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Utility-Scale Solar and Wind Development in Rural Areas: Land Cover Change (2009–20)

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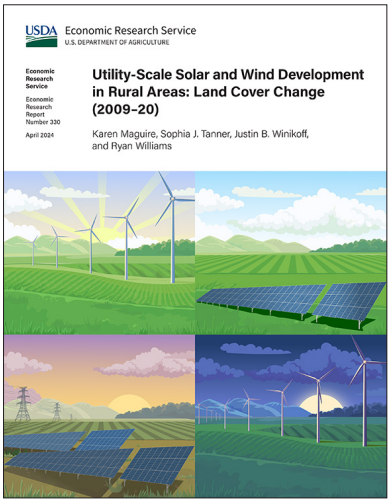
What Is the Issue?



Federal policies to reduce greenhouse gas (GHG) emissions from electricity generation, including the Inflation Reduction Act of 2022, are projected to lead to growth in renewable energy capacity. Although the amount of land directly affected by a solar or wind farm is small (relative to the amount of farmland), large-scale, commercial solar and wind development leads to changes in the rural landscape. There are local community concerns regarding the effects of solar and wind development on agricultural land use, property values, and the environment. Local community resistance to renewable development can delay or prevent development in a particular area, increasing the costs of deploying solar and wind. Information on the types of land used for solar and wind development and land cover change associated with it may benefit stakeholders and reduce uncertainty for individuals and communities considering hosting solar or wind.

What Did the Study Find?

This study examines land cover surrounding rural solar and wind installation sites from 2009–20. It explores regional patterns in the distribution of land cover and estimates the amount of land directly affected by development. Finally, the report examines land cover changes associated with solar and wind projects.

- In rural areas, in 2020, the footprint, or land area directly affected by solar or wind farms, is small relative to the approximately 897 million acres of land in farms. The estimated footprint for solar and wind farms was 336,000 acres and 88,000 acres, respectively.

Land cover prior to solar and wind farm development:

- Most solar farms were installed on land that was in cropland (43 percent) or pasture-rangeland (21 percent) prior to development.
- Wind turbines were predominantly installed on land that was classified as cropland (56 percent) and pasture-rangeland (36 percent).

- Solar projects were more commonly installed on nonagricultural land (17 percent) than wind turbines (3 percent).
- In the Midwest, 66 percent of solar farm sites were characterized as cropland prior to installation. In the Plains and the West, most solar sites were pasture-rangeland (60 percent and 51 percent, respectively).
- In the Midwest, 93 percent of wind turbine sites were classified as cropland prior to installation. In the Plains, 45 percent of turbine sites were pasture-rangeland, and in the West, 65 percent.

Average annual rate of land cover change on land used for a solar or wind installation site:

- On average, 16 percent of all solar sites experienced a year-to-year land cover change. For turbine sites, the share was 4 percent.
- The average annual rate of land cover change was largely unchanged after solar and wind development.

Land cover change in proximity to a solar or wind development, from 3 years before to 3 years after installation:

- Land cover changed at 26 percent of solar sites but only 5 percent of wind sites. Fifteen percent of solar sites shifted out of agriculture after installation; for wind, it was less than 1 percent.
- Typically, solar sites that were categorized as cropland prior to installation remained in the same land cover category after installation (82 percent). For wind turbines, the share was 99 percent.
- Seventy-three percent of solar sites and 92 percent of wind turbine sites that were categorized as pasture-range prior to development maintained the same land cover category after development.
- For sites categorized as continuous cropland prior to installation, a higher share of solar sites (36 percent) was fallow (uncultivated) in at least 1 of the 3 years after installation, compared to wind (7 percent).

How Was the Study Conducted?

This study used data from Federal sources to examine land cover and land cover change associated with solar and wind development from 2009–20 in rural areas of the contiguous United States. Data on solar projects were collected from the U.S. Department of Energy, Energy Information Administration (EIA) Form 860 (EIA-860) and for wind projects, from the U.S. Wind Turbine Database (USWTDB) (Hoen et al., 2018; EIA-860, 2021). The USDA Agricultural Resource Management Survey (ARMS) III farm production expenditure regions delineate five geographic regions for analysis (USDA, National Agricultural Statistics Service (NASS), 2022a). Information from the Major Uses of Land in the United States, 2012 is used to describe land cover (Bigelow & Borchers, 2017). Rural areas are defined using the 2019 U.S. Department of Commerce, Bureau of the Census Topologically Integrated Geographic Encoding and Referencing (TIGER)/Line Shapefiles (U.S. Census Bureau, 2010 and 2019). Land cover and land cover change were measured using the USDA National Agricultural Statistics Service (NASS) Cropland Data Layer (CDL) from 2009–20 (USDA, NASS, 2009–20).