Bee-conomics and the Leap in Pollination Fees

by

Daniel A. Sumner and Hayley Boriss

Commercial pollination services are mostly provided by honeybees through a long-standing and well-organized market. Recently, honeybee pests and other problems have reduced available supplies, while expansion of almond acreage has increased peak-season demand. The resulting leap in pollination fees follows from these market fundamentals.

According to entomologists and other experts, over the past decade populations of pollinators available to service California agriculture have fallen steadily. At the same time, demand for pollination services, especially during the peak period of February and early March, has risen and seems poised to rise even further. One reflection of this situation and outlook is that, from 2004 to 2006, the price of honeybees to pollinate California almonds has jumped from about $54 per colony to about $136 per colony (Figure 1). This article examines the forces behind these market adjustments and some of the consequences for California agriculture.

Much of California agriculture depends on pollination services. While some pollination is by wild insects and other feral pollinators (including some birds and even bats) a major share of pollination services to agriculture is provided by bees, especially commercial honeybee colonies.

The status of pollinators in California and the rest of the United States has attracted national attention. Observers have questioned the future availability of pollination services for important agricultural crops and whether government policy should be marshaled to enhance or ensure the supply of pollination services. As a reflection of these concerns, the National Academy of Sciences created a multidisciplinary committee on the Status of Pollinators in North America to determine the outlook for pollinators and potential policy implications.

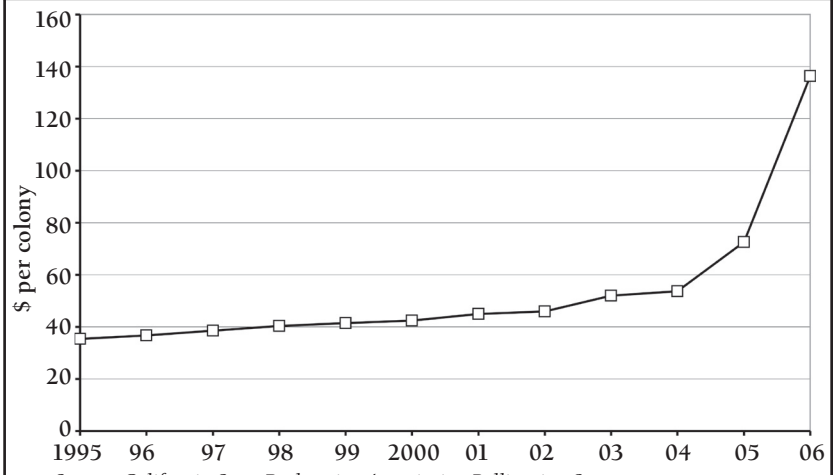
Industry participants and observers express concerns over the spread of pests and diseases and loss of habitat that affect the role of pollinators in the ecosystem generally. Here we will leave aside these broader public-good or externality issues and focus on the services that the commercial pollination industry provides to crop agriculture.

Despite the common metaphor of an unpriced benefit that spills over between pollination and production of honey, in fact, the commercial market for pollination services has been well established for many decades. For example, economists have explained the creation of the market for pollination services in the California alfalfa industry between 1949 and 1951 and the efficiency of the market for pollination of apples in Washington State. Econometric work has also documented the linkages between the honey and pollination markets.

The Supply and Demand Issues and Operation of the Pollination Market

Many honeybees used for pollination in California arrive from other states and often pollinate more than one crop—either here or in other states. Most of these bees also produce commercial honey, either while they are in California or in their home states. Some crops, such as clover, provide nectar for honey while others, such as almonds, are not valuable as sources for commercial honey production. Data from bees based in the Pacific Northwest, indicate that the average fee for pollination services on valuable honey crops is about

Figure 1. Average Almond Pollination Fee, 1995-2006



Source: California State Beekeeping Association Pollination Surveys
Note: 2006 is a forecast.

Table 1. Honeybee Pollination Months for Representative Crops

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Alfalfa Seed									
Almonds									
Apples									
Avocados									
Cherries (late)									
Cherries (early)									
Plums									
Sunflower									

Sources: Traynor, J., "Tree Crop Pollination in California," available at: http://aoi.com.au/acotanc/Papers/Traynor-1/index.htm
Joe Traynor and Eric Mussen: personal communication
UC Davis ARE Department cost and return studies available at: http://coststudies.ucdavis.edu
UC ANR 1999 alfalfa symposium proceedings available at:http://ucanr.org/alf_symp/1999/99-76.pdf

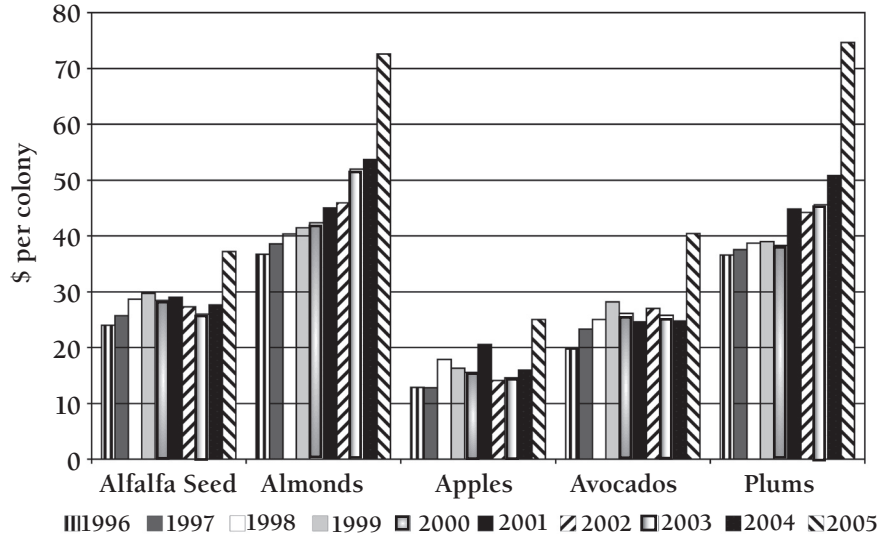
50 percent below the fee for crops that do not provide nectar valuable for honey.

While data are limited, it appears that prices and quantities of pollination services have been reasonably responsive to supply and demand drivers in recent years. The USDA National Agricultural Statistics Service estimates that the number of U.S honey-producing colonies has decreased from 3.4 million in 1989 to about 2.5 million colonies in 2004. Several factors have affected the supply of commercial honeybee colonies recently. First, a jump in the price of honey in 2002 and 2003, and a subsequent drop back to earlier levels, likely affected honeybee populations and the availability of bees for pollination services. Second, the Varroa mite has been spreading with severe effects on winterkill and colony health and vigor. The California State Beekeepers survey estimated that the winter mortality rate doubled from 15 percent in 2003/2004 to 29.6 percent in 2004/2005. (The Varroa mite is also thought to have destroyed most of the feral bee populations, increasing producer dependence on commercial rental of colonies for pollination.) Furthermore, mites have developed resistance to the most common pesticides used for treatment. Finally, in recent months relaxation of restrictions on live-bee imports from New Zealand and Australia have offset some of these negative supply impacts.

On the demand side, the main driver has been the expansion of acreage of almonds, the crop most dependent on honeybee pollination. This increase in bearing acreage requiring commercial pollination services has increased the demand for honeybee services during the late winter months in California.

Table 1 presents the pollination periods for several crops pollinated by honeybees. Plums, some avocado orchards, and early blooming cherries compete with almonds for pollination in February and early March. Apples bloom in the spring directly after almonds, and alfalfa seed and sunflowers require pollination services during the summer months.

Figure 2. Average California Pollination Fees for Representative Crops, 1996-2005



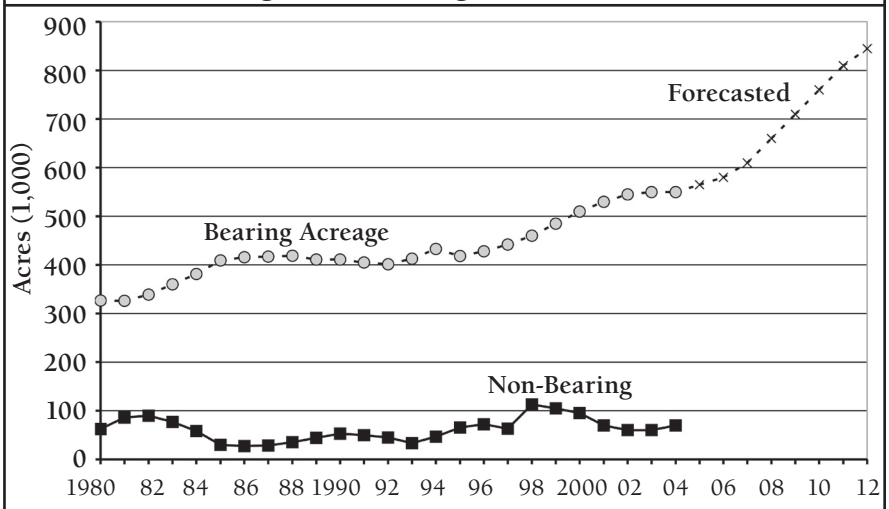
Source: California State Beekeeping Association Pollination Surveys

Figure 2, shows pollination fees from 1996 through 2005 for five important crops, and illustrates both the rise in peak-season pollination fees over the past ten years and the seasonal pattern across crops. Prices are highest and have risen most for almonds and plums, which compete for pollination. Almond production is fully dependent on pollination by honeybees during a six-week blooming period. With an average of about 2.5 hives per acre, pollination costs in 2005 were about $175 per acre. In

2006, using price projections from Figure 1, these pollination costs are expected be about $340 per acre, or about 15 percent of almond operating costs estimated by UC Davis almond budgets. These budgets are available on the Internet at http://coststudies.ucdavis.edu. At this level, pollination may become a significant curb on almond profitability and the expansion of almond acreage in California.

Figure 3 shows that almond acreage increased by 25 percent—from about 430 thousand acres in 1996 to about 550 thousand acres in 2004. The Almond Board of California projects that acreage will increase to more than 800 thousand acres by 2012. Using an estimate of 2.5 colonies per acre, almond acreage required roughly 1.4 million colonies in 2004. Therefore, if all the colonies used for almonds also produced honey sometime during the year, almost 60 percent of the 2.5 million colonies in the United States were required to pollinate almond orchards in 2004 and 2005. Given the growth in almond acreage projected for the next six years, we would expect California to require about two million colonies for almond pollination alone by 2012. This shift in demand, in the face of declining supply trends, has raised alarm among almond producers, pollinators and outside observers.

Figure 3. California Almond Acreage Bearing, Non-Bearing and Forecasted



Sources: USDA National Agricultural Statistics Service. Forecasts from California Almond Board.

Analysis of Longer Run Prospects

With almond acreage expanding rapidly relative to the other uses of pollinators, more and more honeybees will likely be "unemployed" for much of the rest of the pollination season. If most of the honeybees in the country are required in almond orchards in February and early March, many bees will face no further demand for their pollination services during the year. Since almonds do not provide nectar for commercial honey (the honey from almonds is unpalatable to humans), the honey revenue for these bees is also reduced when more of their effort is geared towards almonds. The result is that rather than receiving half or one third of their annual revenue from almonds, many commercial pollinators may now require almonds to cover most of their annual cost of colony maintenance. If this scenario develops as described, we may expect the pollination fee for almonds to remain high. The extreme pollination fee for almonds projected for 2006 seems very high relative to the long term cost of supplying honey bees for pollination during the peak season. Nonetheless with continuing mite problems and the almond crop demanding more than 60 percent of the national honeybee stock, we can expect fees to settle well above those of just a few years ago.Further, under this scenario, with more total bees in the system than otherwise, pollination fees for crops blooming in other seasons would fall, as would the price of honey.

In general, the increase in demand for pollination services during the peak season, together with the increase in costs for pollination services have implied higher pollination fees. This fee increase indicates a pollination market responding as expected to supply and demand signals and does not suggest a role for any particular government interventions, except perhaps additional price and quantity data to allow participants to better track the market.

Daniel Sumner is the director of the University of California Agricultural Issues Center and the Frank H. Buck, Jr. Professor in the Department of Agricultural and Resource Economics at UC Davis. Hayley Boriss is a Junior Research Specialist at the Agricultural Issue Center. *This brief paper derives from a presentation made by Sumner before the National Academy of Sciences committee on Status of Pollinators in North America in Irvine, California on January 14, 2006. The authors thank Joe Traynor, Scientific Agricultural Company, Eric Mussen, Extension Entomologist at UC Davis, and Walter Thurman, North Carolina State University, for information and guidance. We also thank members of the NAS committee for useful discussion.*