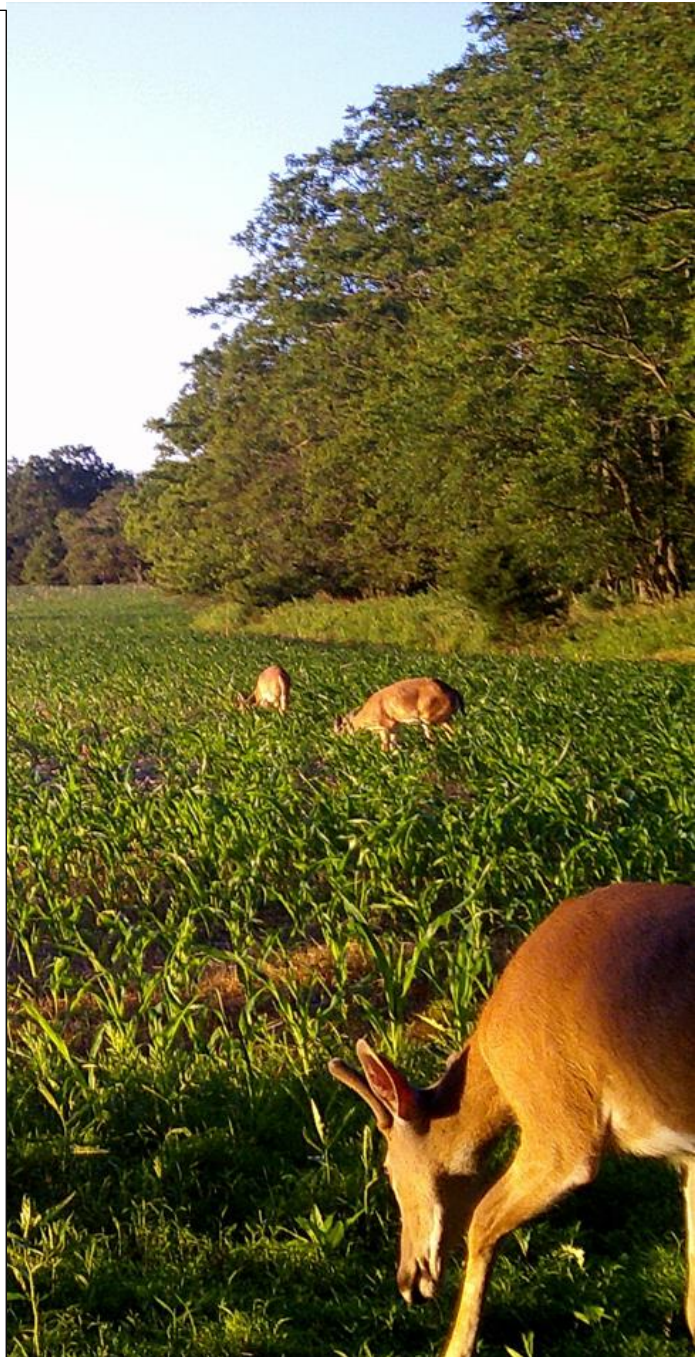


WE **R** HERE WHEN YOU NEED **US**

**White-Tailed Deer and
the Costs to Farmers'
Livelihoods: A Case
Study of New Jersey
Stories**

**REPORT WITHOUT
APPENDIXES**

Joseph B. Paulin
Nazia N. Arbab
Brian J. Schilling



RUTGERS

New Jersey Agricultural
Experiment Station

WE **R** HERE WHEN YOU NEED **US**



Figure 1. White-tailed deer captured by a camera trap while feeding in a cornfield at night.

Abstract

A group of 27 New Jersey farmers shared their stories of struggling with increasing numbers of deer and how it has impacted their farms. These case studies include estimates of direct financial losses from deer eating crops and reduced yields. There is also information on “hidden costs” associated with pressure from deer, such as having to abandon fields, not being able to grow preferred crops that would increase profits, having to change crop rotations, the need for increased use of fertilizers and herbicides, time and money spent on deer management, and the emotional toll it can take. Within this small pool of 27 farmers, the conservatively estimated impact of wildlife damage in 2019 was nearly \$1.4 million. This includes direct deer damage to crops and reduced yields (\$520,940), deer-related “hidden costs” that can be assigned a dollar value (\$755,200), and crop damage from other wildlife species (\$97,749). Farmers’ recommendations to policymakers for enhancing deer management in the state cover: (1) general deer management, (2) venison donation programs and helping those in need, (3) residential development and deer refuge areas, (4) private leased farmland and wildlife management plans, (5) public lands and wildlife management plans, (6) education and outreach for policymakers and communities, (7) deer fencing, (8) enhancing deer management through hunting, and (9) farmer depredation permits.

White-Tailed Deer and the Hidden Costs to Farmers' Livelihoods: A Case Study of New Jersey Stories

Suggested Citation

Paulin, J.B., Arbab, N.N., and B.J. Schilling. NJAES/RCE (2022). White-Tailed Deer and the Hidden Costs to Farmers' Livelihoods: A Case Study of New Jersey Stories. Rutgers University, School of Environmental and Biological Sciences, New Jersey Agricultural Experiment Station, Rutgers Cooperative Extension.

Authors

Joseph B. Paulin, Ph.D. Candidate, Conservation Expert, Wildlife Management, Rutgers University, New Jersey Agricultural Experiment Station, Rutgers Cooperative Extension. jpaulin@njaes.rutgers.edu

Nazia N. Arbab, Ph.D., Assistant Professor, Rutgers University, Department of Agricultural, Food and Resource Economics. nazia.arbab@rutgers.edu

Brian J. Schilling, Ph.D., Director, Rutgers Cooperative Extension and Senior Associate Director, New Jersey Agricultural Experiment Station. brischi@njaes.rutgers.edu

About the Cover Photo—*Photo Joseph B Paulin*

Three deer are eating in a farmer's 40 acre cornfield during the 2021 growing season. At the time the photo was taken, there were actually 11 deer feeding throughout the field. At other times, during surveys, over 40 deer were observed at one time within and immediately adjacent to the field. That's over four times the number of deer you would want in one square mile to try and balance social benefits and reduce economic and landscape damage. Throughout the growing season, the deer ate many of the cornstalks down to waist-high, some to the ground. Weeds took over much of the field. In fact, in much of the field you couldn't even tell corn had been planted. The farmer lost approximately 50% of the 40 acres. They wanted to grow soybeans in the field for a higher profit, but the deer would have caused even more crop damage. The surrounding areas include residential, forested, public, and private lands, many without deer management programs. These lands act as deer refuge areas. Deer often stay in these areas during the day and feed in the farm fields at night causing a tremendous amount of crop damage. Similar stories have been told by farmers throughout the state. In this report, 27 New Jersey farmers share their stories of struggling with increasing numbers of white-tailed deer and how it has impacted their farms and livelihoods. Some, to the point of questioning if they can continue.

Project Reviewers

Larry S Katz, Ph.D., Director Emeritus Cooperative Extension and Professor Emeritus, Rutgers University Department of Animal Sciences

Jason Grabosky, Ph.D., Professor in Urban Forestry, Rutgers University, Department of Ecology, Evolution, and Natural Resources, New Jersey Agricultural Experiment Station, Rutgers Cooperative Extension.

Kevin P. Sullivan, Assistant Director of Statistical Analysis, Office of Research Analytics, New Jersey Agricultural Experiment Station.

Acknowledgements

This project was funded by Rutgers University, New Jersey Agricultural Experiment Station, Rutgers Cooperative Extension. Institutional Review Board (IRB) Approval Number Pro2020000832. The research team expresses its sincere gratitude to the farmers that participated in the case studies and gave generously of their time and insight. The New Jersey Farm Bureau and New Jersey Division of Fish and Wildlife consulted on various aspects of the project and made valuable contributions including review of the mail-back questionnaire. Steward Green conducted all deer density surveys used for the project. We would also like to acknowledge those listed below for their contributions to the project.

William J. Bamka, Rutgers Cooperative Extension of Burlington County

Hank Bignell, Rutgers Cooperative Extension of Warren County

Rhonda Breen-Simone, Rutgers Cooperative Extension

Kate Brown, Rutgers Cooperative Extension of Burlington County

Peter J Furey, New Jersey Farm Bureau

Scott Galdos, Rutgers University

Gene Huntington, Steward Green

Ashley Kerr, New Jersey Farm Bureau

Stephen Komar, Rutgers Cooperative Extension of Sussex County

Jodi Powers, New Jersey Division of Fish and Wildlife

Grace Rademacher, Rutgers University

Scarlett Simpson, Rutgers University

Megan Spina, Rutgers University

Carole Stanko, New Jersey Division of Fish and Wildlife

Estefano Mora Villacres, Rutgers University

Timothy J. Waller, Rutgers Cooperative Extension of Cumberland County

Photography

We would like to thank the following people for generously contributing photographs: Hank Bignell, Kate Brown, Stephen Komar, Joseph B. Paulin, Mary Beth Scumaci, Peter Scumaci, Scarlett Simpson, Geoff Slifer, and Timothy J. Waller.

Table of Contents

Abstract	1
Suggested Citation	2
Authors	2
About the Cover Photo	2
Project Reviewers	2
Acknowledgements	3
Photography	3
Executive Summary	9
Setting the Stage	13
In Their Words – Story from Case Study 1	16
In Their Words – Story from Case Study 2	18
Introduction	19
Purpose of this study	21
Objectives	21
Research Design and Methods	23
Results	27
Demographics	27
Deer Population	30
<i>Changes in Deer Population Over Time</i>	30
<i>Perceptions of Deer Numbers Around Farms</i>	32
Livelihood Impacts	33
<i>Direct Financial Losses from Crop Damage and Reduced Yields</i>	34
<i>Hidden and Emotional Costs</i>	35
<i>Financial Losses from Field Abandonment</i>	37
<i>Financial Losses from Crop Abandonment</i>	37
<i>Other Wildlife Damage</i>	38
Management Challenges – Areas Surrounding Farms	40
<i>Public Awareness</i>	40
<i>Residential Development and Refuge Areas</i>	41
<i>Public Lands (Access and Management)</i>	42
<i>Leased Lands (Access and Management)</i>	43
Management Implementation	45
<i>Management and Effectiveness</i>	45
<i>Fencing</i>	45

Hunting and Ideas for Decreasing Deer Numbers in Refuge Areas 47

Depredation Permits 47

Repellents..... 48

Harassment Techniques 48

Discussion and Management Recommendations49

Farmers' Recommendations to Enhance Deer Management.....50

1) General Deer Management 50

2) Venison Donation Programs and Helping Those in Need 51

3) Residential Development and Deer Refuge Areas..... 52

4) Private Leased Farmland and Wildlife Management Plans 52

5) Public Lands and Wildlife Management Plans 52

6) Education and Outreach for Policymakers and Communities 53

7) Deer Fencing 53

8) Enhancing Deer Management through Hunting..... 54

9) Farmer Depredation Permits 54

References.....55

APPENDIX IError! Bookmark not defined.

What Farmers Want You to Know: Key Topics and Messages from Case Study Stories.....Error! Bookmark not defined.

Messages to Policymakers **Error! Bookmark not defined.**

Food Security **Error! Bookmark not defined.**

Venison Donation..... **Error! Bookmark not defined.**

Environmental Impacts: **Error! Bookmark not defined.**

Changes in Deer Population Over Time..... **Error! Bookmark not defined.**

Livelihood Impacts **Error! Bookmark not defined.**

Management Challenges – Areas Surrounding Farms..... **Error! Bookmark not defined.**

Management Implementation and Effectiveness **Error! Bookmark not defined.**

APPENDIX IIError! Bookmark not defined.

Complete Farmer Case Studies.....Error! Bookmark not defined.

Case Study #1 **Error! Bookmark not defined.**

Case Study #2 **Error! Bookmark not defined.**

Case Study #3 **Error! Bookmark not defined.**

Case Study #4 **Error! Bookmark not defined.**

Case Study #5 **Error! Bookmark not defined.**

Case Study #6 **Error! Bookmark not defined.**

Case Study #7 Error! Bookmark not defined.

Case Study #8 Error! Bookmark not defined.

Case Study #9 Error! Bookmark not defined.

Case Study #10 Error! Bookmark not defined.

Case Study #11 Error! Bookmark not defined.

Case Study #12 Error! Bookmark not defined.

Case Study #13 Error! Bookmark not defined.

Case Study #14 Error! Bookmark not defined.

Case Study #15 Error! Bookmark not defined.

Case Study #16 Error! Bookmark not defined.

Case Study #17 Error! Bookmark not defined.

Case Study #18 Error! Bookmark not defined.

Case Study #19 Error! Bookmark not defined.

Case Study #20 Error! Bookmark not defined.

Case Study #21 Error! Bookmark not defined.

Case Study #22 Error! Bookmark not defined.

Case Study #23 Error! Bookmark not defined.

Case Study #24 Error! Bookmark not defined.

Case Study #25 Error! Bookmark not defined.

Case Study #26 Error! Bookmark not defined.

Case Study #27 Error! Bookmark not defined.

APPENDIX IIIError! Bookmark not defined.

Crops and Products Reported by Case Study Farmers Affected by Direct Deer DamageError!
Bookmark not defined.

Field Crops/Cash Grains and Oilseeds Error! Bookmark not defined.

Vegetables and Melons Error! Bookmark not defined.

Fruits and Berries Error! Bookmark not defined.

Nursery/Christmas Trees/Ornamentals Error! Bookmark not defined.

Forest/Woodlands Error! Bookmark not defined.

Poultry Error! Bookmark not defined.

Figures

Figure 1. White-tailed deer captured by a camera trap while feeding in a cornfield at night.	1
Figure 2. Research plot at the Hutcheson Memorial Forest before and after invasive plant removal.	13
Figure 3. Deer in a residential area of New Jersey.	13
Figure 4. Deer standing by the side of the road as a vehicle passes.	14
Figure 5. Farmer planting field corn.	14
Figure 6. Students help to demonstrate extreme deer damage to corn.	14
Figure 7. Weeds overtaking a corn field as a result of deer damage.	14
Figure 8. Deer damage to soybeans.	15
Figure 9. Buck rub damage at tree nursery.	15
Figure 10. Antlered buck.	15
Figure 11. Buck grazing at a golf course and homeowner looking at a group of deer in their backyard. ...	19
Figure 12. Minimum cost estimates for direct deer damage to crops, hidden costs, and other wildlife. .	20
Figure 13. Examples of direct deer damage to corn and soybeans.	21
Figure 14. White-tailed deer in a forested area.	22
Figure 15. Actual deer density estimates for case study farms.	23
Figure 16. Counties included in case study.	24
Figure 17. Primary output of revenues by crop type.	25
Figure 18. Gross household income generated from farm operations in 2019.	28
Figure 19. Annual gross sales from farm products in 2019.	28
Figure 20. Farmer-owned acres in 2019.	29
Figure 21. Farmer-rented acres in 2019.	29
Figure 22. Group of deer in a cornfield.	30
Figure 23. Doe with three fawns in a residential neighborhood.	31
Figure 24. Farmers' perceptions of deer numbers on farm properties and surrounding areas in 2019. ...	32
Figure 25. Case study farmers' rating of 2019 total losses to deer.	33
Figure 26. Case study farmers' perceptions of crop losses to deer between 2010-2019.	34
Figure 27. Minimum hidden cost estimates.	36
Figure 28. Deer damage leading to weeds overtaking a cornfield.	37
Figure 29. Canada geese landing in a recently harvested cornfield.	38
Figure 30. Bear roll damage in cornfield in northern New Jersey.	39
Figure 31. Deer feeding in a wooded area and deer eating residential landscaping.	40
Figure 32. Case study farms within 1 mile of a property where hunting is not practical or prohibited. ...	41
Figure 33. Example of a suburban deer refuge areas.	42
Figure 34. Rented acres where farmers were not allowed to hunt by landowners in 2019.	43
Figure 35. Rented acres where landowners allowed farmers to use depredation permits in 2019.	44
Figure 36. Management options used by case study farmers in 2019.	45
Figure 37. High-tensile woven wire fencing used in agricultural and forested areas.	46
Figure 38. Farmer-owned acres where hunting was allowed in 2019.	47

Tables

Table 1. Minimum and maximum cost estimates for direct deer damage to crops in 2019. 34

Table 2. Minimum and maximum cost estimates for direct crop damage by other wildlife in 2019. 38

Executive Summary

White-tailed deer (*Odocoileus virginianus*) damage to agricultural crops is often associated with direct impacts from feeding and financial losses associated with reduced yields. However, there are many other costs associated with deer damage that are not as obvious. These other costs include having to abandon fields (field abandonment), not being able to grow preferred crops that would increase profits (crop abandonment), having to change crop rotations, the need for increased use of fertilizers and herbicides, time and money spent on deer management, and the emotional toll it can take. We use the term “**hidden costs**” to describe these additional negative impacts that farmers experience relating to damage from white-tailed deer. The current study builds on the findings of previous New Jersey Agricultural Experiment Station (NJAES) research that estimated costs associated with direct deer damage to crops (Fritzell, 1998; Drake, 2005).

The following pages contain information from a collection of case studies conducted by the Rutgers University, NJAES between October 2020 and March 2021. A group of 27 New Jersey farmers shared their stories of struggling with increasing numbers of white-tailed deer and how it has impacted their farms and livelihoods.

Purpose of this study:

- (1) Gain a deeper understanding of “hidden costs” and the extent to which deer are impacting farms and livelihoods throughout New Jersey.
- (2) Identify opportunities to enhance partnerships, management, and outreach efforts.
- (3) Increase awareness of these issues to inform future conversations relating to white-tailed deer policy and management.

Case study farms were selected from the membership of the New Jersey Farm Bureau in areas documented as having high deer numbers (New Jersey Farm Bureau and Steward Green, 2019; NJAES 2020). Deer density estimates for participating farms ranged from 60 to 239 deer per square mile. For better context, densities of 10 deer per square mile are recommended to maintain benefits for social, economic, and ecosystem integrity (Kelly, 2019).

Counties represented in the case study include Atlantic, Burlington, Cape May, Cumberland, Salem, Hunterdon, Mercer, Monmouth, Passaic, Somerset, and Warren. The sample of farmers was constructed to provide a cross section by region (North, Central, and South), farm type (cash grains and oil seeds, vegetable, fruits or berries, and nursery/Christmas tree/ornamental), and farm size (6 acres to > 2,000 acres), where deer damage to agricultural crops is known to occur. Although not every county was directly represented in this study, similar experiences to those captured in the current research were reported in a previous NJAES survey of over 2,000 farmers throughout the state (Fritzell, 1998).

Case studies were originally planned as face-to-face interviews. However, due to the COVID-19 pandemic, the research team adapted the study to include a mixed-method approach that involved mail-back questionnaires, structured interviews, and follow-up telephone conversations to address the research objectives. The mail-back questionnaire posed a series of questions regarding the extent to which deer are impacting farms in New Jersey and the level of effectiveness of available deer management options. Questions for the case study were informed by (Fritzell, 1998), and consultation with agricultural leaders, New Jersey Farm Bureau (NJFB), and the New Jersey Division of Fish and Wildlife (NJDFW).

Through follow-up telephone conversations and structured interviews, farmers shared stories dating back as far as the 1960s. For some, seeing a deer as a child was a rare and thrilling experience. As deer numbers increased dramatically over time, farmers describe the increase in damage to their crops, challenges to keep farming, emotional toll, and impacts to their families and livelihoods. Some even question if they can continue farming.

Responses from questionnaires and the stories farmers shared during follow-up telephone conversations were used to prepare:

- **Farmers' Recommendations to Enhance Deer Management**
- **APPENDIX I: What Farmers Want You to Know: Key Topics and Messages from Case Study Stories**
- **APPENDIX II: Complete Farmer Case Studies**

In the current study, participating farmers collectively owned 4,185 acres and rented 8,769 acres. In 2019, of the 12,052 acres in production, 3,844 acres of crops were directly damaged by deer. An additional 661 acres were abandoned because of deer. On another 2,620 acres, farmers did not plant their preferred crops that could have generated higher profits because of high deer pressure. Nearly 3,000 hours were spent on deer management activities.

Results revealed that the conservative estimate associated with damage from deer and other wildlife in crop year 2019 was nearly \$1.4 million for the 27 participating farmers. These costs include direct deer damage to crops and reduced yields (\$520,940), deer-related hidden costs that can be assigned a dollar value (\$755,200), and crop damage from other wildlife species (\$97,749).

It should be noted that not all "hidden costs," can be assigned a dollar value. The emotional tolls of struggling to grow crops with high deer numbers and constant damage is one example. Additionally, the \$755,200 estimate mentioned earlier does not represent the true extent of all losses from deer-related "hidden costs" that were experienced by participants. Some farmers did not provide estimates for acres lost to crop and field abandonment. Estimates that were provided include \$36,500 for 211 of 661 acres that were completely abandoned. Losses from crop abandonment were \$383,800 for 1,685 of 2,620 acres. Deer fencing costs reported for 398 acres by 10 farmers totaled \$220,500. Reported costs to implement deer management options, primarily labor, were \$51,400. Costs associated with increased use of fertilizers, herbicides, and pesticides because of changing crop rotations and soil damage due to deer pressure were estimated at \$63,000.

This study provides a better understanding of the complex variety of situations and livelihood impacts that New Jersey farmers are encountering as a result of high deer numbers around the state. Results provide New Jersey's policymakers, communities, landowners and managers, and educators with a more complete understanding of the extent to which deer are currently impacting farm operations and identify opportunities to enhance partnerships, management and outreach efforts. Such knowledge is essential for expanding and enhancing deer management and future policy development.

Based on their experiences, participating farmers offered recommendations to policymakers for enhancing deer management in the state. The following is an overview of farmers' recommendations. Additional information on recommendations is provided later in the *Discussion and Management Recommendations* section.

Overview of farmers' recommendations to policymakers to enhance deer management in New Jersey:

1) General Deer Management

- Promote opportunities for consultation between state agencies and stakeholders impacted by deer damage to coordinate efforts, identify challenges, and pool resources to increase the overall effectiveness of deer management programs throughout New Jersey. Participants should include, among others, the agricultural community, public and private land managers, developers, wildlife managers, researchers and educators, and state and local decision-makers.
- Expand coordinated regional deer management programs where municipal and county representatives can work together with state partners to enhance the effectiveness of deer management activities on public lands.
- Promote the expansion of doe-focused hunting programs on public and private lands wherever possible and raise awareness of the importance of harvesting does in reducing overall deer numbers.

2) Venison Donation Programs and Helping Those in Need

- Provide funding to expand opportunities for venison donation programs, such as Hunters Helping the Hungry, that can benefit from deer taken through farmer depredation permits, and suburban community-based deer management programs.

3) Residential Development and Deer Refuge Areas

- Encourage suburban communities with high deer densities that serve as refuge areas, and where hunting is not possible, to apply for New Jersey Division of Fish and Wildlife, Community-Based Deer Management Permits (<https://www.nj.gov/dep/fgw/cbdmp.htm>).

4) Private Leased Farmland and Wildlife Management Plans

- Require landowners receiving Farmland Assessment, or who rent land to farmers for crop production, to allow deer management activities or develop wildlife management plans to reduce deer causing damage.

5) Public Lands and Wildlife Management Plans

- Establish wildlife management plans on public lands to reduce negative impacts to neighboring farms, forests, and residential areas and decrease deer-vehicle collisions.

6) Education and Outreach for Policymakers and Communities

- Facilitate education and outreach programs, especially for policymakers and the general public, to raise awareness of deer impacts to food production and farmers' livelihoods, environmental impacts, and safety concerns.

7) Deer Fencing

- Provide programs and funding for deer fencing for farmers. Fencing is an effective management option for reducing crop damage.

8) Enhancing Deer Management through Hunting

- Create more opportunities for doe-focused hunting to reduce overall deer numbers such as unlimited antlerless harvest in all Deer Management Zones and require that a doe be harvested before a buck can be taken.
- Expand hunting opportunities by lengthening seasons and allowing hunting on Sundays.
- Streamline the processes for obtaining hunting permits (possibly regional or county permits).

9) Farmer Depredation Permits

- Amend the current regulation for farmer depredation permits to include archery for compatibility near residential areas where shotgun is not permitted.

Setting the Stage

We are fortunate to have white-tailed deer in New Jersey. Deer provide many positive benefits including wildlife viewing, photography and recreational hunting that contribute hundreds of millions of dollars in economic benefits annually (Drake et al. 2005). Many New Jerseyans enjoy going for a hike and the thrill they get when they see deer. Then they may notice the negative impacts to the forest. The native plants that should be there are being replaced by thorny invasive species taking over the ecosystem. There are other times when that thrill can become anxiety like seeing a deer on the edge of the road when driving. For others, there may be frustration from deer eating backyard gardens or residential landscaping. Some people have concerns about ticks as deer are one of several species that carry them during their life cycle. Many of us can relate to these experiences as they touch our lives on a daily basis.



Figure 2. Research plot at the Rutgers Hutcheson Memorial Forest before (above) and after (below) invasive plant removal. Photos - Scarlett Simpson.



For decades white-tailed deer have been changing the composition of New Jersey forests

by eating native plants and facilitating the spread of invasive plant species that threaten native herbaceous plants and tree seedlings (NJAES 2020). This is illustrated by the photos of a student standing in the same research plot at the Rutgers Hutcheson Memorial Forest before and after invasive plants were removed (**Fig.2**).



Figure 3. Deer in a residential area of New Jersey. Photo - Joseph Paulin.

Residential areas (**Fig.3**), and unmanaged public and private lands serve as refuges where deer often spend time during the day before heading to the farm fields to feed at night (**Fig.1**).

“If we are going to see agriculture succeed near residential areas of New Jersey, we need to take into account for a balance of people, nature, and an appropriate amount of wildlife. We need to find a healthy balance for our forests and our roadways.” – Case Study Farmer

Approximately 25,000 deer-vehicle collisions take place in New Jersey each year with insurance payouts of over \$100 million (State Farm Insurance 2016). A deer standing next to the side of the road as traffic passes by is a common scene for New Jersey drivers (**Fig.4**).

As we drive around the Garden State and see the many farms that help put food on our tables, there are things that may go unnoticed. We may

not realize the damage and the losses that occur (**Fig.6**).



Figure 4. Deer standing by the side of the road as a vehicle drives by. Photo - Joseph Paulin.



Figure 5. Farmer planting field corn. Photo - Joseph Paulin.

We fail to recognize that the farmers we see out in the fields were up much of the night dealing with deer that were eating their crops.



Figure 6. Students help to demonstrate extreme deer damage to corn. Photo - Joseph Paulin.

The stalks in the cornfield we pass, that should be overhead, have been eaten down to a few feet from the ground, sometimes lower (**Fig.6**). This damage opens the ground to sunlight, allowing weeds to grow taller, and eventually take over much of the field (**Fig.7**).

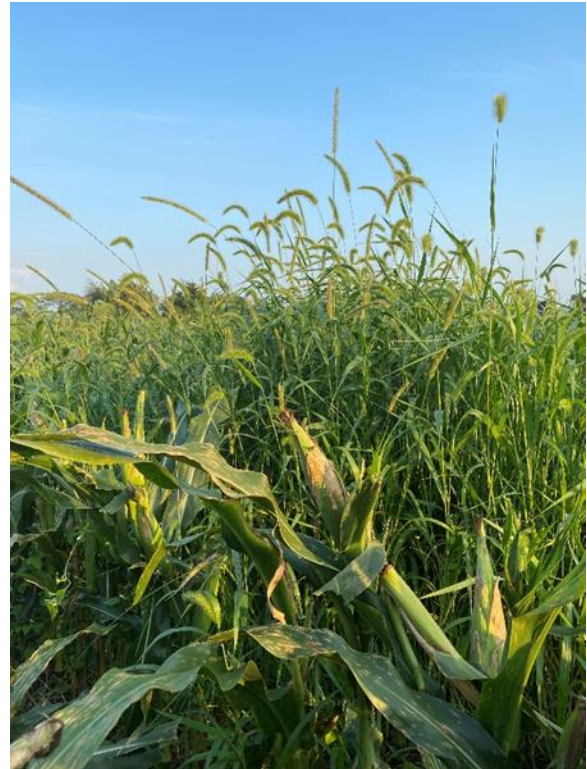


Figure 7. Weeds overtaking a cornfield as a result of deer damage. Photo - Joseph Paulin.

“Most people probably don’t think about financial losses to farms because they see green fields when driving down the road. People don’t realize when they’re looking at damage and how much of the crop has been eaten by the deer.”

- Case Study Farmer

We see a nice green, knee-high, soybean field, not knowing that it would be waist-high if the deer weren’t continuously eating the tops of the plants (**Fig.8**). Or another field that had been thriving only weeks before, now grazed to the ground by deer. Imagine the emotional toll that it takes.



Figure 8. Deer damage to soybeans. Photo - Geoff Slifer.

“What I tell nonfarmers – if you want us here, we can’t be here with all the deer. Imagine taking 10 to 15% of gross income every year and feeding it to the deer. Some farmers lose as much as 40% per year. A lot of us are disappearing.”

– Case Study Farmer

When we visit a tree nursery, we notice that the bark on several of the trunks is damaged (*Fig.9*).



Figure 9. Buck rub. Photo - Timothy J. Waller.

Some of the Fraser Firs appear to be damaged at the Christmas tree farm we visit during the holidays. A buck had been rubbing their antlers on them (*Fig.10*).

“It used to get kind of depressing. A few weeks before Christmas bucks would come in rubbing right before you were about to sell the trees. That’s a loss of \$35,000 per year.”

– Case Study Farmer



Figure 10. Antlered buck. Photo - Joseph Paulin.

Try thinking of it like this - after working around the clock for months, investing all your time, energy, and money into your job or business, someone just takes 10-25% of your paycheck. You don’t make any profit that year. You’re tired, frustrated, depressed, and just don’t know if the thing you have loved doing your whole life, is worth doing anymore at all. These are just some of the ways that white-tailed deer are impacting our farmers’ lives in New Jersey.

“There’s not a field I farm where there’s not deer damage. I’m starting to give up.”

– Case Study Farmer

In Their Words – Story from Case Study 1

When I was a boy, it was a treat to see a deer. You didn't want to shoot it. You wanted to shoot it with a camera. I've been farming my whole life. I started on my own in high school or college. I've done a lifetime of this.

I'm overridden with deer here. If you pull into my farm at night, you can easily see 30-40 deer. My income should be substantially better. My yields are \$150,000-\$200,000 less per year than they should be with my acreage. Each year, the deer can make the difference between a profit and a loss.

People don't realize that this affects several generations. There will be no more farms. You have to preserve those livelihoods. Understand that not only is it jeopardizing my ability to provide safe and healthy food, but it's also impacting the community around you, your health and safety.

Local farms had a major impact in us surviving COVID-19. People need to look at agriculture as essential to them and not just a business. A farm is part of the essential infrastructure around them that puts food on their tables. When you preserve a farm, you're preserving the future of your food source.

There are many hidden costs from deer. There are long-term environmental impacts from overgrazing. Soil erosion and impacts to the water supply. You have to use more fertilizers and herbicides. There's frustration and emotional costs. There's increased liability insurance for a fleet of farm trucks because of deer collisions. There's been impacts of damage to equipment from an antler going through a \$4,000 tire, more than once, and running a deer carcass through a combine. We're always concerned about a deer running out in front of you while you're in harvest or planting.

I've entirely dropped whole farms because of deer damage. The only reason I started growing sorghum at all was because deer don't like it as much as other crops. It's been so long that we've been having deer damage, my expectations for the yields are a lot less than they used to be. I'm probably underestimating the damage.

Over time, deer grazing on soybeans, it's going to kill you. I've had it grazed right to the ground. Some graze can help increase production in the beginning of the season. A little grazing in soybeans can be beneficial, but more often than not, because of the size of the deer herd, they're detrimental. They never just lightly graze, always over graze.

Deer eat a lot more than other wildlife. Corn damage is worst on the perimeter of the fields than the middle. Damage is always worst in smaller fields no matter what the crops are. Corn yields are consistently reduced by 20-30% every year.

Rye straw damage is mostly physical damage from rolling and a little grazing in early to mid-spring. Grass hay is hard to measure. There's grazing, take out about 5% of the overall crop. You end up with soil compaction. If a pasture is grazed, you're not even going to bale it.

Weather also affects deer damage. The later you get in the growing season, the more impact the deer will have. The deer will out graze the growing of the crop. In 2019 it was worse, we got the crop in late because of wet weather. The yields were lower than they should have been. In 2020 I got the crop in earlier, harvested more deer, and one of the landlords got up a deer fence around a few hundred acres.

I see financial incentive to fence. I just can't afford it. We don't always have authority to put it up or manpower to maintain it. I have leases for most of my crops, but I don't control it. If it's my own land it might be cost effective, but not for all the fields. You don't see a hay or grain farmer ever put it up. I've seen increases in

damage because operations around me are putting up fence. They divert the deer to me.

Depredation permits, years ago we used them. I've had issues in the past with homeowners, hunters, animal advocates, and landlords. That's just part of the problem. I don't want liability because of kids trespassing all the time.

Hunters can't take enough deer. Some hunters that hunt rented properties are not hunting does. Landlords control hunting rights, but some landlords don't allow hunting, or they lease to gun clubs.

Repellents, they don't do sh*t. They might do a little until it rains. It's too expensive for a crop growing from April to October. It has to be reapplied every time it rains. If you put them on, 5 days later there's new growth that it's not on. That's what the deer are eating.

It's hard to put a number on the hours spent every year on deer management because it's just incorporated into management period.

We've been telling our story for a long time. I think the damage and risk to society as a whole has not been told. Deer are responsible for damage to property, public safety, and people's livelihoods. This is a real problem, and the politicians need to take action. Unless they take action, they're contributing to the problem.

Policymakers need to take into account environmental impacts, residential damage, health and safety of deer collisions, and health of the deer population. There's a lot that needs to be considered. How long can you sustain this level of overpopulation without some type of detrimental effect to the herd?

We need a comprehensive herd reduction program. Future deer management and development have to adapt together. Until the herd becomes manageable, we need to make it a year-round effort.

We need to reduce burdens, regulations, and fees to hunters. Find avenues to public good through processing and feeding programs to get protein to the needy so it doesn't go to waste. Incentivize doe harvest and donations to food banks. No cost to the hunter and not counted against the hunter's limit. Increase funding for programs like Hunters Helping the Hungry. Figure out ways for donation through depredation permits during the summer months. Use sharpshooters in suburban areas where you can't hunt and donate the venison.

- Case Study Farmer

In Their Words – Story from Case Study 2

We are a large, growing farm. We deal with the deer and add fencing as we expand. I've been trying to reduce losses, but because we are continuously expanding, there's not enough time to fence off more of the area.

If we are going to see agriculture succeed near residential areas of New Jersey, we need to take into account for a balance of people, nature, and an appropriate amount of wildlife. We need to find a healthy balance for our forests and our roadways. There's a lot of land in the area owned by the township. They do little to no deer management. There's also green space that has little to no management. That's a problem.

I see more deer in residential neighborhoods than on my farm. Because we have woods, they can disappear during the day and come out at night and feed on the farm. I have land enrolled in a golden-winged warbler conservation project for forest regeneration. The deer damage is getting bad enough that it may not be suitable for golden-winged warblers.

We haven't entirely stopped farming a field because of deer damage, but have restricted going to new areas until we can get a fence up. We could have farmed tomatoes, squash and other vegetables. The estimated loss is about \$5,000. We've used 4-ft electric fence and a 6-ft fence, but the deer hop over and have knocked down some of the fence. We plan to add 8-ft high-tensile woven wire fence in the future.

Early on we used repellents, chemical and cayenne pepper. Every time it rains you have to go out and reapply. I haven't seen anything worth the time in the long run.

I don't hunt myself, but allow others to hunt on the land. Pretty much every place that can be hunted in the area is hunted, but some people only hunt bucks. We need to find ways to better expand hunting to harvest more deer, seasons and bag limits.

We need to facilitate more ways for hunters to donate to foodbanks. Make it easier. A no-cost option to get the deer from the hunter to the foodbank.

We're interested in getting depredation permits for deer, bear and coyote. The coyotes eat our chickens. The coyotes and fox will take a hit on the electric fence to get a chicken. We've also had Cooper's hawks, red-tailed hawks, fox, bear, raccoons, and sometimes owls eating the chickens.

There's lots of bears in the area. The bears damaged the coop by ripping off the door and pulled out a 50-pound bag of corn. Sometimes a bear will grab a chicken. We lost about 100-feet of electric fence that was dragged off by a bear. Bears also damage fruit trees by breaking branches and eating the fruit.

- Case Study Farmer

Introduction

White-tailed deer are commonly found where forested areas meet a variety of public and private lands including agricultural areas, suburban neighborhoods (**Fig.11**), public parks, golf courses (**Fig.11**) and corporate landscapes (NJAES/HMFC 2020; Boulanger et al. 2014). Development in the state has created fragmented landscapes, and areas that can serve as wildlife refuges, often inaccessible to hunting that controls deer numbers. High deer densities can lead to intolerable levels of damage to native ecosystems, farmers' crops, commercial and residential landscaping, and increased safety concerns from deer-vehicle collisions. (NJAES/HMFC 2020; Boulanger et al. 2014).



Figure 11. Buck grazing on the edge of putting green with a golfer looking on (left). Homeowner looking at a group of deer in their backyard (right). Photos - Mary Beth Scumaci (left) and Joseph Paulin (right).

In a 1998 Rutgers University, New Jersey Agricultural Experiment Station (NJAES) study of over 2,000 farmers, deer densities exceeded the tolerance of producers throughout the state who reported losses from direct deer damage to crops estimated between \$5-\$10 million (Fritzell 1998). The economic impacts from unwanted deer-human interactions in New Jersey, including damage to vehicles and direct damage to agricultural crops were conservatively estimated to be \$69 million annually by a 2005 joint study of Rutgers University, Cornell University and Penn State University (Drake et al. 2005). In more recent years, deer-vehicle collisions have exceeded 25,000 in New Jersey and insurance payouts have averaged an estimated \$100 million (State Farm Insurance 2016). Additionally, damage by white-tailed deer has been estimated at approximately \$2 billion in the United States annually (Boulanger et al. 2014).

The following pages contain a collection of case studies. A group of 27 New Jersey farmers shared their stories of struggling with increasing numbers of deer and how it has impacted their farms. The current study builds on the findings of previous NJAES research that estimated costs associated with direct deer damage to crops (Fritzell, 1998; Drake, 2005). The case studies include estimates of direct financial losses from deer eating crops and reduced yields. There is also information on “hidden costs” associated with pressure from deer, such as having to abandon fields, not being able to grow preferred crops, having to change crop rotations, the need for increased use of fertilizers and herbicides, time and money spent on deer management, and the emotional toll it can take. Deer density estimates for

participating farms ranged from 60-239 deer per square mile. For better context, densities of 10 deer per square mile are recommended to maintain benefits for social, economic, and ecosystem integrity (Kelly, 2019).

A new component of the current study, that builds on previous research, is estimates for deer-related “hidden costs.” Although the Fritzell (1998) study provided insights into “hidden costs,” estimates for economic losses focused primarily on direct deer damage to crops (**Fig.13**). The current study of just 27 farms, found that estimates for direct damage to 3,842 acres affected by deer ranged from a minimum of \$520,940 to a maximum of \$670,250. Additionally, we found “hidden costs” to be substantial, were greater than estimates for direct deer damage to crops, and account for an additional \$755,200 for the 27 participating farms (**Fig.12**).

Minimum cost estimates to responding New Jersey farmers from direct deer damage to crops and reduced yields (\$520,940), hidden costs that can be assigned a dollar value (\$755,200), and crop damage from other wildlife species (\$97,749) was nearly \$1.4 million (**Fig.12**).

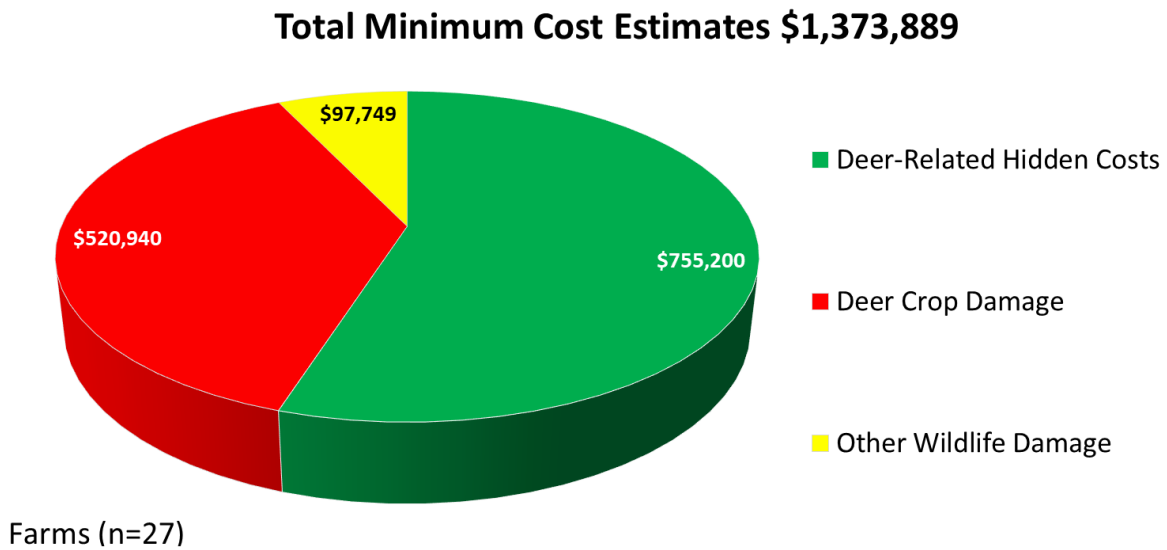


Figure 12. Minimum cost estimates for 27 New Jersey farmers from direct deer damage to crops, deer-related hidden costs that can be assigned a dollar value, and crop damage from other wildlife.



Figure 13. Examples of direct deer damage to corn (left) and soybeans (right). Photos - Joseph Paulin (left) and Kate Brown (right).

Deer damage was described by the New Jersey Farm Bureau as an epidemic and was voted as the #1 issue among farmers at the 2018 Annual Meeting. In 2021, deer damage was again identified as the #1 wildlife control issue faced by farmers at the State Agricultural Convention.

Purpose of this study:

- (1) Gain a deeper understanding of “hidden costs” and the extent to which deer are impacting farms and livelihoods throughout New Jersey.
- (2) Identify opportunities to enhance partnerships, management, and outreach efforts.
- (3) Increase awareness of these issues to inform future conversations relating to white-tailed deer policy and management.

Objectives:

- To obtain information from New Jersey farmers suffering crop losses due to deer.
- To document farmers’ estimates of the value of crops lost to deer in 2019.
- To document the effects of “hidden costs” from deer damage such as crop and field abandonment.
- To determine deer management activities implemented, or lack thereof, in the areas surrounding the farmland on public and private lands.
- To assess farmers’ use of various non-lethal and lethal deer management options.
- To communicate results to policymakers, managers, educators, and local communities.

Through mail-back questionnaires, structured interviews, and follow-up telephone conversations, farmers have shared their perspectives and perceptions on the number of deer in their communities, changes in the deer population over time, development that has created deer habitat and refuge areas, crop losses, and the effectiveness of deer management options. Case study farmers also conveyed messages they would like their communities to know, suggestions for policymakers and a series of recommendations for enhancing deer management in an ever-changing landscape.

This study approach provides a better understanding of the complex variety of situations and livelihood impacts that New Jersey farmers are encountering because of high deer densities around the state. Results provide a more complete understanding of the extent to which deer are currently impacting farm operations and identify opportunities to enhance partnerships, management and outreach efforts. Such knowledge is essential for expanding and enhancing deer management and future policy development.



Figure 14. White-tailed deer in a forested area. Photo - Peter Scumaci.

Research Design and Methods

Case study farms were selected from the membership of the New Jersey Farm Bureau in areas documented as having high deer numbers (New Jersey Farm Bureau and Steward Green, 2019; NJAES 2020). Deer density estimates for participating farms ranged from 60-239 deer per square mile (**Fig.15**). For better context, densities of 10 deer per square mile are recommended to maintain benefits for social, economic, and ecosystem integrity (Kelly 2019).

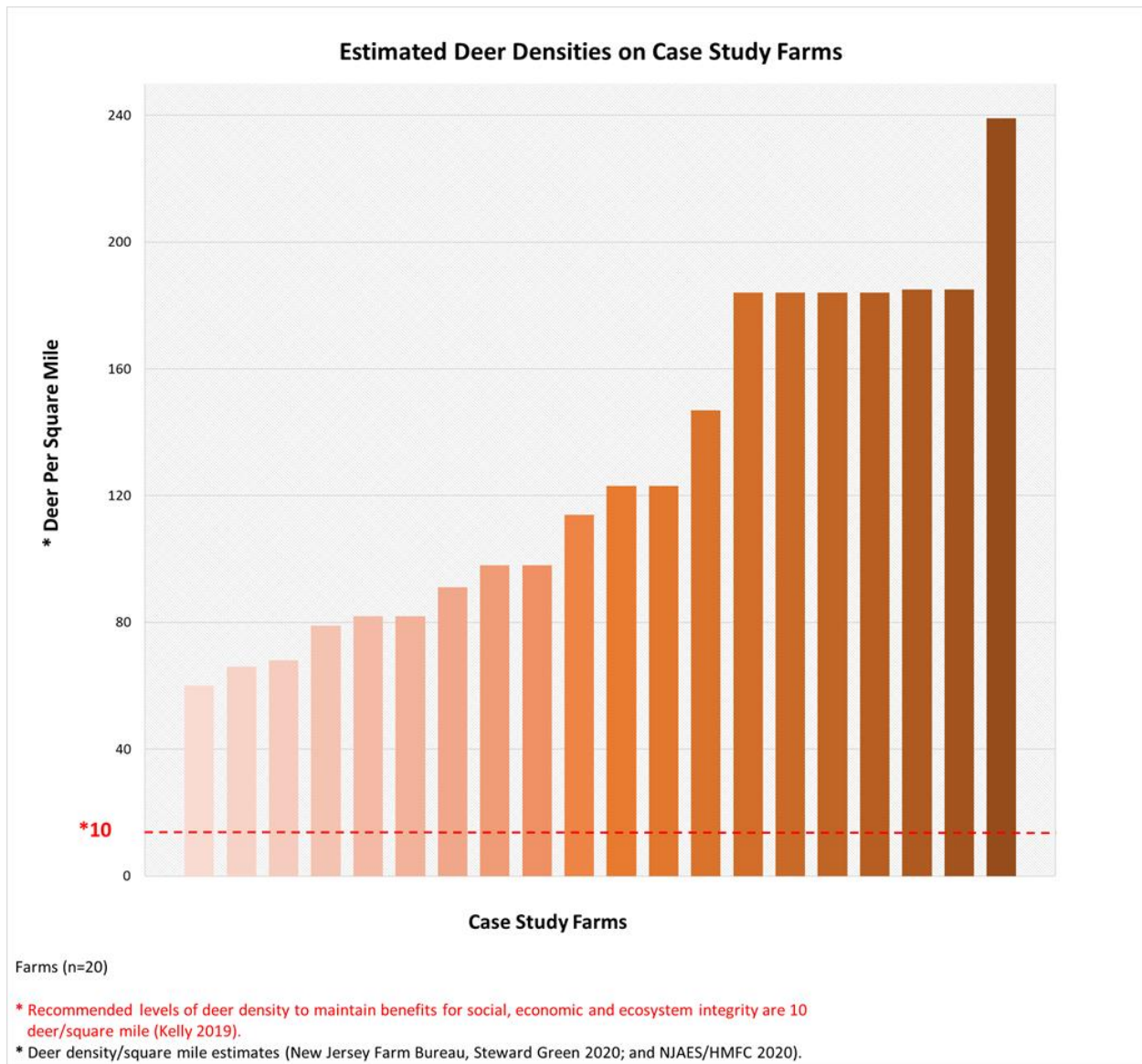


Figure 15. Actual deer density estimates for case study farms ranged from 60 to 239 deer per square mile. That's 6 to 23 times higher than recommended levels.

Counties represented in the case study include Atlantic, Burlington, Cape May, Cumberland, Salem, Hunterdon, Mercer, Monmouth, Passaic, Somerset, and Warren (**Fig.16**). Although not every county was directly represented in this study, similar experiences to those captured in the current research were reported in a previous NJAES survey of over 2,000 farmers throughout the state (Fritzell, 1998).

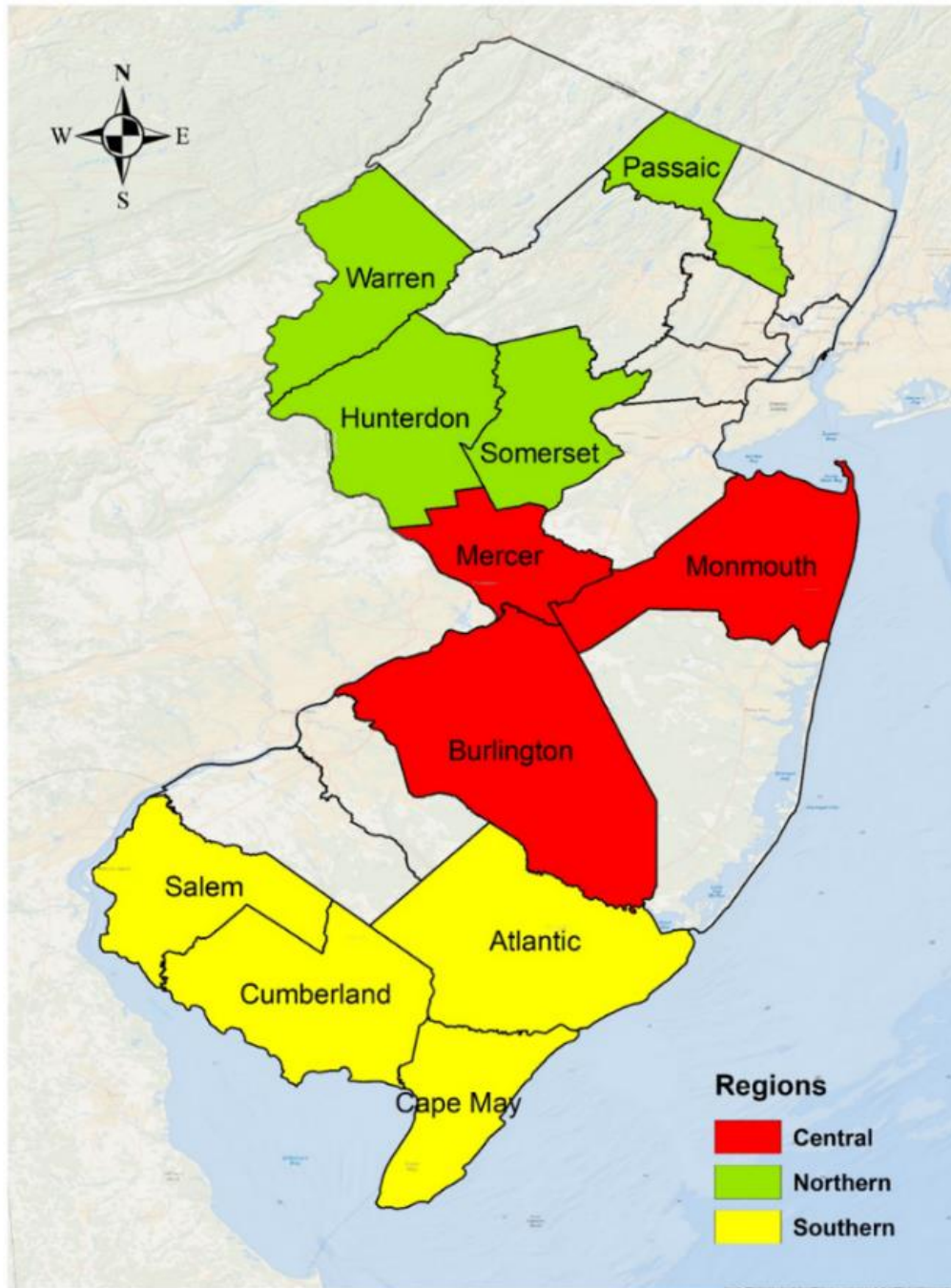
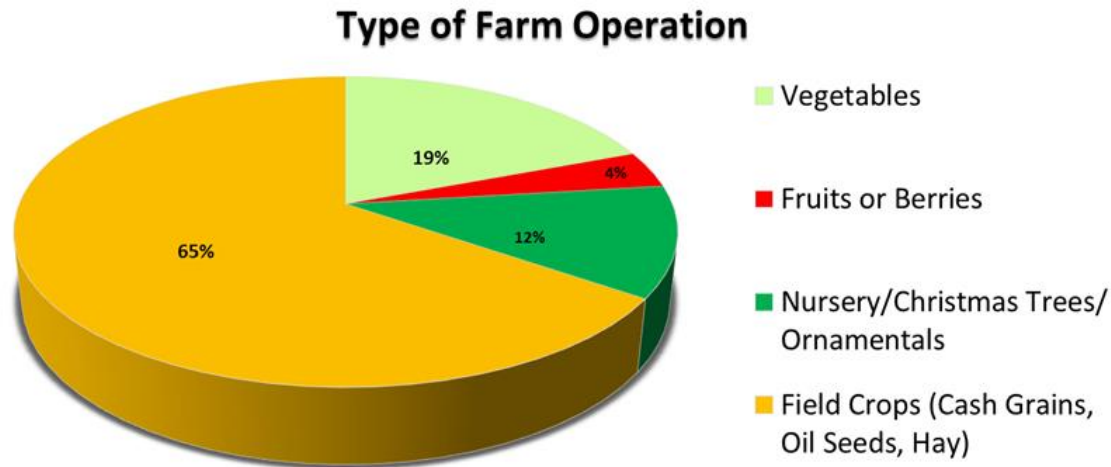


Figure 16. Counties where case study farms are located.

The sample of farmers was constructed to provide a cross-section by region (North, Central, and South) (**Fig.16**), farm type (cash grains and oil seeds, vegetable, fruits or berries, and nursery/ornamental) (**Fig.17**), and farm size (6 acres to > 2,000 acres), where deer damage to agricultural crops is known to occur.



Responses to Question (n=26)

Figure 17. Percentage of primary output of revenues for case study farms by crop type.

Case studies were originally planned as face-to-face interviews. However, due to the COVID-19 pandemic, the research team adapted the study to include a mixed-method approach that involved mail-back questionnaires, structured interviews, and follow-up telephone conversations to address the research objectives. The mail-back questionnaire posed a series of questions regarding the extent to which deer are impacting farms in New Jersey and the level of effectiveness of available deer management options. Questions for the case study were informed by (Fritzell, 1998), and consultation with agricultural leaders, New Jersey Farm Bureau (NJFB), and the New Jersey Division of Fish and Wildlife (NJDFW).

Mail-back questionnaires were sent to farmers (N=28) between October 2020 and March 2021. Questionnaires contained multiple choice, open-ended questions, and fillable charts that addressed (1) general farm operations, (2) farmers' perceptions about the numbers of deer on the farm and surrounding area, (3) livelihood impacts including direct crop losses, and hidden costs such as crop and field abandonment, (4) deer management on farmed properties and surrounding areas, and (5) demographics.

Follow-up telephone conversations (n=25) took place between November 2020 and March 2021. The overall participation rate in the study was 96% (n=27). Most participating farmers (n=24) returned usable mail-back questionnaires via United States Postal Service (USPS). Some farmers (n=2) responded to questionnaires via telephone. An additional farmer (n=1) did not respond to the questionnaire, but did participate in a follow-up telephone conversation. Follow-up telephone conversations provided farmers with the opportunity to share additional details of how deer have impacted their farms and livelihoods in 2019 and previous years.

Farmer mail-back questionnaires were estimated to take approximately 1 hour to complete. Follow-up telephone calls with participating farmers lasted from 30 minutes to 3 hours depending on farmer availability and amount of information shared. Additional details on the case study process are below.

- 1) October 2020: Initial contact message was sent to 28 farmers via email, notifying them that they had been selected to participate in a case study being conducted by the New Jersey Agricultural Experiment Station, Rutgers Cooperative Extension on deer damage and management, and that a questionnaire would arrive in the near future. Farmer contact information was provided by the New Jersey Farm Bureau.
- 2) October 2020: Questionnaire packets were sent out via USPS priority mail and included brief instructions and assurance that all individual responses would be kept confidential. Packets included a Rutgers University "Consent to take part in a research study" form; initial contact letter with information on the study and instructions; and an addressed, prepaid envelope to mail-back the completed questionnaire.
- 3) November 2020: Reminder message to complete the questionnaire was sent to all potential respondents via USPS standard mail and email.
- 4) November 2020: Approximately one month after the first questionnaire packet was sent, a replacement questionnaire packet was sent via USPS priority mail to all non-respondents.
- 5) November 2020: Letters and emails were sent out to thank participants that had returned questionnaires, remind non-respondents to complete and mail-back outstanding questionnaires, and to arrange follow-up telephone conversations.
- 6) November 2020: Telephone follow-up conversations began.
- 7) January 2021: Participants were contacted via email and telephone call to remind non-respondents to complete and mail-back outstanding questionnaires, and to arrange follow-up telephone conversations.
- 8) January 2021: A final replacement questionnaire packet was sent via USPS priority mail to all non-respondents.
- 9) February 2021: Participants were contacted via email and telephone call to remind non-respondents to complete and mail-back outstanding questionnaires, and to arrange follow-up telephone conversations.
- 10) March 2021: Follow-up telephone conversations were completed.
- 11) April 2021-July 2021: Mail-back questionnaire data was entered and analyzed. Notes from follow-up telephone conversations was transcribed. Individual farmer case studies were developed. Overlapping themes, key messages, and farmer recommendations were extracted from case studies and categorized to highlight in the draft report for ease of review. Draft report was completed.
- 12) July 2021-November 2021: Review and revisions of draft report.
- 13) December 2021: Report content finalized.
- 14) February 2022: Final report layout completed and published.

Results

Case study results are presented in several subsections that cover a variety of topics relating to increasing deer numbers, impacts to farmers' livelihoods, and management challenges.

Demographics contains general information on farmers' gross household income generated from farm operations, top sources of income, gross sales from farm products, and acres owned and rented.

Deer Population includes farmers' experiences with changes in the deer population over time and deer numbers around the farms.

Livelihood Impacts presents information on crop losses from deer, direct financial losses and reduced yields, hidden and emotional costs, and other wildlife species impacting farm operations.

Management Challenges – Areas Surrounding Farms addresses deer-related management issues including increasing public awareness, residential development and deer refuge areas surrounding farms, and land access and challenges on public and private lands.

Management Implementation completes the results section and covers farmers' experiences using specific management options and effectiveness.

Additional information, stories of how deer impact farmers' lives, and recommendations to enhance deer management can be found in the following:

- **Discussion and Management Recommendations Section:** Farmers' Recommendations to Enhance Deer Management
- **APPENDIX I:** What Farmers Want You to Know: Key Topics and Messages from Case Study Stories
- **APPENDIX II:** Complete Farmer Case Studies

Demographics

Eighty-one percent of respondents were full-time farmers. More than half (56%) generated between 76-100% of their gross household income from their farm operation (**Fig.18**). The average age for respondents was 61 years and ranged from 42 to 85 years. All respondents were male. Fifty-two percent of farmers ranked cash grains and oil seeds as their highest source of income, followed by vegetables (20%), nursery/Christmas trees/ornamentals (12%), hay (12%), and berries and vineyard (4%).

“It’s been so long that we’ve been having deer damage, my expectations for the yields are a lot less than they used to be. I’m probably underestimating the damage.”

– Case Study Farmer

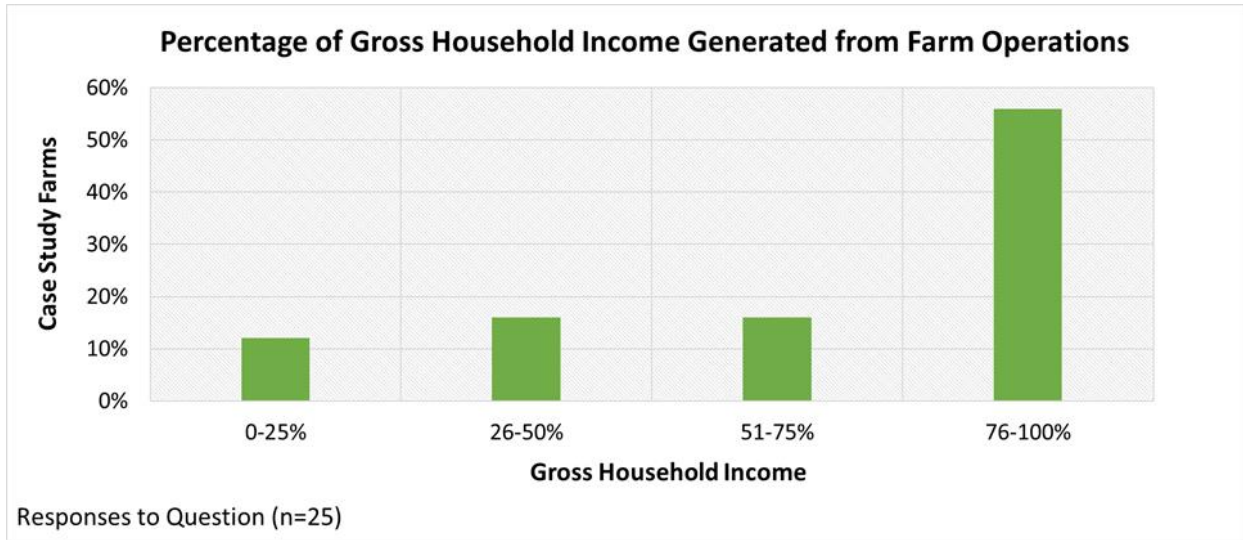


Figure 18. Percentage of gross household income generated from farm operations in 2019.

Annual gross sales for 2019 ranged from less than \$2,500 to \$3 million or more, with 43% of farmers reporting sales between \$100,000 to \$499,999 (Fig.19).

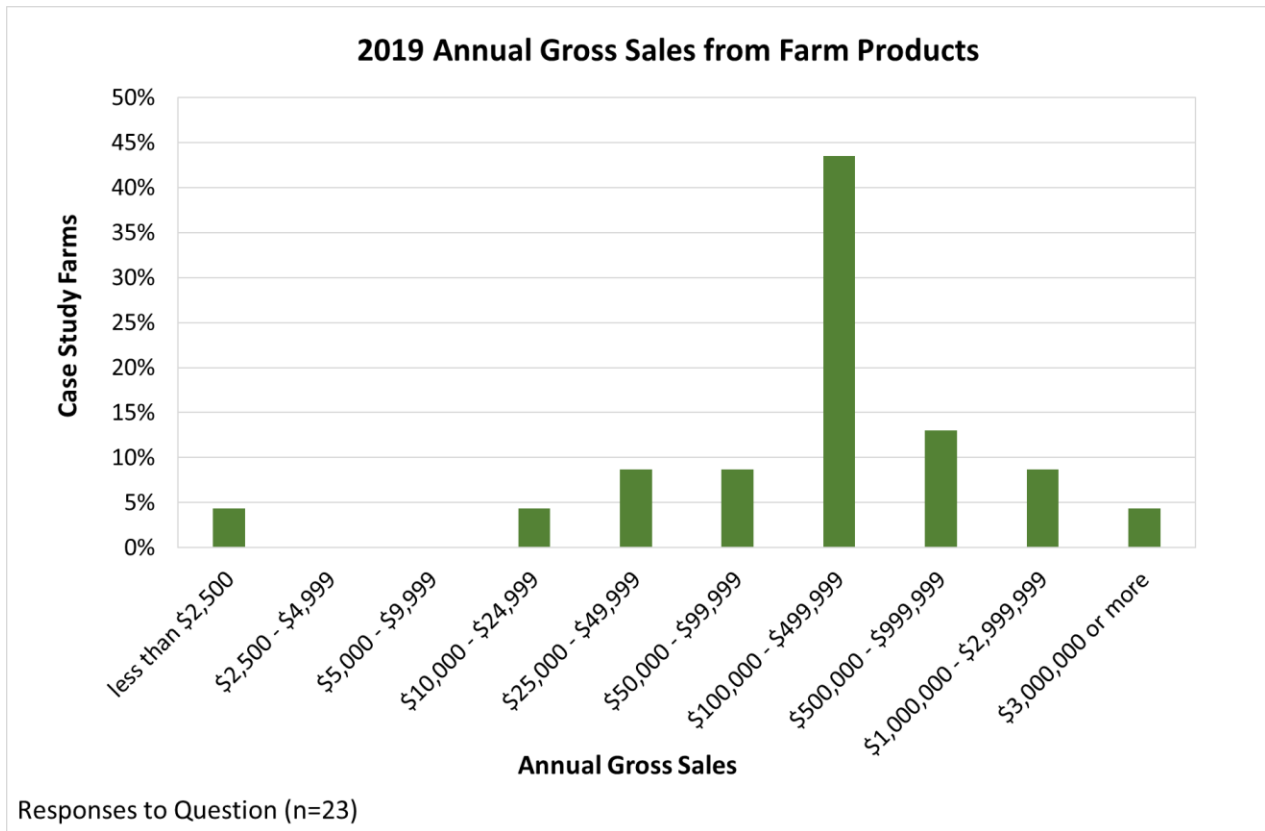


Figure 19. Annual gross sales from farm products in 2019.

Case study farmers collectively owned 4,185 acres and rented 8,769 acres. In 2019, of the 12,052 acres in production, 3,844 acres of crops were directly damaged by deer. Acres owned ranged from 6 acres to 1,200 acres per farmer (**Fig.20**). Rented acres ranged from 0 acres to 2,000 acres per farmer (**Fig.21**).

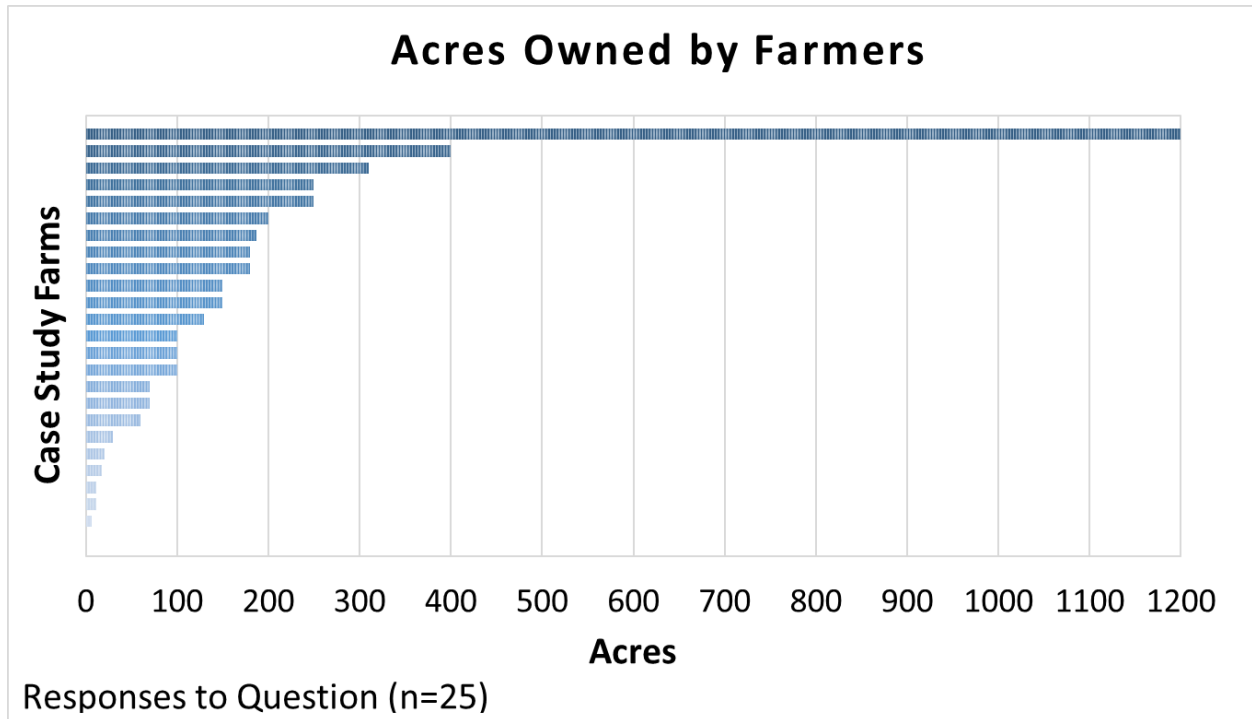


Figure 20. Farmer-owned acres in 2019.

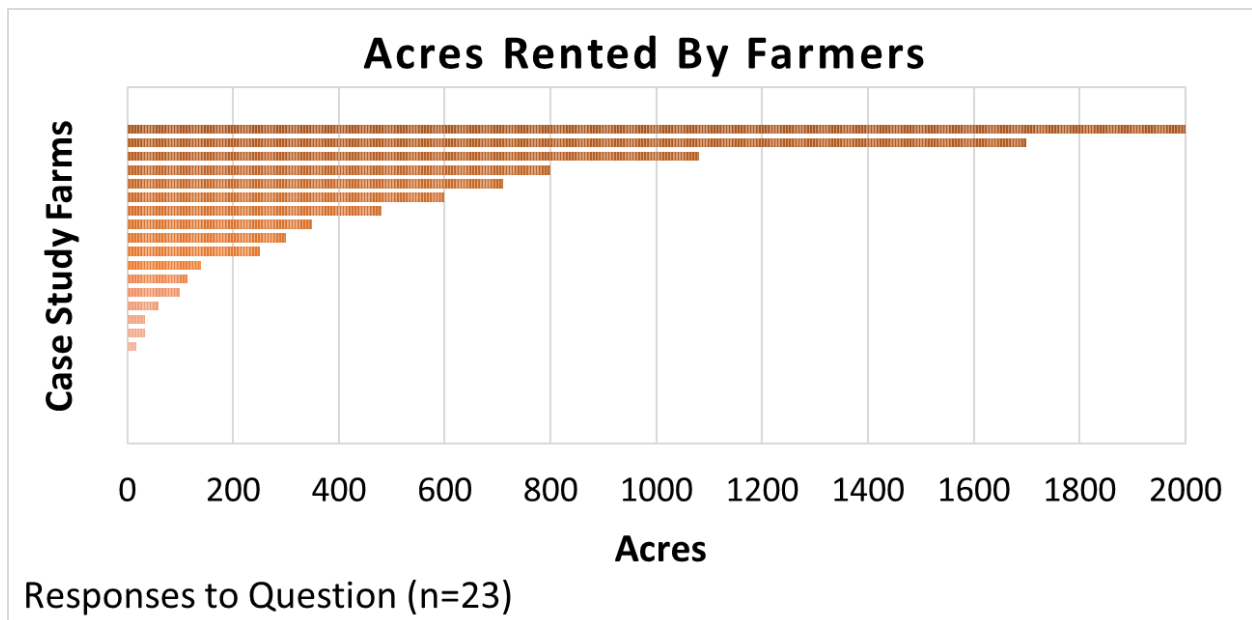


Figure 21. Farmer-rented acres in 2019.

Deer Population

Changes in Deer Population Over Time:

Farmers shared stories of how the deer population has changed in New Jersey over their lifetimes. Several farmers noted that when they were young, back in the 1960s and 1970s, it was rare and exciting to see a deer. Deer numbers increased to levels where crop damage started to become a problem for farmers in the 1980s and 1990s in North and Central New Jersey. More frequent problems in the southern part of the state were noted in the past 20 years. Sightings that were once rare, started becoming frequent visits with groups of 25 or more deer at one time being sighted around the farm and in the fields. Farmers reported regularly seeing groups of deer around farmed properties (**Fig.22**) and seeing does with three fawns (**Fig.23**). An additional consideration for deer management is that adult does can produce two and sometimes three fawns per year under ideal conditions (Boulanger et al. 2014).

“When I was young it was exciting to see a deer. You’d call everyone out to see them. Now it’s common to see 25 deer at a time running across the field.”

– Case Study Farmer



Figure 22. Group of deer in a cornfield. Photo - Kate Brown.

“When I was young growing up here you didn’t really see deer.”

– Case Study Farmer

“The late 1980s and early 1990s, that’s when it started being a problem and we started using fencing. As development went up, pressure started getting worse over the years. I see as many as 25-30 deer at night on the farm. I’ve seen does with 3 fawns this spring.”

– Case Study Farmer



Figure 23. Doe with three fawns in a New Jersey residential neighborhood. Photo - Joseph Paulin.

“It’s not just affecting the farmers. It’s affecting the neighborhoods too. They’re eating all the plants. Everybody in the neighborhood is affected.”

– Case Study Farmer

Perceptions of Deer Numbers Around Farms:

Farmers (96%) believed there were “too many” deer on farmed properties (**Fig.24**). The one farmer who believed there were the “right number” of deer on their property had a small 6-acre farm and had recently installed a deer fence. For the areas surrounding farmed properties, 100% of farmers believed there were “too many” deer.

“For years we’ve been talking about - what we are we going to do about the deer? Nothing has been enough. They’re getting bad.”

– Case Study Farmer

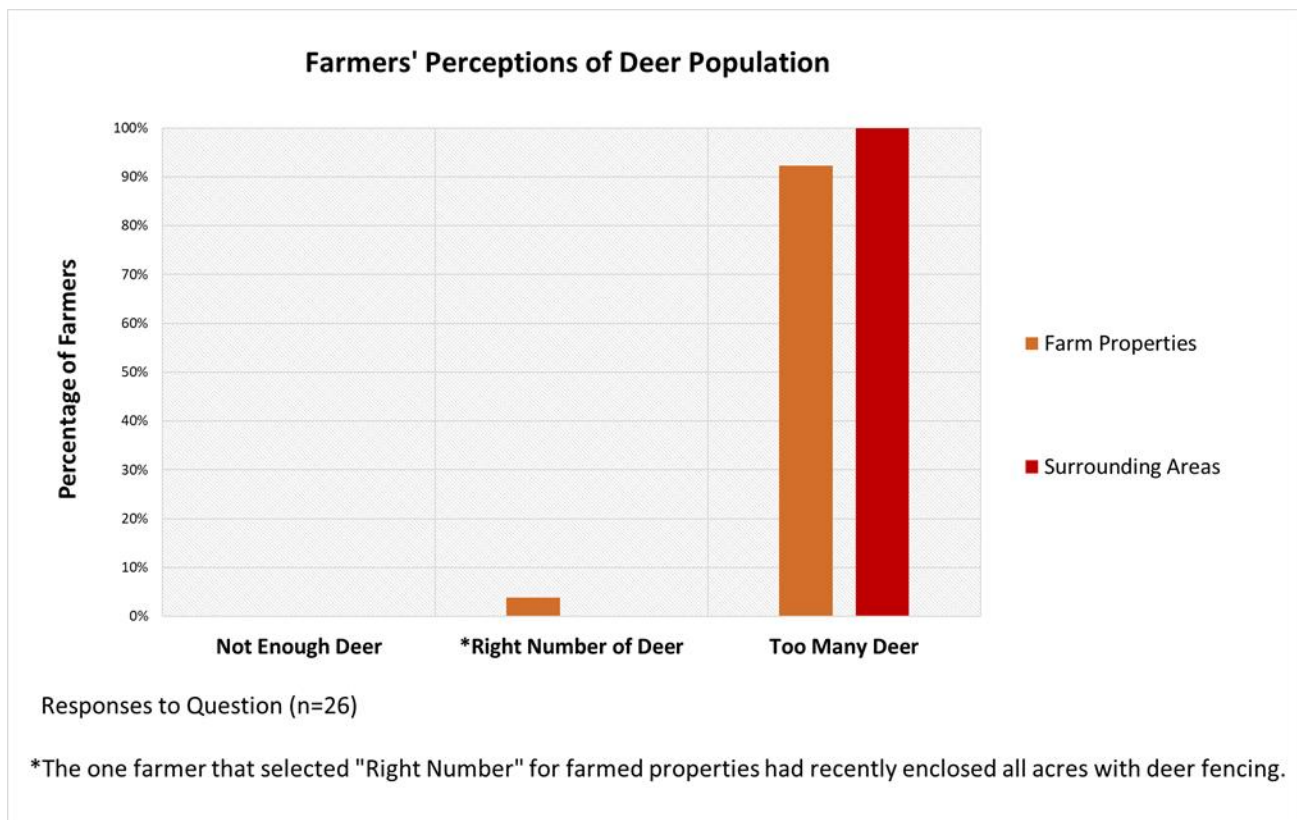


Figure 24. Case study farmers' perceptions of deer numbers on farm properties and surrounding areas.

“The surrounding areas, easily hundreds of acres, are serving as a refuge for huge herds of deer.”

- Case Study Farmer

Livelihood Impacts

Farmers noted significant impacts to their livelihoods from high deer numbers that can affect several generations. Direct damage to crops and deer-related “hidden costs” were estimated from less than \$1,000 to over \$200,000 depending on the size of the farm. It is difficult sometimes to understand the true impact of these estimates. For some farmers, this works out to financial losses from 10% to 25% of their gross income every year, sometimes more. Total crop losses to deer were considered a “problem” for 96% of participating farmers (**Fig.25**) and 81% of farmers were trying to reduce losses.

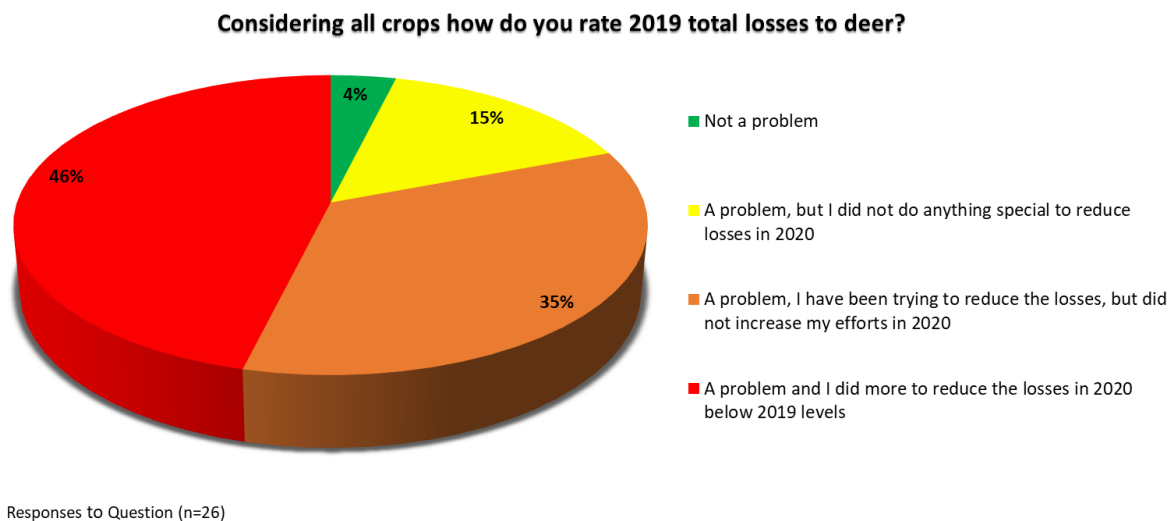


Figure 25. Case study farmers' rating of 2019 total losses to deer.

“The deer take 25% of every paycheck.”

– Case Study Farmer

The current study builds on the findings of previous NJAES research that estimated costs associated with direct deer damage to crops (Fritzell, 1998; Drake, 2005). We found direct deer damage to 3,842 acres on 27 farms ranged from a minimum of \$520,940 to a maximum of \$670,250 (**Table 1**). A new component of the current study, that builds on previous research, is estimates for deer-related “hidden costs.” We found these “hidden costs” to be substantial, were greater than direct deer damage to crops, and account for an additional \$755,200 for participating farms (**Fig.27**).

Results revealed that the conservative estimate associated with damage from deer and other wildlife in crop year 2019 is nearly \$1.4 million for the 27 participating farmers (**Fig.12**). These costs include direct deer damage to crops and reduced yields (\$520,940), deer-related hidden costs that can be assigned a dollar value (\$755,200), and crop damage from other wildlife species (\$97,749).

“My wife and I used to say if we lose less than \$10,000 per year it would be a good year. We haven't had a good year in over 10 years.”

– Case Study Farmer

Crop losses were considered “unacceptable” for 68% to 87% of responding farmers for all years between 2010 and 2019 (**Fig.26**).

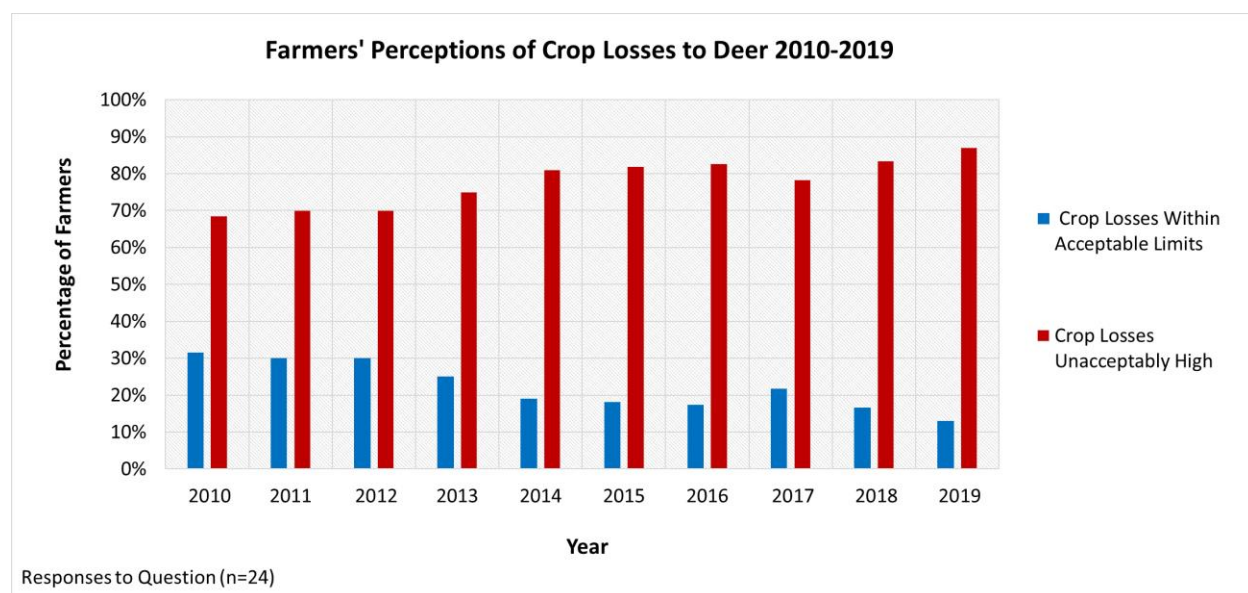


Figure 26. Case study farmers' perceptions of crop losses to deer between 2010-2019.

Direct Financial Losses from Crop Damage and Reduced Yields:

Financial losses that farmers experience from direct deer damage to crops and reduced yields is significant and can be challenging to quantify. Direct losses from the crops that deer eat or damage so badly that they can't be harvested or sold ranged from \$2,000 for a small 6 acre farm to over \$200,000 for a large farm over 2,000 acres. Many farmers believe true losses from deer damage are often underestimated. Participating farmers collectively owned 4,185 acres and rented 8,769 acres. In 2019, of the 12,052 acres in production, 3,844 acres of crops were directly damaged by deer. For the 3,844 acres affected by direct deer damage, loss estimates ranged from a minimum of \$520,940 to a maximum of \$670,250 (**Table 1**).

Table 1. Minimum and maximum cost estimates for direct deer damage to crops and acres affected. Responses to question (n=26).

Crops	Total Acres In Production 2019	Acres Affected by Deer 2019	Minimum Damage Estimate (\$)	Maximum Damage Estimate (\$)
Field Crops (Cash Grains, Oil Seeds, & Hay)	9,669	3,650	\$466,700	\$577,000
Vegetables & Melons	2,319	179	\$39,990	\$75,500
Fruits or Berries	5	2	\$5,750	\$6,250
Nursery, Christmas Trees, & Ornamentals	59	13	\$8,500	\$11,500
Total All Crops	12,052	3,844	\$520,940	\$670,250

“Things would look good at the beginning of the season and by the end it wouldn’t even be worth harvesting.”

– Case Study Farmer

Hidden and Emotional Costs:

Deer damage to agricultural crops is often associated with direct impacts from feeding and financial losses associated with reduced yields. However, there are many other costs associated with deer damage that are not as obvious. These other costs include having to abandon fields (field abandonment), not being able to grow preferred crops that would increase profits (crop abandonment), having to change crop rotations, the need for increased use of fertilizers and herbicides, time and money spent on deer management, and the emotional toll it can take. We use the term **“hidden costs”** to describe these additional negative impacts that farmers experience relating to damage from white-tailed deer. Hidden costs that farmers shared are described in detail in **APPENDIX III: Complete Farmer Case Studies**.

“There’s not a field I farm where there’s not deer damage. I’m starting to give up.”

– Case Study Farmer

In some cases, dollar values can be estimated for financial costs such as reduced yields from having to abandon fields, and not being able to grow preferred crops that would increase profits. Early season losses from deer can require replanting fields a second or even third time. There are also additional costs associated with the need for increased fertilizer, herbicide, and pesticide applications resulting from deer pressure. Farmers often spend considerable time and money on implementing deer management activities such as hunting or implementing depredation permits late into the night after spending all day in the fields. The costs of materials and labor for fence construction and maintenance can also be extremely high, and for many, cost prohibitive.

“I can accept some damage, but this is too much!”

– Case Study Farmer

The \$755,200 estimate mentioned earlier just for “hidden costs,” does not represent the true extent of all losses that were experienced by case study farmers. Some farmers did not provide estimates for acres lost to crop and field abandonment. Estimates that were provided include \$36,500 for 211 of 661 acres that were completely abandoned. Losses from crop abandonment were \$383,800 for 1,685 of 2,620 acres. Deer fencing costs reported for 398 acres by 10 farmers totaled \$220,500. Reported costs to implement deer management options, primarily labor, were \$51,400. Costs associated with increased use of fertilizers, herbicides, and pesticides because of changing crop rotations and soil damage due to deer pressure were estimated at \$63,000 (**Fig.27**).

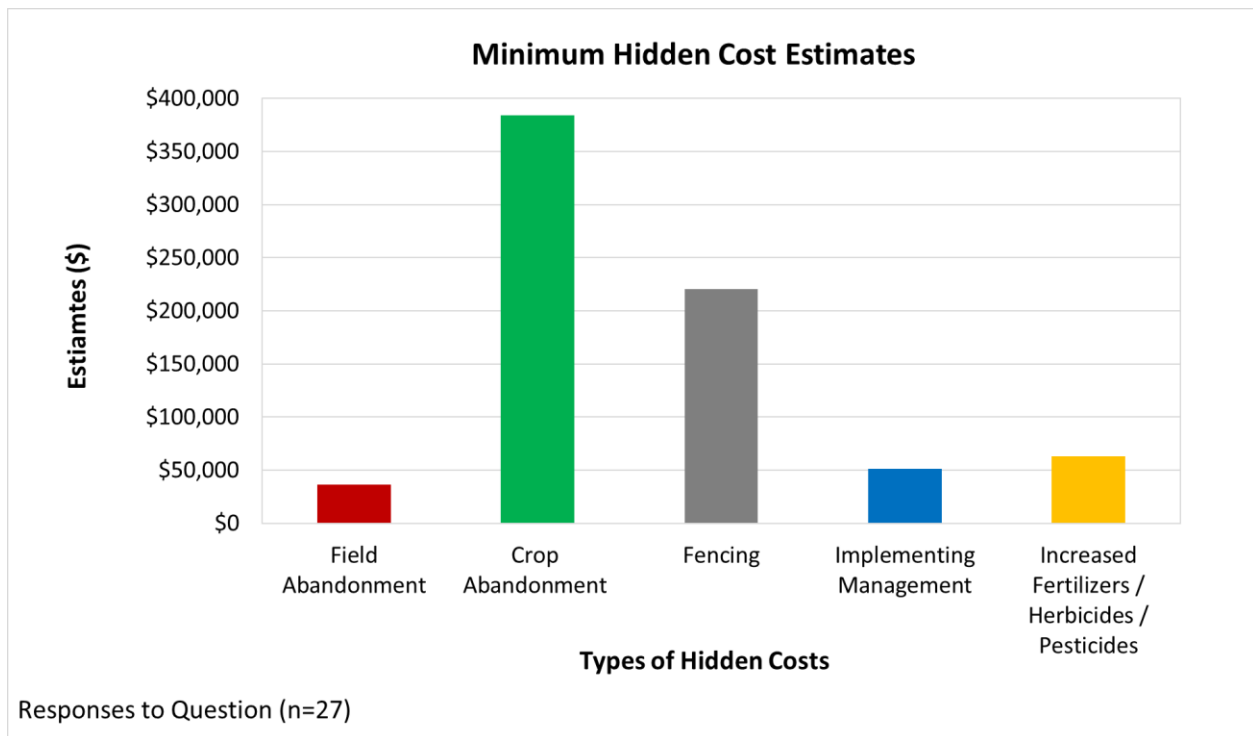


Figure 27. Minimum hidden cost estimates.

“It’s fun to watch the deer and all that, but not when it’s your livelihood they’re eating up. It’s not profitable and hurting the farmers and everybody that depends on them for food.”

– Case Study Farmer

There are also costs that farmers experience that are difficult to estimate or cannot be assigned a dollar value. These can be emotional costs such as frustration and depression from putting time, energy, and money into producing a crop that is starting to thrive just to watch the deer eat it down to the ground in a matter of weeks. There are concerns about being able to pay the bills and wondering if it’s still worth the effort. Crops that are so severely damaged that fields are not worth harvesting at the end of the growing season. Deer browse leads to increased weed growth that overtakes the crop (**Fig.28**). Crop rotations have to be changed in response to deer pressure and can result in soil damage and loss of fertility. Sometimes there is opposition in the community to the use of lethal management options that result in strained relationships with neighbors. For rented farmland, hunting or depredation permits to reduce deer numbers in efforts to decrease crop damage may not be allowed by the landowner.

“Once the deer ate the corn off, the sun got down to the ground and let the weeds grow.”

– Case Study Farmer

Deer have eaten the corn on the left (**Fig.28**) down to waist-high and the field is being overgrown by weeds that are competing with the corn for resources such as light and water. The photo on the right (**Fig.28**) shows undamaged corn in the same field that is 7-feet tall and shading out the smaller weeds between the rows.



Figure 28. Deer damage to corn leading to weeds overtaking the field (left). Undamaged corn in the same field that is outcompeting and shading out the smaller weeds (right). Photos - Joseph Paulin.

Financial Losses from Field Abandonment:

There are costs that often go unnoticed such as having to abandon a field because of deer pressure. These costs lead to significant financial losses. Forty-four percent of responding farmers (n=11) reported having to abandon a field because of deer in 2019. Reported losses ranged from \$2,000 to \$15,000 per farm. Several farmers found losses difficult to estimate. Estimates include \$36,500 for 211 of 661 acres that were completely abandoned (**Fig.27**).

“I’ve entirely dropped whole farms because of deer damage.”

– Case Study Farmer

Financial Losses from Crop Abandonment:

Many farmers are not able to plant preferred crops. In 2019, 63% of case study farmers reported abandoning crops like corn, soybeans, alfalfa, oats, vegetables, and Christmas trees. Financial losses associated with crop abandonment ranged from \$3,500 to \$55,000 per farm. Reported losses from crop abandonment were \$383,800 for 1,685 of 2,620 acres (**Fig.27**).

“There’s 12 acres where I would be growing vegetables if not for the deer damage. That costs \$15,000 to \$20,000 per year.”

– Case Study Farmer

Other Wildlife Damage:

In addition to losses suffered from white-tailed deer, most farmers 81% (n=21) also experienced significant financial losses from other wildlife species in 2019. Farmers (n=26) were “very confident” (88%) or “somewhat confident” (12%) in their ability to correctly distinguish losses caused by deer from losses caused by other wildlife. Depending on the crop and wildlife species, losses ranged from less than \$1,000 to \$35,000 per farm.



Figure 29. Canada geese landing in a recently harvested cornfield. Photo – Joseph Paulin.

“Canada geese damage is in the thousands every year.”

– Case Study Farmer

Table 2. Cost estimates for direct crop damage and acres affected by other wildlife. Responses to question (n=26).

Species	Crop Type	Acres Affected	Minimum Damage Estimates (\$)	Maximum Damage Estimates (\$)
Black Bear	Field crop	7	\$2,249	\$6,249
Black Bear	Fruits	Not provided	\$600	\$650
Blackbirds/Red-winged Blackbirds/Crows	Field crop	102	\$5,000	\$9,000
Blackbirds/Red-winged Blackbirds/Crows	Vegetables	40	\$15,000	\$20,500
Canada Geese	Field crop	622	\$35,900	\$52,900
Canada Geese	Vegetables	Not provided	\$5,000	\$5,000
Groundhogs	Field crop	Not provided	\$3,000	\$3,000
Groundhogs	Vegetables	25	\$27,500	\$33,500
Raccoons	Field crop	Not provided	\$2,000	\$2,000
Squirrels	Field crop	Not provided	\$850	\$1,650
Turkey	Field crop	Not provided	\$650	\$650
Total	All Crops	796	\$97,749	\$135,099

Damage estimates were reported for red-winged blackbirds, blackbirds, crows, black bear, Canada geese (**Fig.29**), groundhogs, raccoons, squirrels, and turkey (**Table 2**). Reported estimates for direct crop damage from these species ranged from a minimum of \$97,749 to a maximum of \$135,099 (**Table 2**). Not all reports included estimates for financial losses or acres affected.

Additional damage reported for other wildlife included beavers flooding fields by blocking ditches and creeks. Black bears (**Fig.30**), damaged chicken coops, beehives, and fencing. There were also reports of coyotes, fox, owls, Cooper's hawks, and red-tailed hawks killing chickens.

“Bears up in north Jersey are getting bad in the cornfields. They roll around and knock down all the corn and eat it.”

– Case Study Farmer

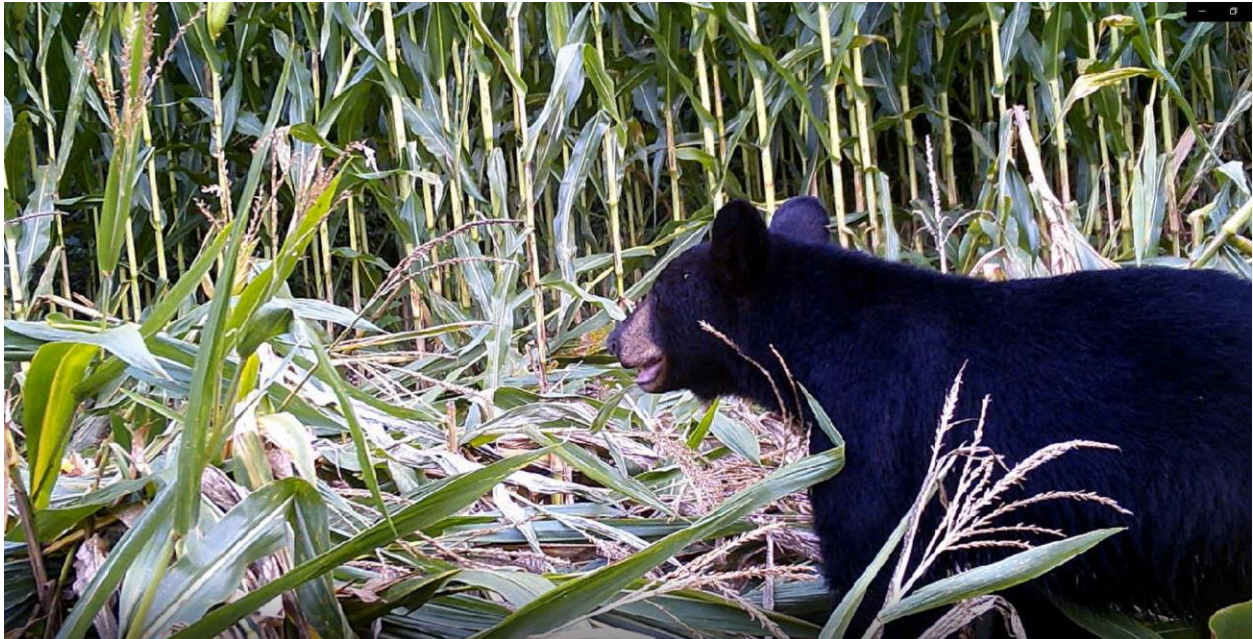


Figure 30. Bear roll damage in a cornfield in northern New Jersey. Photo - Stephen Komar.

“Beaver have been a problem blocking ditches and creeks that flood the lower fields.”

– Case Study Farmer

Management Challenges – Areas Surrounding Farms

Public Awareness:

New Jersey depends on locally produced crops. During case study interviews, farmers stated that this became even more clear to people in 2020 and 2021 during the COVID-19 global pandemic. Many New Jerseyans enjoy locally grown fruits, vegetables, and products made from corn and soybeans. Farmers want communities to know that deer-related crop damage is jeopardizing their ability to provide safe and healthy food. They would like people to make the connection and understand that deer are negatively impacting farmers' properties and lives, as well as the health and safety of local communities.

“Local farms had a major impact in us surviving COVID-19. People need to look at agriculture as essential to them and not just a business. A farm is part of the essential infrastructure around them that puts food on their tables. When you preserve a farm, you’re preserving the future of your food source.”

– Case Study Farmer

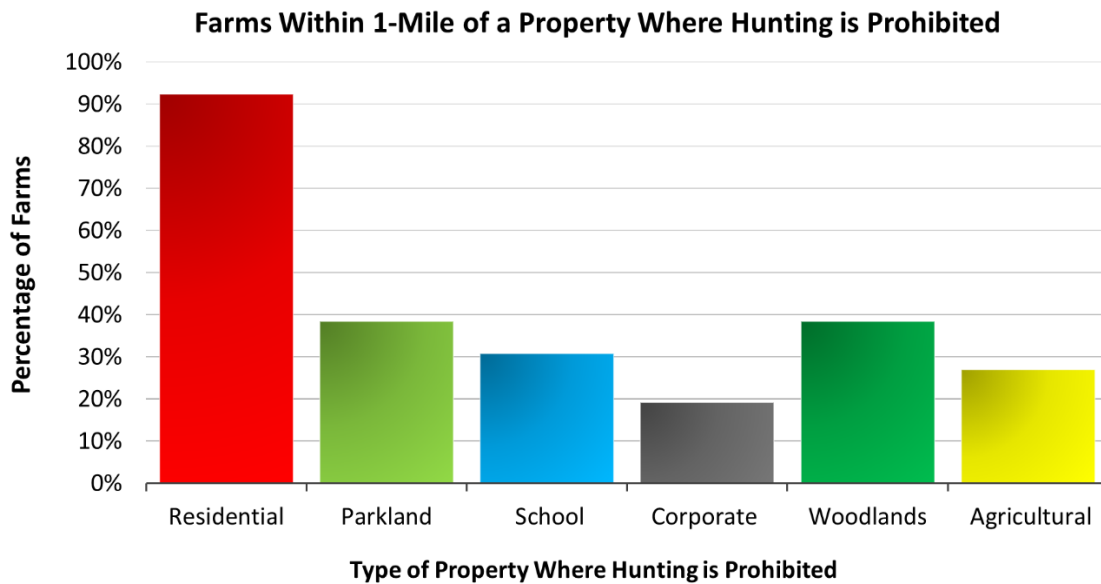


Figure 31. Deer feeding in a wooded area (left) and deer eating residential landscaping (right). When unmanaged and near farms, these types of properties can be refuge areas for deer that feed in farmers' fields. Photos - Mary Beth Scumaci (left) and Joseph Paulin (right).

Residential Development and Refuge Areas:

A deer refuge is an area of publicly or privately owned land with suitable habitat, where the ability to manage deer is limited or restricted (Drake et al. 2002; Department of Environmental Protection, Division of Fish, Game and Wildlife 1999). Farmers noted that as development increased in the state, starting as early as the 1970s, pressure from deer has increased. Many farmers have noted that adjacent neighborhoods, woodlands and open spaces, are serving as refuge areas (**Fig.31**), for deer that feed in the farm fields at night and cause extensive crop damage.

Ninety-six percent of responding farmers (n=25) were within 1-mile of a refuge area, including residential areas (92%), parklands (38%), schools (31%), corporate parks (19%), woodlands (38%), and other agricultural lands (27%) (**Fig.32**).



Responses to Question (n=26)

Figure 32. Percentage of case study farms within 1-mile of a property where hunting is not practical or prohibited.

“There are a lot of refuges in neighborhoods and private lands around the state that are next to farms. The deer use them during the day and feed in the farm fields at night.”

– Case Study Farmer

For developed and residential areas where hunting is not allowed or practical (**Fig.33**), or where hunting alone cannot remove enough deer, farmers encourage townships to apply for a New Jersey Division of Fish and Wildlife, Community Based Deer Management Program permit (<https://www.nj.gov/dep/fgw/cbdmp.htm>). The permit allows for additional lethal management options and removal of deer outside of regulated hunting seasons. Townships can also look for opportunities to donate the venison to foodbanks to help those in need in their community.



Figure 33. Deer that find refuge in suburban areas (left) often find nearby farm fields (right) where they feed and cause crop damage. Photos – Joseph Paulin (left) and Hank Bignell (right).

“When developments started going in the 1980s and 1990s it got worse. The deer would feed in the farm fields that were left.”

– Case Study Farmer

Public Lands (Access and Management):

Public lands near farm fields can act as refuges for deer causing crop damage. Farmers promote expanding coordinated regional deer management programs where municipal and county representatives can work together with each other and the state partners to enhance the effectiveness of deer management activities on public lands. Farmers recommended that public lands should have wildlife management plans to reduce negative impacts to neighboring farms, forests, residential areas and decrease deer-vehicle collisions. Farmers noted county programs for managing deer on public lands, including doe-focused bowhunting programs and allowing depredation permits on leased land as positive steps. It was further recommended that hunting take place as much as possible on public lands to reduce refuge areas.

“There should be hunting allowed as much as possible on public lands. Public lands should have wildlife management programs so deer don’t affect neighboring farms, residential areas, and there are fewer vehicle collisions.”

– Case Study Farmer

Leased Lands (Access and Management):

Many farmers rent land to grow crops throughout New Jersey. Case study farmers (n=19) leased 8,769 acres in 2019. In some cases, landowners that lease land to farmers do not allow them to control access to the properties, or implement management options such as hunting and depredation permits to decrease deer numbers. The percentage of rented acres where hunting was not allowed ranged from 3% to 100% for participating farmers that leased land (**Fig. 34**).

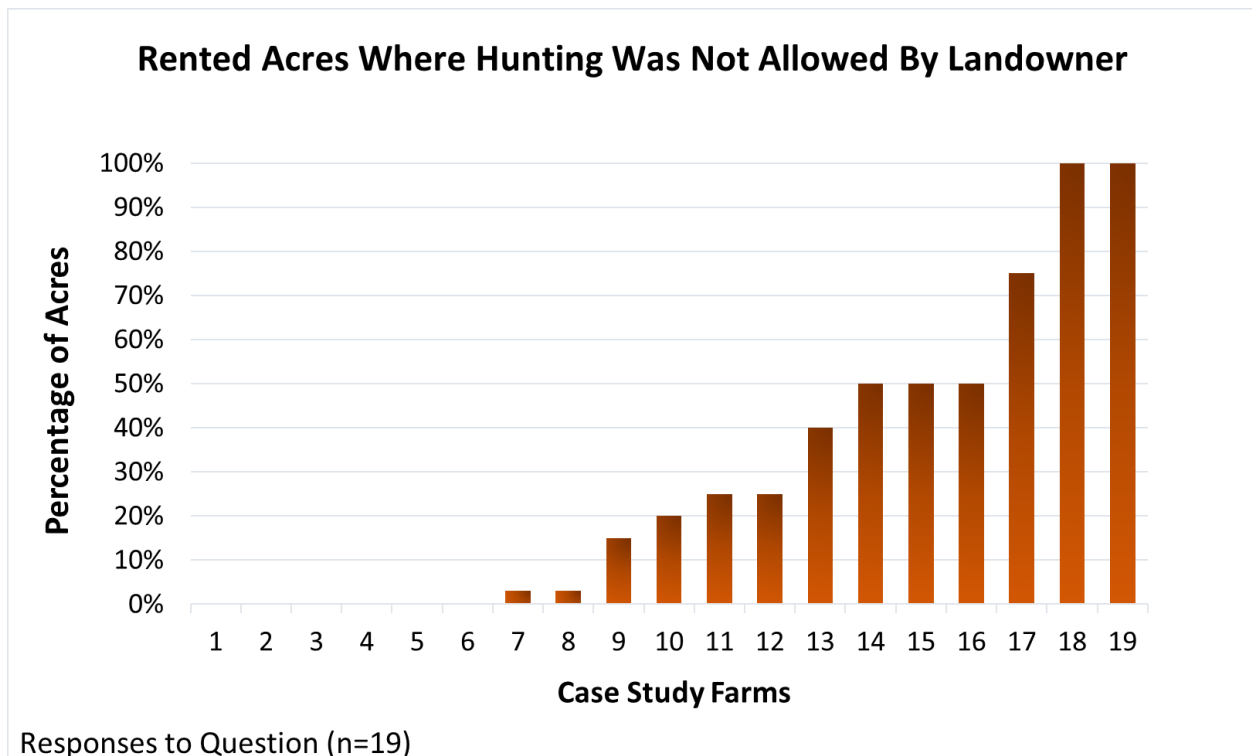


Figure 34. Percentage of acres rented in 2019 where case study farmers were not allowed to hunt by the landowners.

“Landowners that lease should have to allow hunting or be required to create a wildlife management plan. Some don’t allow any hunting and the land is a deer refuge. People that have properties that are refuges should have to develop a wildlife management plan or be assessed a fee or penalty if their land is a refuge for deer causing damage to farms.”

– Case Study Farmer

“Farmers need to be able to hunt on properties that are leased and use deprecation permits. Areas where I can control hunting - it makes a big difference for damage.”

– Case Study Farmer

Although several farmers had positive relationships with local hunting clubs that practiced doe-focused management, others noted clubs that were more focused on buck hunting, that alone, is not as effective in reducing deer numbers. It was recommended that landowners receiving Farmland Assessment, or who rent land to farmers for crop production, should be required to allow deer management activities or be required to develop a wildlife management plan. Promoting the expansion of doe-focused hunting programs on public and private lands wherever possible and raising awareness of the importance of harvesting does was also recommended.

“I’ve been talking with the neighbors that hunt about the need to shoot more does.”

– Case Study Farmer

In 2019, the percentage of rented acres where landowners allowed case study farmers to use deprecation permits ranged from 0 to 100%. Some farmers (n=10) were allowed to use deprecation permits on 2 to 100% of the rented land. However, other farmers (n=6) were not allowed to use deprecation permits on any of the rented property (*Fig.35*).

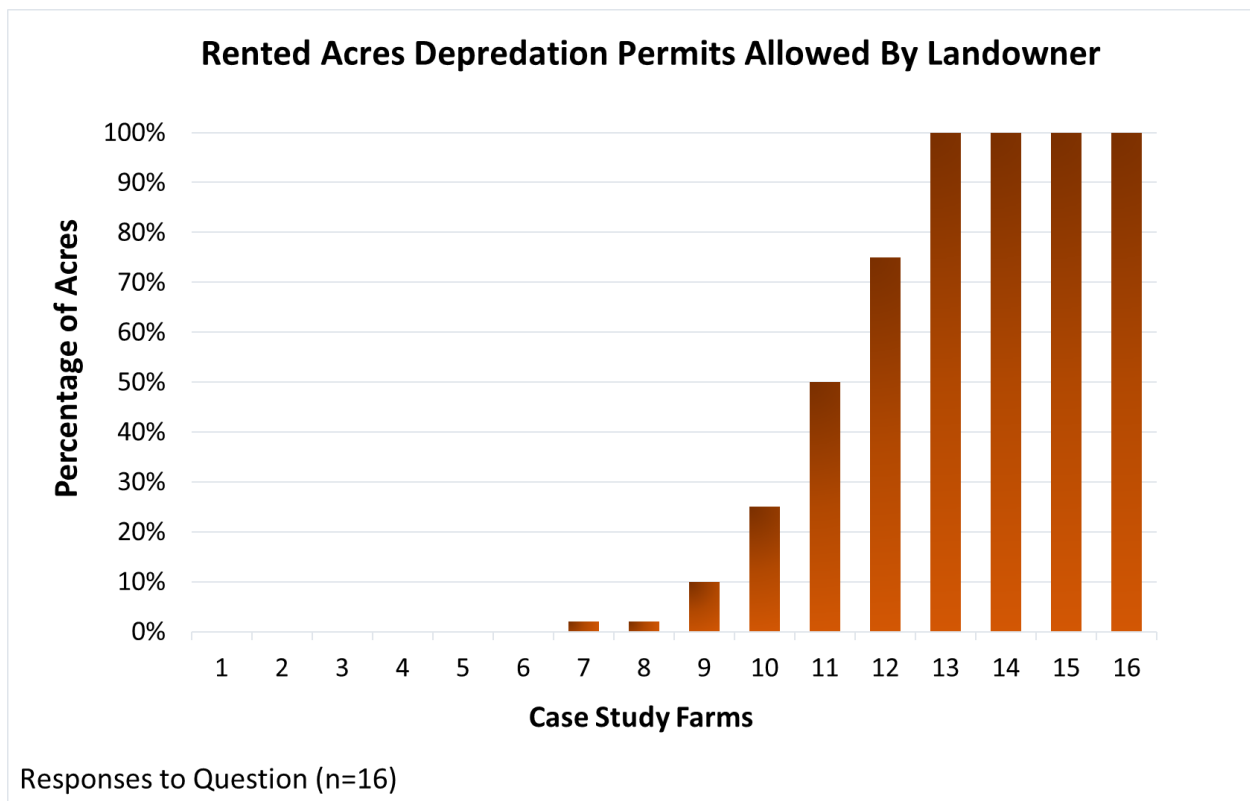


Figure 35. Percentage of rented acres where landowners allowed farmers to use deprecation permits.

Management Implementation

Management and Effectiveness:

Farmers reported using several deer management options that vary in effectiveness, cost, and time required for implementation. Management options implemented in 2019 included 8-foot high-tensile woven wire fencing (31%), electric fencing (23%), hunting (100%), depredation permits (42%), repellents (23%), and harassment techniques (15%) (**Fig.36**). **For more information on wildlife management options available to farmers, see the New Jersey Division of Fish and Wildlife "Information for Farmers" (<https://www.njfishandwildlife.com/farmer.htm>).*

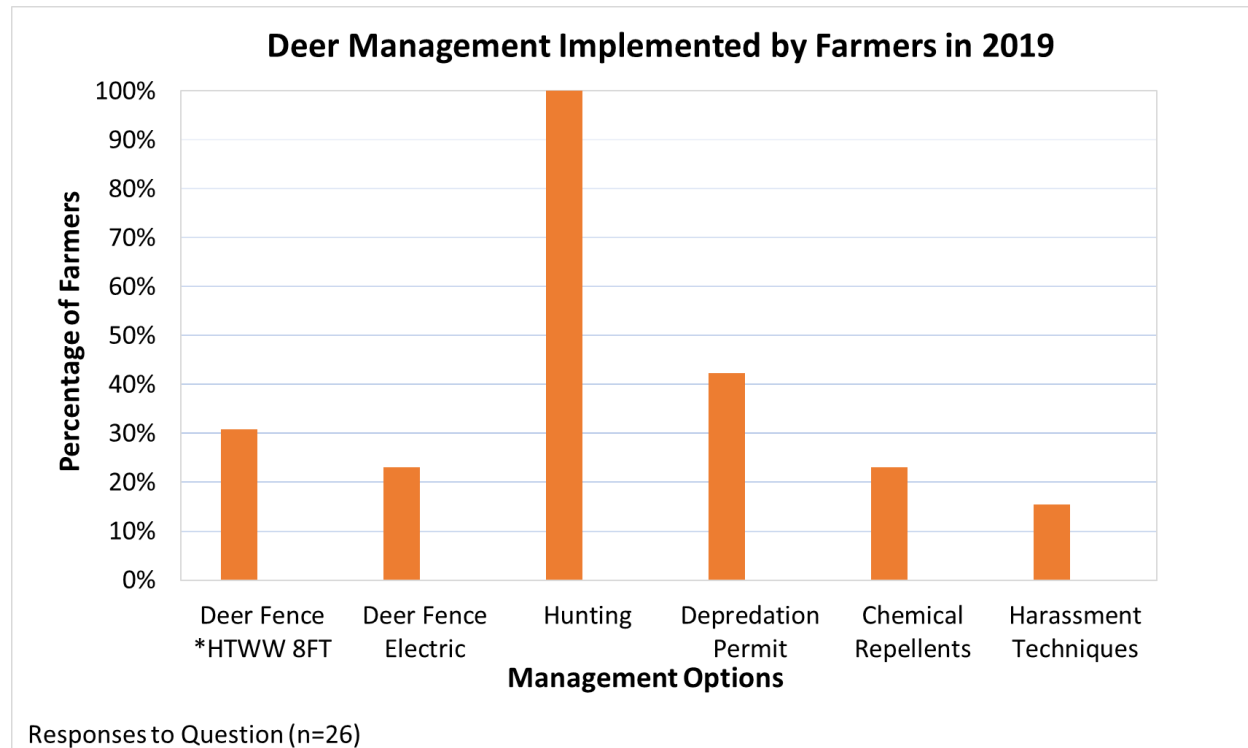


Figure 36. Management options used by case study farmers in 2019. * HTWW= High-Tensile Woven Wire.

Fencing:

Deer fencing costs reported for 398 acres by case study farmers totaled \$220,500 (**Fig.27**). The most effective fences were constructed of 8-foot high-tensile woven wire (**Fig.37**) and were used on 347 acres for a combined cost of \$171,000. This option was typically used for high-value crops such as vegetables. Farmers using 8-foot tall, high-tensile woven wire fencing spent from \$6,000 to over \$100,000 to fence their fields. Several farmers noted that this type of fencing was too expensive and not cost-effective to fence crops such as hay, field corn and soybeans. Additionally, fencing leased land is not always permitted by the landowner. Farmers supported expanding state programs that provided fencing and materials.

“The way my farm is laid out I can’t just go and fence the whole farm. We rent from several different landowners. It’s near impossible with all the roadways. The costs would be huge. I’m pretty much out of options other than to take a beating.”

– Case Study Farmer

Case study farmers also reported using temporary 8-foot plastic and metal fences on a combined 44 acres at a cost of \$44,000. They noted that initially deer would run through the plastic fence, but it became more effective over time. Other types of fences reported by farmers included wooden, and temporary plastic and electric fencing ranging from 4 to 6-foot. These types of fences were used on a combined 7 acres at a total cost of \$5,550. Farmers reported that deer often jumped over these types of fences, and they were typically seen as ineffective.



Figure 37. High-tensile woven wire fencing at least 8-feet tall can be an effective option to protect agricultural crops (left) and forested areas (right). Photos – Joseph Paulin.

“We fenced in the property about 5 years ago. **It was either stop the deer or stop farming.** You can live with some of the damage, but it just got to be too much.”

– Case Study Farmer

Hunting and Ideas for Decreasing Deer Numbers in Refuge Areas:

All farmers either hunted or allowed hunting on farmed properties (**Fig.38**). Hunting was seen as one of the most effective management options. Adjacent properties where hunting was not allowed or practical acted as deer refuges that created challenges for deer management. These areas included public and private lands, leased farmlands, county parks, corporate parks, schools, golf courses, nature preserves, and residential neighborhoods. Farmers recommended opening as much public land as possible to hunting to decrease deer numbers. Additional recommendations included requiring that wildlife management plans for private lands that receive Farmland Assessment.

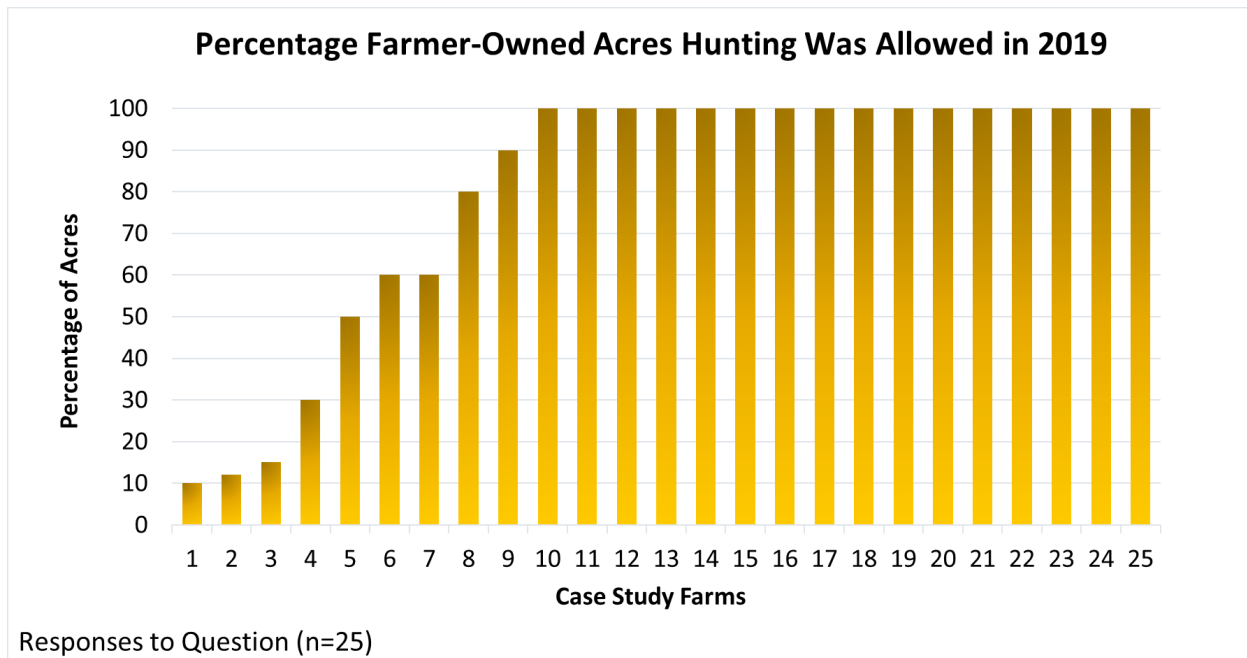


Figure 38. Percentage of farmer-owned acres where hunting was allowed on case study farms in 2019.

“There should be hunting allowed as much as possible on public lands. Public lands should have wildlife management programs so deer don’t affect neighboring farms, residential areas and there are fewer vehicle collisions.”

– Case Study Farmer

Depredation Permits:

Farmers can apply for depredation permits to shoot deer causing crop damage. This option was used by 42% of case study farmers. These permits are an effective management option and are often implemented outside of regulated hunting seasons. Permits can be obtained for year-round use when damage is extensive. Depredation permits are typically implemented using shotgun, but farmers can also apply for permission to use crossbows. This option can be effective for farms that are too close to residential areas and where firearms cannot be discharged.

However, deer damage is often the worst during the summer growing season, the busiest time of year for most farmers. Farmers noted that going out to shoot deer for 3 to 4 hours per night after working sunup to sundown in the heat is extremely difficult.

“It takes a physical toll after working in the field all day. Sometimes you have to go out at 1:00 am. Try doing that after working all day in 90 degree heat.”

– Case Study Farmer

In some cases, farmers would not use depredation permits if the meat could not be eaten as they didn't want the deer to go to waste. Additionally, 63% of case study farmers mentioned previously encountering opposition to the use of depredation permits from residents of adjacent properties, animal advocates, local hunters, and owners of leased farmland. Recommendations included expanding programs that combine the implementation of depredation permits with venison donation programs to help local foodbanks and those in need in the community.

“Figure out ways for donation through depredation permits during the summer months.”

– Case Study Farmer

Repellents:

Taste-based repellents are applied directly to plants to discourage deer from eating them. Area-based or odor-based repellents are applied near plants and are intended to discourage deer browse through smell. Other than temporary relief to landscape plants, of the 23% of case study farmers that had used repellents in 2019 (**Fig.36**), all found them to be ineffective in achieving their desired result. Repellents had to be reapplied after rain and after several days deer would eat new growth that hadn't been treated yet. High deer densities can also lead to repellents being a less effective management option.

“Early on we used repellents, chemical and cayenne pepper. Every time it rains you have to go out and reapply. I haven't seen anything worth the time in the long run.”

– Case Study Farmer

Harassment Techniques:

These techniques are used in attempts to scare deer or other wildlife, often Canada geese, out of an area. They include devices that make loud noises such as propane cannons, cracker shells, and sirens. Visual deterrents included scarecrows, flare guns, and strobes. Driving through areas to scare deer away was also reported. Of the 15% of case study farmers that reported using harassment techniques in 2019 (**Fig.36**), all found them to be ineffective in achieving their desired result.

“I've tried it all, scare them, scarecrows, repellents, harassment techniques. Nothing works for long.”

– Case Study Farmer

Discussion and Management Recommendations

Wildlife management involves striving to achieve a positive balance when it comes to human-wildlife interactions. There are many factors that must be considered including ensuring healthy wildlife populations, benefits associated with wildlife, damage impacts, and safety concerns. This is especially challenging in the most densely peopled state in the US. Development has created fragmented landscapes. People and wildlife live in close proximity and interact regularly.

White-tailed deer numbers have increased in New Jersey over the past several decades. This has presented many challenges to farmers growing crops throughout the state. Although densities of 10 deer per square mile are recommended to maintain benefits for social, economic, and ecosystem integrity (Kelly, 2019), numbers observed around case study farms ranged from 60 to 239 deer per square mile. The majority of participating farmers overwhelmingly reported that there were too many deer on farmed properties and surrounding landscapes.

Nearly all case study farmers reported that adjacent neighborhoods, woodlands, and open spaces, are serving as refuge areas for deer that feed in the farm fields at night causing extensive crop damage. For developed and residential areas where hunting is not allowed or practical, or where hunting alone cannot remove enough deer, farmers encourage townships to apply for a New Jersey Division of Fish and Wildlife, Community Based Deer Management Program permit. This permit allows for additional lethal management options and removal of deer outside of regulated hunting seasons. Townships are also encouraged to look for opportunities to donate the venison to foodbanks to help those in need in their community.

Public and private lands near farm fields also act as refuges for deer causing crop damage. Further, many farmers rent land to grow crops where they do not control access or are not allowed to implement options such as hunting and depredation permits. Case study farmers recommended that owners and managers of these types of lands should allow access for management activities or be required to develop wildlife management plans to reduce negative impacts to neighboring farms, forests, residential areas and decrease deer-vehicle collisions. Some existing county programs for managing deer on public lands, including doe-focused bowhunting programs and allowing depredation permits on leased land, were reported as positive steps.

Farmers noted significant impacts to their livelihoods from high deer numbers that can affect several generations. Deer-related crop losses were unacceptable for the majority of case study farmers from 2010 to 2019. In 2019, total crop losses to deer were considered a problem for 96% of participating farmers and 81% of farmers were trying to reduce losses.

The current study builds on the findings of previous NJAES research that estimated costs associated with direct deer damage to crops (Fritzell, 1998; Drake, 2005). In addition to estimates for direct damage, this new research includes estimates for "hidden costs" that may not be obvious. These costs, resulting from increased deer pressure, include abandoning fields and crops, changing rotations, increased use of fertilizers and herbicides, time and money spent on management, and the emotional toll it can take. Hidden costs (\$755,200) for case study farmers, exceeded minimum estimates for direct deer damage (\$520,940) and crop damage from other wildlife (\$97,749).

Case study farmers reported using several deer management options that varied in effectiveness, costs, and time required for implementation. Fencing was effective, but was often used for high value crops such as vegetables. The most effective fences were constructed of 8-foot tall high-tensile woven wire.

However, for many farmers, this type of fencing was too expensive, not cost effective for field crops, and not always allowed on rented land. All responding farmers hunted or allowed hunting on farmer owned properties where they controlled land access. For rented land, landowners often did not allow access for hunting, or the use of depredation permits. Depredation permits were typically implemented during the summer months, the busiest time of year for most farmers that were already working sunup to sundown. Less than 25% of case study farmers used repellents and harassment techniques in 2019. These options were reported as time consuming and often ineffective in achieving desired results.

Farmers' Recommendations to Enhance Deer Management

Farmers provided many ideas and recommendations on items policymakers can support and take action on to reduce deer numbers and associated negative impacts to native forests, residential landscapes, farmers' livelihoods, and health and safety concerns.

“Policymakers need to take into account environmental impacts, residential damage, health and safety of deer collisions, and health of the deer population. There’s a lot that needs to be considered. How long can you sustain this level of overpopulation without some type of detrimental effect to the herd?”

– Case Study Farmer

1) General Deer Management

- Promote opportunities for consultation between state agencies and stakeholders impacted by deer damage to coordinate efforts, identify challenges, and pool resources to increase the overall effectiveness of deer management programs throughout New Jersey. Participants should include, among others, the agricultural community, public and private land managers, developers, wildlife managers, researchers and educators, and state and local decision-makers.
- Expand coordinated regional deer management programs where municipal and county representatives can work together with state partners to enhance the effectiveness of deer management activities on public lands.
- Promote the expansion of doe-focused hunting programs on public and private lands wherever possible and raise awareness of the importance of harvesting does in reducing overall deer numbers.

“We need a comprehensive herd reduction program. Future deer management and development have to adapt together. Until the herd becomes manageable, we need to make it a year-round effort.”

– Case Study Farmer

2) Venison Donation Programs and Helping Those in Need

- Provide funding to expand opportunities for venison donation programs, such as Hunters Helping the Hungry, that can benefit from deer taken through farmer depredation permits, and suburban community-based deer management programs.

Venison is healthy protein that is needed by foodbanks and will benefit those in need throughout the state. Funding can cover processing costs and incentives that would increase the number of approved and participating butchers. This will increase access for those willing to donate deer and increase the benefits to those in need.

Additionally, funding can be used for regional coolers where deer can be dropped off for processing. This will be especially helpful for donation of deer taken under farmer depredation permits and prevent venison from going to waste during warmer times of the year.

Hunters Helping the Hungry (HHH) participants have donated over 2,000,000 servings of protein to New Jersey families in need over the past 25 years, mostly through private donations. As of summer 2021, HHH has a mobile refrigerated trailer that enables venison donation during warmer months when farmers are taking deer under depredation permits outside of regular hunting seasons. The depredation program was made possible with state funding and a partnership between HHH, Farm Bureau, NJ Department of Health, and the NJ Division of Fish and Wildlife.

“Find avenues to public good through processing and feeding programs to get protein to the needy so it doesn’t go to waste. Incentivize doe harvest and donations to food banks. No cost to the hunter and not counted against the hunter’s limit. Increase funding for programs like Hunters Helping the Hungry. Figure out ways for donation through depredation permits during the summer months. Use sharpshooters in suburban areas where you can’t hunt and donate the venison.”

– Case Study Farmer

3) Residential Development and Deer Refuge Areas

- Encourage suburban communities with high deer densities that serve as refuge areas, and where hunting is not possible, to apply for New Jersey Division of Fish and Wildlife, Community-Based Deer Management Permits (<https://www.nj.gov/dep/fgw/cbdmp.htm>).

This program allows for townships, counties, airports, and County Boards of Agriculture to apply for a permit allowing alternative control measures to take deer in areas where hunting is not a viable option to remove deer.

“The suburban neighborhoods are definitely acting as refuges.”

– Case Study Farmer

4) Private Leased Farmland and Wildlife Management Plans

- Require landowners receiving Farmland Assessment, or who rent land to farmers for crop production, to allow deer management activities or develop wildlife management plans to reduce deer causing damage.

Farmers lease many acres of farmland around the state. In some cases, farmers do not control access to the properties and are not allowed to implement deer management options such as hunting and depredation permits.

“Landowners that lease should have to allow hunting or be required to create a wildlife management plan. Some don’t allow any hunting and the land is a deer refuge.”

– Case Study Farmer

5) Public Lands and Wildlife Management Plans

- Establish wildlife management plans on public lands to reduce negative impacts to neighboring farms, forests, and residential areas and decrease deer-vehicle collisions.

Public lands near farm fields can act as refuges for deer causing damage to crops and native ecosystems. Farmers promote expanding coordinated regional deer management programs where municipal and county representatives can work together with each other and the state partners to enhance the effectiveness of deer management activities on public lands.

“The county is making an effort to allow hunting on ground they rent out to farm and allowing farmers to apply for depredation permits.”

– Case Study Farmer

6) Education and Outreach for Policymakers and Communities

- Facilitate education and outreach programs, especially for policymakers and the general public, to raise awareness of deer impacts to food production and farmers' livelihoods, environmental impacts, and safety concerns.

Programs can include:

1. Deer impacts on farmers' livelihoods, food security, and the ability to provide locally grown, safe and healthy foods that New Jerseyans depend on.
2. The hidden costs of deer damage such as emotional costs, having to replant crops, impacts to crop rotations, and soil damage that can result in the need for increased use of herbicides and fertilizers.
3. Environmental impacts including how high deer numbers and increases in deer herbivory on native plants is changing and threatening forest ecosystems by contributing to the invasion of non-native species.
4. Deer-related safety concerns and the high costs of deer-vehicle collisions.

“There needs to be more education on the damage the deer cause.”

– Case Study Farmer

7) Deer Fencing

- Provide programs and funding for deer fencing for farmers. Fencing is an effective management option for reducing crop damage.

However, fencing can be extremely expensive depending on the size of the farm operation. Many farmers cannot afford to fence in their fields.

“I’m fortunate that I can fence, but some growers can’t fence. It’s too expensive.”

– Case Study Farmer

8) Enhancing Deer Management through Hunting

- Create more opportunities for doe-focused hunting to reduce overall deer numbers such as unlimited antlerless harvest in all Deer Management Zones and require that a doe be harvested before a buck can be taken.
- Expand hunting opportunities by lengthening seasons and allowing hunting on Sundays.
- Streamline the processes for obtaining hunting permits (possibly regional or county permits).

“The permitting process needs to be streamlined, possibly regional permits.”

– Case Study Farmer

As of October 2021, the New Jersey Division of Fish and Wildlife now offers a “Multi-Zone Permit” to hunt antlerless deer in any zone within Regulation Set 7 or 8 for the specified permit season. For additional information see (<https://www.nj.gov/dep/fgw>).

9) Farmer Depredation Permits

- Amend the current regulation for farmer depredation permits to include archery for compatibility near residential areas where shotgun is not permitted.

“Now that I have all these houses on top of me - I can't get a depredation permit anymore.”

– Case Study Farmer

References:

Baiser, B., Lockwood, J.L., La Puma, D. and M.F.J. Aronson. 2008. A perfect storm: two ecosystem engineers interact to degrade deciduous forests of New Jersey. *Biological Invasions*. 10:785-795.

Boulanger, J.R., Curtis, P.D. and B. Blossey. 2014. An integrated approach for managing white-tailed deer in suburban environments: the Cornell University study. Cornell University Cooperative Extension and the Northeast Wildlife Damage Research and Outreach Cooperative.

Coleman-Jensen, A., Rabbitt, M.P., Gregory, C.A., and A. Singh. 2021. Household Food Security in the United States in 2020, ERR-298, U.S. Department of Agriculture, Economic Research Service.

Department of Environmental Protection, Division of Fish, Game and Wildlife. 1999. Governor's report on deer management in New Jersey. New Jersey Department of Environmental Protection, Trenton, New Jersey, USA.

Drake, D., Paulin, J.B., Curtis, P.D., Decker, D.J. and G.J. San Julian. 2005. Assessment of negative economic impacts from deer in the Northeastern United States. *Journal of Extension* Vol. 43 (1). <https://archives.joe.org/joe/2005february/rb5.php>

Drake, D., M. Lock and J. Kelly. 2002. *Managing New Jersey's Deer Population*. Rutgers Agricultural Experiment Station, Rutgers University Press.

Fritzell, P.A. 1998. How are white-tailed deer affecting agriculture in New Jersey? New Jersey Agriculture Experiment Station, Rutgers University Center for Wildlife Damage Control.

Hunters Helping the Hungry: <http://www.huntershelpingthehungry.org>

Kelly JF. 2019. Regional changes to forest understories since the mid-Twentieth Century: Effects of overabundant deer and other factors in northern New Jersey. *Forest Ecology and Management* 444:151-162.

New Jersey Division of Fish and Wildlife, "Community-Based Deer Management" <https://www.nj.gov/dep/fgw/cbdmp.htm> .

New Jersey Division of Fish and Wildlife "Information for Farmers" <https://www.njfishandwildlife.com/farmer.htm>

New Jersey Farm Bureau, Steward Green. 2020. "New Jersey white-tailed deer (*Odocoileus virginiana*) population density survey using sUAS infrared."

NJAES/HMFC. 2020. Rutgers White-Tailed Deer (*Odocoileus virginianus*) Population Density Survey using sUAS Infrared: Hutcheson Memorial Forest Center and surrounding landscapes of Franklin and Hillsborough Townships November 2019 and March 2020. Rutgers University, School of Environmental and Biological Sciences, New Jersey Agricultural Experiment Station, Rutgers Cooperative Extension, Hutcheson Memorial Forest Center and Steward Green. https://njaes.rutgers.edu/home-lawn-garden/pdfs/Rutgers_HMF_Deer_Density_Final_Report.pdf

State Farm Insurance. 2016. <https://www.statefarm.com>