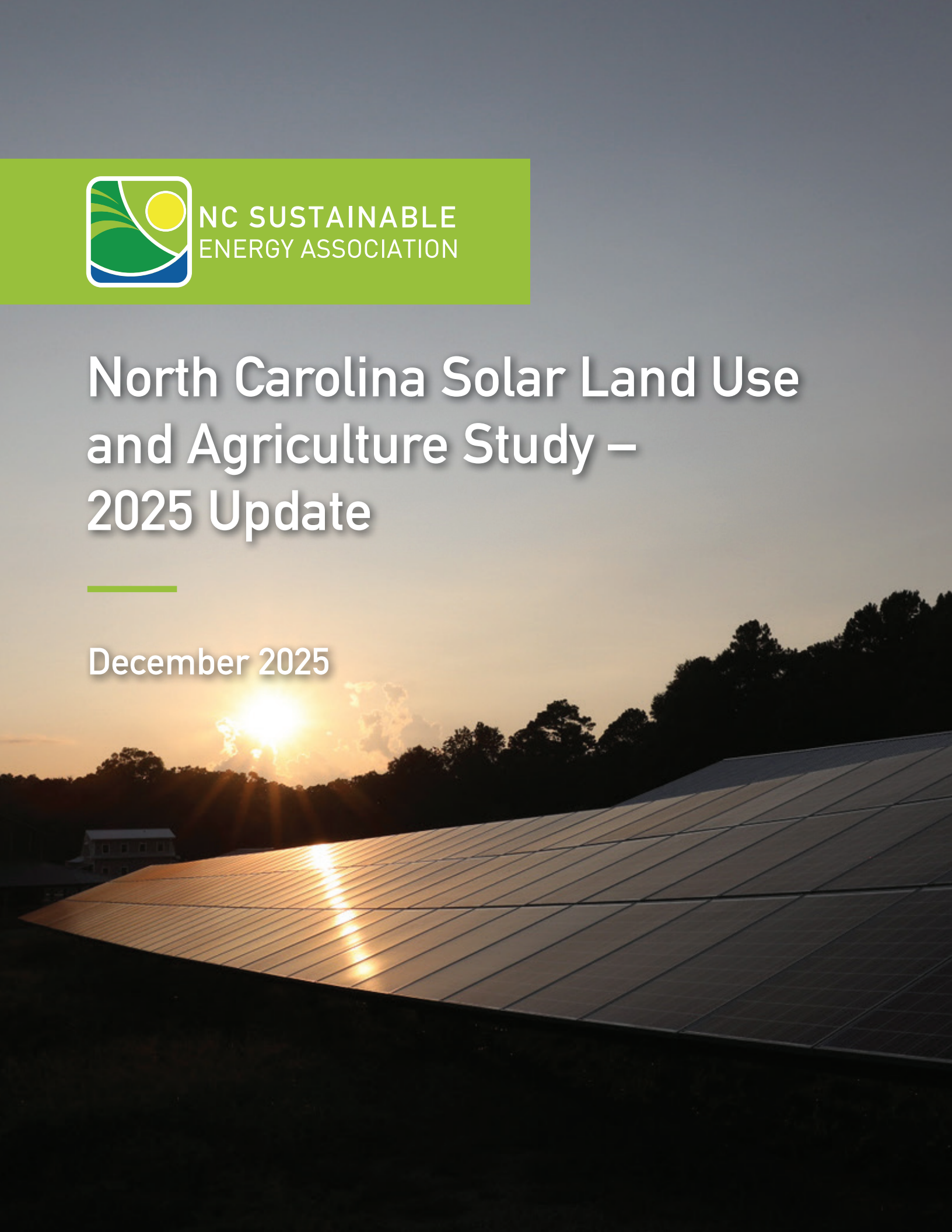
NC SUSTAINABLE ENERGY ASSOCIATION

North Carolina Solar Land Use and Agriculture Study – 2025 Update

December 2025



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About North Carolina Sustainable Energy Association
For nearly 50 years, the North Carolina Sustainable Energy Association (NCSEA) has worked to enable clean energy jobs, economic opportunities, and affordable energy options for North Carolinians. As a 501(c)(3) nonprofit, NCSEA advances these goals through policy and market solutions in collaboration with nearly 300 members, including clean energy providers, nonprofits, corporations, local governments, and universities.

Executive Summary

Utility-scale solar (USS) development has grown significantly in North Carolina, increasing from three total systems in 2009 to currently more than 773. To better understand the amount of land these installations occupy, NCSEA conducted a land use analysis using solar installation data from the organization's Renewable Energy Database (REDB) and land use data from the National Land Cover Database (NLCD). This analysis serves as an update to the report iteration carried out in 2022. Based on NCSEA's analysis, ***only 0.31% of total agricultural land is currently used for USS development.***

This report corroborates the case that USS development has occurred on a small amount of agricultural land in North Carolina compared to other land uses. Additionally, our analysis shows that USS installations occupy only 0.13% of the total land area of the state. For purposes of this report, agricultural land includes the following land categories: cultivated cropland, evergreen forest, and pasture/hay. USS installations occupy 40,284 total acres of land, and 34,012 of these acres are considered agricultural land. The state of North Carolina is comprised of approximately 31.4 million acres of land[1], with over 10.9 million of that being attributed to agricultural purposes.

In comparing to other forms of redevelopment using definitions from the Multi-Resolution Land Characteristic (MRLC) Consortium, NCSEA determined that Developed, Open Space (i.e. large-lot single-family housing, golf courses, parks) and Developed, Low Intensity (mostly single-family housing)[2] occupy **8.18%** and **4.11%** of agriculture land respectively.

KEY FINDINGS

Utility-scale solar (USS) total acres on agricultural land	34,012
USS total acres	40,284
Total agriculture acres in the state	10,999,656
Total acres in the state	31,400,000
% total statewide land occupied by USS	0.13%
% cropland (subgroup of agricultural land) occupied by USS	0.31%
% agricultural land occupied by Developed, Low Intensity land cover	4.11%
% agricultural land occupied by Developed, Open Space land cover	8.18%

1. IndexMundi. North Carolina Land Area in Square Miles, 2010 by County. Accessed March 5, 2025. https://www.indexmundi.com/facts/united-states/quick-facts/north-carolina/land-area#map.
2. Multi-Resolution Land Characteristics (MRLC) Consortium. National Land Cover Database Class Legend and Description. Accessed Aug. 28, 2025. https://www.mrlc.gov/data/legends/national-land-cover-database-class-legend-and-description.

The analysis in this report focuses specifically on USS installations, which are 1 MW or greater in nameplate capacity. According to NCSEA's data, the total generation capacity of the 773 installations throughout the state is 6,846 MW.

Note: NCSEA made updates in this report in December 2025 to reflect data sources on agricultural land that are more consistent with the sources used in previous report iterations.

The analysis determined that solar PV only occupies 0.13% of the total land area of the state and 0.31% of agricultural land.

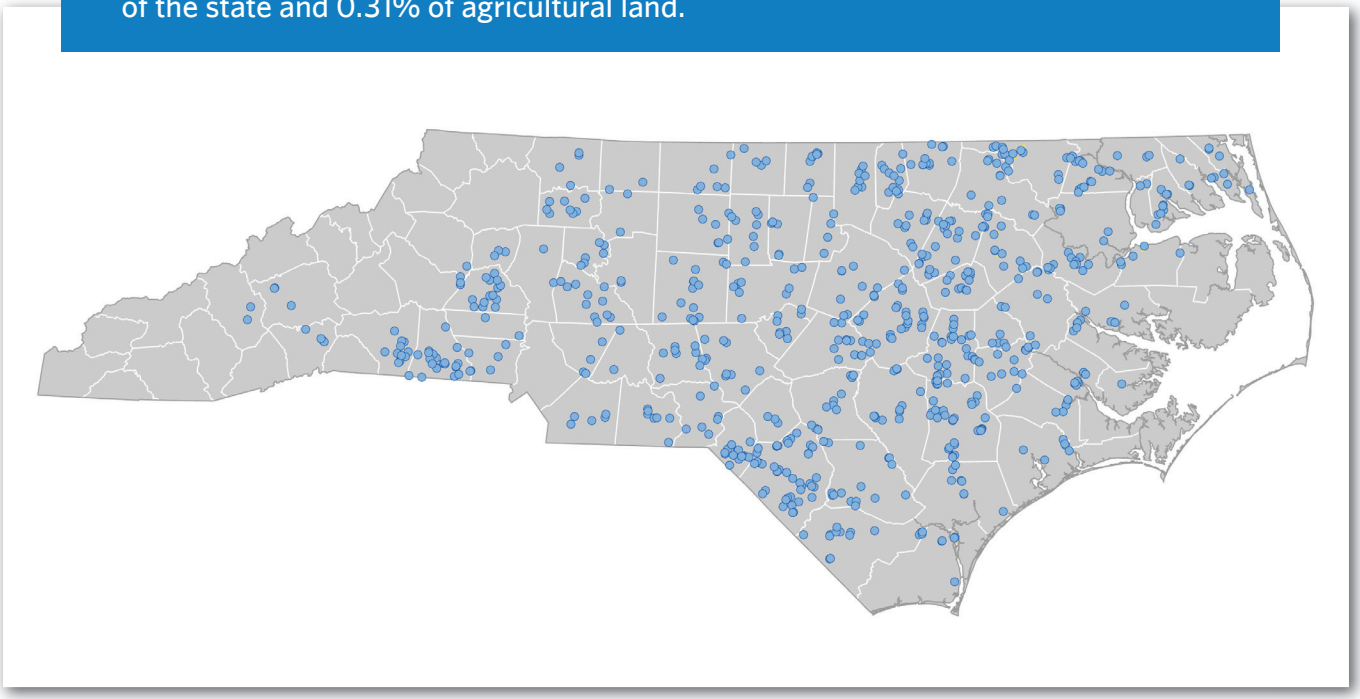


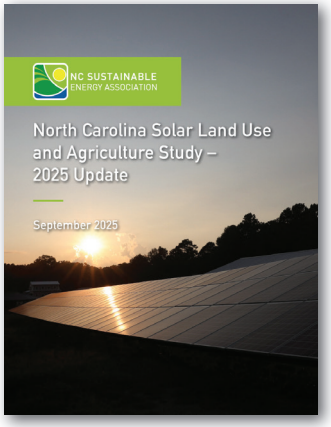
Figure 1. Locations of utility-scale solar PV systems with generating capacity of 1 MW or greater in NC.

Solar and agriculture are two significant industries in North Carolina. The state has long been near the top of the national leaderboard in solar with more than 9,668 megawatts (MW)[3] of total installed capacity as of Dec. 2024, making North Carolina fifth in the country. The solar industry employs 9,819 North Carolinians,[4] and the clean energy industry (renewable energy and energy efficiency) has provided a total economic impact of $59.1 billion from 2007 to 2022, with a significant portion going to economically-distressed areas.[5] Furthermore, USS installations contribute significant tax revenue to counties, as analyzed and reported in NCSEA's Increased North Carolina County Tax Revenue From Utility-Scale Solar – 2025 Update.

3. Solar Energy Industries Association. Solar State By State. Accessed May 30, 2025. https://seia.org/solar-state-by-state/.
4. E2: North Carolina Home to 110K Clean Energy Jobs. #9 in U.S., as Industry Outpaces Overall Economy. Accessed on March 4, 2025. https://e2.org/releases/clean-jobs-nc-2024/.
5. RTI International. Economic Analysis of Clean Energy Development in North Carolina 2023 Update. Accessed on March 6, 2025. https://www.energync.org/wp-content/uploads/2023/09/2023-RTI-Report.pdf.

Agriculture also contributes heavily to the statewide economy. As of 2022, there were 42,817 farms in North Carolina producing goods such as soybeans, corn, sweet potatoes, and livestock, according to the U.S. Department of Agriculture.[6] In 2022, North Carolina was a national leader in sweet potato, turkey and hog production.[7] In all, agribusiness is the largest industry in the state, being responsible for $111.1 billion in economic impact in 2022.[8]

For the land that USS occupies, there can be the co-location of agricultural activities and solar in a practice called agrivoltaics. These activities include planting crops beneath raised solar panels, allowing pollinator plants to thrive, and providing animals grazing opportunities around operating systems. More details on these practices are provided later in this report.



Contents

6. U.S. Dept. of Agriculture. Historical Highlights: 2022 and Earlier Census Years. Accessed on March 5, 2025. https://www.nass.usda.gov/Publications/AgCensus/2022/Full_Report/Volume_1,_Chapter_1_State_Level/North_Carolina/st37_1_001_001.pdf.
7. U.S. Dept. of Agriculture. 2024 State Agricluture Overview. Accessed on March 5, 2025. https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=NORTH%20CAROLINA.
8. N.C. State University. Agriculture and Agribusiness: North Carolina's Number One Industry. Accessed on March 6, 2025. https://cals.ncsu.edu/agricultural-and-resource-economics/wp-content/uploads/sites/46/2017/07/AgricultureAgribusinessReport-2023-digital.pdf.

Agriculture in North Carolina

Agriculture has long been a leading industry in the state, providing thousands of jobs and contributing billions of dollars in revenue for North Carolina while leading the country in the production of a number of commodities. According to N.C. State University, in 2022, nearly 16% of gross state product ($111 billion) came from agricultural activities.[9] Additionally, the industry employs 777,616 people, or 16% of North Carolina's workforce. These workers are spread throughout 42,000 farms that span over 8 million acres according to the U.S. Department of Agriculture.[10]

North Carolina is an agricultural leader in the country. According to the N.C. Department of Agriculture & Consumer Services, close to 54% of all the sweet potatoes grown in the United States are grown in North Carolina.[11]

COMMODITY	NATIONAL RANK
Sweet Potatoes	1st
Poultry & Eggs	1st
Turkeys	2nd
Hogs & Pigs	3rd
Cucumbers	3rd
Bell Peppers	3rd
Peanuts	3rd

Table 1. North Carolina national commodity production ranks (2023) according to the North Carolina Department of Agriculture & Consumer Services Agricultural Statistics Division.[12]

9. N.C. State University. Agriculture and Agribusiness: North Carolina's Number One Industry. Accessed on March 6, 2025. https://cals.ncsu.edu/agricultural-and-resource-economics/wp-content/uploads/sites/46/2017/07/AgricultureAgribusinessReport-2023-digital.pdf.
10. U.S. Dept. of Agriculture. Historical Highlights: 2022 and Earlier Census Years. Accessed on March 5, 2025. https://www.nass.usda.gov/Publications/AgCensus/2022/Full_Report/Volume_1,_Chapter_1_State_Level/North_Carolina/st37_1_001_001.pdf.
11. N.C. Dept. of Agriculture and Consumer Services. About North Carolina Agriculture. Accessed on March 6, 2025. https://www.ncagr.gov/.
12. North Carolina Department of Agriculture & Consumer Services Agricultural Statistics Division. 2024 North Carolina Agricultural Statistics. Accessed March 6, 2025. https://www.nass.usda.gov/Statistics_by_State/North_Carolina/Publications/Annual_Statistical_Bulletin/AgStat/NCHighlights.pdf.

Solar in North Carolina

State Economic Benefits from Solar

Clean energy is a significant industry in the state, providing nearly 110,000 jobs in North Carolina, according to E2 (Environmental Entrepreneurs).[13] Additionally, the industry's total economic impact in North Carolina from 2007 to 2022 is $59.1 billion, according to a study from RTI International.[14] Solar is the second largest subset of the clean energy economy with nearly 10,000 jobs.

Additionally, USS installations contribute significant tax revenue to the counties they are located. In a 2025 report, NCSEA found that on average per county, the property taxes paid on the land after solar was installed increased by 1,801%, when including real estate, personal property, and rollback taxes.[15] In total, the solar installations included in the study paid over $19.6 million in taxes.

Solar National Rank

North Carolina is a national leader in solar with the fifth most solar generating capacity in the country according to the Solar Energy Industries Association.

RANK	COMMODITY	CAPACITY
1	California	52,270
2	Texas	43,563
3	Florida	20,065
4	Arizona	10,377
5	North Carolina	9,709
6	Nevada	7,982
7	Georgia	7,466
8	Virginia	7,046
9	New York	6,821
10	Illinois	6,187

Table 2. Ten states with the most solar generating capacity as of Q1 2025.[16]

13. E2: North Carolina Home to 110K Clean Energy Jobs, #9 in U.S., as Industry Outpaces Overall Economy. Accessed on March 4, 2025. https://e2.org/releases/clean-jobs-nc-2024/.
14. RTI International. Economic Analysis of Clean Energy Development in North Carolina 2023 Update. Accessed on March 6, 2025. https://www.energync.org/wp-content/uploads/2023/09/2023-RTI-Report.pdf.
15. North Carolina Sustainable Energy Association. Increased North Carolina County Tax Revenue from Utility-Scale Solar - 2025 Update. Accessed June 25, 2025. https://www.energync.org/wp-content/uploads/2025/06/2025_June-Property-Tax-Study_6.12.25.pdf.
16. Solar Energy Industries Association. State Solar Map. Accessed on Aug. 28, 2025. https://seia.org/solar-state-by-state/.

Economic Benefits of Solar to Agricultural Landowners

Hosting USS installations can be an opportunity for landowners to generate a stable and higher income. While lease amounts are not publicly available and can vary based on a number of factors, the NC State Extension says rates of land for solar farms have been anecdotally reported at a range of $750 to $1,400 per acre per year.[17]

Furthermore, this type of leasing generally has a number of upsides compared to other activities including consistent income, minimal operations and potential for agrivoltaics. According to the U.S. Dept. of Agriculture, even at the low end of those lease payments, solar would be more lucrative per acre than barley, oats, or hay production.[18]

Land Occupied by Utility-Scale Solar in North Carolina

2022 Report

In the previous iteration of this report, NCSEA reported the following regarding the amount of agricultural land that USS installations occupy in North Carolina.

- 703 utility scale solar (USS) installations occupy 38,081 total acres of land.
- 23,601 of these acres, or 62% of the total land that solar occupies, were categorized as cultivated cropland.
- There is a total of 31.4 million acres in North Carolina, with approximately 11 million of that being used for agricultural.
- USS installations occupy 0.12% of the total land area of the state, and 0.28% of agricultural land in the state.

17. NC State Extension. Solar and Wind Energy Development Opportunities: Tax Implications. Accessed June 25, 2025. https://www.ces.ncsu.edu/solar-and-wind-energy-development-opportunities-tax-implications/

18. U.S. Dept. of Agriculture. 2024 State Agriculture Overview. Accessed March 10, 2025. https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=NORTH%20CAROLINA.

2025 Report

Methodology

NCSEA used the following data sources to carry out the analysis:

- NCSEA's Renewable Energy Database (REDB): contains detailed information on each USS installation throughout the state, including location. REDB sources its information from the North Carolina Utilities Commission website.
- U.S. Geological Survey's National Land Cover Database (NLCD): contains land use parcel data.
- NC OneMap: for satellite imagery to verify USS installations.

First, NCSEA drew Geographic Information Systems (GIS) footprints using aerial imagery of each USS installation in North Carolina. NCSEA utilized data from REDB, a comprehensive source of information on renewable energy systems throughout the state, to identify USS installations 1 MW and greater in nameplate capacity. NCSEA used the latest satellite imagery from NC OneMap to verify installations and guide the drawing of the footprints.

Then NCSEA collected the NLCD land use GIS files, and overlayed the drawn solar footprints over the land use. This allowed NCSEA to calculate the amount of land that the solar footprints occupied in each land use category. Given that the first USS installations included in this analysis were installed in 2009, NCSEA chose land use data from 2008.

The NLCD dataset classifies land in the United States into categories based on its usage and contents including open water, vegetated lands (forests, grasslands, moss, lichens, etc.), and levels of developed land. NCSEA then used ArcGIS Pro, a professional GIS software program, to identify the sections of the NLCD data that the USS installations occupy, allowing for totaling up the amount of area in each land use category.

Example

The following images demonstrate this process for a 20 MW installation located in Maxton, NC.

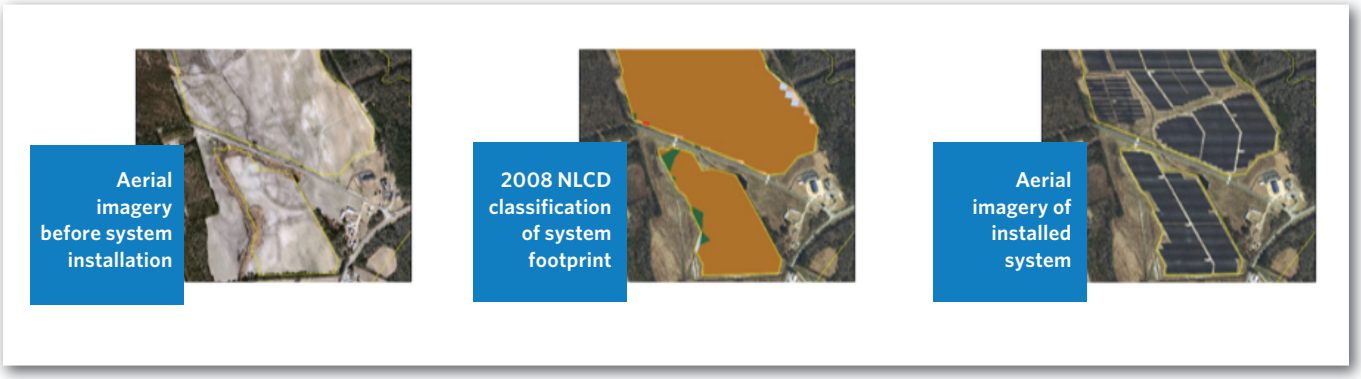


Figure 2. Aerial imagery and GIS files of a utility-scale solar installation in North Carolina.

This system occupies a footprint of 115 acres that was mostly cultivated cropland (image with brown parcels) before installation.

Land Coverage Categories

The National Land Cover Dataset uses 20 land use labels.

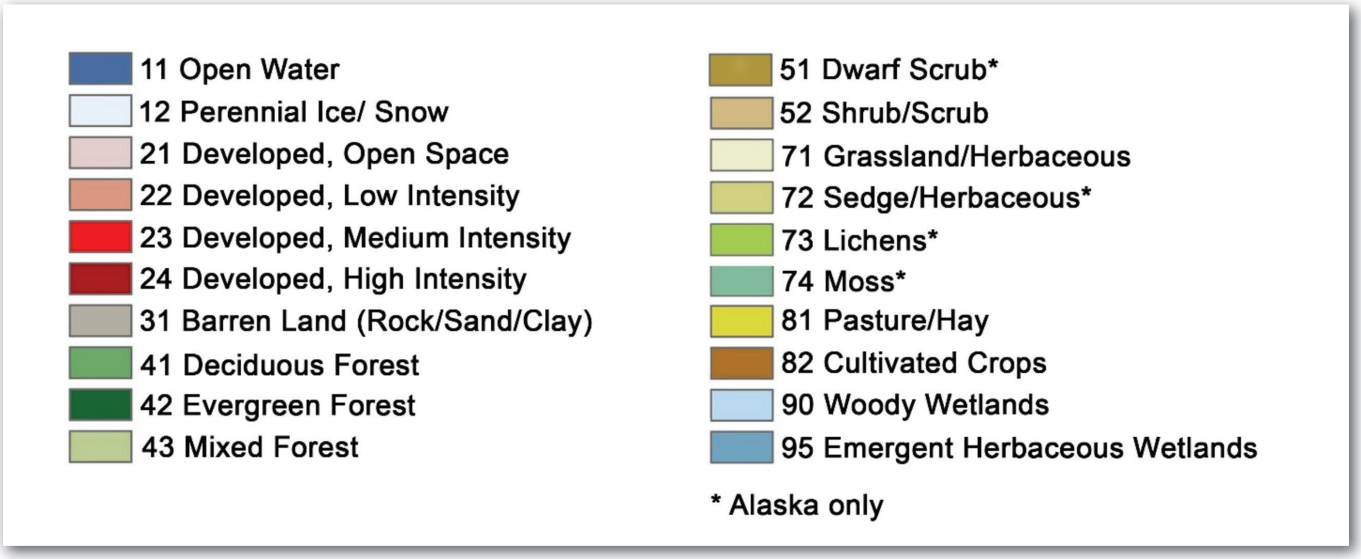


Figure 3. NLCD land cover classification categories

According to the Multi-Resolution Land Characteristics (MRLC) Consortium, which maintains NLCD, the four types of developed categories are:[19]

Developed, Open Space - areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover.

- These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.

Developed, Low Intensity - areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% percent of total cover.

- These areas most commonly include single-family housing units.

Developed, Medium Intensity - areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50% to 79% of the total cover.

- These areas most commonly include single-family housing units.

Developed, High Intensity - highly developed areas where people reside or work in high numbers.

- Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80% to 100% of the total cover.

19. Multi-Resolution Land Characteristics Consortium. National Land Cover Database Class Legend and Description. Accessed on July 11, 2025. https://www.mrlc.gov/data/legends/national-land-cover-database-class-legend-and-description.

Results

From NCSEA's analysis, the 773 utility-scale solar (USS) installations that are 1 MW or greater in capacity occupy a total of 40,284 acres of land. This comprises only 0.13% of the total land in the state. Of that total, 24,633 acres were categorized as cultivated cropland in 2008. The next highest categories of land use were evergreen forest (6,295 acres), pasture/hay (3,084 acres), and deciduous forest (1,706 acres).

LAND USE CATEGORY	ACRES OCCUPIED BY UTILITY-SCALE SOLAR
Cultivated Crops	24,633
Evergreen Forest	6,295
Pasture/Hay	3,084
Deciduous Forest	1,706
Mixed Forest	1,428
Grassland/Herbaceous	1,192
Shrub/Scrub	651
Woody Wetland	540
Developed, Open Space	392
Developed, Low Intensity	278
Barren Land	34
Developed, Medium Intensity	31
Open Water	16
Emergent Herbaceous Wetlands	3
Developed, High Intensity	0.5
TOTAL	**40,284**

Table 3. Land occupied by utility-scale solar installations 1 MW or greater in nameplate capacity by category from 2008 NLCD data

NCSEA also calculated land use totals for the entire state of North Carolina from that same 2008 NLCD land use file.

LAND USE CATEGORY	TOTAL ACRES
Deciduous Forest	6,103,708
Woody Wetland	4,583,597
Cultivated Crops	4,337,847
Evergreen Forest	4,150,557
Mixed Forest	3,241,144
Pasture/Hay	2,511,251
Developed, Open Space	2,265,552
Developed, Low Intensity	1,079,383
Shrub/Scrub	1,024,732
Grassland/Herbaceous	772,049
Open Water	492,115
Developed, Medium Intensity	396,321
Emergent Herbaceous Wetlands	374,962
Developed, High Intensity	137,789
Barren Land	66,608
TOTAL	**31,537,616**

Table 4. Land use categories from 2008 NLCD data for all of North Carolina

Using similar designations from other agricultural land use studies, NCSEA combined the cultivated crops, pasture/hay, and evergreen forest categories to establish an agricultural land use category.

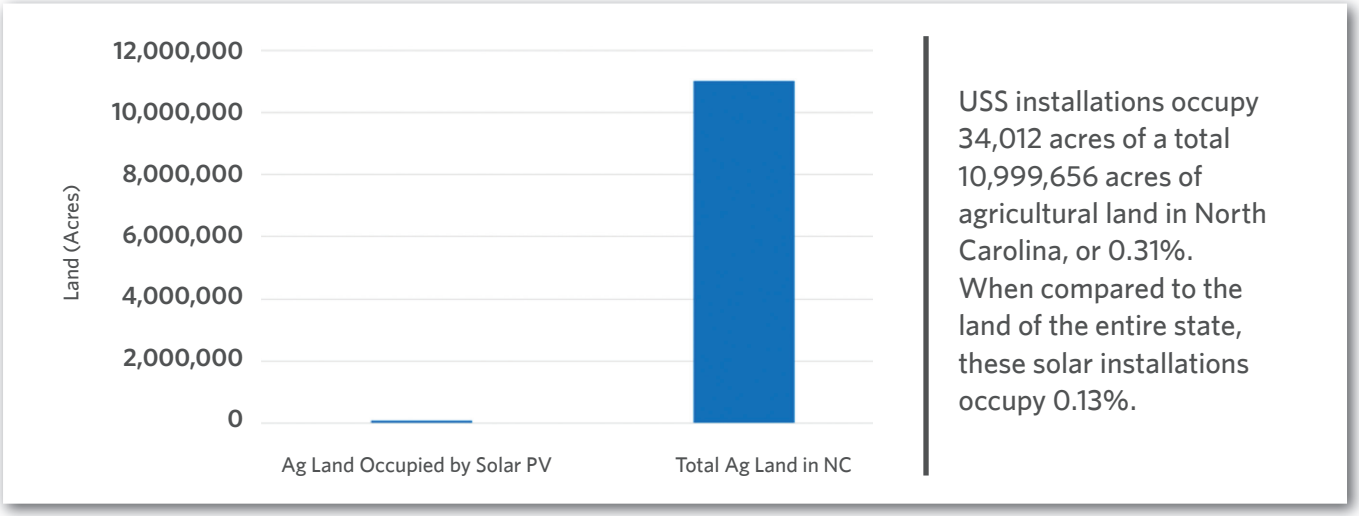


Figure 4. Agricultural land occupied by solar installations and total agricultural land in North Carolina

NCSEA notes that for some of the most recent USS installations, there is not yet satellite imagery available to guide drawings of the solar footprints. For these installations, NCSEA carried out a best-estimate drawing based on imagery and drawings filed at the NC Utilities Commission. In carrying out this process for previous report iterations, we have observed that this has resulted in some adjustments in solar land cover numbers for the subsequent report once the satellite imagery was available and land cover was recalculated.

Discussion

USS installations in some cases do occupy land that was formerly used for agricultural use, although other classifications of development occupy much more. This is conveyed in the above data where only 0.31% of agricultural land is occupied by USS, compared to 4.11% occupied by Developed, Low-Intensity land use and 8.18% by Developed, Open Space land use. According to a study released by the American Farmland Trust in 2024, the state could lose 1.2 million acres of farmland by 2040 with the most cited threat to farmland preservation being urban development, based on interviews with counties throughout the state.[20]

Furthermore, low-density residential development and similar activities have a much more permanent impact on the landscape. USS installations have a typical lifespan of around 25 years, and can then be repowered for further use or decommissioned to return the land to its former use (see Decommissioning section below). The same cannot be said for other types of development.

For instance, this neighborhood in Johnston County has a total footprint of 330 acres, 150 of which are formerly cultivated cropland. This development not only includes homes, but also permanent roadways and utilities servicing the households.

Figure 5. Before (2005) and after (2021) aerial photos of a neighborhood in Johnston County

20. American Farmland Trust. North Carolina Farmland Preservation Comprehensive Report. Accessed July 15, 2025. https://farmlandinfo.org/publications/nc-farmland-preservation-comprehensive-report/.

Highway construction is another significant type of land development, as seen with US 70 and I-795 in Goldsboro, NC.

Figure 6. Before (2000) and after (2021) construction of US 70 Bypass and I-795 in Goldsboro

Responsible Solar Land Use

Native Plants and Pollinators

A key advantage of solar and other clean energy technologies is that its occupation of the land can co-exist with other activities. Ideas for responsible solar land use include restoring native vegetation and grasslands, preventing erosion, placing sheep around the structures for grazing, and refraining from developing locations with high biodiversity.[21] Organizations such as The Nature Conservancy offer general principles when citing and constructing clean energy systems to reduce impact on local ecosystems.[22]

Further, installing USS is an opportunity to develop pollinator areas for organisms integral to the ecosystems such as bees and butterflies. The North Carolina Pollinator Conservation Alliance provides a resource containing guidelines on preparing a solar site, including plant species to consider and creating buffer areas around the solar installations.[23] A number of solar companies in North Carolina have been experimenting with planting pollinator-friendly plants beneath elevated solar structures, including Strata Solar, Cypress Creek Renewables and Pine Gate Renewables.

21. The Nature Conservancy. Making Solar Wildlife-Friendly. Accessed March 11, 2025. https://www.nature.org/en-us/about-us/where-we-work/united-states/north-carolina/stories-in-north-carolina/making-solar-wildlife-friendly/.
22. The Nature Conservancy. Principles of Low-Impact Solar Siting and Design. Accessed Aug. 29, 2025. https://www.nature.org/content/dam/tnc/nature/en/documents/2023SolarGuidanceTNCNC.pdf.
23. North Carolina Pollinator Conservation Alliance. North Carolina Technical Guidance for Native Planting on Solar Sites. Accessed on March 11, 2025. https://ncpollinatoralliance.org/wp-content/uploads/2022/06/NC-Solar-Technical-Guidance-FINAL-May-2022.pdf.

Decommissioning

USS installations generally have a lifespan of around 25 years, although they can continue to generate power after this time at a reduced efficiency. With USS having minimal permanent environmental impact when properly operated, often the land can then be turned back to other uses.

In North Carolina, the Division of Waste Management administers and enforces the decommissioning and financial assurance requirements for USS installations. The state enacted rules that took place April 1, 2025. According to the state website,[24] below are the summarized requirements for owners of USS installations that are capable of generating 2 MW directly and are connected to the electrical grid.

- Properly decommission the project upon cessation of operations and restore the property.
- Register with the North Carolina Dept. of Environmental Quality (NCDEQ) and pay a fee.
- Submit a decommissioning plan and establish financial assurance for new and rebuilt/expanded utility-scale solar projects.
- In addition to complying with the requirements in state law, the utility-scale solar project must comply with any applicable state rules as well as landowner and local government requirements that are more stringent than state law/rules.

24. N.C. Dept. of Environmental Quality. Utility-Scale Solar Project Decommissioning Program. Accessed on July 11, 2025. https://www.deq.nc.gov/about/divisions/waste-management/utility-scale-solar-project-decommissioning-program#BackgroundandRulemakingHistory-13173.