SPECIAL REPORT

FARMS UNDER THREAT

A NEW ENGLAND PERSPECTIVE

New Findings to Guide Our Work and Inspire Action

American Farmland Trust
SAVING THE LAND THAT SUSTAINS US

BY JAMIE B. POTTERN AND LAURA N. BARLEY

AMERICAN FARMLAND TRUST

American Farmland Trust (AFT) is a nonprofit conservation organization founded in 1980 to protect farmland, promote sound farming practices, and keep farmers on the land. AFT approaches our work in a comprehensive, holistic manner. We recognize the connection between the land, forward-looking farming practices, and the farmers and ranchers who do the work. We also recognize the power of combining on-the-ground projects with objective research and effective advocacy. Today, because of AFT, millions of acres of farmland that otherwise would have been converted into house lots and shopping malls remain in farming, and tens of thousands of farmers and ranchers have adopted better farming practices. For more information, visit www.farmland.org or our technical information center at www.farmlandinfo.org.

ABOUT THE AUTHORS

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www.farmland.org/project/farms-under-threat-new-england

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About Farms Under Threat

Farms Under Threat is American Farmland Trust's multi-year effort to produce the most comprehensive assessment ever undertaken of U.S. agricultural land use, clearly identifying the loss of farmland and ranchland to date while examining different scenarios for the future. American Farmland Trust and Conservation Science Partners analyzed agricultural land use, the quality of land for agricultural production, and development pressure on farmland and ranchland in each state in the conterminous U.S. (the lower 48 states; Alaska and Hawaii were excluded due to data limitations). We also conducted in-depth research on six state policies and programs to develop the Agricultural Land Protection state policy scorecard for all 50 states. The upcoming report *Farms Under Threat: The State of the States* reveals the threat to agricultural land in each state; the states' policy responses; and strategies to advance policy to meet the evolving threat. By linking spatial findings to policy solutions, we hope to provide decision-makers with the information they need to take new policy actions that protect and retain agricultural land for future generations of farmers and ranchers.

Land & Territory Acknowledgment

We want to acknowledge that American Farmland Trust's offices occupy the traditional lands of the Piscataway, Nacotchtank, Manahoac, Nisenan, Patwin, Plains Miwok, Pocumtuc, Nipmuc, Haudenosaunee, Mohican, Southern Pomo, Graton Rancheria, Coast Miwok, Oceti Sakowin, Miami, Potawatomi, Sauk and Meskwaki, Peoria, Kickapoo, Duwamish, Twana Skokomish, Suquamish, Coast Salish, Tulalip, Puget Sound Salish, Puyallup, Klallam, Snoqualmie, and the Lakota, Dakota, and Nakota of the Great Sioux Nation—the peoples and nations past and present—and honor with gratitude the land itself and the people who have stewarded it throughout the generations. This calls us to commit to continuing to learn how to be better stewards of the land that we inhabit.[1]

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JERRY MONKMAN ECOPHOTOGRAPHY/ALAMY

INTRODUCTION

American Farmland Trust (AFT) is the national leader advancing farmland protection, regenerative farming practices, and efforts to help keep farmers on the land. We periodically undertake major research projects to catalog and analyze the mounting threats to America's agricultural land and the farmers and ranchers who steward it.

We have identified that in the last 15 years over 11 million acres of this nation's irreplaceable agricultural land has been paved-over, fragmented, or otherwise converted to new uses that jeopardize farming. Since 1982, the United States has lost 25 million acres of agricultural land to development,[2] with development pressures and land values limiting the ability of farmers, especially beginning farmers, to access land. Left unabated, these trends threaten food security, local economies, ecological integrity, climate resiliency, and the very fabric of our communities.

REPORT GOAL

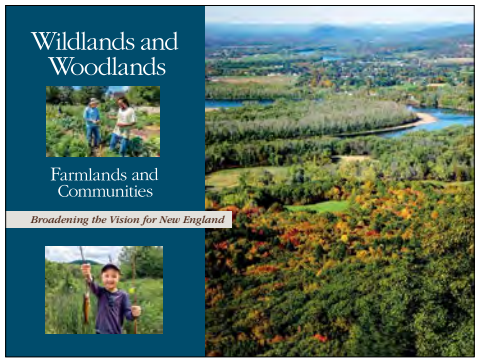
To inform, inspire, and galvanize action for a more diverse, secure, justice-based, and resilient agricultural system in New England.

New England—Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont—has a strong agrarian tradition but is experiencing severe development pressure. *A New England Food Vision* (2014) presented a bold proposal to produce 50% of New England's food by 2060 (up from 12%), yet we continue to lose farmland at a rapid pace, while farmers face mounting economic pressures and the growing impacts of the changing climate—potentially challenging our ability to meet *A New England Food Vision*'s goals. Despite the reduction in housing starts brought about by the Great Recession in 2008, our new data show a renewed uptick in development that has resulted in 19 acres per day, or 7,000 acres per year of New England agricultural land being lost or threatened between 2001 and 2016.

While we have many tools at our disposal and good work being done across New England**, all the states can and must do more.** This report presents new information and frameworks that add insight into how New England agriculture is faring and potential pathways forward.

This report draws data and inspiration from:

- AFT's *Farms Under Threat:*
  - *The State of America's Farmland* national report (2018), looking at 1992-2012, which offered new spatial analyses of land use, land quality, and development pressure.
  - *The State of the States* (pending, 2020) national report, looking at 2001-2016, which offers a more nuanced look at the type of development that is occurring and where it is happening across the landscape; this report will launch the *Agricultural Land Protection Scorecard (Policy Scorecard),* which offers insight into what policies and programs are working to successfully reduce the threat of development on agricultural land.
- AFT's Farmland Information Center's Purchase of Agricultural Conservation Easement (PACE) survey.
- *A New England Food Vision* (2014), which examined possibilities for New England's regional food self-reliance by 2060; and *Wildlands & Woodlands: Farmlands and Communities* (2017), which incorporated *A New England Food Vision's* farmland goals into a regional framework to protect 70% of New England's forests.



A New England Food Vision *(2014) envisions New Englanders in 2060 eating more diverse and healthier foods than today, with three times as much land (15% of the region) producing food. The* Wildlands & Woodlands *vision, first written in 2010 (and then updated and broadened in 2017 to encompass* A Food Vision *goals), recognized that in every New England state, forestland was being lost to development after a 150-year period of regrowth. It called for the permanent protection of 70% of New England's forests in a matrix of sustainably managed forests and unmanaged wild forests. This vision calls for between 7% and 14% of the land being utilized for sustainable, local food production.*

- The *2017 USDA Census of Agriculture*, which compiles farmer-reported economic and demographic data.
- The *Gaining Insights, Gaining Access: Keeping Farmers on the Land* project (2016), which compiled data to assess farm transition trends and needs in New England.
- Other spatial, economic, and climate research conducted by AFT staff and regional partners.
- Insights from key advisors across New England.

New England's ability to sustain and expand its farms and build a resilient food system for the future is a monumental challenge spanning many scales and disciplines. Facing compounding threats due to climate change, corporate consolidation of the food system, volatile markets, and the continuation of unjust systems, New England will be increasingly reliant on new innovations, programs, and collaborations.

This report finds that in order to secure a resilient and justice-driven agricultural system in New England, we'll need:

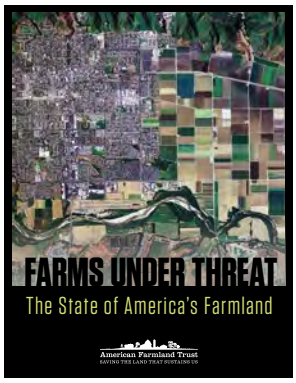
- More funding, models, and tools to protect New England's farmland and keep it in the hands of farmers.
- Flexibility to adapt land uses to a changing world.
- Farm-based solutions that increase ecological and economic resiliency and viability.
- Commitments to listening, learning, and centering justice-based solutions that enable bolder collective action to be successful in New England.

This report highlights new spatial and policy data and examines threats and opportunities for New England's **Land**, **Viability**, and **People**, highlighting the clear overlap and an imperative to develop holistic, justice-driven solutions.

This report does not cover all the needs and opportunities for land, land access, viability, or land justice in New England. Rather, our hope is to build upon existing research and visioning, expand our collective understanding of the issues and opportunities, and move the needle toward intersectional and equity-driven solutions rooted in New England's complex history around land.

CONTEXT

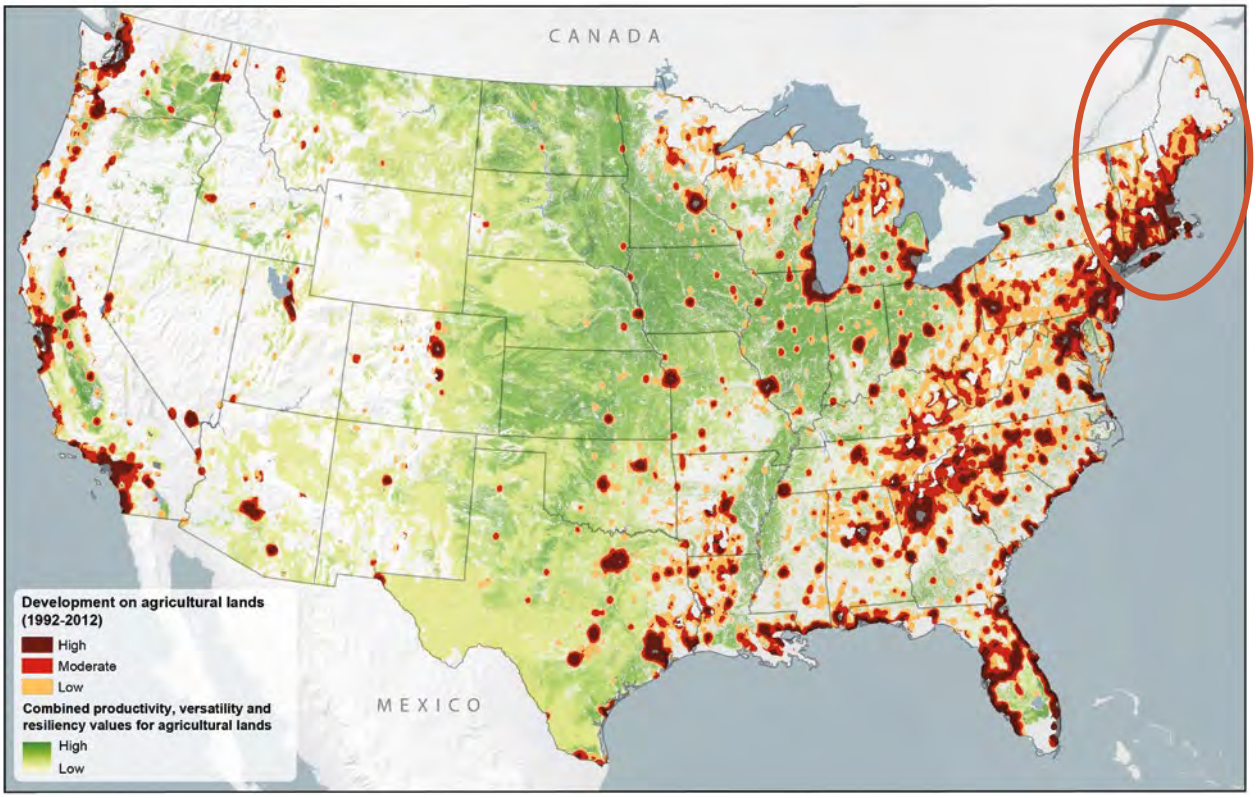
National Data to Inform a New England Analysis



American Farmland Trust's newest collection of reports and datasets from the national *Farms Under Threat* project inform our collective understanding of threats to farmland. This research was conducted in collaboration with Conservation Science Partners (CSP) and with support and guidance from the USDA Natural Resources Conservation Service (NRCS).

Farms Under Threat: The State of America's Farmland (2018), part of the most comprehensive analysis ever undertaken of America's agricultural land, was a national study that analyzed past conversion of agricultural lands from 1992 to 2012. It built upon the **National Land Cover Dataset (NLCD)** to advance geospatial and remote sensing analyses to map land use with a special focus on agricultural lands, identifying the best agricultural lands, and mapping conversion of agricultural lands to development.

FIGURE 1. MANY NEW ENGLAND STATES LOST A HIGH PERCENTAGE OF THEIR AGRICULTURAL LAND TO URBAN AND HIGHLY DEVELOPED USES (1992–2012)



New England in a national context: Farms Under Threat: The State of America's Farmland *(2018) revealed that New England is being affected by moderate-to-high development, which is cause for great concern. A new in-depth examination of New England's converted and threatened lands from 2001–2016 enhances our understanding of New England's on-going development trends and where policy actions are needed (see Land section for new regional analysis and state maps).*

The report identified the **Productivity**, **Versatility**, and **Resiliency (PVR)** of agricultural lands, indicating their suitability for long-term cultivation in the face of changing climate conditions. It also mapped woodlands associated with farm enterprises for the first time.

Farms Under Threat: The State of the States (pending, 2020) improves the analytical methods used in the earlier report and incorporates updated datasets released in 2019, which allow even more detailed analysis of agricultural land and development pressure from 2001 to 2016. These new data and enhanced methods improve the spatial resolution, enabling analysis at the state, county, and even sub-county levels. The improved methods also provide greater insight into the nature of the threat. This report draws a distinction between acres that were irreversibly converted to **urban and highly developed (UHD) uses**, and those that were impacted by **low-density residential (LDR) development**. These updated spatial methods underpin the data and maps presented in this special report (see Appendices for description of the modelling approach).

As part of this project, the ***Policy Scorecard*** (pending, 2020), AFT conducted an extensive analysis of six common state policy responses to the major factors driving the conversion of agricultural land: Purchase of Agricultural Conservation Easement (PACE) Programs, Planning & Land Use Policies, Real Property Tax Relief, Agricultural District Programs, Farm Link Programs, and State Programs to Lease.

These data enable connections between spatial findings and policy solutions at the state level, which allow for comparisons and empower decision-makers to plan for and protect their most important agricultural resources for future generations. These policies will be examined throughout the report in the context of land conversion, economic, and demographic threats to agriculture.

OVERALL POLICY SCORECARD RANKING	
National Ranking	**State**
5th	Vermont
7th	Connecticut
8th	Rhode Island
11th	Massachusetts
15th	New Hampshire
20th	Maine

New England states all ranked in the upper half on the policy scorecard, with Massachusetts, Connecticut, Rhode Island, and Vermont ranked in the upper quartile. Despite having adopted important and responsive policies, the level of threat shows that these policies do not go far enough (see pages 20, 35, 39 for New England policy highlights).

Outside of New England, the states of Oregon and Washington are important to highlight because they both have far greater development pressure than any New England state, and yet their policy responses have resulted in proportionately less threat to their farmland. A difference in outcomes may be attributed to different approaches to planning. With far stronger state and county government and central planning efforts, Oregon and Washington have been able to direct development far more thoughtfully. New England, in large part due to its settlement history, gives far more deference to local government and, to date, has seldom mustered the political will to implement significant planning mandates to protect farmland or forestlands.

New England: New Data and Analysis to Inform Our Work and Inspire Action

New England is a region with a challenging history. In the year 2020, we stand at a crossroads of decision-making. How we use our power, influence, and resources to shape our collective health and well-being will impact us for decades to come. In order to create a future of thriving local farms, resilient communities, and healthy, affordable access to food for all, as envisioned by *A New England Food Vision*, we need to begin by acknowledging the reality that our food system is "built on stolen land and stolen labor."[3] We have an imperative to repair past harms and relationships across racial and economic divides, centering the experiences and perspectives of those who have been most affected.

LAND USE HISTORY AND INDIGENOUS LAND

Many texts discussing and analyzing New England's food system and land use history tend to begin with European settlement and provide a limited analysis of the ramifications of colonization on indigenous communities. The region called New England today has been inhabited by indigenous communities for at least 12,000 years. European colonization of New England in the early 1600s resulted in centuries of genocide, broken treaties, displacement, and land dispossession of native people. Today, indigenous communities remain resilient and active in the fight for land sovereignty.

HARVARD FOREST

From 1830 to 1880, 60 to 80% of the land was cleared for pasture, tillage, orchards, and buildings across much of New England.

European settlement, agricultural practices, and economic forces radically changed New England's landscape over time, starting with the slow clearing of land for subsistence agriculture in the 17th and 18th centuries, leading up to the height of land clearing from 1830 to 1880 (with 80% of the landscape deforested) for extensive agricultural production. Since that time, New England has reversed course—from 80% cleared to about 80% forested—although forests are once again beginning to decline.[4]

New England's land base has been constantly evolving and will need to continue to evolve to achieve the bold visions articulated in *A New England Food Vision* and *Wildlands & Woodlands.*

Subsequent sections of this report examine new data and threats and opportunities in New England that can inform and catalyze our collective work to build a more just, resilient, and livable future. These data are broken into **Land**, **Viability**, and **People** sections and are followed by a summary of major takeaways and potential next steps for New England.

DANITADELIMONT/ALAMY

LAND

JERRY & MARCY MONKMAN ECOPHOTOGRAPHY/ALAMY

Today, New England's land base is roughly 67% forest, 9% farms, 5% urban and highly developed lands, and 4% low-density residential development, with the remaining 15% comprising water, transportation infrastructure, and federal lands.[5] Because New England was one of the first regions in the country to face such intensive population and development pressure, New England states were early leaders and adopters of many policies and programs to protect our land base and ecosystems. The region's independent spirit and distributed forms of government, however, have presented unique challenges when implementing some tools such as comprehensive planning.

New England agriculture is incredibly diverse across the landscape due to its geography, glaciated past, soils, and land use history. The region lends itself to diversified farming, ranging from large-scale crop production to highly diversified operations on small acreages. New England is also host to a range of innovative farmers of all ages and backgrounds who model regenerative practices, improvement of soils on marginal lands, and carbon drawdown solutions. Due to its progressive political leanings, New England is a national leader in developing and coordinating climate mitigation and renewable energy policies and incentives.

Despite the longevity of these efforts, and the abundance of practitioners and policy makers championing good work, New England continues to face many complex and compounding threats to our land base, from development pressure and conversion of farmland to climate change impacts. This section reveals new data and analyses for New England derived from

the national *Farms Under Threat* datasets, as well as new analyses from other sources to showcase the following:

- Recent trends in Urban and Highly Developed (UHD) land use versus conversion to Low-Density Residential (LDR) land use for New England, by state, and by agricultural land type.
- New insights into the threat posed by LDR, what it looks like on the ground, and what it means for New England.
- New England's Productivity, Versatility, and Resiliency (PVR) soils by agricultural land use type, and the use of PVR as a tool for land protection and land use decisions.
- How much of New England's farmland is protected and what it would cost to protect New England's remaining unprotected farmland.
- Climate change threats and opportunities for agricultural land, including mixed land uses and smart solar practices.
- Insights from the *Policy Scorecard* relevant to the New England states.

Note on the Uses and Limitations of *Farms Under Threat* Data

All estimates of agricultural land in this report are derived from our *Farms Under Threat* spatial analysis. These analyses rely on datasets with consistent coverage for the lower 48 states. For the sake of consistency, the same methods were used across the entire country. This approach has many strengths—it would be impossible to tailor the analysis for every idiosyncrasy of our hugely diverse country—but also results in some limitations.

Mapping land cover and use presented some particular challenges in New England, due to the region's high forest cover and active forestry industry. In regions with large acreages of recently logged forests, the regrowth from logging cuts is often classified by the National Land Cover Dataset (NLCD) as Grassland/Herbaceous, Shrub/Scrub, Pasture/Hay, and sometimes Cultivated Crops. These are the NLCD land cover classes that are considered eligible for agricultural land cover, so our model sometimes places cropland and pastureland in these areas. This resulted in substantial errors in parts of northern Maine and New Hampshire. We have addressed this to the degree possible, but it is difficult to remove all these artifacts without affecting land that is truly in agriculture, so some artifacts remain. For the purposes of this report, we have attempted to mask out these artifacts in all maps presented. As we continue to refine our processes to do this more accurately, we suggest contacting us for guidance prior to the re-use of any estimates of agricultural acreage found in this report.

See Appendices for Farms Under Threat Spatial Analysis Methods.

Farms Under Threat: State of the States

This *Special Report of Farms Under Threat New England* is informed by pre-released data relevant to the six New England states.

URBAN AND HIGHLY DEVELOPED (UHD)

The urban and highly developed (UHD) class includes built-up and other developed lands identified by the National Land Cover Database (NLCD), reflecting where agricultural land has generally been irreversibly lost. Lands that were identified as agriculture in 2001 but subsequently identified as urban by 2016 were categorized as converted to UHD during the study period.

LOW-DENSITY RESIDENTIAL (LDR)

Low-density residential (LDR) is a land use category developed specifically for *Farms Under Threat* because remote sensing land cover products do not identify rural and exurban development on agricultural land, yet this threat continues to fragment farmland across the country. The LDR analysis is based on the recognition that agricultural viability is threatened both as the surrounding population density increases and as farms fall below a certain minimum farm size, which will vary depending on local agricultural production systems. To identify LDR areas, we set a minimum farm size threshold using the 10th percentile farm size for each county and identified U.S. Census blocks where the average

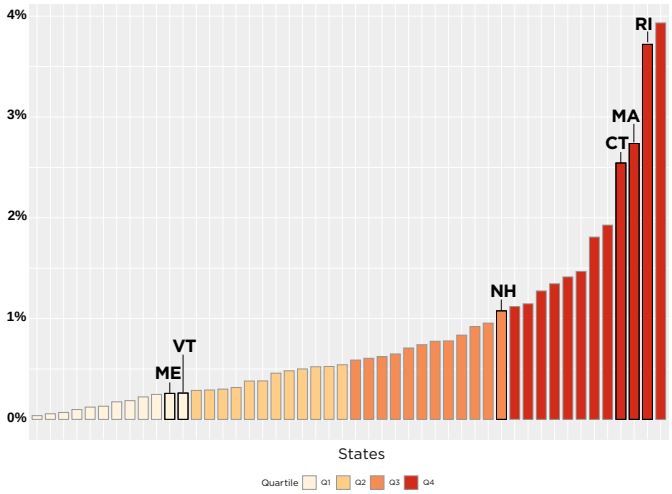


FIGURE 2. PERCENTAGE OF AGRICULTURAL LAND LOST TO URBAN AND HIGHLY-DEVELOPED USE (2001–2016)

Every state's agricultural land lost to UHD development on a continuum (non-New England state names redacted) is shown. While New England agricultural acreage is much less than that of most other states, the proportion of its agricultural land threatened by conversion to urban and highly developed (UHD) land cover ranks highly compared to other states in the nation. For New England, four states are in the top third, while three are in the top four states.

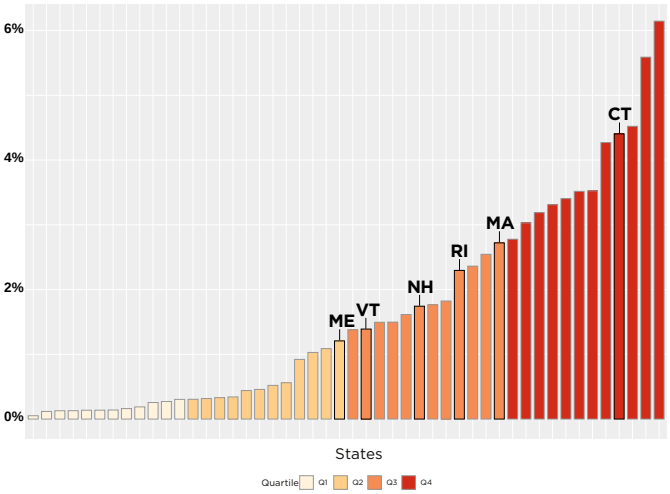
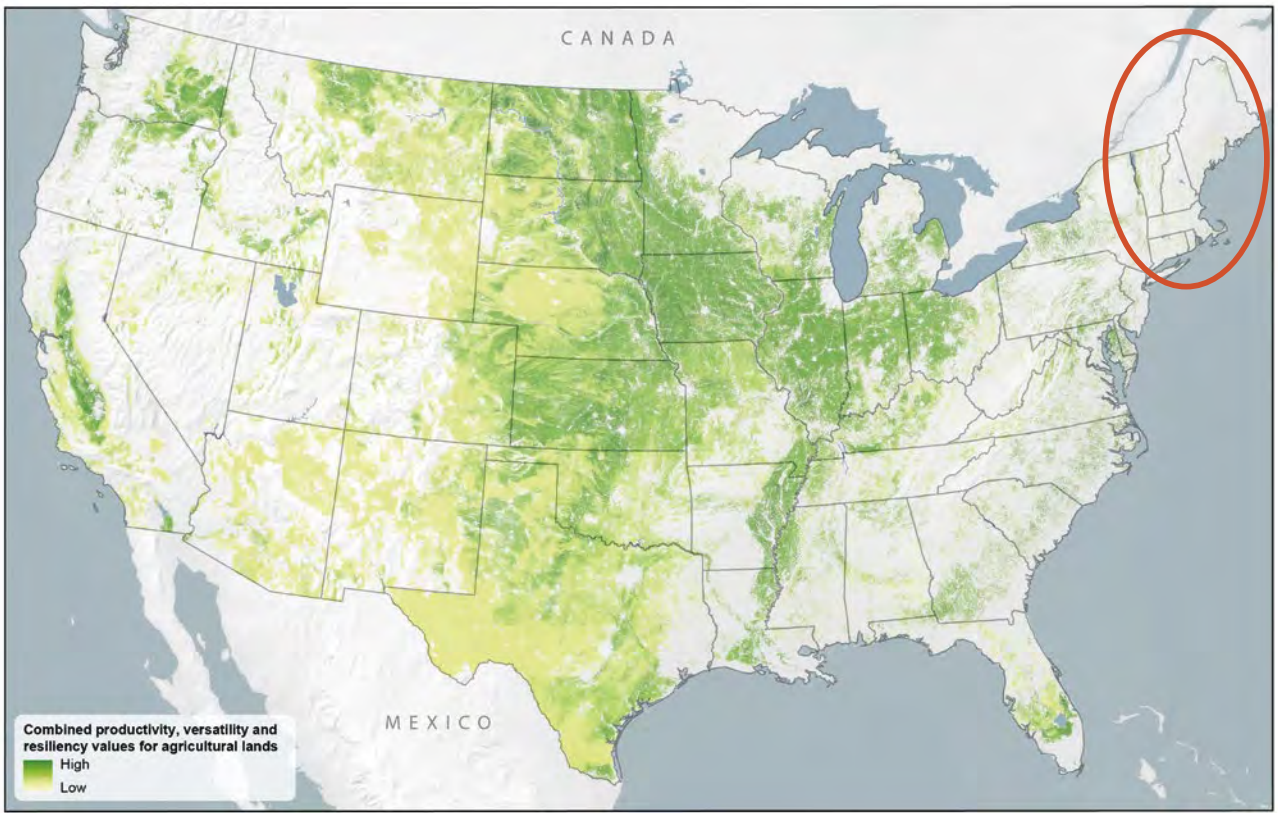


FIGURE 3. PERCENTAGE OF AGRICULTURAL LAND CONVERTED OR THREATENED BY LOW-DENSITY RESIDENTIAL DEVELOPMENT (2001–2016)

Every state's agricultural land impacted by LDR development on a continuum (non-New England state names redacted) is shown. While New England agricultural acreage is much less than that of most other states, the proportion of its agricultural land threatened by expansion of LDR land use ranks highly among other states in the nation. For LDR, most of the New England states are in the top half, with Connecticut coming in at number four.

FIGURE 4. PRODUCTIVITY, VERSATILITY, AND RESILIENCY SOILS CONTINUUM



New England in a national context: When compared to the entire country, New England's predominantly forested and urban lands obscure the region's important agricultural resources. A specific examination of New England's best PVR lands is required to enhance our understanding of the threats to and opportunities for the region's soil resources (see page 18 for new regional PVR map).

parcel size was below this threshold. While some farmland in LDR has been lost, this category also includes some fields that remain viable but are significantly impacted by encroaching development.

PRODUCTIVITY, VERSATILITY, AND RESILIENCY (PVR)

What makes farmland ideally suited for food and other crop production? To address this question, the *Farms Under Threat* project developed a method to quantify the land's productivity, versatility, and resiliency (PVR).

PRODUCTIVITY: Supports high yields, with few limitations.

VERSATILITY: Supports a wide range of crops.

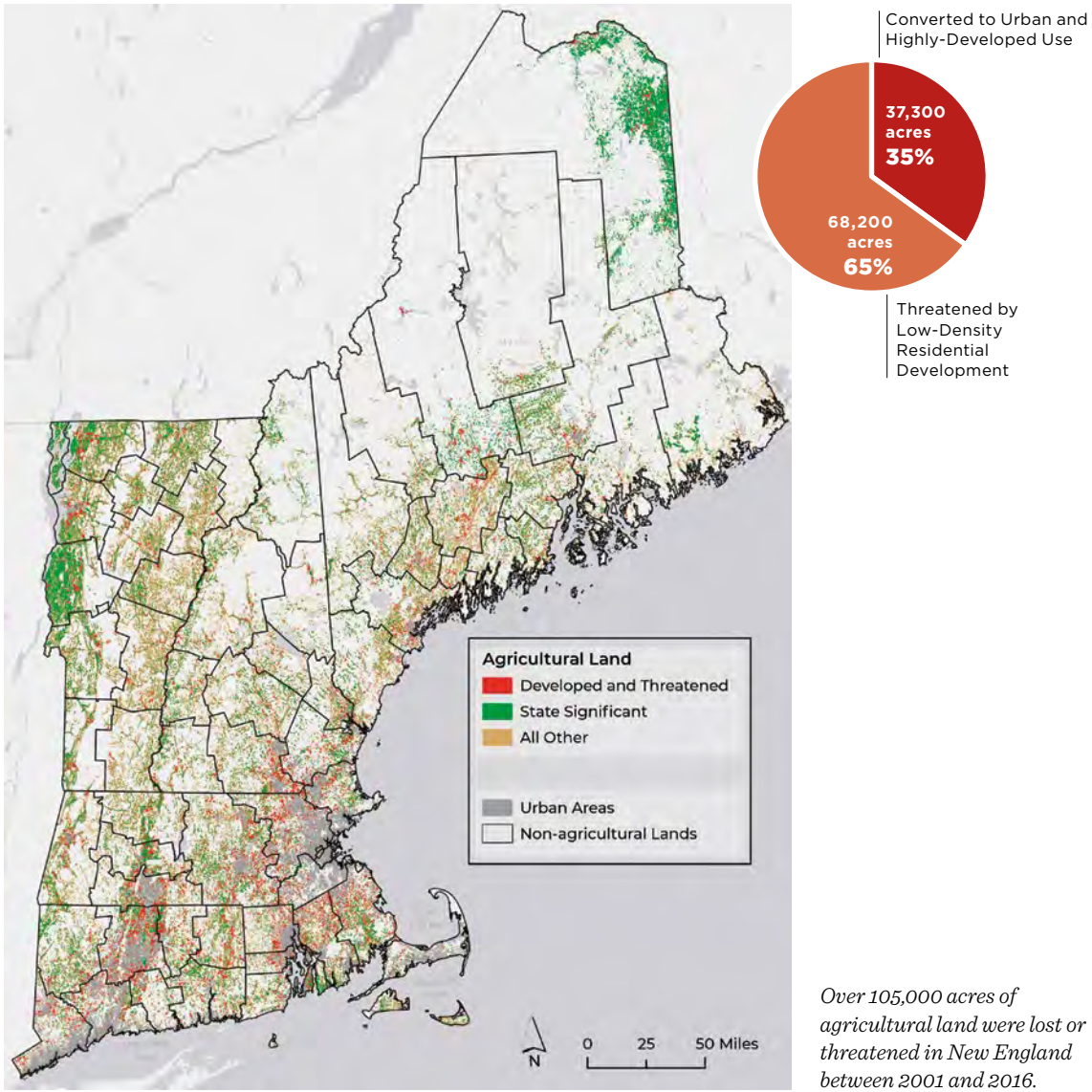
RESILIENCY: Supports production over time in the face of challenging climate conditions.

The PVR model incorporates detailed maps of soil productivity and environmental limitations, land cover/use, types of crops produced, and length of growing season, and prioritizes them according to weights elicited from a group of national experts. **Land with a high PVR score is best suited for long-term cultivation and food production.** Because land cover and land use are inherently built into the prioritization model, land not currently

used for food production—such as woodland—might score lower despite its underlying soil quality. Conversely, land currently used as cropland may score higher even if it has "poor" soils, such as land used for blueberries or cranberries.

For the 2020 analysis, the range of PVR values was then used to identify agricultural land that is significant within the context of each state's remaining agricultural land. For this analysis, **state significant agricultural land** represents all land with a PVR value above the state median, and all regional maps that display state significant agricultural land reflect each state's relative agricultural land quality rather than a spectrum of agricultural land quality for the region as a whole. All other agricultural lands are those with a PVR quality below the state median.

FIGURE 5. DEVELOPMENT CONVERSION AND THREAT ON NEW ENGLAND'S AGRICULTURAL LAND: 2001–2016

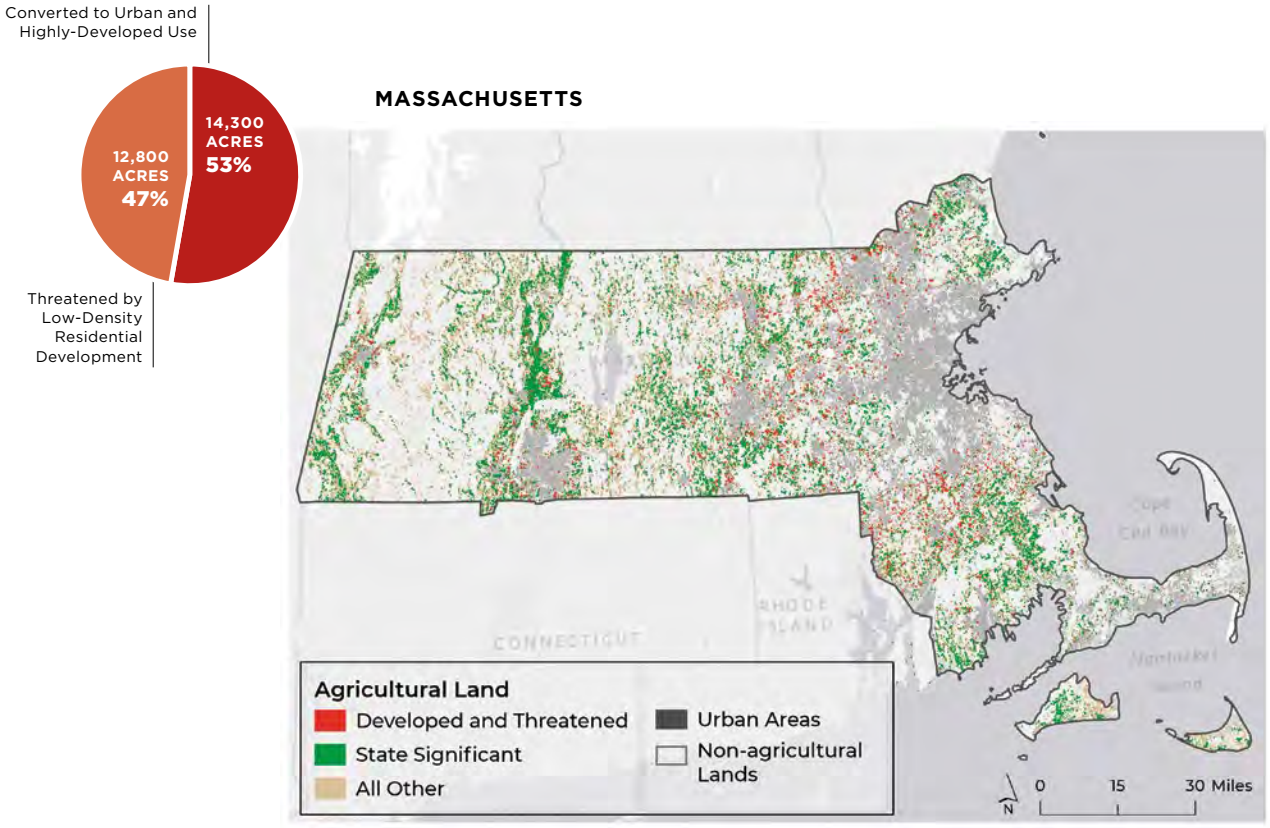


Over 105,000 acres of agricultural land were lost or threatened in New England between 2001 and 2016.

Examining the Threat to New England's Agricultural Land

Between 2001 and 2016, approximately **105,500 acres** were either lost or threatened by development. Of the acres that were impacted, **35% (37,300) of farmland acres were *irrevocably lost*** to other uses like parking lots and buildings ("urban & highly developed," UHD) while **65% (68,200) of farmland acres were *severely impacted*** by encroaching development and may already be lost, or are likely to be irreversibly lost in the near future ("low-density residential development," LDR). Until now, the impact of expanding LDR areas on farmland—two-thirds of New England's total threat—has not been captured and quantified. This new insight is hugely important to understanding the pending threats to New England's farmland.

FIGURE 6. AGRICULTURAL LAND AND DEVELOPMENT IMPACTS FOR EACH NEW ENGLAND STATE (2001–2016)



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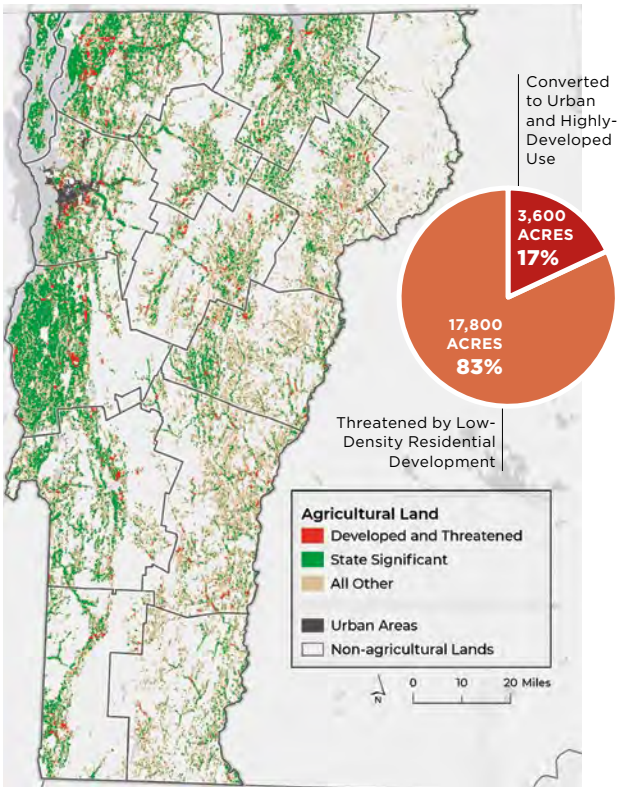

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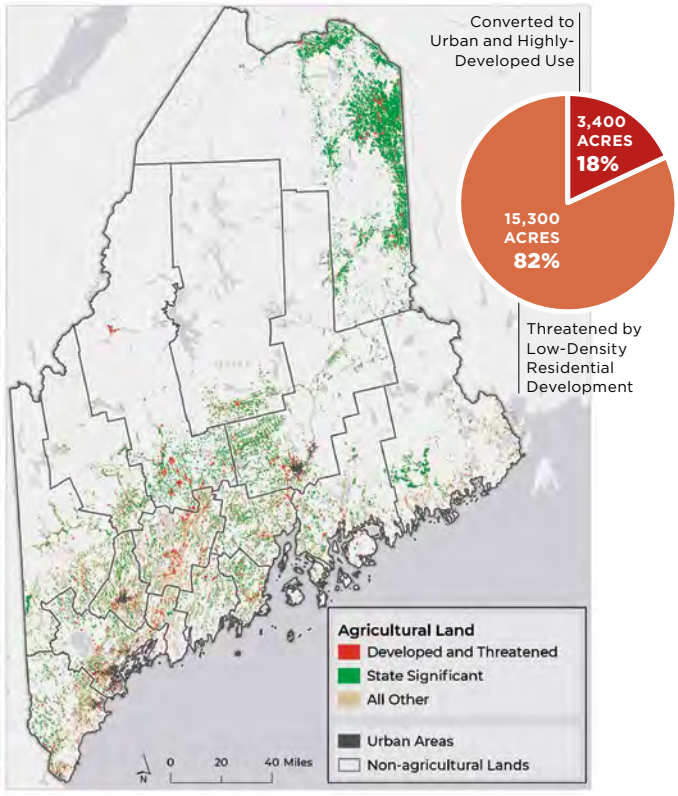

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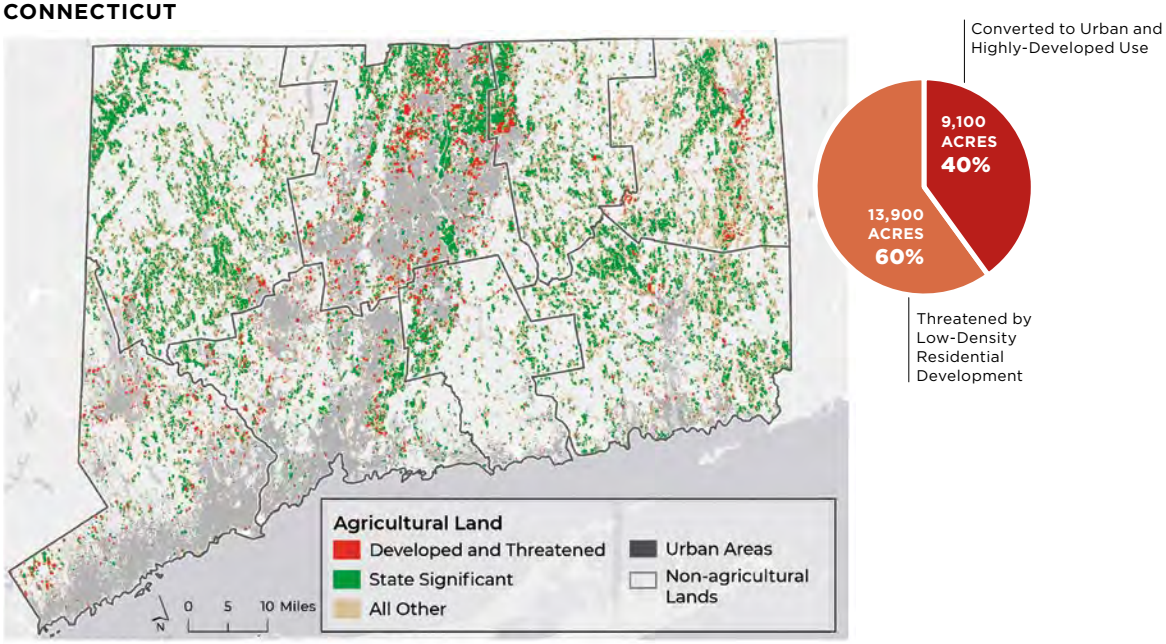


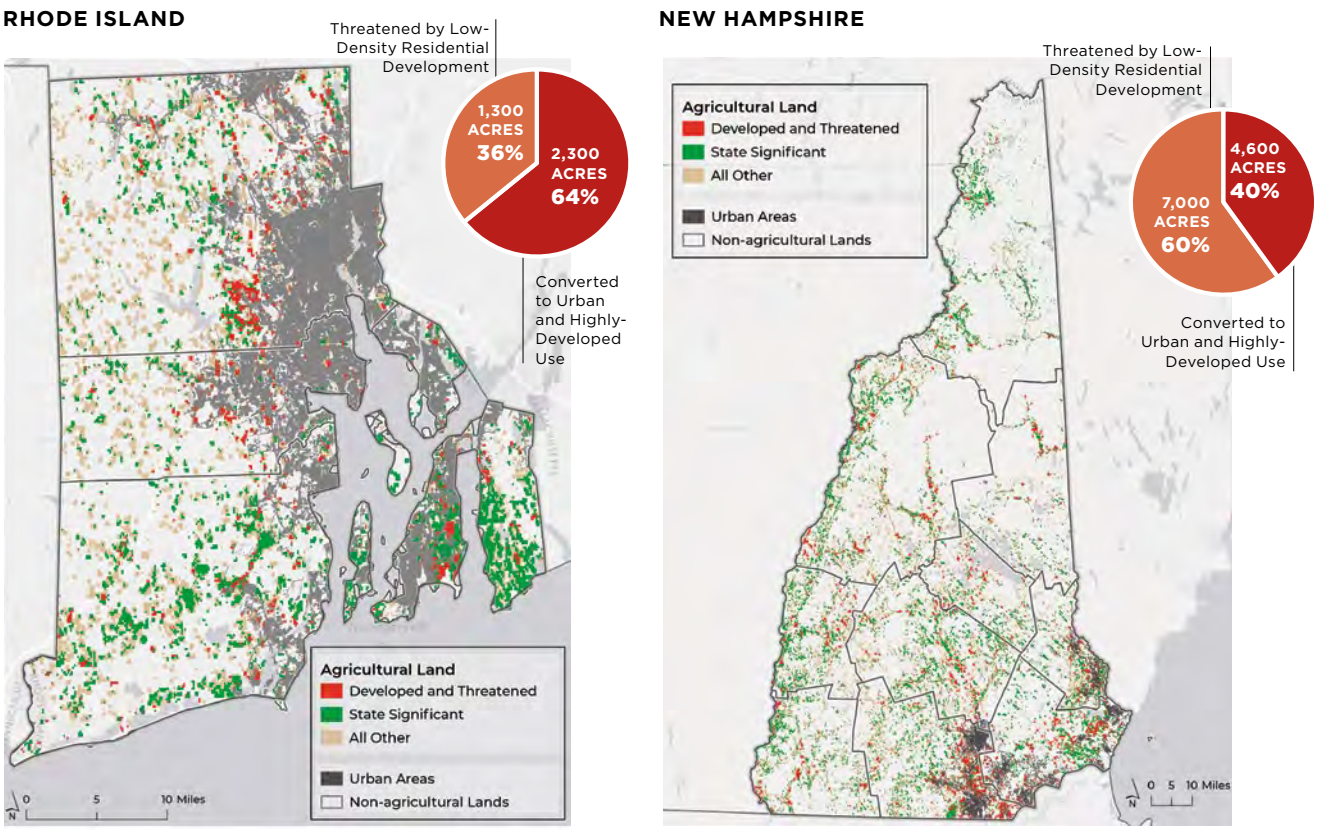
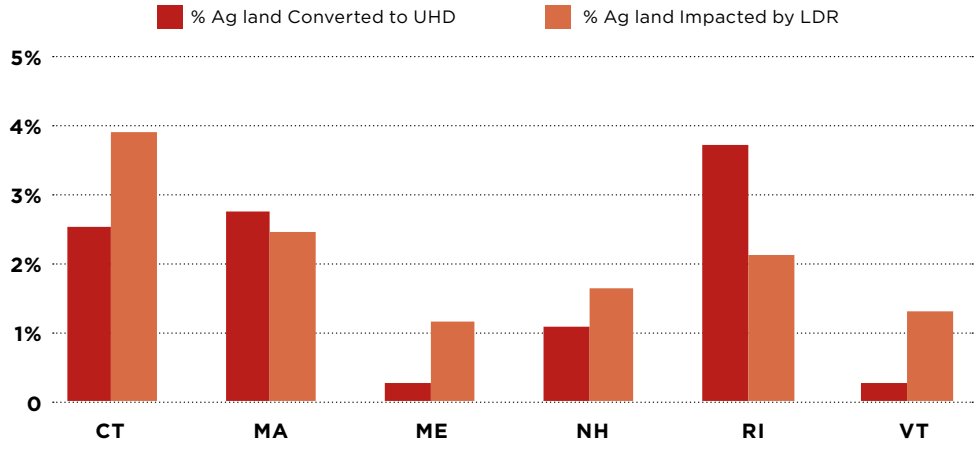


FIGURE 7. TRENDS IN AGRICULTURAL LAND CONVERSION

Percentage of Each State's Total Ag Land Converted to UHD and Impacted by LDR, 2001–2016



THE PERSISTENT THREAT OF UHD

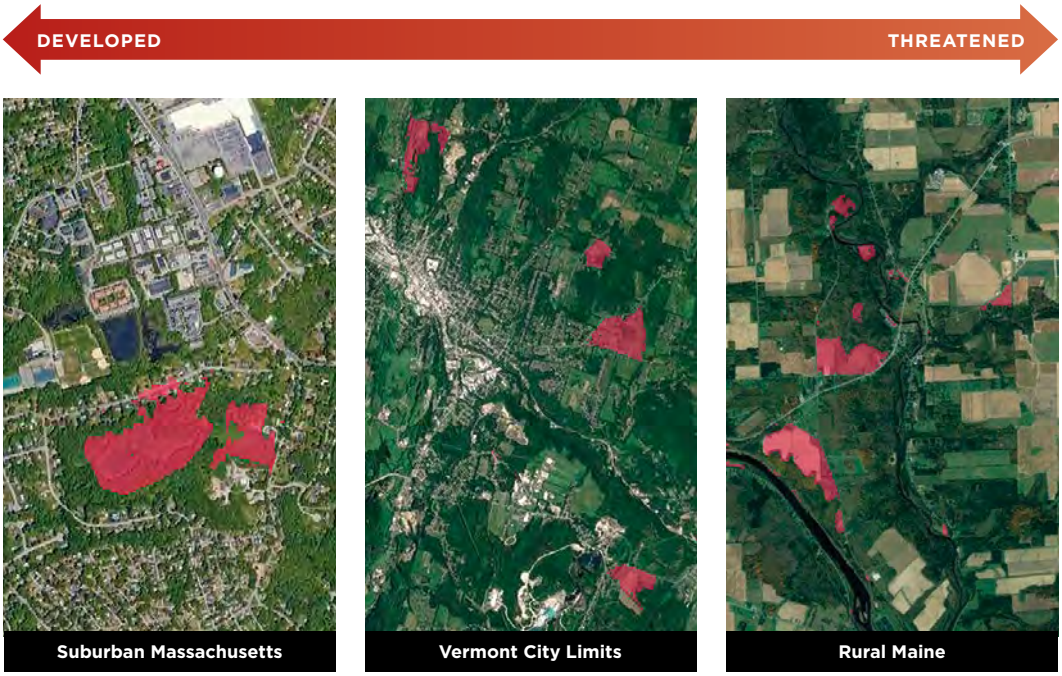
Our estimates show that roughly 1% (37,300 acres) of New England's agricultural land was converted to UHD between 2001 and 2016. The southern New England states typically had much higher rates of UHD conversion, with Connecticut and Massachusetts having each converted approximately 2.5%, and Rhode Island having converted nearly 4% of its agricultural land.

Not surprisingly, much of the conversion to UHD has occurred where dense populations have been established and growing for several decades, if not centuries. Roughly 85% of the land converted to UHD was in metropolitan counties,[6] but many of these higher-population counties feature broader peri-urban and even semi-rural landscapes within them. As urbanized areas continue to expand across New England, long-standing agricultural areas will continue to be paved over.

THE LOOMING THREAT OF LDR

As introduced above, *Farms Under Threat* has identified a new low-density residential (LDR) land use class in which the average housing density is above the level where agriculture is typically viable. While sprawling development swallows many thousands of acres of agricultural land across the country, the threat of low-density residential impacts in New England is a widespread and complex issue that we have not been able to broadly document until now.

FIGURE 8. SPECTRUM OF LOW-DENSITY RESIDENTIAL LAND USE



While the Farms Under Threat *data itself does not allow us to quantify LDR by type, we can see some common themes emerge across different kinds of landscapes when viewing aerial images. Map shows three locations: Billerica, MA; Montpelier, VT; and Caribou, ME.*

While the greatest pressure appears to occur in more built-out communities, LDR in rural communities can cause stressors that undermine the fabric of viable farm communities. Pressures such as rising land values, neighbors who may not be supportive of routine farming practices, and the reduction in a critical mass of the farming community and farm-related businesses are all potential threats. Many of these threats have likely greatly altered the New England farming landscape. As per the USDA Census of Agriculture, the number of farms operating less than 10 acres increased 66% between 2002 and 2017, and has gone from comprising 16% to 23% of all farms. Further studies are needed to more deeply understand the threat of LDR, how it shows up on the landscape, and what tools can help to limit the transition of agricultural lands into LDR.

HOW LOW-DENSITY RESIDENTIAL DEVELOPMENT MANIFESTS ON THE NEW ENGLAND LANDSCAPE

Across New England, LDR land use can take many forms—from fragments of once-larger farms inside of suburbs and cities to rural roadside developments that appear as more gradual threats. Approximately 52% of all LDR development on farmland occurred in metropolitan counties, often in suburban or peri-urban neighborhoods along transit routes. Still, another 32,000 acres remain threatened in counties with smaller urban or completely rural populations, where incremental development threatens to fragment existing agricultural landscapes.

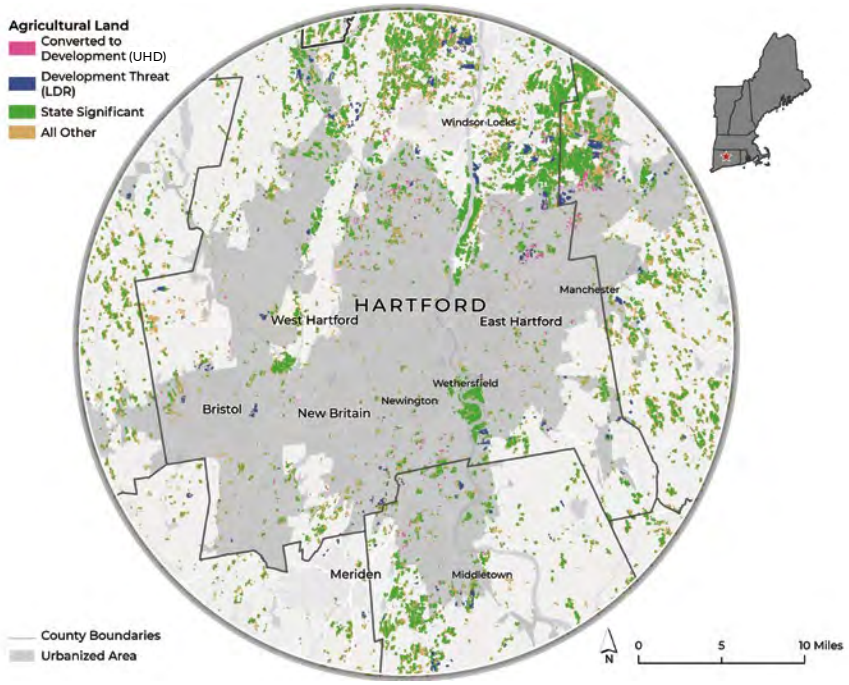
LDR constitutes a substantial and persistent threat to farmland across New England. Farmland that was already in LDR areas in 2001 was *5.1 times more likely* to be converted to urban development by 2016 than non-LDR farmland. As more than 68,000 acres were newly threatened by LDR in this period, nearly 250,000 acres that were threatened by LDR in 2001 remained threatened in 2016. Though it is encouraging that many acres have resisted conversion to UHD, if development trends continue as they have, over 13,000 acres of agriculture in LDR will be lost to urban development by 2031. As housing construction begins to rise to pre-recession levels,[7] these estimates may in fact be conservative, and thus speak to the imperative for an expedited pace of land protection, an enhanced suite of policies and tools to incentivize and require more strategic land protection efforts, as well as the adoption of programs to promote landscape-scale conservation across New England.

URBAN/PERI-URBAN CASE STUDY

As one might imagine, development pressure is greatest around New England's major cities. A spatial analysis of Hartford, Connecticut[8] reveals that 56% of all agricultural land converted to UHD across the state occurred within 20 miles of Hartford's urban center. Importantly, of this converted land roughly 62% was previously identified as low-density residential (LDR). This means that while some agricultural land is getting directly converted, many of the lands that were previously fragmented by sprawling residential development were eventually irrevocably lost.

LDR lands that have become parcelized, but not completely lost, could be opportunities for new and beginning farmers seeking access to smaller parcels more suitable for their operations. Deeper analyses of the threats and opportunities to farmable lands in urban and peri-urban communities in New England are needed. These farms are some of the most expensive and immediately threatened by conversion and would benefit from local and state investment in their protection, which would also increase farmland access and promote local food security. In particular, urban and peri-urban farms can often most readily meet the needs of beginning and/or new entry farmers seeking access to land within reasonable access to transportation and services (see page 38 for further analysis of farmer demographics and land access needs).

FIGURE 9. AGRICULTURAL LAND CONVERSION THREATS AROUND HARTFORD, CONNECTICUT



New England's Remaining Agricultural Land

New England has 3.97 million acres in farms, composed of three main types of agricultural land: cropland, pastureland, and woodland. Cropland accounts for the land most suitable for growing food crops, from kale to apples to potatoes, while pastureland reflects land most suitable for pasturing livestock like dairy and beef cattle, sheep, goats, as well as pigs and poultry.

While the majority of New England is forested, the third agricultural land category—woodland—is that subset of forested lands that are owned or used by farms. The location of these lands was mapped by identifying forested areas adjacent to cropland and/or pastureland. Woodlands are uniquely substantial in New England. With the exception of West Virginia, the six New England states lead the nation in the proportion of agricultural land that is made up of woodland associated with farms. Identified woodlands are the lands most commonly utilized for maple sugar, timber products, and agritourism, although many of New England's farms do not manage or actively utilize their woodlands.

FIGURE 10. NEW ENGLAND'S REMAINING AGRICULTURAL LAND

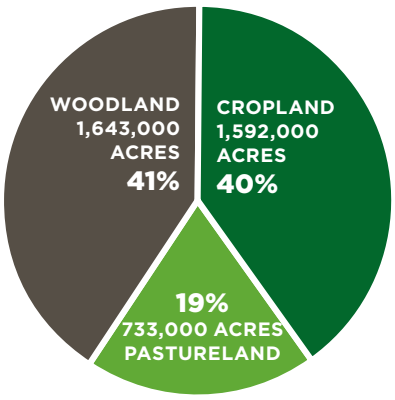
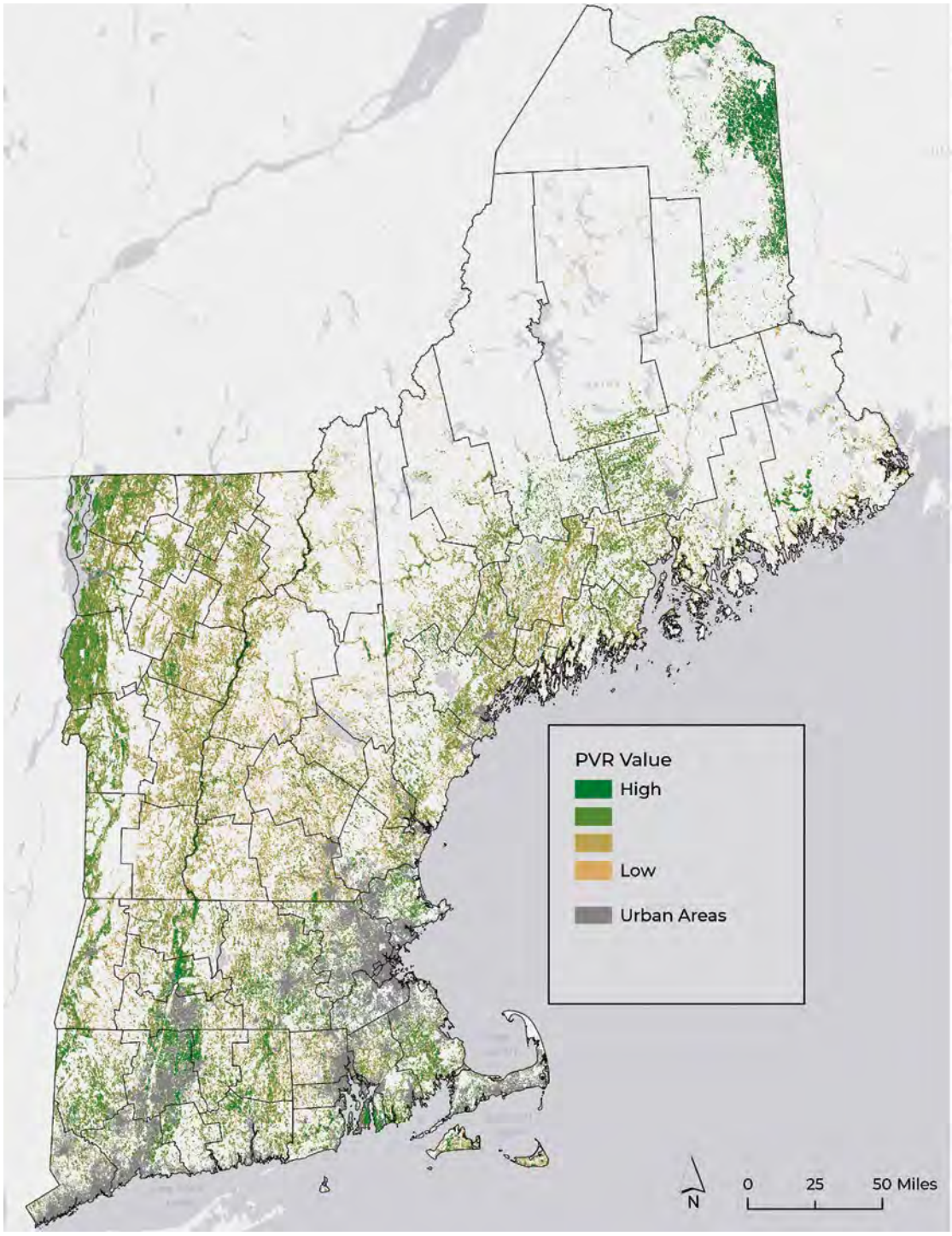


FIGURE 11. NEW ENGLAND'S BEST REMAINING AGRICULTURAL LANDS



A specific examination of New England's Productivity, Versatility, and Resiliency (PVR) continuum shows the land most suitable for food production in dense pockets in northeastern Maine, northwestern Vermont, the Pioneer Valley of Massachusetts, and Connecticut. Large quantities of high-quality land also exist in patches throughout the region.

WHERE ARE NEW ENGLAND'S BEST REMAINING AGRICULTURAL LANDS?

Using novel PVR data to analyze New England's agricultural lands that may be best suited for long-term food production can provide new insights into the threats and opportunities for New England agriculture. These data go beyond the often-used data sources of "prime agricultural soils" and "state important soils," and present a more holistic understanding of New England's land resources for different potential land uses.

Because flat, loamy cropland is not nearly as abundant in New England as it is in other parts of the country, all three categories of land play a significant role in the region's agricultural resiliency. In fact, *A New England Food Vision* sees great potential for increasing the use of our agricultural lands and woodlands for livestock production through grazing. In other words, even lower-PVR lands must be saved to meet the 2060 vision. This expanded view of potential land uses and subsequent funding and resources to protect a broader range of farmland is vital to achieving *A New England Food Vision* and a more resilient, flexible, and secure future.

THE INDISCRIMINATE THREAT TO OUR BEST AGRICULTURAL LANDS

Across New England**, roughly half of all land** converted or threatened by development was state significant (see page 11). Of particular concern is the amount of state significant agricultural land that has been irrevocably converted to urban and highly developed use. About half of New England's state significant agricultural land lies in metropolitan counties—40% in counties with a population of at least 250,000. Over 17,000 acres of state significant agricultural land across New England—11,000 acres in Massachusetts and Connecticut alone—have been converted to urban and highly developed (UHD) land use. Population pressure from the Boston metro area still appears to impact the agricultural lands in surrounding suburbs and exurbs.

State	Acres of **All Agricultural Land** Converted or Threatened	Acres of **State Significant Land** Converted to UHD	Acres of **State Significant Land** Threatened by LDR	Percent of Affected Agricultural Land that was State Significant
CT	22,994	4,242	7,158	**49.6%**
MA	27,154	6,750	6,800	**49.9%**
ME	18,729	1,531	7,277	**47.0%**
NH	11,622	1,947	3,322	**45.3%**
RI	3,608	950	849	**49.9%**
VT	21,384	2,127	9,175	**52.9%**
New England	**105,491**	**17,547**	**34,582**	**49.4%**

This trend poses serious concerns for the future of our remaining agricultural land. Development patterns do not appear to discriminate between our relatively better-quality land and relatively poorer-quality land, implying that our best remaining land will continue to be subject to development threats. If our agricultural land is not strategically protected or planned for, the resiliency of our regional food system remains in jeopardy.

Insights from the Policy Scorecard: Status of State Policy Response to Agricultural Land Protection Challenges

Several state programs and policy levers exist to enhance the protection of farmland. **Purchase of agricultural conservation easement (PACE) programs** permanently protect agricultural land from non-farm development and compensate property owners for selling agricultural conservation easements to a government agency or private conservation organization. As of 2019, the six New England states permanently protected a combined 320,718 acres of agricultural land through state-funded PACE programs. While they have spent a combined $332 million so far, these funds do not always have a dedicated source and have not been consistent over time. Vermont's real estate transfer tax has funded its PACE program for many years, helping it to achieve consistent and high funding per capita relative to other New England states. Additionally, Vermont and Massachusetts' PACE programs uniquely feature the Option to Purchase at Agricultural Value—a tool that helps to keep farms more affordable and accessible to farmers.

QUALITY AND EFFECTIVENESS OF PACE PROGRAMS	
National Ranking	**State**
3rd	Vermont
6th	Massachusetts
8th	Rhode Island
9th	Connecticut
10th	New Hampshire
12th	Maine

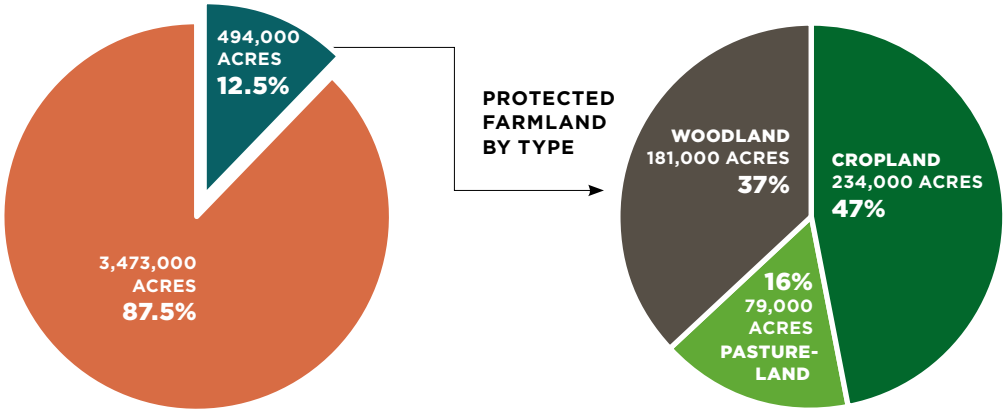
Still, strong state **land-use planning programs** are the best way to manage and contain development, and the most cost-effective approach to protect strategic agricultural resources. Historically, New England states have struggled to achieve comprehensive state-wide planning for agriculture, due largely to the prevalence of home-rule and the power of municipal governments. Currently, no New England state has a requirement for localities to adopt local land-use regulations to protect agricultural resources—Vermont and Rhode Island do have explicit statewide goals to protect agricultural land and promote compact growth, but rely heavily on voluntarily compliance to achieve them. While incentives to comply with state plans are encouraging, they are largely insufficient for the scope of the need to plan for agriculture across each state and the region.

QUALITY AND EFFECTIVENESS OF LAND USE PLANNING PROGRAMS	
National Ranking	**State**
4th	Rhode Island
8th	Connecticut
9th	Vermont
13th	Massachusetts
16th	New Hampshire
19th	Maine

WHAT'S PROTECTED—WHAT'S NOT?

New England has a long history of open space protection and many land trusts, agencies, non-profits, and individual landowners working to permanently protect farmland. The region is home to the oldest conservation land trust in the world, the first public farmland protection program, and the first state-run farmland protection program. Yet despite decades of critical work, **only 12.5% (494,000 acres)** of New England's agricultural land has been protected.[9] This leaves 3.5 million acres (87.5%) of New England's agricultural land unprotected and at risk of conversion to non-farm uses. Just 15% of the region's remaining cropland, 11% of pastureland, and 11% of woodland is protected.

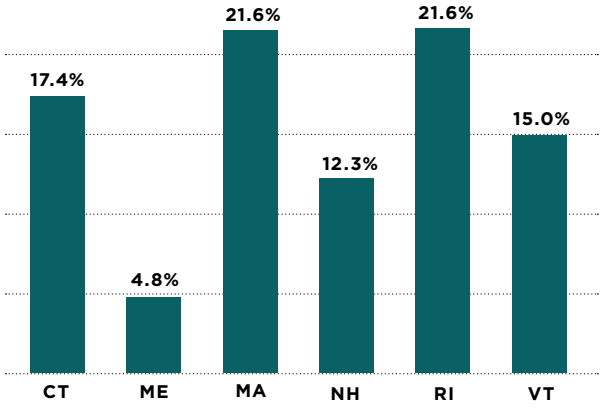
FIGURE 12. NEW ENGLAND'S PROTECTED AGRICULTURAL LAND



These figures are the best-known data on protected lands in New England. A protected lands database was provided by Harvard Forest and then enhanced by American Farmland Trust to include additional state data provided by many land trusts and state agencies. These data include lands that are protected specifically for agriculture, and those that are protected for more general purposes, and includes both easement-protected land and lands held in fee by conservation organizations, towns, and states.

FIGURE 13. PERCENTAGE OF EACH STATE'S AGRICULTURAL LAND CURRENTLY PROTECTED

The regional data, broken out by state, indicates the percent of each state's remaining agricultural land that occurs within permanently protected open space.



WHAT'S THE PRICE TAG? PROTECTING NEW ENGLAND'S REMAINING AGRICULTURAL LAND

Based on the average project cost of agricultural conservation easements in each state by state PACE programs, AFT estimates—conservatively—that it would cost **at least $10 billion** to permanently protect New England's remaining farmland.[10] At the current rate of farmland protection funding using existing purchase of agricultural conservation easement tools, it would take **at least 350 years** to protect New England's remaining agricultural land—during which time a large percentage of it would be converted to development, at current rates of growth.

$10 BILLION

to protect New England's remaining farmland.

At the current rate of farmland protection funding it will take at least **350 YEARS** to protect New England's remaining agricultural land.

NASA

Flooding caused massive runoff of soils and sediments into the Connecticut River during Tropical Storm Irene in 2011, causing devastating impacts to some of New England's best farmland and water resources.

CREATIVE COMMONS/CAMPBELL HALL

Tropical Storm Irene dumped over 11 inches of rain on parts of Vermont,[13] affecting over 450 farms and damaging more than 20,000 acres of farmland in Vermont. The state of Vermont reported that flooding alone caused more than $10 million in crop losses and damages to farmland. High winds, closed or washed out roads, and post-Irene forage shortages caused further hardships and losses to farmers across the state.[14]

Climate Change: Threats and Opportunities for New England Agriculture

Climate change is upon us and poses serious threats to New England's farms,[11] including:

- Increased disease and weed pressure.
- New and increasing invasive pest threats.
- Soil degradation due to higher temperatures and increased erosion.
- Flooding from intense storms and increasing precipitation and increased storm intensity.
- Higher average temperatures and more variable temperatures during shoulder seasons.

Our analysis, combining our *Farms Under Threat* data with the Environmental Protection Agency's Enviroatlas floodplain data, **estimates a projected 177,000 acres** of our cropland and pastureland are directly threatened, because they lie within floodplains in New England.[12] Up to a third of all crop and pastureland may be threatened in some counties.

Increasing financial support over the 21st century will be needed to help New England's farmers withstand ecological and economic impacts to their farms and businesses in the face of climate change.

A FLEXIBLE AND RESILIENT FUTURE: A LOOK AT WOODLAND PVR ASSOCIATED WITH FARMS

A Productivity, Versatility, and Resiliency (PVR) analysis of New England's woodlands associated with farms (see Figure 14, below) can assist farmers, conservationists, and others with thinking about the past and future of New England's woodlands. During the 19th century, most of New England's land was cleared for farming. Many of the region's woodlands sit atop soils suitable for food production. *A New England Food Vision* presents a scenario where New England increases its crop and pasturelands to 15% of the landscape: close to the 1945 levels of forest cover. The vision suggests that this new farmland could come primarily from former pastures and fields that are now covered with trees.

Based on our PVR data, of the two million acres of combined best agricultural lands, **over 350,000 acres (18%)** are woodlands that are associated with farms. While the most robust acreage of state significant woodlands are in Maine, larger proportions of higher-quality woodlands exist across southern New England: 30–35% of available woodlands in Connecticut, Massachusetts, and Rhode Island are of state significance. State significant woodlands comprise 15% of all agricultural land. We must also remember that these numbers only capture the acres of woodland, not all forested lands. Our analysis leads

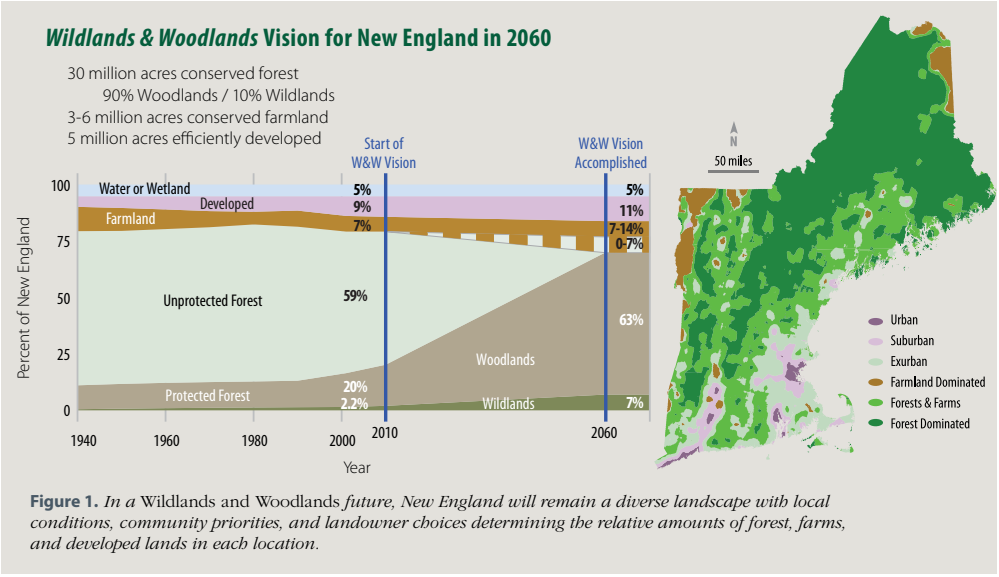


Figure 1. *In a* Wildlands and Woodlands *future, New England will remain a diverse landscape with local conditions, community priorities, and landowner choices determining the relative amounts of forest, farms, and developed lands in each location.*

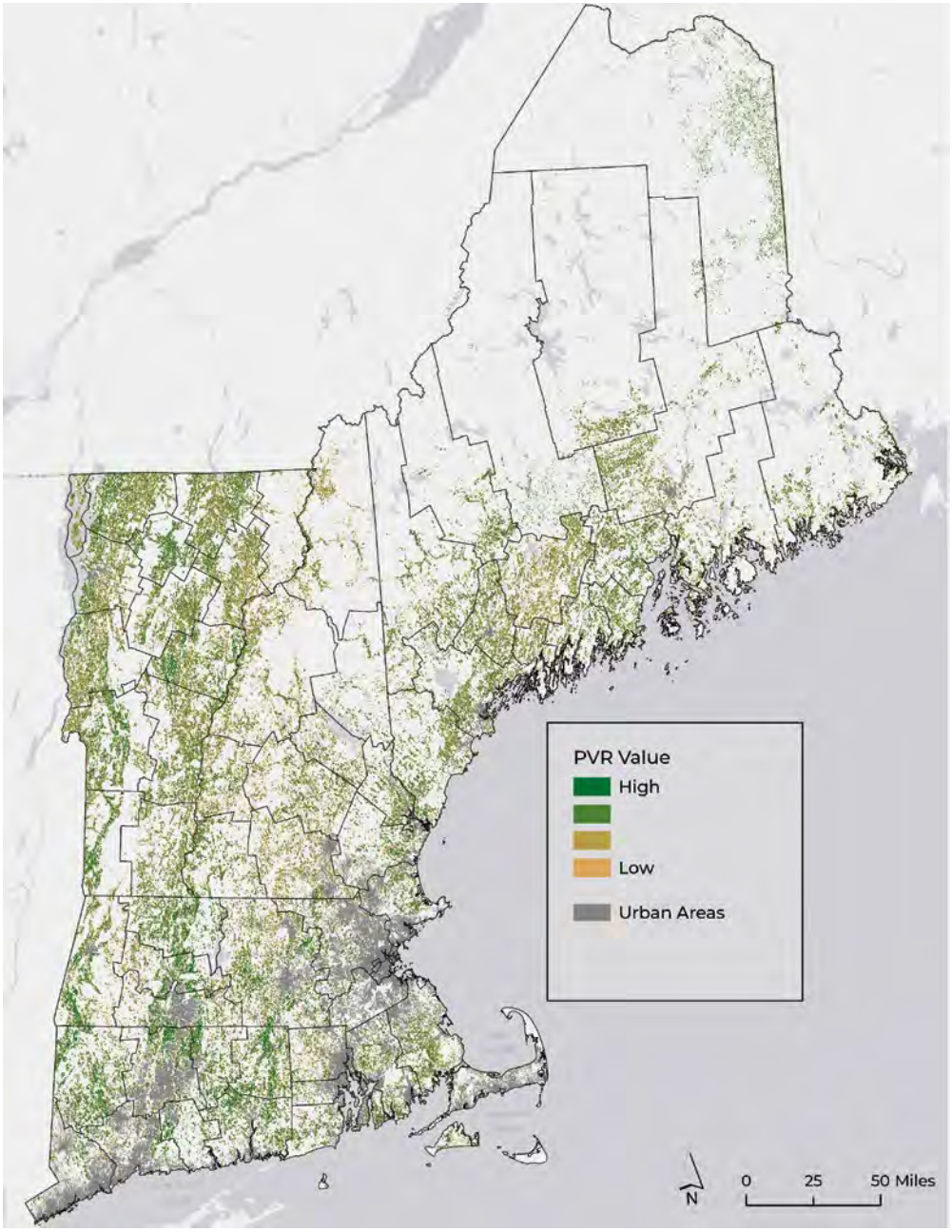
A New England Food Vision*'s goal to triple the total farmed area in New England by 2060 is possible, while still keeping 70% of New England forested. Contained within the brown hashed line in the above graph is a powerful call to dialogue and action about where this new farmland will come from. Decisions made today and over the next 40 years about New England's forests and farmland will help to shape New England's ability to become more food self-reliant and to address the climate crisis.*

us to believe that the vast majority of this could be used for continued high quality forest production OR could be restored to former croplands and orchards (or a mix of uses). There is potentially far more that could be suitable for pasture.

There is a tenuous balance between preserving New England's climate mitigation potential via forest carbon sequestration and increasing its capacity for local, sustainable food production. The severity of the climate crisis forces us to think strategically about where and how we have the capacity to shift land use towards other forms of resilience. Not all forestlands have the same potential for carbon sequestration. An analysis that helps prioritize the potential for future carbon sequestration (versus current carbon storage) is needed to augment the data provided here to make the best choices on this front. Alternatively, landscape-scale changes to forest management and conservation as articulated in such visions as *Wildlands & Woodlands* could be more than sufficient to offset any reasonable conversion of woodlands to crop or pasturelands. Additionally, adopting regenerative and agroecological land management practices can go a long way toward climate mitigation (see page 25).

Within the context of New England's extensive history of pasture-based agriculture, the majority of the land that is currently forested was previously pastured and might have the capacity to be pastured again or used for other silvopastural and agroforesty uses. Beneath their trees, the mature forests of southwestern New England—primarily Franklin (MA), Hampshire (MA), Berkshire (MA), Worcester (MA), Litchfield (CT), and Windham (CT) counties—have some of the relatively highest quality soils for food production. We also see that much of north-central Vermont's woodlands contain relatively high-quality soils, although less is currently known about the maturity levels and, therefore, future carbon sequestration potential.

FIGURE 14. PVR SPECTRUM OF WOODLANDS ASSOCIATED WITH FARMS



The Productivity, Versatility, and Resiliency (PVR) spectrum for woodlands associated with farms shows a range of relatively high-quality land stretching across the western half of New England (displayed in dark green). These lands have a high potential for agriculture, and a more in-depth analysis that looks at other factors like carbon sequestration, water quality, wildlife habitat, and more should be conducted.

In light of these soils data and *A New England Food Vision* goals, states and conservation organizations might consider utilizing more flexible conservation easements and tools to accommodate future land use needs.

REGENERATIVE AGRICULTURE

Regenerative agricultural practices can mitigate carbon dioxide. For example, if New England farms fully adopted just three NRCS conservation practices—planting cover crops, practicing no-till or strip-till, and replacing inorganic fertilizer with dairy manure or compost—New England farmers could remove over **1.65 million MTCO2e annually** from the atmosphere through reduced greenhouse gas emissions and carbon sequestration as organic matter.[15] That is as impactful as **removing over 360,000 cars** from the roads—or roughly 7% of all cars registered in New England, or almost every car registered in Maine[16]—and is equivalent to the carbon sequestered by planting and growing over 27 million seedlings for 10 years.[17]

USDA/NATIONAL AGROFORESTRY CENTER

Regenerative, agroecological agriculture can take many forms and can help expand land management practices beyond the binary of fields and trees. Agroforestry is the intentional integration of trees and shrubs into crop and animal production systems and has been used by indigenous people for millennia. It can take the form of silvopasture, alley cropping, forest farming (or multistory cropping), windbreaks, hedgerows, and riparian forest buffers. These systems can provide models for more climate-resilient agriculture that can increase food security, help diversify production, serve myriad ecological functions, and sustain culturally significant food, fiber, and land management traditions.[18,19]

Resilient soils make farms more resilient—and more viable—in the face of climate change. In addition, as will be discussed in the next section, improving farm viability helps keep farms operational and less likely to be sold for development.

SOLAR ENERGY PRODUCTION: THREATS AND OPPORTUNITIES

New England has seen increased pressure on its farmland due to state goals and programs encouraging more renewable energy—particularly solar. However, the rate at which farmland and woodland have been converted are worrisome for the conservation community. Nationally, solar companies are offering landowners with suitable land anywhere from $5,000 to $10,000 per acre.[20] In extreme cases, offers can be as low as $500 per acre and as high as $105,000 per acre.[21]

Anecdotally, for New England, we've seen between $500 and $5,000 an acre being offered to farmers. This can drive up rental rates, lead to unrealistic assumptions of land value, cause landowners to avoid long-term leases with farmers, and more. In addition, the type of solar that is commonly built not only displaces agriculture from the landscape in the short-term, but without contractually requiring decommissioning at the end of the term, it can potentially displace agriculture permanently. Also, construction and management practices can either benefit or interfere with the carbon storage potential of the soil beneath

BUTTER SOLAR

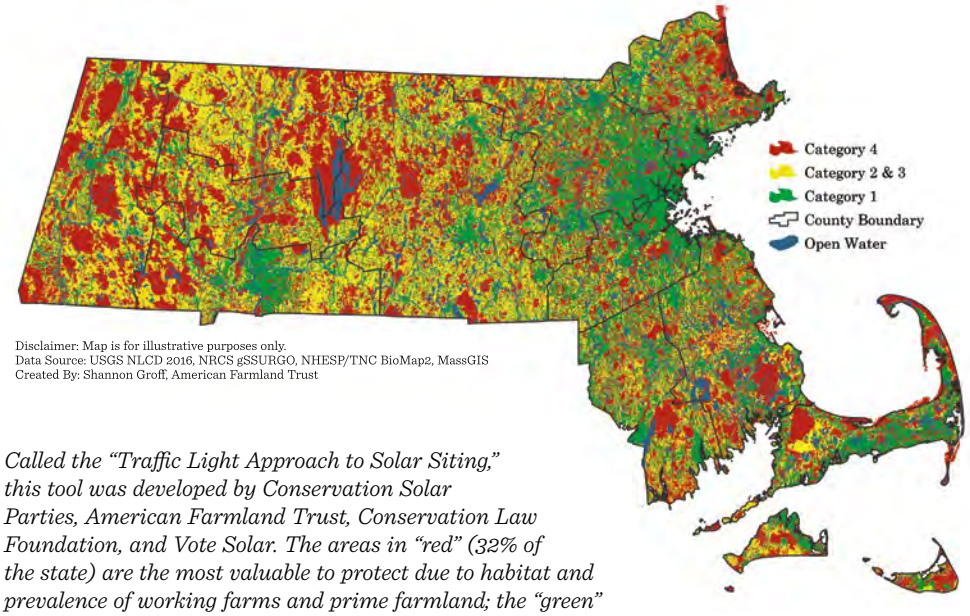
Solar developments are displacing farmland and forests at a rapid pace around New England.

the panels. Native vegetation, integrated animal grazing, and soil conservation practices can improve soil health and carbon sequestration as organic matter, whereas gravel ground cover and reliance upon concrete support structures reduce soil's ability to store carbon.

In Connecticut, solar has become the largest single type of development on agricultural and forested land. The area of farmland and forest selected and/or approved for development of solar facilities in 2016 was almost the same as the amount of those lands protected with easements by the state in an average year.[22]

A recent study by Harvard Forest found that of the 1,232 acres converted to solar developments in Hampshire, Hampden, and Franklin counties in Massachusetts from 2013 to 2018, 77% (952 acres) of the developments were on previously undeveloped land (most of it farms and forests).[23] These figures demonstrate a clear need for the use of smart solar guidelines, incentives for appropriate solar siting, and investment in new technologies that are compatible with farmland, such as dual-use systems. (See Appendices for AFT's new Solar Siting Guidelines for Farmland.)

FIGURE 15. SMART SOLAR SITING



SHANNON GROFF, AMERICAN FARMLAND TRUST

Called the "Traffic Light Approach to Solar Siting," this tool was developed by Conservation Solar Parties, American Farmland Trust, Conservation Law Foundation, and Vote Solar. The areas in "red" (32% of the state) are the most valuable to protect due to habitat and prevalence of working farms and prime farmland; the "green" are already developed sites that are the most appropriate for solar, and the "yellow" (17% of the state) are areas around which to be cautious and evaluated on a case-by-case basis. This partnership advocates for a middle ground that supports solar growth and protects natural and working lands.

*This map is for illustrative purposes only

Dual-use refers to agricultural production and electricity production from solar photovoltaic (PV) panels occurring together on the same piece of land,[24] providing an exciting middle ground for on-farm solar. While this type of construction is generally more expensive due to increased structural costs, state agencies can incentivize and subsidize these projects. For example, with the Solar Massachusetts Renewable Target (SMART) program, there is a six-cent "adder" for dual-use solar arrays, which translates to an extra $2M per mega-watt (MW) over the life of the installation as compared to a standard array configuration and siting. While dual-use arrays require more space (roughly twice the footprint of traditional arrays), more infrastructure, and more thoughtful layout, properly designed systems have the potential to produce both agricultural products and electricity, leading to a net gain.

While climate change is a severe threat, it is creating an urgency to revolutionize land management, food production, and technologies here in New England. The Woodland PVR data (described above) may provide a useful tool to think strategically about appropriate land uses on agricultural land.

EMILY COLE, AMERICAN FARMLAND TRUST

Dual-use solar panels installed by Hyperion Solar at UMass Amherst demonstrating vegetable production under new dual-use arrays.

RANDY DUCHAIN/ALAMY

VIABILITY

CHRISTINE GLADE/ISTOCKPHOTO

New England's farms face serious economic challenges. Climatic changes, pressures from global markets, workforce shortages and labor costs, the challenge of making living wages, declining infrastructure, and development threats are among the many stressors to New England agriculture. Land protection alone is not enough to keep New England's farms operational.

What does it mean for New England to be agriculturally viable?

Agricultural viability means the ability of New England's agricultural land base to retain adequate soil quality and withstand development pressures; for its farmers to be diverse and remain equipped for land transfer; and for its farms to sustain financially profitable operations that anticipate the market and climate challenges ahead.

This section reveals new data and analyses for New England's farm economics derived from the 2017 Census of Agriculture, as well as new analyses from other sources to showcase the following:

- An examination of farm sales and the acreage that different-sized farms control.
- An examination of the need for diverse income streams to increase farm viability.
- An examination of challenges and opportunities for mid-sized farms.
- A look at the challenges and opportunities to strengthen and protect New England's dairy industry and land base.
- Insights from the *Policy Scorecard* relevant to the New England states.

EXAMINATION OF FARM TYPOLOGY AND ASSOCIATED LAND BASE

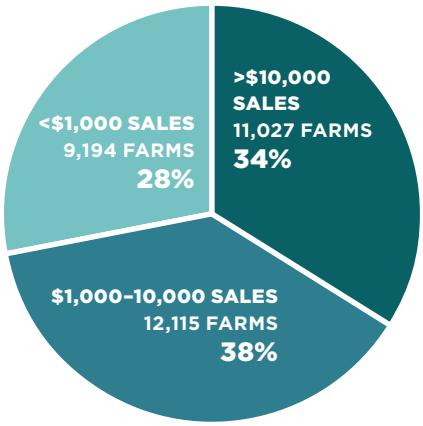
In 2017, two-thirds of New England's 32,000 farms had less than $10,000 in sales.[25] While their individual sales may be small, these farms collectively operated one-third of the agricultural land. The 11,000 farms that sold more than $10,000 operated nearly 2.5 million acres of farmland; thus, the economic viability of both groups is key to maintaining the region's agricultural land base.

The range of farm revenue spans hundreds of thousands of dollars in New England, but approximately a third of all farms with at least $10,000 in sales had between $10,000 and $100,000 in sales. While this constitutes a rough sense of small-to-mid-sized farms, farm operations making upwards of $250,000 and even $1 million in revenue still struggle to remain viable in today's volatile commodity markets. Sales alone is not a clear indicator of viability, and in fact hides a much more complicated issue.

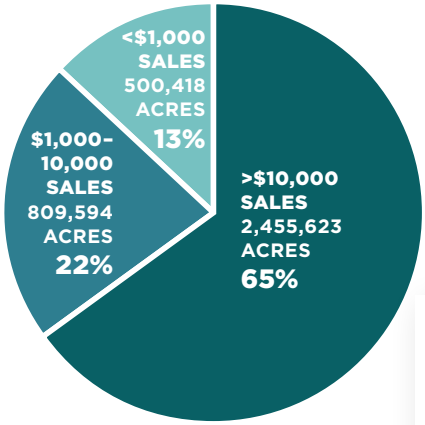
"Agriculture in the middle" is a relevant concept to demonstrate the challenges that farms face in remaining mid-sized. As market consolidation continues to shape the operations

FIGURE 16 (A–C).

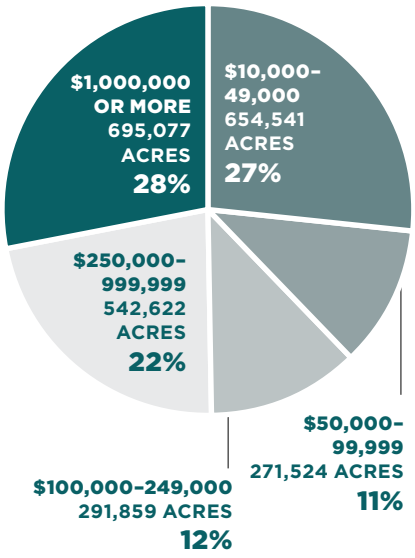
16A. FARM SALES BY # OF FARM OPERATIONS



16B. FARM SALES BY ACRES OPERATED



16C. LAND IN FARMS BY SALES CLASS >$10,000



and land use of many farms, small farms are constrained in their ability to scale up, and large farms built on efficiency and narrow profit margins are in danger of quickly becoming unviable amidst volatile market conditions. While we know that the agriculture in the middle is a pervasive phenomenon in New England, the 2017 USDA Census of Agriculture data limits what we can understand about the needs and the current reality of commodity versus non-commodity-based farms. Though we need more nuanced data, we can ascertain a few realities for contemporary farms struggling to stay afloat.

FIGURE 17. PERCENTAGE OF FARMS BY MAJORITY SALES TYPE

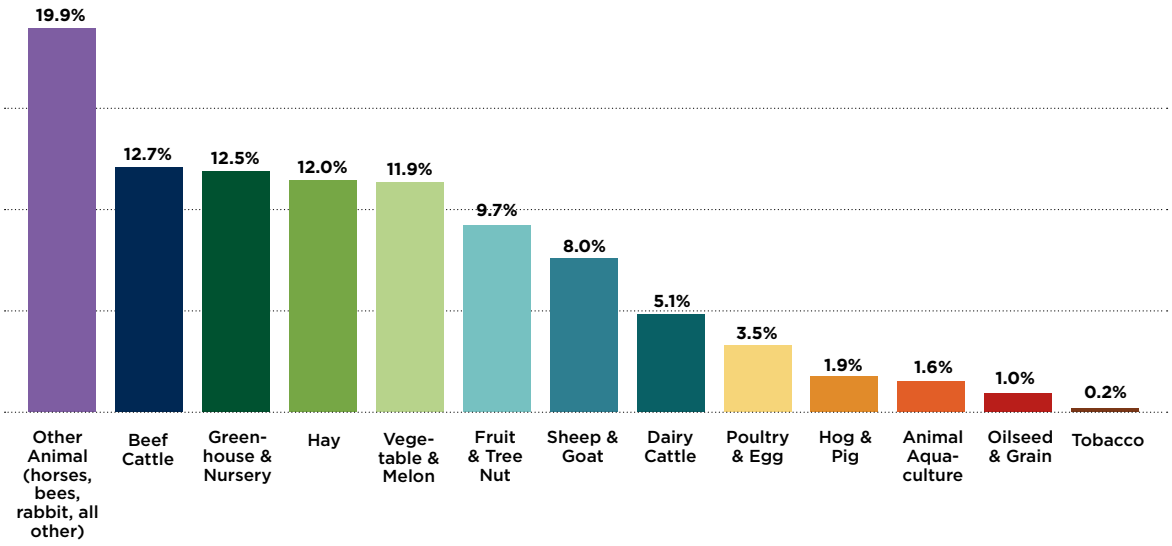
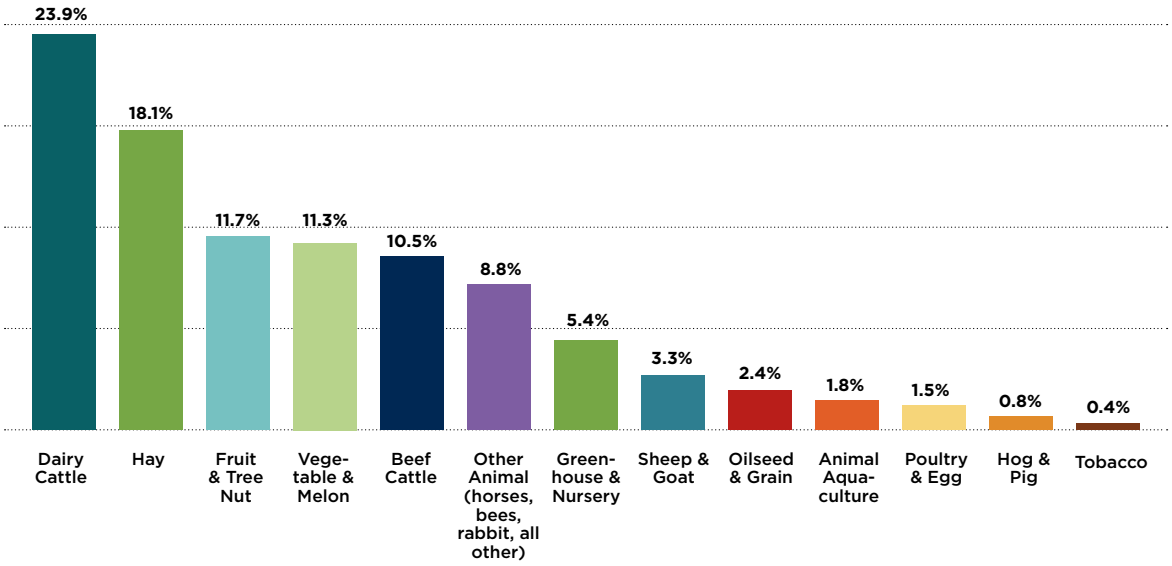


FIGURE 18. PERCENTAGE OF AGRICULTURAL ACRES OPERATED BY MAJORITY SALES TYPE



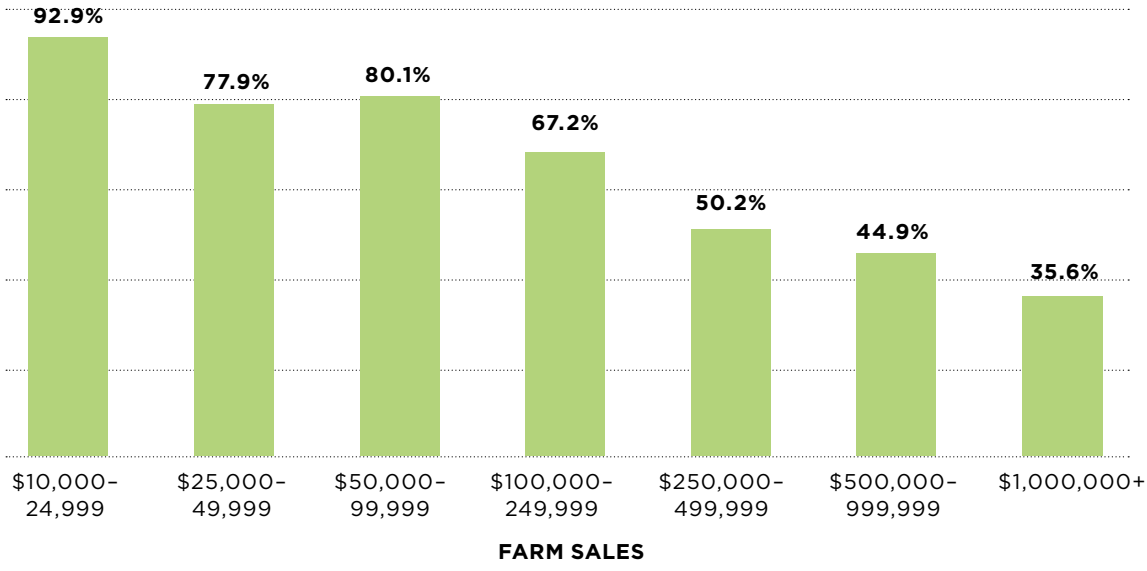
SMALL-TO-MID-SIZED FARMS ARE CONSTRAINED BY LABOR AND CAPITAL

While not all small-to-mid-sized farms logged labor expenses, for those that did, labor expenses comprised roughly 75–90% of all expenses for farms with $10,000–$99,999 in revenue, while they comprised much less for farms with over $100,000 in revenue. These smaller farms also tended to have higher rates of unpaid labor; a majority of farms with less than $100,000 in revenue had at least one unpaid worker, typically the primary farmer, while the proportion dropped off steadily for farms with over $100,000 in revenue. Similarly, for farms with interest expenses on loans, these expenses comprised a much larger portion of all expenses for farms with less than $100,000 in revenue than they did for farms with more than $100,000 in revenue.

These two simple facts highlight what are possibly large gaps in efficiencies between larger and smaller farms, but also indicate major shifts in business models between those farms with less than $100,000 in revenue and those above. This also provides compelling information to inform programs and efforts that might be geared toward job creation, rural wealth building, and the compounded impact of public support for businesses: labor expenses are far more likely to move money through a local economy than many other farm expenses, like fertilizer, machinery, imported feed costs, etc.

FIGURE 19. LABOR COSTS COMPRISE GREATER PROPORTIONAL EXPENSE FOR SMALL AND MID-SIZED FARMS

Proportion of Average Labor Expenses to Average Total Expenses



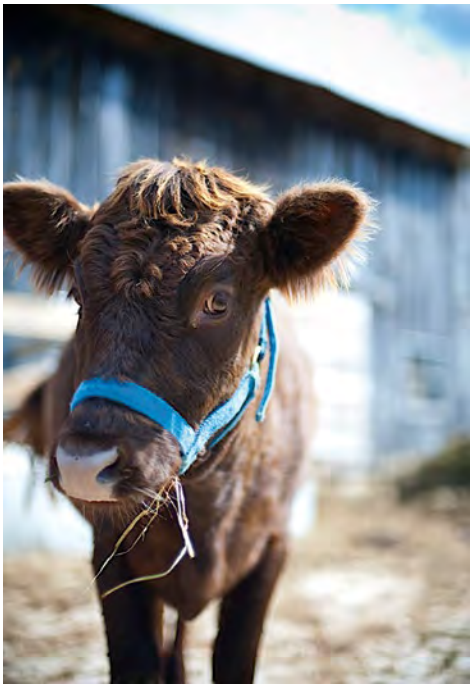
LARGER FARMS HAVE COMPLEX BUSINESS MODELS TIED TO EVEN MORE COMPLEX COMMODITY MARKETS

Large farms, whether they are orchards, greenhouses, or dairies, typically have multiple high-volume revenue streams to sustain their businesses. Those that do have direct-to-market sales aren't entirely direct-to-market operations: they host events, sell wholesale, or if they are a dairy, sell to the commodity market in no small amount. Roughly a third of all farms with between $100,000 and $500,000 in revenue had direct-to-consumer sales (DTC) in 2017, even as the average DTC sales per operation was typically less than 10% of the average total revenue per operation.[26] The cost of production and the effort to upkeep multiple business streams is high, and these operations typically carry high debt and depreciation that jeopardize the viability of the operations year-to-year amid volatile commodity markets or persistent inclement weather.

The Challenge Facing the Future of Livestock Agriculture

As noted on page 30, a small percentage of larger farms control a disproportionately large amount of the agricultural land base. Although dairies comprise just 5% of all New England farms, they operate roughly 24% of farmland. The land base operated by beef cattle farms (11%), sheep and goat farms (3%), dairies (24%), and hay farms (18%) constitute a combined **56%** of total farmland in New England. Pigs and poultry likely contribute a sizable acreage of pastured livestock production as well. *A New England Food Vision* specifically calls for a massive increase in their production alongside small ruminants, beef, and dairy even as they are among the most vulnerable agricultural sectors.

LILY PIEL



LILY PIEL

The future of New England's dairy farms remains uncertain, primarily due to federal pricing policies that often keep the price paid to farmers below their cost of production. The six states combined had nearly 1,100 fewer dairies in 2017 than they did in 2002,[27] and dairies continue to go out of business every year. While some dairy farms continue to maintain financial profitability, those that were not profitable averaged more than $50,000 in net losses, which was tens of thousands more than most other industries.

Social and economic barriers present challenges for the future of dairies in New England. Due to the social and economic barriers to the success of New England dairies, many will likely transition to other uses over time, and the dairy economy of the future may look much different than it does today. *A New England Food Vision* calls for an increase in fluid milk

production for the local markets, but it is likely that many of these farms will need to market more directly, get involved in value-added processing, or engage in diversified production that is complementary to dairy. Conserving existing dairy farms can support the agricultural infrastructure of our region and the future of the land currently utilized by this industry.

Permanent conservation easements and other tools that allow for future flexibility—like on-farm infrastructure, housing, or subdivision—will enable these lands to stay in agricultural production and change uses over time. As the dairy industry continues to consolidate, easements must allow for greater flexibility for subdivided land use to support larger operations or spur the next generation to farm smaller plots. Matching up the land base with appropriate protection tools and programs to meet the needs of the next generation will be critical. However, permanent protection of the land does not imply the preservation of the farm business. Although many conservation easements have been placed on dairy farms throughout New England, not all have managed to sustain their operations. Conserving the land base is essential; however, it's not enough.

Diversification Is Key for All Farms

All farms need the flexibility and support to diversify their operations. As population growth continues to constrain agricultural operations, it may also offer an opportunity for farms to capitalize upon new markets if given the proper flexibility and support.

Agri-tourism presents an opportunity for farms to engage with consumers and increase revenue, especially for small-to-mid-sized farms. Although less than 10% of farms overall reported agri-tourism income, farms with $50,000 to $100,000 in sales that did report it had on average over $100,000 in agri-tourism income.[26] This means that while their agricultural income was significant, for those in this category, agri-tourism constituted the majority of their income and was likely a very meaningful part of their business revenue. While it is crucial to make sure that farms do not slowly morph into mere land-based entertainment venues, these numbers tell us that traditional metrics for allowable uses for farmland—whether in zoning, grant programs, or permanent conservation easements—require more flexible language related to on-farm uses that enable farms to remain viable in order to stay in agriculture.

Improving the direct-to-market economy also offers opportunity for farms of all sizes. Overall direct-to-consumer sales have doubled from 2007 to 2017, amounting to $278 million, and have made particularly large strides in certain industries.[27] Roughly one-fifth of all New England dairies participate directly in local food sales, and their direct-to-consumer sales have increased dramatically in the last 10 years. Direct-to-consumer sales in Vermont tripled to $15.3 million between 2007 and 2017, and although they amount to fewer totals, direct-to-consumer sales in Massachusetts and Maine have increased dramatically to roughly $4 million each. In 2007, Connecticut and New Hampshire had no recorded direct-to-consumer sales, and by 2017, they recorded $2 million and $1 million respectively. State-funded programs have helped to spur this growth, which remains a promising avenue for small, mid-sized, and large farms alike.

In spite of sizable public investment via farm viability programs in half of the region's states, if we are to secure the agricultural land base for the future, we still require massive investments of capital to support the existing viability and/or the transition of these farms to the next generation.

LILY PIEL

Insights from the Policy Scorecard: Status of State Policy Response to Farm Viability Challenges

States have several policy interventions available to improve on-farm viability, such as property tax relief and explicit, state-funded farm viability programs. **Property tax relief programs** have provided considerable relief to New England farms by taxing the land based on its "current use" value rather than its "highest and best use" (or full market value). Enrollment varies widely from just 10% of acres in Maine, to 46% and 48% of acres in Vermont and New Hampshire respectively, to 70% of acres in Connecticut (Massachusetts and Rhode Island do not track acreage enrolled).

QUALITY AND EFFECTIVENESS OF PROPERTY TAX RELIEF PROGRAMS	
National Ranking	**State**
2nd	Vermont
11th	Massachusetts
14th	New Hampshire
16th	Rhode Island
20th	Maine
21st	Connecticut

Farm viability programs provide financial support and technical assistance for farms and are relatively rare as publicly-funded initiatives. Out of the four state-funded farm viability programs nationwide, three are in New England (Maine, Massachusetts, and Vermont). Since 1996, Massachusetts' Farm Viability Enhancement Program has served over 500 farms with $24 million, helping farms develop business plans, upgrade equipment, and invest in large, capital-intensive infrastructure projects. Vermont has spent considerably less—$7.5 million—but has been able to help 1,000 farms with business planning and enterprise changes to improve viability. Maine does similar work, offering loan and grant incentive programs for marketing and technical assistance with $3.8 million serving over 250 farms to date.

RANDY DUCHAIN/ALAMY

JERRY & MARCY MONKMAN ECOPHOTOGRAPHY/ALAMY

PEOPLE

The demographic makeup of New England's farmers today is a product of our complex history of colonization, immigration, policies, and practices related to access to land, wealth, and resources over time. The legacy of colonization has resulted in dispossession of land by native people, who today control a small fraction of the land they once did. While racial diversity is increasing overall in New England, with the non-white farming population having increased 50% since 2002, only 6% of farms are operated by non-white farmers.[28]

Rising land values, a rapidly aging farmer population, and barriers to access for the next generation of farmers create multi-layered challenges that require creative solutions and large-scale investments in our farms and farmers in order to promote a more diverse and socially just food system.

> *Changing the food system without changing the systems of land access, land tenure, and land use is not only unlikely, it may well be impossible.*
>
> **— ERIC HOLT-GIMENEZ**
> from ***Land Justice: Re-imagining Land, Food, and the Commons in the United States***

This section reveals new data and analyses for New England's farmer demographics derived from the 2017 Census of Agriculture, as well as new analyses from other sources to showcase the following:

- An examination of producers by age, race, and beginning farmer status.
- An overview of farmland prices in New England.

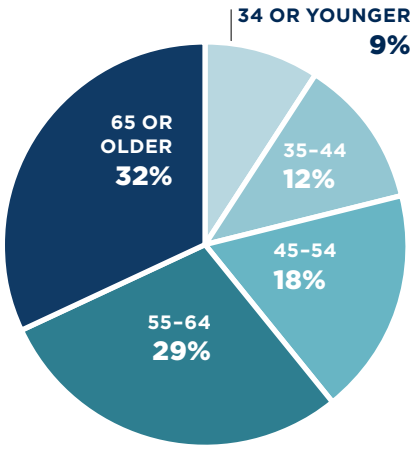
- An examination of the racial breakdown between white and non-white farmers, and trends in numbers and scale of farming operations of non-white farmers.
- A look at the challenges and opportunities for supporting the next generation of farmers.
- Insights from the *Policy Scorecard* relevant to the New England states.

Age Demographics of New England Farmers

A serious and growing challenge is New England's "farm transition gap." That gap results from the rapidly aging farmer population and significant barriers faced by the next generation in finding, affording, and securing access to appropriate farmland and resources. Supporting aging farmers in passing on their farms is imperative. There is a growing and increasingly diverse beginning and young farmer population working on farms with aspirations for secure access and tenure on land in communities across New England. They face significant financial barriers. The inability of the older generation to exit farming and of the next generation to enter farming constitutes one of the greatest challenges for farming that we face as a country and in New England.

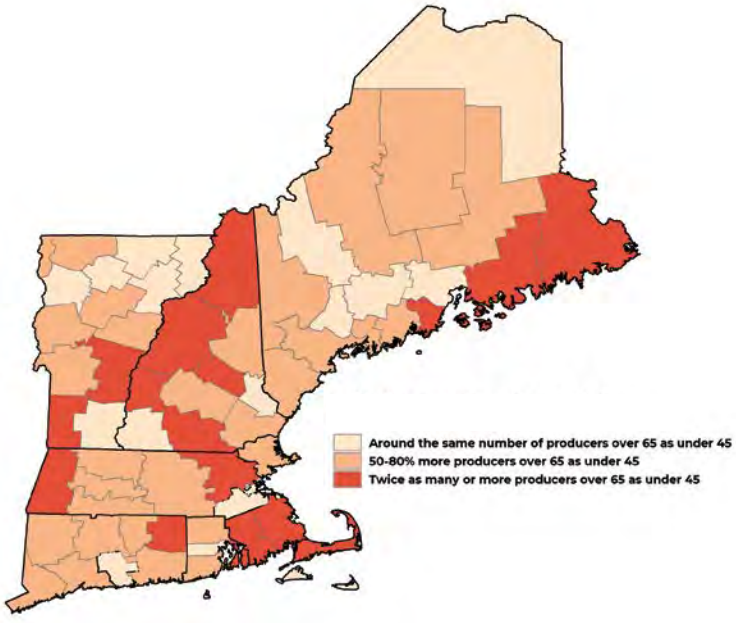
While we are unable to see how much agricultural land is held by age, we can observe the severity of the gap between producers of different ages to demonstrate forthcoming land transition challenges. Land in many counties is disproportionately owned by older farmers. What's more, this balance has shifted dramatically in the last 15 years as producers continue to age. On average, counties have increased their proportion of producers over 65 by at least 50%, and some have more than doubled their older farming population since 2002.[29] This

FIGURE 20. NEW ENGLAND PRODUCERS BY AGE



According to the 2017 Census of Agriculture, 61% of New England's producers are over the age of 55, with nearly a third of all producers over age 65.[29]

FIGURE 21. RATIO OF PRODUCERS OVER THE AGE OF 65 TO PRODUCERS UNDER AGE 45



Pockets of New England face serious land transition challenges. Most counties have at least one-third of producers over 65 and at least 50% more producers over 65 than they do producers under 45.

indicates serious challenges for the newer and younger generation to acquire the larger, expensive farmland parcels typically held by the older generation especially when, most often, less than a fifth of all producers are younger than 45.

Insights from the Policy Scorecard: Status of State Policy Response to Demographic and Land Access Challenges

States have responded to the challenges of accessing affordable farmland in two common ways: farm link and state leasing programs. Most **farm link programs** started as a clearinghouse of farm and property opportunities for land-seekers and owners to lease or sell farmland. Connecticut FarmLink has grown into comprehensive programs that offer one-on-one assistance throughout the search and lease process. Although the program contracts with Land for Good (a New England–wide service provider) and soil conservationists for technical assistance, primarily on negotiating leases and developing purchase agreements, its agricultural database is fully authorized by law and its staff capacity continues to expand. Rhode Island is the only other state in New England that has initiated any publicly funded effort to match landowners with land-seekers, though it primarily relies upon Land for Good for technical assistance and the New England Farmlink Finder for land opportunities. Maine Farmland Trust operates a robust farm link program, but does so without state support.

More dedicated state funding for farm link programs, as well as for sustained matching services to broker connections between farm owners and seekers, is greatly needed.

Each of the six New England states has taken a different approach to best utilize their state-held land through **agricultural leasing programs**, although some are much more comprehensive than others. Massachusetts and Connecticut are the only states in New England to authorize the inventory of all public land suitable for agriculture, in conjunction with interdepartmental cooperation in the management of agricultural leases. Both states also offer relatively long-term leases that require responsible environmental practices, and Massachusetts' Farmland Licensing Program specifically gives preference to new entry farmers that have undergone farm and business planning. The remaining New England states have programs in various stages of progress, either with muted agricultural priorities amidst wildlife habitat preservation or specific industry focus, like maple sugaring in Vermont.

Combined, the New England states lease roughly 3,500 acres for agriculture—less than a tenth of a percent of all land in agricultural use. Given that the soil quality of the region's working lands has been thoroughly mapped, state departments are well-positioned to integrate this knowledge into sound leasing policies to improve land access for the farming community.

QUALITY AND EFFECTIVENESS OF FARM LINK PROGRAMS	
National Farm Link Ranking	**State**
1st	Connecticut
10th	Rhode Island
Tied for Last Place	All other New England states

QUALITY AND EFFECTIVENESS OF STATE LEASING PROGRAMS	
National State Leasing Ranking	**State**
2nd	Massachusetts
3rd	Connecticut
5th	Rhode Island
11th	Vermont
24th	New Hampshire
34th	Maine

Exiting Farmer Challenges and Farm Succession Planning

LILY PIEL

How and to whom these assets transfer will impact agriculture for generations to come.

—from ***KEEPING FARMERS ON THE LAND***

How will New England plan for and address this phenomenal scale of pending farmland transition?

A 2016 American Farmland Trust and Land for Good study found that according to the 2012 census, 92% of New England's senior farmers did not have a farm operator under age 45 working with them. While this data did not necessarily indicate whether they had a succession plan, it suggested that the future of these farms and the land and assets they controlled—a collective $6.45 billion in farmland and buildings and 1.15 million acres of land in farms—is uncertain.[30]

In 2017, for the first time, the Census of Agriculture began asking producers about whether they are involved in estate or succession planning.[31] Although this data is self-reported and does not indicate what form of planning is taking place—meaning, we do not know whether this indicates farmers are planning to transition their land to other farmers—it provides some added insight into how many farms are not involved in any estate planning at all.

Ultimately, the farms involved in this succession planning tended to be larger, although not all producers on these operations were involved. More analysis is needed, but these data tell us that at least 40% of New England's farmland—at least 1.26 million acres—reported no succession or estate planning of any kind.[31]

With the rapidly aging farmer population described above, and with the reality that thoughtful planning takes time, more technical assistance capacity and funding is urgently needed to support these farmers as well as the organizations that serve them. Addressing financial issues that aging farmers face related to retirement, healthcare, and taxes, among others, is a critical need for New England's aging farmer population.

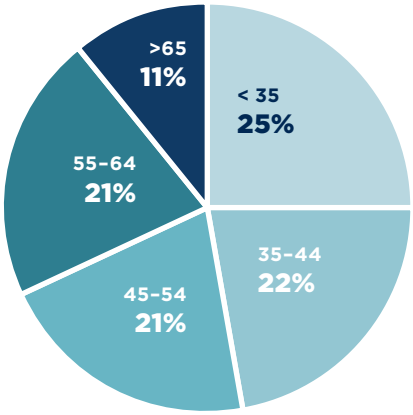
Next Generation Farmer Challenges

As of 2017, New England had over 17,300 new and beginning producers (30%) who have been farming for 10 years or less.[32] Across the six states, the average age of new and beginning producers was roughly 46 years old, consistent with national trends. Many beginning producers who are older start farming as a second-career or hobby operation, but for the roughly 8,000 new and beginning producers under 45, unique challenges await them as less and less land is being passed down within families.[33]

While all farmers face challenges, beginning farmers have greater challenges than more established farmers, and this is no different in New England. They are more reliant on off-farm income, earn less income from farming, have a higher debt-to-asset ratio, and have less wealth than their older counterparts.[34]

Principal producers under 35 are observed to fare significantly worse, typically making 30-50% less than the average new and beginning producer.[35] While affordable housing, access to credit, and competition from established farmers exacerbate their limited financial situation, some of the top barriers to farming identified by young farmers nationally remain access to land, followed by student loan debt, labor, and health care.[36]

FIGURE 23. NEW ENGLAND NEW AND BEGINNING PRODUCERS BY AGE



The average age of a New and Beginning producer in New England is approximately 46 years old.

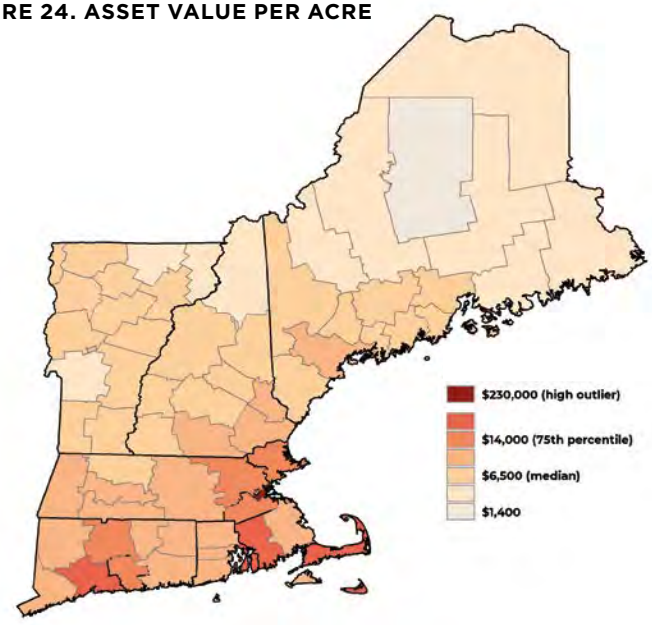
THE HIGH COST OF LAND

Though it varies across the states and counties, as of 2019 New England has some of the highest farm real estate values in the country, with Rhode Island as the most expensive in the country at an average $15,600 per acre.[37] Connecticut is the third highest at $12,200, followed by Massachusetts as the fourth highest at $11,100 per acre. This reality puts enormous pressure on New England farmers both in terms of development pressure from competing uses in urban, suburban, and rural communities, as well as for those attempting to secure access to farmland and those seeking to retire and exit farming. Access to farmland is the number one barrier for young and beginning farmers.[36]

Creating land access opportunities across urban, suburban, and rural communities will require different land access and funding tools and approaches. As shown by analyses of the threat to farmland, urban and peri-urban communities are seeing some of the highest rates of farmland conversion and pressure (see page 15). They are also the most likely to have the greatest levels of economic, racial, and age diversity—as well as some of the greatest inequality. Rural communities may have more affordable land prices for farmers, but accessing farmland and farming it viably can be challenging due to transportation issues, lack of access to markets, and other social and economic factors.

Access to affordable housing across all communities presents a significant barrier to farmers, especially younger beginning farmers, and funding is needed

FIGURE 24. ASSET VALUE PER ACRE



The average value of farmland and buildings varies widely across New England. While the median asset value is $6,500 per acre across all counties, areas of southern New England see averages of $15,000 to $45,000 per acre—and as high as $230,000 in dense urban counties like Suffolk, Massachusetts. The northern half of the region typically stays between $1,500 and $7,000 per acre, although the southern areas of New Hampshire and Maine have seen a pronounced rise in land value as development pressure continues to spread outward from large urban centers.

not only to protect New England's remaining agricultural land, but to ensure adequate and affordable housing exists to help the next generation of farmers take over New England farms and keep them in agriculture.

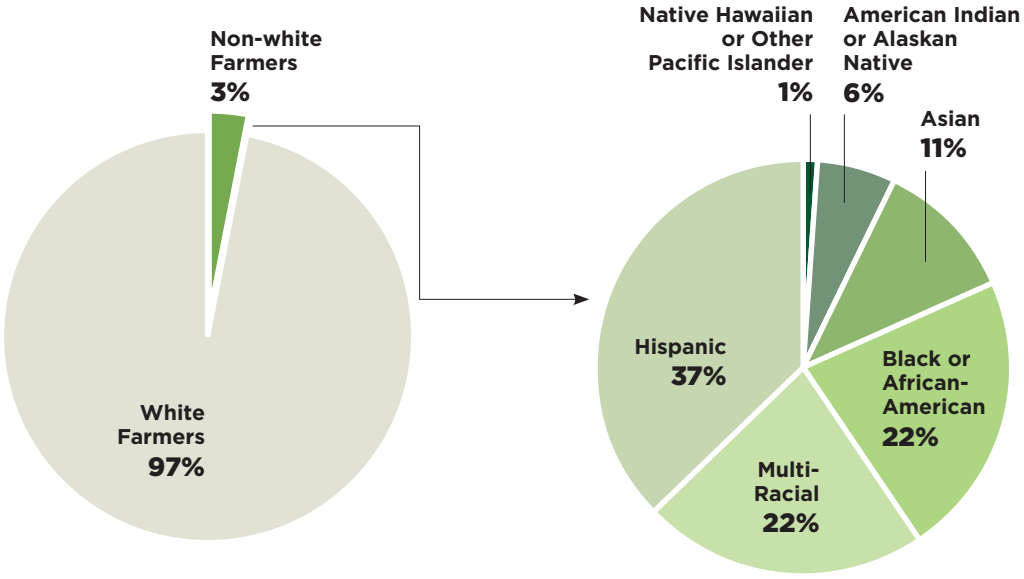
New England has been an innovator in land access work at both the state and regional levels. While new models are needed across the region—particularly to support urban land access and address the racial disparities in agriculture described below—more funding, capacity, and support are also urgently needed to keep pace with the aging farmer population and projected land transitions over the coming decades. Deeper understanding of the interdependencies across the urban-to-rural interface and opportunities for greater food system linkages is needed. More integrated dialogue between policy makers, planners, conservationists, land access practitioners, and farmers is needed to inform thoughtful solutions that can address the multi-layered land access challenges across the region.

Racial Demographics

The USDA Census of Agriculture, while a powerful tool for understanding much about New England's farmers, does not paint a full picture of the racial diversity of New England's farmers and the challenges they face.[38] However, there is enough data to begin to see some patterns emerge.

We can see from the 2017 USDA Census of Agriculture that New England's farmers are overwhelmingly white (97%).[29] Of the 3% "non-white" farmers, we can see a few trends and compare those trends to the white farmer population:

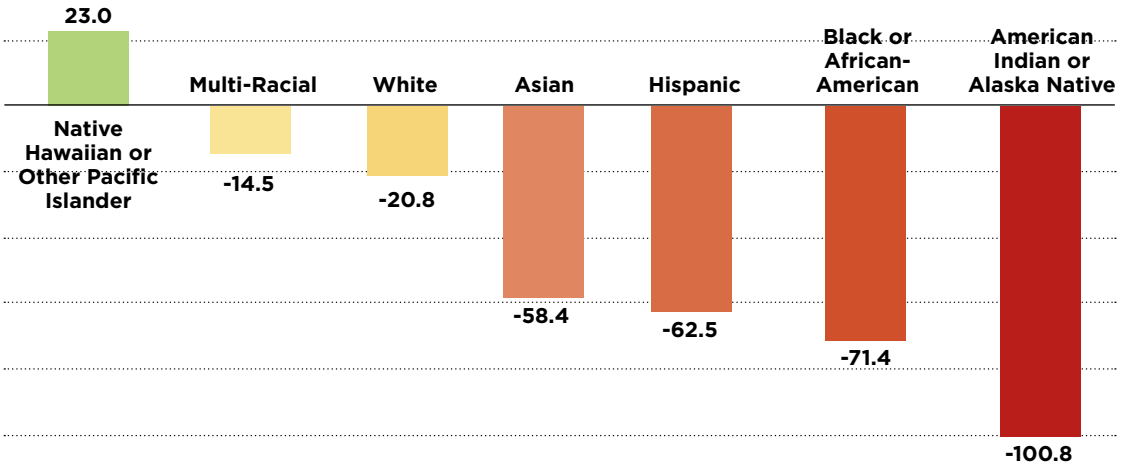
FIGURE 25. RACIAL DEMOGRAPHICS OF NEW ENGLAND'S PRODUCERS



According to the 2017 USDA Census of Agriculture, white farmers compose 97% of New England producers. Of the 3% of non-white farmers, over one-third self-reported as Hispanic (37%), while the rest self-reported as Black or African-American (22%), Multi-Racial (22%), Asian (12%), American Indian or Alaskan Native (6%), and Native Hawaiian or Other Pacific Islander (1%). Hispanic producers are grouped as 'White' in the Census, but they are differentiated above for the purposes of representation. Anecdotally, we know these statistics are likely underreported and may not reflect the full diversity of non-white farmers in New England.[38]

FIGURE 26. DECLINE IN FARM SIZE BY RACE, 2002–2017

Acres Per Operation



Average farm size has dropped among all racial groups in New England, but it is typically far more pronounced in groups of color. Average farm size is derived by the total number of acres operated by the total number of operations held by each group.

- **THE NON-WHITE FARMING POPULATION IS (MOSTLY) INCREASING:** New England's Black or African-American farming population has more than **tripled** since 2007 and grown five times since 2002.[29] Most other groups have **increased** in number. American Indian/Alaskan native producers are the only group to have drastically **declined** in number during this period, from 277 to 125 (2007 to 2017).
- **MANY NON-WHITE FARMERS DO NOT OWN THEIR LAND:** Many farmers of color are not partial or full owners in the operations they farm—this varies, but most Black or African-American farmers are tenant farmers (78%), who operate on average just one acre each.[39] One-fifth of all Asian and Native Hawaiian/Pacific Islander farmers are tenants, as are 10% of both Hispanic and multi-racial producers. Disparities are stark when compared to the average land held by white tenant farmers, which is 65 acres per operation.
- **MANY NON-WHITE FARMERS ARE NEW AND BEGINNING FARMERS:** This varies by group, but most Asian (56%), Black or African-American (79%), and Hispanic (51%) farmers have been farming for 10 years or less.[32] Conversely, only 30% of white farmers are new and beginning.

We can also see that the average farm size has gone down among all racial groups, but the decline in farm size is more severe in non-white populations. More data is needed to fully understand the causes behind the disproportionate decline in farm size for non-white farmers.

Pronounced declines exist within specific groups. At the same time that overall producer numbers are improving, the average farm size of Black or African-American producers has dropped from nearly 90 acres per operation to just 16 (2002 to 2017).[28] This could be attributed to increasing populations of new American farmers with small-holder plots of just several acres, and a simultaneous loss of farmers of color on larger operations. This

> *One core practice of resilience is transformative justice, transforming the conditions that make injustice possible. Resilience is perhaps our most beautiful, miraculous trait.*
>
> **— ADRIENNE MAREE BROWN**
> **Emergent Strategy**

LILY PIEL

Young and beginning farmers face a multitude of challenges in securing land for their growing farm operations.

could also be attributed to improvements in the ability of the 2017 USDA Census of Agricultural to find and report small holder farms in communities of color.

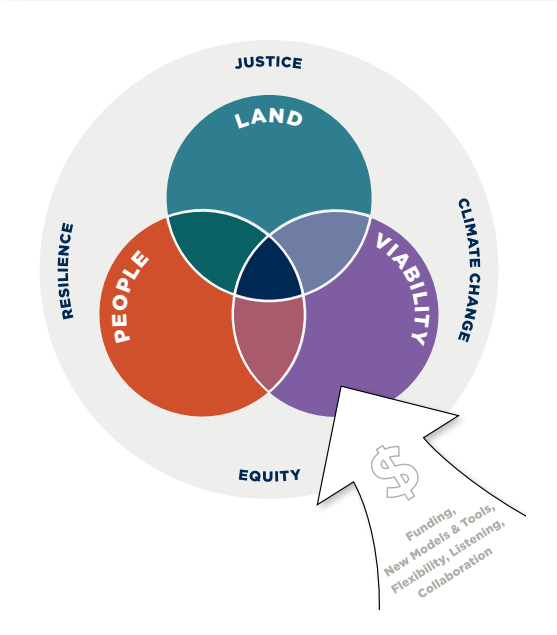
These data—together with the existence of a number of programs and projects around New England that exist to support new entry and immigrant farmers, farmers of color, and Indigenous farmers—reveal that populations of non-white farmers are increasing. Most are young and beginning farmers who rent land and farm small acreages. Typical challenges facing new and beginning farmers (described above) may be further exacerbated by financial, linguistic, and cultural barriers and bias.

The growing diversity of New England's farmers presents clear opportunities to repair past injustices, as part of building a more healthy and resilient food system.

A deeper understanding of the racial composition and dimensions of New England's farmers, as well as deeper listening, is needed to help develop stronger policies, programs, and funding solutions that are more justice-aligned. Some of these may include direct, priority assistance and policy changes for farmers of color and Indigenous farmers to increase long-term, secure land tenure, financing and legal support, collaborative partnerships, racial justice training for historically white-led support organizations, and land gifting and reparations. Leadership of Black, Indigenous, and people of color-led organizations should be at the forefront of these solutions, articulating what support is needed around these complex issues.

NEXT STEPS FOR NEW ENGLAND

Bringing It All Together, Inspiring Holistic Action



New England is a region that prides itself on self-determination, ingenuity, and agrarian values. Between the present moment and the bold, forward-thinking visions set out before us for the year 2060, there are mounting challenges to overcome. These threats—climate change, economic realities, development pressures, and legacies of inequality and injustice—are also opportunities for bold and collective action.

Questions for practitioners as we rise to these challenges might include:

- How can we protect the land we have now, while planning for the economic realities of changing farming industries and changing demographics of farmers?
- How can we center the voices and needs of those closest to the land—from Indigenous communities to new entry immigrant farmers to multi-generational commodity farmers—in our policies and programs?
- How can we shift our conservation policies and practices to acknowledge that we must plan for a flexible future—a future that requires dramatic shifts in land use, land management, and climate-smart agriculture while acknowledging the need for food and energy self-reliance in New England?
- How can we garner the political will to expand funding and develop stronger mandates to protect New England's remaining agricultural land?
- How can we protect and improve the viability of New England's farm businesses?
- How will we work better together, across sectors, traditional silos, and regional differences?
- How can we, especially the majority-white leadership, begin to make the necessary transformations to show up and listen to communities of color, and offer resources and support where it is needed most?
- What will we give back and where can we pay it forward?

Some takeaways and potential next steps are summarized below. We hope they will inspire robust, intersectional conversation that centers the needs of farmers and producers and galvanizes resources toward a more just, equitable, and self-sustaining future for New England. These are not meant to be fully comprehensive and conclusive recommendations, but merely starting points for further dialogue, analysis, and research.

Based on the data presented in this report, and taking a holistic approach to these issues, practitioners and decision-makers in New England should consider commitments to the following imperatives.

More Funding, Models, and Tools to Protect Agricultural Land

- More funding for farmland protection—especially "landscape-scale conservation"—is urgently needed to protect farms and reduce fragmentation.
- New creative approaches to holding and accessing land are needed to secure New England's farmland forever.
- Significant changes to local and regional planning laws are needed. This will require political will to create both requirements and incentives for agricultural-focused land use planning practices that can accommodate growth while directing development away from agricultural lands.
- State investments in rural water and sewer infrastructure can promote more in-fill and mixed-use development and reduce pressure on rural agricultural areas.
- More research is needed to understand how local land use planning laws relate to the trends in Urban and Highly-Developed (UHD) and Low-Density Residential (LDR) conversion across New England.[40]

Flexible Tools for a More Resilient Future

- Linking farmland protection eligibility and funding to new Productivity, Versatility, and Resiliency (PVR) soils data could increase the number and type of farms eligible for protection—especially pastureland and woodlands associated with farms, which are often more difficult to protect.
- Consider allowing provisions in conservation easements for appropriate forest clearing on PVR lands, which will enable land uses to shift over time to meet the needs of a changing world.
- Consider allowing provisions in conservation easements that allow for appropriate new technologies, such as dual-use solar, that can help mitigate the climate crisis, enhance farm economic viability, and increase the resiliency of New England's farms.

Farm-based Solutions to Address Climate Change and Increase Farm Viability

- Farms are threatened by climate change and will need increased funding and assistance to withstand impacts to their land and businesses.
- Farming in New England can be done in ways that mitigate the climate crisis. More state incentives and investments are needed in on-farm climate solutions such as dual-use solar and payments for ecosystem services. Farmers should be supported to adopt more regenerative, agroecological practices.
- Tribal communities should be supported in greater land sovereignty, and their traditional land management practices should be recognized as powerful tools to enhance climate resiliency.
- Restoring former farmland that is now wooded to be productive farmland again is important to achieve *A New England Food Vision,* but these steps need to be taken wisely, utilizing climate-smart techniques and practices, including agroforestry.

Greater Investment in Farm Businesses of All Sizes and Provisions for Flexible Land Use

- Farms will need the flexibility and support to diversify their operations in order to enhance resiliency in the New England food economy.
- Continued investment in on-farm viability, through business planning, technical assistance, and implementation grants for value-added processing or direct-to-consumer marketing, will help farms stay competitive and viable.
- Protection of farmland in the most vulnerable agricultural sectors will be needed to help secure its future in agriculture, primarily livestock industries.
- Flexible easement language and accessible special permitting can help farms earn revenue from agri-tourism events without compromising the integrity of farmland.

JERRY & MARCY MONKMAN ECOPHOTOGRAPHY

Extensive Support and Funding to Address the "Transition Gap" for New England Farmers

- More support and funding for aging farmers is needed to help them retire and transfer ownership of their farms to the next generation of farmers.
- More support and funding for young and beginning farmers is needed to overcome barriers to access farmland and to farm successfully.
- More support for non-white farmers to gain access and secure tenure on land is needed, as well as more data that accurately quantifies these farmers and their specific needs.
- Dedicated funding for matching programs that forge connections between farmland owners and seekers is critical, particularly when seekers are young and/or non-white farmers.
- More tax incentives are needed to transition farms to all farmers, especially to younger beginning farmers and non-white farmers.

Committing to Justice-based Frameworks Enables Bolder Collective Action

- Learn and learn to listen: Predominantly white organizations and institutions should further their work to learn about history, systems of oppression, and realities and needs of those of other races in New England around land, land access, and economics.
- Center and uplift the needs of those who have the least access to land and resources in policies and programs (e.g., incentivize leases to Indigenous, Black, and farmers of color; prioritize funding).
- Support and practice land rematriation for Indigenous communities.

FOOD SOLUTIONS NEW ENGLAND

FOOD SOLUTIONS NEW ENGLAND

CONCLUSION

New England's land base is increasingly threatened by development, despite our best efforts. New data and tools developed by American Farmland Trust and our partners can help us track and understand the magnitude and the type of threats across the region. But addressing these challenges will take a massive shift in approaches. We need more funding, more flexible and creative tools, and more political will to protect New England's remaining agricultural land and facilitate a more climate-resilient future.

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Permanent land protection alone is not enough to keep New England's farms in agriculture. While farms in New England are diverse in size, what they grow, and how they market their products, there are still major threats to farm viability. While we can understand a lot by utilizing the USDA Census of Agriculture and other data sources, there are still huge gaps in our understanding of how different types of farms in New England are faring. We do know farms of all sizes and business models have very different market pressures, challenges, and opportunities, but more research is needed.

New England's farmers are aging rapidly and need support transitioning their farms to a new generation. Though their numbers are increasing, young, beginning, and non-white farmers struggle to be able to afford farms. The racial demographics of New England farmers are changing, and we must help ensure that all farmers have equitable access and are well-prepared to address the obstacles ahead.

> *Individuals make up the system, so this work of challenging our limited perspectives on identity can transform institutions and power structures… Continue to educate yourself, engage in conversations, and catalyze action toward a racially just world.*
>
> ***— FARMING WHILE BLACK: SOUL FIRE FARM'S PRACTICAL GUIDE TO LIBERATION ON THE LAND***

All of these challenges are incredibly interconnected and cannot be addressed alone. They are further exacerbated by a complicated legacy of injustice around land, particularly towards Indigenous communities. Established and well-resourced networks and organizations, especially those that are predominantly white-led, often lack the knowledge, fluency, and experience to successfully address racial justice and equity issues. Deeper commitments to learning, listening, relationship-building, resource-sharing, and power-sharing with those who have historically had the least access is vital to our collective resiliency. Creative new models, ideas, and large-scale public and private investments in New England's farms and farmers can and will bring us closer to a more climate-resilient and equitable future.

We invite readers to engage in dialogue and partnerships to enhance our collective strength, effectiveness, and well-being in New England and beyond.

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APPENDICES

LAND AND TERRITORY ACKNOWLEDGMENT

As an active form of gratitude and relationship building with the Indigenous nations of Turtle Island, organizations and institutions have begun developing Land and Territory Acknowledgment policies to formally offer gratitude and recognition for the Indigenous lands that they occupy, as well as to recognize treaties and, sometimes, lack of such treaties on unceded territory.

Acknowledgment can be a simple, powerful way of showing respect and a step toward correcting the stories and practices that erase the dispossession of Indigenous homelands and Indigenous people's history and culture, moving toward inviting and honoring the truth. When land acknowledgments are done respectfully, without the performative "checking off the box" nature that often comes with them in institutional settings, they can be a key step toward honoring reconciliation and mending treaty relationships.

We want to acknowledge that American Farmland Trust's offices occupy the traditional lands of the Piscataway, Nacotchtank, Manahoac, Nisenan, Patwin, Plains Miwok, Pocumtuc, Nipmuc, Haudenosaunee, Mohican, Southern Pomo, Graton Rancheria, Coast Miwok, Oceti Sakowin, Miami, Potawatomi, Sauk and Meskwaki, Peoria, Kickapoo, Duwamish, Twana Skokomish, Suquamish, Coast Salish, Tulalip, Puget Sound Salish, Puyallup, Klallam, Snoqualmie, and the Lakota, Dakota, and Nakota of the Great Sioux Nation—the peoples and nations past and present—and honor with gratitude the land itself and the people who have stewarded it throughout the generations. This calls us to commit to continuing to learn how to be better stewards of the land we inhabit.

This language was graciously written and provided by Stephanie Morningstar, Oneida, Turtle Clan and Co-Coordinator of the Northeast Farmers of Color Land Trust.

SOLAR SITING GUIDELINES FOR FARMLAND

American Farmland Trust's mission is to save the land that sustains us by protecting farmland, promoting sound farming practices, and keeping farmers on the land. AFT supports accelerated solar development and believes that, with proper planning and siting, our agricultural lands can also play a meaningful role in hosting solar energy while maintaining active and productive agriculture.

Prioritize agriculture and protect farmland for the future

1. Prioritize solar development on state-preferred siting (brownfields, rooftops, building mounted, solar canopies, etc.).
2. Avoid siting solar projects on farmland in a location or in such a way that it displaces agriculture from the land.
3. Incentivize agricultural dual-use arrays and follow smart solar siting guidelines when dual-use* is not an option.

Prioritize land: guide siting to previously disturbed or marginal farmland

1. Other farmland and marginal farmland: preferred locations for on-farm siting, if pursuing a standard ground-mounted solar array; consider dual-use if possible.
2. Actively farmed, unique, or farmland of statewide importance: incentivize dual-use solar to support continued agricultural activity.
3. Prime farmland: protection of prime soils and prime farmland should be prioritized. If solar projects are proposed on prime soils, they should be agricultural dual-use projects and should also undergo careful review to ensure continued production is prioritized.

Prioritize farmers: insist they are part of project development and dual-use design

1. Solar projects on farmland should be farmer-led and developed with the farmer as partner.
2. Primary agricultural activity must be prioritized. Projects should be designed to allow necessary equipment full access and usability around panels and structures.
3. Require reporting from dual-use projects (not reliant upon yield standards or targets) to ensure continued land use as agriculture.
4. Allow flexibility of dual-use construction standards that support differing agricultural activities to continue as the primary site activity .

* Dual-use, also known as agrivoltaics, is the practice of co-locating solar photovoltaic panels on farmland in such a manner that primary agricultural activities including animal grazing, crop or vegetable production, can continue simultaneously on that farmland.

EMILY COLE, AMERICAN FARMLAND TRUST

Project size considerations

1. Agricultural dual-use projects maintain productive farmland and should not be limited in size.
2. Consider size limitations on other farmland project types to protect farmland for production and continued use in natural climate solutions.
3. Require project design to minimize other land use impacts (such as access roads).

American Farmland Trust believes that all solar projects should meet minimum conservation requirements, including but not limited to soil conservation practices during and after construction, soil health building ground cover, pollinator-friendly plantings, water infiltration management, and erosion control. However, these conservation practices are not a substitute for protecting farmland through smart solar siting principles and agricultural dual-use considerations.

—AMERICAN FARMLAND TRUST NEW ENGLAND

FARMS UNDER THREAT SPATIAL ANALYSIS METHODS

To launch the *Farms Under Threat* project in 2016, AFT surveyed and conducted telephone interviews with national experts, including leading academics, state policy leaders, land trust staff and farmland protection program managers. Subsequently, we consulted with technical staff at NRCS and formed a National Advisory Committee of experts in relevant fields from conservation to geography to planning and public policy. This informed our research questions and approach to both the spatial analyses and policy research, as well as the interpretation of our findings.

The following section outlines the spatial methods employed for *Farms Under Threat: The State of the States*. Greater detail will be available from the *Final Technical Report, Description of the Approach, Data, and Analytical Methods* used for the *Farms Under Threat: State of the States* project, when that document is released in 2020.

Spatial Analyses

The *State of the States* spatial analyses build on and improve the methodologies developed for the previous *Farms Under Threat* report, titled *The State of America's Farmland*.[41, 42] Using widely respected datasets with the national coverage required for detailed spatial mapping, we generated two principal spatial data products to derive state level maps and statistics for both 2001 and 2016: 1) Land cover and land use (land cover/use) and 2) Agricultural land productivity, versatility and resiliency (PVR). The approach was designed to achieve two main goals:

1. Demonstrate the extent, location, and quality of each state's agricultural land, including four agricultural land types: cropland, pastureland, rangeland, and woodlands associated with farms.
2. Show the conversion of each state's agricultural land to:
   a. *Urban and highly developed (UHD) land cover:* built-up and other developed lands identified by the National Land Cover Database (NLCD).
   b. *Low-density residential (LDR) land use:* a new land *use* class developed in *Farms Under Threat* to identify distributed, low-density housing development in rural and exurban areas, which is not captured by NLCD.

MAPPING APPROACH

The baseline land cover/use data was derived from the NLCD, which is produced by the federal government and is the national standard for comprehensive, high-resolution spatial data. NLCD uses degree-of-imperviousness to map commercial, industrial, transportation, residential, and other developed lands at a 30-meter resolution. Our *State of the States* analyses benefited greatly from upgraded national datasets released in 2019, which applied an improved approach to mapping land cover/use back to 2001. To take advantage of this improved data, we focused on development that occurred between 2001 and 2016. Other datasets were selected to align as closely with these dates as possible (see data source table).

While the NLCD is comprehensive and can be used to infer the extent of agricultural lands, it is not designed for detailed assessment of agricultural land use. To improve our understanding of agricultural land patterns and development, we incorporated data from 13 additional sources (see data source table). The most critical was NRCS' National Resources Inventory (NRI)[43], a field-based statistical survey of land use and natural resource conditions on non-federal lands that has been the gold standard data source on U.S. agricultural land types and conversion.[44] However, NRI estimates of agricultural land use change are only publicly available at the state level. Thanks to a confidentiality agreement with NRCS, CSP was able to use NRI data to estimate the acres of crop, pasture, and range lands in each county. Combining NLCD, NRI, and other datasets enabled us to more accurately identify agricultural land with landscape-wide coverage, fine spatial resolution, and high confidence.

Further improvements to the mapping methods used in the previous *Farms Under Threat* report have allowed mapping at a finer resolution (10 m instead of 30 m), resulting in smaller minimum mapping units (now 100-200 acres instead of 1,000 acres). We also mapped both roads and LDR land use as separate layers. Due to these updates and improvements, the results of our new analyses cannot be compared to our previous report.

We mapped land cover/use with one model, using additional datasets to identify LDR areas, and generated the PVR map with a second model. Both maps were generated for both 2001 and 2016. The process is laid out sequentially below.

LAND COVER/USE

Step 1. Map Non-Agricultural Lands: We mapped non-agricultural land cover in each county, including urbanized/highly developed areas; water; barren areas; forest; and snow and ice. We mapped major roads separately using the U.S. Census TIGER/line shapefiles, to avoid over-mapping of roads.

Step 2. Calculate Suitability for Agriculture: Next, we calculated the suitability of each county's land to support agricultural production, excluding non-agricultural lands. We assigned a suitability value to each pixel, with higher suitability in pixels with better soils, flatter slopes, and ample non-forest vegetation.

Step 3. Generate the Agricultural Land Cover Layer: The model then assigned agricultural land cover pixel by pixel based on NRI estimates of acres of crop, pasture, and range lands in each county. Assuming the principle of highest best use, the model assigned cropland pixels first, starting with the pixel with the highest suitability value for cropland and going down one-by-one until the county's total cropland acreage was fully allocated. This was followed by the same process to assign pastureland and rangeland.

Since woodlands managed by farms cannot be distinguished from non-farm forested land by remote sensing, we used the 2017 Census of Agriculture to estimate the woodland acres associated with farms in each county. The model applied these acres to pixels of forested lands adjacent to crop and pasture lands, with a preference for areas with flatter slopes, and a limit of 1/10 mile from the nearest crop or pasture area. Once woodland acres were identified, the model combined all the agricultural land pixels into a single, county-by-county map.

Step 4. Generate Final Land Cover/Use Map: Finally, we merged the agricultural and non-agricultural layers into a single land cover/use map. The low-density residential land use analysis, described below, was included as a separate layer that can be added to or removed from other land cover/use layers to facilitate in-depth analysis. More information on our analytical methods is available in the technical report.

TABLE 1. DATA SOURCES FOR SPATIAL ANALYSES

LAND COVER/USE MAP		
Dataset Name	**Source**	**Primary use of the dataset**
National Land Cover Datasets 2001, 2016	Dept. of Interior/U.S. Geological Survey (USGS)	Supplies land cover data for high resolution spatial mapping (30 m resolution)
National Resources Inventory 2002, 2015	USDA Natural Resources Conservation Service (NRCS)	Guides mapping of agricultural lands and a check on accuracy of mapping products (obtained NRI point locations through confidentiality agreement with NRCS)
Woodland acreage 2002, 2012 and 2017	USDA National Ag Statistics Service (NASS) Census of Agriculture	Guides mapping of woodland by providing woodland acreage data by county
Soil Survey Geographic Database (SSURGO) 2018	USDA NRCS	Guides mapping of agricultural lands
State Soil Geographic Database (STATSGO) 2019	USDA NRCS	Guides mapping of agricultural lands where SSURGO was unavailable
National Elevation Dataset 2019	USGS	Guides mapping of agricultural lands
National Hydrography Dataset 2019	USGS	Identifies water bodies including lakes/reservoirs and wide streams/rivers
Protected Areas Database (PAD-US v2.0) 2018	USGS	Identifies protected areas for non-federal and federal lands
BLM National Grazing Allotment polygons 2016	U.S. Bureau of Land Management (BLM)	Identifies grazing on federal lands
USFS Grazing Allotment polygons 2017	U.S. Forest Service (FS)	Identifies grazing on federal lands
Topologically Integrated Geographic Encoding and Referencing (roads) TIGER/Line 2016	U.S. Census Bureau	Provides information for mapping the land cover/use class for "Transportation"
Normalized Difference Vegetation Index (NDVI) 2015	USGS Landsat 8, European Space Agency Sentinel satellite imagery	Differentiates areas that are non-productive due to poor soils to improve accuracy of agricultural land mapping
Housing density 2000, 2016	U.S. Census Bureau American Community Survey	Provides estimates of housing density to map low density residential land use in census blocks
Minimum viable farm size by county 2017	USDA NASS Census of Agriculture	10th percentile farm size for each county used to determine when residential housing density reached a point where it might threaten farm viability in a census block
AGRICULTURAL LAND QUALITY (PVR) MAP		
Dataset Name	**Source**	**Primary Use of Dataset**
SSURGO important farmland designations 2018	USDA NRCS	Assigned values to five important farmland designations (e.g. prime, prime with limitations, unique, statewide important and statewide important with limitations)
SSURGO Land Capability Classes (LCC) 1961	USDA NRCS	Included secondary factor based on production limitations within the NRCS LCC
Cropland Data Layer (CDL) 2014-2018	USDA NASS	Assigned values to crop types (fruit and nut trees; fruits and vegetables; staple food crops; feed grains, forages and crops grown for livestock feed and processed foods; non-food crops)
Growing Season length 2006	USDA NRCS Major Land Resource Areas v4.2	Included secondary factor based on growing season length to account for regional differences
FUT 2016 land cover/use	Farms Under Threat	Assigned values to croplands, pasturelands, rangeland, woodlands and other land types

It is important to note that, due to data limitations, our mapping was unable to account for the myriad and ever-shifting state and local land use regulations across the U.S. Likewise, we have not yet incorporated land protection status into our mapping, because the available data[45] has inconsistent coverage across the country. AFT is currently developing its own Protected Agricultural Land Database, which will be incorporated into future FUT analyses.

Mapping land cover and use presented some particular challenges in New England, due to the region's high forest cover and active forestry industry. In regions with large acreages of recently logged forests, the regrowth from logging cuts is often classified by NLCD as Grassland/Herbaceous, Shrub/Scrub, Pasture/Hay, and sometimes Cultivated Crops. These are the NLCD land cover classes that are considered eligible for agricultural land cover, so our suitability model places cropland and pastureland in these areas. This resulted in substantial errors in parts of northern Maine and New Hampshire. We have addressed this to the degree possible, but it is difficult to remove all these artifacts without affecting land that is truly in agriculture, so some artifacts remain.

LOW-DENSITY RESIDENTIAL LAND USE

To map low-density residential (LDR) land use, we adapted a methodology developed by Dr. Dave Theobald.[46] The LDR analysis is based on the assumption that agricultural viability is threatened and production options are limited below a certain minimum farm size, and that this size will vary across the country depending on local agricultural production systems. The analysis followed these steps:

Step 1. Identify the Minimum Viable Farm Size: To identify the minimum viable farm size, we considered the amount of land currently being used by viable agricultural operations and compared this to each county's farm size distribution from the 2017 Census of Agriculture. Using aerial imagery and regional knowledge, internal and external experts determined that the 10th percentile of a county's farm size distribution was a conservative representation of the minimum viable farm size. This means that just 10% of each county's farms were this size or smaller. Nationally, the average 10th percentile farm size was 16.7 acres, but given the diversity of agriculture across the country, the 10th percentile ranged from 1 to 335 acres.

Step 2. Identify the Threshold Housing Density: The threshold housing density was set based on the assumption that there is one housing unit per farm. For example, if the minimum viable farm size was 15 acres, the threshold housing density was set at one house per 15 acres.

Step 3. Evaluate Census Block Housing Density: We then compared these threshold housing densities to the housing density in each U.S. Census block within each county. Census blocks with housing density above the county threshold were considered to be under LDR land use.

To better understand the impacts of LDR land use on agriculture, we evaluated the fate of agricultural land that was already in LDR areas in 2001. To do so, we calculated an LDR Multiplier by dividing the urbanization rate from 2001–2016 for agricultural land within LDR areas by that for all other agricultural land. Values above one indicate that agricultural land in LDR areas was more likely to be converted to UHD than other agricultural land.

AGRICULTURAL LAND PRODUCTIVITY, VERSATILITY AND RESILIENCY

The PVR analysis identifies agricultural lands best suited to cultivation for food and other crops. We developed detailed maps representing soil productivity and capacity, land cover/use, recent crop types, and length of growing season. The PVR model combined these maps using prioritized weights elicited from a group of national experts. The weighted values measure the productivity, versatility, and resiliency for agricultural use of each 10m by 10m land pixel. The higher the PVR value, the more productive, versatile, and resilient the land is for long-term cultivation.

This analysis was applied to the entire land surface of the United States, except where data was unavailable, which predominantly occurred in urban core areas that lack soil survey data. As a result, the PVR analysis can be used to identify the relative suitability of woodland and forest acres for agricultural production. While the forest and woodland land cover classes were not weighted as highly in the PVR analysis as cropland, pastureland, or rangeland, these areas can still have relatively high PVR scores if the underlying soils are high quality. Soil receives the highest weight in the PVR calculation.

We used the range of PVR values to identify the agricultural land that is the most critical for long-term food security, agricultural communities, and resiliency to climate change. Nationally Significant agricultural land is the land best suited for long-term, intensive crop production, especially for edible food crops. We calculated a minimum PVR value (0.43) based on the following conditions: soils that are designated by USDA NRCS as prime, unique, or prime with limitations; areas that are mapped as cropland and pastureland; and relevant cropland types (fruits, vegetables, staple foods, grains). All pixels with PVR values greater than 0.43 were considered Nationally Significant. Validating against NRI points, we found that this category primarily includes prime farmland and land in USDA NRCS Land Capability Classes I and II.

Our PVR analysis can also help any state identify its best agricultural land, regardless of how much Nationally Significant land is located in the state. In *Farms Under Threat: A New England Perspective,* we identified State Significant agricultural land, which is all agricultural land with a PVR value above the state median PVR.

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38. The USDA Census of Agriculture is self-reported data, and only captures the top four producers on each farm—not all the farmers who may work there. In addition, the USDA will not publicly list information that could be traceable back to individual farm operations. The amount of "non-disclosed" farm operations by people of color in New England reveals that in many counties the numbers of these operations are so few that the specific farm and individual in that county would be identifiable to many by the listing of their race alone.

39. USDA-NASS. (2019a). 2017 Census of Agriculture—State Data. Table 61: Selected Farm Characteristics by Race. Washington, DC: National Agricultural Statistics Service, US Department of Agriculture.

40. For an example of this, see Vermont parcelization reports: https://vtforesttrends.vnrc.org/reports.

41. Sorensen, A.A., J. Freedgood, J. Dempsey and D. M. Theobald. 2018. Farms Under Threat: The State of America's Farmland. Washington, D.C. American Farmland Trust. Technical report: Theobald, D.M., I. Leinwand, A. Sorensen, and B.G. Dickson. 2018. Description of the approach, data, and analytical methods used for the Farms Under Threat State of America's Farmland project. Final Report. Conservation Science Partners, Inc. Truckee, CA, USA.

42. Leinwand, I., B. G. Dickson, D. M Theobald, A. Sorensen and M. Hunter. 2019. Description of the approach, data and analytical methods used for the Farms Under Threat: State of the States project, version 2.0. Final report, October 21, 2019. 30 pp.; and Schnepf, M. and P. Flanagan. 2016. A History of Natural Resource Inventories conducted by the USDA's Soil Conservation Service and Natural Resources Conservation Service. July 2016. 32 pp.

43. National Resources Inventory. https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/nra/nri/

44. Schnepf, M. and P. Flanagan. 2016. A History of Natural Resource Inventories conducted by the USDA's Soil Conservation Service and Natural Resources Conservation Service. July 2016. 32 pp.

45. E.g., the Protected Areas Database of the United States and National Conservation Easement Database.

46. Theobald, D. 2005. Landscape patterns of exurban growth in the USA from 1980 to 2020. Ecology and Society 10(1): 32. [online] URL: http://www.ecologyandsociety.org/vol10/iss1/art32/ andhttps://journals.plos.org/plosone/article?id=10.1371/journal.pone.0094628

American Farmland Trust

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