding burden from the General Fund to the mill fee would be a significant benefit for California taxpayers.*

Improved Health and Environmental Quality

Most Californians would benefit from a transition to sustainable, knowledge-intensive pest management practices. Economic and population growth increasingly burden and fragment California's natural systems and cause millions of acres of high-quality, agricultural land to be converted to urban and suburban uses. New suburban homes adjacent to intensively cultivated farmland create health concerns for residents and operational constraints for farmers. Increasing demand for water and water-based recreation are in conflict with the currently poor quality of agricultural and urban runoff. Reconciling these conflicts is a critical policy challenge in the first decades of the 21st Century. *We believe that pesticide policies that actively promote knowledge-intensive pest management practices are necessary to overcome these challenges, and would strengthen rather than burden the California economy, while improving human health and environmental quality.*

Highly Toxic Pesticides Are Widely Used

Pesticides that are known to be highly toxic are widely used in California. The CDPR currently tracks the use of chemicals known to cause damage to human and animal health and the environment. According to CDPR (2000) records for 1999, chemicals in four categories made up the following percentages by weight of the total reported pesticide use;[13] pesticides listed by the U.S. EPA as B2[14] or worse carcinogens or on the Proposition 65 list of chemicals known to cause cancer, 17 percent (34.3 million lbs.); organophosphates and carbamate chemicals (potential causes of acute neurological health problems), 6 percent (12.2 million lbs.); pesticides on CDPR's groundwater protection list, 1 percent (2.3 million lbs.); and pesticides from CDPR's

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[12] Thousands of such incidents occur annually in California; see Olle (2000) and Reeves, et al, (1999).

[13] These percentages are *not* additive since some chemicals are in more than one category.

[14] B2 carcinogens are defined by USEPA as probable human carcinogens based on sufficient evidence of carcinogenicity from animal studies with inadequate or no data from epidemiological studies in humans (as of the last review by EPA staff, we note). B1 carcinogens are probable human carcinogens with limited evidence from epidemiological studies of humans. Category A carcinogens are known human carcinogens generally based on epidemiological studies of humans.

[15] A cumulative acre is an acre that has received one application of pesticides. Cumulative acres are not the same as actual acres because pesticides are often applied more than once in a year to the same actual acre. For example, 66,788,926 cumulative acres of pesticide application occurred in 1999, on 8.5-9.0 million total planted acres (Susan Kegley, personal communication)

toxic air contaminants list, 13 percent (25.7 million lbs.). In 1999, about 30 percent (19.2 million cumulative acres) of total cumulative acres treated[15] were treated with pesticides from these four categories. By comparison, reduced risk and bio-pesticides together accounted for about 0.4 percent of pesticide use in 1999 by weight (0.7 million pounds) and were applied to about 4 percent (2.8 million cumulative acres) of cumulative acres treated. Detailed discussion of the relative toxicity and use patterns of pesticides in California is provided in Kegley (2000).

As an aside, these facts suggest that the opportunity to shift from the most toxic to the least toxic types of pesticides is large.

Pesticide Transport and Exposure is Widespread

In an ideal world, pesticides would be applied only to the exact places where they would do the most good and would stay there after application. In the real world, some amount of pesticide transport is inevitable. There are many reports that document the widespread transport of pesticides in California and other settings, and the exposure to humans and non-humans that occurs when substances are dispersed throughout the environment.[16] Exposure is difficult to prove because it requires measuring air or water quality at the times and in the places where people or animals come into contact with polluted air or water. Exposure is the logical outcome, however, if widespread transport from the point of use has been demonstrated. A few reports and websites that provide references for the numerous studies of pesticide transport and exposure in California are: Sanders (1996); Ross and Kaplan (1998); USGS (1998); Heavner (1999); Davidson, Shafer, and Jennings (2001); Gray, Ross, and Walker (2001); Lu, et al (2001); and www.cdc.gov/nceh/dls/report, and www.cdpr.ca.gov/docs/dprdocs/methbrom/mb_main.htm.

The USEPA and CDPR attempt to reduce pesticide transport by regulating product registration (i.e., formulations) and application procedures. But limiting transport of any substance at the concentration levels that are often of concern (parts per billion) is extraordinarily difficult, and perhaps impossible. That is, pesticide use inevitably involves some degree of health and environmental risk. Stated in another way, reducing pesticide use is a risk reduction policy that has been underutilized in California.

Human and Non-Human Health is Harmed by Exposure

The Physicians for Social Responsibility, an organization of over 18,000 health care professionals that was founded in 1961, recently prepared an extensive summary of the medical literature on pesticides and human health (Solomon, 2000). The summary is an outgrowth of years of work by the Greater San Francisco Bay Area and Los Angeles Chapters work to educate the medical community and the public about the linkages between environmental toxic exposures and human health. The PSR report includes chapters on dermatological effects, cancer, respiratory disease, neurological and behavioral effects, reproductive and developmental effects, and effects on the immune system.

Numerous, reputable, peer-reviewed studies are cited in each chapter to support the link between pesticide exposure and human health problems. Many of the long-term health impact studies of pesticide exposure are epidemiological; that is, they statistically compare occupationally or geographically pesticide-exposed groups of people with control groups that had much lower exposure to the pesticide(s) of concern. For example, a recent study of cancer mortality in Minnesota found that elevated mortality levels for seven cancers in four regions of the state were statistically more significant in those areas with the most intensive use of pesticides. (Schreinemachers, Creason, and Garry 1999)

There is also extensive evidence that exposure to many pesticides — even at low concentrations — is directly harmful to people, birds, fish, and the phytoplankton and zooplankton that are the foundation of the aquatic food chain. For example, around 67 million bird deaths per year are estimated to occur on U.S. farmland due to ingestion of pesticides (Pimental, et al, 1993). Reduced photosynthetic activity or reproductive success at the base of the food chain also creates an indirect, negative effect on all species in the aquatic habitat, including fish, birds, and terrestrial animals that feed on fish or birds. Appendix 2 in Kegley, Neumeister, and Martin (1999) summarizes pesticide toxicity data for birds, phytoplankton, zooplankton, fish, and bees.

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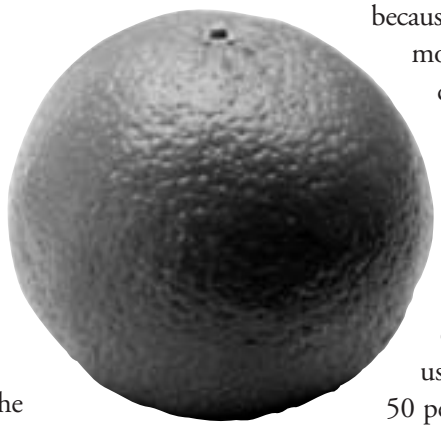
[16] Making pesticide application more precise, and reducing transport from the point of application, are not just good for health and the environment but are also financial opportunities. Technological advances in application and formulation technologies are more highly rewarded at higher pesticide prices since avoided pesticide expenses are higher. Business opportunities and rates of return for knowledge-intensive pest management technologies will be enhanced by an increase in the pesticide mill fee.

A Policy Proposal

Establish a 50 percent Use Reduction Objective for Higher Risk Pesticides

Establishing a use reduction objective would create equality between safe-use and less-use regulatory approaches in California pesticide regulation. Combinations of safe standards and use-reduction policies have been implemented effectively in other states and countries. Dramatically reducing the use of higher-risk pesticides would mean that the inevitable mistakes that occur under all regulatory monitoring and enforcement systems for safe standards would have fewer human health or environmental impacts. It might also reduce the regulatory burden on pesticide users.



Significantly Increase Revenues from the Mill Fee

The CDPR budget currently includes about $15 million of General Fund support and $9 million from unexpended mill fee collections in previous years. This means that a doubling of the mill fee is approximately necessary to fully fund the CDPR. To fund a regulatory policy of investing in sustainable pest management at the same level as the traditional regulatory approach would therefore require, approximately, a quadrupling of the current mill fee. Four times the current fee of 1.75 percent is 7.0 percent. Even when added to sales tax on pesticides, the combined level of tax plus fee would be lower than federal plus state tax on gasoline, tobacco, or alcohol. [17]

One hundred and twenty million dollars of revenue each year — four times current revenue — would allow the General Fund contribution to the CDPR budget to become zero and would provide adequate, and perhaps sufficient, funding to dramatically increase promotion of "clean" pest management technologies and techniques in all sectors of pesticide use, not just agriculture. This revenue level is very modest compared with the previously cited estimate of over $2 billion of pesticide-related costs that are currently not included in the price of pesticides but are borne by the public, indirectly.

Create Tiers in the Mill Fee

We propose a tiered fee structure — for example 5 percent for reduced risk, biopesticides, and other pesticides authorized for use on organic farms, 15 percent for the high-risk categories of pesticides already tracked by the CDPR, and 10 percent for all other pesticides. Tiered fees are sometimes perceived as an incentive device, but that is not our primary reason for proposing them. We propose them because a tiered structure is the most transparent and equitable for pesticide users. Those who use higher toxicity substances should pay more; those who use less should pay less; those who use none at all shouldn't pay at all. In addition, a three-tier fee structure is proposed because newer formulations of less-toxic pesticides cost more than older formulations of more toxic pesticides. A uniform ad valorem (percentage) [18] mill fee would unfairly burden those who use lower toxicity, higher priced pesticides.

A three-tier structure as described might initially generate about $120 million per year.[19] Revenue would decline when pesticide use declines, but the need for reform of pesticide use practices would decline as well. The case of a 50 percent reduction in *total* pesticide use spread equally across all three categories would reduce revenue to about $60 million per year. This would be enough to fully fund the CDPR at its current size.

Any politically feasible increase in the mill fee is unlikely to be high enough to significantly reduce pesticide usage

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[17] Fees and taxes are differentiated by a legal principle established by the Court in the Sinclair Paint decision. A revenue source is a fee when revenue is expended in ways that have a "reasonable nexus" with the activity upon which the fee is imposed. A revenue source is a tax when a reasonable nexus does not exist. Fees require a simple majority approval of the legislature, while taxes require a 2/3 majority. Spending to study, monitor, and mitigate impacts of pesticide use (including all activities of the CDPR) has a reasonable nexus with pesticide use, hence our use of the word "tax" only when referring to the existing sales tax on pesticides.

[18] An ad valorem fee or fees is the most practical approach in California because it builds on the existing system, which is relatively simple to administer. Specific fees (e.g., $1.00 per pound of active ingredient) might be useful in some situations. See Pease, et al, (1996) and Archer and Shogren (2001) for discussion of the advantages and disadvantages of fee design options.

[19] This revenue estimate is within "the ballpark," but not more accurate, because it assumes that pesticides in each tier have the same average pre-fee price per pound.

in and of itself. For example, a measurable change in pesticide use did not occur when the mill fee was raised from 9 to 22 in 1993 (0.9 percent to 2.2 percent). The elasticity[20] of pesticide use in agriculture is reported by McIntosh and Williams (1992) and Capalbo and Vo (1998) as varying from about -0.1 to -0.5. If accurate for California pesticide use, this range of elasticity implies that a 10 percent increase in the price of pesticides would cause a reduction in use of somewhere between one and five percent (1-5 percent). Reductions in use (and therefore revenue) will probably be much larger than 1-5 percent, based on experience elsewhere with policies of this type, but an important driving force for such reductions is the effect of public investment in "clean" pest management as a strong reinforcement of the price signal created directly by the tiered mill fee.

Phase-in the New Fee Schedule

An often-overlooked economic insight is that people change their behavior not just to today's price, but also to expected future prices. The Belgium government has used this insight to very successfully stimulate adoption of "clean technology" in the area of solid waste disposal. For example, they legislatively adopted a significant fee on the disposal of disposable cameras, but scheduled implementation of the fee to occur several years after the initial legislative approval. Camera manufacturers used the interim period to re-design disposable cameras so that they could take back and reuse nearly all components of the camera. When the fee was implemented, very little revenue was generated, but the disposal problem had mostly been solved. The Belgians call this strategy "the stick behind the door."

California should phase-in a permanent, increased, multi-tier pesticide fee system. Pesticide users will have a chance to avoid paying the fee if low-cost alternatives exist. If such alternatives do not exist, pesticide users will have time to prepare for the financial impact of paying higher fees. Phasing in fees is similar, in concept, to past regulatory decisions to phase particularly damaging chemicals out of use: e.g., methyl bromide (a soil fumigant) in agriculture and chlorofluorocarbons (ozone depleting chemicals) in manufacturing. For discussion purposes, we propose that the 5,10, and 15 percent fee system be implemented in three steps: an increase to 5 percent for all pesticides subject to fees on July 1, 2003, a step up to the 10 percent level two years later for pesticides that are not approved for organic farms or in the reduced risk or bio-pesticide categories, and a step up to the 15 percent level two years after that for the most toxic category of pesticides.

Invest Heavily in Transitional Assistance

For farmers, making the transition from conventional to organic farming practices is often prohibitively expensive. Obstacles that farmers must overcome to make the transition are well documented in a recent report from the Funders Agriculture Working Group (Holmes, et al, 2001).

Doing anything differently than in the past is always somewhat difficult and risky. Farmers and other significant users of pesticides who make the effort to reduce pesticide use and/or shift to lower-toxicity pesticides should be financially rewarded and supported during the transition. For example, the State of Minnesota has recently adopted legislation that will pay for 2/3 of the cost of becoming a certified organic farmer (Organic Gardening Magazine, Jan/Feb, 2000), in addition to general information and technical assistance. Sweden, Germany, Norway, Finland, Austria and Switzerland are reported to have adopted similar policies and experienced dramatic increases in the size of their organic farming sectors as a result (Welsh 1999). Based on these experiences, we propose that a high percentage (e.g., 80 percent) of public investment in pesticide use reduction be earmarked for direct transitional assistance payments.

Build on Past Successes

Another priority for investment in pesticide use reduction should be increased funding for successful, existing programs. And although the focus of this report has been on pesticide use in production agriculture, pesticide use reduction has been studied and implemented cost-effectively in a variety of settings (Lynch, et al, 2000). As described previously in this report, pesticide use reduction programs in California have been funded at much lower levels than "safe standard" pesticide use regulation. Yet both policies reduce health and environmental risks. Just as driving a well-built car will reduce the risk of injury from an automobile accident, driving fewer miles will also reduce that risk. California can provide adequate funding for both regulatory approaches, rather than arguing that one is better than the other.

[20] The price elasticity of demand referred to here is defined as the percentage change in quantity used per percent increase in price.

Next Steps

We strongly recommend four next steps:

1. Urge the CDPR to create a format and deliberative process that ensures the independence of the committee created by AB780 from all individual stakeholder groups, including the CDPR. The results of committee work will not be credible unless the committee has substantial control over its agenda and activities, and stakeholder groups exercise control equally.

2. Press the committee for an early commitment to renewal of the mill fee at some level and in some form so that their agenda in the coming year can focus on the difficult practical issues that must be addressed (e.g., the fee system design, and spending priorities).

3. Urge the Governor or a legislative sponsor to create a broad inter-agency task force — including air, water, and health regulatory agencies, and University of California representatives, as well as CDPR and CDFA — to investigate the economic opportunity for California agriculture from a transition to knowledge-intensive, sustainable agriculture that continues the current trend toward specialization in high value crops. The win-win pesticide reform opportunity that exists in California at present is too important to leave entirely to the AB780 subcommittee of the Pest Management Advisory Committee (PMAC) of the CDPR.

   In particular, the inter-agency taskforce should perform a comprehensive review of current programs and proposals to promote reduction in pesticide use (e.g., those named in Section IV.F) or to make a full transition to sustainable agriculture.[21] These programs should be coordinated or fully integrated if public investment in sustainable agriculture is increased significantly.

4. Urge the Governor or a legislative sponsor to require the Department of Finance and other state agencies to estimate reasonably quantifiable costs of pesticide use that are currently "buried" in their budgets, and to report their findings to the legislature, the CDPR, and the inter-agency task force.

These steps will not be easy to take. They will not be taken at all unless the seriousness of the problems associated with pesticide use — for human health and the environment, farm profitability, and state finance — are acknowledged.

The biggest obstacle to reform of pesticide regulation and use practices in California has been an unwillingness to acknowledge that serious problems exist — despite decades of safe standards regulation.

The pesticide mill fee renewal issue and the economic condition of California agriculture, together, create an excellent opportunity for environmental, agricultural, labor, and consumer interests to cooperate effectively. Californians of many stripes need to recognize the commonality of the problems, and work together to solve them.

California's farmers have been consistent innovators in the past. They will continue to innovate whenever doing so is necessary or profitable. But old ways of doing things are remarkably persistent. The use of highly toxic pesticides will continue to be the primary approach to pest management unless public policy, backed up by public investment, encourages and rewards farmers who innovate in this area.

Now is the time to take advantage of proven opportunities to increase farm profitability and to do what the public has wanted for years.[22] We believe that renewing and significantly increasing the mill fee, with re-investment of revenues in the transition to sustainable pest management practices, is good for farmers, taxpayers, and Californians.

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[21] FAWG (2001) and Holmes, et.al., (2001) are highly relevant, recent documents that address these questions.

[22] The Center for Science in the Public Interest found that 86 percent of Americans in 1995 thought federal and state agencies should teach farmers to use fewer pesticides.

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Appendix: Historical Cost and Expenditure Data

Table A-1

Historical Expenditures for Pesticides in the United States

	'80	'85	'90	'92	'94	'96	'98
Crop Sales (billions)	$64.4	$74.1	$83.3	$89.0	$100.4	$115.4	$102.0
Pesticide Expenditures (billions)	$3.5	$4.3	$5.4	$6.3	$7.2	$8.5	$9.1
Indicator Ratio Derived from the Data							
Expenditure/ Crop Sales	5.43%	5.80%	6.48%	7.30%	7.17%	7.37%	8.92%

Source: Table 1108 of U.S. Census Bureau (2000). Original source is data in reports of the Economic Research Service of the U.S. Department of Agriculture (1999).

Table A-2

Cost Time Series For Carrots in the Imperial Valley

	'72	'75	'82	'87	'92	'94	'01
Pesticide Cost per Acre (Material Only)	$52.26	$90.00	$85.00	$126.03	$258.90	$296.20	$275.50
Total Cash Costs Per Acre	$1,691.11	$2,231.25	$3,449.65	$4,179.63	$4,612.35	$4,667.87	$4,687.50
Pesticide Cost as a Percent of Total Cash Costs	3.09%	4.03%	2.46%	3.02%	5.61%	6.35%	5.88%

Source: UC Agricultural Extension Cost and Return Studies for the Listed Years.
Available at: www.agecon.ucdavis.edu/outreach/crop/cost.htm, or from Extension staff

Table A-3

Cost Time Series For Rice in California

	Agricultural Chemical Costs[1] per Planted[1] Acre (in Millions)	Total Cash Costs Per Acre	Agricultural Chemical Costs[1] as a Percent of Total Cash Costs
1986	$49.11	$456.45	10.76%
1987	$47.96	$437.75	10.96%
1988	$48.74	$445.65	10.94%
1989	$50.66	$472.58	10.72%
1990	$53.34	$489.56	10.90%
1991	$57.94	$498.76	11.62%
1992	$65.77	$579.23	11.35%
1993	$68.25	$613.31	11.13%
1994	$71.52	$638.16	11.21%
1995	$79.82	$647.68	12.32%
1996	$83.20	$674.25	12.34%
1997	$83.76	$703.48	11.91%
1998	$83.76	$673.81	12.43%
1999	$84.32	$657.36	12.83%

Source: Survey Data from the Economic Research Service (ERS) of the USDA, obtained via personal communication with William McBride, ERS

[1] Agricultural chemicals are primarily pesticides. Fertilizers, lime, and fuel are categorized separately.

Table A-4

Cost Time Series For Strawberries in Santa Cruz & Monterey Counties

	'76	'80	'85	'90	'96	'01
Pest Management Cost per Acre, Including Labor[1]	$1,396.10	$2,109.81	$3,121.84	$3,838.87	$3,517.78	$4,083.00
Total Cash Cost Per Acre[1]	$12,575.61	$18,518.60	$21,274.34	$27,302.97	$28,153.06	$28,954.00
Pest Management Cost as a Percent of Total Cash Cost	11.10%	11.39%	14.67%	14.06%	12.50%	14.10%

Source: UC Agricultural Extension Cost and Return Studies for the Listed Years. Available at: www.agecon.ucdavis.edu/outreach/crop/cost.htm, or from Extension staff

[1] Costs are for two years; establishment and one year of harvest.

Table A-5

Cost Time Series For Almonds in the Southern San Joaquin Valley

	'76	'80	'85	'89	'97
Pest Management Cost per Acre, Including Labor[1]	$205.60	$705.90	$905.00	$937.00	$1,804.00
Total Cash Cost Per Acre[1]	$1437.10	$3,027.09	$3,568.00	$3,895.00	$6,248.00
Pest Management Cost as a Percent of Total Cash Cost	14.31%	23.32%	25.36%	24.06%	28.87%

Source: UC Agricultural Extension Cost and Return Studies for the Listed Years. Available at: www.agecon.ucdavis.edu/outreach/crop/cost.htm, or from Extension staff

[1] Costs are usually for five years; establishment in year one and four years thereafter. Only four years of information were available in the 1976 report, however.

Acknowledgements

Many people provided information or comments on various drafts of this report. The significant efforts of Susan Kegley (Pesticide Action Network of North America) and Antonia Scatton (Ecoventure) are especially appreciated. Others whose help was invaluable include, in alphabetical order: Marco Barzman, Jenny Broome, and Janet Caprile (University of California, Davis), Nick Cain (Pacific Institute), David Chatfield (Californians for Pesticide Reform), Rich Demoura (University of California, Davis), Mark Glickman (Redefining Progress), Lenny Goldberg (California Tax Reform Association), Dan Jacobson (CalPIRG), Karen Klonsky (University of California, Davis), Doug Linney (Ecoventure), William McBride (Economic Research Service, USDA), Allison Pratt (California Tax Reform Association), and Bill Walker (Environmental Working Group). We also gratefully acknowledge the indirect financial support of the Educational Foundation of America, the W. Alton Jones Foundation, the Clarence E. Heller Charitable Foundation, the Sydney Stern Memorial Trust, and the Steven and Michele Kirsch Foundation.

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