

# Utilizing the National Incident-Based Reporting System to Further Our Understanding of Agricultural Theft

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## Abstract

Research related to rural offending and victimization, while increasing in recent years, is hindered by the difficulties associated with gathering quality data. This is particularly true for investigations of agricultural theft, a crime problem unique to rural America. Several studies have explored the prevalence of such offending—in addition to the characteristics that influence victimization—via surveys administered to farm operators. Though beneficial, they rely upon small samples drawn from limited geographic areas. The current study proposes turning to the National Incident-Based Reporting System to advance our knowledge of agricultural theft, as it presents the opportunity to explore related research questions via a more nationally-representative sample. In addition, it opens the door for inquiries into understudied aspects of theft, such as victim and offender characteristics, theft targets, monetary losses and clearance rates. Each of these potential avenues is discussed, in addition to considerations that should be taken into account when making use of the data.

**Keywords:** agricultural theft; rural crime; National Incident-Based Reporting System



## Introduction

One of the most pressing concerns for scholars interested in exploring rural issues is the ability to gather or access quality data (Morgan, Fahs & Klesh, 2005; Pierce & Scherra, 2004; Shreffler, 1999; Wilkes, 1999). This is particularly true for crime-related studies, and likely partially to blame for the comparative lack of attention to offending and victimization in rural America. These communities feature many of the same problems witnessed in their urban counterparts (Weisheit & Donnermeyer, 2000; Weisheit, Falcone and Wells, 2005), in addition to forms of offending unique to the rural environment (Weisheit et al 2005). One such form is the theft of agricultural equipment and products (Barclay, 2016; Barclay & Donnermeyer, 2011; Cebulak, 2004; Swanson 1981). While studies dedicated to understanding crimes committed against agricultural operations have become more prevalent in recent years, much remains to be understood (Barclay & Donnermeyer, 2011). It is imperative to continuously seek out new sources of data in order to assist in the development of policies and interventions designed to combat them. The current study proposes that data contained within the National Incident-Based Reporting System (NIBRS) presents a unique tool for researchers that has to date been under-utilized. In addition, it attempts to lay the foundation for future investigations by focusing on the information provided by NIBRS, potential research applications, and limitations that must be taken into consideration when making use of the data.

## Agricultural Crime

Though agricultural crime is a relatively broad term and inclusive of many types of offending, the bulk of research on the problem focuses on theft from agricultural operations (Barclay & Donnermeyer, 2011). These operations are reliant upon the use of high-value machinery, specialized tools, and other supplies that may be attractive to motivated offenders (Bunei & Barasa, 2017; Osborne, 2015; Mears, Scott & Bhati, 2007). The products produced by them, such as crops and livestock, present additional targets. In light of this, several researchers have explored the prevalence of farm-related theft within the United States. Taken as a whole, they reveal that theft is relatively common. For example, an early exploration by Dunkelberger, Clayton, Myrick and Lyles (1992) found that approximately one-third of surveyed Alabama farmers had been the victim of some type of equipment theft in their lifetime. Deeds, Frese, Hitcher and Solomon (1992) reached similar conclusions based upon data gathered in Mississippi, as nearly 25 percent of the respondents reported having been victimized. Comparable estimates are present in more recent studies. For instance, a survey administered to California farmers in 2004 revealed that 29 percent had experienced small equipment theft, whereas 14 percent had been the victim of theft of larger equipment (Mears et al 2007). In Georgia, it was found that approximately 33 percent of those queried reported one or more thefts in the preceding year (McIntyre Jr., Prine & Knowles, 2017). While a handful of studies present an exhaustive understanding of prevalence, the consistency of their findings suggests that agricultural theft is far from uncommon and thus deserving of the attention from researchers (Osborne, 2015).

To date, several studies have sought to identify the factors that influence farm-related theft by focusing on the characteristics of agricultural operations, such as size and location. Results indicate that these characteristics serve to either protect operations or increase their risk of victimization. For example, the presence of farm workers has been found to relate to an increase in theft likelihood (Bunei, Rono, & Chessa, 2013; McCall, 2003; Mears et al, 2007), as has a lack of preventative measures (e.g., locks, proper storage of equipment) (Mears et al, 2007). Smaller farms tend to be less likely to experience theft as a result of the increased ability for operators to effectively monitor property (Dunkelberger et al, 1992; Farmer & Voth, 1989; Mears et al 2007), whereas being located near roadways (George Street Research, 1999) and/or densely populated areas (Bunei et al, 2013; Farmer & Voth, 1989; George Street Research, 1999) serves to increase risk of victimization.

While the knowledge gained from these studies has aided our understanding of agricultural theft, it is important to note that all (to a degree) feature two important limitations as a result of their dependence upon survey data. First, they rely upon data gained from relatively small samples. Second, and more importantly, they are focused upon developing knowledge within limited geographic areas. In spite of the fact that generalizations are still possible, it is important to question whether a more exhaustive dataset would reveal additional or unique findings.

### **The National Incident-Based Reporting System (NIBRS)**

As previously stated, the current study advocates for the utilization of NIBRS data to provide a more exhaustive overview of agricultural theft and assist in addressing the limitation of previous research using small samples from limited geographic areas. NIBRS was developed in the 1980's by the Federal Bureau of Investigation (FBI) as a supplement to the Uniform Crime Report (UCR) in hopes of providing a more nuanced and informative census of crime incidents within the United States (Madden, 2015; Strom & Smith, 2017). Whereas the UCR treats agencies as the unit of analysis by providing counts for each type of crime reported within their jurisdiction, NIBRS is an incident-based system (Akiyama & Nolan, 1999; Maxfield, 1999). Each reported incident is matched to a variety of information (a total of 230 data elements), ranging from characteristics of the offense to those of the victim(s) and offender(s).

The detailed data available in NIBRS presents the opportunity to explore crime in a manner that would be impossible if relying upon the more established UCR program (Akiyama & Nolan, 1999; Jarvis, 2015). Not only can data be analyzed for specific forms of offending (including unique types of theft), but for specific types of locations as well. In addition, explorations into victim and offender characteristics are made possible, as are those designed to develop a better understanding of the temporal nature of offending. As much remains to be understood regarding agricultural theft, this information—and the various

research applications made possible by it—should be of interest to those investigating the problem.

Though constituting a significant advancement in terms of the collection and dissemination of crime-related data, participation in the NIBRS program has to date lagged well behind that of the UCR (Biere, 2015; Strom & Smith, 2017). Thirty-six (36) states currently report yearly data via the NIBRS system (McCormack, Pattavina & Tracy, 2017). However, less than half (16 in total) report at 100 percent, with the remaining states submitting only a portion of their data. Put differently, some agencies within these states choose to fully participate, whereas others continue to only provide data in a UCR format (Stogner, 2016). Taken as a whole, agencies providing NIBRS data to the FBI (via their respective state reporting system) cover approximately 29 percent of the country's population (McCormack et al, 2017).

On the surface, this lack of participation would seem to render NIBRS a less than ideal dataset for analyzing crime problems. However, smaller agencies, as well as those located in rural counties, tend to be over-represented (Addington, 2008; Bibel, 2015). Whereas many data sources over-represent urban agencies and populations, NIBRS may be considered especially useful for rural research in light of this bias. For example, Addington (2008) found that crime rates generated through use of NIBRS data did not significantly vary from those generated by UCR data when focusing upon rural counties. As agricultural theft is primarily a rural problem, it would follow that using NIBRS to explore the prevalence and characteristics of such theft would present researchers with accurate findings.

## **NIBRS and Agricultural Theft**

A variety of research questions may be answered via utilization of NIBRS. However, several potential applications seem most promising: (1) assessing prevalence and trends for agricultural theft, (2) queries related to incident-level characteristics, (3) analyzing the various types of offenses committed against agricultural operations; and (4) tests of macro-level criminological theories. The subsequent discussion covers each of these in some detail, while also providing cautions regarding the limitations associated with the dataset and the various measures contained within it.

### **Prevalence and trends**

As previously discussed, a limited amount of scholarly attention has been dedicated to developing an understanding of the prevalence of agricultural theft (see Deeds et al ,1992; Dunkelberger et al, 1992; Mears et al, 2007 for examples). These studies tend to find that a significant percentage of farm operators have been victimized (either in the past year or their lifetime). However, the utilization of small samples that focus upon limited geographic areas serves to make generalizations difficult. NIBRS may offer a more exhaustive overview of the prevalence of such theft, as it contains data for a much larger portion of the U.S. population.

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This is made possible by the ability of law enforcement agencies to code thefts by the category of item(s) that were involved (Rantala & Edwards, 2000). Although a number of categories are available, three relate specifically to agricultural targets: (1) farm equipment, (2) livestock; and (3) crops. Agencies are provided with definitions and examples for each category within the NIBRS user manual (U.S. Department of Justice, 2017), and asked to make coding decisions based upon their interpretation of them (see Table 1 for a reference). Researchers are thus able to extract incidents that fall within each of these three categories in order to determine how many incidents have been reported each year nationwide.

**Table 1: Theft Target Definitions**

<b>Theft Classification</b>	<b>Definition</b>
Farm Equipment	Any kind of machinery used on a farm to conduct farming; tractors, combines, etc.
Livestock	Domesticated animals raised for home use or profit; cattle, chicken, hogs, horses, sheep, bees, household pets such as dogs and cats if commercially raised for profit, animals raised and/or used for illegal gambling, e.g., dogs, roosters, etc.
Crops	Cultivated plants or agricultural produce grown for commercial, human, or livestock consumption and use that is usually sold in bulk; grains, fruits, vegetables, tobacco, cotton, etc.

Source: National Incident-Based Reporting System User Manual (2017)

In addition to providing information on theft targets, each incident is matched to indicators for the state in which it occurred and the respective reporting agency (Strom and Smith, 2017). For example, a crime reported by a municipal police department lists the name of the department and the state within which it is located. This opens the door to explorations of prevalence at a variety of levels. State- and national-level analyses are certainly the easiest to conduct, as all necessary information is contained within the NIBRS dataset. With that said, more specific explorations are also possible. County-level prevalence is made possible via reliance on the FIPS code, a unique identifier provided to each county within the United States and attached to each incident contained within the NIBRS database (Maltz & Weiss, 2006). Simple aggregation of all incidents reported by municipal, county and state-level agencies within the county (via the FIPS code) allows for an understanding of the total count for each offense type that occurred within it for a particular year.

Trend studies related to agricultural theft prevalence can be accomplished by pulling information from multiple years of NIBRS data (Haas, LaValle, Turley & Nolan, 2012). These trends, much as is the case with studies of yearly prevalence, can be explored at the national, state, and county levels. However, it is important to consider participation when conducting analyses of this type. Additional agencies choose to participate (or not) in NIBRS over time (Addington, 2009; Krienert & Walsh, 2011), meaning that reliance upon raw counts without considering changes in participation present validity issues. Two steps can be taken to remedy these concerns. First, researchers may choose to control for participation when assessing national trends. Second, investigations into state- and county-level trends may be best served by relying upon states (and thus the counties contained within them) that have featured 100 percent participation over the course of several years (Bibel, 2015; Osborne, 2015). Because no new agencies are added within these states, provided counts should not be impacted by changes in participation.

### **Incident characteristics**

NIBRS also offers the opportunity to explore the characteristics of incidents involving the theft of farm equipment, livestock and/or crops. Though any number of research questions may be explored (as a result of the 230 data elements available for each incident), several seem most fruitful: (1) Estimating the monetary impact of theft, (2) determining the spatial and temporal nature of offending, (3) exploring victim and offender characteristics; and (4) assessing clearance and recovery rates.

To date, knowledge regarding the economic impact of agricultural theft is lacking. Several estimates have been put forth (Barclay, 2001; Swanson, Chamelin & Territo, 2002), but all suffer from questions of validity. NIBRS may offer a new avenue by which to add to our understanding of monetary loss, as each theft incident is matched to an estimate of the value of the property taken (Barnett-Ryan & Swanson, 2008). Researchers may make use of this information in one of two ways. First, it offers an understanding of the losses that result from the average theft incident. Table 2 reports average losses for incidents contained in the 2015 iteration of the NIBRS dataset as an example of the information that can be obtained. Second, it can be utilized to develop national estimates of losses resulting from agricultural theft. Doing so requires that researchers use caution when interpreting the available data. As mentioned, only a portion of law enforcement agencies currently submit data in NIBRS format. Controlling for this requires that a detailed analysis be conducted for reporting jurisdictions and the agricultural characteristics (e.g., proportion of land dedicated to farming operations) of the area contained within them. Calculating a baseline national estimate for yearly losses (for each theft target) may be achieved by considering similar characteristics for jurisdictions that do not participate and making extrapolations based upon data for those that do participate.

**Table 2: Average Losses from Agricultural Theft Incidents**

<b>Offense Type</b>	<b>Equipment</b>	<b>Livestock</b>	<b>Crops</b>
Average Value	\$3,744	\$7,182	\$20,185

Source: National Incident-Based Reporting System (2015)

It should be noted that the value of property stolen is determined based upon the judgment of the victim and/or responding officer(s) (Goodnight, Shah, Jakobovits, Fromm, Brown & Conklin, 2008). The NIBRS user guide suggests that initial estimates should rely upon information obtained from victims, while taking into account devaluation based upon years of use and resulting wear (U.S. Department of Justice, 2017). Reasonable victim estimates are typically reported in the final data. However, those that appear to be biased (e.g., overvaluation for insurance purposes) are to result in independent investigation by the officer(s) and/or agency. The user guide suggests that officers turn to outside resources such as Craigslist or Ebay for assessing valuations in these instances (U.S. Department of Justice, 2017). This opens the door to potential validity concerns when utilizing value of property data provided by NIBRS, as valid estimates only occur via consideration of victim estimates and a thorough assessment of outside resources (Goodnight et al, 2008). No study to date has explored the accuracy of these estimates. Hence, researchers should proceed with caution (and document this limitation) when pursuing related research questions (Jarvis, 2015). In addition, they should be aware of policies concerning valuations for property that is ultimately recovered. These estimates are representative of the valuation at the time of recovery (and may differ from initial estimates). For example, equipment that has been damaged will result in a valuation that reflects this damage (U.S. Department of Justice, 2017). Determining the average loss associated with agricultural theft incidents may be best served by excluding recovered items from calculations for this reason.

The recent popularity of environmental criminology and its focus on criminal opportunities has motivated studies concerning the influence of time and place on offending (Andresen, 2014; Barclay & Donnermeyer, 2011). NIBRS allows for the exploration of these factors in relation to agricultural theft. For example, each included incident contains information regarding the day of the week and time of day that it was reported (Maxfield, 1999; Snyder, 2010). Though beneficial, researchers should use caution when interpreting this data. Data available from the United States Census of Agriculture indicate that over 50 percent of all farms are ran by part-time operators who hold other forms of employment (U.S. Department of Agriculture, 2012). In addition, the leasing of property has become more common in recent years (Nickerson, Morehart, Kuethe, Beckman, Ifft & Williams, 2012). This suggests that operators may not be able to offer constant guardianship over potential targets, as their residence is not adjacent to the property. Taken together, it is likely that many theft incidents are not known to the farm operator until sometime after they occurred. An exploratory analysis of NIBRS data for 2015 indicates that Mondays are the most common day for the reporting of thefts, and that peak times are either in the early morning or near

midday. Inferences are certainly difficult, but these findings suggest that information regarding the temporal nature of theft may be less reflective of the time and/or day for which the offense occurred, but rather the time/day that the theft was made known to the farm operator(s) and/or reporting agency (see Jarvis, 2015 for a discussion of this issue).

Little research has explored the characteristics of victims of farm-related theft (see McIntyre et al, 2017 for an example), and no study to date has focused upon similar characteristics for offenders. NIBRS provides information that can assist in filling these gaps, as the age, gender, race/ethnicity, and residential status (i.e., whether the individual lives within the area covered by the reporting agency) are provided for all known victims and offenders in relation to each respective incident (Addington, 2009). Not only can this information be utilized to develop an exploratory understanding of victim/offender characteristics, but also to determine whether these characteristics differ from those of the population as a whole. Table 3 provides an overview of the data regarding characteristics contained within the 2015 iteration of NIBRS, and serves as an example of the knowledge that can be gained from studies of this type.

**Table 3: Victim and Offender Characteristics**

<b>Victim Characteristics</b>	
Measure	Sample
Age	55 Years
Gender	85% Male
Race	96% White
<b>Offender Characteristics</b>	
Measure	Sample
Age	36 Years
Gender	90% Male
Race	90% White
Residency	75% Residents

Source: National Incident-Based Reporting System (2015)

Comparing characteristics of victims and offenders with the greater population requires turning to other data sources. For example, demographic characteristics for the U.S. farming population can be gathered from the United States Department of Agriculture’s quinquennial Census of Agriculture. An exploratory comparison between information contained within the 2012 iteration of the Census and the NIBRS victim data referenced above suggests that the age and race of victims is in line with the characteristics of farm operators as whole, though males tend to be overrepresented. Offenders tend to be younger (than the average farm

operator) as a group, and the majority are white males who reside within the area covered by the reporting agency. While a full analysis is beyond the scope of the current work, future researchers can utilize NIBRS to better understand and interpret such data.

Finally, NIBRS allows for an analysis of information related to the clearance of offenses (Roberts & Roberts, 2016). More specifically, researchers can determine the proportion of incidents that result in arrest and/or the recovery of stolen property. In addition, they can seek to determine the average time that passes between the offense and each of these outcomes (Roberts, 2009). It should be noted that arrests and/or recovery of property may occur after the agency has submitted their data for a given year. However, NIBRS participation requires that updates be filed should this be the case (U.S. Department of Justice, 2017). For example, a theft that occurred in 2015, but resulted in an arrest in 2016, would still contain valid information regarding clearance in the publically-available dataset. With that said, one limitation must still be taken into account. Reporting agencies are only required to submit these updates if the individual is arrested within their jurisdiction. As such, an arrest made by a neighboring agency would not result in clearance information being added for the incident in question. Researchers should be cognizant of this limitation when analyzing the available data.

### **Agricultural operations**

As discussed within the review of the literature on agricultural theft, several studies have sought to develop an understanding of theft victimization by farms and their operators. Though each of these attempts has varied slightly in focus, they typically feature survey questions related to the theft of equipment, tools, and other items. NIBRS offers the potential to go beyond these common categories and assess a wide variety of thefts via a data element that reports the location in which offenses were committed (Snyder, 2010). One category is farm facilities, which are defined in the NIBRS user guide as “facilities designed for agricultural production or devoted to the raising and breeding of animals, areas of water devoted to aquaculture, and/or all building or storage structures located there” (U.S. Department of Justice, 2017). Pulling out of the dataset incidents that are coded as occurring within these facilities allows for a more comprehensive understanding of the types of theft that they experience. Table 4 provides an exploratory overview of the most common theft types reported in the 2015 NIBRS dataset as an example. Results suggest that equipment, livestock and crops are far from the only targets attractive to potential offenders.

Researchers may also seek to understand other forms of offending committed against farm facilities, such as arson and vandalism, as past research suggests that these are of concern to farm operators (Barclay & Donnermeyer, 2002; Cleland, 1990; Dunkelberger et al, 1992). Such an undertaking is possible via NIBRS data. However, regardless of the offense type being explored, those performing these investigations should be aware of the directions provided to reporting agencies when determining the appropriate selection for location type (U.S. Department of Justice, 2017). Thefts that occur from the land contained

**Table 4: Theft from Farm Facilities**

Property Type	Count	Property Type	Count
Farm Equipment	571	Consumable goods	70
Tools	522	Trucks	64
Livestock	151	Crops	64
Vehicle Parts	148	Firearms	62
Automobiles	138	Trailers	61
Other Vehicles	103	Building materials	57
Garden Equipment	83	Fuel	46
Money	81	Construction equipment	34
Recreational vehicles	75	Chemicals	9

Source: National Incident-Based Reporting System (2015)

within farms are to be coded as occurring in field/woods. Those that involve items being taken from the home or property and/or outbuildings that immediately surround it are to result in the code for residence/home being selected. Hence, the total count for each theft target is not representative of all theft victimizations experienced by farms and their operators, but rather those that occurred from buildings on the property that are not in the immediate vicinity of the operators home.

### Testing macro-level theories

Finally, NIBRS can be utilized to develop dependent measures when testing the applicability of criminological theories to the crime of agricultural theft. To date, both routine activity theory (Bunei & Barasa, 2017; Bunei et al, 2013; Mears et al, 2007; Osborne, 2015) and social disorganization theory (Osborne, 2015) have been explored, with results indicating that each theory may be useful to furthering our understanding of the problem. With one exception (Osborne, 2015), these studies have focused upon micro-level investigations. Macro-level investigations seeking to determine the relationship between community-level characteristics and agricultural theft might offer a new avenue for research worthy of our attention. Doing so requires that data (for both dependent and independent measures) be available for appropriate units of analysis. Counties and/or states might constitute the best options, as theft data can be aggregated to these levels if relying upon those that feature 100 percent reporting (as discussed previously).

Fortunately, other data sources exist that allow for the operationalization of the independent measures associated with each theory. For example, tests of social disorganization theory may make use of the Census of the Population to acquire data related to household instability, residential mobility and poverty. Those taking a routine activity approach could turn to the United States Census of Agriculture for a variety of data related to

farm characteristics for counties located throughout the United States. Although not all factors commonly found to relate to theft in micro-level applications of routine activity theory can be replicated at the macro-level (e.g., terrain, location near roadways), several options are possible (see Osborne, 2015 for an example).

## **Cautions Regarding the Data**

NIBRS presents a unique opportunity for explorations of agricultural theft. With that said, it is not without limitations (Addington, 2009; Addington, 2004; Haas, Jarvis, Jefferis & Turley, 2007; Stamatel & Mastrocinque, 2011). These can be broadly grouped into issues associated with data complexity and the potential for missing data (both unit- and item-nonresponse). The following discussion focuses on these concerns and addresses steps that researchers can take to minimize their impact.

### **Working with NIBRS Data**

Working with NIBRS data can be problematic due to the complexity of the dataset and the sheer computing power required to perform analyses (Addington 2009; Akiyama and Nolan, 1999; Dunn & Zelenock, 1999; Maxfield, 1999). The FBI makes data available in a single file, comprised of millions of records and information regarding the 230 available data elements for each crime incident (Abdu et al, 2011; Dunn & Zelenock, 1999). Not all research questions (in particular those related to agricultural theft) require the full dataset. As such, it is possible to rely upon data for a single unit of analysis (Jarvis, 2015). This has been made possible by the work of the Inter-university Consortium for Political and Social Research (ICPSR), which disseminates NIBRS data to the public. The organization has taken the initiative to provide data in extract files that require fewer computing resources and make analyses more efficient (Abdu et al, 2011). Four such files are available: incident (administrative), victim, offender and arrestee (Akiyama & Nolan, 1999). The incident file contains detailed information on the offense type, its temporal and spatial characteristics, the agency that submitted the report, and of interest to the current line of research, theft targets. Victim and offender files provide data regarding age, gender, race and other relevant characteristics.

Many of the potential research applications previously discussed can be achieved by relying solely on the incident-level file. For example, it serves to provide data necessary to understanding prevalence of agricultural theft (at the national, state, and county levels), the targets of such theft (e.g., farm equipment, crops, livestock), and offenses (of all types) committed against farm facilities. In addition, research questions related to economic impact (property value) and case clearance can be achieved through these data. Queries revolving around the characteristics of victims (farming operators) and offenders require use of the victim-level and offender-level files, respectively. In summation, the files necessary are dependent upon the research question being pursued, but the availability of extract files

should remove many of the barriers previously associated with the NIBRS dataset (Addington, 2015).

Researchers should still be cognizant of one important limitation: Creation of the extract files requires limiting the records associated with each incident to three (ICPSR, 2016; Fegadel and Heide, 2015). In other words, a theft incident involving four or more items will list only the first three entered by the reporting agency. Similarly, an incident with four or more offenders and/or four or more victims will not provide information for any additional individuals (outside of the first three listed in the report) and their respective characteristics (e.g., age, race, gender). This is certainly problematic, but the concern is to some degree mitigated by the fact that over 99 percent of all incidents contained within the raw NIBRS file are not impacted by this rule when translated into extract files. Put differently, they are left unaltered in the created extract files, as they do not feature four or more theft targets, victims, and/or offenders (ICPSR, 2016).

An additional concern revolves around the coding of incident information by law enforcement agencies. Although the NIBRS user guide offers detailed directions regarding coding offenses and their characteristics, past research suggests that these directions do not ensure complete validity of the data (Bibel, 2015; Maxfield, 1999). Put differently, officers may be unsure how to properly code each incident, as the examples provided to them do not cover the full range of offenses and characteristics. For example, farm equipment is defined in the NIBRS user guide as “any kind of machinery used on a farm to conduct farming; tractors, combines, etc.” (U.S. Department of Justice, 2017). This is far from an exhaustive definition, and provides only two examples of equipment that would fall under the farm equipment umbrella. Hence, the potential exists for misclassification. Though steps have been taken to address these issues at both the national (via FBI protocols) and state levels, the effectiveness of these measures have been questioned, rendering coding concerns a limitation that researchers must take into account (Barnett-Ryan & Swanson, 2008; Bibel, 2015).

### **Missing Data**

Researchers should also be cautioned to the potential for missing data to impact the validity of their findings (Bibel, 2015). Unit nonresponse is an obvious issue when taking into account the fact that only a fraction of agencies currently submit data via the NIBRS program (Addington, 2009; Addington, 2008; Bibel, 2015). This concern, as it relates to agricultural theft incidents, is largely mitigated by the fact that rural agencies are overrepresented in the NIBRS dataset (Addington 2008). However, item nonresponse may be problematic as well (Addington, 2009; Roberts & Lyons, 2009; Thompson, Saltzman, & Bibel, 1999). The NIBRS system contains a number of checks and audits to promote data quality (Barnett-Ryan & Swanson, 2008). With that said, audits are far from common, and as such their impact remains questionable (Snyder, 2010; Thompson et al, 1999). This brings about two concerns for researchers interested in utilizing the data to explore agricultural theft. First, it is possible that theft counts derived at the national, state and/or county level are not an accurate picture of the problems faced. Past research has suggested that several states (and the counties

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contained within them) that feature 100 percent NIBRS participation and a large proportion of land dedicated to farming operations report questionable farm equipment theft counts (Osborne, 2015). This indicates that reporting agencies may assign the wrong classification when selecting the theft target. Second, data available for each of the elements (e.g., age, race and gender of the victim/offender) tied to agricultural theft incidents may not be accurate, as NIBRS reporting allows for the selection of categories such as other and not available (Addington, 2004; Roberts & Lyons, 2009; Thompson et al, 1999). Past research proposes that this may be problematic for all manner of NIBRS investigations (see Liao, Berzofsky, Hiller, Barrick & DeMichele, 2015 for an example).

An exploratory analysis of NIBRS data for 2015 suggests that this problem partially extends to agricultural theft. For example, approximately 83 percent of all incidents contain no information regarding method of entry (e.g., picking a lock) into buildings. However, missing data appears to be less of an issue in relation to other key data elements. Only 12 percent do not include a designation for the location in which they occurred (e.g., farm facility), and fewer than 5 percent contain no information regarding property value. Data regarding characteristics of the victim(s) and offenders(s) feature an even lower prevalence of missing data. As such, research into the problem may not be significantly impacted by this limitation. With that said, any lingering concerns may be eliminated by pursuing techniques for imputation when relying upon elements with higher levels of item nonresponse. Several options for imputation are available (Haas et al, 2012) and have been shown to be effective.

## **Conclusion**

In spite of the difficulties associated with complexity and missing data, NIBRS presents researchers with a unique avenue for expanding our understanding of agricultural theft. To date, scholarly examinations have focused upon the prevalence of such theft and the characteristics of farming operations that serve to influence risk of victimization. Though beneficial, they have been largely limited to small samples representing limited geographic areas. NIBRS presents the opportunity to embark upon similar projects utilizing a more generalizable set of data. In addition, it opens the door for other research questions related to victim and offender characteristics, clearance of offenses, targets of theft from farming operations, the value of property taken, and spatial/temporal considerations. These have been largely ignored in the research to date, and are vital to developing a better understanding of the problem. By designing studies that take into account the limitations that have been covered, NIBRS should only enhance our ability to understand and combat agricultural theft.

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