OXFORD

BioScience, 2025, **75**, 9–14
https://doi.org/10.1093/biosci/biae110
Advance access publication date: 26 November 2024
Viewpoint

Wild harvests could aid food insecurity and reduce wildlife hyperabundance

David S. Mason, Mark E. Bell, Kenneth F. Kellner, Abigail Bennett, Tom Weston, Joseph Presgrove and Jerrold L. Belant

David S. Mason (masonda6@msu.edu), Mark E. Bell, Kenneth F. Kellner, Abigail Bennett, and Jerrold L. Belant are affiliated with the Wild Foods Institute, Department of Fisheries and Wildlife, at Michigan State University, in East Lansing, Michigan, in the United States. Tom Weston and Joseph Presgrove are affiliated with the Michigan Department of Natural Resources, in Lansing, Michigan, in the United States.

Global food insecurity has increased despite a more than decade-long commitment to end hunger by 2030 (FAO et al. 2024). In the United States, 12.8% of households (17.0 million) reported food insecurity in 2022 (Rabbitt et al. 2023). Government and charitable organizations spend billions of dollars on food assistance annually across the United States (Feeding America 2023, Rabbitt et al. 2023) but often fall short of providing desired meat products or meeting nutritional needs (IOM 2005, Oldroyd et al. 2022).

Wild-harvested game donations from at least 48 programs across the United States provide about 860 metric tons of meat annually (10.1 million meals, assuming 85 grams represents one adult serving; USDA 2019) with an estimated value of US$13.1 million (LeBleu and Landry 2022, Responsive Management 2023a, USDA 2024). Wild-harvested game meat donation programs can also enhance hunter harvest rates and social acceptance (Hildreth et al. 2011, Ljung et al. 2012). Although most hunters state they are willing to donate meat to hunger relief organizations, only 4.3% of those surveyed participate (Responsive Management 2023b). Consequently, there remains substantial potential to increase the positive impacts of wild meat donation programs.

Michigan case study

We explored a wild-harvested meat donation program in Michigan, in the United States, designed to enhance food security and potentially reduce hyperabundant wildlife (i.e., when a species' population density exceeds twice the long-term density; *sensu* Moore et al. 2023). Michigan has the thirteenth greatest food insecurity rate among US states, with an estimated 14.2% (about 1.4 million) of residents experiencing food insecurity at least part of the year in 2022 (figure 1a, b; Feeding America 2024). Hunters contribute harvested white-tailed deer (*Odocoileus virginianus*) to Michigan Sportsmen Against Hunger (MSAH), an effort to reduce food insecurity that has provided about 520 metric tons of venison since 1991 (MSAH 2024).

In addition to hunters, government agencies performing culls and farmers seeking to reduce agriculture damage donated harvested white-tailed deer to processors who process the meat into ground venison (figure 2). Historically, culls represented more than half of donated deer, followed by hunters, with less than 10% from farmers (Joseph Presgrove, Michigan Department of Natural Resources, 9 August 2024). Government agencies and farmers donate deer throughout the year, typically outside the hunting season.

Processors remove the lymph nodes from each deer then label the meat and lymph nodes with unique identifiers. The lymph nodes are submitted for testing by the Michigan Department of Natural Resources (MDNR) for bovine tuberculosis and chronic wasting disease. If either is detected, the corresponding meat is destroyed. The processed meat is also taken to a lab certified by the US Department of Agriculture to scan for metal (figure 1c). Any packages of venison containing metal are also destroyed. The venison free of metal and disease is then distributed by the MDNR to charitable recipient organizations. The meat processors and the metal detection lab are compensated for their work from MSAH and MDNR, respectively. Funds are provided to MSAH from direct donations and hunters that contribute when purchasing hunting and fishing licenses.

Between 1 October 2022 and 30 September 2023, 31 processors and 100 recipient organizations participated in venison donations (figure 1c; MSAH 2023), providing over 600,000 meals (MSAH 2024; figure 1d). The Food Bank Council of Michigan estimates this represents 5.7% of the annual amount of venison that could be used by their food donation facilities (Garrett Zuver, Food Bank Council of Michigan, Lansing, Michigan, personal communication, 18 July 2024) at most. Venison donations occurred in 42 counties (mean [$\bar{x}$] = 1225 kilograms [kg], standard error [SE] = 195 for participating counties), with 41 counties receiving no donations (mean [$\bar{x}$] = 620 kg, SE = 154 when including all counties; figure 1d; MSAH 2023). On average, the recipient organizations were 18 kilometers (Euclidean distance) from the nearest processor and 183 kilometers from the metal testing facility.

To characterize the amount of venison donated as individual meals (i.e., servings), we divided the mass of donated meat in each county by 85 grams representing one adult serving (USDA 2019). The mean servings per person ranged from 0 to 6.5 across counties (figure 1e). We then divided the donated servings by the number of people in each county experiencing food insecurity to estimate the overall mean value (0.5 servings per food insecure person when including all counties).

Our investigation demonstrates that venison donations can be increased to further address food insecurity in Michigan. White-tailed deer are hyperabundant in southern Michigan (MDNR 2016), where food insecurity is also greater. Although regionally venison donations are greatest in these areas (MDNR 2016), at

Received: August 30, 2024. **Revised:** September 9, 2024. **Accepted:** October 2, 2024

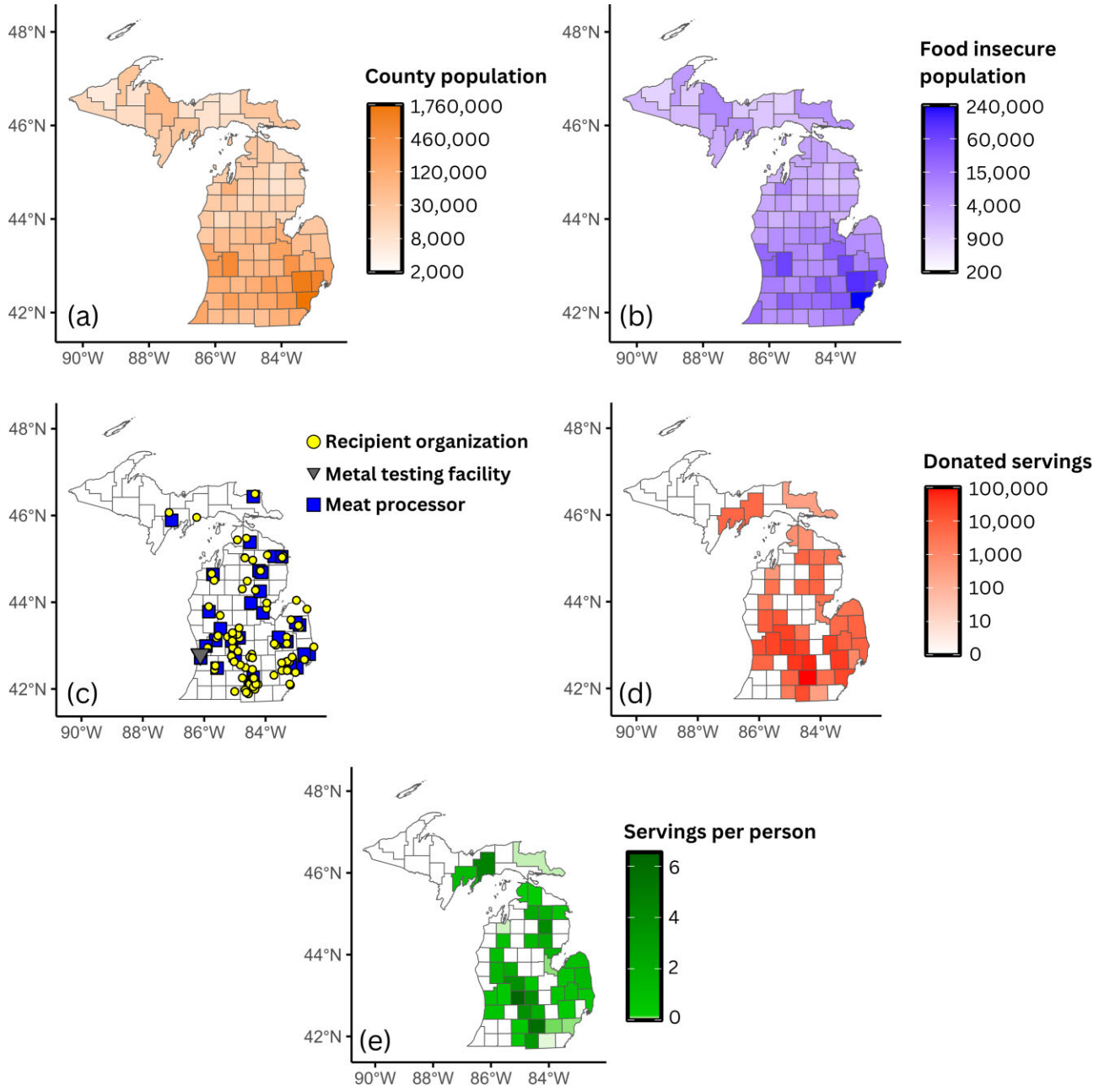

Figure 1. (a) County populations in 2022 and (b) number of people reporting food insecurity, Michigan, United States, 2021 (Gundersen et al. 2023, US Census Bureau 2024). (c) Locations of venison recipient organizations (n = 94 of 100 represented) and venison processors (n = 31). (d) Venison servings (i.e., meals) donated and (e) servings per person reporting food insecurity by county, 1 October 2022–30 September 2023.

the county level, they are misaligned with the magnitude of food insecurity. The reasons for this disparity include the following:

Economic constraints

Current voluntary financial contributions are unpredictable and support operating costs only (MSAH 2023), creating challenges with planning, increasing processor reimbursements, and making large purchases for program improvement (e.g., refrigeration trailers).

Declining participation

The number of deer hunters is declining 1.4% annually (MDNR 2024), reducing the number of potential participants. For the remaining hunters, participation may be limited by proximity to participating processors (Responsive Management 2023b). Processor recruitment and maintenance is hindered by concerns with government bureaucracy, inadequate compensation, and storage because of venison testing and distribution wait times that conflict with standard business operations.

Limited resources and facilities

In Michigan, all venison donations are transported by a small team to a single certified metal testing lab, which delays venison pickups and therefore creates storage issues.

Figure 2. (a) White-tailed deer herd. Photograph: Amy Lutz. (b) Processed ground venison. Photograph: Michigan Department of Natural Resources.

Lack of awareness

Hunters report that increasing awareness would amplify program participation (Responsive Management 2023b). Similarly, culling can be more socially acceptable when venison is donated to people experiencing food insecurity (Hare et al. 2021), but there could be limited program awareness across the state that limits deer removal efforts.

Need for data and data standards

The program collects data on individual venison donations, then reports the total mass of processed venison and where it is donated. However, there are inconsistencies in data entry and no centralized, backed-up database. Moreover, while a survey found that about 1% of responding Michigan hunters donate venison (Goguen et al. 2018),

participant characteristics and resident awareness remains understudied.

Recommendations

From our Michigan case study and relevant literature, we provide six interrelated recommendations to reinforce food security:

Explore additional funding models

Taxpayer funding through stable government appropriations would make programs more financially stable and enable expansion. The potential financial savings related to alleviating food insecurity and reducing hyperabundant wildlife (e.g., reduced deer–vehicle collisions and crop damage) could offset these costs (Drake et al. 2005).

Develop best practices on the basis of evidence

Research-based evidence and long-term monitoring could help donation programs quantify and increase acceptability of venison among their recipients; improve decisions regarding organizational structure; develop protocols for testing and distributing meat; and refine outreach to hunters, processors, and the people reporting food insecurity. Standardized protocols for data collection (e.g., data standards, common formats, and data governance) could enhance program efficiency and capacity (Hildreth et al. 2011, LeBleu and Landry 2022).

Streamline donations and quality control measures

Strategies and protocols that simplify processes and reduce costs for hunters, meat processors, and agency personnel could broaden program participation. In particular, recruiting meat processors in new areas would increase spatial coverage of programs and decrease travel for hunters that donate deer. Similarly, using portable metal-detection equipment or strategically establishing more metal- and disease-testing facilities could reduce transportation costs and test result wait times, in turn decreasing venison storage costs before distribution while testing occurs.

Align wildlife removal and game meat distribution to better target needs

Improved game meat donation programs could better align with areas of hyperabundant wildlife and high food insecurity while considering cultural differences (e.g., rural versus urban communities) that influence how much venison individuals will consume (i.e., acceptability; Goguen and Riley 2020). Doing so would further storage, transport, processing, and testing efficiencies.

Enhance outreach efforts

Effective outreach to hunters could increase program participation (Responsive Management 2023b), and efforts to promote public acceptance of game meats could bolster the desire for venison.

Encourage collaboration within and across states

Wildlife abundance and food insecurity vary regionally in the United States (Rabbitt et al. 2023). Increased coordination could facilitate problem wildlife removal and transportation of game meat to communities in need across state borders, further reducing food insecurity and wildlife damage nationally. Greater organization could also increase sharing of resources and improve data standardization and quality.

Broader impacts

White-tailed deer in the eastern United States demonstrate the multifaceted benefits of wild meat donation programs. Deer hyperabundance increases the frequency and magnitude of damage to vehicles, crops, and ecosystems. In the United States, an estimated 2.1 million deer–vehicle collisions occur annually, causing about US$10 billion in damages, 59,000 human injuries, and 440 human deaths (Cunningham et al. 2022). Crop damage by deer caused an estimated US$276 million (adjusted for inflation) in losses in the northeastern United States alone (Drake et al. 2005). Through increased herbivory, high deer densities can reduce plant diversity and forest regeneration while potentially facilitating invasive species (DeCalesta 1994, Rawinski and Square 2008). Venison donation programs emphasizing meat derived from hyperabundant deer populations could therefore advance food security while reducing economic loss and improving ecosystem health.

Globally, the United Nations adopted 17 Sustainable Development Goals to secure a future of peace and prosperity (UNGA 2015). Wild-harvested game meat donation programs meet at least four of these goals. While primarily working to end hunger (goal 2: zero hunger), they also deliver healthy, fresh, and desirable protein sources to food-insecure populations (goal 3: good health and well-being; Hoffman and Cawthorn 2012). Achieving these goals could incentivize hunters to increase harvests of hyperabundant wildlife species (Hildreth et al. 2011), protecting terrestrial biodiversity and ecosystem function (goal 15: life on land; Heffelfinger et al. 2013). Finally, with effective natural resource management, this renewable source of game meat could contribute to sustainable food production (goal 11: sustainable cities and communities).

Wild harvest limitations

Wildlife conservation policy in North America was formed to protect overexploited species (Organ et al. 2012). These policies were effective for many species, including white-tailed deer, now considered hyperabundant throughout most of eastern North America (Waller 2008). In contrast to commercial fur harvesting, restrictions on commercial harvest and sale of other wildlife products (e.g., meat) limit the means of white-tailed deer population reduction through hunting and culling by government agencies (Hygnstrom et al. 2014). Moreover, hunting as a tool for population control is now ineffective at reducing deer populations across large spatial extents because of reduced hunter numbers (Riley et al. 2003). Hunters typically stop hunting once they meet their personal needs; however, hunters able to donate meat could increase overall harvests. Although there is some evidence of this from hunter responses to existing donation programs (Hildreth et al. 2011), this relationship is tentative, and venison donation programs remain limited in part by voluntary participation. Moving forward, several considerations appear warranted, including increasing government culls and voluntary participation in wild-harvested game meat donation programs, implementing more liberalized hunting seasons with increased harvest limits, establishing more formalized food donation programs with stable government or grant-sponsored funding, and exploring regulated commercial harvest (Hygnstrom et al. 2014).

Acknowledgments

This research was funded by the Michigan Department of Natural Resources (PD72892) and was supported by the Boone and

Crockett Program in Wildlife Conservation at Michigan State University. We also thank Shannon Lott and Kristin Phillips of the Michigan Department of Natural Resources, Dean Hall of Michigan Sportsmen Against Hunger, and Garrett Zuver of the Food Bank Council of Michigan for their communication, data, and support of this project.

Author contributions

David S. Mason: conception and design, interpretation of data, drafting manuscript, reviewing and revising manuscript. Mark E. Bell: conception and design, interpretation of data, drafting manuscript, reviewing and revising manuscript. Kenneth F. Kellner: interpretation of data, reviewing and revising manuscript. Abigail Bennett: interpretation of data, reviewing and revising manuscript. Tom Weston: interpretation of data, reviewing and revising manuscript. Joeseph Presgrove: interpretation of data, reviewing and revising manuscript. Jerrold L. Belant: conception and design, interpretation of data, reviewing and revising manuscript.

References cited

Cunningham CX, et al. 2022. Permanent daylight saving time would reduce deer–vehicle collisions. *Current Biology* 32: 4982–4988.

DeCalesta DS. 1994. Effects of white-tailed deer on songbirds within managed forests in Pennsylvania. *Journal of Wildlife Management* 58: 711–718.

Drake D, Paulin JB, Curtis PD, Decker DJ. 2005. Assessment of negative economic impacts from deer in the northeastern United States. *Journal of Extension* 43: 15.

FAO et al. Food and Agriculture Organization of the United Nations, International Fund for Agricultural Development, United Nations Children's Fund, World Food Programme, World Health Organization. 2024. The State of Food Security and Nutrition in the World 2024: Financing to End Hunger, Food Insecurity, and Malnutrition in All Its Forms. FAO.

Feeding America. 2023. Annual Report 2023. Feeding America. www.feedingamerica.org/sites/default/files/2024-01/FA_23AR_EV_with%20Board_F.pdf. Accessed on 7/07/2024.

Feeding America. 2024. Food Insecurity among the Overall Population in the United States. Feeding America. https://map.feedingamerica.org/.

Goguen AD, Riley SJ. 2020. Consumption of wild-harvested meat in society. *Wildlife Society Bulletin* 44: 553–563.

Goguen AD, Riley SJ, Organ JF, Rudolph BA. 2018. Wild-harvested venison yields and sharing by Michigan deer hunters. *Human Dimension of Wildlife* 23: 197–212.

Gundersen C, Strayer M, Dewey A, Hake M, Engelhard E. 2023. Data from: Map the Meal Gap 2023: An Analysis of County and Congressional District Food Insecurity and County Food Cost in the United States in 2021. Feeding America.

Hare D, Daniels M, Blossey B. 2021. Public perceptions of deer management in Scotland. *Frontiers in Conservation Science* 2: 781546.

Heffelfinger JR, Geist V, Wishart W. 2013. The role of hunting in North American wildlife conservation. *International Journal of Environmental Studies* 70: 399–413.

Hildreth AM, Hygnstrom SE, Hams KM, Vercauteren KC. 2011. The Nebraska deer exchange: A novel program for donating harvested deer. *Wildlife Society Bulletin* 35: 195–200.

Hoffman LC, Cawthorn DM. 2012. What is the role and contribution of meat from wildlife in providing high quality protein for consumption? *Animal Frontiers* 2: 40–53.

Hygnstrom S, Drake D, Van Deelen T, Vantassel S. 2014. Managing overabundant white-tailed deer: Is it time to consider regulated commercial harvest? *Outlooks on Pest Management* 25: 11–16.

[IOM] Institute of Medicine. 2005. Dietary Reference Intakes for Energy, Carbohydrates, fiber, Fat, Protein, and Amino Acids (macronutrients). National Academies Press.

LeBleu G, Landry MJ. 2022. Hunting-based food donation programs: Program characteristics across the US. *Journal of Nutrition Education and Behavior* 54: 677–683.

Ljung PE, Riley SJ, Heberlein TA, Ericsson G. 2012. Eat prey and love: Game-meat consumption and attitudes toward hunting. *Wildlife Society Bulletin* 36: 669–675.

[MDNR] Michigan Department of Natural Resources. 2016. Michigan Deer Management Plan. Michigan Department of Natural Resources. Wildlife Division report no. 3626.

[MDNR] Michigan Department of Natural Resources. 2024. 2023 Deer Harvest Survey. MDNR. www.michigan.gov/dnr/-/media/Project/Websites/dnr/Documents/Boards/NRC/2024/May-2024/Deer_Survey.pdf.

Moore JH, Gibson L, Amir Z, Chanthorn W, Ahmad AH, Jansen PA, Mendes CP, Onuma M, Peres CA, Luskin MS. 2023. The rise of hyperabundant native generalists threatens both humans and nature. *Biological Reviews* 98: 1829–1844.

[MSAH] Michigan Sportsmen Against Hunger. 2023. Data from: Addendum to the 2022-23 Michigan Sportsmen Against Hunger Overview Report.

[MSAH] Michigan Sportsmen Against Hunger. 2024. Home. MSAH. www.sportsmenagainsthunger.com. Accessed on 11/07/2024.

Oldroyd L, Eskandari F, Pratt C, Lake AA. 2022. The nutritional quality of food parcels provided by food banks and the effectiveness of food banks at reducing food insecurity in developed countries: A mixed-method systematic review. *Journal of Human Nutrition and Dietetics* 35: 1202–1229.

Organ JF, et al. 2012. The North American model of wildlife conservation. *The Wildlife Society Technical Review* 12: 12.

Rabbitt MP, Hales LJ, Burke MP, Coleman-Jensen A. 2023. Household Food Security in the United States in 2022. US Department of Agriculture, Economic Research Service. Report no. ERR-325.

Rawinski TJ, Square N. 2008. *Impacts of White-tailed Deer Overabundance in Forest Ecosystems: An Overview*. USDA Forest Service, Newton Square, PA.

Responsive Management. 2023a. Hunters' Donations of Game Meat to Hunters for the Hungry Organizations. National Rifle Association Hunters' Leadership Forum.

Responsive Management. 2023b. Quantifying Hunters' Donations and Sharing of Game Meat. National Rifle Association Hunters' Leadership Forum.

Riley SJ, Decker DJ, Enck JW, Curtis PD, Lauber TB, Brown TL. 2003. Deer populations up, hunter populations down: Implications of interdependence of deer and hunter population dynamics on management. *Ecoscience* 10: 455–461.

[UNGA] United Nations General Assembly. 2015. Transforming Our world: The 2030 agenda for sustainable development. United Nations. UN Doc A/Res/70/1. 1–41.

US Census Bureau. 2024. Data from: Annual Estimates of the Resident Population for Counties in Michigan: April 1, 2020 to July 1, 2023. US Census Bureau. https://www.census.gov/data/datasets/time-series/demo/popest/2020s-counties-total.html.

[USDA] US Department of Agriculture. 2019. Game meat, deer, tenderloin, separable lean only, cooked, broiled. USDA (1 April 2019). https://fdc.nal.usda.gov/fdc-app.html#/food-details/174430/nutrients. Accessed on 5/08/2024.

[USDA] US Department of Agriculture. 2024. Meat price spreads. USDA (11 September 2024). www.ers.usda.gov/data-products/meat-price-spreads. Accessed on 7/07/2024.

Waller DM. 2008. White-tailed deer impacts in North America and the challenge of managing a hyperabundant herbivore. Pages 135–147 in Gaston AJ, Golumbia TE, Martin JL Sharpe ST, eds. *Lessons from the Islands: Introduced Species and What They Tell Us about How Ecosystems Work*. Canadian Wildlife Service, Environment Canada.

Received: August 30, 2024. **Revised:** September 9, 2024. **Accepted:** October 2, 2024