American Farmland Trust

GREENER FIELDS

Combating Climate Change by Keeping Land in Farming in New York

PHOTO: DIETRICH GEHRING

By SANAZ ARJOMAND
and DAVID HAIGHT

MAY 2017

American Farmland Trust (AFT) is the largest national organization dedicated to saving the land that sustains us by protecting farmland, promoting sound farming practices and keeping farmers on the land.

AFT unites farmers and environmentalists in developing practical solutions that protect farmland and the environment. We work from "kitchen tables to Congress"—tailoring solutions that are effective for farmers and communities and can be magnified to have greater impact. Since our founding, AFT has helped to protect more than five million acres of farmland and led the way for the adoption of conservation practices on millions more.

AFT has a national office in Washington, D.C., and a network of field offices across America where farmland is under threat. We established our New York office in 1990, as the state is home to some of the most threatened farmland in the nation.

AFT greatly appreciates the generous financial support of the individuals and organizations that made the *Greener Fields* report possible: The David and Lucile Packard Foundation; New York State Conservation Partnership Program, administered by the Land Trust Alliance, in coordination with New York's Department of Environmental Conservation and Environmental Protection Fund; and AFT's members.

We are also grateful to the following people for their insights and assistance that contributed to the development of this report: Nelson Bills, Katie Borgella, Jimmy Daukas, Suzanne Hagell, Lauren Kutina, Rick Lederer-Barnes, Jeff Mapes, Teri Ptacek, Nathan Putnam, Robyn Reynolds, Steve Shaffer, Francis Sheehan, Gabriella Spitzer, Brian Steinmuller, Karen Sullivan, Jeff Ten Eyck, Ed Thompson, Ethan Winter, Peter Woodbury and Jim Yienger.

American Farmland Trust

New York State Office
(518) 581-0078
www.farmland.org/newyork

AmericanFarmlandTrustNY @FarmlandNY NewYorkFarmland

PHOTO: LINDSAY MORRIS

PHOTO: JIM NEWTON

Climate change has, and will continue to have, dramatic effects on all New Yorkers—including farmers and citizens concerned about their food and where it comes from. In the future, farming and food production could be significantly affected by severe weather, including warmer winters with more lake-effect snowstorms; hotter summers with serious droughts; or intense storms with heavy rainfall. At the same time, sea-level rise along our coasts could encroach upon millions of people living along the state's heavily-populated coastline, displacing residents and pushing new real estate development onto farmland.

New York State has made a strong commitment to fighting climate change, establishing a goal of reducing statewide greenhouse gas (GHG) emissions by 80 percent by 2050. AFT's *Greener Fields* report has found that keeping land in farming and promoting good stewardship of the land—while encouraging new development in cities, villages and developed areas—offer important ways for New York to reduce GHG emissions, as farmland emits approximately 66 times fewer GHGs per acre than developed land in New York.

PHOTO: ALAMY/PAT BLACKLEY

An acre of farmland in New York produces

66x fewer greenhouse gases

than an acre of developed land

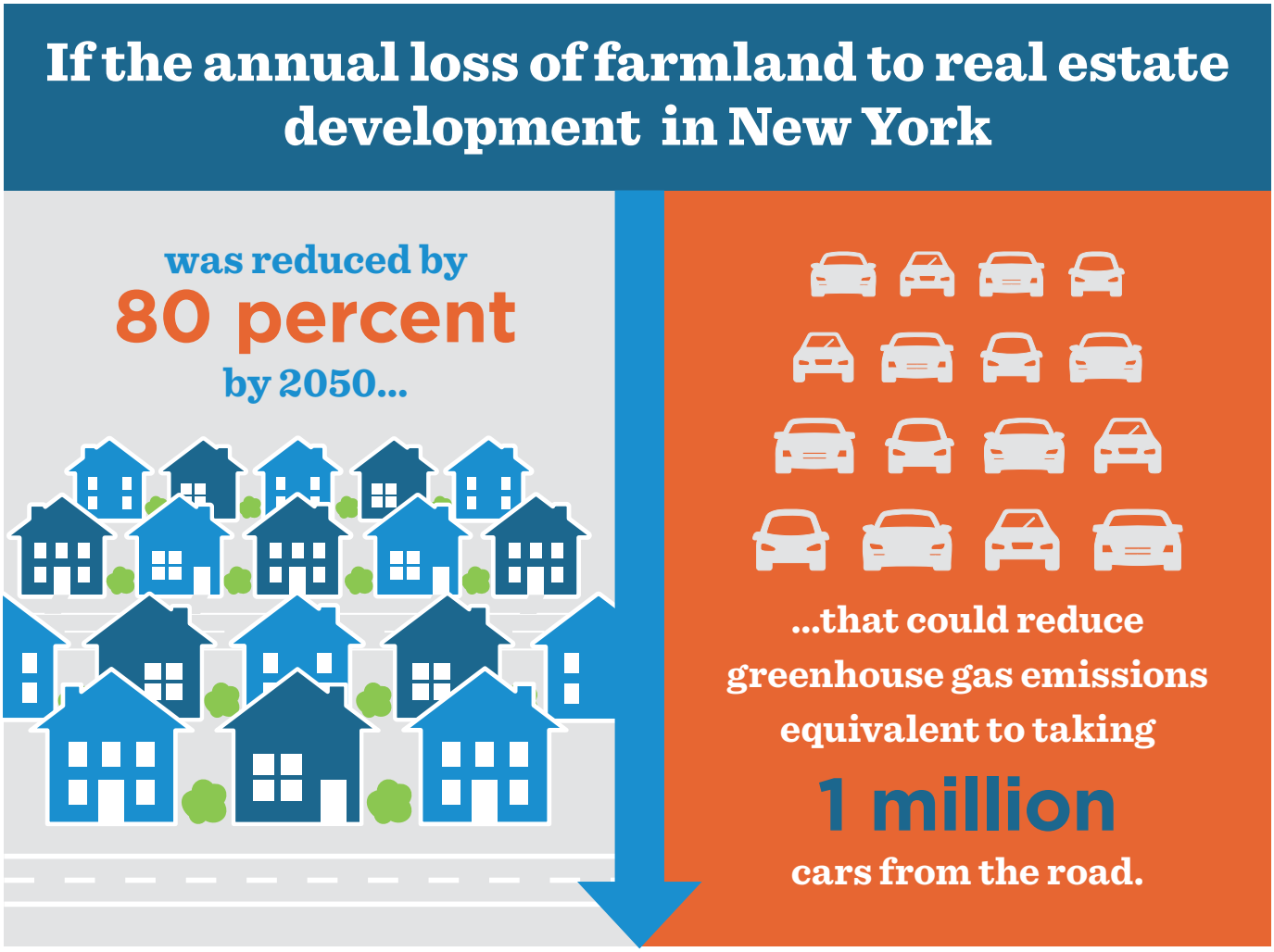
Continuing the current rate of farmland conversion until 2050 would potentially add another nine million metric tons of carbon dioxide equivalent ($MTCO_2e$) emissions annually.* However, if the annual loss of farmland to real estate development were gradually reduced 80%, by 2050, 130,000 acres would be kept in farming. That could provide a reduction of nearly 6 million $MTCO_2e$ emissions in that year alone—roughly the equivalent of removing more than 1 million cars from the road. Reducing the conversion of farmland by 80 percent is projected to generate four percent of the state's overall GHG reduction goal.

If land is kept in agriculture, there are also significant opportunities for farmers to take additional steps to reduce GHG emissions. These include:

- Adopting soil health practices, such as cover crops, reduced tillage, crop rotations and composting that enhance soil carbon levels;
- Storing carbon in permanent pasture and woodlands;
- Capturing and destroying methane from manure handling facilities;
- Generating electricity from renewable sources, such as biodigesters, solar and wind, in ways that are compatible with farming and keep productive farmland in agriculture;
- Increasing energy efficiency and reducing energy demand.

AFT's *Greener Fields* report suggests that taking steps to protect farmland and reduce the conversion of farmland to real estate development is an important component of New York's efforts to reduce GHG emissions 80 percent by 2050. For farmers to continue growing food and bolstering New York's economy—while contributing to the state's climate change goals—action must be taken.

* Metric tons of carbon dioxide equivalent (MTCO2e) is a metric measure used to compare the emissions from different greenhouse gases based upon their global warming potential.



Five Ways that Farmers in New York Can Reduce Greenhouse Gas Emissions

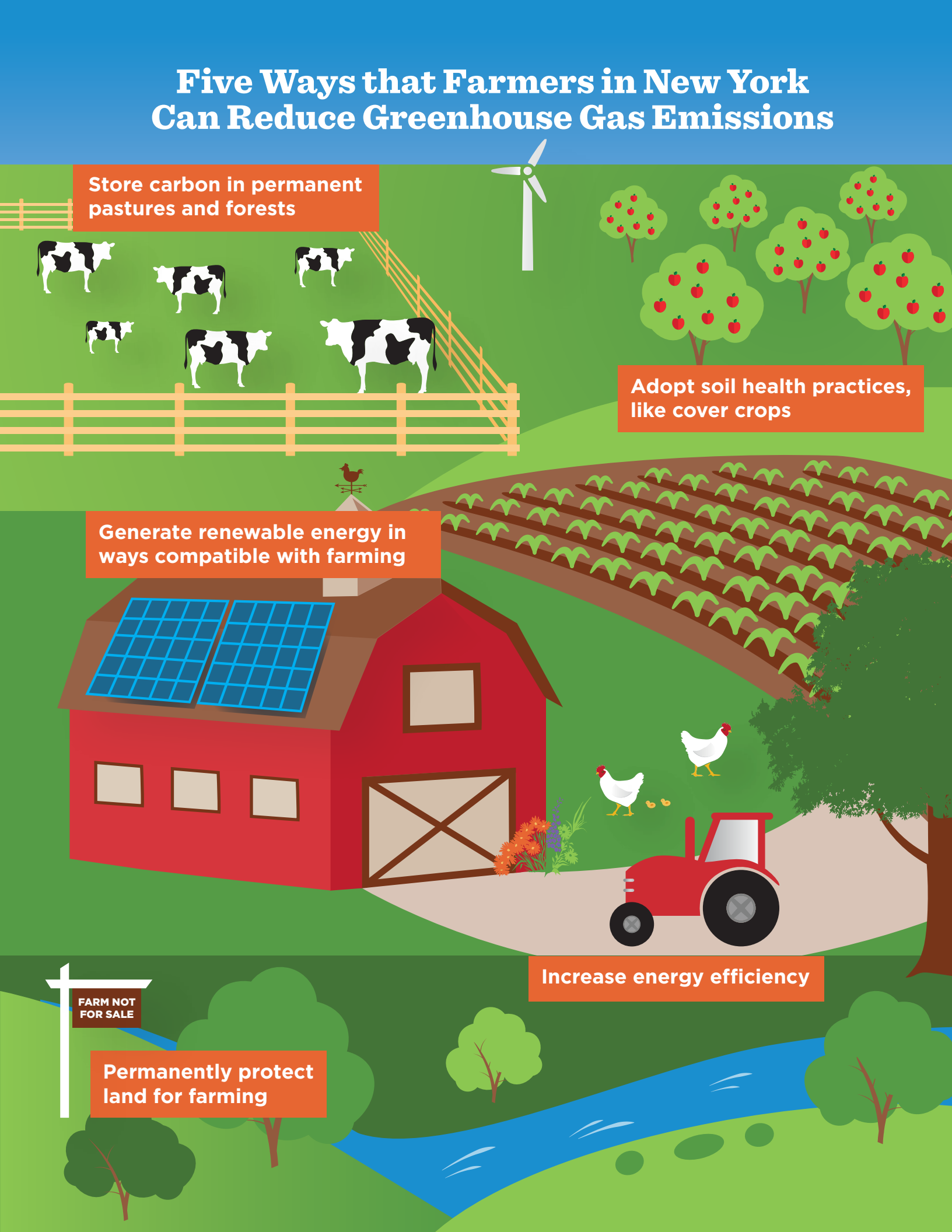


PHOTO: ALAMY/JAMES SCHWABEL

Introduction

New York is an agricultural state. Its seven million acres of farmland provide the base for over $39 billion in economic activity and 160,000 jobs.[4] New York is one of the nation's leading dairy producers, and much of New York's farmland is dedicated to crops that serve as silage, forage or feed in the dairy industry. Other important fruit and vegetable crops by acreage include apples, grapes and sweet corn. On average, each acre of New York farmland has the potential to produce about 1,000 local meals per year.[5]

However, the positive benefits that farms provide in New York are at risk from climate change. Predicted climate impacts on agriculture include:

- Increased spring flooding, leading to delays in planting or fieldwork
- Increased soil erosion from heavy storms
- Increased risk of short-term summer drought
- Heat stress on cool-season crops, including apples and maple syrup
- Heat stress on animals, including dairy cows
- More weeds and insects due to warmer winters, and
- Invasions of new pest species from warmer climates[6, i]

The impacts of climate change will extend beyond farmers to all New Yorkers interested in eating healthy food from local farms. New York City has committed to increasing the average number of servings of fruits and vegetables that adult New Yorkers eat every day by 25 percent in the next 20 years.[7] Importantly, New York City has also committed to supporting the regional food system as part of its long-term strategy for climate resilience:

> "Increasing the amount of food from the region has broader benefits. It will reduce greenhouse gas emissions from shipping food from far away, make our food system more resilient to climate change and other potential disasters, and create jobs locally and across the region."
>
> —ONE NEW YORK: THE PLAN FOR A STRONG AND JUST CITY

i The challenges likely to be faced by farmers in New York are not predicted to be as severe and prohibitive as in other parts of the country, for instance in California where severe droughts are anticipated. New York farmers will potentially have the opportunity to produce more fruits, vegetables and dairy for national consumption to make up for climate-change-induced decreases in production elsewhere.

Connecting Greenhouse Gas Emissions with the Conversion of Farmland

In New York, farmland takes up almost 25 percent of the state's land area, but only emits about 2.5 percent of the state's GHGs. This is a minor amount compared to emissions from transportation (33.9 percent), residential fuel use (14.8 percent) and commercial fuel use (11.5 percent).[8]

Evidence suggests that GHG emissions correlate with lower density, suburban-style real estate development. Specifically, suburbs account for roughly 50 percent of the GHG emissions in America. Cities generally have significantly lower GHG emissions than suburbs, and the gap between them is particularly large in older areas like New York City.[9]

By comparison, more compact, higher-density development patterns generally have been found to have reduced GHG emissions:

> "Compact development provides a double benefit, typically reducing transportation energy use and emissions by 20 to 40% relative to sprawl and having a comparable percentage impact on residential energy use and emissions."
>
> —EWING, REID AND FANG RONG[10]

A 2013 study by researchers from the University of California at Davis found that irrigated cropland in Yolo County emits about 70 times fewer GHGs than developed land uses per hectare.[11] A statewide study of California by AFT in 2015 found that cropland emits about 58 times fewer emissions per acre than developed land uses in California.[12] Subsequently, the California Air Resources Board allocated $40 million to its Sustainable Agricultural Lands Conservation Program, becoming the first state to protect farmland through permanent agricultural conservation easements[ii] as part of its GHG mitigation strategies.[13]

The impacts of the conversion of farmland to real estate development are significant for New York, as the state has lost 471,000 acres of farmland to real estate development between 1982 and 2012.[14] While the annual conversion of farmland has slowed in New York, there is evidence that new development pressures on farmland may increase due to climate change.

According to a newly-published article in the journal *Nature Climate Change*, anywhere from 742,000 to 1.06 million people may be at risk of losing their homes to a six-foot sea level rise in New York by 2100.[15] And as higher seas and increasingly intense storms make living in the city more dangerous, people may move further north and inland, developing farmland to do so.

To better understand the connection between farmland conversion and GHG emissions, county-level emissions data for agricultural land and developed land from the New York Energy Research and Development Authority

PHOTO: ISTOCK/ KEN WEAKLEY

ii An agricultural conservation easement is a restriction voluntarily placed on the deed to a property. It legally prevents the owner from using the property in ways that are inconsistent with commercial agriculture, including real estate development.

PHOTO: LINDSAY MORRIS

(NYSERDA) Cleaner, Greener Communities program[iii] were compared. The counties included in this study were those where farmland loss was determined to be a more serious issue given the mix of developed and agricultural land uses.

New York City's highly developed counties were excluded from the study, and so too were largely rural counties where the Urban Influence Code (UIC) showed no major urban development pressure (counties with UICs of 6 or higher).[iv] Counties with vulnerable farmland but where reliable agricultural emissions data was not available, including Rockland County and counties on Long Island, were also omitted.

GHG emissions associated with agriculture stemmed from three major sources in New York: manure, enteric fermentation and fertilizer use. By contrast, developed land emissions were summarized from multiple forms of developed land, including residential, commercial and industrial development. See *Appendix 1: Research Methods* for more details about the methods that were used in making these comparisons.

iii Each report was prepared by a consortium of municipalities, led by various entities and their planning teams in the course of performing work contracted for and sponsored by the New York Energy Research and Development Authority (NYSERDA). The leaders for each regional report used for this research are: Finger Lakes: Monroe County, North Country: Essex County, Mohawk Valley: Otsego County, Central: Onondaga County, Southern Tier: Tompkins County, Western: Allegany County, Mid-Hudson: Orange County and the Town of Greenburgh, Capital: City of Albany.

The opinions and analyses expressed in the cited reports do not necessarily reflect those of NYSERDA or the state of New York.

iv Urban Influence Codes (UICs) are classifications created by the U.S. Department of Agriculture to categorize counties by the population size of their major metropolitan area, city or town, and by proximity to other major metropolitan areas. For example, an UIC of 1 represents the most urbanized county in a metropolitan region of one million or more residents.

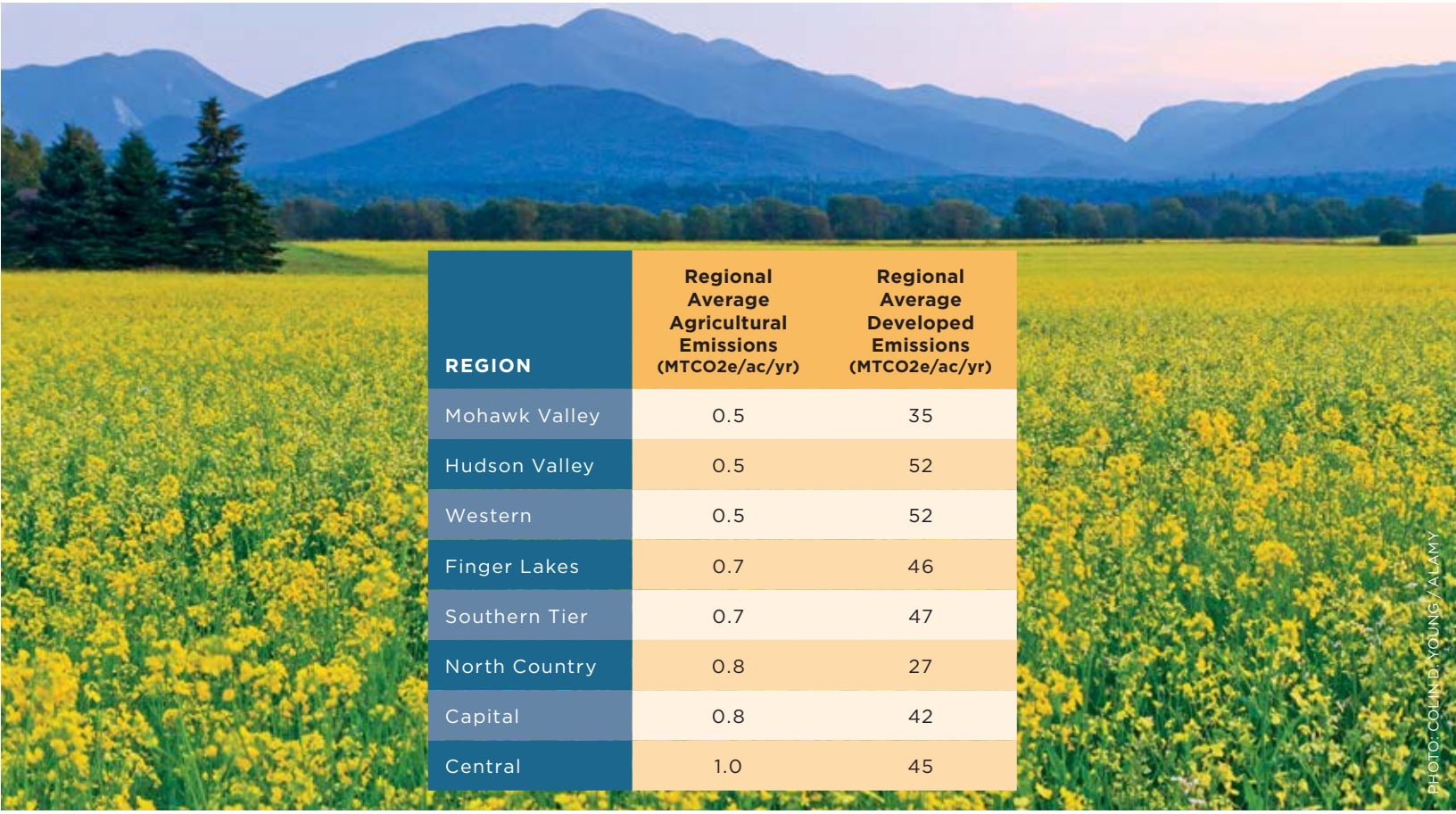
Results

The statewide average for agricultural emissions per acre for New York is 0.69 $MTCO_2e$ per year. The statewide average for developed emissions is 45.68 $MTCO_2e$ per year. The regional averages, which ranged from 27 $MTCO_2e$ in the North County to 52 MTCO2e in the Hudson Valley, are reported in the table below.

These results are comparable to the California studies; the results from AFT's California study found a statewide average for agricultural emissions per acre of 0.89 $MTCO_2e$ per year, and the UC Davis study for Yolo County found 0.81 $MTCO_2e$. The California statewide average for developed emissions were 51 $MTCO_2e$ and 61.6 $MTCO_2e$, respectively."

Compared to the statewide average for developed emissions, agriculture emits approximately 66 times fewer GHGs per acre per year. Again, this is comparable to recent studies in California, which found differences of 58 times (AFT) and 70 times (UC Davis for Yolo County) fewer GHG emissions from agricultural versus developed land.

These results suggest that at the current rate of farmland loss of about 5,800 acres per year, the difference in GHG emissions from developed land and agricultural land is approximately 262,000 $MTCO_2e$/year. But—using the current trends and extrapolating into the future—if New York could focus new development in urbanized areas and reduce its farmland conversion rate by 80%, as many as six million $MTCO_2e$ of GHG emissions could be avoided annually, the equivalent of removing more than 1 million cars from the road.[v]



REGION	Regional Average Agricultural Emissions (MTCO2e/ac/yr)	Regional Average Developed Emissions (MTCO2e/ac/yr)
Mohawk Valley	0.5	35
Hudson Valley	0.5	52
Western	0.5	52
Finger Lakes	0.7	46
Southern Tier	0.7	47
North Country	0.8	27
Capital	0.8	42
Central	1.0	45

PHOTO: COLIN D. YOUNG / ALAMY

v This projection assumes a 10% annual reduction in farmland converted to real estate development beginning in 2018 until an 80% reduction in farmland conversion is achieved in 2032 and sustained until 2050. These estimates of avoided emissions depend partly on GHG emissions associated with developed land, housing and population levels in New York as well as GHG emissions associated with agricultural practices. The emissions that come from developed land could increase over time on a per-acre basis in areas where populations increase, especially if other policy measures do not adequately encourage energy efficiency, low-carbon transportation and renewable energy along with infill development. However, if farmland is left in its current low emissions use, and smart growth is coupled with state investments in GHG reductions, greater emissions on a per capita basis can be avoided.

Recommendations for Action

New York has been actively engaged in fighting climate change. In 2005, the state joined with six others to create the Regional Greenhouse Gas Initiative (RGGI), a cap-and-trade system that has decreased GHG emissions while raising over $580 million in proceeds for other emission reduction programs.

One of the programs funded by RGGI—the Cleaner, Greener Communities program—has supported regional economic development and sustainability planning across New York.[16] The program supported the calculation of the greenhouse gas inventory data used in this report, as well as projects that have decreased GHG emissions in the state by 1.9 million $MTCO_2e$.[17] As of 2016, 151 local governments have pledged to take concrete steps to reduce their GHG emissions through the RGGI-funded Climate Smart Communities program.

In 2010, New York state adopted the target of decreasing emissions 80 percent below 1990 levels by 2050.[18] As Governor Cuomo stated during the signing of the Under 2 MOU[19] in October 2015:

"Climate change is a reality, and not to address it is gross negligence by government and irresponsible as citizens."

—GOVERNOR ANDREW CUOMO

The 2015 State Energy Plan adopted an equally ambitious goal of decreasing emissions from the power sector by 40 percent by 2030. Steps have already been taken to reach this goal, including the creation of Reforming the Energy Vision (REV) to revolutionize energy generation and distribution statewide.

The *Greener Fields* report suggests that protecting agricultural land and promoting good stewardship of this land—while encouraging new real estate development in cities, villages and developed areas—offer important ways for New York to achieve its climate objectives. Such "smart growth" has many climate benefits, including decreasing transportation emissions and streamlining energy transmission for less energy loss.[20]

However, reducing the conversion of farmland will require direct action to sustain the economic viability of agriculture and steer new real estate development away from farmland towards cities, villages and developed areas.

PHOTO: MEREDITH HEUER

Ways to Combat Climate Change by Keeping Land in Farming in New York

PHOTO: LINDSAY MORRIS

For Farmers

- Investigate options for permanently protecting your farmland. Go to www.farmlandinfo.org to find a land trust and learn more.
- Adopt climate smart farming practices, such as cover crops and reduced tillage.
- Generate renewable energy in ways compatible with farming and keep productive farmland in agriculture.

For Interested Citizens

- Shop at farm stands, farmers markets and other places that sell local farm products. Talk with farmers about challenges they face in keeping their land in farming.
- Reach out to a local land trust about their efforts to protect farmland.
- Encourage public leaders to support funding and initiatives that protect farmland and climate smart farming practices.

PHOTO: ALAMY/LEN HOLSBORG

For Land Trusts

- Help farm families permanently protect the most valuable and resilient land for farming and growing food.
- Educate your community about the importance of keeping land in farming and the connection with increasing resilience to a changing climate.
- Work with partners to help farmers adopt soil health practices and generate renewable energy in ways compatible with agriculture and keep productive land in farming.

PHOTO: LINDSAY MORRIS

For Planners and Local Officials

- Make agriculture and protecting farmland a priority in land use, economic development and climate change plans.
- Participate in the Department of Environmental Conservation's Climate Smart Communities Program and integrate farms into community climate strategies.
- Work with the Department of Agriculture and Markets Agricultural and Farmland Protection Planning Grants Program to develop pro-active plans to keep land in farming and support the economic viability of farming.

PHOTO: LINDSAY MORRIS

PHOTO: ISTOCK/USCHOOLS

For State and Federal Leaders

- Incorporate farmland protection into public policy agendas for combatting climate change.
- Include the protection of farmland and local food systems in state or federal plans for land conservation and economic development.
- Commit resources to helping farm families permanently protect their land for farming and adopt conservation practices that build soil health.

For Researchers

- Conduct additional research related to alternative land use scenarios—such as higher density residential development compared with lower density residential development—and the associated impact on greenhouse gas emissions.
- Estimate the climate change impacts of farmers expanding the use of soil health and other climate-smart farming practices.
- Explore ways for farmers to successfully integrate renewable energy into active farm operations while keeping productive farmland in agriculture.

PHOTO: LINDSAY MORRIS

Conclusion

The *Greener Fields* report shows that agricultural activities emit far fewer GHGs than the activities that take place on developed land. To avoid greater emissions from sprawling real estate development, the protection of agricultural land and promotion of new development in cities, villages and developed areas should play a major role in efforts to reduce GHG emissions in New York.

Notes

1 United States Environmental Protection Agency. "Greenhouse Gas Equivalencies Calculator." Last modified May 2016. www.epa.gov/energy/greenhouse-gas-equivalencies-calculator.

2 American Farmland Trust Farmland Information Center, http://www.farmlandinfo.org/statistics/New%20York.

3 Environmental Protection Agency Greenhouse Gas Equivalencies Calculator, https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

4 Lopez, Rigoberto, Nataliya Plesha, Benjamin Campbell, and Chris Laughton. *Northeast Economic Engine: Agriculture, Forest Products, and Commercial Fishing*. N.p.: Farm Credit East, 2015.

5 Calculations based on Peters, Christian J., Jennifer L. Wilkins, and Gary W. Fick. "Testing a Complete-Diet Model for Estimating the Land Resource Requirements of Food Consumption and Agricultural Carrying Capacity: The New York Example." *Renewable Agriculture and Food Systems* 22, no. 2 (2007): 145-53.

6 Cornell Climate Change Program Work Team. *Farming Success in an Uncertain Climate*. 2014. http://climatechange.cornell.edu/wp-content/uploads/2013/03/climate_and_farming.pdf.

7 *One New York: The Plan for a Strong and Just City*, www.nyc.gov/html/onenyc/downloads/pdf/publications/OneNYC.pdf.

8 New York Energy Research and Development Authority. New York Greenhouse Gas Inventory and Forecast: Inventory 1990-2011 and Forecast 2012-2030. 2015.

9 Christopher Jones*† and Daniel M. Kammen*†‡§ *Environ. Sci. Technol.*, 2014, *48* (2), pp 895–902

Publication Date (Web): December 13, 2013 (Policy Analysis).

†Energy and Resources Group, ‡Goldman School of Public Policy, and §Department of Nuclear Engineering, University of California, Berkeley, California 94720, *Environ. Sci. Technol.*, 2014, *48* (2), pp 895–902,

Publication Date (Web): December 13, 2013, http://pubs.acs.org/doi/abs/10.1021/es4034364.

10 Ewing, Reid and Fang Rong. *Housing Policy Debate*, Volume 19 Issue 1 © 2008 Metropolitan Institute at Virginia Tech.

11 Haden, Van R., Michael Dempsey, Stephen Wheeler, William Salas, and Louise E. Jackson. "Use of Local Greenhouse Gas Inventories to Prioritise Opportunities for Climate Action Planning and Voluntary Mitigation by Agricultural Stakeholders in California." *Journal of Environmental Planning and Management* 56, no. 4 (May 2013): 553-71.

12 Shaffer, Steve, and Edward Thompson, Jr. *A New Comparison of Greenhouse Gas Emissions from California Agricultural and Urban Land Uses*. N.p.: American Farmland Trust, 2015.

13 "California's Sustainable Agricultural Lands Conservation Program." American Farmland Trust. www.farmland.org/initiatives/californias-sustainable-agricultural-lands-conservation-program.

14 U.S. Department of Agriculture. "New York Developed Land." 2010 National Resources Inventory. Last modified 2015. www.nrcs.usda.gov/Internet/NRCS_RCA/reports/nri_dev_ny.html.

15 Hauer, Matthew E., Jason M. Evans, and Deepak R. Mishra. "Millions Projected to Be at Risk from Sea-Level Rise in the Continental United States." Nature Climate Change, March 14, 2016. Accessed March 14, 2016. http://dx.doi.org/10.1038/nclimate2961.

16 Homer, C.G., Dewitz, J.A., Yang, L., Jin, S., Danielson, P., Xian, G., Coulston, J., Herold, N.D., Wickham, J.D., and Megown, K., 2015, "Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information." *Photogrammetric Engineering and Remote Sensing*, v. 81, no. 5, p. 345-354.

Appendix 1: Research Methods

The figures for GHG emissions associated with agriculture in New York considered emissions from three major sources: manure, enteric fermentation and fertilizer use. Depending on the way that it is managed, manure emits varying amounts of methane and nitrous oxide. Enteric fermentation refers to the digestion process in ruminants such as cows, which also releases methane.

Accounting for animal emissions in New York is important not only because of the wide reach of animal agriculture, but also because both methane and nitrous oxide have high global warming potentials, from between 28 to 36 times that of CO_2 for methane and 265 to 298 that of CO_2 for nitrous oxide.[21] Nitrogen fertilizer use is also a source of nitrous oxide emissions. In order to account for the use of machinery such as tractors, all off-road agricultural fuel use emissions were also added to county totals. These off-road emissions were obtained from data calculated using the U.S. Environmental Protection Agency NONROAD model.

These calculations do not include long-term carbon sequestration in orchards, tree farms, pastureland or woodlands located on farms, making these estimates for agricultural emissions conservative. Further, these figures do not include measures for annual carbon sequestration by crops; this is because soil carbon stocks tend to reach an equilibrium if the same land management technique is used over time.[22] Given its limited use in the state, irrigation impacts were not considered.

To calculate the areas of agricultural land within each county, a geospatial analysis of the National Land Cover Database (NLCD) was conducted using ArcGIS software. The NLCD has a spatial resolution of 30 m^2 (about .007 acres). As of the publication of this paper, an accuracy test for the dataset has not yet been completed, although the second most recent 2006 NLCD was about 80 percent accurate.[23]

This publicly available national dataset is widely used by other state agencies and researchers and is considered adequate for analysis at the county level. The types of agricultural land included were cultivated crops and hay/pastureland. Although the carbon storage of pastureland is not being taken into account, pastureland is included in this study because the land area is tied to the emissions from livestock through forage production and manure deposits.

Developed Emissions Methods

The data for developed emissions was also gathered from county-level emissions inventories completed by each Regional Economic Development Council through the NYSERDA Cleaner, Greener Communities program. The methods used to calculate emissions were comparable among counties, given that they were all based on the New York Community and Regional GHG Inventory Guidance for the baseline year of 2010. Because the document established fairly specific emissions calculations methods, the results are considered to be highly comparable between counties. In quantifying the emissions from developed land uses, residential, commercial and industrial development were included. The categories of emissions included in the county totals were:

- Direct emissions from industrial processes (e.g. cement production)
- Emissions from residential, commercial and industrial energy consumption[vi]
- Energy supply losses from transmission and distribution
- The use of refrigerants
- On-road transportation
- Solid waste management in landfills
- Sewage treatment

Biogenic sources of emissions (including, wood, ethanol and biodiesel) were not included, given that these sources will theoretically cycle carbon and remain carbon neutral (i.e. the trees used for wood will be replaced by other trees that will sequester carbon as they grow). Emissions from air, rail, marine and off-road fuel use were not included.[24]

Comparing Agricultural and Developed Emissions

Overall, using this county-by-county comparison allows us to calculate a statewide average that considers nearly all areas of New York where farmland may be under threat from real estate development. The statewide average for agricultural emissions was calculated by dividing the sum of agricultural emissions in the considered counties by the sum of agricultural acres in those counties. The average for urban emissions was also calculated by dividing the sum of all developed emissions by the sum of all developed acres.

vi Rather than including emissions from the source of power generation (direct emissions), emissions calibrated to use were included (indirect emissions). This avoids disproportionate emissions in counties with high energy generating capacities.

PHOTO: DIETRICH GEHRING

No Farms No Food®

American Farmland Trust

Join American Farmland Trust in saving the land that sustains us.

Visit www.farmland.org/newyork or contact (518) 581-0078; newyork@farmland.org.

www.farmland.org/greenerfields

AmericanFarmlandTrustNY @FarmlandNY NewYorkFarmland