The medfly crisis:

Little research has been done on risk evaluation: how risks are perceived, what psychological and social factors influence perception, and how individuals interpret the impacts of events with uncertain consequences. The Mediterranean fruit fly eradication program provided an opportunity to assess public attitudes toward technological risks. This is a case study of 126 residents from a metropolitan area south of San Francisco, who, at the time, were undergoing exposure to aerial spraying with a pesticide.

The target pest, Mediterranean fruit fly (Ceratitis capitata), infested a large portion of Santa Clara County, spreading into Alameda, San Mateo, Stanislaus, and San Joaquin counties. Using both attitude and behavioral assessments, we took the opportunity to study persons immediately exposed to a technological event of limited but unknown risk, which was generating considerable public debate.

Research on the perception of potentially hazardous technologies suggests that as the degree of exposure to, and experience with, specific hazards increases, risk perception decreases. These findings lead to the conclusion that for those living in hazard-prone areas, it is easier to change attitudes about living in potential risk situations than to change residences. Other data suggest that increased exposure to, or experience with, specific dangerous conditions may serve to reinforce indifference than men. Younger subjects received benefit of technologies. High acceptability of risks appears to be influenced by other factors, such as perceived benefit of technologies. High acceptability may also result when (1) one is better informed of the benefits of or has heard less about the risks of the event; (2) social traditions and norms.

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favors acceptance: (3) experts are considered substantively competent, using optimal strategies, and serving the participants' interests. Finally, whether or not the protection is voluntary influences acceptance.

The study

The aerial spraying of malathion in Santa Clara County resembled other events involving public assessment of risk. The concern expressed was with the efficacy and safety of the manner of eradication. Attempts to eradicate the medfly by stripping fruit from trees, quarantining infested counties, and dispersing sterile flies had been publicly criticized. Differences among and within governmental agencies, agribusinesses, and technical experts and decision-makers had been highly visible in the media and the situation was politically charged. In addition, aerial spraying of such duration had never been tried in populous urban centers, and long-term effects had not yet been adequately studied.

We selected the community of Milpitas, in the center of the infestation area, as the survey site, from which we drew a random sample. After a brief telephone interview to solicit cooperation and to determine eligibility, we sent a mail questionnaire. Of the 218 phone contacts, 141 (65 percent) agreed to receive the survey, and 126 (58 percent) actually returned a completed questionnaire.

The Milpitas sample was 52 percent female, and the median family income was $31,322. Median educational level of the respondents was 13.7 years; age ranged from 15 to 74 years; and they were predominantly white. Most (51 percent) described their political ideology as moderate, 26 percent were conservative, and 23 percent indicated they considered themselves liberal (or radical). The sample characterized itself as well informed about the situation and about the protective behaviors recommended to avoid exposure to malathion spraying.

Four dependent variables were measured: degree of perceived health risk, degree of perceived environmental risk, number of precautions taken, and degree of acceptability. We determined degree of perceived risk by asking to what extent the ground and aerial sprayings presented health and environmental dangers. We asked if aerial spraying (and again ground spraying) was of serious, moderate, slight, or no hazard to humans. The health risk scale was constructed by summing scores on these two items. Two similar items were used to build an environmental risk scale.

We constructed a behavioral response variable by summing the number of precautions taken, the nature of which would imply efforts to protect personal human health. It was presumed that the higher the number of precautions taken, the greater the perceived risk. Questions were phrased as exceptions to the respondent’s normal behavior (for example, “did you stay indoors but otherwise would not have”).

To measure acceptability, two questions addressed the level of agreement with eradication methods, both aerial and ground. The acceptability scale was constructed by summing responses across these questions.

The questionnaire yielded information on a large number of potential predictor variables, such as sex, age, education, political ideology, and the presence of children. Experience with chemicals was elicited from a list of items regarding use of pesticides in four settings. Knowledge of pesticides was composed from items related to ability to identify chemicals used in past experience, poisoning symptoms, and self-rankings on level of knowledge. Total amount of spraying experienced was merely the sum of aerial sprayings that occurred until the survey ended.

Confidence in experts was measured by summing agree/disagree responses to three statements: (1) “Scientists and industry experts have done detailed studies on the health effects of pesticides.” (2) “The information experts have used to protect the public from pesticide injuries.” (3) “If used according to instructions and warnings on the labels, pesticides are completely safe for home use.” A significant media event was identified after reviewing the major newspaper, San Jose Mercury-News, from the date of the first spraying in Milpitas to the end of the survey period. During one two-day period (August 23-24, 1981) medfly coverage exceeded 1,500 column inches, almost four times the amount of exposure given before and after these dates. Responses to questionnaires completed before and after the event were compared.

Finally, a measure of perceived benefit was derived from “yes” or “no” responses by Milpitans to a question on whether the eradication decisions were made in their best interest.

Risk perception

We expected a perception of high risk, because subjects had little control over the spraying and its uncertain consequences. In addition, exposure to aerial application was involuntary. Only 35 percent indicated perceiving serious risks to humans from the aerial method, and only 40 percent felt there were serious dangers to the environment.

Behavioral response contrasted sharply with these expressions; 94 percent of the total sample took at least one precaution. Specific precautions were recommended to residents through the local news media and specially distributed flyers, and most precautions could be easily executed. Of the respondents, 64 percent said they stayed indoors, 73 percent closed windows and doors, and 50 percent washed objects exposed to spray.

As a subgroup, parents with children under the age of 12 took more precautions than the sample as a whole. For instance, 21 percent (parents) reported having left town to avoid aerial spraying, as opposed to 9 percent of the total; 75 percent stayed inside, as opposed to 64 percent of the total; and over 4 percent used protective clothing, whereas only 2 percent of the total sample took this precaution.

The high proportion of those taking precautionary measures suggests that...
participants actually perceived a greater health risk than they were willing to admit directly. On the other hand, the low frequency of expressed risk may reflect an assumption that protective measures were adequate to mitigate potential harm. This possibility suggests that risk perceptions must also be evaluated in the context of available safeguards.

Variations in perception

As in other studies, women tended to perceive a higher risk to health (30 percent) and environment (33 percent) than men did (18 and 26 percent, respectively), but this difference did not reach statistical significance in our sample. Also, as others have observed, younger respondents expressed a greater concern over health and environment than the older respondents, but not significantly so. Although a larger proportion of those with college degrees perceived the chemical uses as presenting a high environmental risk — an observation supporting prior studies on environmental concern — this difference did not reach statistical significance either. Thus, the effects of sex, age, and education were all in the expected direction but were not of sufficient magnitude to be regarded as reliable.

Even though experience with and knowledge of pesticides approached significance (p < 0.10) in influencing the perception of health risks, both were clearly nonpredictive regarding perceived environmental dangers. Greater perception of risk to health was associated with low experience and knowledge. The number of aerial pesticide applications experienced had virtually no predictive value in the present study.

Four factors were reliable predictors of health and environmental risks. Respondents with the least confidence in industry safeguards expressed the highest degree of perceived risk. Conservatives perceived the least risk in the spraying situation, and liberals perceived the most. The press had great influence: respondents questioned after the media event perceived considerably more environmental risk than those polled before the event. And finally, as expected, those believing the eradication program was beneficial expressed little worry about the attendant risks, compared with those seeing no benefit.

Each predictor was examined a second time with the influence of the other three first extracted through statistical procedures. All significant predictors of the perception of health risk (confidence in experts, political affiliation, and perceived benefit) continued to be significant and accounted for 24 percent of the variance in perception. Political ideology dropped out as a predictor of the perception of environmental risks when the regression analysis was completed. This result suggests that political ideology operates only indirectly in influencing the perception of environmental risk, perhaps by influencing confidence in experts and perceived benefits. The remaining three variables accounted for 23 percent of the variance in perceived environmental risk.

Acceptability of risks

Five variables reliably predicted acceptability of malathion spraying. Those expressing less confidence in experts indicated less acceptability, and liberals were less accepting than conservatives. Acceptability increased with higher perceived benefit. High health and environmental risks were associated with less acceptability.

When each predictor was re-examined with all other significant predictors extracted, only perceived health risk ($F_{1,90} = 6.96, p < 0.01$) and perceived environmental risk ($F_{1,90} = 4.326, p < 0.05$) were significant predictors. These results suggest that, in the present situation, acceptance was primarily influenced by one's opinion of the health and environmental hazards involved. Political ideology, confidence in experts, perceived benefits, and the media event all influenced risk acceptability by influencing perception of health risks. Nevertheless, both health and environmental risk perceptions contained variance unaccounted for by these other variables, and both remained predictive when all other predictors were statistically controlled. These two variables accounted for 50 percent of the variance in acceptability.

Influence over decisions

Finally, we considered the perceived influence of citizens on the decision-making processes. Respondents were asked to indicate the six most influential aspects of the eradication program ranked themselves low in influence on decisions.

Past research focused on attitudes toward use of pesticides and other hazardous substances. However, in-depth work is needed on the relationship between one's personal experience with such substances and one's perception of their risks and benefits. In addition, the mass abdication of control over circumstances with potentially harmful effects is attributable to more than an indoctrination and belief in democracy. Future studies in the area of risk assessment could provide valuable insight into individual decision-making acceptance of risks under various circumstances, and the perception of elected officials and industry experts.
In a state known for innovation in technology and business, agriculture remains California's largest, most dynamic industry. Each year the state's 82,000 farms and ranches produce nearly 250 agricultural commodities worth billions of dollars — an unparalleled array of fruits, vegetables, animal and dairy products, and ornamental plants for millions of consumers around the world.

Contributing to this productivity are the nine agricultural field stations maintained by the University of California throughout the state. The charge of these field stations, administered by the University's Agricultural Experiment Station under the Division of Agricultural Sciences, is to provide land, labor, and facilities to researchers in agriculture and to aid in public education in matters relating to agriculture and agricultural research.

With more than 70 years of achievement to draw upon, California’s agricultural field stations are an essential part of the University’s commitment to agriculture and to extension of the benefits of public research to every citizen.

The field stations range the length of the state, from Imperial Valley on the Mexico-California border, to Tulelake on the Oregon-California border. They are strategically situated in California’s major climatic zones: the north and central coasts, the high mountain valleys and ranges of the Sierra Nevada, the arid regions of southern California, and the prolific Sacramento and San Joaquin valleys. Each station serves a unique set of local or regional needs and provides manpower, equipment, and facilities to fulfill all field and laboratory requirements for on-station basic or applied research.

Field station research falls into two categories: basic research designed to probe the fundamental processes of organisms and their interactions with the physical world, and applied studies that translate into practical innovations to solve a wide variety of specific agricultural problems. The extraordinary range of crops and growing conditions represented in California makes the state an ideal laboratory for the development of solutions to agricultural concerns around the world, and the field stations attract thousands of visiting researchers and farm representatives each year.

Any scientist within the UC Division of Agriculture and Natural Resources may conduct a research project on a field station, provided the project is recommended by a research review committee, funding is available, and the station has space for the project. The hundreds of projects in progress at the nine stations range from long-term research to short-term experiments testing untried, creative approaches. In addition to University scientists, researchers from federal, state, and local agencies use field station facilities.

Cooperative Extension staff members play a major role in field station activities. Through Extension, research results are made available to other investigators, farmers, consumers, environmental groups, government officials, and the public.

Communicating the results of field station research can take the form of tours, seminars, lectures, bulletins, and public field days, providing visitors with a first-hand look at scientific work in progress. Numerous technical articles by researchers and project leaders are published as a result of field station work.

The field stations also serve as educational resources for students in agricultural sciences, providing “hands-on” learning opportunities through work-study programs and short courses. By providing dormitory living space, the University encourages its students to conduct research on the stations.

Collectively, the stations have 12,000 acres available for use and physical plant space of 335,000 square feet. A large inventory of farm equipment is available for research projects along with irrigation water, barns, pastures, range feedlots, laboratories, and laboratory equipment.

The main systemwide administrative office for the nine Agricultural Field Stations is on the University of California Davis campus. Policies and procedures, fiscal and personnel matters, as well as physical plant construction and maintenance for all stations, are managed from this office.

The public may visit the field stations by making arrangements in advance with the Davis administrative headquarters. The address is: Agricultural Field Stations, University of California, Davis, CA 95616. Telephone: (916) 752-0126.

Harold R. Myers, Director
Agricultural Field Stations
Desert feedlot
Winter vegetable crops
Mixing experimental feed ration

IMPERIAL VALLEY FIELD STATION
1004 East Holton Road
El Centro, CA 92243
(619) 352-0111

Research emphasis: Desert agriculture field crops, alfalfa breeding, vegetable crops, livestock environmental and feedlot management, irrigation and drainage management

Size: 255 acres
Climate zone: Interior desert valley
Terrain: Flat alluvial plain below sea level
Average annual rainfall: 2.65 inches
Seasonal temperatures:
Annual mean: 72.6°F
Summer: Maximum monthly mean – 92.2°F
Winter: Minimum monthly mean – 53.6°F
Elevation: −60 feet

Imperial Valley

The desert climate of southern California’s Imperial Valley provides favorable conditions for growing many vegetable, grain, and field crops under irrigation. The field station at El Centro, only eight miles from the U.S.-Mexico border, is a highly diversified center for agricultural research, conducting studies in such areas as vegetable crop breeding and culture, irrigation management, soil salinity, improved varieties of grain and forage crops, and control of various insects and pests.

The station is a center for the national livestock feedlot industry. UC researchers use it to study beef and sheep feeding practices under low desert valley conditions, where summertime temperatures can reach 120°F.

In an area where average annual rainfall is less than three inches, research stresses development of optimal irrigation-fertilization strategies that will take full advantage of desert conditions.

Many of the projects at Imperial Valley are designed to improve grain varieties used for livestock feed. The station is a major germplasm testing point for various crops. In a recent year, over 1,100 rice lines from foreign countries were grown there under quarantine and increased for experimental purposes.
South Coast

The South Coast Field Station, 10 miles southeast of Santa Ana in Orange County, occupies 200 acres of former coastal desert in one of California’s leading agricultural areas. It is a center for intensive research on fruits, vegetables, and ornamental plants, ranging from strawberries and avocados to tomatoes, citrus, turfgrass, nursery plants, and landscape trees. As one of the world’s foremost strawberry research facilities, the station has been the site for development of many of the new high-yielding varieties released by the University.

Major research is done on the fruit that gave Orange County its name, with special attention to biological control of citrus insect pests. Environmental horticulturists use the facility to develop landscaping plants with increased vigor, resistance to pests and pathogens, and other desirable characteristics suited to southern California. Considerable effort is directed at tissue culture techniques for propagating genetically superior or disease-indexed fruit and vegetable plant materials. Numerous studies deal with pest and disease management.

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**SOUTH COAST FIELD STATION**

7601 Irvine Boulevard  
Santa Ana, CA 92705-5997  
(714) 559-4050

**Research emphasis:** Pest and disease management, citrus, avocados, strawberries, ornamentals, turf

**Size:** 200 acres  
**Climate zone:** Coastal plain – temperate  
**Terrain:** Medium sloped local alluvial fan  
**Average annual rainfall:** 1316 inches  
**Seasonal temperatures:**  
**Annual mean:** 62.1°F  
**Summer:** Maximum monthly mean – 71.4°F  
**Winter:** Minimum monthly mean – 52.6°F  
**Elevation:** 400 feet

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**Whitefly control test enclosures**  
**Turfgrass irrigation trials**  
**Pest management in tomatoes**  
**Citrus pest control**
The area of Tulare County where the Central Valley meets the gently rising western slopes of the Sierra Nevada provides an ideal environment for citrus research. Since it was founded in 1959, the Lindcove Field Station has played a major role in providing California growers with higher yielding, longer living cultivars, with resistance to pests and diseases that once threatened the citrus industry.

Two of the most important activities at Lindcove are maintenance of the Citrus Clonal Protection Program foundation block and distribution of disease-free planting stock. From a collection of over 400 citrus-indexed parent stock, tiny shoot-tip buds are excised and grafted onto specially conditioned seedlings in test tubes. Later regrafted onto a vigorous seedling rootstock and tested for diseases, the shoots provide budwood for certified disease-free citrus trees. About a quarter of a million certified buds have been provided to growers. Other research at this station is devoted to vegetable and tree fruit crops—small tomatoes, peaches, and plums.

**Lindcove**

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**LINDCOVE FIELD STATION**

22963 Carson Avenue

Exeter, CA 93221

(209) 592-2408

**Research emphasis:** Citrus, stone fruits, tomatoes, pest management, frost control

**Size:** 175 acres

**Climate zone:** Interior valley modified by west slope of Sierra Nevada

**Terrain:** Medium to flat slopes

**Average annual rainfall:** 14.06 inches

**Seasonal temperatures:**

- **Annual mean:** 63.9°F
- **Summer:** Maximum monthly mean - 82.3°F
- **Winter:** Minimum monthly mean - 46.6°F

**Elevation:** 450 feet
Situated in the geographic center of the fertile San Joaquin Valley, this research facility was formed in 1962 to serve the diverse agricultural industry of the Valley. It has since become internationally recognized for research that has resulted in new fruit, nut, and grape varieties, innovative irrigation practices, better pest and disease management techniques, and more efficient fertilization methods.

Grapes — for table use, wine, and raisins — are a high-priority research subject. Studies include the effect of smog on yield, development of new varieties, improved trellising systems, pest and disease control, and mechanical harvesting.

Stone fruits — peaches, plums, nectarines, cherries, avocados — are studied extensively. Various aspects of high-density fruit orchards, close planting of normal-size fruit and nut trees and development of high-yielding dwarfed trees are major projects. Other studies range from alfalfa and garlic to figs, olives, and vegetable crops grown in the Central Valley.

The UC Mosquito Research Laboratory is located at Kearney Agricultural Center. It is also headquarters for a number of Cooperative Extension specialists, and is a regional Cooperative Extension office.

**Kearney Agricultural Center**

9240 South Riverbend Avenue
Parlier, CA 93648

(209) 646-2794

**Research emphasis:** Grapes, stone fruits, pest management, nuts, irrigation management, plant disease

**Size:** 268 acres

**Climate zone:** Interior valley

**Terrain:** Flat alluvial plain from Sierra Nevada

**Average annual rainfall:** 11 inches

**Seasonal temperatures:**
- **Annual mean:** 62.4°F
- **Summer:** Maximum monthly mean - 80.6°F
- **Winter:** Minimum monthly mean - 45.5°F

**Elevation:** 337 feet
West Side

Large fields exceeding in size the station's 320 acres illustrate the scale of agriculture in the vicinity of West Side Field Station, one of two University research facilities serving the San Joaquin Valley. As in the Valley itself, research at West Side encompasses a great variety of fruit, vegetable, cereal, and fiber crops. The station is especially noted for cotton research. Nut crops — almonds, walnuts, pecans, and pistachios — are well represented in research plots. West Side is also a center for regional cereal grain trials. Yield and performance tests of wheat and barley provide data on new breeding lines and new and established varieties for comparison with other regions.

Vegetable crop research ranges from garlic to melons, asparagus, peppers, and tomatoes. Major attention is directed at improved alfalfa germplasm and breeding methods. Irrigation techniques for sugar beets, drip irrigation for tomatoes, cotton, fruit trees, and other crops, and salinity control under high-frequency, low-volume irrigation are studied.

West Side Field Station
17353 West Oakland Avenue
(P.O. Box 158)
Five Points, CA 93624
(209) 884-2411

Research emphasis: Cotton, alfalfa, pest management, irrigation management, stone fruits, nuts, and vegetable crops, predator management

Size: 320 acres

Climate zone: Interior valley

Terrain: Flat alluvial plain from Coast Mountain Range

Average annual rainfall: 8 inches

Seasonal temperatures:
Annual mean: 62.2°F
Summer: Maximum monthly mean - 80.5°F
Winter: Minimum monthly mean - 45.2°F

Elevation: 285 feet
The Deciduous Fruit Field Station in San Jose is the smallest, but one of the most heavily used agricultural research facilities in the University system. Its 17 acres serve scientists investigating fruits, cut flowers, turfgrass, vegetables, landscaping plants, berries, nuts, and biomass for energy.

From the time it was established in 1920, the station has contributed significantly to agriculture in the rich Santa Clara Valley. It is the northern center for research and development of strawberries, a major crop in the area. Now surrounded by the city of San Jose, it is one of the most frequently visited field stations.

In recent years research has focused on minimum irrigation, minimum-maintenance landscaping grasses, and plants for the urban environment.

**Deciduous Fruit**

**Research emphasis:** Deciduous fruits, ornamental plants, landscape management, pest management, strawberries, turf

**Size:** 17 acres

**Climate zone:** Interior coastal valley

**Terrain:** Flat alluvial plain

**Average annual rainfall:** 13.11 inches

**Seasonal temperatures:**
- **Annual mean:** 59.4°F
- **Summer:** Maximum monthly mean – 68.2°F
- **Winter:** Minimum monthly mean – 49.2°F

**Elevation:** 60 feet
The Hopland Field Station, in the brush-covered hills of the Coast Range 100 miles north of San Francisco, is the University's principal sheep research facility. Researchers use Hopland's substantial breeding flock of ewes to study the effects of pasture management on meat and wool production, to develop better breeds, and to improve survival of newborn lambs.

The station is the site of long-term studies on range improvement, brushland management, and watershed maintenance. More than 500 species of plants and 200 species of wildlife populate the hills, woods, and meadows that make up the 5,300-acre facility.

A captive population of coyotes is kept to test scent compounds used to help alleviate predation of sheep. A herd of 600 to 800 deer has provided valuable information on deer parasites and management practices beneficial to sport hunting.
Sierra Foothill

A working cattle ranch until it was acquired by the University in 1960, the Sierra Foothill Range Field Station retains that atmosphere today. Most of the research conducted there is related to beef cattle. A herd of several hundred Herefords graze the rolling terrain typical of the region.

Experiments involve growth and development of calves, management systems for cattle and other livestock under foothill range conditions, animal nutrition, and causes and control of diseases and insect pests affecting range animals.

Researchers use the station to investigate management of open space; the effects of rangeland improvement on water quality, wildlife, and nutrient cycling; soil erosion; and the effects of irrigation on the productivity of pasturelands.

Gathering subclover seed

C\(^{14}\) nutrient infusion study

Rangeland fertilization

Erosion measurement
Located on a former lakebed near California’s northern border, the Tulelake Field Station provides facilities for research on cool-climate field and vegetable crops, especially potatoes, onions, small cereal grains, and alfalfa — crops important to local farmers and the agribusiness community of the region.

Many new varieties of potatoes have been developed and evaluated there. Cereal grain breeding, genetic, and production research have been conducted at the station for many years. New and improved varieties of durum wheat, common wheat, feed barley, and triticale have been developed at Tulelake.

Nearly half of Tulelake’s acreage is used in the development of crops particularly suited to northern California. Wild horseradish growing in the area was developed into a commercial crop at the station, and the region now accounts for a third of total U.S. production of this crop.

Research emphasis: Potatoes, small grains, pest management, onions
Size: 118 acres
Climate zone: High mountain interior valley
Terrain: Flat organic soils — former lakebed
Average annual rainfall: 12.88 inches
Seasonal temperatures:
Annual mean: 49.7°F
Summer: Maximum monthly mean – 73.0°F
Winter: Minimum monthly mean – 29.1°F
Elevation: 4,000 ft
Field station tours and demonstration days are popular ways for farmers and others to get a first-hand look at research in progress.

Each field station maintains a weather recorder. Some are highly sophisticated electronic units that are part of the official U.S. weather-reporting system.

All stations have well-equipped laboratories.

The entire field station network is linked to a central computer at the Davis headquarters.