A Process and Impact Evaluation of the Agricultural Crime, Technology, Information, and Operations Network (ACTION) Program

by

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National Institute of Research Grant #2003-DD-BX-1017

Abstract

Research Goals and Objectives

Agricultural crime is a serious problem in the United States, with significant financial consequences for farmers, insurers, and consumers—some sources estimate that agricultural crime results in $5 billion in economic losses annually. Yet few prevention or reduction interventions have been developed, and fewer still have been evaluated. As a result, policy makers and practitioners lack critical information about how to deal with this costly problem. The Urban Institute and Florida State University multi-disciplinary research team employed a multi-method approach to evaluate one promising initiative, the Agricultural Crime, Technology, Information, and Operations Network (ACTION) project, located along the southern coast and Central Valley of California and supported by the Bureau of Justice Assistance.

The goal of the proposed research was to provide policymakers, practitioners, program developers, and funders with empirically-based information about whether ACTION works. The specific objectives were:

- To assess the effectiveness of the ACTION project in reducing agricultural crime;
- To provide a cost-benefit analysis of ACTION; and
- To identify how programs like ACTION can be effectively adopted by other jurisdictions.

Research Design and Methodology

The study involved: collection of Agricultural Census and Census Bureau data; collection and analysis of two victimization surveys, administered one year apart from one another to farmers; and interviews with ACTION staff, and law enforcement and agriculture officials in the intervention site and other states.

The impact evaluation entailed a diverse set of analyses, including assessment of the causal logic of ACTION, extent to which the "dose" of ACTION (i.e., the level of implementation in various areas and counties) influenced victimization outcomes, and a range of measures that collectively could be used to provide a balanced assessment of impact. In general, the results suggest that ACTION may have changed law enforcement and farmer behaviors, as well as reduced victimization, increased prosecution, and increased recovery of stolen property. Spatial mapping analyses indicated the need for more complete geographic information on agricultural crime incidents and highlighted the potential for such analyses to inform crime prevention efforts.

Cost-benefit analysis is an empirical technique used to systematically compare the economic efficiency of two or more policies or programs. In a separate, stand-alone report, the research team created a report describing the CBA methodology as a means of evaluating the effectiveness of crime prevention programs, with a specific focus on ACTION. The report describes the key steps in formulating a CBA design, discusses the trade-offs implicit in specific design decisions, and then concludes by applying the principles of CBA to assess ACTION.

Interview data were examined to identify lessons about how to improve ACTION and features of ACTION that could be feasibly adopted and sustained by other jurisdictions. The results suggest that ACTION could easily be adopted in many other places, but that successful implementation requires sustained attention to forging and maintaining collaborative relationships across a range of law enforcement and justice system agencies.

FINAL REPORT

January 2007

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research for safer communities

Acknowledgements

The authors thank our colleagues, especially Shelli Rossman, Nancy La Vigne, and Janine Zweig, and the staff at ACTION, especially Bill Yoshimoto and Mary Beth Hash, for their considerable support and assistance. Lou Barrett, Claudia Canales, Josh Rowlett, David Singleton, and Patrick Warner, all current or past members of the ACTION team, were extremely helpful throughout the study and uniformly accommodated our many requests for assistance. Ed Zedlewski and Maggie Heisler, with the National Institute of Justice, provided guidance and insights that greatly improved the project's design and execution, and Sandy Woerle helped guide us through the final stages of the project. Joe Donnermeyer offered many helpful ideas for improving the research design. We give special thanks to the many farmers who participated in the study, without whom there would not have been anything to report. John Roman and Aaron Chalfin were primarily responsible for the cost-benefit analysis discussions, which are detailed in a separate report. (Chalfin, Aaron, John Roman, Daniel P. Mears, and Michelle L. Scott. 2007. *The Costs and Benefits of Agricultural Crime Prevention.* Washington, D.C.: The Urban Institute.) John Kempf, at Allied Insurance, provided many insights about ACTION and agricultural crime. Jesse Jannetta, who worked on this project while at the Urban Institute, conducted, analyzed, and summarized interviews for the transferability analyses and discussion. Elisa Ranck, formerly of the Urban Institute, assisted with the transferability analyses. Some of the findings in this report have been presented in a number of settings and meetings, including:

- Mears, Daniel P., and Michelle L. Scott. 2006. "Results from an Impact Evaluation of an Agricultural Crime Prevention Initiative." American Society of Criminology Annual Meeting, Los Angeles, CA.
- Chalfin, Aaron, and John Roman. 2006. "The Crowding Out Effect: Does Government Provision of Crime Prevention Reduce Crime?" College Park, MD: University of Maryland.
- Mears, Daniel P., and Michelle L. Scott. 2005. "Opportunity Theory and Agricultural Crime Victimization." American Society of Criminology Annual Meeting, Toronto, Canada.
- Scott, Michelle L., and Daniel P. Mears. 2005. "Applying Spatial Analysis to Survey Research of California Farmers." Annual Meeting of the Rural Sociological Society, Tampa, FL.
- Scott, Michelle L., and Daniel P. Mears. 2005. "Agricultural Crime: It's More than Cow-Tipping." The Urban Institute, Washington, D.C.
- Scott, Michelle L., and Daniel P. Mears. 2005. "Understanding and Reducing Survey Nonresponse Rates among Rural Farming Populations through Spatial Analysis." National Institute of Justice Annual Crime Mapping Research Conference, Savannah, GA.
- Mears, Daniel P. 2004. "Reliability and Validity Issues in Evaluation Research." National Institute of Justice Evaluation Cluster Conference, Arlington, VA.
- Scott, Michelle L., and Daniel P. Mears. 2004. "Where's the Beef? Agricultural Crime Victimization and What Can Be Done About It." Annual Meeting of the Rural Sociological Society, Sacramento, CA.

This project was supported by Grant No. 2003-DD-BX-1017, awarded by the National Institute of Justice, Office of Justice Programs, U.S. Department of Justice. Points of view in this report are those of the authors and do not necessarily represent the official position or policies of the U.S. Department of Justice, the Urban Institute, its board of trustees, or its sponsors, or ACTION.

A Process and Impact Evaluation of the Agricultural Crime, Technology, Information, and Operations Network (ACTION) Program

HIGHLIGHTS OF THE EVALUATION*

What the Study Did

Agricultural crime, including theft of farming-related commodities, supplies, and equipment, causes billions of dollars of losses each year to farmers, insurers, and consumers. Drawing on analyses of law enforcement, farm survey, site visit, and interview data, the Urban Institute and Florida State University evaluated the theory and impacts of a promising initiative in California—the Agricultural Crime, Technology, Information, and Operations Network (ACTION) project (www.agcrime.net)—aimed at addressing this problem. ACTION collects and analyzes agricultural crime data; encourages and enables information-sharing among law enforcement agencies and prosecutors within and across counties; educates the public and farmers about agricultural crime and how to combat it; marks equipment with owner applied numbers (OANs); and promotes aggressive law enforcement and prosecution.

What the Study Found

- Program theory. ACTION is guided by well-established criminological theories, including opportunity, situational crime prevention, and deterrence theories. The analyses suggest that these theories help predict agricultural crime and that efforts like ACTION can reduce crime.
- Impacts. ACTION's activities appear to have reduced victimization and to have increased agricultural crime arrests and prosecutions, recovery of stolen property (over $6.3 million in 2004 and 2005), and farmers' investment in crime prevention.
- Transferability. The results of the study suggest that one or more of the activities that collectively comprise ACTION could easily be adopted in many other places, and that jurisdictions across the country are greatly in need of and interested in efforts like ACTION.

*Program and Policy Recommendations***

- Continue ACTION's efforts and consider expansion. In 2005, agricultural crime victimization resulted in an estimated $101 million in losses across the nine ACTION counties examined in this study. However, only $8 million of these losses were reported to law enforcement agencies. In addition, only 12 percent of agricultural crime victimization is reported. Considerable reductions in agricultural crime could be produced through increased reporting and crime prevention efforts.
- Monitor and improve ACTION's operations. ACTION's effectiveness ultimately depends on its ability to implement each of a set of diverse activities efficiently and with fidelity to program design. At the same time, the program operates with limited resources. For these reasons, it should continue to monitor program operations, taking corrective steps where necessary, and seek additional funding.
- Test the feasibility of implementing ACTION in other places. Because of the diverse activities that comprise ACTION, other jurisdictions in California and throughout the country may find it possible to adopt or modify the program to fit their unique circumstances and needs. Ultimately, however, research will be needed to assess the extent to which that holds true, especially in places where agricultural production differs. Future efforts should be guided by lessons gleaned from ACTION.

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* Source: *A Process and Impact Evaluation of the Agricultural Crime, Technology, Information, and Operations Network (ACTION) Program*, a report by Daniel P. Mears (Florida State University), Michelle L. Scott (The Urban Institute), and Avinash S. Bhati (The Urban Institute), available from the Urban Institute (www.urban.org).

** The full set of policy recommendations are detailed in Section 10 of the report.

EXECUTIVE SUMMARY

Research Goals and Objectives

Agricultural crime is a serious problem in the United States, with significant financial consequences for farmers, insurers, and consumers—some sources estimate that agricultural crime results in $5 billion in economic losses annually. Yet few prevention or reduction interventions have been developed or evaluated. As a result, policy makers and practitioners lack critical information about how to deal with this costly problem. The Urban Institute and Florida State University multi-disciplinary research team employed a multi-method approach to evaluate one promising initiative, the Agricultural Crime, Technology, Information, and Operations Network (ACTION) project, located along the southern coast and Central Valley of California and supported by the Bureau of Justice Assistance.

The goal of the research was to provide policymakers, practitioners, program developers, and funders with empirically-based information about whether ACTION works. The objectives included assessing the effectiveness of the ACTION project in reducing agricultural crime, examining the costs and benefits and cost-benefit analysis (CBA) issues related to evaluating the program, and identifying how programs like ACTION can be effectively adopted by other jurisdictions. Briefly, the evaluation findings suggest that ACTION's activities have contributed to increased arrests, prosecutions, and recovery of property; increased farmers' investment in crime prevention; and reduced victimization. They also suggest that many of the activities are needed in and can be adopted by other jurisdictions.

Research Design and Methodology

The study involved several strategies, including: collection of Agricultural Census and Census Bureau data; creation, administration, and analysis of data from two victimization surveys administered in 2004 and 2005, respectively, and developed with extensive assistance from farmers, program staff, and experts on rural crime; and interviews with ACTION staff, and law enforcement and agriculture officials in the intervention site and other states.

The impact evaluation entailed a diverse set of analyses, including examination of the causal logic of ACTION, extent to which county-level variation in the implementation of ACTION influenced victimization outcomes, and a range of measures that collectively could be used to provide a balanced assessment of impact. Spatial mapping analyses indicated the need for more complete geographic information on agricultural crime incidents and highlighted the potential for such analyses to inform crime prevention efforts.

The cost-benefit analysis entailed exploration of the unique issues involved in applying this methodology to agricultural crime and the sensitivity of cost-benefit analyses of agricultural crime to assumptions about or fluctuation in the level of crime prevention that might reasonably be expected with programs like ACTION and in crime prevention investments that farmers take in the presence of a funded intervention.

Interview data were examined to identify lessons about how to improve ACTION and features of ACTION that could be feasibly adopted and sustained by other jurisdictions.

Background

Agricultural Crime

Agricultural crime, like rural crime generally (Wells and Weisheit 2004), remains largely unstudied by criminologists and unaddressed by policymakers (Weisheit and Donnermeyer 2000; Barclay 2001; Donnermeyer and Barclay 2005). Such crime—including theft of farming-related commodities, supplies, or equipment, or behaviors that otherwise influence farm production—has impacts extending not only to farmers but also to consumers. Swanson et al. (2002) have estimated that agricultural crime results in $5 billion annually in losses. Apart from ACTION, there appear to be no systematic and comprehensive attempts to prevent or reduce such crime.

ACTION

ACTION, the focus of this study, has undertaken a range of measures collectively designed to reduce crime. These measures include:

- Developing a database for tracking agricultural crime and encouraging and enabling information-sharing within and across counties, as well as among prosecutors and law enforcement;
- Education of and outreach to the public and farmers about agricultural crime and what can be done to prevent it;
- Encouraging and facilitating the use of equipment- and crop-marking, especially the stamping of equipment with owner applied numbers (OANs);
- Encouraging and facilitating the use of surveillance equipment among farmers; and
- Active targeting and vertical prosecution of offenders.

Communication within and between law enforcement agencies, and between these agencies and prosecutors and ACTION, is a central feature of the program, one that cross-cuts the above areas.

The creation of distinct agricultural crime units in each participating county's sheriff's office and the assignment of prosecutors to specialize in agricultural crime cases has been central to the program's efforts. The premise of the program is that collectively the diverse set of efforts will reduce agricultural crime both through "target-hardening," making it more difficult or less attractive for offenders to steal from farmers, and through punishments, facilitated by more proactive prosecution of offenders, that create a general deterrent effect.

ACTION has expanded considerably. At the time the study began, in 2003, there were eight

participating counties from the San Joaquin Valley. Since then, five more have joined. The thirteen program counties include: Fresno, Kern, Kings, Madera, Merced, Monterey, San Benito, San Joaquin, San Luis Obispo, Santa Barbara, Santa Cruz, Stanislaus, and Tulare. San Luis Obispo, the ninth participating county, joined ACTION in 2004, followed by Monterey in 2005, and San Benito, Santa Barbara, and Santa Cruz in 2006. The study focused only on nine of these counties—the original eight and San Luis Obispo.

The range of activities, coupled with both the expansion of the program over time to include more counties and the absence of baseline information on the prevalence of agricultural crime in these and other counties, renders any simple or direct assessment of impact difficult. This study thus relied on a diverse range of approaches to assess ACTION's likely impact.

Findings

Descriptive

Analyses of the survey data indicate that over half of all farmers experience some type of victimization annually, with equipment theft and vandalism being the most common types. As much as 88 percent of agricultural crime victimization is not reported. In 2005, such victimization resulted in $101 million in costs across the nine ACTION counties, only $8 million of which was reported. Victimization has other effects, such as limiting the extent to which farmers take vacations and leading some to contemplate leaving farming. Additional analyses suggested findings relevant to informing efforts to reduce agricultural crime. For example, one in four farmers indicated that they preferred to receive crime prevention information via e-mail. Spatial mapping analyses indicated the need for more complete geographic information on agricultural crime incidents and highlighted the potential for such analyses to inform crime prevention efforts.

Impact

After consultation with methodologists and experts on agricultural crime, the research team developed a "dosage" model approach to evaluating ACTION. This approach took advantage of a naturally-occurring experiment that enabled us to assess whether higher levels of dosage of ACTION activities translated into lower levels of agricultural crime victimization. As part of the assessment of the impact of ACTION, the research team investigated whether it is premised on a sound theoretical logic, since sound theory typically is a prerequisite for effective interventions (Rossi et al. 2004).

Causal Logic[1]

ACTION consists of several inter-related activities, each of which entails its own logic. For

[1] This section draws on analyses and discussion from Mears et al. (2007b).

example, the aggressive prosecution strategies are premised on the notion that they will produce a general deterrent effect. The increased communication within and across counties and different parts of the criminal justice system is assumed to create efficiencies and greater success in identifying, apprehending, and convicting offenders. Analysis of the database, apart from serving to document that agricultural crime exists, is believed to enable law enforcement to identify emerging "hot spots" and other locations where crime may be likely to occur and to target their efforts accordingly.

A central focus of ACTION consists of educating farmers about ways in which "target hardening" can be undertaken to prevent agricultural crime victimization, and of facilitating target-hardening efforts. The logic builds on situational crime prevention research and rests largely on opportunity theory, which argues that crime is less likely when potential targets are less attractive, offenders are less proximate to targets, and targets are less exposed (e.g., easier to see) and more guarded (Felson and Clarke 1995; Akers and Sellers 2004). Opportunity theory arguably is especially appropriate in farming communities, where opportunities for theft and offending are ubiquitous (Barclay and Donnermeyer 2002). The research team thus investigated how the theory might best be applied to farms.

The results suggested mixed support for the theory. Targets that are more attractive, such as those that are portable and relatively valuable (e.g., fruit and nuts), were more likely to be stolen than, say, livestock. Proximity measures were not typically associated with victimization, although farms with more workers experienced more theft. Similarly, exposure did not surface as a particularly salient factor. However, larger farms and those resting on flat terrain were somewhat more likely to experience relatively more theft and vandalism. Finally, farms that employed more guardianship steps (e.g., locking equipment, using guard dogs) typically experienced less victimization, though the effect was not consistent across all measures of guardianship. In some cases, the results were the opposite of what was expected—for example, farms that used surveillance equipment were associated with higher levels of victimization. Disentangling causal order issues is difficult with cross-sectional research designs. The likely explanation is, however, that farmers who experience greater levels of victimization invest in surveillance equipment to prevent future victimization.

Impact on Agricultural Crime Victimization

The results of the diverse evaluation methodologies suggest that ACTION may have changed law enforcement behaviors (e.g., increasing communication within and between counties, sheriff's offices, and District Attorneys), albeit more so in some counties than in others, farmer behaviors (e.g., increasing the amount of crime prevention efforts taken), and, most importantly, reduced agricultural crime victimization. Two distinct approaches were used to assess impact.

The first approach involved analyses of the first year (2004) survey of farmers and the creation of dosage measures for each county. A main limitation of this approach was its cross-sectional nature, which raised the following causal order problem—namely, counties experiencing higher rates of agricultural crime appear to have been more likely to implement or participate in ACTION, creating the appearance, in cross-sectional analyses, of a positive relationship between the program and victimization. This issue was addressed in part by controlling statistically for property crime rates and characteristics of farms. The study found

that at higher dose thresholds, greater amounts of program implementation were associated with reduced levels of victimization. Also, farmers in higher-dose counties were more likely to undertake the types of activities promoted by ACTION; controlling for such activities largely eliminated the statistical significance of dose. These results suggest both that ACTION has changed farmers behaviors and that doing so can influence the likelihood of victimization.[2]

The second approach relied on analysis of data from a similar survey of farmers conducted in late 2005. This survey differed from the first in collecting independent dosage measures. Such information was needed because the ACTION database provided an insufficient foundation for accurately quantifying the full range of activities associated with ACTION. The survey also differed in asking about dosage and victimization over two time periods—the preceding year (i.e., 2005) and the year prior to that (i.e., 2004). Results suggested that farmers in communities that more aggressively implemented ACTION activities in 2004 experienced less victimization in 2005, net of a variety of controls. Specifically, higher doses of ACTION contributed to less victimization in general and to less of several specific types of victimization, including chemical and fuel theft, small tool and equipment theft, and vandalism. At higher levels of dose, there was still a crime-reducing effect, but the effect was less than at lower levels of dose.

Non-Victimization Impacts

A central feature of ACTION is its attempt to improve law enforcement success in identifying and arresting offenders and in facilitating their conviction. ACTION appears to have had an appreciable impact on identifying suspects and increasing arrests and convictions. For example, over a two-year period of time, ACTION deployed surveillance equipment 69 times, and these efforts in turn resulted in identification of 35 suspects and 15 arrests. Similarly, in 2004 and 2005, at least 522 defendants were convicted of agricultural crime-related charges among the participating counties. Interviews with practitioners emphasized that without the evidence collected using the equipment, virtually none of the suspects would likely have been identified and no arrests or convictions would have occurred.

ACTION also has encouraged farmers to use OANs and directly stamped equipment at many farms. From 2003 through mid-year 2006, ACTION recorded 793 farms that had marked at least 52,298 pieces of equipment totaling at least $360 million in value. Nonetheless, only 2.6 percent of farms in the counties use OANs, leaving considerable room for expanded marking efforts.

The study's investigations identified that farmers underreport 85 percent or more of victimization and that counties vary in their entry of information into the ACTION database. Such factors argue against drawing strong inferences about the spatial distribution or impacts of ACTION (e.g., potential displacement of agricultural crime from one area to another). However, spatial analyses suggest that agricultural crime clusters along major highways and roads, indicating that crime prevention efforts likely should target farms in such areas.

Finally, ACTION appears to have increased the recovery of stolen property. During 2004 and 2005 alone, ACTION recorded $6.3 million in recovered property.

[2] This section draws on analyses and discussion from Mears et al. (2007a).

Cost-Benefit Analysis

The application of CBA to the study of crime is not as straightforward as it is in other fields (e.g., health, welfare). Unlike labor or health care, crimes do not have a market price, and, as such, the costs of crime are more difficult to measure. Criminal justice policies may also affect the welfare of local communities in interdependent ways. The ripples in the community either from new crimes or from reductions in offending extend well beyond those few individuals directly affected. Determining the scope of an evaluation of the costs and benefits of crime control programs presents significant challenges that may be more limited in other policy areas with more discrete, easily measurable outcomes.

With this issue in mind, and recognizing that cost-benefit analyses frequently are desired, the research team developed a report that outlines the steps involved in cost-benefit analysis of agricultural crime prevention efforts and the issues and concerns that should be addressed (Chalfin et al. 2007). The report introduces the CBA methodology as a means of evaluating the effectiveness of crime prevention programs, with a specific focus on ACTION. The report describes the steps necessary to conduct a CBA, emphasizing issues related to evaluating a property crime reduction program, and concludes with a CBA of ACTION. Special attention is given to considering the perspective of the analysis (determining whose costs and benefits should be counted), development of robust measures of hard-to-value benefits, selecting an appropriate time period for the evaluation, and strategies for dealing with specific CBA challenges. Cost-benefit analyses indicated that ACTION increased farmers' expenditures on crime prevention. The analyses and their implications are detailed in the CBA report.

Transferability

The results of this study suggest that ACTION could easily be adopted in many other places, and that jurisdictions across the country are in need of and interested in efforts like ACTION. However, successful implementation requires sustained attention to a range of issues, not least the forging and maintaining of collaborative relationships across a range of law enforcement and justice system agencies. More generally, the study's analyses point to a set of barriers and facilitators to implementation for each of the five specific activities undertaken by ACTION. In addition, barriers and facilitators may vary depending on the phase of implementation, including start-up, sustainability (i.e., maintenance of the program's operations over time), and expansion.

Conclusion

ACTION is a pilot initiative that consists of many components or activities, and it has expanded considerably, all during a period in which agricultural markets have fluctuated. Thus, generalizations about the impacts or whether it would be effective in other contexts must be made with considerable caution. Nonetheless, the study's findings suggest that programs modeled after ACTION may well contribute to reduced agricultural victimization, to more successful attempts to identify, arrest, and prosecute offenders, and to increased recovery of stolen property. A range of theory, research, and policy implications flow from the ACTION

evaluation, and are detailed in the final report and accompanying policy brief.

Any attempts to expand ACTION further or implement it in other places will require careful attention to a range of issues relating to the different activities that comprise ACTION. Attempts in other jurisdictions will want to pay especially close attention to the challenges of starting a new program. In addition, careful attention should be given to collecting and analyzing agricultural crime data that can facilitate formative evaluations in which lessons are learned on an ongoing basis about program operations and what can be done to improve them.

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Table of Contents

1. INTRODUCTION, GOALS, AND OBJECTIVES

Agricultural crime is a serious problem in the United States, with significant financial consequences for farmers, insurers, and consumers. Some sources estimate that agricultural crime results in $5 billion in economic losses annually (Swanson et al. 2002). Yet few prevention programs or polices have been developed, and fewer still have been evaluated. As a result, policymakers and practitioners lack critical information about how to deal with this costly problem. The Urban Institute (UI) and Florida State University (FSU) multi-disciplinary research team employed a multi-method approach to evaluate one promising initiative, the Agricultural Crime, Technology, Information, and Operations Network (ACTION) project, located along the southern coast and Central Valley of California, and supported in part by the Bureau of Justice Assistance.

The goal of the research was to provide policymakers, practitioners, program developers, and funders with empirically-based information about whether ACTION works. The specific objectives were to assess the effectiveness of the ACTION project in reducing agricultural crime, examine the costs and benefits and cost-benefit analysis issues related to evaluating the program, and identify whether programs like ACTION can be effectively adopted by other jurisdictions.

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The impact evaluation entailed a diverse set of analyses, including examination of the causal logic of ACTION, the extent to which the level of program implementation in various areas and counties influenced victimization outcomes, and a range of measures that could be used to provide a balanced assessment of impact. As discussed below, the results suggest that ACTION may have changed law enforcement and farmer behaviors and reduced victimization. Spatial mapping analyses indicated the need for more complete geographic information on agricultural crime incidents and highlighted the potential for such analyses to inform crime prevention efforts.

The cost-benefit analysis entailed exploration of the unique issues involved in applying this methodology to agricultural crime and the sensitivity of cost-benefit analyses of agricultural crime to assumptions about or fluctuation in the level of crime prevention that might reasonably be expected with programs like ACTION and in the value of commodities, equipment, chemicals, fuel, and other farm production-related items. The analyses indicate that, among other things, ACTION may have increased farmers' monetary investments to protect their property. They also suggest that the results of any cost-benefit analysis of ACTION and similar agricultural crime prevention efforts are highly variable depending on the perspective of analysis and assumptions about or actual levels of impact. As such, it is difficult to arrive at any absolute assessment of costs versus benefits. To the extent that cost-benefit analyses are desired, a range of issues and concerns should be addressed. The project created a report to facilitate such efforts (Chalfin et al. 2007).

Finally, site visit and interview data were examined to identify lessons about how to improve ACTION and features of ACTION that could be feasibly adopted and sustained by other jurisdictions. The results suggest that ACTION could easily be adopted in many other places, but that successful implementation requires sustained attention to forging and maintaining collaborative relationships across a range of law enforcement and justice system agencies.

The results of the evaluation should be of interest to policymaker, funder, law enforcement agency, and prosecutor efforts to prevent and reduce agricultural crime victimization. Briefly, the evaluation found that ACTION's diverse efforts appear to have a relatively solid foundation in theory, influence farmers' behaviors (e.g., taking steps to protect farm property) as well as law enforcement and prosecutor actions (e.g., increasing arrests and prosecutions), and ultimately show promise in reducing agricultural crime victimization and increasing recovery of stolen property. For policymakers, funders, law enforcement officers, and prosecutors, the results should be of interest because they suggest that, contrary to traditional views, there are steps that can be taken to reduce agricultural crime. For ACTION, the results should be of interest, or so it is our hope, in providing insights about areas in which improvements might be made. Ultimately, there continues to be a need for more theoretical and empirical research that can inform agricultural crime prevention efforts. The lessons from the ACTION initiative provide a useful starting point for such work, not least because the program has pursued a diverse range of strategies, thus enabling other jurisdictions to select those that may be most appropriate or feasible to implement, given available resources.

The structure of the report is as follows. We first discuss agricultural crime and why it merits attention, the ACTION program, and the design and methodology of the study. We then provide descriptive analyses that should be of interest in their own right—many of the findings suggest policy implications independent of the evaluation. Crime mapping is an increasingly useful approach to monitoring and assessing crime and crime policy, and so we discuss this approach, as applied to agricultural crime. We then discuss the impact evaluation results, which are the main focus of the study. The cost-benefit analysis is not discussed in this report but rather, as mentioned earlier, is detailed in a separate report. The final substantive analyses focus on the results of our investigation into the transferability of the ACTION program to other places. The report then provides a discussion of specific program and policy recommendations both for ACTION and for practitioners, policymakers, and funders who are interested in addressing agricultural crime. Finally, it concludes by discussing theory, research, and policy implications emerging from the study. Chapter tables and figures are located at the end of each chapter. All references and appendices, including the two survey instruments used in the study, are provided at the end of the report.

2. BACKGROUND

Overview

Today, 2 million farms—three-quarters of which are owned or run by families—operate in the U.S. The number of farms has declined over the past six decades, but those that remain have triple the sales and are twice the size of farms in 1950 (Lobao and Meyer 2004:13). As an industry, agriculture also factors heavily in the economy: "The entire agricultural sector accounts for 17 percent of all employment and 13 percent of gross domestic product" (Lobao and Meyer 2004:17). In addition, in rural areas, it constitutes the "largest segment of the economy" (Donnermeyer and Barclay 2005:3) and so naturally serves to attract criminals, leading to billions of dollars in losses each year (Swanson et al. 2002:628).

Agricultural crime occupies an unusual place in the range of offenses typically studied by criminologists or addressed by policymakers (Weisheit and Donnermeyer 2000; Barclay 2001; Donnermeyer and Barclay 2005). That place is reflected in part by the dearth of studies focusing on rural crime (Wells and Weisheit 2004), especially the victimization of farmers (see, e.g., Saltiel et al. 1992), and by the lack of classification schemes in official records. Compliance with Uniform Crime Report (UCR) classification does not, for example, require jurisdictions to quantify how many agricultural crimes have occurred. Indeed, few jurisdictions include separate codes for agricultural crime (Barclay 2001). Instead, they subsume such crimes under other headings, such as "burglary" or any of a range of generic "theft" categories. The explanation may lie in part with the fact that any number of "types" of theft could be identified (hotel, grocery store, gas station, etc.).

Regardless, agricultural crime—including theft of farming-related commodities, supplies, or equipment, or behaviors that otherwise influence farm production—occurs. And its impacts extend not only to farmers, who must replace what is stolen or have fewer products to sell, but also to consumers, who may have to pay higher costs for commodities, and to the insurance industry, which may have to pay for the replacement of equipment and supplies. Even if the latter two groups were unaffected, farmers as a group experience billions of dollars in theft annually, according to Swanson et al. (2002).

Agricultural crime is unique for an additional reason—apart from ACTION, there appear to be no systematic and comprehensive attempts in other places to prevent or reduce such crime. The study uncovered some efforts that have been or are being undertaken in different parts of the country, but none that rely on ACTION's range of efforts to address agricultural crime or that have been evaluated or in existence for very long. Notably, there have been few published evaluations of agricultural crime prevention programs, due primarily to the fact that such programs are scarce (Barclay 2001).

What Is Agricultural Crime?

Agricultural crime essentially is any property crime that directly or indirectly affects

agricultural production and distribution. As defined by ACTION, which will be described below, agricultural crime is "any property crime against a farmer, rancher, agricultural related business or other designated industry which takes place in the unincorporated rural areas of the state and impacts the victims' commercial production, distribution or economic livelihood derived from agricultural products, livestock, petroleum, chemicals, farm implements, and equipment." That definition largely mirrors one provided by Swanson et al. (2002:629-632) and encompasses examples of theft provided by the authors, such as livestock, equipment, chemicals (including pesticides, fertilizers, herbicides, and veterinary medicines), commodities, burglary of farm and storage buildings, and vandalism.

Clearly, there is considerable diversity in the types of theft that can occur (e.g., livestock, crop, chemical, equipment), and within the different types there is even more diversity. Milk crates, for example, constitute but one of many of hundreds of types of equipment used on farms. In many instances, it might appear at first glance that such items are not particularly costly. Consider, however, a recent Wall Street Journal article documenting a case in California in which a dairy farm lost over 420,000 milk crates in 2005, costing the farm roughly $1.6 million (Brat 2006:B1). To what purpose are stolen crates put? They "are going into recycling plants . . . As oil prices have climbed, so too have prices for the petroleum-based resin used in milk crates. . . . Prices of the resin jumped more than 40 percent after Hurricane Katrina" (Brat 2006:B1). The example illustrates, among other things, the salience of market conditions to agricultural crime, an issue that is discussed below and in the accompanying cost-benefit analysis report (Chalfin et al. 2007).

What Is the Prevalence of Agricultural Crime?

Little systematic evidence on the prevalence of agricultural crime exists, a result of the fact that typically such crime is subsumed under "other" as a classification within many law enforcement departments, both in the United States and in other countries (Barclay 2001:19). Anecdotally, evidence of the prevalence of agricultural crime is reflected in part by the many news accounts of it. The ACTION website (www.agcrime.net/ag_crime_news.htm) maintains lists of such accounts. Empirically-based studies in the United States, primarily a small number of surveys conducted in the 1980s, suggest that agricultural crime is common, with substantial variation by type of crime. Vandalism typically is the most common. In Deeds et al.'s (1992) study, for example, 24 percent of farmers reported that they had experienced vandalism during the previous year. In this study, and others, burglary occurred more frequently (18 percent) than other types of crime. Overall, the authors found that 22 percent of the respondents had experienced theft over the one-year period (p. 4). Although similar patterns have been identified in other studies (Bean and Lawrence 1978; Cleland 1990; Dunkelberger et al. 1992; see, generally, Barclay 2001), considerable variation also exists because of the use of different crime categories and time periods (e.g., past year vs. lifetime estimates).

The true costs of agricultural crime are difficult to establish without national statistics, though news accounts frequently suggest they are considerable and increasing (Malone 2005). As noted, Swanson et al. (2002:628) have estimated that such crime results in $5 billion in costs annually. They also have emphasized that even if agricultural crime occurs relatively rarely, a small amount still can be quite costly given that "farm products nationally are worth more than

$1,000 billion annually" (Swanson et al. 2002:628). Some crimes, such as theft of tractors and chemicals, can be extremely lucrative. For example, the replacement value for a single theft of herbicide can cost up to $70,000; in a recent case in California, officials prosecuted an individual who had fenced $1.5 million in stolen herbicides (Weisheit and Donnermeyer 2000: 337). Similarly, bull semen can be costly—"a full tank of bull semen can be worth $10,000 and is easy to dispose of" (Swanson et al. 2002:629-630)—and thus is a common target for theft. Indeed, accounts of such theft are common (e.g., Hernandez 2005:B3, citing an instance in which $75,000 of bull semen was stolen from one farm). Other crimes are less lucrative, but, when stolen in high volumes, can result in considerable costs to farmers. One New York Times cover story, for example, highlighted the impact of avocado theft on California farmers (Brown 2004).

Agricultural Crime Theory

Rural crime remains a neglected area of theoretical focus in criminology (Wells and Weisheit 2004), and agricultural crime even more so (Weisheit and Donnermeyer 2000; Barclay 2001). Such crime in general may most appropriately be classified as a type of property theft. Therefore, theories about property offending and victimization would appear to be best-suited to helping explain agricultural crime offending and victimization. In particular, and as will be discussed, opportunity theory, and place-focused theories of crime generally, appear to be well-suited to explain agricultural crime, given the fact that agricultural production typically occurs in areas where environmental factors, such as the size of a farm, limit the ability to protect against theft (Barclay and Donnermeyer 2002; Swanson et al. 2002). In the conclusion of the report, we review insights gleaned from our attempts to apply opportunity theory to the explanation of agricultural crime, and discuss avenues along which future theoretical work might proceed.

3. THE ACTION PROGRAM

Context of Program

Before proceeding, several general observations merit mention to establish part of the context for understanding why ACTION has pursued some of its particular strategies. First, agricultural crime traditionally has not been taken seriously by law enforcement agencies or prosecutors, and farmers typically have felt that nothing could be done about it (Barclay 2001). As one Farm Bureau director with whom we spoke noted, until ACTION came along, theft was accepted as the price of doing business. That refrain is one we heard repeatedly throughout the course of the project. Indeed, one of the central challenges in addressing agricultural crime are farmers themselves. More precisely, farming communities tend to be closed and mistrustful of law enforcement agencies and their ability to help them (Weisheit and Donnermeyer 2000). That view is changing, but clearly is still prevalent. And it is one that extends to law enforcement officers and the courts. Several prosecutors told us, for example, that agricultural crime has not traditionally been an offense that their offices or that judges take seriously.

In contrast to traditional crime scenes, those involving agricultural crime present unique obstacles. Typically, officers receive training for burglary investigations, but this training generally is insufficient to investigate an agricultural crime scene adequately, as law enforcement officers emphasized to us. To illustrate, there are certain methods that can be used to find a bullet in a cow. Most officers would not know how to retrieve the bullet and thus would not be able to retrieve critical evidence. More generally, surveillance, including deployment of surveillance equipment, is typically not easily done in farm settings, and, so, again, specialized training is needed to learn how to do so effectively.

Additional challenges exist, including the frequently mentioned (in our site visits and the literature) facts that protecting property on farms is difficult and that farmers traditionally have not had much faith in the effectiveness of taking various security precautions. To illustrate the first point—while at the World Agricultural Exposition, the research team staff spoke with a chemical and fertilizer supplier, who noted that there is little that farmers can do to safeguard the chemicals they purchase. It is not, for example, a product that can be easily marked and thus traced. The best that can be done is to lock chemicals away. But, he emphasized, thieves can always cut a building to gain entry, and they generally will if they know the location of the chemicals and if there is a sufficient amount. To illustrate the latter—we spoke with a young farmer at the Exposition who noted that farmers, in his experience, were not good about accounting. They would, for example, purchase major products, like the $250,000 tractor near to where we spoke, and would not record the serial or product number or save the receipt. So, if it were stolen, there would be no way to show ownership or to help law enforcement track the vehicle. (A representative of a major supplier of tractors noted that even though new tractors have unique identification numbers, farmers often do not record this information. In addition, there is no simple way to stop theft of the types of tractors his company sells since most of the tractors use the same ignition key.) This issue was mentioned in many interviews and meetings.

Not least, a challenge confronting efforts to reduce agricultural crime involves the influence

of market conditions. The research team attended the 2005 World Agricultural Exposition and at that time, fuel and steel theft were reportedly on the rise. Orange groves use fuel to power heaters during cold snaps, and the heaters typically are easy to access. Similarly, steel from various sources is plentiful on many farms. When prices are low, the effort required to steal fuel and steel may not be worth the effort, but when they rise high enough, theft becomes a lucrative proposition (Swanson et al. 2002). Thus, in contrast to some conventional property crimes (e.g., burglaries of residences), in which a set of preventive measures may be more or less consistently effective over time, efforts to prevent certain types of agricultural crime may vary in their effectiveness depending on the prices associated with certain supplies or goods.

What Is ACTION?

Against that backdrop, ACTION, which is headquartered in Tulare County and at the time of the evaluation consisted of nine full-time and one part-time employee, was developed to fight agricultural crime and consists of a range of activities, including:

- Developing a database for tracking agricultural crime and encouraging and enabling information-sharing within and across counties, as well as among prosecutors and law enforcement;
- Education of and outreach to the public and farmers about agricultural crime and what can be done to prevent it;
- Encouraging and facilitating the use of equipment- and crop-marking, especially the stamping of equipment with owner applied numbers (OANs);
- Encouraging and facilitating the use of surveillance equipment among farmers; and
- Active targeting and vertical prosecution of offenders.

Communication within and between law enforcement agencies, and between these agencies and prosecutors and ACTION, is a central feature of the program, one that cross-cuts the above component areas.

The creation of distinct agricultural crime units in each participating county's sheriff's office and the assignment of prosecutors to specialize in agricultural crime cases has been central to the program's efforts. Salaries for agricultural crime units are covered by State funds. Agricultural crime unit detectives typically are given smaller caseloads than detectives in other units, reflecting the fact that typically more time is needed to investigate and collect evidence on agricultural crimes.

The premise of the program is that collectively the diverse set of efforts will reduce agricultural crime both through "target hardening," making it more difficult or less attractive for offenders to steal from farmers, and through punishments, facilitated by more proactive prosecution of offenders, that create a general deterrent effect.

The emphasis on local control is a critical part of ACTION. Local law enforcement agencies are more likely to know about the culture and needs prevalent in their area. Consider, for

example, that across the different counties, farm operations are run by families and by large corporations. Many of the operations are owned or run by Mennonites or farmers with Armenian, Dutch, Japanese, Laotian, or Portuguese ancestry.

ACTION also conducts spatial mapping analyses of its database to try to identify hot spots and to develop geographic profiles that might facilitate apprehension of offenders. Predictive modeling has been attempted, but has not constituted a central focus. Often, sheriffs' offices simply want the address location of a particular case, which can be easily obtained from the database. As discussed below, farmers do not consistently report all crimes (we estimate that over 85 percent of most agricultural crimes are not reported) and not all counties consistently enter information about those crimes that are reported, thus limiting the feasibility or accuracy of predictive spatial modeling.

The range of activities, coupled with both the expansion of the program over time to include more counties and the absence of baseline information on the prevalence of agricultural crime in these and other counties, renders any simple or direct assessment of impact difficult. This study thus relied on a diverse set of strategies to assess ACTION's likely impact.

ACTION's History

ACTION has expanded considerably. (To join ACTION, each county must have a dedicated, though not necessarily full-time, prosecutor and detective who focus on agricultural crimes.) At the time the study began, in 2003, there were eight participating counties from the San Joaquin Valley. Since then, five more have joined. The thirteen program counties include: Fresno, Kern, Kings, Madera, Merced, Monterey, San Benito, San Joaquin, San Luis Obispo, Santa Barbara, Santa Cruz, Stanislaus, and Tulare. San Luis Obispo, the ninth participating county, joined ACTION in 2004, followed by Monterey in 2005, and San Benito, Santa Barbara, and Santa Cruz in 2006. The study focused only on nine of these counties—the original eight and San Luis Obispo.

In 1995, the Rural Crime Prevention Program was developed by the Tulare County District Attorney. In 1996, the California Legislature authorized the creation of the Rural Crime Prevention Demonstration Project to be administered by the county District Attorney jointly with the county sheriff's office for a three-year period. In 1999—the same year that ACTION emerged—the Legislature extended the Program and authorized an additional seven counties to implement the Rural Crime Prevention Program (RCPP). This extension authorized $3.5 million to be distributed to these counties to support primarily law enforcement and District Attorney staff salaries. As mandated by the legislation, the counties formed a regional task force known as the "Rural Crime Task Force" that included county Agricultural Commissioners, District Attorneys, county sheriffs, and interested property owner groups or associations. The task force was mandated to develop a system for reporting rural crimes that enables swift recovery of stolen goods and apprehension of criminal suspects for prosecution. The task force also was charged with developing computer software and communication technology to implement the reporting system.

In 2002, the program was extended to operate until July 2005 and was renamed the Central

Valley Rural Crime Prevention Program (CVRCPP). This legislation required the task force to adhere to uniform procedures for all counties to collect data on agricultural crime. They also had to establish a central database for the collection and maintenance of data on agricultural crimes and designate one county to maintain this database. In 2003, the Legislature created the Central Coastal Rural Crime Prevention Program (CCRCPP), a sister program of the CVRCPP but consisting of coastal counties. ACTION is the federally funded initiative, supported by the Bureau of Justice Assistance (award no. 1999-DD-BX-0080), that supplements and enforces—through its various activities—the work of the RCPP (now the CVRCPP) and the newly formed CCRCPP. Because the efforts of the CVRCPP, CCRCPP, and ACTION parallel one another, the evaluation focuses on activities encompassed by all three but refers simply to "ACTION" throughout the report.

4. DESIGN AND METHODOLOGY

Overview

The main research objectives of the study were to assess the impacts of ACTION, including its causal logic, to conduct cost-benefit analyses and investigate the application of this analytic approach to agricultural crime prevention efforts, and to examine implementation issues associated with the program and what would be involved in effectively implementing it in other jurisdictions. To address these objectives, the research team used data from: two site visits, conducted one year apart, including interviews and meetings with program staff, law enforcement officers, prosecutors, and farmers; ACTION data and official records from law enforcement agencies; and two surveys of farmers, the first of which was conducted in fall 2004 and the second of which was conducted in fall 2005.

The methods used for each objective are detailed in subsequent chapters of the report. Briefly, they consist of the following approaches. First, the descriptive statistical analyses rely on survey, ACTION, and official records data, and consist primarily of the presentation of means and percentages. The crime mapping chapter employs a variety of spatial analytic techniques to examine the distribution of crime events using these data. The impact evaluation chapter uses a variety of regression analyses to examine the relationship between opportunity-related factors and victimization and levels of program implementation and victimization. The chapter includes descriptive analyses that examine potential program impacts on such non-victimization outcomes as prosecutorial activity and deployment of surveillance and equipment. The cost-benefit analysis is presented in a separate stand-alone report (Chalfin et al. 2007). Like the mapping chapter, it examines the steps involved in, as well as issues related to, applying cost-benefit analysis to agricultural crime prevention programs. It also presents cost-benefit analyses. Finally, the transferability analysis chapter examines the program materials, site visit information from meetings and observations, and interviews with program staff and practitioners in other states for themes bearing on the different components of ACTION and different phases of implementation, including start-up, sustainability (i.e., maintenance of program operations over the long-term), and expansion.

Site Visits and Interviews

Prior to conducting visits, interviews, accessing data, or conducting surveys, the research team complied with all Institutional Review Board requirements both at the Urban Institute, and, in the later stages of the research, Florida State University. The team also met with National Institute of Justice (NIJ) staff to obtain their views about the research methodology. One of the program officers accompanied the research team on the first site visit, which proved instrumental in helping to establish solid working relationships between NIJ, ACTION staff, and the research team. The first stage of the project involved conducting a site visit to the ACTION program to learn first-hand about the program and the nine-county area it serves (see Appendix C); meet with staff about issues related to the transferability of the program (focusing on general questions concerning implementation challenges); meet with local Farm Bureau and Agricultural

Commissioner executives as well as law enforcement officers and prosecutors; learn about the ACTION database; and begin developing the first year survey instrument through visits to farms and with farmers as well as discussions with program staff. The site visit was also used to establish ways in which the project could best ensure a rigorous impact evaluation and provide information that might help the program improve its efforts.

A second site visit was conducted one year later. The research team and ACTION staff maintained regular phone and e-mail communications throughout the intervening period and subsequently. However, the site visit afforded an opportunity to conduct in-person interviews with prosecutors in the different counties, attend the World Agricultural Exposition to meet with farmers and learn about the range of products used on farms that are vulnerable to theft, to talk with program staff about past or impending program changes, and discuss any concerns or issues related to the program or the evaluation. In addition, the research team collected program information that could be used for the cost-benefit analyses. This information continued to be collected subsequently through continued communications with program staff.

The site visit interviews served as a main source of information for the team's investigation of the transferability of ACTION, or ACTION-like programs, to other places. The other main source was telephone interviews with law enforcement agency, agricultural department, and District Attorney staff and representatives in other states. The contacts were selected using a snowball sampling strategy. The ACTION staff had several contacts they had developed and so these were pursued initially. We then asked these respondents who they would recommend contacting. At the same time, the research team conducted newspaper and internet searches to identify places in the country where there was some evidence of agricultural crime and/or agricultural crime prevention efforts. The interviews in each instance focused on investigating the types of efforts, if any, that were under way in the given jurisdiction or state, whether there would be interest in the types of efforts ACTION undertakes, and what challenges they foresaw in implementing such efforts. In all, over 30 interviews, separate from those conducted with ACTION staff and individuals in the nine-county ACTION region, were conducted with individuals from across the country, including California, Florida, Hawaii, Iowa, Mississippi, New Mexico, Oklahoma, Texas, and West Virginia.

ACTION and Official Records Data

The ACTION staff provided the research team access to their online records management system upon the start of the evaluation project in fall 2003. This database system contains crime report records for all agricultural crime incidents entered by the county sheriff agricultural crime units. If applicable, arrest and court procedure information is also included, as is OAN information. Below, the database is described in more detail.

One method for sharing information across all the ACTION counties is ACTION's incident-based records management system designed especially to capture agricultural crime incidents. The secure, web-based system, similar to traditional police records management systems, serves as the central repository for electronic agricultural crime reports from each county Sheriff's Agricultural Crime Unit and District Attorney's Office. ACTION developed what may be the first database system specifically to collect agricultural crime records. The database stores

information about agricultural crime cases including: case number, officer assigned to case, date assigned, case type, crime code and description, case narrative, scene, point of entry, tool, location of occurrence, reporting officer, date of offense, time of offense, and arrest details. Details about victims and perpetrators may also be entered as well as prosecutorial and court progress information, if applicable, and detailed information or evidence, including digital photographs, regarding stolen or damaged property.

The database is equipped with several pre-designed, standardized report queries that can provide summary information for any county for any dates specified. For instance, one can query for a summary report of District Attorney actions, by county and a specified date range, and view such information as the number of cases filed, number of defendants convicted by type of conviction, average sentence length (in days) of defendants sentenced to incarceration, dollar amount of restitution orders, and cases combined with other, related agricultural crime cases.

It is also possible to generate incident-level datasets based on similar queries. Records may be viewed in a web browser or directly downloaded to a computer as a tab-delimited text file. The incident-level data fields include, among other type of information, street address of offense, city, latitude and longitude coordinates, date and time of offense, property type, property status (stolen), description of items stolen, property value, and county name.

ACTION also maintains records for each farmer who applies for OANS or for whom ACTION provides assistance (e.g., stamping farm equipment). (The program provides this service for all of California and for Nevada as well.) The following information is recorded: the unique OAN Number; farmer name, organization, and address; the date the equipment was stamped; the number of pieces stamped; the value of the equipment stamped; latitude and longitude; and time spent stamping. ACTION also tracks any OAN-marked equipment that is stolen. Although the OAN information is retained in the theft incident record, separate listings are provided of the property stolen, related case number, OAN number, value of theft, and whether or not a piece was recovered.

ACTION requires any law enforcement agency or ACTION staff who deploy surveillance technology on a farmer's property to fill out a surveillance usage report upon completion of the deployment. Information captured in this report and saved in database format includes: the surveillance item(s) used; number of suspects arrested; number of suspects identified; the county in which the technology was deployed; date of operation; and time of day (day or night or both). In addition, law enforcement are asked several questions, including:

- How many personnel would have been needed for surveillance without the equipment?
- How many hours of personnel time would have been needed?
- Was the equipment helpful?
- Would this surveillance have been done if this equipment had not been available?

In the instances where equipment was deemed helpful, subjective comments can be entered. For example, officers may enter such comments as "four suspects arrested," "served as a deterrent," able to pinpoint the time of arrival of the suspects for future arrest," and "eliminated the need for manned surveillance."

Surveys

Two paper-and-pencil, self-administered surveys—one in fall 2004 and the second in fall 2005—were sent to samples of farmers in the nine ACTION counties. We identified farms using lists provided by Agricultural Commissioners in each county. Specifically, an ACTION staff member contacted each county's Agricultural Commissioner office and obtained their most accurate pesticide permit holder lists in June and July of 2004. (This list was used for the 2005 survey as well. Before sampling for the second wave of survey mailings in 2005, the researchers confirmed with Agricultural Commissioners' offices that their lists of pesticide permit holders do not change more than 10 percent from year to year as permits are valid for three years at a time.)

The lists provide relatively complete enumerations of farm operations that use pesticides—which typically includes all but the smallest operations and livestock operations that do not grow their own feed—because these farms must register with the Agricultural Commissioners. Conversations with Commissioners' offices and representatives from the National Agriculture Statistics Service indicated that the sampling approach was likely to capture the majority of pesticide users, particularly medium and large operations. Nonetheless, any results using these data may not fully generalize to all farms, such as those focused primarily on livestock or that do not use pesticides, or to farms beyond the study region. The survey instruments, developed with the assistance of experts who consulted on the project and with farmers, and drawing on instruments used in previous studies (e.g., Bean and Lawrence 1978; Farmer and Voth 1989; Cleland 1990), were administered in the fall (2004 and 2005, respectively) and asked farmers about experiences with agricultural crime victimization during the 12 months prior to the survey. It also asked questions about characteristics of their farm operations and the activities that they take to prevent agricultural crime.

Adhering to Dillman's (2000) recommendations, advance notice of the study was given to farmers through the use of postcards, then surveys were sent to farmers in three waves at one-month intervals, with the second and third waves targeting non-respondents. Cover letters were included, as was a letter of support from the California Farm Bureau Federation and a self-addressed, stamped return envelope. For the first survey, which was fielded in fall 2004, the response rate was 43.2 percent for a final sample of 823 respondents (farms). Initially, 2,286 surveys were mailed, but 64 were returned due to bad addresses. Of the 2,222 mailed surveys with good addresses, collectively constituting the eligible survey pool, 960 were returned. Of these, 134 were not farmers (having so indicated on the instrument) and 3 were not completed. Thus, the final sample was 823.

For the second survey, which was fielded in fall 2005, the response rate was 44.5 percent for a final sample of 818 respondents (farms). Initially, 2,286 surveys were mailed, but 30 were returned due to bad addresses. Of the 2,256 mailed surveys with good addresses, collectively constituting the eligible survey pool, 1,004 were returned. Of these, 157 were not farmers (having so indicated on the instrument) and 29 were not completed. Thus, the final sample was 818.

These response rates are comparable to other studies of farmers (see, e.g., Cleland 1990; Peale 1990; Ballweg 1991; Abaidoo and Dickinson 2002; Barham et al. 2004; Donnermeyer and Barclay 2005). Cleland (1990:1), for example, has emphasized that response rates with farmers

typically lie between 30 and 40 percent, even with short surveys (see also Peale 1990; Donnermeyer and Barclay 2005). Many studies report substantially lower response rates (e.g., Czapar et al. 1995; Abaidoo and Dickinson 2002; Weigel and Barlass 2003). Of course, the possibility of non-random responses exists. However, there is little research or basis to suggest that the farmers who responded systematically differ from non-respondents with respect to the likelihood or, more importantly, the causes of victimization. Furthermore, response rates were largely comparable across counties, which served as the primary basis for assessing the "dose" of program implementation in the impact evaluation analyses.

We conducted pencil-and-paper surveys because telephone surveys were not a viable option. During site visits and initial discussions with program staff and experts, many issues were identified. A single example is illustrative—many farmers work outside all day and in the evenings, and therefore cannot easily be contacted by telephone. That problem might be addressed by using cell phone numbers, but these typically are not readily available to the public.

The strategy we used to increase the response rate in the first and second surveys bears discussion. For the first survey, concern about the relatively low response rate prompted us to reconsider incentive options for the follow-up mailing. Dillman (2000) has emphasized that no response-inducing technique is as likely to improve mail response rates as financial incentives do. We therefore decided to provide a one or two-dollar incentive in each survey mailed in the third follow-up. Because prior research provided no basis for determining whether two dollars would garner more responses than would one dollar, half the final follow-up received two-dollar incentives and the other half received one-dollar incentives. Subsequently, we found little difference in the response rates of farmers who received one dollar versus two dollars. However, the incentives did appear to boost the response rate. After the first two mailings, the response rate was just over 20 percent; the third mailing almost doubled that response rate. Typically, response rates decline markedly after an initial mailing. Given the improvement gained from using the incentives, and the lack of difference in using one dollar versus two dollars, the second-year survey included one-dollar incentives in all three waves of mailings. In addition, a raffle incentive was introduced in the final follow-up; respondents who returned the survey within three weeks were eligible to win $100.

Impact Evaluation Design Considerations

Official Records and Changes in Reporting

Reporting of crime by farmers is likely to have changed over time, reflecting ongoing efforts by ACTION that encourage farmers to report when they have been victimized. Disentangling precisely what part of the trends in victimization, as indicated in the ACTION database, reflect reporting versus true offending changes remains unknown. Based on the research team's initial investigations, there was reason to believe that reporting might have stabilized after the first few years following ACTION's inception and that such information might in turn be used to identify proxy measures of agricultural crime, using official arrest records, and in turn identify changes in that proxy measure before and after the implementation of ACTION. However, our site visits, interviews, and analysis of the ACTION database indicated that reporting was still changing.

Moreover, the issue was compounded by clear evidence that not all counties consistently updated the ACTION database. According to our analyses, in which we compared survey responses to those from the ACTION database, 85 percent or more of farmers do not report crimes (see the next chapter, Table 4). In a sense, that is good news for ACTION—it means that there is a substantial problem that remains to be addressed. However, any success in encouraging farmers to report crime will mean that for the indefinite future the database will not readily permit accurate identification of crime trends. In addition, the likely success of geographic profiling efforts likely will remain substantially limited by the underreporting. A central challenge in the future will be securing resources to facilitate consistent county-level reporting.

Variation in Program Implementation

During our site visits, it also became clear that some sites have more aggressively implemented ACTION than have others. The agricultural crime units in some counties, for example, work more closely with prosecutors, use ACTION's surveillance equipment more frequently, attend more meetings where farmers are present, and invest more time educating the public and farmers; in these same counties, prosecutors tend to be more aggressive in pursuing agricultural crimes. It was not clear why exactly some counties "bought in" more to ACTION than others. However, a likely candidate, as reported to us in different interviews, included the relative disinterest some sheriffs' and District Attorneys' offices had in addressing agricultural crime. For some attorneys, other types of crimes may simply be a greater priority. Regardless of the cause, the inconsistent implementation afforded the opportunity to conduct the equivalent of a naturally-occurring experiment, in which some counties minimally adopt a program while others aggressively adopt it. This strategy is described as part of the discussion of the impact evaluation.

The Second Year Survey

Although the response rate of the first survey was comparable to that found in surveys of farming populations generally, the research team wanted to increase the response rate in the second survey and thus targeted a new sample of farms. A review and discussions with consultants suggested that if the same sample from the first survey were used, the response rate likely would be substantially lower. For this reason, a new sample of farms was identified. More importantly, the content of the second survey varied from the first year because of the need to develop better measures of program dose. Initially, and as described in the discussion of the impact evaluation, the research team relied on ACTION data and staff interviews to quantify the extent of program implementation in each county. However, because of the issues discussed above with respect to the data, the research team decided, after conversations with the project consultant, NIJ staff, and methodologists, to use the second year survey to develop independent and ideally better measures of program dose. In addition, the survey was designed to develop measures of dose and victimization for both 2004 and 2005, thereby enabling analyses that would more rigorously estimate program impact by controlling for prior victimization.

5. DESCRIPTIVE ANALYSES

ACTION Counties

Table 1 presents several basic descriptive statistics about the ACTION counties, which collectively comprise a geographic area roughly the size of New England. (A more detailed account is provided in Appendix C.) Briefly, as of 2002, the nine ACTION counties collectively are home to 39 percent of all farms in California (i.e., 30,679 of the 79,631 farms in California). These farms collectively cover over 11 million acres and over 41 percent of the total farm acreage in the state. Not surprisingly, 42 percent of the farmers in the state reside in the nine counties. The size of the farms among the counties varies; the median farm size, in acres, ranges from a low of 28 (Stanislaus) to a high of 167 (Kern). A similar rank ordering emerges if the average farm size is used. In all the counties, crop sales contribute substantially to the market value of all agricultural products (from a low of 42 percent in Merced to a high of 92 percent in San Luis Obispo). Notably, half of the over $25 billion in market value of agricultural products in California come from the nine ACTION counties.

Descriptive Statistics from the Two Surveys

The evaluation included the creation of two waves of survey data, one collected in 2004 and another in 2005 from different samples of farmers in nine counties, that would facilitate assessing the impacts of ACTION. The surveys provided an opportunity, however, to collect other data that could shed light not only on the victimization experiences of farmers but also on various other dimensions, such as the steps they take to protect their property, experiences with law enforcement, and factors that influence reporting, as well as other activities.

Below, some of the key descriptive findings are summarized. (See tables 2 and 3 for the more complete set of descriptive statistics.) Not all questions were asked in both years, and so some statistics are presented for only one of the years. For each statistic, we discuss potential implications of the findings for policy efforts.

- In 2005, 50 percent of farmers reported victimization, compared with 62 percent in 2004 (see Figure 1). Among victimized farmers, the average number of crimes experienced was 5.2 and 8.8 in each of these years, respectively.

  Although victimization may have declined, many farmers are victimized, some more frequently than others. Thus, effective policy interventions might focus not only on agricultural crime but also on the characteristics of highly victimized farms.

- Small equipment theft and vandalism were the most prevalent types of victimization experience among farmers. In 2005, 47 percent of farmers reported experiencing small equipment theft and 33 percent reported vandalism; in 2004, the ordering, in terms of prevalence, was reversed, with 30 percent of farmers reporting small equipment theft and 49 percent reporting vandalism.

Both types of victimization were reported to be of particular concern among farmers, and clearly are highly prevalent. Thus, efforts specifically targeting them may be warranted. Neither are likely candidates for prosecution, given that the severity of the offenses may not always be viewed as warranting action. Thus, targeted prevention measures may be more feasible and effective.

- Other types of victimization were less common in 2005 and 2004, respectively: tractor theft (7 percent in 2005, 4 percent in 2004); large equipment theft (11 vs. 6 percent); livestock or poultry theft (4 vs. 2 percent); chemical or fuel theft (29 vs. 13 percent); fruit, vegetable, grain, feed, or seed theft (10 vs. 7 percent); burglary of farm buildings (20 vs. 11 percent). The higher prevalence of chemical or fuel theft in 2005 likely was due to dramatic increases in the price of fuel.

  Policy efforts might more productively focus on higher prevalence crimes. Tractor theft is, for example, relatively rare, and thus would be correspondingly difficult to prevent. However, the trade-off is that such crimes can also be more costly.

- Almost all (86 percent of) farmers in 2004 reported that they knew friends or family who were victims of agricultural crime.

  Policy efforts that reach individual farmers have the potential to influence other farmers through their friendship and family networks. If a given farmer finds a particular approach to crime prevention to be helpful, he or she might be more likely to discuss the approach with friends and family.

- Theft of machinery, trash dumping, burglary of farm buildings, and vandalism were the primary areas of concern expressed by farmers in 2004.

  Crime prevention efforts might meet a more receptive audience among farmers if they focus on those crimes of most concern to farmers.

- When asked how much compensation would be needed to offset the one-year costs of crime victimization, farmers in 2005 reported that on average they would need $5,200.

  Farmers on average experience a relatively large amount of victimization, in monetary terms. Crime prevention efforts thus hold the potential to contribute to cost-savings among farmers.

- Fear of crime had diverse effects on farmers—62 percent of farmers in 2005 reported that they hired security if they went away, 59 percent said that they only made off-farm trips during the day, 46 percent worried generally about victimization, 32 percent rarely took vacations, 24 percent started carrying a concealed weapon, 24 percent took out extra insurance, and 7 percent considered leaving farming.

  Any balanced assessment of a crime prevention program should consider the full range of impacts that may result from the program. In this case, an effective program has the potential not only to reduce victimization but concomitantly such outcomes as investment in security, concern about victimization, and comfort taking vacations or leaving one's property.

- Although crime victimization was a concern expressed by farmers in 2005, it was reportedly not as much of a concern as such factors as fuel costs, taxes, water availability, and the economy.

  Concerns about crime fluctuate from year to year, but typically are a top priority. Nonetheless, efforts to invest in agricultural crime prevention should be placed in a broader context of concerns that farmers have.

- The major reasons why farmers said that they did not report victimization was that they did not believe that law enforcement would take the crime seriously (54 percent of respondents in 2004) and that the crime simply was not serious enough (45 percent). Respondents in the 2005 survey also emphasized that they did not typically have enough proof that a crime occurred.

  Such explanations are common in the research literature on agricultural crime. The prevalence of these views suggests that there is considerable room for law enforcement to improve how seriously they address agricultural crime and/or communicate their concern to farmers.

- When asked a series of questions about law enforcement efforts, the 2005 respondents were largely favorable in their views, but there was also room for improvement. For example, when asked if the local sheriff's department had been helpful in investigating crimes or marking equipment, most respondents reported that law enforcement efforts were either not at all helpful or only a little helpful. Respondents in the 2004 survey rated the quality of law enforcement protection as average.

  ACTION appears to have improved the quality of law enforcement efforts that focus on agricultural crime, and improved law enforcement agency and farmer relationships appear to be a central part of that progress. Continued and perhaps increased efforts to improve relations may be warranted.

- When asked what activities law enforcement should prioritize, farmers in the 2005 survey emphasized, in order of highest to lowest ranking, increased patrols of agricultural areas, greater responsiveness when called, being e-mailed about crime occurring in their (the farmers') area, assisting with equipment-marking, meeting with farmers about security measures, and encouraging farmers to share surveillance equipment.

  Farmers' views on what they think should be prioritized might well reflect the types of crime prevention strategies that could be most effective in reducing victimization. As such, consideration should be given to testing their ideas.

- Most farmers in 2004 reported receiving crime prevention information from newspapers, television, or radio (69 percent), farm magazines (67 percent), friends, neighbors, and relatives (62 percent), the Farm Bureau (62 percent), local law enforcement (42 percent), and the county extension agent (18 percent).

  Since farmers receive crime prevention information from a diverse range of sources, effective communication with them about crime prevention may well require disseminating information through as many such sources as possible.

- When asked how they would prefer to receive crime prevention information, farmers in the 2005 survey overwhelmingly favored postal mail (55 percent) followed by electronic mail (24 percent).

  The latter finding suggests that compiling lists of farmer e-mail addresses and sending out crime prevention tips to such lists might be a cost-effective way to reach a larger group of farmers in a manner in which many would prefer.

- Only 5 percent of farmers in 2005 reported visiting the ACTION website. Of those who visited it, the average number of visits was 3.3. Respondents found the website somewhat useful.

  Given the relatively low percentage of farmers accessing the website, there may be a potential need to better advertise the website and to solicit feedback from farmers about the website content.

- Almost half (48 percent) of farmers in 2005 reported using some type of markings on their equipment, crops, and livestock. Twenty-six percent said they used surveillance equipment.

  Clearly, many farmers use markings to protect their property. Increasing the percentage of farmers that do so may be warranted, as may be increasing the percentage of property that is marked.

- Notwithstanding studies reporting that farmers typically take few crime prevention measures, the 2004 survey found that farmers take a wide range of precautions—on average, farmers used 43 percent of 30 possible prevention measures.

  Again, farmers clearly take many steps to protect their property. Improvements in crime prevention might nonetheless be had through efforts to increase both the percentage of farmers who protect their property and the number of prevention steps they take.

- The percent of farms not reporting crimes to law enforcement is considerable—across all counties, 88 percent of agricultural crime victimization experiences are not reported (see Figure 2). The rate of non-reporting varies across counties and types of crime.

  Increased reporting of agricultural crime is essential to developing accurate trends in such crime and developing more valid estimates of its true prevalence and impact. Given the low rates of reporting, considerable effort may be warranted in distributing, through diverse media, information to farmers about the importance of crime-reporting. When crime is reported, it is essential that counties in turn enter the reports into the ACTION database.

- Reflecting the underreporting of crime generally, the dollar value of reported crime substantially understates the true costs of agricultural crime victimization. In 2005, such victimization resulted in $101 million in costs across the nine ACTION counties, only $8 million of which was reported (see tables 4 and 5 and Figure 3).

  Underreporting of agricultural crime is reflected in underestimates of the value of

stolen property. Efforts to increase reporting of crime might therefore focus on the fact that increased reporting is necessary to develop accurate assessments of the monetary impact of agricultural crime.

- On a methodological note, although results from the two surveys points to a reduction in overall victimization—from 62 to 50 percent—that may be due to differences in the two samples or to the design of the 2005 survey. For example, in the latter, and as shown in Figure 1, respondents were asked to report both on 2004 and 2005 victimization, and the results from that survey indicate an increase, not a decrease, in overall victimization.

  Surveys can be used to develop more precise and valid estimates of victimization. Nonetheless, the information they generate may be influenced by many factors, including the survey design, the time period covered, and by changes over time in how farmers respond to surveys. Few farm surveys exist and greater attention is needed to developing consistent and valid measures of victimization.

Estimation of Prevalence, Costs, and Reporting of Victimization

Both the 2005 survey of farms and the ACTION database were used to generate estimates of the prevalence and costs of victimization at the county-level and to estimate non-reporting of victimization. The ACTION data used to create these estimates are described here, and the accompanying tables provide the steps taken to generate the estimates.

Each county's sheriff's agricultural crime unit uses the ACTION-designed and maintained web-based database to record agricultural crimes reported by farmers. Each county's District Attorney also provides data about cases brought to court and their status. This database is set up much like a traditional law enforcement records system; information about the incident, victims, suspects, and property is recorded electronically. However, the linking of District Attorney data constitutes a unique feature of this database; two sides of law enforcement are able to contribute to and look up related information. UI researchers were given read-only access to this database. Within the database, there are also a variety of standardized queries, which, when run, compile the data in various ways depending on the user's interest. There are reports highlighting District Attorney or court-related details, property details, and summary statistics. For this analysis, the "Crime Pattern" query was used to create records for all reported incidents in 2005.

One of the fields in the database records information about the type of property stolen and details of that property. Types of property include chemicals, commodities, farm equipment, livestock, tractor, and miscellaneous. The UI survey collected victimization data about thefts within these property types, as well as tools or small equipment, large equipment, and fuel. The database category of farm equipment included the equivalent of the survey's large equipment category. The database's miscellaneous category includes tool or small equipment, fuel, and other property categories. To create parallel categories between the database and survey data, the data from the latter source were manually recoded to categorize fuel thefts into "chemical" thefts and to recode the tool and small equipment thefts in a similar manner.

Another modification was required because incident information was stored in non-uniform ways across the counties. All thefts attributed to the same incident would be given the same case

number. In the database, each property type might be stored on its own line so that there would be multiple records for the same case number. Similarly, there might be only one record for the same incident even though there were multiple types of property thefts; in this case, for our analyses only one type of property was recorded even though an entire list of stolen property is available in a free-text field. For simplicity's sake, when the miscellaneous category was recoded, only one record (and thus one property type) was recorded for each case number. The calculations are likely to produce substantial underestimates given the inconsistencies in recording multiple property items stolen during the same event.

After recoding, the dataset was manipulated so that there was only one record per case number. Where present, the multiple recordings of property type were retained and used in the analyses. Once transposed, the database dataset structure paralleled the structure of the survey dataset so that the number of incidents involving each type of property theft could be counted.

Table 1. ACTION County Descriptive Facts

	No. of Farms	Land in Farms (acres)	Avg. Farm Size (acres)	Median Farm Size (acres)	Main Occupation= Farmer	Mkt. Value Ag Products ($1,000)	Pct. Crop Sales	Pct. Livestock Sales
California	79,631	27,589,027	346	35	49,132	25,737,173	74	26
Fresno	6,281	1,928,865	307	40	4,363	2,759,421	78	22
Kern	2,147	2,731,341	1,272	167	1,504	2,058,705	87	13
Kings	1,154	645,598	559	75	776	793,061	50	50
Madera	1,780	682,486	383	80	1,295	710,433	71	29
Merced	2,964	1,006,127	339	60	2,106	1,409,254	42	58
San Joaquin	4,026	812,629	202	35	2,713	1,222,454	74	26
San Luis Obispo	2,322	1,318,142	568	56	1,397	396,394	92	8
Stanislaus	4,267	789,853	185	28	2,770	1,228,607	46	54
Tulare	5,738	1,393,456	243	39	3,813	2,338,577	51	49

Source: U.S. Department of Agriculture. 2004. *2002 Census of Agriculture*. Vol. 1. Washington, D.C.: U.S. Department of Agriculture, National Agricultural Statistics Service. See Appendix C for additional county-level details.

Table 2. Survey of Farmers, Fall 2004 (N=823)*

	Mean	S.D.
Any crime (1=yes, 0=no)	0.62	0.48
If yes, number of crimes	8.84	35.88
All crime (count)	5.51	28.64
Small equipment theft (1=yes, 0=no)	0.30	0.46
If yes, number of thefts	2.69	3.21
If yes, dollar value of thefts	3989.19	17096.87
If yes, pct. of thefts reported to law enforcement	52.49	46.65
Tractor theft (1=yes, 0=no)	0.04	0.10
If yes, number of thefts	1.25	0.46
If yes, dollar value of thefts	9857.17	4552.60
If yes, pct. of thefts reported to law enforcement	92.86	18.90
Large equipment theft (1=yes, 0=no)	0.06	0.23
If yes, number of thefts	1.43	.73
If yes, dollar value of thefts	8998.84	11164.61
If yes, pct. of thefts reported to law enforcement	92.86	41.53
Livestock or poultry theft (1=yes, 0=no)	0.02	0.15
If yes, number of thefts	2.89	4.62
If yes, dollar value of thefts	2941.58	5707.50
If yes, pct. of thefts reported to law enforcement	48.42	47.64
Chemical or fuel theft (1=yes, 0=no)	0.13	0.34
If yes, number of thefts	1.79	1.41
If yes, dollar value of thefts	2030.06	6141.77
If yes, pct. of thefts reported to law enforcement	49.86	47.36
Grain, feed, seed, fruit, or vegetable theft (1=yes, 0=no)	0.07	0.26
If yes, number of thefts	20.88	97.51
If yes, dollar value of thefts	2015.10	4387.49
If yes, pct. of thefts reported to law enforcement	14.09	28.60
Burglary of farm buildings (1=yes, 0=no)	0.11	0.31
If yes, number of burglaries	1.61	0.89
If yes, dollar value of burglaries	3532.85	5455.08
If yes, pct. of burglaries reported to law enforcement	71.69	41.58
Vandalism (1=yes, 0=no)	0.49	0.50
If yes, number of vandalism events	5.95	11.54
If yes, dollar value of vandalism	1159.23	3676.10
If yes, pct. of events reported to law enforcement	25.51	36.24

Friends/family whose farms were victimized (1=yes, 0=no)	0.86	0.35
Extent of concern about . . . (1=most concerned; 5=least)		
Equipment or machinery theft	1.92	1.16
Trash dumping	2.02	1.22
Burglary of farm buildings	2.03	1.26
Vandalism	2.14	1.24
Chemical or fuel theft	2.28	1.38
Trespassing	2.32	1.27
Chemical or toxic dumping	2.68	1.46
Theft of crops	3.21	1.46
Bio-terrorism (e.g., contamination of feed)	3.93	1.37
Fear of victimization influences behavior (1=yes, 0=no)	0.45	0.50
If yes, influence on activities (1=yes, 0=no) . . .		
Maintain constant vigilance	0.41	0.49
Mistrust strangers, esp. those near property	0.37	0.48
Worry about victimization	0.31	0.46
Family member must be present on property	0.15	0.36
Rarely or never take vacations	0.15	0.36
Reasons for not reporting crime to law enforcement (1=yes, 0=no)		
Didn't believe law enf. would take it seriously	0.54	0.50
Crime was not serious enough	0.45	0.50
Wanted to avoid insurance issues (e.g., increase in premiums)	0.15	0.36
Didn't have proof that crime occurred	0.12	0.33
How much loss necessary to report crime (pct.)		
$1-99	0.23	0.42
$100-299	0.23	0.42
$300-599	0.19	0.40
$500-999	0.10	0.30
$1,000-2,999	0.17	0.38
$3,000-5,999	0.05	0.22
$6,000-9,999	0.02	0.13
$10,000 or more	0.01	0.12
If farmer suspected stolen goods were being sold to them (1=yes, 0=no)		
Buy goods and say nothing	0.07	0.26
Buy goods and report person to authorities	0.03	0.17
Not buy the goods and not report suspect	0.61	0.49
Not buy the goods and would report suspect	0.29	0.45

Get information about crime prevention from . . . (1=yes, 0=no)		
Newspaper, television, or radio	0.69	0.46
Farm magazines	0.67	0.47
Friends, neighbors, relatives	0.62	0.49
Farm Bureau	0.62	0.49
Local law enforcement	0.42	0.49
County extension agent	0.18	0.39
California Department of Agriculture	0.15	0.36
Farm commodity organizations	0.10	0.29
Other civic or community organizations	0.05	0.22
Hardware or other retail store	0.04	0.21
Locksmith	0.01	0.10
Use OAN or other markings (1=yes, 0=no)	0.21	0.41
If yes, percent of equipment marked	69.70	27.10
Use surveillance equipment (1=yes, 0=no)	0.24	0.43
Pct. of property locked away each night (1=0-20%; 5=80-100%)		
Chemicals/fertilizer	4.46	1.22
Tools/small equipment	4.26	1.29
Tractors	2.59	1.74
Large equipment/machinery	2.36	1.65
Harvested crops	2.12	1.69
Livestock/poultry	1.95	1.60
Pct. of 30 measures taken to protect property	43.43	13.61
Quality of protection by authorities (1=very poor, 10=very good)	4.99	3.06
Number of acres used in farm operation	610.83	3260.81
Market value of operation's agricultural products ($)	839214.19	3846820.83
Who buys stolen products (1=very likely, 5=very unlikely)		
Illicit drug producers	1.99	1.36
People and businesses in other countries	2.73	1.52
Small businesses and markets	3.42	1.35
Other farmers	3.54	1.29
Commercial distributors	4.34	1.00

* The survey was administered in fall 2004 and asked about victimization experiences during the preceding 12 months (October 2003 - September 2004), as well as a range of other questions.

Table 3. Survey of Farmers, Winter 2005 (N=818)*

	2005		2004	
	Mean	S.D.	Mean	S.D.
Any crime (1=yes; 0=no)	0.50	0.50	0.45	0.50
If yes, number of crimes	5.22	8.74	4.59	7.69
All crime (count)	3.24	7.33	2.70	6.32
Small equipment theft (1=yes; 0=no)	0.47	0.50	0.44	0.50
If yes, number of thefts	2.19	1.70	2.07	1.60
If yes, dollar value of thefts	2868.89	6077.91	2377.69	4356.61
If yes, pct. reported to law enforcement	57.59	45.55	55.74	47.21
Tractor theft (1=yes; 0=no)	0.07	0.26	0.05	0.22
If yes, number of thefts	1.41	0.98	1.36	0.66
If yes, dollar value of thefts	14814.81	23877.36	11536.84	22861.25
If yes, pct. reported to law enforcement	80.00	40.68	89.39	29.79
Large equipment theft (1=yes; 0=no)	0.11	0.32	0.12	0.33
If yes, number of thefts	1.28	0.56	1.21	0.57
If yes, dollar value of thefts	5939.58	7857.09	5586.17	9757.57
If yes, pct. reported to law enforcement	88.68	31.99	88.24	32.54
Livestock or poultry theft (1=yes; 0=no)	0.04	0.20	0.04	0.20
If yes, number of thefts	5.95	11.55	6.47	16.53
If yes, dollar value of thefts	22365.29	60218.73	4883.33	7947.81
If yes, pct. reported to law enforcement	52.63	51.30	63.73	46.49
Livestock or poultry theft (1=yes; 0=no)[a]	0.04	0.20	— —	— —
If yes, number of thefts	4.05	8.33	— —	— —
If yes, dollar value of thefts	8425.00	14364.55	— —	— —
If yes, pct. reported to law enforcement	55.56	51.13	— —	— —
Chemical or fuel theft (1=yes; 0=no)	0.29	0.45	0.24	0.43
If yes, number of thefts	2.28	2.72	2.02	1.56
If yes, dollar value of thefts	2758.22	8482.91	2934.64	7696.77
If yes, pct. reported to law enforcement	51.81	47.44	53.04	46.93
Fruit, vegetable, grain, feed, seed theft (1=yes; 0=no)	0.10	0.30	0.12	0.32
If yes, number of thefts	4.57	8.13	3.50	7.51
If yes, dollar value of thefts	1517.56	3341.28	1971.74	5287.23
If yes, pct. reported to law enforcement	17.83	36.40	27.41	43.82
Burglary of farm buildings (1=yes; 0=no)	0.20	0.40	0.17	0.38
If yes, number of burglaries	2.06	2.52	1.80	1.79
If yes, dollar value of burglaries	3204.30	6838.40	2599.24	4296.88
If yes, pct. reported to law enforcement	76.39	39.42	71.05	43.17

Vandalism (1=yes; 0=no)	0.33	0.47	0.29	0.45
If yes, number of vandalism events	3.40	6.56	3.46	6.67
If yes, dollar value of vandalism events	1348.61	3845.68	1166.64	2632.90
If yes, pct. reported to law enforcement	39.05	46.65	42.85	46.75
Friends/family who have been victimized (#)	2.94	7.89	2.69	7.71
Extent of concern (1=least concerned; 5=most)				
Fuel costs	4.21	1.07	— —	— —
Taxes	3.89	2.29	— —	— —
Water distribution	3.74	2.33	— —	— —
Economy	3.70	1.17	— —	— —
Crime victimization	3.40	1.95	— —	— —
Real estate pressures	3.04	1.51	— —	— —
Drought	3.36	1.35	— —	— —
Availability of necessary supplies	2.63	1.27	— —	— —
Employee retention	2.56	1.58	— —	— —
Disease among cattle/livestock/poultry	1.81	1.69	— —	— —
Law enforcement prot. (1=very poor; 5=very good)	3.27	1.04	3.24	1.03
Unsolicited law enf. visits (#)	0.42	1.42	0.34	1.15
Local sheriff helps (1=not at all; 4=very much)	1.91	1.08	1.84	1.04
Law enf. investigates (1=str. agree; 4=str .disagree)	2.27	0.79	2.29	0.79
Priority law enf. should give to . . . (1=low; 5=high)				
Increase patrols of agricultural areas	3.91	1.15	— —	— —
Be more responsive when called	3.78	1.15	— —	— —
E-mail farmers about crime locations	3.45	1.67	— —	— —
Assist with OAN marking	3.33	1.32	— —	— —
Meet with farmers about security measures	3.27	1.27	— —	— —
Encourage farmers to share surveillance equip.	2.96	1.23	— —	— —
Law enf. adeq. knowledge of ag crime (1=yes; 0=no)	0.72	0.45	— —	— —
Law enf. needs special trg. for ag crime (1=yes; 0=no)	0.84	0.37	— —	— —

Fear of crime effects (1=str. agree; 4=str .disagree)				
Hired security if I went away	2.32	1.02	2.34	1.02
Worried about victimization	2.40	0.92	2.41	0.91
Changed daily routines	2.60	0.92	2.64	0.92
Rarely took vacations	2.79	0.87	2.79	0.88
Took out extra insurance	2.89	0.88	2.92	0.87
Made off-farm visits only during daytime	2.99	0.81	3.01	0.81
Started carrying a concealed weapon	3.10	0.96	3.13	0.95
Spent more time on crime prevention	3.30	0.69	3.32	0.69
Considered leaving farming	3.47	0.70	3.48	0.69
Fear of crime effects (1=agree; 0=disagree)				
Hired security if I went away	.62	.49	— —	— —
Made off-farm visits only during daytime	.59	.49	— —	— —
Worried about victimization	.46	.50	— —	— —
Changed daily routines	.32	.47	— —	— —
Rarely took vacations	.32	.47	— —	— —
Started carrying a concealed weapon	.24	.43	— —	— —
Took out extra insurance	.24	.42	— —	— —
Spent more time on crime prevention	.10	.30	— —	— —
Considered leaving farming	.07	.25	— —	— —
Approp. compensation for victimization ($)	5272.02	43510.84	4673.48	43661.53
Visited ACTION website (#)	0.05	0.21	— —	— —
If visited, how often (#)	3.33	4.28	— —	— —
If visited, how helpful (1=not at all; 3=very)	2.08	0.49	— —	— —
Prefer to receive crime prev. info. (1=yes; 0=no)				
Through postal mail	0.55	0.50	— —	— —
Through electronic mail	0.24	0.43	— —	— —
At farm bureau or similar meetings	0.10	0.30	— —	— —
Through individual meetings with law enf.	0.08	0.27	— —	— —
No. people convicted of ag crime in your county (#)	4.49	40.59	3.92	40.17
Courts aggressive with ag crime (0=not; 10=very)	4.67	2.43	4.60	2.42
Why farmers don't report crime (1=str. agree; 4=str. dis.)				
Don't believe law enf. will take it seriously	2.18	0.95	— —	— —
Don't have enough proof that crime occurred	2.43	0.88	— —	— —
Don't believe crime is serious enough	2.48	0.93	— —	— —
Don't want law enf. on property	3.33	0.76	— —	— —
Engaged in illegal acts that may be discovered	3.65	0.64	— —	— —
Use OAN or other markings (1=yes; 0=no)	0.48	0.50	0.46	0.50
If yes, pct. of equipment marked	53.17	31.85	50.22	31.31
Use OANs due to law enf. (1=str. agree; 4=str. dis.)	2.26	0.95	— —	— —
Use surveillance equipment (1=yes; 0=no)	0.26	0.44	0.22	0.41

Law enf. ask to install such equipment (#)	0.05	0.36	0.03	0.26
Law enf. installed such equipment (1=yes; 0=no)	0.02	0.12	0.01	0.12
How much spent on fire/theft ins. ($)	4571.00	9222.52	4392.90	9274.33
How much spent on . . . ($)				
Fences	1052.01	2860.51	850.11	2880.35
Alarm systems	314.52	1153.91	294.84	9274.33
Surveillance equipment	249.58	1344.27	159.03	963.34
Locks	159.30	866.82	105.07	395.19
Avg., 10 prop. prot. measures (1=never; 5=always)	4.23	0.66	3.82	0.61
Hours per week on crime prevention (#/week)	3.18	6.92	3.38	10.34
Approp. reimbursement for prev. efforts ($/week)	113.02	581.94	114.07	601.38
Number of acres used in farm operation (#)	735.39	2821.00	— —	— —
Market value, operation's ag. products ($)	2845150.20	24188566.13	— —	— —

* The survey was administered in winter 2005 and asked about victimization experiences during 2005 and 2004, as well as a range of other questions. Some questions focused only on current views and conditions; in these instances information is presented under the 2005 column. Some outliers have been removed for some variables.

a. The livestock 2005 data were re-run with several extreme outliers removed.

Table 4. Estimated Agricultural Crime Victimization, 2005

	No. of farmers reporting theft to law enf.[1]	No. of thefts reported to law enf.[2]	No. of farmers reporting theft in survey[3]	No. of thefts reported in survey[4]	Pct. of respondents reporting theft[5]	Est. farms experiencing theft[6]	Pct. farms not reporting theft to law enf.[7]
Fresno	N=587		N=67				
Any Crime	118	119	9	16	13.4	844	86.0
Chemicals	41	42	2	13	3.0	187	78.1
Commodities	39	40	8	13	11.9	750	94.8
Lrg. Equip	27	27	1	3	1.5	94	71.2
Livestock	360	390	21	47	31.3	1,969	81.7
Tools, Small Equip	27	27	3	4	4.5	281	90.4
Tractor Crime	563	645	33	164	49.3	3,094	81.8
Kern	N=387		N=78				
Any Crime	74	76	22	39	28.2	606	87.8
Chemicals	30	30	9	27	11.5	248	87.9
Commodities	14	15	15	19	19.2	413	96.6
Lrg. Equip	10	10	1	5	1.3	28	63.7
Livestock	248	273	26	61	33.3	716	65.3
Tools, Small Equip	15	15	7	9	9.0	193	92.2
Tractor Crime	383	419	49	259	62.8	1,349	71.6
Kings	N=71		N=98				
Any Crime	18	22	19	43	19.4	224	92.0
Chemicals	9	9	3	6	3.1	35	74.5
Commodities	11	17	9	10	9.2	106	89.6
Lrg. Equip	8	8	2	4	2.0	24	66.0
Livestock	25	32	37	86	37.8	436	94.3
Tools, Small Equip	6	7	5	5	5.1	59	89.8
Tractor Crime	71	95	58	249	59.2	683	89.6
Madera	N=69		N=83				
Any Crime	27	30	15	23	18.1	311	91.3
Chemicals	2	2	4	31	4.8	83	97.6
Commodities	8	8	3	3	3.6	62	87.1
Lrg. Equip	1	1	1	2	1.2	21	95.2
Livestock	3	3	25	68	30.1	518	99.4
Tools, Small Equip	33	39	2	7	2.4	41	20.4
Tractor Crime	67	83	38	192	45.8	787	91.5
Merced	N=181		N=81				
Any Crime	32	32	15	37	18.5	549	94.2
Chemicals	12	12	3	5	3.7	110	89.1
Commodities	10	10	4	4	4.9	146	93.2
Lrg. Equip	33	33	5	7	6.2	183	82.0
Livestock	90	91	32	50	39.5	1,171	92.3
Tools, Small Equip	11	11	3	6	3.7	110	90.0
Tractor Crime	175	189	43	146	53.1	1,573	88.9

Table 4. Estimated Agricultural Crime Victimization, 2005 (cont.)

	No. of farmers reporting theft to law enf.[1]	No. of thefts reported to law enf.[2]	No. of farmers reporting theft in survey[3]	No. of thefts reported in survey[4]	Pct. of respondents reporting theft[5]	Est. farms experiencing theft[6]	Pct. farms not reporting theft to law enf.[7]
San Joaquin	N=167		N=94				
Any Crime	35	36	18	41	19.1	771	95.5
Chemicals	10	10	5	69	5.3	214	95.3
Commodities	41	42	5	6	5.3	214	80.9
Lrg. Equip	4	4	1	1	1.1	43	90.7
Livestock	77	87	25	58	26.6	1,071	92.8
Tools, Small Equip	8	8	4	4	4.3	171	95.3
Tractor Crime	164	187	46	330	48.9	1,970	91.7
San Luis Obispo	N=2		N=102				
Any Crime	0	0	5	10	4.9	114	100.0
Chemicals	0	0	3	7	2.9	68	100.0
Commodities	1	1	1	1	1.0	23	95.6
Lrg. Equip	0	0	2	41	2.0	46	100.0
Livestock	1	1	18	33	17.6	410	99.8
Tools, Small Equip	0	0	1	3	1.0	23	100.0
Tractor Crime	2	2	24	112	23.5	546	99.6
Stanislaus	N=86		N=110				
Any Crime	10	1	20	63	18.2	776	98.7
Chemicals	6	6	5	18	4.5	194	96.9
Commodities	12	13	5	8	4.5	194	93.8
Lrg. Equip	8	17	4	46	3.6	155	94.8
Livestock	42	66	44	90	40.0	1,707	97.5
Tools, Small Equip	4	4	4	6	3.6	155	97.4
Tractor Crime	77	117	64	369	58.2	2,483	96.9
Tulare	N=302		N=97				
Any Crime	60	75	19	49	19.6	1,124	94.7
Chemicals	29	29	11	32	11.3	651	95.5
Commodities	67	105	4	5	4.1	237	71.7
Lrg. Equip	18	19	2	4	2.1	118	84.8
Livestock	132	273	39	64	40.2	2,307	94.3
Tools, Small Equip	8	8	1	1	1.0	59	86.5
Tractor Crime	290	509	52	300	53.6	3,077	90.6
All Counties	N=1,852		N=811				
Any Crime	374	401	141	325	17.4	5,323	93.0
Chemicals	139	141	45	208	5.5	1,699	91.8
Commodities	203	251	53	651	6.5	2,001	89.9
Lrg. Equip	109	119	19	113	2.3	717	84.8
Livestock	1,008	1,252	267	582	32.9	10,080	90.0
Tools, Small Equip	82	83	32	45	3.9	1,208	93.2
Tractor Crime	1,792	2,247	408	2,037	50.3	15,404	88.4

Notes

[1] Number of farmers reporting theft to law enforcement/county sheriff's agricultural crime unit in 2005. Calculated using data downloaded from the ACTION database. The column signifies the number of farmers, out of all farmers in the nine ACTION counties (including San Luis Obispo, which joined in 2004 and excluding counties that joined later), reporting thefts in 2005. The data were not assessed to determine if farmers reported more than one incident. Rather, each case number was considered a unique incident and farmer.
[2] Number of thefts reported to law enforcement. Within each reported case, multiple items were listed. The number of incidents farmers reported was multiplied by the number of farmers reporting a given number of incidents. For example, if 25 farmers reported experiencing 1 livestock theft incident and 11 farmers reported 2 livestock theft incidents, then the computation was: ((25*1)+(11*2)) = 47 incidents involving livestock theft. Given the inconsistencies in recording multiple property stolen during the same event, the total number of theft incidents reported to law enforcement are underestimated. The calculations here are based on the property-type field in the ACTION database. Vandalism and burglary, two categories included in the survey, are captured in a crime-type field and thus can not be calculated in the same manner as the other property-type calculations shown here.
[3] Number of farmers reporting theft in the survey. This value is calculated using data from survey of farmers conducted in the 9-county region in December 2005.
[4] Number of thefts reported in survey. This value is calculated by multiplying the number of incidents farmers reported (e.g., 0, 1, 2, 3) by the number of farmers reporting each given number of incidents. Note 2 above provides an illustration of the calculation involved.
[5] Percent of respondents reporting theft. This value was calculated by dividing the number of farmers reporting theft in the survey by the number of survey respondents.
[6] Estimated number of farms experiencing theft. This estimate is a projection based on generalizing the county-specific survey results to all farms in each county. Specifically, the number of farms in each county is multiplied by the proportion of survey respondents experiencing theft (see note 5). The number of farms in each county was identified using information from the U.S. Department of Agriculture's *2002 Census of Agriculture*: Fresno (6,281); Kern (2,147); Kings (1,154); Madera (1,720); Merced (2,964); San Joaquin (4,026); San Luis Obispo (2,322); Stanislaus (4,267); Tulare (5,739). Source: U.S. Department of Agriculture. 2004. *2002 Census of Agriculture*. Vol. 1. Washington, D.C.: U.S. Department of Agriculture, National Agricultural Statistics Service.
[7] Percent of farms not reporting theft to law enforcement. This estimate of underreporting is calculated as follows: [((estimated number of farms experiencing theft, as per note 6) - (number of farmers reporting theft, as per note 1)) / (estimated number of farms experiencing theft, as per note 6) * 100]. The calculations show that underreporting of crime to law enforcement is common—across all counties, 85 percent or more any given crime is not reported.

Table 5. Estimated Dollar Value of Agricultural Crime Victimization Based on Survey Responses, 2005

	No. of farmers reporting theft to law enf.[1]	Value of thefts reported to law enf. ($)[2]	No. of farmers reporting theft in survey[3]	Value of thefts reported in survey ($)[4]	Number of farms in county[5]	Avg. loss per respondent ($)[6]	Est. loss for whole county ($)[7]	Est. loss not reported to law enf. ($)[8]
Fresno	587	1,824,068	67	251,525	6,281	3,754	23,579,530	21,755,462
Kern	387	2,103,882	78	316,510	2,147	4,058	8,712,141	6,608,258
Kings	71	656,419	98	404,600	1,154	4,129	4,764,371	4,107,953
Madera	69	468,316	83	204,345	1,720	2,462	4,234,619	3,766,304
Merced	181	1,008,020	81	102,840	2,964	1,270	3,763,182	2,755,162
San Joaquin	167	686,301	94	245,185	4,026	2,608	10,501,221	9,814,920
San Luis Obispo	2	5,693	102	368,840	2,322	3,616	8,396,534	8,390,841
Stanislaus	86	525,411	110	639,975	4,267	5,818	24,825,212	24,299,802
Tulare	302	897,791	97	152,430	5,739	1,571	9,018,513	8,120,722
All Counties	**1,852**	**8,175,901**	**811**	**2,686,250**	**30,620**	**3,312**	**101,421,671**	**93,245,770**

Notes

[1] Number of farmers reporting theft to law enforcement/county sheriff's agricultural crime unit in 2005. Calculated using data from the ACTION database. The column signifies the total number of farmers, out of all farmers in the nine ACTION counties (including San Luis Obispo, which joined in 2004 and excluding counties that joined later), reporting thefts in 2005. The data were not assessed to determine if farmers reported more than one incident. Rather, each case number was considered a unique incident and farmer.
[2] Value of thefts reported to law enforcement. This value is the sum of all reported loss, in dollars, from reported thefts.
[3] Number of farmers in the survey reporting theft.
[4] The dollar value of self-reported theft, as reported in the survey. The values are likely conservative estimates because not all farmers filled out the survey in its entirety.
[5] Number of farms in each county, as identified in the U.S. Department of Agriculture's *2002 Census of Agriculture*. Source: U.S. Department of Agriculture. 2004. *2002 Census of Agriculture*. Vol. 1. Washington, D.C.: U.S. Department of Agriculture, National Agricultural Statistics Service.
[6] Average loss per respondent. The value of thefts reported in the survey is divided by the number of respondents reporting thefts.
[7] Estimated loss for whole county. The average dollar loss per survey respondent is multiplied by the number of farms in each county.
[8] Estimated loss not reported to law enforcement. The value of thefts reported to law enforcement (see note 2) is subtracted from the estimated loss per county (see note 7). This calculation shows that only 8 percent of losses, as calculated in dollars, are reported to law enforcement. The calculation is: (101,421,671 - 8,175,901) / (101,421,671).

Figure 1. Victimization of Farmers in 2004 and 2005

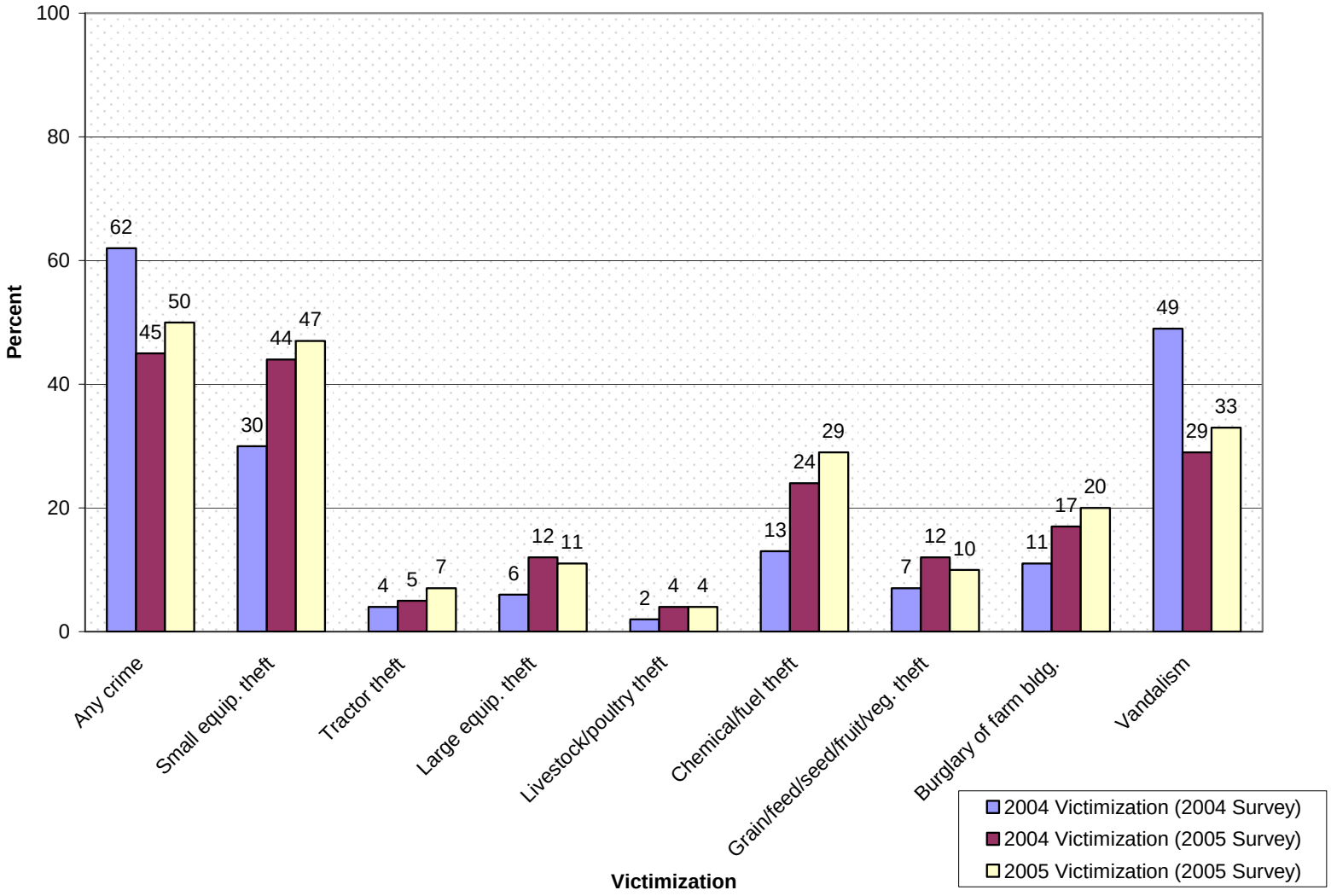
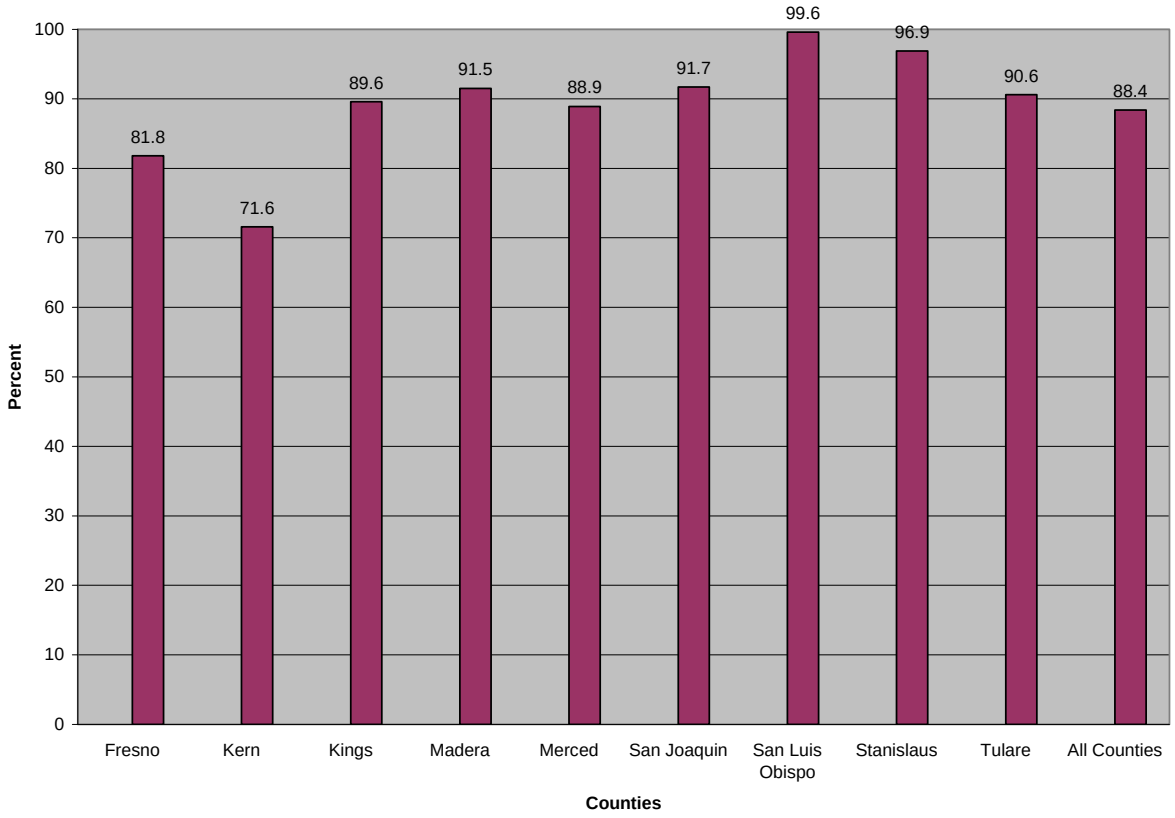
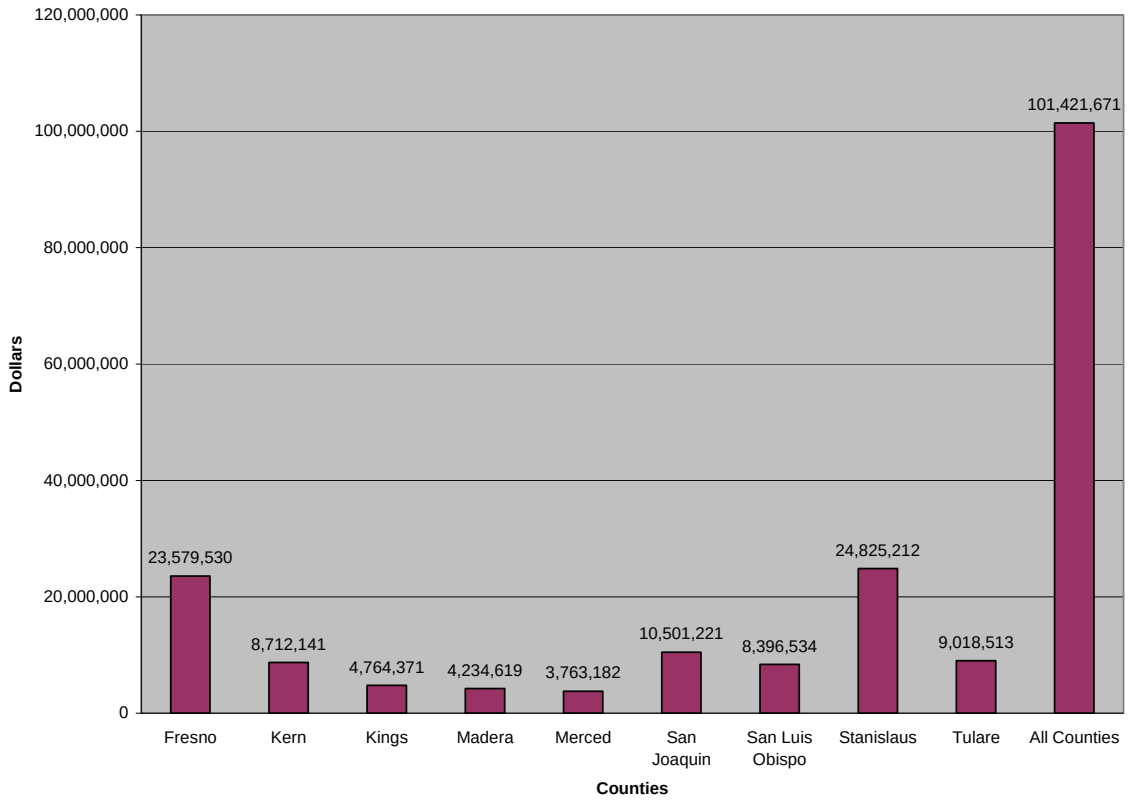


Figure 2. Estimated Percent of Farms Not Reporting Agricultural Crime Victimization Experiences to Law Enforcement, by County, 2005



Source: 2005 Survey. See text for details on the derivation of these estimates. In some counties, the percentages in part reflect the fact that some counties do not consistently enter all reported crimes into the ACTION database.

Figure 3. Estimated Agricultural Crime Victimization Costs, by County, 2005



Source: 2005 Survey. See text for details on the derivation of these estimates. Non-reporting of agricultural victimization costs paralleled that for victimization generally. The dollar amount of per-county victimization costs and the percent of per-county costs reported, in 2005, were as follows:

County	*Dollar Amount Reported*	*Percent Total Costs Not Reported*
Fresno	1,824,068	92.3
Kern	2,103,882	75.9
Kings	656,419	86.2
Madera	468,316	88.9
Merced	1,008,020	73.2
San Joaquin	686,301	93.5
San Luis Obispo	5,693	99.9
Stanislaus	525,411	97.9
Tulare	897,791	90.0
All Counties	8,175,901	91.9

6. CRIME MAPPING[1]

Introduction

Computerized mapping was developed in the 1960s in response to limitations associated with analysis of hard copy maps. Computerized mapping is conducted with geographic information systems (GIS), which consist of computers (including hardware and software), geographically based data, data management, and analysis capabilities. Despite technological and software developments throughout the 1970s and 1980s, GIS technology was not available in affordable, commercially available formats until the late 1980s (Weisburd and McEwen 1997). Since then, availability of data continues to grow as computer power and processing improves (Heywood et al. 1998). Computerized mapping has been applied to a broad range of topics, including land use planning, direct marketing or target site location, utility network management, environmental impact assessment, and public safety planning and management (Goodchild and Janelle 2004).

Throughout the 1990s, computerized crime mapping became widely diffused throughout law enforcement agencies (La Vigne and Groff 2001; Weisburd and Lim 2005), a welcome alternative to color-coded pins on wall maps of police departments (Harries 1999). With ever-improving computer technology and accessibility, virtually any law enforcement department has the ability to produce their own crime maps. Crime mapping has become increasingly popular in and used by the criminal justice system and researchers for wide range of purposes (La Vigne and Groff 2001; Ratcliffe 2004a; Karuppannan 2005).

In this chapter, we discuss the usefulness of GIS applications to agricultural crime prevention efforts. Our goal is to illustrate the potential for crime-mapping analyses to inform efforts to monitor agricultural crime and in developing strategies for most effectively reducing it. In addition, we want not only to illustrate ways in which mapping can be applied to the analysis of agricultural crime but also to identify lessons we have gleaned that may be useful for practitioners in general and ACTION in particular.

We begin by briefly describing the use of mapping in law enforcement, and then discuss the limitations associated with crime mapping in general as well as those unique to agricultural crime. We describe specific mapping approaches, discuss they are useful, and provide empirical examples focused on agricultural crime spatial clustering and hot spot identification. This discussion is followed by a focus on analysis of the expansion or contraction of hot spots over space and time. We give particular attention to identifying divergences in spatial patterns using official police records and survey self-reports to discern when differences are sufficient to warrant caution in guiding law enforcement efforts based on hot spot analyses that rely on official records data. We show potential uses to which mapping of agricultural crime can be put, and we emphasize that considerable caution is needed in letting such analyses guide law enforcement or policy efforts in situations where the data being used are incomplete. In such instances, the validity of patterns is questionable; thus, policies based on such patterns risk misallocating resources. Nevertheless, the application of crime mapping to agriculture-specific crimes should be pursued while agencies and software developers work to address challenges to mapping in rural areas.

[1] This chapter was primarily written by Michelle Scott. Citation references are included at the end of this chapter.

Background: Mapping for Law Enforcement

Crime is not evenly distributed through space or constant over time, thus making computerized mapping techniques particularly well-suited for analysis of criminal activity. Historically, crime incident records were stored as paper records or in remote mainframe computers. Likewise, mapping was accomplished by hand or with pushpins on a paper wall map, with each pin symbolizing a crime location. As the cost of computing power and data storage decreased and newer computer technologies became more widely accessible, law enforcement agencies adopted more user-friendly information systems which allowed integration of GIS hardware and software with computerized police records (Weisburd and McEwen 1997; La Vigne and Groff 2001; Ratcliffe 2004a). Concurrently, many researchers, police scholars, and members of the policing community challenged the effectiveness of traditional policing practices. As a result, there was a shift to a place-based crime prevention perspective throughout the U.S. (Weisburd and McEwen 1997; Weisburd and Lum 2005), with greater concern paid towards physical, organizational, and social environments that make crime possible (Clarke 1980, 1983, 1992, 1995; Cornish and Clark 1986). With "place" as a new focus of crime prevention efforts, automated and computerized mapping emerged as a vital tool for the latest generation of crime prevention (Weisburd and McEwen 1997).

In its most elementary form, maps merely display information recorded from police officer reports into a database. However, as policing strategies evolved, the application of crime mapping to law enforcement diversified (Weisburd and Lum 2005) Crime mapping is now applied as form of problem solving, to assist in investigation processes, to aid in apprehension of offenders, and to improve police operations. It also supports command and control decisions, cross-jurisdictional or multi-agency analysis, and can be used to raise community awareness (La Vigne and Groff 2001).

One simple law enforcement application of mapping is to show the distribution of different types of crime through pin or point mapping or hot spot maps. The former allows officers to easily see the general distribution of crime or to find especially problematic addresses while the latter provides more detail about areas with the highest density of criminal activity. Once identified, hot spots may be targeted for patrol activities (La Vigne and Groff 2001).

Likely, the most prominent application of crime mapping to command and control decisions is New York Police Department's (NYPD) CompStat[2] program. Developed to gather and disseminate information about and track efforts to control New York's crime problem, Compstat has taken on many forms as departments across the U.S. have adapted it to their specific needs (Weisburd et al. 2003). As part of an overall accountability mechanism, police commanders must address their precincts' criminal activity and develop strategic and tactical responses to crime (Harries 1999; La Vigne and Groff 2001; Weisburd et al. 2003).

In other applications, suspect identification and pattern analysis may be conducted with GIS to aid investigations. This technique is particularly helpful when victims and offenders are strangers. Law

[2] There is disagreement about the origins of the abbreviation "Compstat," which is sometimes spelled "Comstat." William Bratton, former New York Police Department Commissioner responsible for first implementing the program, suggests that Compstat stands for "computer -statistics" while others argue that the term stands for "compare stats" or "computer comparison statistics" (Willis et al. 2003).

enforcement may generate a list of suspects using on-file information about current parolees, probationers, sex offenders, arrestees, or pre-trial persons, as well as descriptions from victim(s). Information about crime events that may be associated can be used to examine spatial patterns in sequence or location. Moreover, analysts may calculate where the next crime in a series of activity may occur (La Vigne and Groff 2001).

With the widespread application of web-based software, crime mapping is no longer limited to technically savvy analysts but has been introduced to the general public. For example, agencies can use crime maps to provide information to community members. Residents can affirm or refute mapped police records and assist in determining where police action may be most needed. In recent years, police departments nationally have added crime map links to their department Internet pages. Residents or anyone interested to learn more about crimes occurring in certain areas can see near real-time accounts of criminal activity. Examples include the Jacksonville (FL) Sheriff's Office, the Prince George's County (MD) Police Department, and the City of Los Angeles (CA) Police Department.[3] However, the production of near real-time accounts of criminal activity requires a large amount of coordination between the officers writing reports and analysts preparing data for public consumption. The process of preparing data for analysis—for public use or otherwise—can be particularly cumbersome for cross-jurisdictional partnerships.

Typically, law enforcement agencies share little information about cases with other agencies. That can raise problems, given that criminals do not necessarily confine their illegal activity to certain areas. Sharing data and resources across multiple jurisdictions is becoming more popular. To be effective, there must be data sharing across jurisdictional lines to allow analysts to develop a broader picture of crime, one that is easier to accomplish with increasing and widespread use of geographic data. Interagency partnerships and collaborations can move beyond simply sharing crime data or resources and towards integrating other important geographic data including health, economic, or social services data at the same time. By pooling technical and analytic resources, jurisdictions may address public safety in comprehensive manner (La Vigne and Groff 2001). ACTION's efforts illustrate cross-jurisdictional data-sharing possibilities.

As previously mentioned, ACTION systematically collects data on agricultural crime incidents for each county involved in the initiative; each partner agency may also access all the records. The ability for ACTION analysts to access all records across the multiple counties allows them to perform comprehensive analyses. One county could, for example, determine if a similar type of offense is being committed in neighboring counties. This added knowledge and potential collaboration with other law enforcement can be instrumental in assisting efforts to apprehend suspects or identify cross-county crime patterns.

La Vigne and Wartell (2001) present five examples of cross-jurisdictional data sharing and analysis throughout the nation—Virginia, Delaware, San Diego, Baltimore, and Orange County, California. These innovative partnerships, begun in the 1990s, illustrate the benefits and challenges of data sharing across multiple law enforcement jurisdictions. Prominent challenges include integrating existing and different data records systems from multiple jurisdictions and developing a regional infrastructure to

[3] Jacksonville (http://maps2.coj.net); Prince George's County (http://www.co.pg.md.us/Government); Los Angeles (http://www.lapdonline.org).

support analysis and data collection. ACTION bypassed the complications of integrating multiple data systems by creating their own. However, having a second database to which law enforcement must dedicate resources is not ideal either and likely contributes to unwillingness or inability of all counties to record new cases in a timely manner. Additional challenges exist, some of which are specific to analysis of agricultural crime.

Challenges to Mapping

No matter what the subject of study, analyses can only be as good as the data being used. If the data are not accurate, the results will not be either. Incomplete date or time-of-offense information does not, for example, allow for a complete or likely accurate temporal analysis.

One of the most prevalent sources of inaccuracy confronting GIS applications is offense location information. If GPS units are not used to collect coordinates, address-specific locations can be assigned geographic coordinates through a process known as "geocoding." Incomplete, inaccurate, or unstandardized addresses increase the resources required to perform address matching. Likewise, errors emerge if the reference data files required to perform geocoding are not current. Historically, geocoding has had an urban bias because most people live in cities and early address-matching initiatives were associated with the Census' metropolitan areas (Clarke and Eck 2003).

Geocoding accuracy is a particular problem in analyses of agricultural crime, an issue of particular relevance to ACTION's efforts and those of others aimed at reducing agricultural crime. Rural areas have been nearly impossible to geocode completely because of the use of rural routes and post office boxes addresses, and, more recently, rapid residential and commercial development (Clarke and Eck 2003). In some cases, analysts must rely on investigators' descriptions or sketches of rural crime scenes to successfully find the exact locations of rural farms and offense locations (Wood 1998).

Additional challenges exist for agricultural crime. Farms can be single tracts of land covering a few acres or several thousand acres spread across multiple geographic locations. Likewise, equipment may be equally dispersed. In short, there frequently is no utility in using a typical residential or business address. At the same time, farmers may know only that an item was stolen, not the precise location, day, or time it was stolen.

Delays in accessing accurate, mappable data ultimately hinder proactive law enforcement efforts. This challenge is particularly relevant to rapidly changing regions, such as the one ACTION encompasses. As we discuss below, the inaccuracy of geocoding is a major problem that confronts effective use of crime mapping. When the validity of patterns is questionable, policies based on such patterns risk misallocating resources. That is not to say that agencies should not attempt crime mapping; they should, however, develop procedures to minimize data incompleteness or inaccuracies.

Data and Methods

Program Data

ACTION promotes information-sharing among partner agencies. The program's secure, web-based incident records system, similar to traditional police records management systems, serves as the central repository for electronic agricultural crime reports from each county Sheriff's Agricultural Crime Unit and District Attorney's Office. ACTION developed what may be the first database system

specifically to collect agricultural crime records. The database stores information about agricultural crime cases, including: case number, officer assigned to case, date assigned, case type, crime code and description, case narrative, scene, point of entry, entry tool, location of occurrence, reporting officer, date of offense, time of offense, and arrest details. Details about victims and perpetrators may also be entered as well as prosecutorial and court-related actions, if applicable, and detailed information or evidence about stolen or damaged property.

The database includes several standardized reports, which can provide summary information tailored for any county for any dates specified. It is also possible to generate datasets based on pre-specified queries. Records may be viewed in a web browser or directly downloaded to a computer as a tab-delimited text file. Unlike many other law enforcement systems, ACTION's database is accessible to police officers and District Attorneys across all ACTION counties. Police officers or prosecutors in one county may enter information on their own cases and view records from other counties. The information-sharing mechanism allows collaborative investigative processes across jurisdictions.

ACTION's database captures geographic-specific location information to allow for mapping records as up-to-date as the data provide, which allows police personnel to conduct more proactive work with possible near real-time analytic capabilities. However, there are database limitations. The most serious relates to geographic locations of incidents saved in the form of latitude and longitude coordinates. Many, but not all, records in the database have assigned geographic coordinates. An ACTION staff member manually (time permitting) geocodes cases with missing coordinates. The online database system must then be updated. The database, in short, can be labor-intensive to maintain, and it suffers from missing data elements, which can compromise the validity of crime mapping analyses.

Ideally, geographic coordinates would be automatically assigned to each case number based on a GPS (global positioning system) reading the reporting officer takes at a crime scene. As the prevalence of GPS units increases throughout law enforcement, the coordinates can automatically be saved during investigations. That, in turn, may save staff time, reduce errors introduced with geocoding, and increase ACTION's ability to conduct proactive efforts.

ACTION gave the UI evaluation team read-only access to the database. We downloaded criminal incident records using the "crime pattern" pre-specified queries for the nine counties of interest for 2005 directly from ACTION's secure server. This incident-level dataset includes 22 fields of data. Our analyses focus on street address of offense, city, latitude and longitude coordinates, date and time of offense, property type, property status (stolen), description of items stolen, property value, and county name. Since the geographic specificity of the records was not complete, UI acquired geocoding updates from ACTION. However, a large proportion of all incidents remained ungeocoded even after the update.

Survey Data

As discussed earlier, the Urban Institute fielded a survey to a sample of farmers throughout the ACTION region in late 2005. The survey asked farmers about their experiences with agricultural crimes and about prevention measures taken to prevent future victimizations. Each respondent was asked to recall crime incidents, or specific events involving theft or vandalism, that

occurred on their operations. For each of eight property categories—tools and small equipment, tractors, large equipment, livestock and poultry, fuel or chemicals, fruit/vegetables/grain/feed/seed, burglary, or vandalism—respondents provided the number of each incident they experienced and the value of the losses. Respondents were asked to report victimization experiences in both 2004 and 2005; only the 2005 reported victimization is used in this analysis as this period most closely aligns with the 2005 records in the database. To prepare for geographic analysis, UI geocoded the addresses to which surveys were mailed. Many farmers in the survey sample used post office boxes and not their home addresses for mailing purposes. As with the ACTION records, not all addresses were geocoded.

Methods

The survey and program datasets do not have a parallel structure—the survey is victim-level and the ACTION dataset is incident-level. To approximate a parallel data structure, the incident-level ACTION data file was aggregated by address of incident to create a victim-level file with the number of separate incidents recorded for each. Although not possible in this instance, the survey data ideally would be disaggregated to the incident level rather than remaining at the victim level. To be clear, this data manipulation allows us to best compare reporting practices of surveyed farmers and farmers reporting to law enforcement in the ACTION region; comparing a victim-level file and incident-level file would not be appropriate.

We must emphasize that records without geographic coordinates can not be used in the type of analysis presented here. The inability to geocode is a challenge for many mappers, particularly in less urban areas. However, geographic analysis should not be dismissed. Instead, agencies and software developers should institute measures to address the challenges and minimize their impact on subsequent analyses and decisions.

Agricultural Crime Mapping: A Regional Analysis

A nearly endless supply of thematic maps may be produced with GIS software. We will introduce several different types of maps and illustrate some of the analyses that are possible with crime mapping. Using the survey respondent data and ACTION records, we start with simple, illustrative (choropleth) maps, followed by point (or pin) maps (an electronic version of the push pins on wall maps), and then discuss several others. Environmental Systems Research Institute (ESRI) ArcGIS 9.0 software is used to produce the maps presented below.

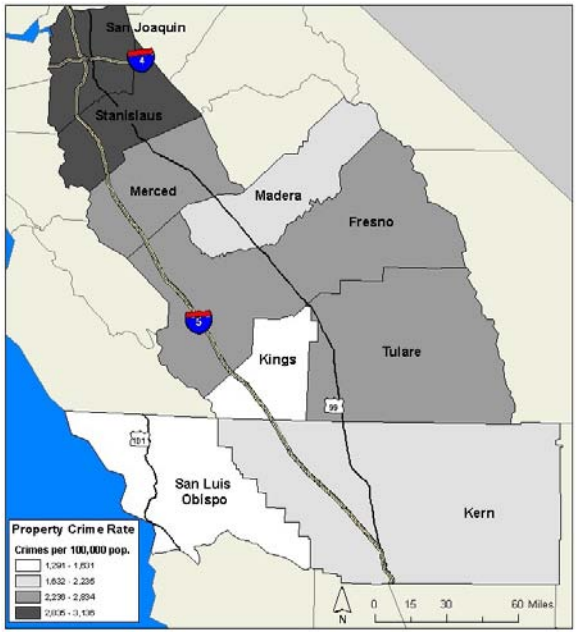
Choropleth Maps

Choropleth maps display quantitative data with discrete or ordinal classes for a particular area (Harries 1999). Color symbols represent each class or division within the data. This relatively simple presentation of information is often used to present data on socioeconomic characteristics or crime rates. Despite being informative, a central limitation of the approach is that the user manually defines the data classes. As a result, the data can be presented in ways that can be misleading (Monmonier 1996; Heywood et al. 1998).

Map 1 presents California's official property crime rates in 2003 for nine ACTION counties. The property crime rate range is divided based on one standard deviation increments from the mean (2,235 crimes per 100,000 residents). The two lightest shades signify those counties with rates below the mean while the darkest counties have rates above the mean. It is evident that the two northernmost counties

are the furthest above the mean while Merced, Fresno, and Tulare Counties are above, but closer to, the mean. However, if the crime rate range was classified differently and in an arbitrary fashion, as presented in Map 2, a different pattern emerges. San Joaquin County is the only county in the largest rate category while five counties comprise the middle rate grouping.

Map 1. County Property Crime Rates, 2003

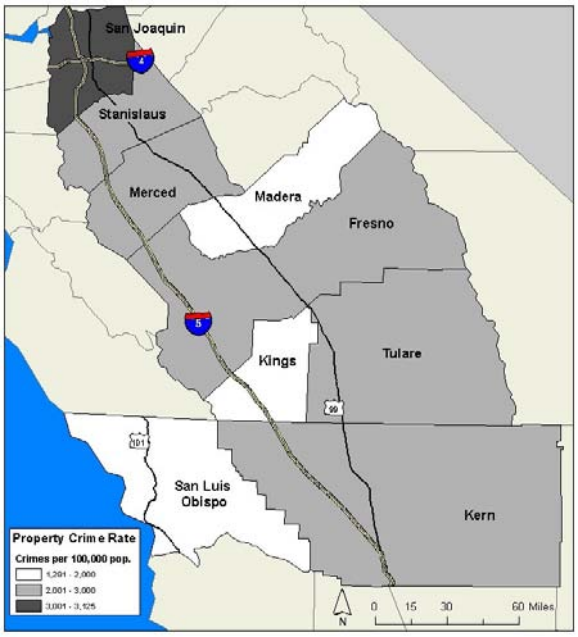


Source: Authors' analysis of State of California Department of Justice data.

Point Maps

The result of geocoding survey sample addresses is shown on Map 2 below; this type of map is known as a point or pin map because each location is depicted with its own point or dot. Although they can be useful in identifying potential clusters of crime, pin maps have several limitations First, they are snapshots of a particular moment. Thus, over-time changes in areas of particularly dense activity are not easily identified with point maps (Canter 1995).

Map 2. County Property Crime Rates, 2003



Source: Authors' analysis of State of California Department of Justice data.

Also, the level of analysis can be particularly important; at a region or county level, the distribution of points will not appear the same as it would at the neighborhood level. In addition, at any level, points may be deceiving since they can overlap and the human eye can not accurately detect clusters or broad trends in the data (Ratcliffe 2004a).

Another limitation of point maps is the requirement of latitude and longitude assignments for each address. Such assignments, made through geocoding, can be labor-intensive and inaccurate, and thus result in low geocoding rates. However, as GPS usage broadens and becomes more affordable, there will be an increase in the automatic generation of coordinates with GPS systems by law enforcement.

Low geocoding rates are problematic because analyses may portray unrepresentative patterns. This problem is illustrated in Map 3 which displays the locations of the entire survey sample to whom we mailed surveys. The same number of farmers was randomly selected

from each county to receive a survey. Therefore, we would expect to see about the same number of points located in each county. However, not every county appears to have the same number of points, particularly Madera. Although overlapping points could be the cause, it more likely is the case that geocoding failures are to blame.

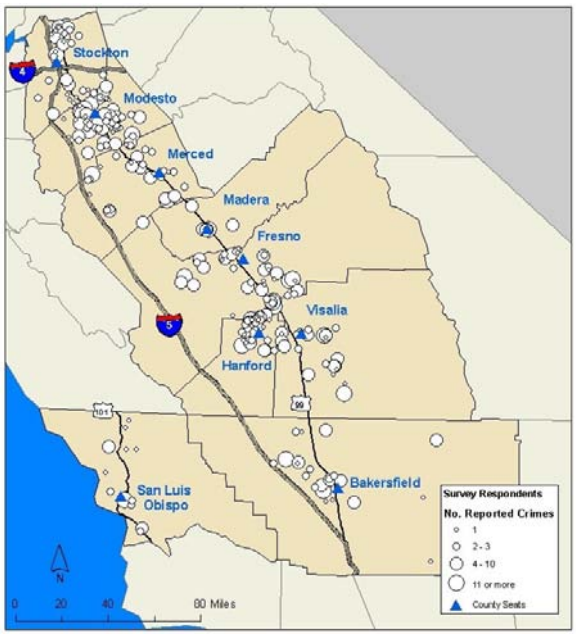
Map 3. ACTION Survey Sample

Source: Authors' mapping of survey sample.

Aside from merely generating an illustrative map, law enforcement may use the point mapping technique to identify and analyze criminal activity; this approach is particularly useful for neighborhood analyses. For example, an analyst can map a series of criminal incidents for a few city blocks. Locations of frequent victimization can be highlighted and incident locations can be mapped in the context of the demographic or zoning characteristics of the area. Analysts can also examine non-spatial characteristics of criminal incidents, such as the time of occurrence, modus operandi associated with crimes, or type of offense (La Vigne and Groff 2001; Ratcliffe 2004a). Maps depicting events before and after an intervention can be used in determining whether the intervention was effective (Canter 1995).

Although pin mapping is considered rudimentary (Ratcliffe 2004a) when compared to more sophisticate mapping techniques, it has some unique features. The symbols associated with each address can be designed in such a way to detect multiple incidents; for example, the size of the symbol can correlate to the number of events at any one address (see Map 4).

Map 4. Survey Respondents' Reported Crime Volume

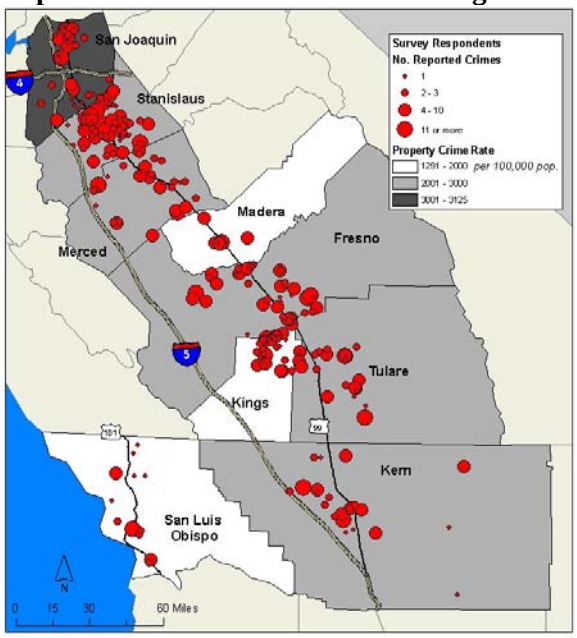


Source: Authors' analysis of survey data.

Point data can also be mapped with discrete data on a choropleth map to provide a more holistic analysis as displayed in Map 5. Overlaying survey respondents' reported crime with the county property crime rates provides analysts a method to gauge relationships between the two data elements. For example, and noting that missing data may create misrepresentative distribution, based on Map 5, there does not seem to be any prominent relationship between levels of reported agricultural crime in 2005 and property crime rates in 2003. The same data

can be converted from point data into a continuous surface and analyzed in a more advanced way.

Map 5. Property Crime Rates and Survey Reports of Crime across ACTION Region



Source: Authors' analysis of State of California Department of Justice data and survey data.

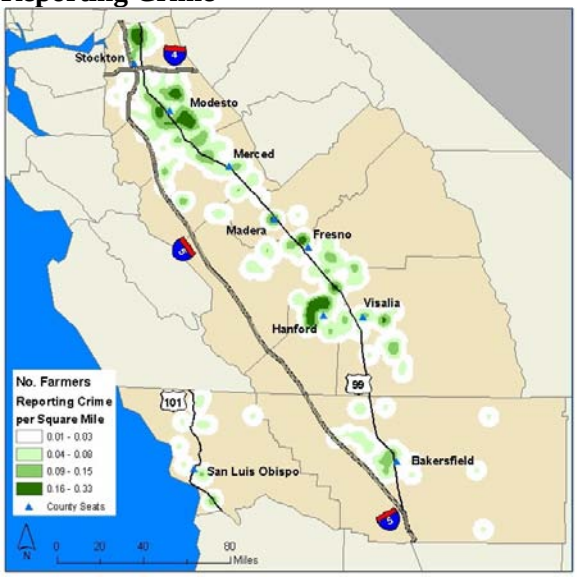
Continuous Surface Maps

A continuous surface map is created by converting points into cells throughout a continuous space. Crime density maps may be created through density mapping, which generates a continuous surface—points are used to calculate density values based on the number of points within a preset radius of each cell (Mitchell 1999). Another common use for density mapping is the representation of population density per square mile (Eck et al. 2005).

Such maps can be used to visualize the density of crimes across a city or county. Employing this technique improves an analyst's ability to visually detect areas with higher concentrations of crimes. However, as with choropleth maps, the mapper may also manually classify the color scheme of the map and, therefore, manipulate the display of data in ways, some of which may be misleading.[4]

In Map 6, the continuous color palate represents the number of surveyed farmers reporting any crime in 2005 per square mile. The darkest areas have the largest densities of farmers reporting crime. The data divisions, as represented by different colors, were set to represent one standard deviation segments from the mean.

Map 6. Density of Surveyed Farmers Reporting Crime



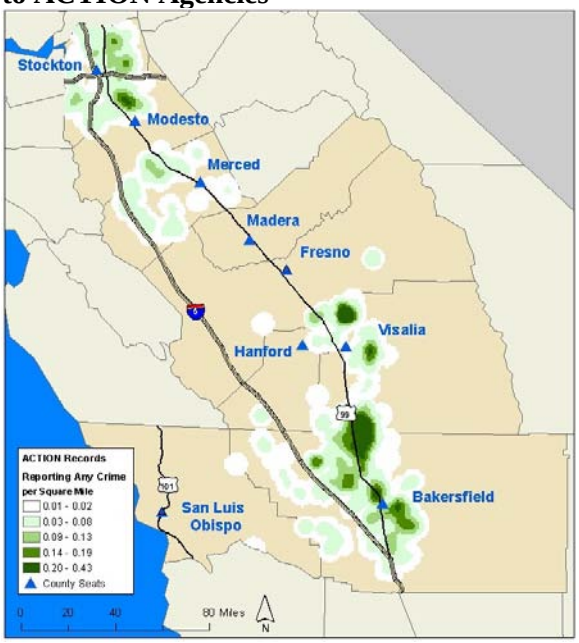
Source: Authors' analysis of survey data.

This classification technique is but one of many and the interpretation of results may vary depending on the technique used (Monmonier 1996). In this case, there is obvious clustering of respondents reporting any crime around the county seats, especially Modesto and Hanford. The clustering may be due to farmers who live farther from town centers using rural routes or post office boxes instead of traditional street addresses; their true farm addresses therefore could not be geocoded.

[4] For discussion and examples of producing effective maps that communicate clearly, see Michelle Scott's contribution to La Vigne and Cohen's (2005) report.

Map 7 presents a density map of crimes reported to ACTION agencies. There is a distinct lack of reporting displayed throughout the midsection of the region, which can be attributed to the lack of cases geocoded for those counties. Nevertheless, there are several noticeable areas of high density reporting, particularly along Route 99 between the county seats of Visalia (Tulare County) and Bakersfield (Kern County).

Map 7. Density of Farmers Reporting Crimes to ACTION Agencies



Source: Authors' analysis of ACTION database.

Although we have presented the data here based on one standard deviation from the mean, we still do not have statistical evidence that one area reports statistically more crime than another does. To do so, we turn to another procedure known as hot spot analysis.

Hot Spot Analysis

Hot spot analysis of crime incident locations determines geographic concentrations of activity and may be one reason why crime mapping was adopted by police agencies at such a rapid pace in the 1990s (Weisburd and Lum 2005). Hot spot analysis may be used to focus human or financial resources in the areas of greatest need (Ratcliffe 2004b). The National Institute of Justice's Mapping and Analysis for Public Safety program published a special report in 2005 documenting hot spot analysis as applied to crime mapping (Eck et al. 2005). As Eck and colleagues (2005) document, hot spot analysis may be conducted with a variety of methods that range in statistical sophistication, yet there remains little consensus among researchers about when a hot spot actually exists or which technique is best to calculate hot spots. To further complicate matters, hot spots can be detected at multiple levels, by addresses, blocks, neighborhoods, or even larger areas, as will be introduced below. Thus, hot spots, if they exist, can result from multiple factors, and they can change slowly or quickly. Hot spots may be chronic or acute; chronic hot spots are areas of persistent high crime while acute hot spots are areas of abnormally high levels of crime (Brantingham and Brantingham 1995; Clarke and Eck 2003).

One better-known program for hot spot analysis, Spatial and Temporal Analysis of Crime (STAC), analyzes point data to determine the highest concentrations, unlike many programs which require points to be aggregated to areal units such as Census tracts (Block 1995; Eck et al. 2005). We employ the STAC analysis, which uses standard deviation ellipses to distinguish areas of high intensity agricultural crime. STAC is available through the publicly accessible and free program CrimeStatIII.[5] Originally, a stand-alone application, STAC was developed by the Illinois Criminal Justice Information Authority in the late 1980s with support from the Bureau of

[5] CrimeStatIII is available through the U.S. Department of Justice, National Institute of Justice (http://www.ojp.usdoj.gov/nij/maps).

Justice Statistics (Illinois Criminal Justice Information Authority 2005). In 2002, STAC was included in the CrimeStatIII package.

CrimeStatIII is a windows-based spatial statistics program that was developed through a National Institute of Justice grant and provides supplemental statistical tools to aid law enforcement agencies and criminal justice researchers in their crime mapping efforts. The program inputs incident locations, such as the address of chemical theft locations, through various formats (e.g., DPF, SHP, ASCII, or ODBC-compliant) using either spherical or projected coordinates. A variety of spatial statistics are available with CrimeStat, including STAC, which calculates standard deviation ellipses and then writes graphical objects that can be directly imported into a variety of mapping software, such as ArcView® and MapInfo® (Levine 2004). STAC also outputs a table for each set of ellipses generated, which includes information about cluster hot spots, such as the number of points and the point density.

To prepare survey data for analysis, a number of parameters may be specified: size of search radii used in the hot spot algorithm, number of simulation runs, and output file specifications. When activated, the program implements a search algorithm to determine any hot spots. STAC overlays a 20 by 20 grid on the plane defined by the area boundary of the location file. STAC places a circle on every node of the grid with a radius equal to the square root of two times the specified search radius creating overlapping circles. The number of points falling within each circle is counted and ranked in descending order by the number of points within each. If a point belongs in more than one circle, the circles are combined and the process is repeated until there are no more overlapping circles. This approach produces what are known as "hot clusters." The data points within each hot cluster are used to calculate the best-fitting standard deviation ellipse and these are called hot spot areas (Block 1995; Levine 2004). Analysts can specify the output standard deviation ellipses as one, one and one-half, or two standard deviations. All hot spot maps presented here are at the one standard deviation level. Analyses were preformed with two and one-half and five mile radii parameters; some of both are presented throughout the rest of the chapter. The minimum number of points per cluster was set to 12 points for regional analysis and reduced by half for county-level analysis. The CrimeStat program manual guided the parameter-setting decisions (Levine 2004).

The survey data for respondents reporting any crime is analyzed with STAC to produce three hot spot ellipses distinguished for significant concentrations of crime reports (see Map 8). Based on the density maps presented in Map 6, without CrimeStat processing, we would have a generally good indication of significant crime activity as reported by survey respondent farmers for 2005, given that the hot spots appear to overlay the darkest areas of density. However, the statistical summary of hotspots as represented by ellipses in Map 8 provides additional support.

Next, we analyze the ACTION records with STAC to calculate standard deviation ellipses for any crime incidents reported to ACTION. Seven ellipses are distinguished for significant concentrations of reported criminal activity (see Map 9). The largest concentration of reported crime was in an area along Route 99, which crosses between Tulare and Kern counties (between Visalia and Bakersfield), the same area displaying high density reporting in Map 7. This display of hot spots gives a broad review of agricultural crimes reported to law enforcement in 2005. However, looking at

an entire year of activity would not be helpful to law enforcement in their policing efforts. Instead, a more detailed temporal analysis would be needed to assist in determining where resources should be allocated or investigations conducted.

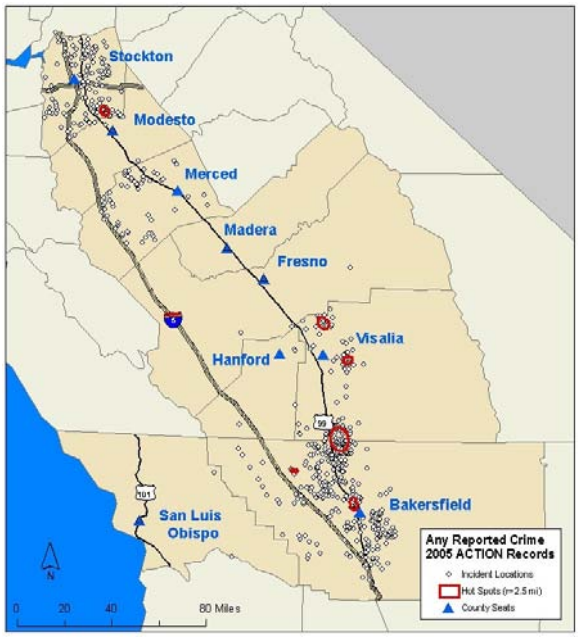
Map 8. Hot Spots of Survey Respondents Reporting Crime

Source: Authors' analysis of survey data.

Temporal Analysis

Temporal analyses can identify seasonal patterns as well as patterns by time of day and day of week. There has been less effort in developing techniques for determining temporal dynamics of local crime patterns as compared to general hot spot analysis. The main challenge with temporal analysis is the lack of detail in police databases, the source of data for many crime studies, including this one. The lack of detail is often simple: a victim does not know exactly what time of day or date a crime occurred. This uncertainty is particularly likely to occur for thefts of agricultural equipment, which may go unnoticed for hours, if not days or months.

Map 9. Hot Spots of Crime Reports to ACTION



Source: Authors' analysis of ACTION database.

Nevertheless, temporal analysis of hot spots could help diagnose a crime problem and aid in addressing it. It also may be particularly useful in knowing how to allocate resources within specific periods during which criminal activity may be the greatest (Ratcliffe 2004b). Given ACTION's dedication to deploying a variety of surveillance technologies, temporal analysis has the potential to be useful in determining the best time, day, and locations for such deployment. To the extent that agricultural production fluctuates throughout the year, the seasonality of production should be considered in identifying temporal dimensions of agricultural crime.

The survey did not collect specific information about the time of victimization; therefore, temporal analysis is not conducted with survey data. Alternatively, we employ data from ACTION's incident database, which includes information regarding date and time of offense, when specified. The growing season in California is nearly year-round for many commodities. However, in May through August, harvesting activity is

at its peak (California Department of Food and Agriculture 2006). With the assumption that peak harvest season presents the greatest opportunity for criminals to steal ripe commodities (before a farmer harvests them) or equipment (a farmer is less vigilant during the busiest season), we analyze the 2005 incidents based on harvest seasons. To analyze seasonal changes in hot spots, we create a file for each of three general harvest seasons: off, high, and low season. Off-season crimes are those occurring January through April, during which time there are the fewest commodities harvested; high-season crimes occurred May through August, during the peak of harvesting. Finally, during low season, September through December, harvesting reaches a balance between high- and off-season.

Each temporal data file is analyzed with STAC and standard deviation ellipses are calculated for any crime incident reported to ACTION. Map 10 displays the hot spots produced; the off-season ellipse is solid black, the high season ellipses are outlined in black, and the low season ellipses are solid light blue.

Aside from the lone high season ellipse to the north of Visalia, all other hot spots are located very close to or surrounding the major transportation thoroughfare through the San Joaquin Valley, Route 99. Furthermore, there are several noticeable differences in incident distribution between the three seasons. By far, the most geocoded crime incidents were reported to occur during the high season (n=300). Surprisingly, the fewest were reported for the low rather than off season (n=203). There are definite differences between the distributions of off, low, and high seasons as the sole off-season ellipse is located in the northern area of ACTION. The high season and low season hot spots overlap along the border of Tulare and Kern Counties (between Visalia and Bakersfield), but each have other locations of hot spots as well. This analysis, or one similar, would be useful for ACTION or law enforcement to plan targeted efforts during specific periods. If repeated for several years of data, potential chronic hot spots could be detected.

Map 10. Temporal Hot Spots of Crime Reports to ACTION

Source: Authors' analysis of ACTION database data.

Displacement Analysis

One common feature of crime studies and evaluations of crime prevention initiatives is the assessment of displacement of crime, in addition to assessing reductions in criminal activity. Displacement, an unintended change in criminal activity because of crime control initiatives, has been described as consisting of five types: spatial, temporal, target, tactical, and functional (Barr and Pease 1990). Of these, the first two are most applicable to crime mapping. Spatial or geographic displacement occurs when offenders relocate their activity to another location, most likely because of increased risk at the original location. If police activity is increased in

one part of a county, criminals could re-locate to a less patrolled part of the county.

Temporal displacement occurs when criminal activity shifts to a different time during the day, week, month, or year. This shift may be caused by increased risk or increased opportunity during a certain time period. For example, criminal activity, such as avocado theft, could shift from pre-dawn hours to midnight because of increased patrolling of avocado groves at dawn. It is important to acknowledge that some types of temporal shifts in agricultural crime are a function of the growing season of certain commodities; this shift in the timing of commission is caused by natural factors and therefore would not be considered displacement.

The dynamics of hot spots—expansion, contraction, or migration—can be monitored as part of spatial and temporal displacement analysis. However, the ability to do so depends entirely on the specificity of the data. If precise dates and times are not consistently collected for all incident records, then a rigorous analysis of temporal changes are not possible. Likewise, precise geographic locations of crime incidents are necessary to perform spatial displacement analyses. In both cases, an analyst also needs detailed information regarding timing and location of law enforcement activity. Given the vast territory law enforcement must cover throughout the ACTION region, it is especially challenging to develop a sufficient record of enforcement activity to conduct rigorous displacement analyses. Indeed, such analyses are not feasible at present.

Agricultural Crime Mapping: A County Analysis

In the preceding discussion, we have highlighted various types of mapping techniques and analyses applicable to crime mapping using the entire ACTION region as an example. We now turn to a more specific analysis of agricultural crime patterns in one ACTION county, San Joaquin County. This detailed discussion will follow many of the same steps already introduced. Furthermore, we will attempt to identify divergences in spatial patterns using official and self-report records to discern when differences are sufficient to warrant caution in guiding law enforcement efforts. This empirical example will provide evidence for one of the neglected issues in crime mapping, namely, official records and the impacts of their accuracy (or inaccuracy).

Inaccuracy of official records has a variety of sources including underreporting of incidents to police and lack of specific incident information gathered or reported by investigating police officers. An inherent requirement of crime mapping is geographic location specificity. Without automatic assignment of geographic coordinates, the process of geocoding may introduce error to the spatial data by assigning incorrect coordinates, if any assignment is able to be made at all. These inaccuracies of spatial data have implications for analysis results and the strategic or policy decisions that stem from them.

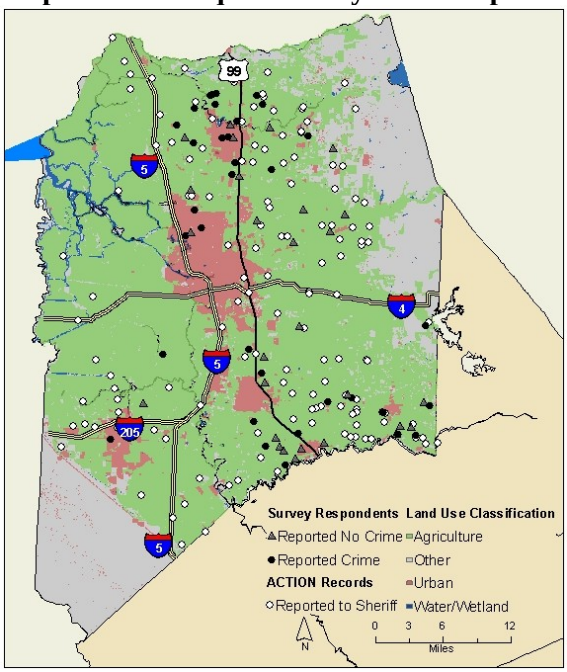
San Joaquin County was chosen for detailed review because of the thorough geocoding (near or better than 80 percent geocoded) of both the ACTION and survey data. The same survey and ACTION database records are used for this county-specific analysis. Recall that to create a parallel data structure, the incident-level ACTION data file was aggregated by address of incident to create a victim-level file similar to the survey.

San Joaquin County is the northernmost county of the ACTION region. According to the 2002 Census of Agriculture, the county boasts over 4,000 farms and in 2005 was the seventh highest-grossing county in the state, with milk, grapes, and almonds

among its top commodities (California Department of Food and Agriculture 2005). In 2005, 146 farmers reported 202 theft incidents to the Sheriff's office for investigation (seven cases were not geocoded and thus not examined here). During this same period, 46 of the 94 San Joaquin survey respondents (farmers) reported being victimized.

The reported incident locations for ACTION and survey data are displayed on Map 11. There seems to be no clear pattern in the location of each except that in general, all survey respondents and incident reports are located east of Interstate 5. That pattern may suggest that the western portion of the state is free of farms, generally underreports victimization to the sheriff's office, or was underrepresented in the survey sample.

Map 11. San Joaquin County Point Map



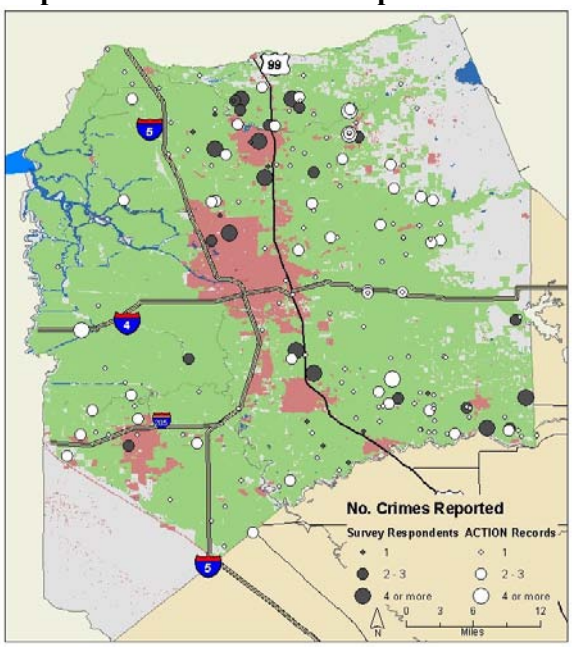
Source: Authors' analysis of ACTION and survey data.

Perhaps more meaningful analysis to law enforcement is identifying areas that experience a greater volume of agricultural crime or farmers who have been victimized multiple times. Such information would aid in improving resource allocation either for law enforcement patrols or for ACTION staff to engage farmers to take more proactive measures to safeguard their property.

The ACTION records are intrinsically limited to those farmers reporting crime to the Sheriff. Forty-eight of the original 94 farmer survey respondents from San Joaquin County reported experiencing no crime in 2005. Furthermore, some of the farmers' reports could not be geocoded and so are not included in this analysis. Thirty-six farmers reporting any crime in 2005 remain in the survey dataset for analysis.

In Map 12, the graduated circles represent the volume of crime reports of each farmer in the survey (black circles) and to county law enforcement (white circles).

Map 12. Volume of Crimes Reported



Source: Authors' analysis of ACTION and survey data.

There are distinct clusters of survey respondents reporting multiple incidents in the north of the county surrounding Route 99 as well as in the southeastern corner. Multiple incidents reported in the ACTION

records seem to be distributed throughout the county, particularly in areas in which there are no survey respondents. At a glance, it seems that survey respondents report more incidents than are reported to law enforcement. Although this pattern could be a function of the methodology employed to restructure the ACTION database, it is more likely evidence of underreporting to law enforcement in general.

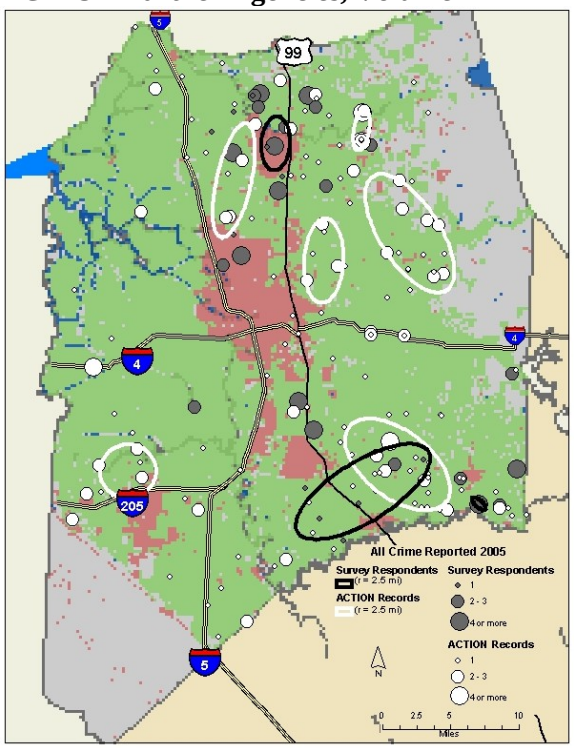
It has been documented here and elsewhere that many property crimes go unreported. Indeed, based on our analysis of the survey data, over 85 percent of agricultural crimes are not reported to law enforcement. (The survey respondents attributed the lack of reporting to a belief that law enforcement would not take their reports seriously and to what they believed was a lack of evidence to support an arrest or conviction.)

Since the regional comparison of density and hot spot maps highlighted similarities among the two, we move directly from point maps to hot spot analysis of the volume of crime reported by survey respondents and to ACTION partner agencies.

Using CrimeStatIII and STAC once again, parameters are set to use the volume of incidents as a weight in hot spot calculations so that locations with multiple victimizations are given greater emphasis in calculating the hot spot ellipses. As before, we employ two variants on the radius setting. If we were analyzing city blocks of data, we would likely use a relatively small radius, say one-quarter mile or less. Using such a small radius for a county-level analysis is inappropriate given the large area of the county (nearly 2,000 square miles) and the relatively large size of farms within the county; some farms could be well over one mile away from their nearest neighbor. We present 2.5-mile settings. Because the analysis involves fewer total cases, the minimum number of points to form a hot spot is decreased by half.

Since this hotspot analysis is confined to San Joaquin crime reports only, the results may not be entirely accurate, particularly in those areas closest to the southern border with Stanislaus County. In this situation, the advantage of regional or multi-jurisdictional data and analysis is evident. With the previous analysis of the entire region, we detected clustering that crossed county boundaries. However, this approach is not possible when only analyzing one county's data. Nevertheless, results from the 2.5-mile radii calculations are presented in Map 13.

Map 13. Hotspots of Crimes Reported to ACTION Partner Agencies, Volume



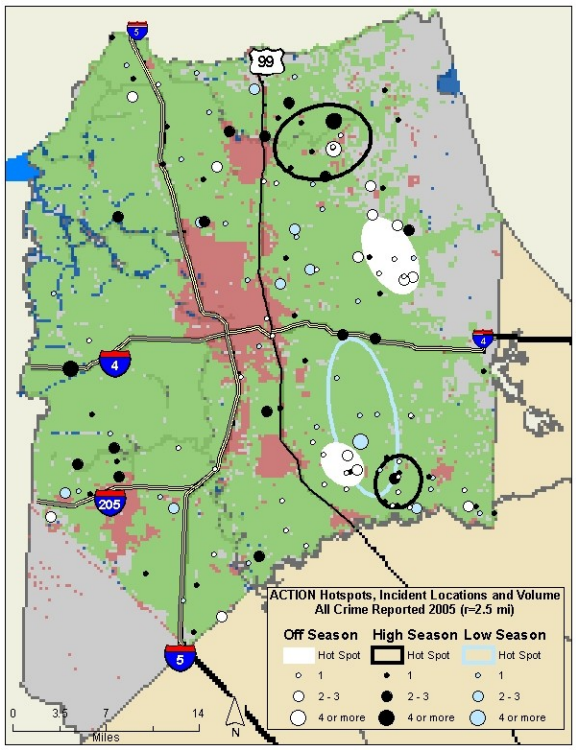
Source: Authors' analysis of ACTION data survey data.

Two ellipses are generated for the survey while the ACTION data produces six ellipses. One survey hotspot partially overlaps an ACTION hotspot in the southern portion of the county while another pair comes close in the northern region.

Since one set of ellipses partially overlap, we cannot say the official ACTION records and survey data are entirely divergent. However, the disjuncture of the other hotspots may indicate that farmers closest to Route 99 in northern San Joaquin County need encouragement to report offenses to the Sheriff's Office. We move to temporal analysis of the ACTION records to discern further differences in reporting to law enforcement.

As before, the 2005 records were parsed into three analytic files for a harvest season temporal analysis. The results of a 2.5-mile radius calculation produce two hotspots for high and off-season and one hot spot for low season and are presented in Map 14.

Map 14. Temporal Hot Spots of Crimes Reported to ACTION Partner Agencies



Source: Authors' analysis of ACTION data.

Interestingly, all seasonal hot spot ellipses are distinctly located east of Route 99. The southern region of San Joaquin County seems particularly prone to crime, as reported to ACTION, throughout the entire year. Reported criminal activity, however, seems particularly concentrated in the south during the off (solid white ellipse) and high (black outline ellipse) seasons, although in slightly different locations.

Likewise, throughout the rest of the county off and high season reported crimes are relatively concentrated in distinct locations. Given the concentration of off- and high-season reported activity, it would be feasible to integrate specific, local information into a spatial analysis of the hot spot locations in southern San Joaquin. For example, an analyst could investigate potential environmental differences that could contribute to the one area experiencing greater concentrations of high season crime.

By analyzing a much smaller area, detailed transportation networks, land use parcels, and even locations of particular buildings could be used in conjunction with crime report locations. Even further, non-spatial incident details, such as modus operandi, time of day (if known), or type of crime could be analyzed. Rather than focusing on a smaller area, an analyst could also re-run a hot spot analysis with a different question in mind, analyzing, for example, the concentration of reported chemical theft locations. These specific analyses could result in a more refined area to concentrate ACTION and Sheriff's Office resources for a costly crime.

Lessons Learned and Recommendations

In this chapter, we introduced crime mapping through a summary of 2005 reported agricultural crime incidents to ACTION-area law enforcement as compared to self-reported victimizations for the same year. Although point maps may be useful at the city or county level, they have little utility for crime analysis at a regional level.

Our analyses also suggest that density maps provide meaningful depictions of geographic concentrations of crime, but they can be more complicated than hotspot ellipses to produce. Hotspot ellipses, calculated with the STAC portion of CrimeStatIII, are relatively easy to produce and have the advantage of providing a statistical summary of the data, but decisions need to be made about the search radius and specific geographic area of inquiry. Integrating statistical analyses with spatial analysis is a particularly useful tool for increasing the credibility of mapping results.

The discussion here provides a starting point for determining the types of analyses that may be most useful in identifying spatial patterns and trends in agricultural crime and in using such information to guide law enforcement efforts. It bears emphasizing that geographic analysis at the regional level is not as useful for tactical planning at the county-level. Rather, regional analysis is likely most useful for guiding overall planning, such as where ACTION or other such programs should target OAN-marking recruitment.

With greater attention to local context, analysts can perform more localized crime analyses. For example, integrating land use or parcel data elements with Census block or tract data elements and more detailed transportation networks could provide a rich background of information to determine ecological influences on criminal activity. Moreover, parcel data on the location of each farms' commodities may be useful in identifying particular commodity-based theft patterns and predicting future thefts. Such detailed analysis would be most helpful for tactical planning efforts. Nonetheless, any analysis—at the regional or local level—can only be as good as the available data.

Above all else, the specificity, accuracy, and completeness of data are most important to performing an accurate analysis for planning purposes. As with any property crime, specific dates or times-of-offense occurrence are difficult to collect. This challenge directly affects the detail of temporal analysis results.

To improve the amount and quality of data, the most efficient solution is for all reporting officers to automatically collect geographic coordinate information from a GPS unit during an initial investigation. In so doing, ACTION avoids potential error introduced by geocoding and assures complete coordinate coverage for all agricultural crime cases. Furthermore, the amount of available data will grow exponentially as ACTION continues to include new counties in their network. Consequently, the accuracy of data will become more critical in maintaining an even distribution of resources for all partner agencies. Avoiding the need for geocoding has the added benefit of giving analysts more time to undertake statistical and mapping analyses that could be used to help guide targeted prevention efforts.

ACTION's agricultural crime database is unique in that it records information about agricultural crime. Like many law enforcement agencies across the nation, ACTION is focused on developing the capacity to conduct spatial analyses that can help educate the public and inform law enforcement efforts. One strategy to further that goal is to integrate a GIS interface with the records management system. Law enforcement officers, District Attorneys, or ACTION staff across the ACTION region could efficiently generate near real-time maps of agricultural crime incidents reported to partner agencies with only the use of a web browser. This user-friendly GIS tool could be tailored to query and display records based on a specified date range or time range, offense type, property type, or other relevant incident

characteristics captured in the incident database.

Allowing access of near real-time criminal incidents to ACTION partners provides a mechanism for law enforcement to conduct more proactive policing. In addition, the multiple law enforcement agencies within ACTION would not have to rely on an ACTION crime systems analyst to prepare analytic maps for them. Although resource-intensive during planning and start-up, the integration of geographic information and records management systems would likely prove to be resource-efficient in the long term, especially given the expanding scope of ACTION across California.

Providing mapping capabilities to ACTION partner agencies would allow testing of an interface design and its products before allowing access to the general public through ACTION's website. And providing user-friendly GIS capabilities to farmers and area residents interested in agricultural crimes would serve multiple ends. ACTION would further the goal of public education about agricultural crime and prevention as well as equip farmers with more information to avoid victimization. For example, farmers could view recent criminal activity in their areas and better secure their own property accordingly. There are many concerns with mapping crime incident data, not least of which are privacy concerns. However, consultation with police departments with existing applications would aid a great deal in preparing for and avoiding potential problems.

Another direction to consider is mapping of OAN-marking farms. ACTION maintains records of each farmer for whom they provide OANs and assist in permanently stamping their equipment and tools. The records ACTION keeps about OANs include the geographic coordinates of the farm. Mapping these locations would allow ACTION to develop a targeted plan to enlist farmers in areas not prominently involved in having OANs. In addition, crime analysts could analyze theft trends along with marking trends to determine where OAN marking may be most needed.

ACTION's efforts to date constitute a significant step in the right direction. However as the program develops to include more partner agencies across California, it is increasingly important to maintain, and even expand, its support system while serving more District Attorneys, law enforcement officers, and farmers with a budget that will likely not grow as quickly. ACTION could strategically expand its capabilities to accommodate the integration of more partner agencies into the network, in part, by considering applications that exploit innovative technologies.

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7. IMPACT EVALUATION

Overview

A rigorous evaluation of the impact of the ACTION program ideally would involve reference to outcomes, especially agricultural crime, prior to and after implementation of ACTION, as well as to comparable counties in which ACTION was not present. Such a strategy was not feasible, however, for this study. The research team's investigations, as well as consultations with practitioners and experts, identified no counties that would be considered comparable in relevant respects (e.g., composition of the population, proximity to the coast, types of products raised or grown, extent of crime prevention efforts already in place, importance of agriculture to local economy). The problem associated with relying on counties that only superficially appear comparable is that spurious differences (positive or negative) between the intervention and comparison counties may be identified (Rossi et al. 2004).

For these reasons, and after consultation with methodologists and experts on agricultural crime, the research team developed a "dosage" model approach to evaluating ACTION. This approach was premised on the assumption, bourne out in site visits, interviews, and analyses, that ACTION was not equally implemented across counties. Indeed, San Luis Obispo, the ninth county, joined ACTION in 2004 soon after the study began, and essentially constituted a "zero dosage" comparison. Other counties had higher levels of implementation, but the levels varied considerably, creating a naturally-occurring experiment that enabled us to assess whether higher levels of dosage translated into lower levels of agricultural crime victimization.

As part of the assessment of the impact of ACTION, the research team investigated whether it is premised on a sound theoretical logic, since sound theory typically is a prerequisite for effective interventions (Rossi et al. 2004). If, for example, X is held to cause crime but it in fact does not, a program aimed at X is unlikely to reduce crime. The team thus examined whether empirical support for the program's logic exists. The evaluation examined this issue, identifying opportunity theory as the central theoretical perspective on which ACTION rests and then empirically investigating whether the perspective indeed helps predict agricultural crime.

The impact analyses relied on several sources of data, including official records from the ACTION database and the two surveys—the first in 2004 and the second in 2005—of farms. The ACTION data include such information as crimes reported to the police, arrests, and the dollar value associated with victimization (where a value can be determined). It also includes information about farms that have used OANs to mark their equipment, whether and where surveillance deployment was used, and whether use of the equipment led to identifying suspects or arrests.

Causal Logic[3]

Opportunity Theory

ACTION consists of several inter-related activities, each of which entails its own logic. For example, the aggressive prosecution strategies are premised on the notion that they will produce a general deterrent effect. The increased communication within and across counties and different parts of the criminal justice system, especially the police and prosecutors, is assumed to create efficiencies and greater success in identifying, apprehending, and convicting offenders. Analysis of the database, apart from serving to document that agricultural crime exists, is believed to enable law enforcement to identify emerging "hot spots" and other locations where crime may be likely to occur and to target their efforts accordingly.

However, the perhaps central focus of ACTION consists of educating farmers about ways in which "target hardening" can be undertaken to prevent agricultural crime victimization, and of facilitating target-hardening efforts. The logic builds on situational crime prevention and place-based theories (Eck 2002), and, in particular, opportunity theory, which argues that crime is less likely when potential targets are less attractive (e.g., less portable and less valuable), offenders are less proximate to targets, and targets are less exposed (e.g., easier to see) and more guarded (Felson and Clarke 1995; Akers and Sellers 2004). Opportunity theory arguably is especially appropriate in farming communities because opportunities for theft and offending are ubiquitous, the farms are isolated but easily accessible, many of the items on farms are portable (e.g., commodities, machinery, equipment) and can be quite expensive (e.g., chemicals), and farmers typically adopt few security measures and are unlikely to call the police (Barclay and Donnermeyer 2002). Notably, however, applications of opportunity theory to such communities is almost non-existent, thus raising questions about whether the theory provides a sound, empirically-based foundation for a program aimed at reducing agricultural crime victimization. The research team thus investigated how exactly the theory might best be applied to farms and, using the data from the first year (2004) survey, empirically tested whether each of the four opportunity theory variables were associated with reduced victimization.

Opportunity theory argues that four factors contribute to victimization at the individual or ecological level—target attractiveness, proximity between targets and offenders, exposure, and lack of guardianship. These are the factors typically used in tests of the theory (see, e.g., Miethe and Meier 1990, 1994). Attractiveness, according to Cohen et al. (1981), refers to the "material or symbolic desirability of persons or property targets to potential offenders" (p. 508). Objects that are more portable or accessible are more attractive. Proximity is "the physical distance between areas where potential targets of crime reside and areas where relatively large populations of potential offenders are found" (p. 507). Accordingly, residing near major transportation routes would also increase one's vulnerability to crime because potential offenders can easily traverse the distance between urban and rural areas. Exposure is the "physical visibility and accessibility of persons or objects to potential offenders at any given time or place" (p. 507); increased visibility of targets increases the likelihood of victimization (Miethe and Meier 1994; Felson 1998). Finally, guardianship refers to the "effectiveness of persons (e.g.,

[3] This section draws on and/or uses analyses, tables, and discussion from Mears et al. (2007b).

housewives, neighbors, pedestrians, private security guards, law enforcement officers) or objects (e.g., burglar alarms, locks, barred windows) in preventing violations from occurring, either by their presence alone or by some sort of direct or indirect action" (Cohen et al. 1981:508). Guardianship can be either social (i.e., provided by people) or physical (i.e., provided by equipment, geography, or architecture) (Tseloni et al. 2004).

Attractiveness and guardianship typically are construed as representing micro-level processes, on the assumption that individual offenders make choices about whether to commit a crime, and do so by weighing such dimensions as the benefits (e.g., the attractiveness of a target) and the risks (e.g., the likelihood of apprehension given a level of a guardianship). By contrast, exposure and proximity typically are construed as representing macro-level processes, on the assumption that the variables capture spatial dimensions that directly or indirectly affect victimization (Miethe and Meier 1990).

Empirical tests have supported parts of opportunity theory, although the extent to which it accounts for particular crimes varies (Akers and Sellers 2004). Many studies suggest that exposure is an important predictor of victimization; evidence for attractiveness, proximity, and guardianship is less consistent (Birkbeck and LaFree 1993; Miethe and Meier 1994; Hoyt et al. 1999). Prior research suggests that opportunity theory is especially well-suited to explain offenses like residential burglary and robbery, and presumably agricultural crime, that involve material benefits (Miethe and Meier 1994).

Coinciding with research on the etiology of crime have been evaluation efforts focused on "target-hardening" programs informed by opportunity theory and its variants. Such programs typically have focused on increasing guardianship (e.g., locking doors, marking property, using exterior lighting, participating in collective efforts to monitor property and report suspicious behavior) and have burgeoned over the past twenty years. The evaluations of these efforts have, however, yielded mixed results (Miethe and Meier 1994; Eck 2002; Tseloni et al. 2004). More importantly, the generalizability of such studies, as well as etiological research, to rural areas, and to farm operations in particular, remains largely unknown.

Although opportunity and other place-based theories of crime would appear likely to help account for agricultural crime, there has been limited work conceptualizing and measuring opportunity theory risk factors as they pertain to such crime. One of the few exceptions is a study of Australian farmers, which found that burglary and fuel, tool, and machinery theft were greater among farms where sheds and buildings were not visible from the main residence; livestock theft was greater among farms isolated and surrounded by dense cover; vandalism was greater among farms distant from urban centers and near highways; and dumping was greater among farms closer to urban centers and highways (Barclay et al 2001:90-91). Another study, focusing on agricultural crime in Arkansas, found, contrary to Barclay et al. (2001), that vandalism was greater among farms closer to urban areas (Farmer and Voth 1989). This study also found that serious property crimes occurred more frequently among farmers in rural areas as compared with those who lived nearby to urban centers.

Barclay and Donnermeyer (2002) conducted a follow-up study of Australian farmers, examining whether several ecological factors and security steps were associated with specific types of agricultural crime. Echoing Barclay et al.'s (2001) work, they found that some factors,

such as proximity to a town, were positively associated with certain offenses (e.g., fuel, tool, and livestock theft), but not others (e.g., burglary, trespassing). They also found that properties bordering highways were more likely to be victims of vandalism, trespassing, and illegal shooting, but not fuel, tool, or livestock theft. Having buildings in sight of the main residence was negatively associated with most types of agricultural crime. By contrast, the authors found that almost none of the 23 precautionary behaviors—that is, steps or actions farmers took to prevent crime—were statistically associated with agricultural crime of any kind.

These studies suggest that opportunity theory may provide a powerful foundation for explaining variation in agricultural crime victimization. Turning to a central dimension of opportunity theory, guardianship is likely to be lower in rural areas and may not be as effective given the difficulty of monitoring a neighbor's property that extends over many acres (Weisheit and Donnermeyer 2000:328). Indeed, guardianship via formal control mechanisms, such as the police, may not prove to be effective in rural areas, especially among farmers. "Rural residents are more likely to be suspicious of government" (Weisheit and Donnermeyer 2000:329), and farmers are particularly reluctant to call for assistance due to their independence and to their mistrust of government. In addition, the number of officers per acre is perforce dramatically lower in rural as compared to urban areas. Finally, as mentioned earlier, farmers typically do not invest in surveillance equipment or other measures that might protect their property. Deeds et al. (1992:4) found, for example, that 80 percent of the farmers they surveyed had not "spent anything on insurance or security devices in the past 3 years" (see also Bean and Lawrence 1978), this despite the fact that certain measures, such as installing video cameras, can be implemented relatively cheaply.

Collectively, these conditions point to the considerable opportunities for agricultural crime and, equally, the possibility that opportunity theory can help account for variation among farmers in their risk of victimization. Specifically, agricultural crime victimization should be greater among farm operations that are more attractive, more proximate to potential offenders, more exposed, and less guarded.

Data and Methods

Tests of opportunity theory frequently fail to include measures of each of the theory's four constructs, and typically either neglect a focus on proximity or use questionable measures of it and the other constructs (Miethe and Meier 1994:52-55; Akers and Sellers 2004:39). For this reason, we include measures designed to operationalize each of the theory's four constructs as they apply to agricultural crime and rural settings. We then used logistic regression analyses to examine the extent to which the measures predict victimization; the binary logistic regression models serve to predict the six dichotomous victimization outcomes in Table 1 (DeMaris 1992; Menard 1995; Allison 1999). We also examine factors, using ordinary least squares (OLS) regression, that may contribute to farmers' use of opportunity theory-related crime prevention measures. The data used for the analyses came from the first-year (2004) survey (see Appendix A).

As shown in Table 1, we examined five types of agricultural crime, as well as a general agricultural crime measure (1=victimized, 0=not victimized). The five types included: (1) small

equipment theft (e.g., tools), (2) serious theft (e.g., tractors, large equipment, livestock, poultry, and commodities, such as grain, feed, seed, fruit, or vegetables), (3) chemical theft (e.g., insecticide, herbicide, fungicide, fertilizer, fuel, or such veterinary supplies as hormones), as well as (4) vandalism of machinery, fences, fields, or other property, or dumping of cars, dead livestock, or trash, and (5) burglary of farm buildings. The guardianship measure is the percent of each of thirty possible security precautions that farmers reported using (see Appendix A).

Each of the independent variables was operationalized using several measures, and coded in accordance with the expectations one would derive from opportunity theory—for example, greater attractiveness, exposure, proximity, and lack of guardianship should be associated with greater victimization. We used several measures for each of the main constructs associated with opportunity theory, and did so precisely because considerable work is still needed to identify the most relevant measures of each in an agricultural context. The situation contrasts markedly, for example, with studies of urban crime, where many studies have, over time, converged on a core set of measures that can be viewed as more or less adequate measures of the theory's main constructs (Miethe and Meier 1994). In short, we wish to capture as many dimensions of each construct as the data will allow. Subsequent research may, of course, reveal the best measures or indices to use.

We operationalized attractiveness using two measures. The first is the amount of all property marked by farmers with owner-applied numbers (OANs) (0=all, 10=none), scaled down and reversed from an original range of 0 to 100 percent for ease of interpretation. We argue that the level of OAN use serves as a general indication of the extent to which potential offenders may view a farm as attractive. The second is what farms grow as their primary commodity—farms that grow fruits or nuts as their primary commodity are likely to be viewed as more attractive because these commodities are highly portable (0=fruit/nut is not primary product, 1=fruit/nut is primary product). Farms that mark little of their equipment and grow fruits and nuts are more attractive and so should experience more victimization.

Ideally, one might measure attractiveness using a variable that ranked different agricultural crimes according to their combined portability and value, with the most attractive targets being those that maximized both portability and value. Then we would want a measure that captured how many of each type of product farm operations had (e.g., how many highly vs. less attractive commodities). This type of a variable is not, however, easily constructed without posing a burden on survey respondents. Nonetheless, we have as an indirect assessment of whether highly attractive targets are stolen more often. The descriptive statistics in Table 1 show, for example, that small equipment, arguably the most attractive from the standpoint of portability and value, is stolen more frequently than, say, serious theft.

We operationalized proximity in three ways. First, farms where the main residence is located on a dead-end are arguably less geographically proximate to potential offenders in comparison to farms located near intersections (0=residence at dead-end, 1=not located at dead-end). Second, accessibility of buildings and farm to roads and highways is included as a measure of proximity because these serve as efficient conduits between potential offenders and targets (0=not accessible, 10=highly accessible). As with the property-marking variable, accessibility was scaled down from a 0 to 100 percent range to facilitate interpretation of the results. Third, the number of workers employed by each farm also is used as a proximity measure, the assumption

being that greater numbers of on-site employees creates more opportunities for theft because of their physical proximity to attractive targets. Farms with residences not located at a dead-end, that are highly accessible, and that have larger numbers of workers should be at increased risk of victimization.

Exposure was operationalized in three ways as well. When land cover (e.g., trees, shrubs) is sparse, potential targets are more visible and thus more exposed (0=dense, 1=sparse) (see Barclay and Donnermeyer 2002). A similar logic holds for farms whose terrain is largely flat (0=not flat, 1=flat)—the greater visibility creates greater exposure. Farms that are physically larger (in terms of acres) could have greater amounts of commodities, equipment, and materials that are exposed. In short, when farm land cover is sparse, the terrain is flat, and farms are physically larger, victimization should be greater.

Finally, we operationalized guardianship using the following measures: farm proprietor or staff attendance at crime prevention meetings (0=attended, 1=have not attended); use of surveillance equipment (0=have used, 1=not used); lock or hide property (1=lock or hide a lot, 5=lock or hide little); take traditional steps to protect property (0=many steps, 10=no steps); and surveillability (0=property highly visible from main residence, 10=not visible). This latter measure bears elaboration. Traditionally, opportunity theory contemplates that targets that are more visible to offenders will be more likely to be victimized. In that sense, visibility is a measure of exposure. Within the context of guardianship, however, visibility assumes a slightly different meaning, especially on farms. Specifically, the salient issue is the extent to which farmers can, from a central residence or building, easily survey an entire property to protect it from would-be offenders. It is this dimension that our surveillability measure is meant to capture. As with several other variables, surveillability was scaled down from a 0 to 100 percent range. Victimization should be greater among farms where no one has attended crime prevention meetings, that do not use surveillance equipment or lock or hide property, that take few protective steps, and whose property is less visible from the main residence.

We conducted a separate analysis aimed not at testing opportunity theory but instead at exploring factors that might contribute to guardianship. Independent variables consisted of whether farmers were victimized in the prior year (0=not victimized, 1=victimized); whether friends or family have been victimized (0=not victimized, 1=victimized); concern about crime, including such offenses as theft, vandalism, assault, and burglary (1=not very concerned, 5=highly concerned); whether respondents were contacted by law enforcement (0=no, 1=yes); type of operation (0=not family-owned or operated, 1=family-owned or operated); age; and race (0=non-white, 1=white).

In the regression models we present, we use probability values of $p<.10$, as well as conventional levels, to identify factors that may be statistically significant. Re-analysis using multiple imputation, a procedure available in SAS v. 9 (Rubin 1987; Shafer and Olsen 1998), produced results largely mirroring those from the non-imputed data. That is, the results convey what one would expect with larger samples—namely, the direction and size of effects generally remain the same, but some coefficients emerge as statistically significant. The imputation is useful here because non-overlapping missingness across variables led to reductions of close to 40 percent of respondents in some models. The concern in these instances is that too few cases exist to detect statistical significance.

We adopt these different approaches because testing of opportunity theory in rural areas is at a nascent stage of development and presenting models with restricted sample sizes may create the misleading impression that some factors are not associated with victimization. The issue is more of a concern in cases involving relatively rare events, which is the case with three of the dependent variables we examine (serious theft, chemical or fuel theft, and burglary). To reiterate our concerns, given the dearth of research on agricultural crime, it is important to avoid obscuring results that may ultimately prove to be of substantive and statistical significance. Fortunately, review of the multivariate models involving the non-imputed and imputed data, and comparison of these with bivariate models, reveals a largely similar set of findings. Put differently, the use of the different approaches achieves our purpose—it identifies factors that appear likely to be linked to agricultural crime victimization, but that are unlikely to be identified as statistically significant in smaller samples.

Findings

A preliminary conclusion from the analyses was that it remains unclear how best to operationalize opportunity theory within the context of farming communities. For example, proximity typically is measured as the distance a residence or business is from high-crime areas. In rural communities, most farms typically reside far from cities or town centers, and it is unclear that residences of such areas systematically stray out into the country, though some accounts suggest that gangs and organized crime may do so (Swanson et al. 2002). Nonetheless, drawing on other studies (e.g., Barclay and Donnermeyer 2002), the study developed a series of measures that arguably represent each of the four opportunity theory factors.

Several descriptive findings from the survey bear mention. First, as discussed above, theft of small equipment is relatively common compared to serious theft, chemical or fuel theft, vandalism, and burglary (see Table 1). Such equipment, though not always of high value, is highly portable and so may be viewed as more attractive. Viewed from this perspective, these findings suggest support for opportunity theory—namely, more attractive targets are stolen more often.

Second, relatively few farmers experience serious property theft, suggesting that farms on average may be buffered against such crime. The prevalence of serious agricultural property theft appears to be somewhat lower than in other studies (see, however, Donnermeyer 1987), which typically estimate 1-2 year prevalence rates of 12-25 percent (Donnermeyer and Barclay 2005:9; Barclay 2001:55-72). If true, serious property theft is sufficiently rare to raise questions about the feasibility of reducing it even further through efforts guided by opportunity theory and its variants.

Third, with the exception of vandalism and, to a lesser extent, small equipment theft, few farmers experience repeat victimization within a one-year period. The percentage of farmers experiencing two or more victimizations, by offense, was: vandalism (42.0), small equipment theft (17.3), serious theft (8.2), chemical or fuel theft (5.8), and burglary (4.7). The results suggest that opportunity-blocking may be sufficiently in place on average to prevent such victimization.

In general, the results from the multivariate analyses (see Table 2) suggest support, though in some cases the evidence was mixed, for the ability of opportunity theory to account for variation among farms in their level of victimization. Targets that are more attractive, such as those that are portable and relatively valuable (e.g., fruit and nuts), were more likely to be stolen than are, say, livestock. The latter are quite valuable, but not easily portable. Proximity measures were not typically associated with victimization, although farms with more workers (a key source of potential offenders) experienced more theft. Similarly, exposure did not surface as a particularly salient factor. However, larger farms and those resting on flat terrain were somewhat more likely to experience relatively more theft and vandalism. Finally, farms that employed more guardianship steps (e.g., locking equipment, using guard dogs) typically experienced less victimization, though the effect was not consistent across all measures of guardianship. In some cases, the results were the opposite of what was expected—for example, farms that used surveillance equipment were associated with higher levels of victimization. Disentangling causal order issues is difficult with cross-sectional research designs, and, in this instance, not much easier with over-time data analysis strategies. Nonetheless, there is little logical reason to anticipate that surveillance indeed increases victimization. More likely is the possibility that farmers who experience greater levels of victimization invest in surveillance equipment as a crime prevention strategy. Indeed, Barclay et al. (2001:91-92) make precisely this point after observing similar patterns in their review and own studies.

Several observations about these results merit discussion. First, as noted, they suggest broad, if tentative, support for opportunity theory, as applied to agricultural crime. Second, the risk factors are not equally predictive of all offenses—for some, they are significant, while for others they are not, and for still others the strength of effect varies. This variation actually comports with what opportunity theory research would suggest. Specifically, the unique situational contexts of certain crimes may influence which factors are significant and to what extent. Locking and hiding property may be effective, for example, in preventing vandalism and burglary because access clearly is critical to successfully committing such offenses. By contrast, such steps may do little to prevent theft of tractors or fuel because these typically will be left in fields overnight, where locks can easily, and without notice, be broken.

Finally, we conducted exploratory analyses to determine what might influence the use of guardianship measures among farmers. The results suggested that being victimized or having friends or family who were victimized, being concerned about crime, and being older all contribute to a greater amount of guardianship. By contrast, family-owned farm operations take fewer guardianship measures, perhaps reflecting a resource issue—namely, greater resources typically are required to invest in a greater range of such measures.

Impact Evaluation—Part I[4]

Data and Methods

As noted at the outset, the results of the diverse evaluation methodologies suggest that

[4] This section draws on and/or uses analyses, tables, and discussion from Mears et al. (2007a).

ACTION may have (a) changed law enforcement behaviors (e.g., increasing communication within and between counties, sheriffs' offices, and District Attorneys), albeit more so in some counties than in others, (b) changed farmer behaviors (e.g., increasing the amount of crime prevention efforts taken), and, most importantly, (c) reduced agricultural crime victimization. Two distinct approaches were used to assess impact. The first, and less rigorous, suggested that dosage was positively associated with victimization but, after a certain threshold, negatively associated with it; additional analyses indicated that ACTION has improved the ability of law enforcement agencies to identify, arrest, and prosecute suspects. The second, and more rigorous, suggested that dosage was negatively associated with victimization. Here, we discuss the first approach; in the next section (Impact Evaluation—Part II), we discuss the second.

In the first approach, we employed a range of what we term "dosage" measures—that is, measures that reflect the level of program implementation in each county. These county-level measures were used to predict individual-level (farm-level) agricultural crime victimization as well as other dimensions, such as the quality of life among farmers, relevant to evaluating the success of the program. We include in the analyses a process evaluation, which involves assessing whether higher county-level doses of ACTION contribute to greater farm-level involvement in activities, such as increased guardianship of property, that comprise the program's intermediate process outcomes. We then link the process and outcome evaluations by examining whether inclusion of the process measures reduces or eliminates any observed association between the dose and outcome measures. The causal logic, stated simply, is that ACTION's activities (e.g., educating farmers about steps they can take to fight crime) will contribute to intermediate process outcomes (e.g., farmers actually taking recommended steps for protecting their property) and, in turn, to "end" (longer-term) outcomes (e.g., less victimization).

Given that multiple counties participate in ACTION, it is unrealistic to assume that program treatment is provided equally across them. Rather, one would anticipate, and the program staff verified, that even though ACTION has been in existence for several years, some counties have implemented ACTION to a greater degree than others. As a result, we can expect that outcomes among farmers would be influenced by the county in which they reside, and, in particular, the level of program implementation in that county. For the analyses, we use logistic, Poisson, and ordinary least squares (OLS) regression analyses to test the hypothesis that farmers in higher-dosage counties should have improved intermediate outcomes (e.g., greater use of guardianship measures) and improved end outcomes (e.g., less victimization).

Dependent Variables

As shown in Table 3, we examine the following dependent variables from the first-year survey, computed at the farm unit of analysis: a global measure and five specific types of victimization, including small equipment theft (e.g., tools), serious theft (e.g., tractors, large equipment, livestock, poultry, and commodities, such as grain, feed, seed, fruit, or vegetables), chemical or fuel theft (e.g., insecticide, herbicide, fungicide, fertilizer, diesel fuel, or gasoline), vandalism of machinery, fences, fields, or other property, or dumping of cars, dead livestock, or trash, and burglary of farm buildings (0=not victimized, 1=victimized); a victim diversity index (0=no victimization, 4=4 or more types of victimization); a measure of perceived change in victimization over the past year (1=increased a lot, 7=decreased a lot); loss from victimization in dollars (logged); quality of life (0=no change in quality of life due to fear of or actual

victimization, 1=some type of change); and a measure of whether intermediate process outcomes (IPO) were achieved.

The IPO measure merits discussion. As previously mentioned, the ACTION program consists of several efforts designed to promote certain crime prevention activities, termed here intermediate outcomes, among farmers. These activities—such as increased reporting of incidents to law enforcement, marking equipment, using surveillance technology, and adopting other proactive steps to protect property—in turn are held to cause reductions in victimization, the primary end, or long-term, goal of the program. A factor analysis of farmers' survey responses led to the identification of a single IPO measure used here to capture the extent to which farmers in counties where ACTION has been more aggressively implemented have been more likely to undertake the various recommended crime prevention activities. A higher IPO factor score indicates that a given respondent reported undertaking more such activities.

Independent (Dosage) Variables

Three measures of county-level dosage were used as independent variables: staff ranking, percent of farms using OANs, and police responsiveness. For each of the measures, county-level values were computed and then assigned to farmers residing in each respective county.

For the first dosage measure, ACTION staff and an insurance agent familiar with the program and actively involved in efforts to reduce claims in the region were asked in a survey to rank order the nine counties according to each county's level of program implementation. All responses were averaged and are used here as one measure of each county's overall level of program implementation (10=least implemented, 90=most implemented). (The responses were initially coded 1 to 9, where 1 was equivalent to the county with the most implementation while 9 indicated the county with the lowest amount of program implementation. The inverse of this scale was taken so that an increase in staff ranking would be associated, or so we hypothesized, with a reduction in agricultural crime victimization. We then scaled the responses up by a factor of ten to produce coefficients large enough to easily denote in tables.) We relied on staff assessments for three reasons. First, few other sources of data exist to provide valid indicators of program implementation. Second, and related to the first, ACTION consists of many different activities, with some counties more aggressively implementing certain activities as compared to others. Third, ACTION staff are involved on a daily basis with all counties and have little obvious incentive to give biased assessments of one county over another.

A second measure of dose—county-level percentages of farms with OANs—was calculated by dividing the number of farms in each county recorded by ACTION staff as having used OANs in 2003 and 2004 by the total number of farms per county. The latter counts were obtained from U.S. Department of Agriculture (2004) for the most recent year (2002) in which an agricultural census was conducted. (One county emerged as an outlier in that the percentage of farmers using OANs, though relatively small, was substantially greater than that of the other counties. We therefore omitted this county in the models in which percent OAN served as a measure of dose. The results were largely similar to those obtained when the county was included.)

The final dosage measure came from the survey, which asked respondents to rate the change

in the responsiveness of local law enforcement in the prior twelve months (0=same or worse, 1=improved). County-level averages were computed and then assigned to each farmer. The logic was that victimization among farmers should be lower among those residing in counties where law enforcement responsiveness was greater.

Each of these measures of dose captures different aspects of the program. The first, staff rankings, reflects a global assessment of program implementation; the second, percent OANs, reflects an assessment of the extent of implementation of only one program activity, albeit a prominent one; and the third, like the second, yet again focuses more narrowly than the first, in this case capturing law enforcement proactiveness. Given the varying dimensions that these measures capture and the possibility that their influence on victimization may vary, we examine their effects separately. Analyses in which all three dose measures and the associated quadratic terms were simultaneously included produced similar results, although the statistical or substantive significance of some estimates diminished or were altered, likely resulting from the fact that introducing six terms (three dose and three quadratic terms), in addition to the presence of the many controls, placed excessive demands on the data. Also, two of the dose measures (percent OAN and police responsiveness) were correlated, while neither was strongly correlated with the third. By examining each dose measure separately, we are better able to assess whether similar patterns emerged, regardless of the dose measure used, and to identify potential differential effects of the various types of dose on the outcomes.

Controls

Several variables were included in each regression model to control for county- and farm-level effects. The county-level control consisted of the 2003 reported property crime (burglary, motor vehicle theft, and larceny theft over $400) rate (per 1,000 residents) (California Criminal Justice Statistics Center 2005). County-level values were assigned to each individual farm. At the farm level, controls included the number of acres farmed (per 1,000 acres), the age group of operators (1=less than 30 years, 2=30 to 50 years, 3=greater than 50 years old), whether fruits/nuts were the primary product, and whether an operation was family-operated.

Methods

The analyses were performed with SAS PROC GENMOD (SAS version 9.1), a procedure that fits generalized linear models (GLM). The GENMOD procedure is an extension of traditional linear models that can accommodate a wider range of data situations, including logistic and normally distributed response probabilities (SAS Institute 1999). This procedure was chosen because of its wide applicability to the different types of dependent variable distributions in our study. For example, it accommodates those variables with a binomial distribution (e.g., any victimization, small equipment theft, serious theft, chemical or fuel theft, vandalism, burglary, and change in quality of life), those that are Poisson-distributed counts (e.g., the victim diversity index), and those that are normally distributed and typically examined using ordinary least squares (OLS) regression (e.g., change in victimization, loss from victimization, and the IPO measure).

In each regression model, the independent dosage variable and its squared version are used to predict the ten dependent variables. Inclusion of the squared term allows for the detection of

potential curvilinear relationships, which we anticipate may be evident in a dose model. (For example, program effects may be stronger at higher rather than lower levels of dose.) Across all models, we computed "pseudo-R2" statistics to measure model goodness of fit. Computing the exponent of the negative of this quantity and subtracting that from 1 provides a pseudo-R2 measure that ranges between 0 and 1 (Allison 1995:248); the closer the model fit statistic is to 1.00, the better the model predicts the dependent variable.

We then calculated predicted probabilities for dependent and independent variable pairings. In each case, control variables were set to the grand mean across all counties and independent variables were set to each county's mean. For each measure of dose, the predicted probabilities (for logistic models) and predicted outcomes (for Poisson and OLS models) for statistically significant models were calculated and their values plotted for visual inspection of curvilinear relationships in cases where the quadratic (squared) dosage term was statistically significant.

All tests of statistical significance were conducted using a modified sandwich variance estimator to calculate robust standard errors, which are presented in tables 2, 3, and 4. Sandwich variance estimates are commonly used in econometrics and statistics when researchers are unsure about the complete specification of the distribution in a fully parametric model but are relatively sure that the mean value is well-specified. The estimator used in this paper further adjusts the sandwich estimates for the possibility that there may be unobserved but persisting heterogeneity within clusters (e.g., counties).

Before proceeding, our evaluation strategy should be reiterated: in the absence of appropriate pre-intervention data, and in a situation where a program has changed and expanded over time and where no other obvious "no treatment" counties exist, an analtyic approach is needed that can provide some foothold in assessing whether an ecological-level program has been effective. In the present context, it was not until 2002 that ACTION appeared to fully crystallize. And even then, each county had not fully embraced the program. Thus, we devolved on the following strategy: create measures of the "dose" (i.e., amount) of the program implemented in each county, then survey farmers in these counties about crime they experienced. The central premise is that farms in counties with higher doses of the ACTION program in the years immediately prior to 2004 should experience less victimization, net of other factors.

Findings

A main limitation of the first impact evaluation approach was its cross-sectional nature, which, in an evaluation context, can render inferences about causal order questionable. If victimization is lower among farmers in higher-dose counties, perhaps that is because counties that are more aggressive generally in fighting crime and that therefore have lower crime rates are more likely to participate actively in ACTION. In fact, the analyses suggested that a different type of causal order problem arose—namely, counties experiencing higher rates of agricultural crime likely were more inclined to implement or participate in ACTION, creating the appearance, in cross-sectional analyses, of a positive relationship between the program and victimization. This issue was addressed in part by controlling statistically for property crime rates and various characteristics of farms. Nonetheless, a notable finding was that at higher dose thresholds, greater amounts of program implementation were associated with reduced levels of

victimization. An additional finding of note from the analyses were that farmers in higher-dose counties were more likely to undertake the types of activities promoted by ACTION and that controlling for such activities largely eliminated the statistical significance of dose. These results suggest both that ACTION changed farmers' behaviors and that doing so can influence the likelihood of victimization. The analyses—essentially a coupling of a process with an outcome evaluation—lend further support to the theoretical foundation on which ACTION rests. Below, we discuss the analyses that support these assessments.

First, like those in other studies, our analyses suggest that agricultural crime is relatively common. Inspection of Table 3 shows, for example, that over 60 percent of farms in this study experienced some type of victimization in the year prior to the study. Closer inspection shows that the bulk of such crime involved vandalism (49 percent of farms) and small equipment theft (30 percent). Nonetheless, a non-trivial percentage of farms, ranging between 11 and 14 percent, experienced serious theft, chemical or fuel theft, or burglary.

The victimization diversity index indicates that farms on average experienced 1.11 types of victimization. Among those victimized, however, the mean was 1.78 (s.d. .95), suggesting that such farms typically experience two different types of victimization. Specifically, although 51 percent experienced one type of victimization, 26 percent experienced two types, 15 percent experienced three types, and 7 percent experienced four. Farmers as a group reported that there had been little change in victimization during the prior year. The annual per-farm loss due to victimization was $3,020, with $0 and $305,000 representing the lowest and highest claims, respectively, made by farmers (the logged version of this variable, presented in Table 1, is used in the subsequent analyses). Close to half of all respondents reported a change in their quality of life in the prior twelve months. (We examine the IPO variable below when discussing the analyses. The factor score is standardized, so there is no intuitive interpretation of the mean.)

Examining the dose measures, we see that the staff ranking mean lies exactly in between the low and high rankings. That results from asking the staff to rank order the counties from lowest to highest in implementation. Examining the dose measures, we see that few farms mark their equipment. The average is 1.3 percent of all farms per county, with a low of 0.0 percent and a high of 3.0, indicating marked variation. For the third dose measure, we see that, on average, 18 percent of farmers reported that police responsiveness had improved in the prior year, with a low 12 percent in one county and a high of 30 percent in another.

Finally, counties varied considerably in their property crime rates. The average was 2.3 crimes per 1,000 residents, but the rates ranged from a low of 1.3 to a high of 3.1. Farms in the sample varied in size from less than 100 acres to 30,000 acres, with a mean of 540 acres. Almost three-fourths of the farms produced fruits and nuts as their primary commodity and 78 percent were family-owned operations. The average age of farmers was roughly 40 years.

We turn now to the question of whether higher doses of ACTION correspond to better outcomes (e.g., lower rates of victimization). Table 4 presents analyses for ten outcomes regressed on three measures of dose, controlling for such factors as property crime rates. Logistic regression results are presented for each of the dichotomous victimization outcomes as well as the change in quality of life measure; Poisson regression is used for the victim diversity index outcome; and ordinary least squares (OLS) regression is used for the change in

victimization and victimization loss outcomes. Review of the table shows that all three dose measures are statistically significant for five of the outcomes, including any victimization, chemical or fuel theft, vandalism, the victim diversity index, and victimization loss. One or more of the dose measures is statistically significant in all but two cases—change in victimization and change in quality of life. In addition, the quadratic term is statistically significant in most models. Together, these patterns suggest that dose is consistently associated with the diverse set of outcomes and that the dose-outcome relationship is non-linear, signifying that the effect of dose on the outcomes varies depending on the level of dose.

Interpretation of the linear and quadratic dose terms is not entirely straightforward. The linear term indicates how unit changes in dose translate into unit changes in the outcome, but such an effect is modified by the quadratic term, depending on the level of dose. For this reason, we graphed predicted probabilities for varying levels of dose to facilitate interpretation. Unexpectedly, the general pattern suggests a counter-intuitive interpretation—namely, as dose increases (i.e., as we progress from counties with low levels of program implementation to those with high levels of implementation), the risk of victimization actually increases. However, after dose exceeds a certain threshold, the risk of victimization begins to drop. The latter finding suggests that with fuller implementation the program might well contribute to lower rates of victimization. However, the former raises important questions since one would not logically expect increases in an intervention to produce worse outcomes. Notably, this pattern was not anomalous—in plotting the predicted probabilities for the other outcomes, the same general pattern consistently emerged.

A relatively simple two-part explanation exists. First, counties with the highest amounts of agricultural crime may have more strongly embraced and implemented ACTION, and, second, insufficient time may have passed for the program implementation to have resulted in lower crime rates. Program staff confirmed that in their view the counties that most embraced ACTION were indeed those with larger perceived crime problems. Because of the absence of valid, over-time measures of agricultural crime, we cannot, however, empirically assess that impression. Our preliminary assessment was that the program had sufficiently matured over time, and that enough time had elapsed for a substantial program effect to emerge. But those assumptions could be incorrect. For example, although it appears that the program largely matured into a coherent effort by 2003, clearly—as the dose model itself implies—not all counties equally embraced ACTION.

These considerations give rise to the following possible scenarios. On the one hand, counties with low rates of agricultural crime were not aggressive in implementing ACTION and thus, by the time of the survey, continued to have low levels of implementation and agricultural crime relative to other counties. On the other hand, counties with higher rates of agricultural crime aggressively implemented ACTION and continued to do so up to and through the survey. Even if the program reduced rates of agricultural crime among all participating counties and even more so among the higher-dose counties, crime might well still be substantially higher in the latter counties precisely because their baseline rates of agricultural crime were so much higher.

Finding that a relationship indeed exists between dose and outcomes, the next step is to determine whether this relationship can be explained by ACTION's anticipated intermediate outcomes. Preliminary analyses showed that farms in counties where ACTION was more

aggressively implemented were more likely to undertake activities—such as locking equipment and livestock in protected or guarded buildings, asking neighbors to watch one's property when away—promoted by the program. Viewed from the perspective of a process evaluation, such a finding is important in its own right because it suggests that the program has been effective in achieving behavioral changes among farmers.

More importantly, given that higher levels of dose are associated with intermediate outcomes, the logical question to address is whether the observed relationship between dose and the end outcomes can be explained by inclusion of the IPO variable, which itself is correlated with each of the outcomes. If inclusion of this variable in the models presented in Table 4 can reduce or eliminate the dose effects, we have grounds to believe that the program's logic is sound—namely, the activities it undertakes may produce the desired intermediate outcomes (i.e., changes in farmers' behaviors) and these changes in turn likely contribute to the end outcomes.

Table 5 presents the results of regression analyses in which the IPO variable is included as a control. In almost all models, the dose effects are either eliminated or substantially reduced. Observe, for example, that the linear and quadratic dose terms are statistically insignificant in most models or, in those models where one or both are significant, the coefficients generally are considerably smaller than in Table 4. Thus, ACTION appears to be producing changes in farmers' behaviors and these behaviors in turn appear to contribute to the likelihood of victimization. Notwithstanding the seemingly paradoxical dose effects discussed earlier, this pattern lends support to the general causal logic that guides ACTION. A reasonable supposition, which will require empirical evaluation, is that continued and aggressive implementation of ACTION might well create significant reductions in agricultural crime over time.

Impact Evaluation—Part II

Data and Methods

The second approach to evaluating the impact of ACTION on victimization relied on analysis of data obtained from a second survey of farmers conducted in late 2005, one year after the first survey. As discussed earlier, the survey sampled a different set of farmers from the same sampling frame and collected information about victimization and program dosage both in the year prior to the survey (2005) and in the year prior to that (2004). This design created an opportunity to more rigorously assess the impact of ACTION over time and to control for prior levels of victimization.

Dependent Variables

For the analyses, we used six dependent variables, each of which is a count of the number of victimizations per farmer in 2005. The variables were: all crime (i.e., a count of any type of victimization that occurred), burglary, chemical theft, commodity theft, large equipment theft, tool and small equipment theft, tractor theft, and vandalism. As Table 6 shows, the counts for each type of victimization reflect the relative ordering that emerged in the first survey. Specifically, tool and small equipment theft and vandalism are quite common, while large equipment theft and tractor theft are both rare; burglary, chemical theft, and commodity theft,

while not as common as tool theft or vandalism, occur roughly three times more often than equipment or tractor theft.

Independent (Dosage) Variables

Dose measures were created using responses farmers gave to a series of questions in the survey that focused on perceptions about the following dimensions in 2004—quality of protection by law enforcement, number of unsolicited law enforcement visits, helpfulness of sheriff's office, perceptions about whether law enforcement agencies investigated incidents thoroughly, number of people convicted of agricultural crimes, aggressiveness of courts with agricultural crimes, whether law enforcement asked to install surveillance equipment, and whether law enforcement actually deployed surveillance equipment. A factor analysis identified one statistically significant factor (eigenvalue = 1.862). To identify potential non-linear effects, a quadratic term was introduced (dose*dose).

Controls

To address concerns that any identified dose effect might be spurious, several controls were introduced. The central concern is that a dose effect might reflect the fact that individuals who have been victimized more, or who live in high crime areas, might be more prone to take steps to protect their property. We therefore introduced measures of prior (i.e., year 2004) farm-level victimization and county-level property crime rates for 2003 (the most recent year for which such rates were available) in predicting farm-level victimization in 2005. We also introduced other farm-level controls, including size of farm, distance to nearest city, number of paid farm workers, percent of equipment marked with OANs, visibility of property, measures taken to protect property, and dummy variables for each county (Tulare County is the omitted county). Visibility of property was measured by summing the responses for four survey questions: percent of farm buildings not visible from house, percent of property bordering highway, percent of property bordering paved roads, and percent of crops or livestock visible from public roads. Property protection was measured by summing the responses (1=never, . . ., 5=always) to a ten-part survey question gauging the extent to which farmers protected their property in 2004. Items included: neighbors watch farm when out, had home insurance, left house lights on at night or when away, had watchdog, had pistol or gun, kept building doors locked, locked up pesticides or veterinary items, locked windows on buildings, locked fuel storage tanks, and attached outside lights to buildings.

Methods

For each dependent variable, two models are presented. The first uses all the above-listed controls except prior victimization; the second uses only the county-level dummy variables and prior victimization as a control. The latter approach was undertaken because prior victimization is highly correlated with current (2005) victimization, and as such serves as a strong control. Inclusion of the other controls with prior victimization would therefore potentially and unnecessarily undermine our ability to statistically detect a significant dose effect with the given sample size. Comparison of the two approaches provides a stronger basis for assessing ACTION's impact. Poisson and Negative Binomial regression models were used since the dependent variables were counts. In cases where overdispersion was present, Negative Binomial

modeling was the regression approach used.

Findings

Results from analyses of the second-year survey can be summarized briefly. Inspection of tables 7a through 7h indicates that farmers in communities that more aggressively implemented ACTION activities in 2004 experienced less victimization in 2005, net of the diverse controls. Specifically, higher doses of ACTION contributed to less victimization in general (Table 7a) and to less of several specific types of victimization, including chemical and fuel theft (Table 7c), small tool and equipment theft (Table 7f), and vandalism (Table 7h). In addition, the effect of dose was curvilinear for crime in general (Table 7a) and for vandalism (Table 7h)—specifically, at higher levels of dose, there was still a crime-reducing effect of dose, but the effect was less than at lower levels of dose.

These findings are especially notable because they rely on measures of dose that capture the diverse dimensions on which ACTION is focused, because they include a temporal dimension (i.e., one where dose precedes the outcome), which creates stronger grounds for making causal inferences, and because they emerge despite the inclusion of controls for prior victimization and property crime rates.

The impact on vandalism, which can include dumping trash on farm property, bears emphasis. During site visits, the research team was repeatedly told that such crime can take a considerable toll on farmers. Trash dumping occurs frequently and can entail substantial clean-up costs. A similar point was made in comments farmers made on the surveys. When old cars, refrigerators, tires, and other refuse are left on farm property, farmers are legally required to remove it. Doing so takes time and can be costly, especially in cases involving chemicals. Thus, the possibility that ACTION may have helped reduce vandalism should be of particular salience to farmers.

Non-Victimization Impacts

A central feature of ACTION is its attempt to improve law enforcement success in identifying and arresting offenders and in facilitating their conviction. Such goals can reasonably be viewed as important outcomes in their own right, irrespective of whether they reduce crime. Indeed, the criminal justice system is grounded in no small part on an emphasis on accountability and retribution, not just deterring other crime. Notably, then, ACTION appears to have had an appreciable impact on identifying suspects and arrests. For example, over a two-year period (2003-2004), ACTION deployed surveillance equipment 69 times, and these efforts in turn resulted in identification of 35 suspects and 15 arrests (see Table 8). Similarly, in 2004 and 2005, at least 522 defendants were convicted of agricultural crime-related charges among the participating counties (see Table 9). The latter count is likely an underestimate since some county District Attorney offices do not always record all such convictions.

Interviews with practitioners emphasized that without the evidence collected using the equipment, virtually none of the suspects would likely have been identified and no arrests would

have occurred. Moreover, had arrests in fact occurred, there likely would have been insufficient evidence—absent the equipment—to obtain a conviction. Prosecutors with whom the research team talked consistently emphasized that such evidence had been extremely helpful in mounting successful prosecutions, many more than they reportedly have been able to obtain in the past. (Prior to ACTION, prosecutorial activity involving agricultural crime-related offenses was not systematically recorded; it thus is not possible to quantify exactly how many more convictions occur now as a result of ACTION.) In both instances, the counterfactual is that few if any arrests or convictions would occur. To the extent that assumption is correct—and the site visits, interviews, and our review of the literature suggests it is reasonable—the evidence in the tables suggest impacts of ACTION on law enforcement and prosecution outcomes.

ACTION also has encouraged farmers to use OANs and ACTION staff have directly stamped equipment at many farms. From 2003 through mid-year 2006, ACTION recorded 793 farms that had marked at least 52,298 pieces of equipment totaling at least $360 million in value (see Table 10). Nonetheless, only 2.6 percent of all farms in the counties use OANs, leaving considerable room for expanded marking efforts (see the earlier discussion of the descriptive analyses).

ACTION appears to have increased the recovery of stolen property, in part through promoting the use of OANs. Recoveries, like arrests and prosecutions of agricultural crime, traditionally have been minimal, we were told, largely reflecting the absence of identifying marks as well as the difficulty of identifying suspects. Thus, the counterfactual may be assumed to be one in which any amount of recoveries constitutes an impact of the program. Ultimately, however, that assessment rests on the accuracy of the assumption, one that cannot be tested based on existing records. Nonetheless, the amount of recoveries is notable—during 2004 and 2005 alone, ACTION recorded $6.3 million in recovered stolen property (see Table 11).

Finally, as highlighted in the earlier discussion of the descriptive analyses, the study's investigations identified that farmers underreport 85 percent or more of victimization and that counties vary in their entry of information into the ACTION database. Such factors argue against drawing strong inferences about the spatial distribution or impacts of ACTION (e.g., potential displacement of agricultural crime from one area to another). However, spatial analyses, as described in the discussion of crime mapping, suggest that agricultural crime clusters along major highways and roads, indicating that crime prevention efforts likely should target farms in such areas. Increased and more consistent reporting of crimes, as well as entry of such reports into a database, may enable spatial crime-mapping analyses to improve law enforcement and crime prevention efforts.

Caveats

In recent years, there have been calls for increased and more rigorous impact evaluations of crime programs and policies (Sherman 2003; U.S. Government Accountability Office 2003). Except in instances where experiments can be conducted, basic challenges arise, however, in evaluating the impacts of such programs and policies, including ACTION. Indeed, the Urban Institute evaluation confronted a basic challenge that has been described in the evaluation literature (see also Heckman and Smith 1995). Here, it is instructive to quote one of the leading

evaluation textbooks at length:

> Sometimes evaluations of new programs are expected to address questions of impact and efficiency, but the unsettled nature of programs in their beginning years most often makes those issues premature. It can easily take a year or more for a new program to establish facilities, acquire and train staff, make contact with the target population, and develop its services to the desired level. During this period, it may not be realistic to expect much impact on the social conditions that the program is intended to affect. Formative evaluation aimed at clarifying the needs of the target population, improving program operations, and enhancing the quality of service delivery . . . is more likely to fit these cases. (Rossi et al. 2004:39)

This situation describes ACTION, which has continuously evolved and expanded, not only since its inception but also since the beginning of the evaluation, which was initiated in 2003. The change is reflected in part in the findings of the first set of impact analyses ("Impact Evaluation—Part I"), which found that some counties with higher doses of the program actually appeared to have more crime. Notably, however, the second set of impact analyses ("Impact Evaluation—Part II"), which employed better, more valid measures of program dose and incorporated stronger controls, found that higher levels of program implementation were associated with reduced victimization. Thus, in spite of the changes to and evolution of ACTION, there appears to be evidence of a crime-reducing effect of the program in places where it is implemented more aggressively.

This observation aside, it is important to emphasize that the evaluation, while using a comparative approach in which lower-dose and higher-dose counties were contrasted, did not and could not, given that the program was already implemented at the time the evaluation began and that pre-intervention data on agricultural crime did not exist, employ an experimental design. In some cases, an impact evaluation might proceed by identifying comparison counties that are similar in all respects except the presence of the intervention of interest. As we discuss above, our efforts to uncover such counties strongly suggested that few, if any, such counties existed. Thus, attempts to forge ahead with comparison counties of suspect comparability would have risked creating biased estimates of impact, whether favorable or unfavorable to the program.

This concern merits underscoring, especially given the rapidly changing nature of the intervention and the ecological context in which it has operated. For example, fuel and commodity prices changed dramatically during the course of the evaluation, in turn contributing in a largely unmeasured way to increases in agricultural crime that might well obscure real impacts (e.g., less of an increase in victimization relative to other areas). Unless comparison counties grew similar commodities or relied on similar supplies, any differences (or similarities) in victimization rates between the counties might be spurious. Notably, the nine ACTION counties were considerably more similar to one another than they collectively were to other counties in the state, which focus on different commodities and thus supplies and equipment. In addition, relative to its role in the economy of the ACTION counties, agriculture generally contributes less to the economy of most other counties in the state. For these reasons, again, the evaluation strategy emphasized a dose model approach to assessing impact.

Also, although we used similar victimization measures in each of the two surveys, we lacked sufficient measures of dose from the first-year survey, which had not been designed for developing an independent measure of dose. Rather, we had expected the ACTION database to provide sufficient data for purposes of establishing dose (e.g., largely complete records on a range of activities comprising ACTION). To ACTION's credit, they collect a considerable amount of data, but the bulk of it focuses on recording offense information. Thus, it is difficult to collect reliable and valid per-county information on such activities as number and quality of ACTION farm contacts, collaborations between law enforcement agents and prosecutors, all attempted and successful prosecutions, information dissemination activities, etc. The second survey differed as well in that it targeted a different sample of farms from the same sampling frame and 9-county region. Program staff, our consultants, and our reviews suggested that surveying the same farmers would likely have resulted in a lower overall response rate and that few of the original respondents would complete the second-year surveys. Thus, there would have been too few cases in which respondents completed surveys from both years to conduct both over-time analyses at both the county and farm units of analysis.

For these reasons, we redesigned the second-year to enable us to collect over-time estimates of both victimization and dosage, and included a range of questions that tapped different types of activities that comprise ACTION. In turn, we then were able to use these data to estimate a series of models, discussed above, aimed at assessing whether, in areas where ACTION types of activities were proactively pursued, victimization was lower. These analyses provided one of the three main pillars—in addition to the assessment of causal logic and the assessment using the first-year survey—for the impact evaluation.

Table 1. Descriptive Statistics for Causal Logic Analysis

	Min – Max	Mean (S.D.)	N
Dependent Variables			
Small equipment theft (0=not victimized, 1=victimized)	0 – 1	.295 (.457)	782
Serious theft (0=not victimized, 1=victimized)	0 – 1	.140 (.347)	810
Chemical or fuel theft (0=not victimized, 1=victimized)	0 – 1	.130 (.336)	785
Vandalism (0=not victimized, 1=victimized)	0 – 1	.491 (.500)	766
Burglary (0=not victimized, 1=victimized)	0 – 1	.107 (.309)	796
Any victimization (0=not victimized, 1=victimized)	0 – 1	.623 (.485)	812
Independent Variables			
Attractiveness			
Property OAN-marked (0=all marked, 10=none)	0 – 10	9.056 (2.586)	738
Fruit/nut as primary product (0=not primary, 1=primary)	0 – 1	.698 (.460)	728
Proximity			
Not a dead-end residence (0=dead-end, 1=not a dead-end)	0 – 1	.910 (.286)	702
Accessible to rds/hwys (0=not accessible, 10=highly accessible)	0 – 10	5.553 (2.821)	804
Number of workers	0 – 500	9.751 (31.605)	728
Exposure			
Land cover (0=dense, 1=sparse)	0 – 1	.831 (.375)	782
Terrain (0=not flat, 1=flat)	0 – 1	.818 (.386)	786
Acres (x 1,000)	.001 – 80	.611 (3.261)	758
Guardianship			
Attended crime meetings (0=yes, 1=no)	0 – 1	.853 (.355)	800
Use surveillance equipment (0=use, 1=not used)	0 – 1	.755 (.430)	797
Lock or hide property (1=lock/hide a lot, 5=lock/hide little)	1 – 5	2.595 (1.227)	747
Trad. protection steps (e.g., use of dogs) (0=many steps, 10=none)	0 – 10	1.840 (2.326)	778
Surveillability (0=property highly visible from house, 10=not visible)	0 – 10	3.327 (3.492)	791

Note: To enhance the ease of interpretation, all independent variables are coded to indicate that a specific condition (including the absence of that condition) should contribute to increased victimization or guardianship.

Table 2. Multivariate Logistic Regression of Victimization on Opportunity Theory Risk Factors

	Small Equip. Theft	Serious Theft	Chemical or Fuel Theft	Vandal-ism	Burglary	Any Victim-ization
Attractiveness						
OAN-marked	.887***[b]	.922†	.879**[d]	.950	.916†	.858**[d]
Fruit/nut	.910	.404**[c]	1.009	1.436	1.210	.727
Proximity						
Not dead-end	.813	.908	1.711	1.044	1.608	1.111
Accessibility	1.034[a]	1.119*	1.081[a]	1.000[a]	.997	1.029[b]
Workers	1.005[c]	1.013**[c]	.997	1.012†[a]	1.018***[d]	1.028*[c]
Exposure						
Land cover	.982	.878	1.690	.818	.633	.691
Terrain	1.558	1.408	1.029	1.201	2.221†[a]	1.423
Acres	1.161	1.016	1.013	1.205	1.021	1.210
Guardianship						
Attended mtg.	1.012	1.127	1.016	.868[a]	.790	1.042
Surveillance	.739	.711[a]	.315***[c]	.729	.774	.778
Lock/hide prop.	1.062[a]	1.210	1.191	1.316**[a]	1.250†	1.295**[b]
Trad. prot. steps	.978	1.123†	1.147*	.998	1.106	1.006[a]
Surveillability	1.048[a]	1.084*[c]	.994	1.152***[d]	1.001	1.132***[d]
Likelihood ratio	31.159**	45.600***	36.439***	55.284***	28.691**	68.575***
Df	13	13	13	13	13	13
N	474	485	476	467	481	485

Note: The dependent variables have binary outcomes and so odds ratios are presented for ease of interpretation.

† $p \leq .10$ * $p \leq .05$ ** $p \leq .01$ *** $p \leq .001$ (denotes that odds ratio estimate significantly differs from 1.0)

a $p \leq .10$ b $p \leq .05$ c $p \leq .01$ d $p \leq .001$ (significance levels from imputed data models)

Table 3. Descriptives for Impact Evaluation—Part I

	N	Min - Max	Mean (S.D.)
Dependent Variables			
Any Victimization (0=not victimized, 1=victimized)	812	0.0 - 1.0	0.62 (.48)
Small Equipment Theft (0=not victimized, 1=victimized)	782	0.0 - 1.0	0.30 (.46)
Serious Theft (0=not victimized, 1=victimized)	810	0.0 - 1.0	0.14 (.35)
Chemical or Fuel Theft (0=not victimized, 1=victimized)	785	0.0 - 1.0	0.13 (.34)
Vandalism (0=not victimized, 1=victimized)	766	0.0 - 1.0	0.49 (.50)
Burglary (0=not victimized, 1=victimized)	796	0.0 - 1.0	0.11 (.31)
Victim Diversity Index (0=no victimization, 4=4 or more)	812	0.0 - 4.0	1.11 (1.15)
Change in Victimization (1=increased a lot, 7=decreased a lot)	779	1.0 - 7.0	3.89 (1.55)
Victimization Loss (log $)	811	0.0 - 12.63	3.71 (3.80)
Change in Quality of Life (0=no, 1=yes)	796	0.0 - 1.0	0.45 (.50)
Intermediate Process Outcomes (I.P.O.)	663	-1.4 - 5.3	0.00 (1.00)
Independent Variables			
Average Staff Dosage Ranking (10=lowest, 90=highest)	9*	12.0 - 81.9	51.50 (21.06)
Percent of Farms using OANs	9*	0 - 3.0	1.29 (.74)
Police Responsiveness (0=same or worse, 1=improved)	9*	11.6 - 30.0	18.38 (6.40)
Control Variables			
Property Crime Rate (per 1,000 residents)	9*	1.3 - 3.1	2.32 (.61)
Acres Operated (x 1,000)	758	0.0 - 30.0	0.54 (1.86)
Age of Operator (1= <30 yrs, 2= 30-50 yrs, 3= >50 yrs)	823	1.0 - 3.0	2.48 (.71)
Fruit/Nut as Primary Product (0=not primary, 1=primary)	728	0.0 - 1.0	.70 (.46)
Type of Operation (0=not family-owned/operated, 1=family)	770	0.0 - 1.0	0.78 (.42)

* County-level values were computed and then assigned to farmers in each respective county.

Table 4. Regression Analyses of Program Dosage Effects on End Program Outcomes

	Dose = Avg. Staff Ranking				*Dose = Pct. Farms Using OANs*				*Dose = Police Responsiveness*			
	Intercept (S.E.)	X (S.E.)	X^2 (S.E.)	Pseudo R2	Intercept (S.E.)	X (S.E.)	X^2 (S.E.)	Pseudo R2	Intercept (S.E.)	X (S.E.)	X^2 (S.E.)	Pseudo R2
Dependent Variables												
Any Victimization	.088	.085***	-.001***	.036	.480	2.439***	-.980**	.038	-2.280*	.318**	-.008*	.027
	(.560)	(.022)	(.000)		(.581)	(.653)	(.330)		(1.699)	(.149)	(.004)	
Small Equipment Theft	-1.170*	.063*	-.001*	.021	-.775	2.274**	-1.021**	.025	-1.626	.129	-.004	.016
	(.612)	(.025)	(.000)		(.643)	(.736)	(.365)		(1.772)	(.154)	(.004)	
Serious Theft	-1.619*	.030	-.000	.019	-.950	1.878*	-.923*	.022	-3.267	.208	-.006	.020
	(.794)	(.033)	(.000)		(.787)	(.916)	(.460)		(2.357)	(.204)	(.005)	
Chemical or Fuel Theft	-2.50**	.090**	-.001*	.021	-1.720	3.302**	-1.281*	.024	-6.814***	.546**	-.014**	.021
	(.888)	(.035)	(.000)		(.966)	(1.115)	(.533)		(2.319)	(.197)	(.005)	
Vandalism	-.670	.069**	-.001*	.031	-.367	1.554*	-.414	.035	-3.982**	.395**	-.009**	.029
	(.562)	(.022)	(.000)		(.588)	(.664)	(.332)		(1.668)	(.146)	(.004)	
Burglary	-2.800**	.083*	-.001	.013	-1.990	1.942	-.423	.015	-9.546***	.746***	-.018***	.016
	(.982)	(.039)	(.000)		(1.041)	(1.189)	(.569)		(2.643)	(.223)	(.005)	
Victim Diversity Index	-.233	.046***	-.000***	.051	.101	1.453***	-.529***	.056	-1.948***	.229***	-.006***	.041
	(.264)	(.011)	(.000)		(.276)	(.315)	(.154)		(.737)	(.063)	(.002)	
Change in Victimization	3.551***	-.016	.000	.021	3.277***	-.388	.096	.024	4.495***	-.104	.002	.020
	(.384)	(.015)	(.000)		(.395)	(.426)	(.219)		(1.262)	(.111)	(.003)	
Victimization Loss (log $)	2.989***	.150***	-.001***	.061	4.378***	5.256***	-2.157***	.066	-1.840	.619**	-.015**	.046
	(.916)	(.035)	(.000)		(.943)	(1.039)	(.531)		(2.883)	(.249)	(.006)	
Change in Quality of Life	-1.275*	.033	-.000	.018	-.848	.701	-.183	.015	-2.109	.119	-.003	.016
	(.551)	(.022)	(.000)		(.557)	(.631)	(.317)		(1.632)	(.142)	(.003)	

Note: Unstandardized coefficients are presented (standard errors are in parentheses). Logistic regression results are presented for each of the victimization outcomes as well as the change in quality of life measure; Poisson regression is used for the victim diversity index outcome; and ordinary least squares (OLS) regression is used for the change in victimization and victimization loss outcomes. Asymptotic standard errors were computed using a modified sandwich variance estimator (see discussion in text).

* $p < .05$ ** $p < .01$ *** $p < .001$

Table 5. Regression of End Program Outcomes on Program Dosage, Controlling for Intermediate Process Outcomes

	Dose = Avg. Staff Ranking				*Dose = Pct. Farms Using OANs*				*Dose = Police Responsiveness*			
	Intercept (S.E.)	X (S.E.)	X^2 (S.E.)	Pseudo R2	Intercept (S.E.)	X (S.E.)	X^2 (S.E.)	Pseudo R2	Intercept (S.E.)	X (S.E.)	X^2 (S.E.)	Pseudo R2
Dependent Variables												
Any Victimization	1.308	.055*	-.001	.130	1.376	1.218	-.410	.129	.174	.165	-.004	.127
	(.693)	(.026)	(.000)		(.696)	(.774)	(.394)		(2.056)	(.180)	(.004)	
Small Equipment Theft	-.987	.018	-.000	.131	-.600	.855	-.454	.131	.481	-.114	.002	.132
	(.775)	(.030)	(.000)		(.771)	(.877)	(.442)		(2.325)	(.202)	(.005)	
Serious Theft	-1.838	.006	-.000	.060	-1.791	.562	-.543	.063	-.652	-.110	-.002	.062
	(.925)	(.037)	(.000)		(.929)	(1.082)	(.553)		(2.974)	(.262)	(.006)	
Chemical or Fuel Theft	-2.437*	.058	-.001	.072	-1.542	2.458	-1.198	.083	-5.368	.372	-.010	.075
	(1.096)	(.043)	(.000)		(1.151)	(1.345)	(.664)		(2.949)	(.251)	(.006)	
Vandalism	-.527	.056*	-.000	.074	-.127	.888	-.123	.089	-2.705*	.273*	-.001*	.074
	(.645)	(.025)	(.000)		(.665)	(.755)	(.380)		(1.914)	(.167)	(.004)	
Burglary	-2.477	.032	-.000	.127	-2.275	-2.422	1.529*	.129	-9.951*	.689*	-.015	.134
	(1.329)	(.052)	(.001)		(1.274)	(1.575)	(.783)		(3.820)	(.318)	(.008)	
Victim Diversity Index	-.207	.025*	-.000*	.195	-.052	.548	-.196	.200	-1.010	.107	-.003	.193
	(.287)	(.011)	(.000)		(.292)	(.345)	(.169)		(.818)	(.070)	(.002)	
Change in Victimization	3.369***	.015	-.000	.118	3.327***	.736	-.382	.119	3.029**	.050	-.001	.117
	(.379)	(.016)	(.000)		(.382)	(.424)	(.215)		(1.206)	(.106)	(.003)	
Victimization Loss (log $)	4.045***	.075*	-.001	.240	4.704***	2.225*	-.941	.236	4.898*	.004	.005	.235
	(.827)	(.033)	(.000)		(.833)	(.952)	(.481)		(2.479)	(.214)	(.005)	
Change in Quality of Life	-.904	-.003	.000	.068	-.706	-.192	.181	.052	-1.430	.049	-.001	.070
	(.620)	(.025)	(.000)		(.617)	(.707)	(.357)		(1.866)	(.162)	(.004)	

Note: Unstandardized coefficients are presented (standard errors are in parentheses). Logistic regression results are presented for each of the victimization outcomes as well as the change in quality of life measure; Poisson regression is used for the victim diversity index outcome; and ordinary least squares (OLS) regression is used for the change in victimization and victimization loss outcomes. Asymptotic standard errors were computed using a modified sandwich variance estimator (see discussion in text).

* $p < .05$ ** $p < .01$ *** $p < .001$

Table 6. Descriptives for Impact Evaluation—Part II

	N	Min - Max	Mean (S.D.)
Dependent Variables (Victimization Counts, 2005)			
All crime	663	0 - 94	3.24 (7.33)
Burglary	505	0 - 22	0.42 (1.40)
Chemical theft	498	0 - 20	0.66 (1.79)
Commodity theft	451	0 - 50	0.47 (2.92)
Large equipment theft	470	0 - 3	0.15 (.45)
Tool and small equipment theft	568	0 - 10	1.04 (1.60)
Tractor theft	455	0 - 6	0.10 (.44)
Vandalism	514	0 - 52	1.13 (4.10)
Independent Variables			
Dose in 2004[a]	818	-2.19 - 4.06	0.00 (1.00)
Dose*dose (quadratic) in 2004	818	0.00 - 16.47	1.00 (.00)
Control Variables			
Size of farm (x 1,000 acres)	782	0 - 42	0.74 (2.82)
Distance to nearest city (in miles)	801	0 - 70	9.66 (9.68)
Number of paid farm workers	737	0 - 1969	22.57 (114.00)
Percent of equipment marked with OANs	781	0 - 100	23.09 (32.82)
Visibility of property[b]	800	0 - 400	166.89 (74.40)
Measures taken to protect property[c]	764	5 - 50	42.17 (6.65)
County (nine counties, eighth omitted)[d]			
Fresno (1=Fresno, 0=other)	818	0 - 1	0.08 (.27)
Kern (1=Kern, 0=other)	818	0 - 1	0.10 (.30)
Kings (1=Kings, 0=other)	818	0 - 1	0.12 (.32)
Madera (1=Madera, 0=other)	818	0 - 1	0.10 (.30)
Merced (1=Merced, 0=other)	818	0 - 1	0.10 (.30)
San Joaquin (1=San Joaquin, 0=other)	818	0 - 1	0.11 (.32)
San Luis Obispo (1=San Luis Obispo, 0=other)	818	0 - 1	0.13 (.33)
Stanislaus (1=Stanislaus, 0=other)	818	0 - 1	0.14 (.35)
Tulare (1=Tulare, 0=other)	818	0 - 1	0.12 (.33)
All crime victimization experienced in 2004[e]	628	0 - 72	2.70 (6.32)

a. The dose measure, reflecting program or program-like activities in a given farmer's community, was created by factor analysis of eight questions from the 2005 survey but that referenced the year 2004 (eigenvalue = 1.862). The questions focused on perceptions about the quality of protection by law enforcement, number of unsolicited law enforcement visits, helpfulness of sheriff's office, perceptions about whether law enforcement agencies investigated incidents thoroughly, number of people convicted of agricultural crimes, aggressiveness of courts with agricultural crimes, whether law enforcement asked to install surveillance equipment, and whether law enforcement actually installed surveillance equipment.

b. Visibility was measured by summing the responses for four survey questions: percent of farm buildings not visible from house, percent of property bordering highway, percent of property bordering paved roads, and percent of crops or livestock visible from public roads.

c. Property protection was measured by summing the responses (1=never, . . ., 5=always) to a ten-part survey question gauging the extent to which farmers protected their property in 2004. Items included: neighbors watch farm when out, had home insurance, left house lights on at night or when away, had watchdog, had pistol or gun, kept building doors locked, locked up pesticides or veterinary items, locked windows on buildings, locked fuel storage tanks, and attached outside lights to buildings.

d. In the models, Tulare County is the omitted county.

e. The measure is a self-reported count of any type of crime victimization experienced in 2004.

Table 7a. Impact Evaluation—Part II: Dependent Variable = All Crime Count (2005)

	Model 1[a]	Model 2[b]
Intercept	-0.22	0.76***
	(0.52)	(0.06)
Dose	-0.15*	-0.16***
	(0.06)	(0.02)
Dose x Dose	0.10*	0.14***
	(0.05)	(0.01)
Model fit	0.11	0.79
N	571	592

NOTE: Unstandardized coefficients are presented (standard errors are in parentheses).

† $p \leq .10$ * $p < .05$ ** $p < .01$ *** $p < .001$

[a] For Model 1, the control variables are: size of farm (in acres), distance (in miles) to nearest city, number of paid farm workers, percent of equipment marked with OANs, visibility of property, and measures taken to protect property. Eight county dummies also are included (with the ninth omitted). Negative Binomial modeling is used because of overdispersion.

[b] For Model 2, the control variables is the count of all crime victimization experienced by each farmer in 2004. Eight county dummies also are included (with the ninth omitted). Poisson modeling is used.

Table 7b. Impact Evaluation—Part II: Dependent Variable = Burglary Count (2005)

	Model 1[a]	Model 2[b]
Intercept	-3.29**	-1.41***
	(1.20)	(0.34)
X	-0.16	-0.09
	(0.14)	(0.13)
X^2	0.10	0.11
	(0.11)	(0.10)
Model fit	0.06	0.07
N	435	471

NOTE: Unstandardized coefficients are presented (standard errors are in parentheses).

† $p \leq .10$ * $p < .05$ ** $p < .01$ *** $p < .001$

[a] For Model 1, the control variables are: size of farm (in acres), distance (in miles) to nearest city, number of paid farm workers, percent of equipment marked with OANs, visibility of property, and measures taken to protect property. Eight county dummies also are included (with the ninth omitted). Negative Binomial modeling is used because of overdispersion.

[b] For Model 2, the control variable is the count of all crime victimization experienced by each farmer in 2004. Eight county dummies also are included (with the ninth omitted). Negative Binomial modeling is used because of overdispersion.

Table 7c. Impact Evaluation—Part II: Dependent Variable = Chemical Theft Count (2005)

	Model 1[a]	Model 2[b]
Intercept	-2.768**	-1.09***
	(0.96)	(0.28)
X	-0.25*	-0.19[†]
	(0.10)	(0.10)
X^2	0.09	0.10
	(0.07)	(0.07)
Model fit	0.07	0.11
N	439	470

NOTE: Unstandardized coefficients are presented (standard errors are in parentheses).

[†] $p \leq .10$ * $p < .05$ ** $p < .01$ *** $p < .001$

[a] For Model 1, the control variables are: size of farm (in acres), distance (in miles) to nearest city, number of paid farm workers, percent of equipment marked with OANs, visibility of property, and measures taken to protect property. Eight county dummies also are included (with the ninth omitted). Negative Binomial modeling is used because of overdispersion.

[b] For Model 2, the control variable is the count of all crime victimization experienced by each farmer in 2004. Eight county dummies also are included (with the ninth omitted). Negative Binomial modeling is used because of overdispersion.

Table 7d. Impact Evaluation—Part II: Dependent Variable = Commodity Theft Count (2005)

	Model 1[a]	Model 2[b]
Intercept	-7.24**	-2.08***
	(2.35)	(0.50)
X	-0.08	0.08
	(0.31)	(0.21)
X^2	0.26	0.19
	(0.19)	(0.14)
Model fit	0.04	0.07
N	393	432

NOTE: Unstandardized coefficients are presented (standard errors are in parentheses).

† $p \leq .10$ * $p < .05$ ** $p < .01$ *** $p < .001$

[a] For Model 1, the control variables are: size of farm (in acres), distance (in miles) to nearest city, number of paid farm workers, percent of equipment marked with OANs, visibility of property, and measures taken to protect property. Eight county dummies also are included (with the ninth omitted). Negative Binomial modeling is used because of overdispersion.

[b] For Model 2, the control variable is the count of all crime victimization experienced by each farmer in 2004. Eight county dummies also are included (with the ninth omitted). Negative Binomial modeling is used because of overdispersion.

Table 7e. Impact Evaluation—Part II: Dependent Variable = Large Equipment Theft Count (2005)

	Model 1[a]	Model 2[b]
Intercept	-4.49**	-2.79***
	(1.43)	(0.51)
X	0.12	0.03
	(0.15)	(0.13)
X^2	0.02	0.06
	(0.09)	(0.08)
Model fit	0.06	0.05
N	409	445

NOTE: Unstandardized coefficients are presented (standard errors are in parentheses).

† $p \leq .10$ * $p < .05$ ** $p < .01$ *** $p < .001$

[a] For Model 1, the control variables are: size of farm (in acres), distance (in miles) to nearest city, number of paid farm workers, percent of equipment marked with OANs, visibility of property, and measures taken to protect property. Eight county dummies also are included (with the ninth omitted). Poisson modeling is used.

[b] For Model 2, the control variable is the count of all crime victimization experienced by each farmer in 2004. Eight county dummies also are included (with the ninth omitted). Poisson modeling is used.

Table 7f. Impact Evaluation—Part II: Dependent Variable = Tool and Small Equipment Theft Count (2005)

	Model 1[a]	Model 2[b]
Intercept	-1.17**	-0.30*
	(0.42)	(0.13)
X	-0.11*	-0.07[†]
	(0.05)	(0.05)
X^2	-0.01	0.01
	(0.03)	(0.03)
Model fit	0.15	0.15
N	490	525

NOTE: Unstandardized coefficients are presented (standard errors are in parentheses).

[†] $p \leq .10$ * $p < .05$ ** $p < .01$ *** $p < .001$

[a] For Model 1, the control variables are: size of farm (in acres), distance (in miles) to nearest city, number of paid farm workers, percent of equipment marked with OANs, visibility of property, and measures taken to protect property. Eight county dummies also are included (with the ninth omitted). Poisson modeling is used.

[b] For Model 2, the control variable is the count of all crime victimization experienced by each farmer in 2004. Eight county dummies also are included (with the ninth omitted). Poisson modeling is used.

Table 7g. Impact Evaluation—Part II: Dependent Variable = Tractor Theft Count (2005)

	Model 1[a]	Model 2[b]
Intercept	-25.56***	-4.42***
	(1.50)	(1.17)
X	-0.10	-0.06
	(0.19)	(0.23)
X^2	-0.08	0.11
	(0.12)	(0.15)
Model fit	0.06	0.02
N	396	433

NOTE: Unstandardized coefficients are presented (standard errors are in parentheses).

† $p \leq .10$ * $p < .05$ ** $p < .01$ *** $p < .001$

[a] For Model 1, the control variables are: size of farm (in acres), distance (in miles) to nearest city, number of paid farm workers, percent of equipment marked with OANs, visibility of property, and measures taken to protect property. Eight county dummies also are included (with the ninth omitted). Poisson modeling is used.

[b] For Model 2, the control variable is the count of all crime victimization experienced by each farmer in 2004. Eight county dummies also are included (with the ninth omitted). Poisson modeling is used.

Table 7h. Impact Evaluation—Part II: Dependent Variable = Vandalism Count (2005)

	Model 1[a]	Model 2[b]
Intercept	-0.24	-1.04***
	(0.85)	(0.25)
X	-0.27*	-0.10
	(0.11)	(0.09)
X^2	0.25**	0.16**
	(0.09)	(0.06)
Model fit	0.08	0.17
N	444	482

NOTE: Unstandardized coefficients are presented (standard errors are in parentheses).

† $p \leq .10$ * $p < .05$ ** $p < .01$ *** $p < .001$

[a] For Model 1, the control variables are: size of farm (in acres), distance (in miles) to nearest city, number of paid farm workers, percent of equipment marked with OANs, visibility of property, and measures taken to protect property. Eight county dummies also are included (with the ninth omitted). Negative Binomial modeling is used because of overdispersion.

[b] For Model 2, the control variable is the count of all crime victimization experienced by each farmer in 2004. Eight county dummies also are included (with the ninth omitted). Negative Binomial modeling is used because of overdispersion.

Table 8. Surveillance Equipment and Identification and Arrest of Suspects, 2003-2004

County	No. Deployments	No. Suspects Identified as Result of Deployments	No. Arrests Occurring as Result of Deployments
Fresno	4	2	1
Kern	7	8	4
Kings	3	0	0
Madera	8	2	0
Merced	1	0	0
San Joaquin	3	8	4
San Luis Obispo	3	0	0
Stanislaus	7	5	1
Tulare	33	10	5
Total	69	35	15

Source: ACTION records.

Table 9. Number of Defendants Convicted of Any Agricultural Crime-Related Charge by District Attorneys Participating in ACTION

	2004	2005	Total
Fresno	79	75	154
Kern	68	84	152
Kings	2	2	4
Madera	7	9	16
Merced	20	8	28
San Joaquin	51	21	72
San Luis Obispo	0	0	0
Stanislaus	0	2	2
Tulare	36	58	94
Total	263	259	522

Source: ACTION database.

Table 10. Number of Farmers Acquiring OANs for First Time

	2003	2004	2005	2006*	Total	Percent*	Amount of Equip. Stamped	Value ($) of Equip. Stamped
Fresno	47	45	33	17	142	2.26	8,407	53,514,142
Kern	14	14	22	21	71	3.31	5,326	40,207,756
Kings	27	16	18	9	70	6.07	4,717	36,848,370
Madera	14	13	6	1	34	1.98	2,162	11,958,317
Merced	21	18	6	2	47	1.59	3,091	17,895,786
San Joaquin	47	19	20	18	104	2.58	6,356	50,978,448
San Luis Obispo	0	0	15	3	18	0.78	1,136	8,955,867
Stanislaus	14	14	6	2	36	0.84	2,382	15,584,812
Tulare	52	67	83	69	271	4.72	18,721	123,747,507
Total	236	206	207	144	793	2.59	52,298	359,691,005

Source: ACTION records. For 2006, data are only through June. OAN figure include farms marked by ACTION as well as those that may not have been marked by ACTION staff but nonetheless registered with ACTION. Some farms were visited by ACTION more than once; here, however, only information on markings conducted on the first visit are provided. The percent of all farms is calculated based on data from the U.S. Department of Agriculture (2004). Reference: U.S. Department of Agriculture. 2004. *2002 Census of Agriculture*. Vol. 1. Washington, D.C.: U.S. Department of Agriculture, National Agricultural Statistics Service.

Table 11. Recovery of Stolen Property

	2004	2005	Total
Fresno	$683,503	$571,922	$683,503
Kern	$1,032,347	$1,225,950	$2,258,297
Kings	$114,655	$501,172	$615,827
Madera	$23,367	$29,450	$52,817
Merced	$108,617	$60,893	$169,510
San Joaquin	$496,336	$397,441	$893,777
Stanislaus	$201,033	$341,441	$542,474
Tulare	$417,770	$631,292	$1,049,062
Total	$3,077,627	$3,187,639	$6,265,266

Source: ACTION database.

8. COST-BENEFIT ANALYSIS

The cost-benefit analysis discussion is presented in a separate, stand-alone policy brief written principally by John Roman and Aaron Chalfin, with assistance from Daniel Mears and Michelle Scott.

> Chalfin, Aaron, John Roman, Daniel P. Mears, Michelle L. Scott. 2007. *The Costs and Benefits of Agricultural Crime Prevention*. Washington, D.C.: The Urban Institute.

9. TRANSFERABILITY ANALYSIS

This chapter was written primarily by Jesse Jannetta and Daniel Mears. Elisa Ranck assisted with data collection.

Introduction

In this chapter, we discuss the transferability of the ACTION program. Specifically, we answer the question: what should a state or local jurisdiction think about in attempting to implement, maintain (sustain), or expand the ACTION model, in whole or in part? The former emphasis (on phases of implementation) is important because some challenges are unique to attempts to start a program, while others may be more salient to maintaining or expanding a program. The latter emphasis (on distinct parts of ACTION) is important because ACTION consists of many activities. Some jurisdictions may want to implement all of them, but may only have the resources or support to implement some.

For these reasons, we identified barriers and facilitators to program implementation along two dimensions. First, we examined phase-specific (start-up, sustainability, and expansion) barriers and facilitators relating to the component elements of ACTION, including:

- owner applied numbers,
- database and information-sharing,
- deployment of technology,
- education and outreach, and
- vertical prosecution.

It should be emphasized that communication within and between law enforcement agencies, and between these agencies and prosecutors and ACTION, is a central feature of the program, one that cross-cuts each of the above component areas. As such, it is a critical dimension to each component, and one that consistently emerged in our analyses of these components.

Second, setting aside the focus on specific components of ACTION, we examined each of three phases of implementation, including:

- start-up,
- sustainability (i.e., ability to maintain program operations), and
- expansion.

Summaries or our analyses are provided in tables at the end of this chapter. Once the summaries were completed, the research team identified recommendations that flowed from each identified barrier and facilitator. Thus, the recommendations essentially provide a summary of the main findings. Below, we discuss the specific recommendations for implementation of each component and phase. The recommendations are intended to be useful whether policymakers or practitioners are interested in implementing all of the components or only some of them.

Methodology

We gathered information for this analysis from telephone interviews with staff of the agencies implementing ACTION, and with stakeholders across the United States who have an interest in addressing agricultural crime, from sheriffs' departments, state departments of agriculture, farm bureaus, and other agencies. In total, more than 30 people across 9 states were interviewed. Interviews lasted 30 to 60 minutes. Some of the interviews took the form of conference calls, with two to three individuals contributing to the discussion. Interviews were conversational in nature and explored and probed the general question of what factors facilitated and hindered successful implementation of ACTION or would likely influence implementation of a similar program in other places. Additional interviews were conducted throughout the project study periods with program staff, law enforcement officers, and prosecutors, with more intensive discussions occurring during two site visits.

Most interview subjects were identified via a snowball method, with each interview including a request for names of other individuals who would be good sources of information. Others were identified by researching agricultural crime initiatives around the country, or by targeting states with a heavy investment in agriculture.

Interviews with staff from ACTION-participating agencies drew from several counties, and both law enforcement and prosecution agencies. Interview subjects were asked about barriers and facilitators they had encountered to implementation of the five ACTION program components or that they would anticipate facing if a similar initiative were implemented elsewhere. To those who worked at ACTION, we asked what they would view as the core, or essential, features of ACTION, what they would do differently to improve the implementation of the program, and what advice they would give to other jurisdictions interested in implementing all or part of ACTION.

Interviews with persons working on agricultural crime outside the state of California drew from state, local, and private agencies. Some had contacted ACTION out of interest in their program. Interview subjects were asked about each component of the ACTION program, whether each would be of value in their jurisdiction, and what barriers and facilitators might arise if they were to seek to implement it.

A detailed listing of the findings can be found in the tables at the end of this chapter. In separate sections below, we provide a listing of recommendations for improving component-specific implementation and then a listing of recommendations for improving phase-specific implementation. The recommendations either come directly from people interviewed for the project or from the research team's assessment of the interviews.

Recommendations for Each Component

Owner-Applied Numbers (OANs)

An Owner Applied Number (OAN) system should be standardized, computerized, and

accessible. A standard system of assigning numbers and placing them on equipment allows law enforcement to check them quickly and easily. A computerized records system that can be readily accessed in the field is the kind most likely to be regularly used by law enforcement. If records are inconvenient to access, as they are in jurisdictions that keep paper records in centralized locations, they are unlikely to be used.

Use existing marking systems, where possible. Adopting a pre-existing numbering system, as ACTION did with California's OAN system, saves on design costs, and allows a program to benefit from pre-existing marking. Where no numbering system exists, a program has to devote resources to designing one. Programs can also take advantage of identification systems that come into existence for other reasons, such as the universal cattle-identification system proposed by the U.S. Department of Agriculture.

Dedicate substantial staff time to bringing the marking program to farmers. Farmers may not regard marking their equipment as a pressing need and so delay having it done. ACTION addresses this possibility by constantly marketing the program to farmers, and making participation convenient by sending staff to the farms to stamp equipment.

Set priorities for what should be marked. ACTION's OAN program is designed for the marking of equipment, but the concept is adaptable. A jurisdiction faced with limited resources for marking can determine the category of theft of greatest concern (equipment, livestock, produce, etc.) and tailor a marking system to it.

Decide whether this is a proactive or reactive program, or both. A reactive OAN program uses the markings to look for items reported stolen, or to return abandoned items to their owner. A more aggressive strategy would involve checking for OAN markings on items for sale. This would require OAN marking to be prevalent for such efforts to be worthwhile. It is possible to used an OAN system in both ways, but a program with limited resources may not be able to do both effectively.

Database and Information-sharing

Use direct communication within the program effort to ease concerns about sharing information. ACTION encountered some initial resistance to sharing information because jurisdictions did not want outsiders coming in and handling their cases. This concern was especially pronounced among law enforcement officers. These concerns eased over time as participants became familiar with one another through regular meetings and the instant communication facilitated by Nextel phones.

Use the ACTION agricultural crime database software. It took ACTION several years to design its database software. Other jurisdictions can avoid most of that design period by adopting ACTION's software. ACTION is willing to assist with any modification necessary to apply their database in other states.

Secure commitment from participating agencies to do the data entry work necessary to build and maintain the database. An agricultural crime database requires considerable labor to build before it begins providing value. Implementing agencies are often resistant to doing this work.

ACTION addressed this issue by devoting staff time to help participating counties, but what was intended as a short-term facilitative arrangement has continued in several jurisdictions.

Take advantage of the need for data on agricultural crime. There were no agricultural crime data being consistently collected in the United States prior to ACTION. Local, state, and federal policymakers with an interest in agriculture need this information, which can be used to justify dedicating resources to combat agricultural crime. California now requires counties to enter data into ACTION's database as a condition of receiving agricultural crime funding, greatly increasing the incentive for counties to participate in ACTION.

Develop data analysis capability within the program. An agricultural crime database is a potentially powerful analytical tool. To realize the full potential of the database as a tool for setting strategy around agricultural crime intervention, a program should have staff with skills in data-mining and statistical analysis. At the same time, participation in the program (e.g., full and complete recording of crime events) is a necessity. Policymakers should set goals for the program, which will dictate analyses that are most appropriate.

Deployment of Technology

ACTION deploys two types of technology—communications and surveillance. Some of the recommendations below apply to one or both types.

Find outside funding for equipment purchases. Due to budget limitations, few agencies interested in addressing agricultural crime will be able to devote their own monies to equipment purchases. An agricultural crime intervention program that provides quality technology to cash-strapped local agencies will give them a substantial incentive to participate.

Distribute communications equipment as soon as possible to increase program buy-in from participants. Instant communication between agencies participating in ACTION has proved very popular and fostered strong collaborative relationships within the program. It also has helped county law enforcement officials to learn more quickly from one another about crime problems and solutions. Putting this communications network in place early will greatly accelerate the cohesion of a multi-jurisdictional effort.

Distribute program equipment to participating agencies rather than storing it in a central location. If surveillance equipment is not readily at hand, it will not be used. The equipment should be housed where each participating agency can easily access it. Alternatively, equipment should be rotated regularly from one jurisdiction to another.

Deploy surveillance equipment proactively. Law enforcement agencies with access to surveillance equipment generally deploy it against agricultural crime as a last resort, if at all. ACTION counties have had success deploying surveillance equipment as one of their first responses to complaints of theft from a farm.

Support the technology with training and technical support. A minimal level of training and technical support is necessary to ensure that everyone using the equipment knows how it works, and that it is maintained. More substantively, implementers need to be trained and encouraged to

use the equipment in ways that maximize its effectiveness, such as proactive deployment of surveillance equipment and placement of equipment where it will yield the most benefit.

Education and Outreach

Direct outreach efforts toward convincing farmers to subscribe to the idea of law enforcement as advocates for farmers. The ACTION model requires farmers to actively report agricultural crimes to law enforcement, and to be comfortable with their presence on their farms for activities like OAN marking and surveillance. Outreach must address three potential barriers to this. Farmers tend to be independent and may not be used to reporting crimes or looking to law enforcement for help, instead considering losses from agricultural crime a cost of doing business. They may be dissatisfied with law enforcement and not believe they care about or can effectively address agricultural crime. Also, they may actively wish to keep law enforcement away from their property, for fear that they are there to enforce water use, diesel emission, labor, or other regulations, rather than to assist the farmer on crime-related problems.

Ground the program in the agricultural community. Selecting outreach staff culturally familiar with the agricultural community, who speak their language and have a genuine concern for them, helps build credibility for law enforcement as an advocate for farmers. Allying with agricultural commissioners or farm bureaus can afford the program legitimacy, as well as opportunities to meet with many farmers at once, on neutral ground, and disseminate information about the program and about agricultural crime and how to prevent it.

Conduct a needs assessment on agricultural crime issues. The agricultural crime issues of greatest concern to local farmers can be determined via surveys or focus groups. Surveys are most effective if administered at gatherings of farmers, such as farm bureau meetings. A needs assessment allows the program to calibrate its activities to the areas of greatest concern to farmers, particularly during the early period when the database is not yet operational. ACTION also sent staff out to visit individual farms to talk about their program and to hear farmer concerns.

Create print material and a website. Print material and websites are efficient ways to disseminate information about agricultural crime and its prevention to farmers. ACTION has print materials and website that can serve as models for other jurisdictions.

Direct education efforts internally to agencies participating in the program. Many sheriffs' departments and prosecutors' officers do not have much knowledge about agricultural crime. Internal education efforts help build support for the program, and ensure that agency staff recognize agricultural crime cases and direct them to the agricultural crime unit for action.

Direct outreach efforts to the general public to build awareness of agricultural crime as a problem and support for addressing it. Such efforts may be complicated in areas in which there are political tensions between the agricultural and non-agricultural communities over issues such as environmental harm from agriculture. Building broad public support for agricultural crime interventions is particularly important in mixed rural/urban jurisdictions, where the non-agricultural community generally holds most of the political power.

Vertical Prosecution

Obtain outside funding to enable prosecutors to dedicate time to agricultural crime prosecutions. In jurisdictions that are mixed rural/urban, District Attorneys have more claims on their resources, the support of the agricultural community reportedly is less important to them, and their constituents often have other priorities. Prosecutors may be either unwilling or unable to dedicate their limited resources to prosecution of agricultural crimes. Grant funding can make it possible for prosecutors to devote more time to agricultural crime.

Have law enforcement lobby for vertical prosecution. Prosecutors may not be devoting time or energy to prosecuting agricultural crime cases due to limited resources or lack of pressure from the wider community. If a law enforcement agency wants to promote agricultural crime as a priority, lobbying efforts may spur the prosecutor's office to devote more attention to it.

Assign a prosecutor to work exclusively with agricultural crimes. Dedicating one prosecutor to agricultural crime, even if the focus is part-time, allows the prosecutor to become more involved in the overall agricultural crime effort, including attending meetings and writing affidavits for agricultural crime warrants. A prosecutor devoted exclusively to agricultural crime cases requires a high degree of commitment to the issue from the District Attorney, and sufficient arrests generated by law enforcement.

Inform farmers about what prosecutors are doing about agricultural crime. This measure is particularly beneficial to District Attorneys in rural counties, who derive more of their support from the agricultural community. Information about prosecutions and sentences also builds farmer and community support for the program.

Recommendations for Each Phase of Implementation

Start-up

Identify a spearheading agency. A lead agency has to want to promote an agricultural crime intervention and must have a decision-maker who is willing to invest agency resources to establish the program.

Hire a full-time program staff from the outset. ACTION's implementation was slowed by being administered initially by people who could only devote a portion of their time to the project.

Empower partners; do not dictate to them. Potential partner agencies are likely leery of outsiders usurping their prerogatives. The spearheading agency must be sufficiently active and aggressive to persuade other agencies and jurisdictions to join the effort, and not so aggressive as to alienate people. The agency or jurisdiction at the center of a program has to be committed from the start to distributing resources, funds, and control to other regions in the program.

Convince farmers to subscribe to the idea of law enforcement as an advocate for farmers. If there has been a good history of cooperation between farmers and law enforcement, this step will

not be very difficult. But if farmers are not used to reporting crimes or looking to law enforcement for help, do not believe they care about or can effectively address agricultural crime, or fear that they are there to enforce laws against them, resources must be devoted to building this relationship.

Build on existing agricultural crime prevention arrangements. ACTION folded the California OAN system into their strategy, and was able to rely on relationships from the California Rural Crimes Prevention Unit to assist different agencies in collaborating. Jurisdictions wanting to adopt an agricultural crime intervention now have the option of adapting material from ACTION for their use, most notably the agricultural crime database, but also the ACTION outreach material, strategy for deploying surveillance equipment against agricultural theft, approach to vertical prosecution, and education strategies.

Bring state or federal money to the project. Agencies working on agricultural crime are often resource-strapped. Outside funding makes costs like purchasing equipment or devoting prosecutor time to agricultural crime much easier for local agencies. Cultivation of state and national legislative support is valuable.

Make program staff available to assist participating agencies in building their program. ACTION staff devoted substantial time to easing implementation for participating counties, by driving surveillance equipment halfway to distant counties, helping with OAN registration at county fairs, and assisting with data entry. This assistance built capacity in participating counties, and strengthened commitment to ACTION.

Sustainability

Ensure that regular program work is done by the participating agencies. Staff support from the program center is a facilitator early in project implementation, but it can become a problem if participating agencies come to depend upon program staff to do routine tasks, such as data entry for the agricultural crime database. Support of this nature should phase out after the start-up period but only if consistent data entry can be maintained.

Market the program to the media, public, and policymakers. Agricultural crime is not a high priority in most places, so a program addressing it must constantly tend to and build its public support. The data from the agricultural crime database is a great asset for making the case for the importance of agricultural crime, as are specific stories of arrests and prosecutions. Stories from individual farmers about positive impacts of the program are particularly effective with elected officials.

Market the program internally. As the program becomes routine, maintaining enthusiasm for it among implementers becomes a challenge. If dedication to combating agricultural crime begins to flag, cases may not be pursued as vigorously, undermining support from the agricultural community. An agricultural crime intervention program energizes and empowers people who have long cared about agricultural crime. They must be active advocates for the program within their agencies.

Plan for an uncertain funding environment. Although obtaining grant or other discretionary

funding at the outset of the program helps attract agencies to participate, this kind of funding is the most vulnerable to cuts if the funding environment gets tougher. Program staff may need to fight funding cuts annually and plan for how to maintain program activities with restricted funds.

Expansion

Design program elements to minimize start-up costs for new jurisdictions. An agricultural crime program interested in expanding should have a package ready to offer to interested new jurisdictions, including, for example, database software, an OAN-style marking system, and a communications network. It should also include training in how to use all the systems and equipment.

Empower new participants to enter as equals. New jurisdictions will be entering a program that already has established leadership in one or more counties, or state agencies. New jurisdictions may be resistant to the effort if they feel the program is being dictated to them. The program should be marketed to them as a tool, not a mandate.

Leverage expansion of the agricultural crime database. The more jurisdictions that contribute data, the better descriptive and analytical tool the agricultural crime database will become. Entities that want this data may be willing to reward new jurisdictions for participating, as the state of California did by making contributing to the ACTION database a requirement to receive state agricultural crime grants.

Expand program infrastructure to keep pace with geographical reach. Program expansion will require the central office of the program to hire more staff, do more outreach, and provide more equipment. As the program becomes geographically expansive, regional offices will be required to maintain program cohesion. It is unclear how large a territory a program like ACTION can cover without losing cohesion. Programs may wish to operate on a large scale on some dimensions, such as shared access to an agricultural crime database, but in smaller clusters for collaboration that requires more direct contact.

Balance program maintenance and expansion. As programs look at expansion, there is a tension between investing resources into including more areas in the program, and investing resources in sustaining the program in its current size and scope. ACTION is already facing this issue, and will have to grow very carefully to avoid overextending itself.

Transferability Summary Tables

The tables that follow are organized as follows. First, four tables are provided for each of the five ACTION components. The first of the four provides a summary of the barriers and facilitators specific to a given component, regardless of phase of implementation. The second through fourth then provide a summary of barriers and facilitators that are specific to the start-up, sustainability, and expansion phases of implementation, respectively. With only one exception, barriers and facilitators are identified for each phase (for vertical prosecution, no expansion phase lessons were identified). The tables summarize the findings for implementation of OANs (tables 1.1-4), a database and information-sharing (tables 2.1-4), deployment of technology (tables 3.1-4), education and outreach (tables 4.1-4), and vertical prosecution (tables 5.1-3).

Second, three tables are provided that identify barriers and facilitators specific to each phase of implementation—start-up (Table 6), sustainability (Table 7), and expansion (Table 8)—with no distinctions made concerning component-specific issues.

Table 1.1. Owner Applied Number (OANs)—Barriers and Facilitators (General)

- State numbering systems like OAN across the country either do not exist or are under-utilized. Where systems are under-utilized, it is often because the records are kept on paper and cannot be accessed quickly or easily. These systems could be made functional by computerizing the records and making them accessible.

- OAN registration is labor-intensive. ACTION staff go out to individual farms to stamp equipment. The program also requires considerable staff time for outreach, targeted at alerting farmers to the program and encouraging them to get their equipment stamped.

- The OAN concept is adaptable. The OAN system ACTION uses is designed for equipment, but livestock or produce could be targeted for identification instead. Livestock identification would be brands or tattoos, while produce identification would probably involve requiring certificates of sale or origin from anyone in possession of designated quantities of produce.

- USDA-mandated universal cattle-marking will create a standardized cattle identification system that might be utilized much like the OAN system. It is unclear whether records of brands will be computerized and made available to local law enforcement for the purpose of combating livestock theft.

- High rates of OAN marking open the possibility of actively seeking out stolen equipment. If marking were sufficiently widespread, it could be used to spot-check equipment at sales and other likely transit points for stolen equipment.

Table 1.2. Owner Applied Numbers (OANs)—Barriers and Facilitators (Start-up)

- State numbering systems like OAN across the country either do not exist or are under-utilized. Where systems are under-utilized, it is often because the records are kept on paper and cannot be accessed quickly or easily. These systems could be made functional by computerizing the records.

- Creating a new numbering system takes time. Implementing a numbering system like OAN has generally been a state activity. It could take a considerable amount of time to get state government to respond to requests for a numbering system due to numerous claims on their time. The delay could be avoided by creating the systems at the local level, but this approach opens the possibility of different systems arising within a state.

- OAN marking is labor-intensive. ACTION staff go to each farm that requests to have its equipment registered, and marks it on-site. This approach creates a serious commitment when assistance for agricultural crime prevention is scarce in many jurisdictions.

- The OAN concept is adaptable. The OAN system ACTION uses is designed for equipment, but livestock or produce could be targeted for identification instead. Livestock identification would be brands or tattoos, while produce identification would probably involve requiring certificates of sale or origin from anyone in possession of designated quantities of produce.

- Each kind of marking system requires different kinds of equipment and record-keeping. Limited resources will probably restrict most agricultural crime programs to one kind of marking, at least during the initial phase of the program.

Table 1.3. Owner Applied Numbers (OANs)—Barriers and Facilitators (Sustainability)

- Farmers do not view marking their equipment as a pressing need. They may recognize the value of participation in the OAN program, but it is not an immediate priority for them.

- Recoveries of marked equipment demonstrate the value of the OAN program. If recoveries of equipment occur as a result of OAN markings, and are publicized to farmers, it will likely encourage them to participate.

- The U.S. Department of Agriculture is planning to create a national cattle-identification system. All cattle owners would be required to mark their cattle. This plan will create an OAN-equivalent system for cattle, if law enforcement agencies have access to it.

- Cattle marking may temporarily crowd out other kinds of marking. In jurisdictions with large numbers of cattle, implementing this system will take up sufficient time and resources to preclude marking of equipment or other kinds of livestock.

Table 1.4. Owner Applied Numbers (OANs)—Barriers and Facilitators (Expansion)

- Expansion of an OAN program requires more stamping equipment and more staff. Resources must be available to provide this infrastructure or expansion of the program will result in reduced effectiveness.

- Once a marking system with computerized record-keeping system is in place, design costs to adopt it are lower for other jurisdictions.

Table 2.1. Database and Information-sharing—Barriers and Facilitators (General)

- Law enforcement agencies may fear outside interference in their cases. This can result in a reluctance to share information.

- Regular face-to-face interaction and instant communication with counterparts in partner agencies builds comfort with and support for information-sharing among law enforcement personnel.

- Building and maintaining an agricultural crime database requires substantial manpower devoted to data entry. Law enforcement agencies have difficulty finding the staff time to undertake data entry, particularly early in the program, when data must be entered to build the database and it is not yet providing any value to the agency. ACTION has committed project staff time to assist participating counties with the initial data entry.

- Agricultural crime data is in demand at the local, state, and federal level. Policymakers interested in agricultural crime need data to make the case for directing resources to combating it. ACTION's database provides these data, which are available nowhere else. California makes contribution to ACTION's database a condition of receiving state agricultural crime grants.

- Agencies may not have the expertise to realize the potential of the database as an analytical and planning tool. Agencies need to build the staff capacity to do statistical analysis and policymakers need to set goals to guide that analysis.

- ACTION has created a database design that can be adapted for use in other jurisdictions with minimal redesign costs.

Table 2.2. Database and Information-sharing—Barriers and Facilitators (Start-up)

- Law enforcement agencies have differing degrees of comfort with sharing information. Some are concerned that outsiders are going to take a role in handling their crimes. Others are accustomed to sharing information through entities like the California Rural Crime Prevention Unit or the Florida Agricultural Crime Intelligence Unit.

- Sharing information provides value in regions in which agricultural crimes crosses jurisdictional boundaries. In places where offenders typically do not cross institutional or jurisdictional boundaries, there may be little interest in or need for information-sharing.

- ACTION has created a database design that can be adapted for use in other jurisdictions with minimal redesign costs. Use of such a database system ideally should occur prior to implementing a new agricultural crime prevention effort, so that stronger evaluation designs can be implemented to assess the impact of the effort.

- Getting the database functioning as quickly as possible is important. Local law enforcement agencies may be unwilling or unable to commit the manpower necessary to build the database. Substantial data-entry work is required before an agency begins to benefit from an agricultural crime database, and the longer that process takes, the more difficult it will be to maintain support for implementing the database. ACTION has committed project staff time speed the completion of the initial data entry.

- Interest in a database like ACTION's is high among practitioners working on agricultural crime across the country. Many practitioners cite the lack of reliable data on agricultural crime as a serious problem.

Table 2.3. Database and Information-sharing—Barriers and Facilitators (Sustainability)

- Regular information-sharing builds and maintains support for the program. ACTION law enforcement personnel believe that sharing information across jurisdictions made their efforts against agricultural crime more effective, and it made them more committed to the program as a whole.

- Difficulties dedicating manpower to database maintenance persist in some agencies. Some counties continue to rely on ACTION staff to assist with their data entry.

- The database provides information that can be used to demonstrate the prevalence and impact of agricultural crime, and justify the deployment or resources to address it.

- Agencies may not have the expertise to realize the potential of the database as an analytical and planning tool. Agencies need to build the staff capacity to do statistical analysis, and policymakers need to set goals to guide that analysis.

Table 2.4. Database and Information-sharing—Barriers and Facilitators (Expansion)

- Agricultural crime data is in demand at the local, state and federal level. Policymakers interested in agricultural crime want data to make the case for directing resources to combating it. They may be willing to reward agencies that assist in gathering this information. California made contribution of data to the ACTION database a condition of receiving state grant money for agricultural crime.

- Incentives to participate in the database could be seen as coercive. Some counties in California resented being required to do the administrative work necessary to participate in ACTION data collection in or forgo California agricultural crime grant funding.

- Databases built on ACTION software can be linked, creating a national agricultural crime database that any participating agency can access. ACTION and the Florida Office of Agricultural Law Enforcement plan to link agricultural crime databases.

Table 3.1. Deployment of Technology—Barriers and Facilitators (General)

- Distributing communications equipment to participating agencies has an immediate impact. Many agencies have different communications systems, which can make cross-county communication difficult without other equipment. Law enforcement agencies can contact each other from anywhere instantly once they have the Nextel phones from ACTION. The phones have proved tremendously popular with program participants and, it was reported, have greatly improved communications.

- Agencies have limited ability to pay for equipment. A program like ACTION can offer a considerable incentive to join by providing local law enforcement with communications and surveillance equipment it would otherwise be unable to dedicate to agricultural crime.

- Surveillance equipment provides a tool to combat theft of difficult-to-trace items from remote farms. It is difficult to prove that someone has stolen an item like produce or diesel fuel without video evidence. Without surveillance equipment, law enforcement agencies would have few effective options for pursuing such cases.

- ACTION provides a strategy for deploying surveillance equipment against agricultural crime. ACTION provides a model for how to adapt surveillance equipment to address farm theft, and when to deploy it.

- Technology is most effective if distributed to each implementing agency. If law enforcement agencies do not have ready access to the equipment, they will not use it.

Table 3.2. Deployment of Technology—Barriers and Facilitators (Start-up)

- There is a resistance to new technology. Incorporating new technology into an agency requires staff to modify work procedures, which may be initially unpopular.

- Cost of equipment is a big concern in an environment where money for any agricultural crime intervention is scarce. A program like ACTION can offer an incentive to join by providing local law enforcement with good communications and surveillance equipment.

- Department of Homeland Security funding is available to combat agricultural terrorism. Some jurisdictions are using this money to build communication networks that could also be used to combat agricultural crime.

- Distributing communications equipment to participating agencies has an immediate impact. Many agencies have different communications systems, which can make cross-county communication difficult without other equipment. Law enforcement agencies can contact each other from anywhere instantly once they have the Nextel phones from ACTION. The phones have proved tremendously popular with program participants and, it was reported, have greatly improved communication.

- Some agencies have or have access to most of the equipment that ACTION provides. These agencies may not be interested in ACTION equipment, but might still benefit from adopting ACTION strategies for deploying the equipment.

- Surveillance equipment provides a tool to combat theft of difficult to trace items from remote farms. It is difficult to prove that someone has stolen an item like produce or diesel fuel without video evidence. Without surveillance equipment, law enforcement agencies would have few effective options for pursuing such cases.

Table 3.3. Deployment of Technology—Barriers and Facilitators (Sustainability)

- Communications and surveillance equipment have been very popular within ACTION. Law enforcement personnel think the equipment allows them to pursue agricultural crime more effectively. This sense of increased efficacy builds and sustains commitment to the program.

- Sharing surveillance equipment over large geographical areas is difficult. During the early years of ACTION, all the surveillance equipment was housed in Tulare County. Although ACTION staff would drive long distances to pass off the equipment to law enforcement agencies in other counties, the inconvenience was sufficient that some counties were not using the equipment at all. Housing equipment with other participating counties has eliminated this problem.

Table 3.4. Deployment of Technology—Barriers and Facilitators (Expansion)

- Expanding technology deployment to new areas requires securing funding for purchasing more equipment. Communication equipment must be provided to each new jurisdiction entering a program like ACTION. Sharing surveillance equipment is possible, but doing so across long distances is cumbersome and prevents the equipment from being used optimally.

Table 4.1. Education and Outreach—Barriers and Facilitators (General)

- Farmers are not used to reporting agricultural crimes. Farmers may consider agricultural crime to be an inevitable cost of doing business, or they think that law enforcement or prosecution will not do anything productive about them. None of the ACTION program elements can work without farmers reporting crimes or asking for assistance.

- Farmers do not perceive law enforcement agencies as advocates for them. Farmers may not be comfortable working with law enforcement agencies that in other contexts may be monitoring their compliance with environmental, water use, or labor regulations.

- Program implementers may not know the agricultural crime issues of greatest concern to farmers. Assessing farmer needs allows implementers to tailor agricultural crime interventions to the areas of greatest concern to farmers.

- Staff of participating agencies may not understand the importance of agricultural crime. ACTION directs outreach efforts into the organization as well as outward into the wider community. Many sheriffs' departments and prosecutors' offices don't understand or prioritize agricultural crime, which impedes agricultural crime efforts and building confidence in ACTION within the agricultural community.

- Print material and a website facilitate the dissemination of agricultural crime information.

- Staff that speak the language of the agricultural community build credibility for the program with farmers.

Table 4.2. Education and Outreach—Barriers and Facilitators (Start-up)

- Satisfaction with law enforcement is low among farmers in some jurisdictions. Many farmers believe that officers do not care about agricultural crime. Farmers may also be more accustomed to law enforcement investigating them (for water use regulation compliance, diesel emissions levels, or employing illegal immigrants) than as advocates for them as victims of crime.

- Program implementers may not know the agricultural crime issues of greatest concern to farmers. Some agencies have conducted needs assessments through surveys or visits to farmers as part of their agricultural crime interventions.

- Education and outreach material created by ACTION can be adapted for use in other jurisdictions. Florida plans to take this step.

- Staff of participating agencies may not understand the importance of agricultural crime. Knowledge about agricultural crime is absent in many sheriffs' departments and prosecutors' offices. This issue is particularly prominent in mixed rural/urban jurisdictions.

- Setting reasonable program goals and expectations prevents disappointment later. The program provides an opportunity for law enforcement to do something about agricultural crime, and an asset to protect farmers, but it will not eliminate agricultural crime.

- Agencies that deal with agricultural crime generally have regular contacts with farmers. The contact may be direct or facilitated by local or state farm bureaus. More formal outreach efforts can be built upon these contacts.

Table 4.3. Education and Outreach—Barriers and Facilitators (Sustainability)

- Working through agriculture commission meetings and other regular meetings of farmers allows ACTION to reach many farmers at once with education and outreach efforts.

- Information on reporting agricultural crimes or avoiding crime victimization can be easily disseminated via a website.

- ACTION staff speaks the language of agriculture and law enforcement. This ability helps them build credibility in both communities.

- Failure of law enforcement or prosecution to follow through on agricultural crime cases erodes support for the program among farmers. ACTION's internal education efforts are necessary to sustain law enforcement officers' and prosecutors' commitment to proactively and aggressively address agricultural crime.

Table 4.4. Education and Outreach—Barriers and Facilitators (Expansion)

- Targeting education and outreach to the media and the general public can build awareness of the importance of agricultural crime and political support for addressing it.

- If farmers are satisfied with the program, they can become partners in program outreach through formal and informal farmer networks.

Table 5.1. Vertical Prosecution—Barriers and Facilitators (General)

- Prosecutors in counties that contain urban areas are much less able or willing to devote resources to the prosecution of agricultural crimes. Prosecutors with responsibility for urban areas have a higher volume of overall cases, and their agricultural communities are less politically powerful relative to other constituencies, which may be actively hostile to agricultural interests.

- Outside funding for the portion of a prosecutor's time going specifically to agricultural crimes increases prosecutor willingness to designate a prosecutor to handle agricultural crimes.

- Having a prosecutor designated to work agricultural crime prosecutions creates a repository of the technical knowledge necessary for such prosecutions, and an advocate for the agricultural community within the prosecutor's office.

- Law enforcement agencies interested in pursuing agricultural crime more aggressively can motivate prosecutors to respond.

Table 5.2. Vertical Prosecution—Barriers and Facilitators (Start-up)

- District Attorneys in rural counties tend to be responsive to the needs of the agricultural community. They are open to vertical prosecution, and may already be prosecuting agricultural crimes, if the local farmers consider it to be a serious problem.

- Agricultural crimes tend to be much less of a priority for prosecutors in jurisdictions that contain urban areas. They are less willing and able to put their own financial and personnel resources into the prosecution of agricultural crimes, and win less stringent punishments when they do prosecute and convict.

- California agricultural crime grants pay for the time of prosecutors working agricultural crimes. This funding makes dedicating a prosecutor to agricultural crime much more feasible for prosecutors who have limited resources.

- Some law enforcement agencies have moved to get their counties to join ACTION to secure a commitment to prosecute agricultural crimes.

Table 5.3. Vertical Prosecution—Barriers and Facilitators (Sustainability)

- Vertical prosecution builds knowledge of and investment in agricultural crime within the prosecutor's office. There are many technical issues in agricultural crime prosecutions, and vertical prosecution makes a prosecutor familiar with them.

- Prosecutors who handle only agricultural crimes are able to have more active involvement in program activities, such as writing affidavits for agricultural crime warrants and attending agricultural crime meetings.

- Grant funding is highly sensitive to changes in budget situations. Grant funding is often the first area cut when state or federal budgets need to be reduced. It is unclear whether the vertical prosecution aspect of the ACTION model would function without the state grant funding.

- Farmers want to know how many prosecutions are happening for agricultural crimes, and how serious the sentences are. Prosecutors can build support within the agricultural community by disseminating this information.

- Law enforcement agencies must send enough agricultural crime cases to the prosecutors to sustain their interest in vertical prosecution.

Table 6. Barriers and Facilitators—Start-up Phase of Implementation

- A program like ACTION needs a spearheading agency. The agency needs to have a policymaker willing to put the agency's resources behind combating agricultural crime. The spearheading agency must be careful not to control all the program monies and control too tightly, or it will have difficulty finding partner agencies.

- Farmers are indispensable partners to ACTION, but may be disinclined to seek assistance from law enforcement. Many farmers believe that officers do not care about agricultural crime. Farmers may also be more accustomed to law enforcement investigating them (for water use regulation compliance, diesel emissions levels, or employing illegal immigrants) than as advocates for them as victims of crime.

- Jurisdictions interested in implementing a project like ACTION have the option of adopting ACTION material such as the database software, promotional material, or website.

- Program elements that have an immediate impact, such as communication networks across jurisdictional boundaries, can be used to gain project buy-in for elements that require more time and effort to get operational, like the database.

- ACTION cultivated congressional support for its program. This strategy helped contribute to federal support for the program.

- A full-time program coordinator will help a program like ACTION to proceed more quickly. ACTION's coordinator initially held that position in addition to other job responsibilities, which reportedly slowed the implementation of ACTION.

Table 7. Barriers and Facilitators—Sustainability Phase of Implementation

- ACTION devotes significant staff time to making implementation easier for the participating counties. For example, they drive surveillance equipment halfway to distant counties, help participating counties with OAN registration at county fairs, and assist with data entry.

- ACTION needs to be constantly marketed to participating agencies and potential partners. Agricultural crime is not a high priority for most local law enforcement and prosecution agencies, thus ongoing marketing and education about agricultural crime are needed.

- ACTION builds continual promotion of the program into its activities. Education and outreach include raising awareness of the existence and applicability of ACTION. Successes are publicized in the media and on ACTION's website.

- Follow-through on agricultural crime cases is crucial for maintaining and increasing farmer support for the program.

- State grant funding has been a key facilitator of ACTION, but grant funding is vulnerable to cuts in difficult budget climates. ACTION counties have been struggling with these cuts and trying to strategize ways to maintain their programs in the face of decreased funding.

Table 8. Barriers and Facilitators—Expansion Phase of Implementation

- ACTION has developed resources, particularly the database software, the can substantially lower design costs and reduce implementation time for similar programs in other jurisdictions.

- Agricultural crime data generated by ACTION is a unique resource. There is no other such source of agricultural crime data in the United States. The data can be offered to federal, state, and local governments in exchange for program support, and can be used to advocate for agricultural crime interventions.

- Potential new partners in a program like ACTION will be more inclined to join if they feel they will be more empowered to do things, rather than having ways of operating dictated to them. California has made participating in ACTION data collection a requirement of receiving agricultural crime grant funding. This requirement creates an incentive to bring more counties into ACTION, but it has also engendered some resentment toward ACTION by counties that want the grant money but not the data entry responsibility.

- Expansion of a program like ACTION requires more money and staff time. Obtaining the funds necessary to expand ACTION is difficult in the current funding environment, and requires ACTION to balance the needs for sustainability and expansion carefully.

10. PROGRAM AND POLICY RECOMMENDATIONS

ACTION is a pilot initiative that consists of many components or activities, and it has expanded considerably, all during a period in which agricultural markets have fluctuated. Thus, generalizations about the impacts or whether it would be effective in other contexts must be made with considerable caution. Nonetheless, the study's findings suggest that programs modeled after ACTION may well contribute to reduced agricultural victimization and to more successful attempts to identify, arrest, and prosecute offenders. More than most types of offenses, agricultural crime remains largely unaddressed and yet is ubiquitous. Most farmers experience some type of theft annually, but do little to address it. Indeed, over 85 percent never report victimization experiences, generally because they do not believe law enforcement will take it seriously or that anything can be done (Barclay 2001; Barclay and Donnermeyer 2002). With these observations in mind, several sets of recommendations are provided below concerning ways to improve ACTION. The recommendations generally apply equally well to attempts to implement ACTION, or similar programs, in other places. General recommendations concerning the transferability of the program are also discussed.

Monitor Program Implementation

A critical step in improving any program is being able to document what the program currently is doing (Rossi et al. 2004). ACTION has undertaken such efforts through the development of a centralized database, one that collects information not only on outcomes (e.g., victimization) but also on program activities (e.g., OAN-marking efforts). Now, however, the program is well-positioned to build off this work to develop more systematic monitoring of its activities. In particular, the program, and similar initiatives, might consider developing annual reports that detail the type and level of each of the core sets of activities that collectively comprise the program. In some cases, queries would need to be developed that enable records to be more accessible for analysis. Drawing on the extensive information in the ACTION records and database system, annual reports might provide such information, by each activity area, as:

- Database—staff time expended on entering data; time spent responding to data and crime-mapping analysis requests; the number of such requests;
- Education and outreach—the number of presentations or trainings made to farmers, law enforcement personnel, and other groups about the program or agricultural crime prevention; the number of requests for such presentations; the type and number of materials (e.g., flyers, brochures) distributed to different groups; the number of visits to the ACTION website;
- Equipment- and crop-marking—the number of requests for such marking; the percentage of cases in which program staff directly assisted farmers in marking equipment; staff time expended on going to farms to mark equipment;
- Surveillance equipment—the number of requests for such equipment; the percentage of cases in which staff directly assisted farmers in deploying equipment; staff time expended on going to farms or to law enforcement agencies to assist with installing surveillance

equipment; the total amount of equipment and how many days of use each received;

- Targeting and prosecution of agricultural crime offenders—the number of agricultural crime arrests and prosecutions; the percentage of these cases involving marked equipment or information from surveillance equipment; the percentage of all arrests resulting in prosecution; the extent to which each county District Attorney adheres to the vertical prosecution approach (e.g., dedicating one prosecutor rather than assigning prosecutors on an as-needed basis to agricultural crime cases).

Communication is also an important emphasis of the program. Therefore, to the extent possible, the report should also provide some evidence concerning communication across counties and between law enforcement agencies and prosecutors. Quantifying such contact is difficult. However, annual one-page surveys could perhaps be administered to participating county prosecutors and law enforcement agencies about the frequency of their contact with each other and with their counterparts in other counties.

Certainly, other activities may merit systematic monitoring. But the ones identified here are among the more central ones undertaken by the program and thus should be given particular attention. Where possible, such information should be provided by county, given that the program is largely built on the activities of county personnel. Providing information in aggregate and for each county can aid in identifying whether corrective action is needed. To illustrate, if some counties make no or few requests for crime mapping analyses, it might suggest the need for improved program-county communications. Perhaps, for example, some counties are unaware of the full range of analyses that can be conducted and that might assist them in their investigations or crime prevention efforts. In addition, important changes to the program (e.g., increased or decreased funding, changes in personnel) should be discussed, as should the results of any studies that may have been undertaken concerning program operations or their impacts on farmers' behaviors or victimization. Ultimately, such reports can be used to monitor changes over time in the program. If coupled with descriptive accounts of the program and illustrations of its work and impacts, they also could be used to educate the public about the full range of activities that ACTION undertakes.

In addition to, and perhaps as part of, creating annual reports, the program might consider conducting focus groups or small-scale surveys of program staff, including county-level prosecutors and law enforcement staff, as well as of farmers. Such efforts could be used to obtain feedback on whether, for example, outreach efforts have been helpful and what could be done to improve them. In the surveys, for example, some farmers complained that law enforcement agencies are not responsive to their calls for assistance. Even if ACTION has improved law enforcement responsiveness, there is clearly room for improvement.

Monitor Program Intermediate Outcomes

ACTION's diverse efforts aim to create several changes—such as farmers increasing the number of protective measures they take to protect their property—that in turn ultimately are hoped to reduce agricultural crime victimization. Monitoring such changes is not simple, if only because it can require collection of new data. Nonetheless, such data may be more feasible and

affordable to collect than accurate measures of victimization. The information gleaned from analysis of intermediate outcomes can be used to document whether program activities are associated with these outcomes. Should such associations be found, they lend support to assertions about the program's effectiveness.

As importantly, however, changes in these outcomes can be used to determine if program activities need to be shifted. For example, if the percentage of surveillance deployments resulting in an arrest changes dramatically from one year to the next—from, say, 30 to 10 percent—there may have been a change in how deployments are conducted that needs to be reviewed, or it may be that no change occurred but that one is needed. Below are examples of intermediate outcome measures that ACTION or similar efforts might consider collecting. In some cases, measures similar or identical to those used for monitoring program activities are provided, reflecting the fact that some measures can be used to monitor activities as well as intermediate outcomes. For example, requests for data analysis (e.g., crime mapping) from law enforcement agencies clearly involves staff time and thus reflects program activity. At the same time, the program aims to improve law enforcement efforts by encouraging them to rely on analysis, and so the measure also indirectly reflects that intermediate outcome.

- Database—the number of times the database is accessed by law enforcement; the number of data analysis requests; the percentage of such requests resulting in identification or apprehension of suspects;
- Education and outreach—the extent to which presentations or trainings increased the knowledge or behavior of farmers, law enforcement, or other groups about ACTION or agricultural crime prevention (as measured through short surveys before and after trainings or through periodic surveys of participants);
- Equipment- and crop-marking—although no obvious intermediate outcome is associated with marking, information from farmers and law enforcement personnel about the experience might be informative, including data on whether they found ACTION's assistance helpful and whether the marking effort contributed to increased efforts more generally to take steps to protect farm property;
- Surveillance equipment—the percentage of deployments in which suspects were identified, arrested, and convicted;
- Targeting and prosecution of agricultural crime offenders—the number of agricultural crime arrests and prosecutions; the percentage of these cases involving marked equipment or information from surveillance equipment; the percentage of all arrests resulting in prosecution.

Monitor and Assess Program Impacts

The ultimate goal of the program is to reduce agricultural crime victimization by reducing opportunities for theft to occur and increasing specific and general deterrence through aggressive law enforcement and prosecution. Therefore, ACTION and similar efforts will want to monitor agricultural crime trends. Unfortunately, official records provide a questionable foundation for deriving accurate assessments of the type or amount of agricultural crime, as the present study

has shown. (Much the same is true of other non-agricultural crime.) Therefore, self-report surveys of farms likely remain the best alternative strategy for monitoring agricultural crime victimization. In addition, they can be used to measure other critical outcomes—such as victimization costs and quality of life—related to fear of crime and to actual victimization. In the likely event that administering such surveys is not possible on an annual basis, programs should endeavor to conduct them as frequently as possible and, in the interim, seek to measure appropriate intermediate outcomes.

It bears emphasis, however, that prosecutorial activity—and convictions, in particular—may merit particular monitoring, not only because doing so is possible but also because it stands as a critical outcome. Research on deterrence is far from definitive, though studies do indicate that punishment can produce a deterrent effect (Akers and Sellers 2004). Moreover, no studies have, to the research team's knowledge, assessed the deterrent effect of sanctions involving agricultural crime. Nonetheless, a deterrent effect requires that punishment actually occur, and since agricultural crime typically goes unpunished, showing that punishment in fact happens is a critical step toward documenting an impact. In addition, convictions, not actual reductions in crime, typically are the gold standard by which prosecutors are evaluated and thus arguably serve as an end outcome in their own right.

Recoveries of stolen property should be monitored. Without comparable data from before the program began, it remains difficult to assess whether recoveries indeed have increased more than would have occurred in the absence of ACTION. Nonetheless, as with the interpretation of the arrest and conviction data, a reasonable supposition is that without the ACTION database and amount and quality of evidence collection, few recoveries typically would occur. Even without the ability to document an impact, monitoring of recoveries can help to identify any notable increases or decreases that might bear investigation.

Finally, the various costs of the program should be consistently collected and monitored annually. The costs should ideally be easily classified by activity to show which activities cost more than others. Such information in turn can be used to help inform efforts in other places and to ground cost-benefit analyses.

It should be emphasized that monitoring outcomes does not show that a program has an impact. For that, evaluations such as the present one, or ideally ones that involve some type of experimental design, are preferable. Nonetheless, it can contribute greatly to such efforts (Rossi et al. 2004).

Improve Program Design

Almost any program can benefit from small or large refinements to program design, especially when, as is the case with ACTION, it consists of many different activities. For this reason, it can be useful to obtain feedback semi-annually through staff, law enforcement, prosecutor, and farmer interviews, meetings, or short survey instruments, about the program—what is easy to implement, what have been challenges to implementation, what can be done to effectively address those challenges. Certain activities may be more useful in some years than others, and such monitoring can be used to identify such possibilities and adjust the program

accordingly.

The general causal logic on which ACTION rests is sound—drawing, as it does, on a large body of work on opportunity theory (and situational and place-based crime prevention more generally) and deterrence—but there may be other strategies that bear exploration. Although this study found little guidance in the extant literature, there are methods for uncovering potentially effective strategies. One possibility, for example, is to conduct interviews with convicted offenders about the advice they would give to farmers about how best to prevent theft. The answers may not always be honest. However, criminology has a long history of seeking insights from offenders (Nee 2003). Indeed, in many respects offenders are best situated to provide insights about effective theft reduction efforts. To illustrate, ACTION assumes that aggressive prosecution may create a general deterrent effect, but perhaps offenders report having no knowledge of District Attorney activities. That in turn would suggest the need to find ways to make the activities more widely known.

Similarly, focus groups might cost-effectively be conducted with farmers to learn from them their impressions about the program and its activities, as well as new activities that they would recommend. The groups could be used to help prioritize program efforts as well as to provide informal assessments about program performance.

The database is central to ACTION's efforts and constitutes a substantial improvement over the situation in most jurisdictions in the country, which collect no information on agricultural crime. There are, however, some changes that may be warranted. First, not all counties consistently enter crime reports. Ultimately, the issue appears to be one of resources, but unless that issue is resolved, the impact is that the utility of the database is undermined. Second, there are some minor but significant coding changes that may be warranted. For example, the "miscellaneous" category includes many offenses that likely should be disaggregated (e.g., chemical and fuel theft). And other data fields should be considered for inclusion, such as ones that capture law enforcement, District Attorney, and ACTION staff activities. Third, ACTION should consider eliminating the need for geocoding of crime incidents by requiring that all reporting officers take global positioning system (GPS) coordinates during investigations. The program would want to allow for easy and manageable uploading of these coordinates into the database. These steps would entail up-front costs but would eliminates the staff time required for geocoding and updating the online database, and it would eliminate any error introduced in the process of geocoding. Fourth, ACTION should consider attempting to increase ACTION's capacity to support new partner agencies by taking advantage of the increasing integration of geographic information systems (GIS) and records management systems in law enforcement agencies across the nation. For example, integrating the ACTION database with GIS would enable partner agencies to independently create maps relevant to their specific crime prevention efforts. Eventually, the program might want to consider allowing public users to access mapping capabilities through ACTION's website. This change would serve multiple purposes: reduce demand for staff time for mapping; provide another educational tool for the public and farmers; and increase the capabilities of ACTION as more partners join the network.

Finally, a range of more specific program design additions or emphases emerged from the descriptive analyses of the second-year (2005) survey. Below, we summarize some of the potential design and policy implications emerging from the analyses.

- Effective policy interventions might focus on characteristics of farms that experience greater amounts of victimization.
- Small equipment and tool theft, as well as vandalism, were reported to be of particular concern among farmers and are highly prevalent, and so efforts specifically targeting both may be warranted. Neither are likely candidates for prosecution, given that the severity of the offenses may not always be viewed as warranting action. Thus, targeted prevention measures may be more feasible and effective.
- Crime prevention efforts might meet a more receptive audience among farmers if they focus on those crimes of most concern to farmers. These include theft of machinery, trash dumping, burglary of farm buildings, and vandalism.
- Many farmers believe that law enforcement will not take their calls about agricultural crime seriously, suggesting a need to improve how seriously law enforcement addresses agricultural crime and/or communicates their concern to farmers.
- Farmers' views on what they think should be prioritized might well reflect the types of crime prevention strategies that could be most effective in reducing victimization. As such, consideration should be given to testing their ideas, which focused on increased patrols of agricultural areas, greater responsiveness of law enforcement when called, being e-mailed about crime occurring in their (the farmers') area, assisting with equipment-marking, meeting with farmers about security measures, and encouraging farmers to share surveillance equipment.
- Since farmers receive crime prevention information from a diverse range of sources, effective communication with them about crime prevention may well require disseminating information through as many such sources as is possible.
- Given the low rates of crime reporting among farmers, considerable effort may be warranted in distributing, through diverse media, information to farmers about the importance of crime-reporting.

Transferability

Any attempts to expand ACTION further or implement it in other places will require careful attention to a range of issues relating to the different activities that comprise ACTION, including equipment marking, database use and analysis and information-sharing, deployment of technology, education and outreach, and vertical prosecution. These issues are discussed in detail in the transferability section of the report. In each instance, the central recommendation is that stakeholders first assess the feasibility of implementing each of these diverse activities. Will it be possible, for example, to dedicate, if only on a part-time basis, some law enforcement officers or prosecutors, to agricultural crime cases? Is there funding to support staff who could assist with equipment marking? Are there political divisions between counties that make cross-county collaborations and information-sharing unlikely? Answering such questions can help to ensure that time and resources are invested in those activities that can realistically be implemented and thus that are most likely to produce beneficial outcomes.

Attempts to implement programs like ACTION in other jurisdictions will want to pay

especially close attention to the challenges of starting a new program. As the report details, many substantial barriers exist, including the reluctance of law enforcement agencies and prosecutors to take agricultural crime seriously, the lack of communication within and among different justice system agencies and across counties, and, not least, the unwillingness of many farmers to contact law enforcement or to take proactive steps to prevent crime. These barriers are not insurmountable, especially if attention is given to developing and sustaining effective communication among these different groups. Indeed, creating such communication is likely to be the most important foundation for any effective, long-term strategy to reducing agricultural crime.

Because efforts similar to ACTION likely will target ecological areas—that is, entire communities or counties—documenting that particular activities contribute to crime reductions can be difficult, especially in the absence of comparable counties or experiments. Nonetheless, careful attention to collecting and analyzing agricultural crime data, as well as interviewing farmers and program staff, can facilitate formative evaluations in which lessons are learned on an ongoing basis about program operations and what can be done to improve them. Such efforts are especially important in the early stages of developing a program since they can contribute to important refinements to core program activities. For example, certain types of agricultural crime (e.g., fuel theft) may be more common than others (e.g., livestock theft), and so program activities might need to be adjusted to be better able to affect such crime.

Recommendations from Other Studies

The ACTION program emphasizes a range of activities to prevent and reduce agricultural crime. One or all of the activities may be useful as strategies that other jurisdictions can pursue in their crime-fighting efforts. To summarize, the activities include:

- Developing a database for tracking agricultural crime and encouraging and enabling information-sharing within and across counties and among prosecutors and law enforcement;
- Education of and outreach to the public and farmers about agricultural crime and what can be done to prevent it;
- Encouraging and facilitating the use of equipment- and crop-marking, especially the stamping of equipment with owner applied numbers (OANs);
- Encouraging and facilitating the use of surveillance equipment among farmers;
- Active targeting and vertical prosecution of offenders; and, cutting across these diverse efforts,
- Building and maintaining effective communication between law enforcement agencies and prosecutors and between counties.

Other reviews have identified overlapping strategies. For example, Swanson et al. (2002:640-641), in a review of research on environmental and agricultural crime, have emphasized a range of crime-specific guardianship measures that they recommend farmers

pursue. The measures, by type of crime, include:

- Farm equipment theft
  - — Place all equipment in secure buildings near main house and use locked gates.
  - — If not housed, hide and disable the equipment.
  - — Use equipment identification numbers.

- Agrichemical theft
  - — Buy only the amount of agrichemicals needed.
  - — Store in secure buildings.
  - — Employ security personnel.
  - — To reduce the market for stolen products, do not purchase stolen chemicals.

- Livestock and tack theft
  - — Mark all livestock with identification numbers.
  - — Take daily counts of livestock.
  - — Vary daily routines.
  - — Create cooperative supervision agreements with neighbors.
  - — Mark tack and place in secure buildings.
  - — Maintain photographic records of livestock and tack.

More recently, a report issued by the National Crime Prevention Programme (2004) and produced by the Australian Institute of Criminology, provided several sets of recommendations, one for farmers, one for local government and industry, and one for rural communities. Because they build off prior research and a review of the literature, are consonant with what ACTION has implemented, and parallel many of the insights gleaned from the ACTION evaluation, each set of recommendations is reproduced below.

- Recommendations for farmers (National Crime Prevention Programme 2004:11)
  - — *Develop and maintain good relations with your neighbors*. A community that can work together is your best defense against crime. Let your neighbors know when you will be away from the farm and leave a contact telephone number and address—ask them to keep an eye out for strangers and strange vehicles entering your property and ask them to contact you if any problems arise.
  - — *Install security lighting and closed circuit television if possible near your homestead and farm buildings if practical*. For example, security lighting and CCTV can help ensure the security of important and valuable property, such as your home, the sheds where you store vehicles and equipment, and fuel holding tanks.
  - — *Electrify and alarm fences*, particularly those around the perimeter of the property and adjoining public roads (remember to check with your local government authority before installing electric fences or alarms).
  - — *Maintain gates* and ensure they have sturdy locks and hinges.
  - — *Report all suspicious activity and crime* to your local police or live stock squad.

- Recommendations for local government and industry (National Crime Prevention Programme 2004:12)
  - — *Maintain good networks within the local farming and rural communities*, and encourage the community to commit to, or establish, Neighborhood Watch and Rural Watch programs.
  - — *Explore training options for young people on farms and in local industry*, through government or community training programs—this could help reduce youth crime and unemployment, enhance community spirit and help young people develop self esteem and confidence.
  - — *Organize community forums* to regularly discuss new security technology and other strategies to help prevent local farm and rural crime. This could include setting an agenda item on local council meetings.
  - — *Provide local businesses and farmers with materials to engrave their farming equipment, tools and other household or farming items*, and provide free or subsidized "No Trespassing" signs.
  - — *Encourage local business and farms to insure whatever personal and business property they can to lessen the impact of crime*. This may also encourage the reporting of crime to police.
- Recommendations for local communities (National Crime Prevention Programme 2004:15)
  - — *Report all crime to the police*. This will help to build up a profile of local farm crime and help police to target resources to areas of greatest need.
  - — *Encourage police to visit farmers and their farms* regularly to build up a sense of community and help reduce the feeling of isolation that some farmers may experience.
  - — *Work in partnership with police to encourage the development of Neighborhood Watch and Rural Watch* in the town and outlying rural community.
  - — *Work with the police to initiate a local newsletter* to provide regular information to the community on crime and crime prevention strategies, and to encourage discussion about these important issues.
  - — *Help the police by volunteering* to provide regular training for local police on general farm and livestock issues.
  - — *Invite police to visit saleyards and abattoirs regularly*. Police can use the visits as an opportunity to talk to a range of farmers, livestock agents and saleyard or abattoir officials about farm crime.

11. IMPLICATIONS FOR THEORY, RESEARCH, AND POLICY

Few studies of agricultural crime exist, and the few that have been conducted in America are relatively dated (e.g., Farmer and Voth 1989; Cleland 1990; Deeds et al. 1992; Dunkelberger et al. 1992). A larger body of work exists, especially if one includes work conducted in Australia and the United Kingdom (Barclay 2001; National Community Crime Prevention Programme 2004). Considerably more research is needed, however, as Weisheit and Donnermeyer (2000) and others (e.g., Barclay 2001) have argued. The situation is improving slowly, especially with increased theory and research on rural versus urban crime differences (Wells and Weisheit 2004). These changes bode well for theory, research, and, as discussed above, policy.

Theory

As this evaluation demonstrates, a large body of theory can inform agricultural crime prevention efforts, and, in particular, opportunity theory and deterrence theory. At the same time, these theories can be tested and refined through application to rural areas and specifically to agricultural crime. Indeed, opportunity theorists argue that the theory should be tested across a diverse set of contexts to establish its generalizability and to identify changes that may be needed to increase its explanatory power. In addition, despite a large literature on deterrence research, basic questions remain largely unanswered, ones that could advance the literature.

Opportunity theory has emerged as part of general set of theories or perspectives—for example, lifestyle and routine activities theory, environmental criminology, "hot spot" analysis, "defensible space," "crime prevention through environmental design," situational prevention, and problem-oriented policing—that have become prominent in recent decades and that emphasize the notion that crime results from characteristics of places as well as that of the people who frequent them (Clark and Felson 1993; Akers and Sellers 2004). In general, however, studies have focused on urban settings. Despite research findings that lend support to opportunity theory and other place-focused theories of crime, it remains unclear how well the theories account for crime in rural areas, where population density is markedly lower and where there is no necessary analogue to an "inner city." Farms are notable in this regard because they tend to be more isolated, occupy large swaths of land, and cannot easily be guarded. For these and other reasons, such as the traditional reluctance of farmers to seek assistance from law enforcement, applying opportunity and place-based theories to agricultural crime may provide unique insights into the scope of these theories, their potential limits, and ways in which they may need to be modified to improve their ability to predict crime. As but one example, opportunity theory emphasizes the importance of exposure to victimization—all else equal, individuals, buildings, or places that are more visible to potential offenders should be more likely to be victimized. In a farm setting, however, exposure is seemingly ubiquitous. Perhaps, then, it is either not salient, or less so than other dimensions, such as guardianship.

Of course, other theories may also be helpful in predicting agricultural crime victimization and bear investigation. Social disorganization and collective efficacy theories (Sampson et al. 2002) may, for example, prove useful because they emphasize informal social controls, which can be particularly salient in rural areas (Weisheit and Donnermeyer 2000; Barnett and Mencken

2002). Efforts to conduct such studies have the benefit of potentially stimulating new insights about the scope of specific crime theories and important ways that they might be modified. For example, accounts of community-level social control processes often assume contexts in which social and geographic spaces are configured differently than in rural areas. It may well be that the type and extent of social ties and networks, and other social control mechanisms, vary in rural areas and in ways that affect agricultural crime. If so, such findings could prove useful in expanding and modifying theories of social control.

The study of agricultural crime also affords an opportunity to investigate several important questions relating to deterrence. Evaluations of prosecutor-focused interventions hold particular promise. The present study confirmed what other studies have found—agricultural crime typically has not been a priority for law enforcement or prosecutors, and thus convictions for agricultural crime are rare. If, therefore, a jurisdiction implements an aggressive prosecution strategy, and if a similar county exists that does not plan to implement such a strategy, opportunities arise for investigating the neglected question of whether certain thresholds must be met before general deterrent effects emerge. In short, how many convictions, or what percentage increase in or level of convictions, must occur to reduce crime through general deterrence? Similarly, if aggressive prosecution results in reduced crime, does that effect remain stable, increase, or decrease over time? If multiple sites were involved in such a study, additional questions could be pursued. To illustrate, for a given amount of prosecutorial activity, is there a larger reduction in agricultural crime to be had in counties where prior prosecution efforts have been minimal versus counties where some prosecution of agricultural crime has occurred?

Research

For researchers, especially those involved in evaluation efforts, we believe the results of this evaluation should be of interest. They reinforce the importance of linking process and outcome evaluations, taking a broad view of program effectiveness, and being creative in identifying and developing appropriate measures of effectiveness. Just as clearly, they reinforce that serious limitations attend to cross-sectional evaluations of ecological-level programs—such as community policing initiatives—not least because of the difficulty of randomly assigning some communities an intervention and the questionable utility of relying on statistical controls to approximate an experimental design. Too often, comparisons are made between an intervention site and a comparison site, where the latter cannot safely be assumed to be identical in all regards except the presence of the intervention and where statistical controls cannot produce true equivalence. At the same time, the baby should not be thrown out with the bathwater. Cross-sectional designs can, for example, help test the logic of a program, and the results can be juxtaposed against the findings from other studies, such as evaluations using longitudinal data that examine whether changes in implementation create changes in outcomes. In such cases, a cumulative body of findings from diverse methodological approaches may create a more compelling case in support of or against a program than any one approach by itself might allow.

The ACTION evaluation and recent research reviews point to a range of specific research questions and issues that bear investigation. There is, first, the need to develop operational definitions of crime categories that will allow more readily for appropriate comparisons across studies. Should, for example, tractor theft be separated from large equipment theft? Should

pesticides, hormones, and fertilizer be combined into one category?

Second, what is the full universe of individuals, farms, and companies that should be included in assessments of the prevalence of agricultural crime? For example, the evaluation of ACTION focused on farmers. But perhaps individuals and companies that contract with farmers—for example, in providing supplies, equipment, or storage—should be included in future surveys. The issue again is one of developing a standardized operational definition of agricultural crime.

Third, how should victimization be operationalized? Should it consist of frequencies? If so, how, then, should crop theft be measured? Should it consist of dollar estimates? If so, how, then, to establish accurate estimates?

Fourth, what is the prevalence or costs of each type of crime, and how does it vary among farmers, counties, regions, and states? How does it vary over time?

Fifth, what are the correlates of victimization, at the individual and ecological levels? Are market prices for supplies and commodities central determinants of theft? If so, how do such influences affect not only crime but also cost-benefit analyses of agricultural crime prevention programs?

Sixth, more generally, what new or promising agricultural crime prevention efforts exist? Which ones have the greatest potential to reduce crime? Which ones are most likely to be adopted by farmers, law enforcement agencies, prosecutors, or communities?

Finally, the ACTION evaluation indirectly highlights an important question that remains neglected in the criminological and evaluation literature. Specifically, to what extent do marginal general deterrent effects exist, especially among crimes that typically are rarely prosecuted? For example, does prosecuting a small handful of such crimes produce the same general deterrent effect as prosecuting many more? How many exactly are needed to produce a more-than-nominal effect? After certain threshold levels of prosecution are achieved, do increases in prosecution make any difference? By and large, the literature is largely silent on this issue (see, generally, Nagin 1998; Akers and Sellers 2004). A similar question applies to other activities undertaken by ACTION and, more generally, to any components of any program or policy. That is, at what point does a particular activity produce a substantively significant effect, and is that effect in any way modified by the baseline level of the activity or of the outcome it is designed to influence? Such questions are, we submit, fundamental to evaluating criminal justice policies (Goldstein 1987). We suggest, however, that the more important issue they highlight is the potential, as Blumstein (1996) and others (e.g., Rossi 1980) have argued, for evaluation research studies to prompt social scientists to investigate basic questions about social phenomena.

Policy

The lessons from the current evaluation and from a review of the literature are summarized in the recommendations chapter above. Here, however, several observations bear mention. First,

agricultural crime is a serious and costly social problem that can harm not only farmers but also society at large. Second, such crime continues to be largely neglected by law enforcement agencies and prosecutors. And, third, farmers often are reluctant to take steps to protect their property.

Juxtaposed against these observations is the fact that there are many policy options from which farmers, law enforcement agencies, prosecutors, and communities can choose in their attempts to reduce agricultural crime. Not least, as detailed in the recommendations chapter, there exist a wide range guardianship and target-hardening efforts (Eck 2002) that make agricultural crime less easy, and aggressive law enforcement and prosecution, guided by a general problem-solving orientation, one informed by research and analysis, to crime-fighting (Ratcliffe 2003; Peak and Glensor 2004). Education of farmers, law enforcement officers, and prosecutors also can be critical, leading to increased reporting of crime and more proactive, effective approaches to addressing it. Ultimately, however, effective agricultural crime prevention strategies must begin with assessing the need for crime prevention, the feasibility of the diverse strategies listed above, and the unique capacities in and context of specific communities.

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13. APPENDICES

Appendix A. 2004 Survey Instrument

AGRICULTURAL CRIME SURVEY

INSTRUCTIONS: This is a survey designed by the Urban Institute with the advice of Central Valley farmers, law enforcement personnel, Farm Bureau staff, and Agricultural Commissioners to learn about agricultural crime in your area and how you combat it. We know agriculture is vital to the nation and that the loss of agricultural products and supplies can harm your business. Greater understanding of agricultural crime can help inform future crime prevention initiatives.

This survey should only take 15 minutes to complete, and all responses will be kept anonymous. In this survey, an "operation" refers to land you operated for agricultural purposes at any time in the past year (October 2003 through September 2004). If you make decisions for more than one operation, provide information only for the largest.

Please return the completed survey using the enclosed self-addressed, stamped envelope or by fax (202-659-8985). Your participation, while voluntary, is critical to ensuring the accuracy and usefulness of the results. If you have questions or concerns about the survey, please contact Michelle Scott (202-261-5230; mscott@urban.org). Thank you for being an important part of this project.

CRIME ON YOUR FARM OR RANCH

1. Are you a farm or ranch owner or operation manager (or spouse of owner or manager) who engaged in any farming or ranching in the past 12 months?

☐ NO → **Stop and return the survey in the envelope provided.**

☐ YES

2. Did you stop farming or ranching in the past 12 months?

☐ NO → **Skip to question 3**

☐ YES

2a. In what month did you stop farming or ranching? _____

(Please continue with the survey and respond to the following questions, referring only to the period of time in the past 12 months in which you were engaged in farming.)

3. What crimes are you most concerned about occurring on or against your farm or ranch operation? For each crime, please circle a number that best represents your level of concern.

	MOST CONCERNED				LEAST CONCERNED
Theft of crops	1	2	3	4	5
Trash dumping	1	2	3	4	5
Theft of chemicals or fuel	1	2	3	4	5
Theft of livestock	1	2	3	4	5
Theft of equipment or machinery	1	2	3	4	5
Vandalism	1	2	3	4	5
Trespassing	1	2	3	4	5
Chemical or toxic dumping	1	2	3	4	5
Assault on your person	1	2	3	4	5
Assault on your employees	1	2	3	4	5
Burglary of farm buildings	1	2	3	4	5
Bio-terrorism (e.g., contamination of feed)	1	2	3	4	5
Other (please specify) _____	1	2	3	4	5

CONTINUE TO NEXT PAGE →

4. Compared to previous years, the number of thefts, vandalism, or burglaries on your farm operation in the past 12 months (Oct. 2003 – Sept. 2004) has . . . (please check *one*):

☐ Decreased a lot (31% or more)	☐ Decreased some (11-30%)	☐ Decreased a little (1-10%)	☐ Remained the same	☐ Increased a little (1-10%)	☐ Increased some (11-30%)	☐ Increased a lot (31% or more)

5. Compared to previous years, do you believe the number of news and media stories about agriculture-related theft in your area in the past 12 months (Oct. 2003 – Sept. 2004) has . . . (please check *one*):

☐ Decreased a lot (31% or more)	☐ Decreased some (11-30%)	☐ Decreased a little (1-10%)	☐ Remained the same	☐ Increased a little (1-10%)	☐ Increased some (11-30%)	☐ Increased a lot (31% or more)

6. Have any of your friends' or family's farm operations ever been victims of theft, vandalism, or burglary?

☐ NO
☐ YES

7. Does your fear of being a victim of an agriculture-related crime change your typical daily or weekly activities?

☐ NO → **Skip to 9**
☐ YES

8. (If yes) How are your daily or weekly activities affected? (Check *all* that apply)

☐ A family member must now always be present on the farm or ranch property.
☐ I worry more that the farm or ranch or my family will be a victim of crime than I ever did before.
☐ I don't trust any strangers, particularly ones near my property.
☐ I constantly keep watch for potential crime.
☐ I rarely or never take vacations because of the need to keep watch over the property.
☐ Other _____

In the next series of questions, you will be asked about eight different types of agricultural crime that may have occurred in the past 12 months (Oct. 2003 – Sept. 2004). Please answer *all* parts of each question.

9. In the past 12 months (Oct. 2003 – Sept. 2004), were any *tools or small farm equipment* stolen? (Please include garden equipment, hand or power tools, hoses, loading chutes, chain saws, etc.)

☐ NO → **Skip to 10**
☐ YES

9a. If yes, please complete all parts of this table.

Number of tool or equipment thefts last year?	Total value of all tool or equipment thefts last year?	How many of these incidents were reported to local law enforcement?	Who were the suspects?
_____ # of thefts	$ _____	_____ # of reports	□ Unknown □ Family □ Employee □ Friend □ Employee's kin/peers □ Neighbor □ Other _____

9b. Please provide details about the 2 costliest incidents of *tool/equipment* theft in the past 12 months.

Type of tools/equipment?	Value of tools/equipment?	Filed claim to your insurance?	Reported to law enforcement?	Item(s) ever recovered or found?	Month of theft?
	$ _____	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	_____
	$ _____	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	_____

CONTINUE TO NEXT PAGE →

10. In the past 12 months (Oct. 2003 – Sept. 2004), have you had any *tractors* stolen?

☐ NO → **Skip to 11**
☐ YES

10a. If yes, please complete all parts of this table.

Number of tractor thefts last year?	Number & total value of all tractors stolen last year?	How many of these incidents were reported to local law enforcement?	Who were the suspects?
_____ # of thefts	# _____ stolen $ _____ total value	_____ # of reports	□ Unknown □ Family □ Employee □ Friend □ Employee's kin/peers □ Neighbor □ Other _____

10b. Please provide details about the 2 costliest incidents of *tractor* theft in the past 12 months.

Brand/model of tractors?	Value of tractors?	Filed claim to your insurance?	Reported to law enforcement?	Item(s) ever recovered or found?	Month of theft?
	$ _____	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	_____
	$ _____	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	_____

11. In the past 12 months, was any *large (non-tractor) farm equipment* stolen? (Please include water pumps, combines, plows, wagons, etc.)

☐ NO → **Skip to 12**
☐ YES

11a. If yes, please complete all parts of this table.

Number of large equipment thefts last year?	Total value of all large equipment thefts last year?	How many of these incidents were reported to local law enforcement?	Who were the suspects?
_____ # of thefts	$ _____	_____ # of reports	□ Unknown □ Family □ Employee □ Friend □ Employee's kin/peers □ Neighbor □ Other _____

11b. Please provide details about the 2 costliest incidents of *large equipment* theft in the past 12 months.

Type of large equipment?	Value of large equipment?	Filed claim to your insurance?	Reported to law enforcement?	Item(s) ever recovered or found?	Month of theft?
	$ _____	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	_____
	$ _____	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	_____

12. In the past 12 months, have you had any *livestock or poultry* stolen?

☐ NO → **Skip to 13**
☐ YES

12a. If yes, please complete all parts of this table.

Number of livestock/poultry thefts last year?	Total value of all livestock/poultry stolen last year?	How many of these incidents were reported to local law enforcement?	Who were the suspects?
_____ # of thefts	$ _____	_____ # of reports	□ Unknown □ Family □ Employee □ Friend □ Employee's kin/peers □ Neighbor □ Other _____

12b. Please provide details about the 2 costliest incidents of *livestock/poultry* theft in the past 12 months.

Type of livestock/poultry?	Value of livestock/poultry?	Filed claim to your insurance?	Reported to law enforcement?	Item(s) ever recovered or found?	Month of theft?
	$ _____	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	_____
	$ _____	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	_____

CONTINUE TO NEXT PAGE →

13. In the past 12 months (Oct. 2003 – Sept. 2004), have you had any *chemicals*, such as insecticide, herbicide, fungicide, commercial fertilizer, or *fuel* stolen?

☐ NO → **Skip to 14**
☐ YES

13a. If yes, please complete all parts of this table.

Number of chemical or fuel thefts last year?	Total value of all chemical or fuel thefts last year?	How many of these incidents were reported to local law enforcement?	Who were the suspects?
_____ # of thefts	$ _____	_____ # of reports	□ Unknown □ Family □ Employee □ Friend □ Employee's kin/peers □ Neighbor □ Other _____

13b. Please provide details about the 2 costliest incidents of *chemical/fuel* theft in the past 12 months.

Type of chemical/fuel?	Value of chemical/fuel?	Filed claim to your insurance?	Reported to law enforcement?	Item(s) ever recovered or found?	Month of theft?
	$ _____	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	_____
	$ _____	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	_____

14. In the past 12 months, have you had any *grain, feed, seed, fruit, or vegetables* stolen?

☐ NO (OR UNSURE) → **Skip to 15**
☐ YES

14a. If yes, please complete all parts of this table.

Number of crop thefts last year?	Total value of all crop thefts last year?	How many of these incidents were reported to local law enforcement?	Who were the suspects?
_____ # of thefts	$ _____	_____ # of reports	□ Unknown □ Family □ Employee □ Friend □ Employee's kin/peers □ Neighbor □ Other _____

14b. Please provide details about the 2 costliest incidents of *crop* theft in the past 12 months.

Type of crop?	Value of commodities?	Filed claim to your insurance?	Reported to law enforcement?	Item(s) ever recovered or found?	Month of theft?
	$ _____	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	_____
	$ _____	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	_____

15. In the past 12 months, did anyone *vandalize* any machinery, fences, fields, or other farm property or *dump* any trash (e.g., used cars, trash, dead livestock)?

☐ NO → **Skip to 16**
☐ YES

15a. If yes, please complete all parts of this table.

Number of vandalism/dumps acts last year?	Total cost of all vandalism/dumps last year?	How many of these incidents were reported to local law enforcement?	Who were the suspects?
_____ # of acts	$ _____	_____ # of reports	□ Unknown □ Family □ Employee □ Friend □ Employee's kin/peers □ Neighbor □ Other _____

15b. Please provide details about the 2 costliest incidents of *vandalism/dumping* in the past 12 months.

Type of vandalism/dump?	Cost of vandalism/dump?	Filed claim to your insurance?	Reported to law enforcement?	Month of incident?
	$ _____	☐ NO ☐ YES	☐ NO ☐ YES	_____
	$ _____	☐ NO ☐ YES	☐ NO ☐ YES	_____

CONTINUE TO NEXT PAGE →

16. In the past 12 months (Oct. 2003 – Sept. 2004), did anyone *burglarize* your *farm buildings*?

☐ NO → **Skip to 17**
☐ YES

16a. If yes, please complete all parts of this table.

Number of burglaries last year?	Total value of all burglaries last year?	How many of these incidents were reported to local law enforcement?	Who were the suspects?
_____ # of burglaries	$ _____	_____ # of reports	□ Unknown □ Family □ Employee □ Friend □ Employee's kin/peers □ Neighbor □ Other _____

16b. Please provide details about the 2 costliest incidents of *burglary* in the past 12 months.

Type of building burglarized	Value of stolen goods?	Filed claim to your insurance?	Reported to law enforcement?	Item(s) ever recovered or found?	Month of burglary?
	$ _____	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	_____
	$ _____	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	_____

17. In the past 12 months, did you purchase any agricultural goods (e.g., equipment, chemicals, livestock, crops) worth over $1,000 from anyone you later believed was selling stolen goods?

☐ NO → **Skip to 18**
☐ YES

17a. (If yes) How many separate times has this type of misrepresentation occurred? _____ times

17b. How many of these incidents did you report to local law enforcement? _____ incidents

17c. In how many of these incidents were the people caught? _____ (**I don't know** _____)

REPORTING CRIME ON YOUR FARM OR RANCH

18. If you indicated in any question above that you were a victim of crime but did *not* report the crime to law enforcement, what was your primary reason for *not* reporting? (Check *all* that apply)

☐ Not applicable (I report all crimes).
☐ The crime was not serious enough.
☐ I didn't believe law enforcement would have done anything about the crime.
☐ I didn't have proof that a crime occurred.
☐ For insurance reasons. (Example: I thought my insurance premiums would increase.)
☐ Other _____

19. If you indicated above that you *did* report a crime to law enforcement in the last year, what was your primary reason for reporting? (Check *all* that apply)

☐ Not applicable (I never report crimes).
☐ The seriousness of the crime.
☐ I wanted to stop crime from occurring again.
☐ I wanted the offender to be caught.
☐ For insurance purposes. (Example: I needed to report incident to police to file an insurance claim.)
☐ Other _____

20. If your operation was victim to a theft of any kind, how much would the value of the loss have to be before you would report it to law enforcement? (Please check *one*)

☐ $1 - $99
☐ $100 - $299
☐ $300 - $599
☐ $600 - $999
☐ $1,000 - $2,999
☐ $3,000 - $5,999
☐ $6,000 - $9,999
☐ $10,000 or more

CONTINUE TO NEXT PAGE →

21. What would your neighbors likely do if they suspected someone was trying to sell them stolen goods, such as produce or equipment? (Please check *one*)

☐ Buy the goods, and say nothing.
☐ Buy the goods, and then report the suspect to authorities.
☐ Not buy the goods, and not report the suspect to authorities.
☐ Not buy the goods, and then report the suspect to authorities.

PROTECTION OF FARM OR RANCH ASSETS

22. Did you attend any meetings or workshops about agricultural crime in the past 12 months?

☐ NO
☐ YES

23. Where do you get information about agricultural crime and its prevention? (Check *all* that apply)

☐ Farm magazines
☐ Friends, neighbors, or relatives
☐ County extension agent
☐ Newspaper, television, or radio
☐ Local law enforcement
☐ Farm Bureau
☐ Other civic or community organizations
☐ California Department of Agriculture
☐ Hardware or other retail store
☐ Locksmith
☐ Farm commodity organizations
☐ Other source _____

24. Do you use Owner-Applied Numbers (OANs) or other permanent markings to identify your farm equipment?

☐ NO → **Skip to 25**
☐ YES

24a. (If yes) In what month/year did you begin using OANs or permanent markings? ___ Month ___ Year

24b. What percentage of your equipment is marked with OANs or other identifiers? (Please circle *one*)

% 0 10 20 30 40 50 60 70 80 90 100 %

24c. Why did you start marking your equipment? (Check *all* that apply)

☐ I heard of the OAN marking program.
☐ I had a theft and wanted to protect the operation from future theft.
☐ Law enforcement encouraged me to do so.
☐ Other _____

25. Do you use surveillance equipment (e.g., video cameras, security alarms, motion detectors) for security purposes on your farm or ranch?

☐ NO → **Skip to 26**
☐ YES

25a. (If yes) In what month/year did you first begin using surveillance equipment? ___ Month ___ Year

25b. What types of surveillance equipment do you use? (Check *all* that apply)

☐ Video cameras
☐ Motion detectors or sensors
☐ Security alarms
☐ Closed circuit television
☐ Other _____

CONTINUE TO NEXT PAGE →

25c. Compared to years prior, how has your use of surveillance equipment changed? (Check *one*)

- ☐ This is my first year using surveillance equipment.
- ☐ I used surveillance equipment more this past year.
- ☐ I used surveillance equipment less this past year.
- ☐ My use of surveillance equipment remained the same as in prior years.

25d. Why did you start using surveillance equipment? (Check *all* that apply)

- ☐ I heard of loaner equipment available from local law enforcement.
- ☐ I had a theft and wanted to protect the operation from future theft.
- ☐ Law enforcement encouraged me to.
- ☐ Other _____

25e. Did law enforcement deploy surveillance technology on your property during the past year?

- ☐ NO
- ☐ YES

26. In the past 3 years, how much have you spent on installations and maintenance of farm security measures to protect against crimes of any kind in your operation?

- ☐ $0
- ☐ $1 - $99
- ☐ $100 - $999
- ☐ $1,000 - $2,999
- ☐ $3,000 - $6,999
- ☐ $7,000 or more (please specify how much _____)

27. For each of the following, what percentage (%) is locked away each night? (Please check the range that applies to each item.)

	0-20%	21-40%	41-60%	61-80%	81 100%	Not Applicable
Chemicals/fertilizer						
Tractors						
Tools/small equipment						
Large equipment/machinery						
Livestock/poultry						
Harvested crops						

28. Approximately how much of your crops or livestock *cannot* be seen from public roads due to a barrier (e.g., trees, fences, buildings, hills) blocking the view of your crops or livestock? (Please circle *one*)

% 0 10 20 30 40 50 60 70 80 90 100 %

29. What steps have you taken to secure buildings in secluded areas? (Check *all* that apply)

- ☐ None
- ☐ Put up fencing
- ☐ Put up lighting
- ☐ Use surveillance equipment
- ☐ Other _____

CONTINUE TO NEXT PAGE →

30. In the past 12 months, have you used any of the following measures to secure your farm or ranch property against theft or other crimes? (Check *all* that apply)

	Yes	No	N/A	
1.	☐	☐	☐	Have neighbors watch farm when out of town
2.	☐	☐	☐	Use brands, ear tags, notches, or other means to identify livestock
3.	☐	☐	☐	Have insurance on farm machinery
4.	☐	☐	☐	Keep record of all serial numbers on large farm machinery
5.	☐	☐	☐	Leave farm machinery overnight in fields out of sight from house
6.	☐	☐	☐	Operation has own security guards
7.	☐	☐	☐	Keep doors on farm buildings locked
8.	☐	☐	☐	Lock up pesticides, other chemical applications, or veterinary items
9.	☐	☐	☐	Paint or mark saplings, crops, or other agricultural products
10.	☐	☐	☐	Keep windows on farm buildings locked
11.	☐	☐	☐	Have theft insurance on crops or livestock
12.	☐	☐	☐	Inform sheriff when away from farm for several days
13.	☐	☐	☐	Tattoo bales, sacks, or crates used for crops
14.	☐	☐	☐	Mix identification confetti with grains
15.	☐	☐	☐	Farm buildings are visible to neighbors
16.	☐	☐	☐	Locks on fuel storage tanks
17.	☐	☐	☐	Outside lights attached to barns and/or other important farm buildings
18.	☐	☐	☐	Remove keys from all vehicles, including tractors
19.	☐	☐	☐	“No trespassing” or other warning signs on farm property
20.	☐	☐	☐	Locks on farm gates
21.	☐	☐	☐	Decals indicating farm equipment and buildings are protected by security
22.	☐	☐	☐	Locks on farm machinery
23.	☐	☐	☐	Bars or grills on storage building windows
24.	☐	☐	☐	Alarm systems in farm buildings
25.	☐	☐	☐	Use security cameras
26.	☐	☐	☐	Have home insurance (fire and/or theft)
27.	☐	☐	☐	Leave house lights on at night or when away
28.	☐	☐	☐	Have watchdog, even if family pet
29.	☐	☐	☐	Have pistol, rifle, or shotgun on premises, even if for sport
30.	☐	☐	☐	Have geese or guineas for noise

ABOUT LAW ENFORCEMENT IN YOUR COUNTY

31. In the past year, have you been contacted by your county Sheriff’s Agricultural Crime Unit in person, by mail, or by phone?

☐ NO
☐ YES

32. How would you rate the overall quality of farm protection provided by your county Sheriff’s Agricultural Crime Unit? (Please circle *one* choice, where “1” is very poor and “10” is very good.)

1	2	3	4	5	6	7	8	9	10	N/A
Very Poor	←								Very Good	Not Applicable

CONTINUE TO NEXT PAGE →

33. If you indicated earlier that you <u>reported a crime</u> to local law enforcement (e.g., the county Sheriff's Agricultural Crimes Unit), how would you rate their overall interest in assisting you? (Circle *one* choice, where "1" is very poor and "10" is very good. If you did not report a crime, please go to question 34.)

1	2	3	4	5	6	7	8	9	10	N/A
Not very Interested	◄								Very Interested	Not Applicable

34. Has your local Agricultural Crime Unit's interest in helping you changed in the past year? Responsiveness has . . .

☐ . . . improved.
☐ . . . become worse.
☐ . . . remained the same.

ABOUT YOUR FARM OR RANCH OPERATION

35. Approximately how many acres did you use for your operation in the past 12 months? Please include all land owned, rented or leased, or used through other arrangements. _____ acres

36. Which best describes the land you operate?

☐ One contiguous tract of land
☐ Two or more adjoining tracts
☐ Two or more non-adjoining (scattered) tracts

37. Check which best applies to the location of the main farmhouse or office building in this operation.

☐ Located at an intersection of two roads.
☐ Located between two intersections.
☐ Located near the center of the property.
☐ Located at a dead-end or cul-de-sac.
☐ Other _____

38. What best describes your farmland?

☐ Flat
☐ Hilly
☐ Combination flat and hilly

39. What best describes the cover (trees, shrubs, etc.) on your farm?

☐ Low
☐ Medium
☐ Dense

40. What percentage of your farm or ranch buildings are visible from the house in which you or other farm residents live? (Please circle *one*)

%	0	10	20	30	40	50	60	70	80	90	100	%
	◄											

41. What percentage of your farm buildings are located within easy access of a paved public road or highway? (Please circle *one*)

%	0	10	20	30	40	50	60	70	80	90	100	%
	◄											

CONTINUE TO NEXT PAGE →

42. What percentage of your main property's perimeter borders county or state highways? (Please circle *one*)

% 0 10 20 30 40 50 60 70 80 90 100 %

43. What best describes your farm operation? (Check *all* that apply)

☐ This is a *family or individual* operation.

☐ This is a *partnership* operation (include family partnerships).
→ If so, is this partnership registered under state law? ___ NO ___ YES

☐ This operation is *incorporated* under state law.
→ If so, is this a family-held corporation? ___ NO ___ YES
Are there more than 10 stockholders? ___ NO ___ YES

☐ This is *another type of operation* (estate or trust, prison farm, grazing association, American Indian Reservation, etc.). Please specify: _____

44. Rank the following agricultural products in terms of the contribution of each to this operation's average annual gross income, where "1" is the largest and "6" is the smallest. (Skip those items that are not produced by your operation.)

___ Vegetables
___ Field crops (alfalfa, grain, soy, etc.)
___ Fruit and nuts
___ Nursery or greenhouse products
___ Dairy
___ Cattle and calves

45. Do you work full time for this operation?

☐ YES → **Skip to 46**
☐ NO

45a. (If not) What is your primary occupation? _____

46. In the past year, was the total market value of all the operation's agricultural products at least $1,000?

☐ YES → **If so, what was the approximate total market value? $** _____
☐ NO

47. Please indicate the total number of *each* type of machine in this operation during the past year.

Tractors (less than 40 horsepower) _____
Tractors (41 – 99 horsepower) _____
Tractors (100 or more horsepower) _____
Grain and bean combine, self-propelled _____
Cotton picker and stripper, self-propelled _____
Forage harvester, self-propelled _____
Hay baler _____

48. What is the approximate total market value of ALL machinery, equipment, and implements that were used in this operation in the past year? $ _____

49. What is the approximate current market value of all land and buildings used for this operation?
$ _____

CONTINUE TO NEXT PAGE →

50. How many hired farm or ranch workers, including paid family members and office workers, did your farm or ranch operation support in the past year (exclude contract workers)? _____ # of paid workers

50a. How many are seasonal or migrant workers? _____ # of seasonal or migrant workers

50b. How many are part-time (less than 150 days)? _____ # of part-time workers

51. In what year were you born? _____

52. Please circle your gender: Male Female

53. In your view, which groups or populations are most responsible for the theft of tractors, chemicals, equipment, livestock, or commodities? Please rank the following possibilities from 1 to 8, where "1" is most responsible and "8" is least responsible.

___ Other farmers
___ Family or kin of farmers
___ Neighbors of farmers
___ Organized theft rings
___ Illicit drug ring
___ Employees
___ Legal migrants
___ Undocumented or illegal residents
___ Other (please specify) _____

54. We are interested in who purchases stolen agricultural products. (A) Please review the groups below and circle how likely each is to buy stolen goods, where "1" is very likely and "5" is very unlikely. (B) Then indicate whether you believe each group is likely to have purchased stolen goods *knowingly*.

How likely is each of the following groups to buy stolen goods?	Very likely				Very unlikely	Likely to have purchased stolen goods *knowingly*?	
Small businesses and markets	1	2	3	4	5	☐ YES	☐ NO
Other farmers	1	2	3	4	5	☐ YES	☐ NO
Commercial distributors	1	2	3	4	5	☐ YES	☐ NO
People and businesses in other countries	1	2	3	4	5	☐ YES	☐ NO
Producers of illicit drugs	1	2	3	4	5	☐ YES	☐ NO
Other (please specify) _____	1	2	3	4	5	☐ YES	☐ NO

55. Are you of Hispanic or Latino origin or background, such as Mexican, Cuban, or Puerto Rican?

☐ NO
☐ YES → **Please specify** _____

55a. Please indicate what best describes you. (Check *all* that apply)

☐ White
☐ Black or African American
☐ American Indian or Alaska Native, specify tribe _____
☐ Native Hawaiian or Pacific Islander
☐ Asian, specify country _____
☐ Other, please specify _____

55b. Please list your ancestry (Examples: Dutch, Portuguese, Irish, etc.): _____

THANK YOU FOR YOUR TIME IN FILLING OUT THIS SURVEY!

Appendix B. 2005 Survey Instrument

AGRICULTURAL CRIME SURVEY

INSTRUCTIONS: This is a survey designed by the Urban Institute with the advice of Central Valley and Central Coast farmers, Farm Bureau staff, and Agricultural Commissioners to learn about agricultural crime, how it affects you, and how you combat it. We know agriculture is vital to the nation and that the loss of agricultural products, supplies, and equipment can harm your business. We hope that greater understanding of agricultural crime can help inform future crime prevention efforts in your community.

This survey should only take 15 minutes to complete, and all responses will be kept *anonymous and confidential*. Any reference to your "operation" refers to land you operated for agricultural purposes at any time in the past two years. If you make decisions for more than one operation, provide information only for the largest. Many questions ask you to provide information separately for the most recent year, 2005, and then for 2004. Please ensure that your responses are accurate for *each* year and complete *all* questions regardless of how much crime you experienced in these years.

When you are done, please return the completed survey using the enclosed self-addressed, stamped envelope or send it by fax (202-296-2252). Your participation, while voluntary, is critical to ensuring the accuracy and usefulness of the results. If you have questions or concerns about the survey, please contact Michelle Scott (202-261-5230; mscott@urban.org). ***Thank you for being an important part of this project.***

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1. Are you a farm or ranch owner, or operation manager (or spouse of owner or manager), who engaged in any farming or ranching in the past 12 months?

☐ NO ⟶ Stop and return the survey in the envelope provided

☐ YES

2. Did you stop farming or ranching in the past 12 months?

☐ NO

☐ YES

3. Do you work full time for your operation?

☐ NO

☐ YES

4. Is your operation a *family or individual* operation?

☐ NO

☐ YES

5. Is your operation a *partnership* operation?

☐ NO

☐ YES

6. Is your operation *incorporated* under state law?

☐ NO

☐ YES

7. Is your operation *another type of operation*? For example, an estate or trust, prison farm, grazing association, or American Indian Reservation.

☐ NO

☐ YES ⟶ If so, please specify: _____

8. About how far is your main property from the nearest *large* town or city? _____ miles

8a. What is the name of the nearest *large* town or city? _____

CONTINUE TO NEXT PAGE →

Part 1: Crime on your farm and in your county

Throughout this survey, you will be asked about events that occurred in this past year, 2005, and in 2004. Please respond as accurately as you can, using holidays or other seasonal events to help your recall.

9. For 2005 and 2004, respectively, how many of your farming friends or family were victims of agriculture-related theft, vandalism, or burglary?

2005	2004
_____ #	_____ #

10. Thinking about 2005 and 2004, please recall any crime incidents (i.e., specific events involving theft or vandalism) that occurred on your operation and respond to *each* question for *each* year.

	2005				2004			
	Number of incidents?	Number reported to police?	Number recovered?	Value of losses ($)?	Number of incidents?	Number reported to police?	Number recovered?	Value of losses ($)?
Tools, Small Equipment (pump, saw, drill, welder, etc.)	_____ #	_____ #	_____ #	_____ $	_____ #	_____ #	_____ #	_____ $
Tractors	_____ #	_____ #	_____ #	_____ $	_____ #	_____ #	_____ #	_____ $
Large Equipment (vehicle, harvester, etc.)	_____ #	_____ #	_____ #	_____ $	_____ #	_____ #	_____ #	_____ $
Livestock or Poultry	_____ #	_____ #	_____ #	_____ $	_____ #	_____ #	_____ #	_____ $
Fuel or Chemicals (insecticide, herbicide, fungicide, fertilizer, etc.)	_____ #	_____ #	_____ #	_____ $	_____ #	_____ #	_____ #	_____ $
Fruit, Vegetables, Grain, Feed, or Seed	_____ #	_____ #	_____ #	_____ $	_____ #	_____ #	_____ #	_____ $
Burglary	_____ #	_____ #	_____ #	_____ $	_____ #	_____ #	_____ #	_____ $
Vandalism	_____ #	_____ #		_____ $	_____ #	_____ #		_____ $

CONTINUE TO NEXT PAGE →

11. We know farmers and ranchers face many challenges. Below, please assess the level of concern you have about each potential challenge, with "1" indicating the least concern and "5" the greatest concern.

	Least Concern				Greatest Concern	N/A
Water distribution	1	2	3	4	5	N/A
Real estate pressures	1	2	3	4	5	N/A
Fuel costs	1	2	3	4	5	N/A
Availability of necessary supplies	1	2	3	4	5	N/A
Taxes	1	2	3	4	5	N/A
Employee retention	1	2	3	4	5	N/A
Crime victimization	1	2	3	4	5	N/A
Drought	1	2	3	4	5	N/A
Economy	1	2	3	4	5	N/A
Disease among cattle/livestock/poultry	1	2	3	4	5	N/A
Other, please specify: _____	1	2	3	4	5	N/A

Part 2. Law enforcement in your county

For questions 12 – 15 below, please provide answers for 2005 and 2004, respectively.

	2005	2004
12. How would you rate the quality of protection provided b the local law enforcement? ***Circle a response for <u>each</u> year.***	1- Very poor 2- Poor 3- Average 4- Good 5- Very good	1- Very poor 2- Poor 3- Average 4- Good 5- Very good
13. How many times did local law enforcement officers stop by your farm without being requested to do so? ***Provide a number for <u>each</u> year.***	_____ # times	_____ # times
14. To what extent did the local sheriff's office help you (e.g., by investigating crimes or marking equipment)? ***Circle a response for <u>each</u> year.***	1- Not at all 2- Very little 3- Some 4- Very much	1- Not at all 2- Very little 3- Some 4- Very much
15. To what extent would you agree with the following statement: "When called about a crime problem, local law enforcement investigated agricultural crime incidents in my county very thoroughly." ***Circle a response for <u>each</u> year.***	1- Strongly agree 2- Agree 3- Disagree 4- Strongly disagree	1- Strongly agree 2- Agree 3- Disagree 4- Strongly disagree

CONTINUE TO NEXT PAGE →

16. What priority should law enforcement give to the following agricultural crime prevention strategies?

	Low Priority				High Priority
Assist farmers with applying identifying markings or Owner Applied Numbers (OANs) to agricultural property	1	2	3	4	5
Meet with farmers about how to secure property	1	2	3	4	5
Encourage farmers to share monitoring or surveillance equipment cost and use	1	2	3	4	5
Increase patrols of agricultural areas by local law enforcement	1	2	3	4	5
E-mail farmers about where agricultural crime is happening	1	2	3	4	5
Be more responsive when called to an agricultural crime scene	1	2	3	4	5
Other (please list) _____	1	2	3	4	5

17. Do you think your local law enforcement officers have adequate knowledge or understanding to deal with agricultural crimes on farms or ranches?

☐ No ☐ Yes

18. Do you think it is necessary for law enforcement officers working in rural areas to have special skills and training to deal with agricultural crime on farms or ranches?

☐ No ☐ Yes

19. For 2005 and 2004, respectively, describe the extent to which your fear of being a victim of agricultural crime affected each of the following. Check the box corresponding to your answer for *each* year.

	2005				2004			
	Strongly Agree	Agree	Disagree	Strongly Disagree	Strongly Agree	Agree	Disagree	Strongly Disagree
I rarely took vacations because I needed to watch over the property.	☐	☐	☐	☐	☐	☐	☐	☐
I hired security or had someone watch the property if I went away.	☐	☐	☐	☐	☐	☐	☐	☐
I changed my daily routines regularly to be less predictable.	☐	☐	☐	☐	☐	☐	☐	☐
I made off-farm social or business visits during daytime hours only.	☐	☐	☐	☐	☐	☐	☐	☐
I considered leaving farming/ranching because of the cost of crime.	☐	☐	☐	☐	☐	☐	☐	☐
I took out extra insurance to cover losses from agricultural crime.	☐	☐	☐	☐	☐	☐	☐	☐
I spent less time on daily operation or production activities and more time fighting crime.	☐	☐	☐	☐	☐	☐	☐	☐
I worried that the operation would be a target of agriculture crime.	☐	☐	☐	☐	☐	☐	☐	☐
I started carrying a concealed weapon for protection.	☐	☐	☐	☐	☐	☐	☐	☐

20. Agricultural crime can harm the quality of life among farmers. Thinking about your responses to the question above, please estimate how much you would want to be compensated (in dollars) in 2005 and 2004, respectively, because of the effect of agricultural crime on your quality of life.

	2005	2004
Dollars ($) for each year	_____	_____

CONTINUE TO NEXT PAGE →

Part 3. Information about agriculture crime

21. In each year (i.e., 2005 and 2004, respectively), how many meetings did you attend that were arranged to specifically address agricultural crime issues in your county?

	2005	2004
Number of meetings	_____	_____

22. In 2005, how often did you visit the Internet to learn how to fight agricultural crime? _____ # times

23. In 2005, how often did you visit the www.agcrime.net web site? _____ # times **(If 0 times, skip to #24)**

23a. If you visited www.agcrime.net at least once, how useful did the web site? Please check *one*.

- ☐ Not at all useful
- ☐ Somewhat useful
- ☐ Very useful

24. How would you prefer to receive information about preventing agricultural crime? Please check *one*.

- ☐ Through postal mail
- ☐ Through electronic mail (i.e., e-mail)
- ☐ During farm bureau or similar meetings
- ☐ Through individual meetings with local law enforcement
- ☐ Other, please specify _____

25. In each year, about how many people have you heard about—through the local media, TV, radio, or by word of mouth—who have been convicted of agricultural crimes in *your* county?

	2005	2004
Number of people convicted	_____	_____

26. How aggressive have the courts in *your* county been in convicting offenders of agricultural crimes?

	Not aggressive										Very aggressive
2005	0	1	2	3	4	5	6	7	8	9	10
2004	0	1	2	3	4	5	6	7	8	9	10

27. In your view, what are the reasons why farmers do not report agricultural crime? For *each* reason, please indicate whether you strongly agree, agree, disagree, or strongly disagree.

Farmers . . .	Strongly Agree	Agree	Disagree	Strongly Disagree
. . . believe that the crime is not serious enough.	1	2	3	4
. . . believe that law enforcement won't do anything.	1	2	3	4
. . . do not have enough proof that a crime occurred.	1	2	3	4
. . . do not want law enforcement on their property.	1	2	3	4
. . . are engaged in illegal acts that may be discovered.	1	2	3	4

CONTINUE TO NEXT PAGE →

Part 4. Safety and security on your property

Please remember that you are being asked about events that occurred in this past year, 2005, as well as those that occurred in 2004. Please respond as accurately as you can, using holidays or other seasonal events to help you remember.

28. For 2005 and 2004, respectively, about what percentage of your equipment was marked with Owner Applied Numbers (OANs) or other identifiers? Please circle a percent for <u>each</u> year.

2005	%	0	10	20	30	40	50	60	70	80	90	100	%
2004	%	0	10	20	30	40	50	60	70	80	90	100	%

29. Please indicate the extent to which you agree with the following statement:

"My use of OANs or other equipment, crop, and livestock identifiers was a direct result of encouragement by my local law enforcement."

☐ Strongly agree

☐ Agree

☐ Disagree

☐ Strongly disagree

☐ I do not use OANs

	2005	**2004**
30. For <u>each</u> year, did you use surveillance equipment (e.g., video cameras, security alarms, motion detectors) for security purposes on your farm or ranch?	☐ NO ☐ YES	☐ NO ☐ YES
31. For <u>each</u> year, how many times did local law enforcement approach you about using surveillance technology on your farm or ranch?	_____ # times	_____ # times
32. For <u>each</u> year, did local law enforcement actually deploy surveillance equipment on your farm at any time?	☐ NO ☐ YES	☐ NO ☐ YES
33. For <u>each</u> year, how much did you spend on insurance to protect against damage from fire or theft on your operation?	$_____	$_____
34. For <u>each</u> year, how much have you spent on installations and maintenance of the following specific farm security measures to protect against agricultural crime on your farm or ranch?		
Surveillance equipment (e.g., video cameras)	$_____	$_____
Alarm systems	$_____	$_____
Locks	$_____	$_____
Fences	$_____	$_____
Other, please specify: _____	$_____	$_____

CONTINUE TO NEXT PAGE →

35. For *each* year, indicate the extent to which you undertook the following to protect your property.

	2005					2004				
	Never	Rarely	Sometimes	Frequently	Always	Never	Rarely	Sometimes	Frequently	Always
Had neighbors watch farm/ranch when out.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Had home insurance (fire and/or theft).	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Left house lights on at night or when away.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Had watchdog, even if family pet.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Had pistol, rifle, or shotgun on premises, even if for sport.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Kept doors on buildings locked when not in use.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Locked up pesticides, chemicals, or veterinary items when not in use.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Locked windows on farm/ranch buildings at all times.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Locked fuel storage tanks.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Attached outside lights to barns and/or other important farm buildings.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

35a. Thinking specifically about the items above, on average how much time did you spend per week on crime prevention activities?

	2005	2004
Number of hours per week	_____	_____

35b. If you could be reimbursed for the crime prevention activities you marked above, how much (in dollars) would you be owed for an average week?

	2005	2004
Dollars ($) in average week	_____	_____

Part 5. You and your farm or ranch operation

36. Approximately how many acres did you use for your operation in the past 12 months? Please include all land owned, rented or leased, or used through other arrangements.

_____ acres

37. Check which best applies to the location of the main farmhouse or office building in your operation.

☐ Located at an intersection of two roads.

☐ Located between two intersections.

☐ Located near the center of the property.

☐ Located at a dead-end or cul-de-sac.

☐ Other _____

CONTINUE TO NEXT PAGE →

38. What best describes your farmland? Check *one*.

☐ Flat
☐ Hilly
☐ Combination flat and hilly

39. What best describes the cover (trees, shrubs, etc.) on your farm? Check *one*.

☐ Low
☐ Medium
☐ Dense

40. What percentage of your operation's buildings are visible from the house in which you or other residents live?	%	0	10	20	30	40	50	60	70	80	90	100	%
41. What percentage of your main property's perimeter borders county or state highways?	%	0	10	20	30	40	50	60	70	80	90	100	%
42. What percentage of your main property's perimeter borders a public, paved road?	%	0	10	20	30	40	50	60	70	80	90	100	%
43. What percentage of your crops or livestock cannot be seen from public roads due to barriers (e.g., trees, fences, buildings, hills)?	%	0	10	20	30	40	50	60	70	80	90	100	%

44. On average, what agricultural product is your operation's greatest annual revenue generator? *Please mark only one*.

☐ Vegetables
☐ Field crops (alfalfa, grain, soy, etc.)
☐ Fruit and nuts
☐ Nursery or greenhouse products
☐ Dairy
☐ Cattle and calves

45. In the past year, did your operation generate at least $1,000 in revenue (i.e., the total market value of agricultural products sold)?

☐ NO
☐ YES → If so, what was the approximate revenue? $ _____

46. What is the approximate market value of all machinery, equipment, and implements that were used in your operation in the past year?

$ _____

47. What is the approximate current market value of all land and buildings used for your operation?

$ _____

48. How many paid workers—including paid family members, seasonal or migrant workers, and office workers—did your operation support in 2005 (exclude contract workers)? _____ # paid workers

48a. What was the average daily wage for your workers? $_____ per day

49. In what year were you born? 19 __ __

Thank you!
Please return this survey in the self-addressed, stamped envelope provided.

Appendix C. ACTION County Profiles

Fresno County: A Profile

Population

Total 2000 Population:	799,407
Percent Non-Hispanic White:	39.7
Percent African American:	5.3
Percent Hispanic:	44.0
Median Age (years):	29.9
Population Density (per sq. mile):	134.1
Land Area (sq. miles)	5,962.7

Agriculture

County land in farms (acres):	1,881,418
Number of farms in 1997:	6,592
Median Farm Size (acres):	39
Average Farm Size (acres):	285
Principle Occupation of farming (full time):	4,108
Market value of agricultural products sold ($):	2,772,785,000

Crop sales account for 76 % of market value.
Livestock sales account for 24 % of market value.

Leading 4 Agricultural Commodities in 2002 (according to gross value of products):

- Grapes
- Cotton
- Poultry
- Tomatoes

Crime

Property crimes reported for the Federal Bureau of Investigation's Annual Uniform Crime Report

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
PROPERTY CRIMES*	29,377	28,950	27,441	22,379	19,543	15,672	13,511	15,076	17,663	17,299
BURGLARY	13,385	12,312	11,904	10,340	9,973	8,079	7,086	7,409	8,357	7,662
M.V. THEFT	15,992	16,638	15,537	12,039	9,570	7,593	6,425	7,667	9,306	9,637
LARCENY-THEFT	23,027	27,280	29,176	28,116	27,077	24,547	22,991	27,134	26,801	27,441
ARSON	752	1,033	1,437	1,230	1,222	1,133	1,070	961	1,128	1,216

Reported Total Loss of Agricultural Equipment for 2003: $2,186,462

Sources: U.S. Census Bureau, U.S. Department of Agriculture, U.S. Department of Justice-Federal Bureau of Investigations.

Kern County: A Profile

Population

Total 2000 Population:	661,645
Percent Non-Hispanic White:	49.5
Percent African American:	6.0
Percent Hispanic:	38.4
Median Age (years):	30.6
Population Density (per sq. mile):	81.3
Land Area (sq. miles)	8,141.0

Agriculture

(1997)

County land in farms (acres):	2,851,462
Number of farms in 1997:	1,997
Median Farm Size (acres):	155
Average Farm Size (acres):	1,428
Principle Occupation of farming (full time):	1,274
Market value of agricultural products sold ($):	1,968,513,000

Crop sales account for 91% of market value.
Livestock sales account for 9% of market value.

Leading 4 Agricultural Commodities in 2002 (according to gross value of products):

- grapes
- all citrus
- all carrots
- almonds & by products

Crime

Property crimes reported for the Federal Bureau of Investigation's Annual Uniform Crime Report

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
PROPERTY CRIMES*	13,410	13,381	12,144	10,833	11,161	10,812	8,549	8,547	8,699	9,935
BURGLARY	9,781	9,083	8,127	7,932	7,875	7,585	6,073	5,909	5,926	6,515
M.V. THEFT	3,629	4,298	4,017	2,901	3,286	3,227	2,476	2,638	2,773	3,420
LARCENY-THEFT	19,709	19,796	18,037	16,940	17,629	15,994	14,412	13,773	15,221	15,842
ARSON	1,354	1,257	1,370	1,502	1,249	1,234	1,235	1,157	773	646

Reported Total Loss of Agricultural Equipment for 2003: $2,878,046

Sources: U.S. Census Bureau, U.S. Department of Agriculture, U.S. Department of Justice-Federal Bureau of Investigations.

Kings County: A Profile

Population

Total 2000 Population:	129,461
Percent Non-Hispanic White:	41.6
Percent African American:	8.3
Percent Hispanic:	43.6
Median Age (years):	30.2
Population Density (per sq. mile):	93.1
Land Area (sq. miles)	1,391.0

Agriculture

(1997)	
County land in farms (acres):	656,968
Number of farms in 1997:	1,079
Median Farm Size (acres):	45
Average Farm Size (acres):	609
Principle Occupation of farming (full time):	671
Market value of agricultural products sold ($):	693,677,000

Crop sales account for 53% of market value.
Livestock sales account for 47% of market value.

Leading 4 Agricultural Commodities in 2002 (according to gross value of products):

- milk
- cotton
- cattle/calves
- hay/alfalfa

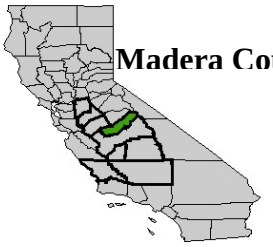
Crime

Property crimes reported for the Federal Bureau of Investigation's Annual Uniform Crime Report

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
PROPERTY CRIMES*	1,395	1,486	1,596	1,470	1,606	1,195	1,169	1,115	1,129	1,294
BURGLARY	1,009	981	1,101	966	1,118	817	783	748	754	792
M.V. THEFT	386	505	495	504	488	378	386	367	375	502
LARCENY-THEFT	2,498	2,427	2,442	2,715	2,625	2,415	2,016	1,697	1,914	2,198
ARSON	39	34	35	59	37	20	14	27	20	44

Reported Total Loss of Agricultural Equipment for 2003: $289,084

Sources: U.S. Census Bureau, U.S. Department of Agriculture, U.S. Department of Justice-Federal Bureau of Investigations.



Madera County: A Profile

Population

Total 2000 Population:	123,109
Percent Non-Hispanic White:	46.6
Percent African American:	4.1
Percent Hispanic:	44.3
Median Age (years):	32.7
Population Density (per sq. mile):	57.6
Land Area (sq. miles)	2,135.8

Agriculture

(1997)	
County land in farms (acres):	749,465
Number of farms in 1997:	1,673
Median Farm Size (acres):	60
Average Farm Size (acres):	383
Principle Occupation of farming (full time):	977
Market value of agricultural products sold ($):	627,210,000

Crop sales account for 81% of market value.
Livestock sales account for 19% of market value.

Leading 4 Agricultural Commodities in 2002 (according to gross value of products):

- grapes
- almonds
- milk
- pistachios

Crime

Property crimes reported for the Federal Bureau of Investigation's Annual Uniform Crime Report

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
PROPERTY CRIMES*	2,317	2,506	2,897	1,975	2,340	2,019	1,720	1,696	1,925	1,855
BURGLARY	1,683	1,610	2,176	1,246	1,470	1,263	1,082	1,087	1,219	1,137
M.V. THEFT	634	896	721	729	870	756	638	609	706	718
LARCENY-THEFT	2,326	2,433	2,370	2,543	2,414	2,279	1,994	2,096	2,615	2,434
ARSON	74	79	94	100	140	128	32	24	24	41

Reported Total Loss of Agricultural Equipment for 2003: $ 727,533

Sources: U.S. Census Bureau, U.S. Department of Agriculture, U.S. Department of Justice-Federal Bureau of Investigations.

Merced County: A Profile

Population

Total 2000 Population:	210,554
Percent Non-Hispanic White:	40.6
Percent African American:	3.8
Percent Hispanic:	45.3
Median Age (years):	29.0
Population Density (per sq. mile):	109.6
Land Area (sq. miles)	1,928.7

Agriculture

(1997)	
County land in farms (acres):	881,696
Number of farms in 1997:	2,831
Median Farm Size (acres):	42
Average Farm Size (acres):	311
Principle Occupation of farming (full time):	1,752
Market value of agricultural products sold ($):	1,273,475,000

Crop sales account for 45% of market value.
Livestock sales account for 55% of market value.

Leading 4 Agricultural Commodities in 2002 (according to gross value of products):

- milk
- chickens
- almonds
- cattle/calves

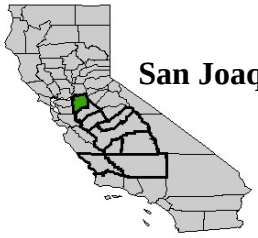
Crime

Property crimes reported for the Federal Bureau of Investigation's Annual Uniform Crime Report

	1993	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
PROPERTY CRIMES*	4,130	4,432	4,129	3,970	4,107	3,786	3,158	2,951	3,060	4,025
BURGLARY	3,075	3,063	3,031	2,922	3,050	2,858	2,437	2,169	2,060	2,702
M.V. THEFT	1,055	1,369	1,098	1,048	1,057	928	721	782	1,000	1,323
LARCENY-THEFT	5,645	5,168	5,567	5,582	5,688	4,977	4,717	4,735	5,054	5,707
ARSON	72	58	48	189	87	80	88	63	75	82

Reported Total Loss of Agricultural Equipment for 2003: $751,505

Sources: U.S. Census Bureau, U.S. Department of Agriculture, U.S. Department of Justice-Federal Bureau of Investigations.



San Joaquin County: A Profile

Population

Total 2000 Population:	563,598
Percent Non-Hispanic White:	47.4
Percent African American:	6.7
Percent Hispanic:	30.5
Median Age (years):	31.9
Population Density (per sq. mile):	402.8
Land Area (sq. miles)	1,399.3

Agriculture

(1997)	
County land in farms (acres):	808,838
Number of farms in 1997:	3,862
Median Farm Size (acres):	30
Average Farm Size (acres):	209
Principle Occupation of farming (full time):	2,289
Market value of agricultural products sold ($):	1,179,706,000

Crop sales account for 73% of market value.
Livestock sales account for 27% of market value.

Leading 4 Agricultural Commodities in 2002 (according to gross value of products):

- milk, all
- grapes, all
- tomatoes, all
- almond meats

Crime

Property crimes reported for the Federal Bureau of Investigation's Annual Uniform Crime Report

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
PROPERTY CRIMES*	15,615	15,289	13,031	11,113	10,912	9,773	8,587	8,424	10,416	12,074
BURGLARY	9,948	8,778	7,489	6,254	6,264	5,956	5,009	5,140	5,670	6,110
M.V. THEFT	5,667	6,511	5,542	4,859	4,648	3,817	3,578	3,284	4,746	5,964
LARCENY-THEFT	22,256	21,184	19,952	18,363	18,781	17,990	16,816	16,615	18,972	20,329
ARSON	269	321	247	253	328	235	274	285	276	190

Reported Total Loss of Agricultural Equipment for 2003: $ 520,122

Sources: U.S. Census Bureau, U.S. Department of Agriculture, U.S. Department of Justice-Federal Bureau of Investigations.

San Luis Obispo County: A Profile

Population

Total 2000 Population:	246,681
Percent Non-Hispanic White:	84.6
Percent African American:	2.0
Percent Hispanic:	16.3
Median Age (years):	37.3
Population Density (per sq. mile):	74.7
Land Area (sq. miles)	3,304

Agriculture

(1997)	
County land in farms (acres):	1,301,889
Number of farms in 1997:	1,916
Median Farm Size (acres):	50
Average Farm Size (acres):	679
Principle Occupation of farming (full time):	927
Market value of agricultural products sold ($):	312,950,000

Crop sales account for 90% of market value.
Livestock sales account for 10% of market value.

Leading 4 Agricultural Commodities in 2002 (according to gross value of products):

- wine grapes
- broccoli
- cattle and calves
- head lettuce

Crime

Property crimes reported for the Federal Bureau of Investigation's Annual Uniform Crime Report

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
PROPERTY CRIMES*	2,343	2,459	2,331	1,844	1,842	1,883	1,622	1,753	1,799	1,991
BURGLARY	1,949	2,008	1,965	1,556	1,523	1,533	1,283	1,351	1,371	1,493
M.V. THEFT	394	451	366	288	319	350	399	402	428	498
LARCENY-THEFT	5,289	5,148	5,153	5,093	4,384	4,652	4,483	4,706	4,443	4,913
ARSON	83	127	162	122	95	92	155	124	134	68

Reported Total Loss of Agricultural Equipment for 2003: Not a member of ACTION in this year

Sources: U.S. Census Bureau, U.S. Department of Agriculture, U.S. Department of Justice-Federal Bureau of Investigations.

Stanislaus County: A Profile

Population

Total 2000 Population:	446,997
Percent Non-Hispanic White:	57.3
Percent African American:	2.6
Percent Hispanic:	31.7
Median Age (years):	31.7
Population Density (per sq. mile):	299.2
Land Area (sq. miles)	1.493.8

Agriculture

(1997)	
County land in farms (acres):	732,736
Number of farms in 1997:	4,009
Median Farm Size (acres):	24
Average Farm Size (acres):	183
Principle Occupation of farming (full time):	2,239
Market value of agricultural products sold ($):	1,208,524,000

Crop sales account for 46% of market value.
Livestock sales account for 54% of market value.

Leading 4 Agricultural Commodities in 2002 (according to gross value of products):

- milk, all
- almonds
- chickens, all
- cattle/calves, all

Crime

Property crimes reported for the Federal Bureau of Investigation's Annual Uniform Crime Report

	1993	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
PROPERTY CRIMES*	10,303	10,216	10,317	9,636	10,144	8,578	7,199	7,042	7,512	9,081
BURGLARY	7,021	6,591	6,594	6,266	6,270	5,333	4,578	4,481	4,288	4,837
M.V. THEFT	3,282	3,625	3,723	3,370	3,874	3,245	2,621	2,561	3,224	4,244
LARCENY-THEFT	15,094	16,562	16,781	14,365	15,402	14,340	12,064	13,708	14,509	16,358
ARSON	559	576	528	504	528	367	479	534	597	473

Reported Total Loss of Agricultural Equipment for 2003: $ 547,173

Sources: U.S. Census Bureau, U.S. Department of Agriculture, U.S. Department of Justice-Federal Bureau of Investigations.

Tulare County: A Profile

Population

Total 2000 Population:	368,021
Percent Non-Hispanic White:	41.8
Percent African American:	1.6
Percent Hispanic:	50.8
Median Age (years):	29.2
Population Density (per sq. mile):	76.3
Land Area (sq. miles)	4,824.0

Agriculture

(1997)	
County land in farms (acres):	1,309,525
Number of farms in 1997:	5,446
Median Farm Size (acres):	35
Average Farm Size (acres):	240
Principle Occupation of farming (full time):	3,022
Market value of agricultural products sold ($):	1,921,381,000

Crop sales account for 58% of market value.
Livestock sales account for 42% of market value.

Leading 4 Agricultural Commodities in 2002 (according to gross value of products):

- milk
- oranges, navel/Valencia
- grapes
- cattle/calves

Crime

Property crimes reported for the Federal Bureau of Investigation's Annual Uniform Crime Report

	1993	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
PROPERTY CRIMES*	6,471	6,618	6,376	5,694	5,947	6,155	5,436	5,611	6,288	6,801
BURGLARY	4,495	4,181	4,163	3,508	3,594	3,993	3,775	3,795	4,352	4,318
M.V. THEFT	1,976	2,437	2,213	2,186	2,353	2,162	1,661	1,816	1,936	2,483
LARCENY-THEFT	11,053	10,173	10,658	9,831	9,165	8,854	7,697	8,101	8,943	9,279
ARSON	561	545	529	636	646	611	620	609	647	707

Reported Total Loss of Agricultural Equipment for 2003: $ 1,530,101

Sources: U.S. Census Bureau, U.S. Department of Agriculture, U.S. Department of Justice-Federal Bureau of Investigations.