CONSERVATION INNOVATION CENTER
CHESAPEAKE CONSERVANCY

Chesapeake Conservancy

Solar growth in the Chesapeake watershed

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Nature Plus

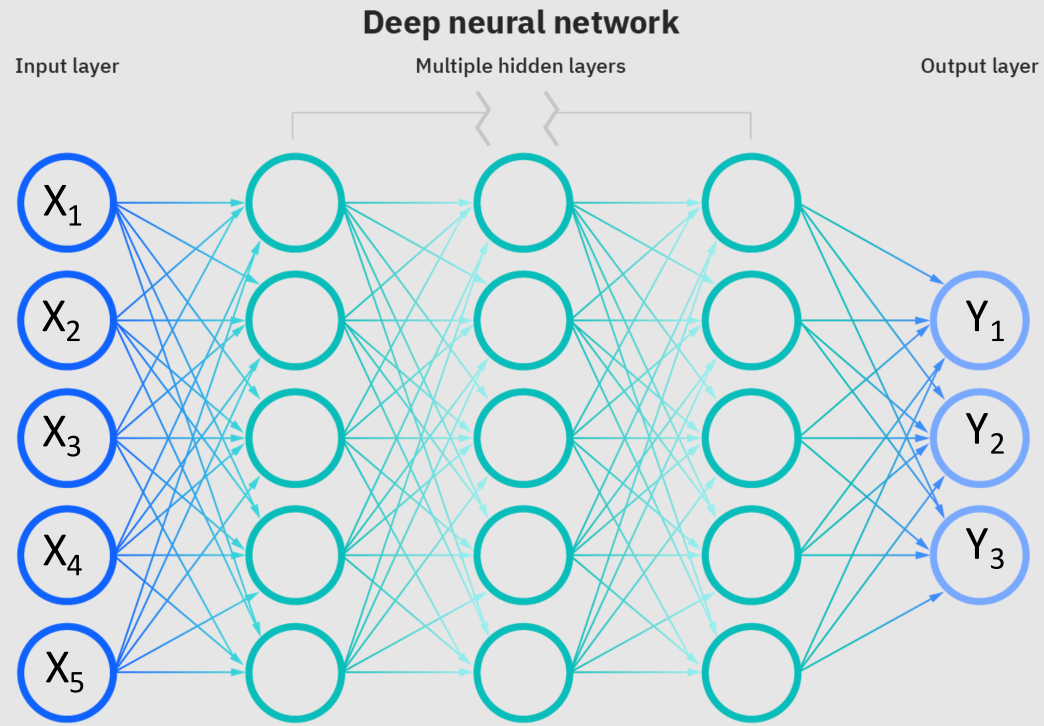
Objectives

1. Map solar arrays with AI
2. Quantify land use transitions
3. Predict future trends

Remote Sensing

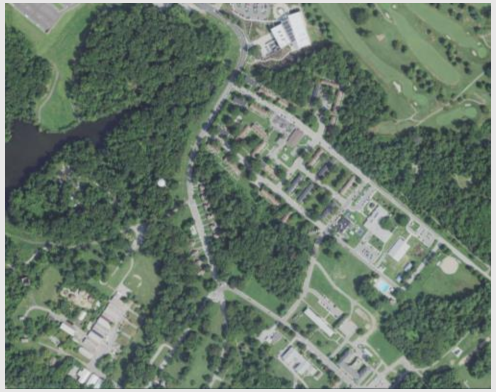
1. Data about Earth's surface
2. Collected by satellite or plane
3. Can have multiple 'bands'
4. Many types of data (radar, lidar, etc.)

Deep Learning (AI)



Great at accommodating non-linearities, conditionality, complex interactions

Image Segmentation with U-Net



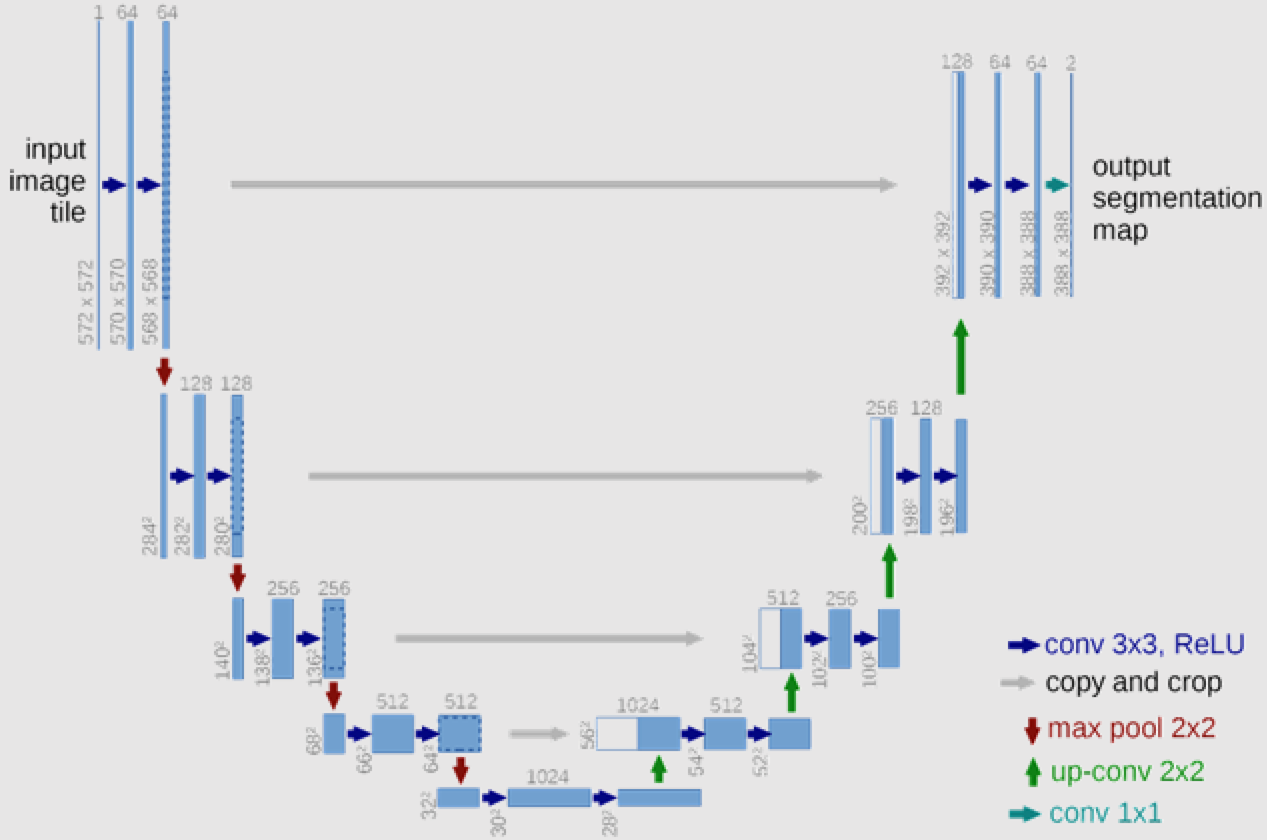
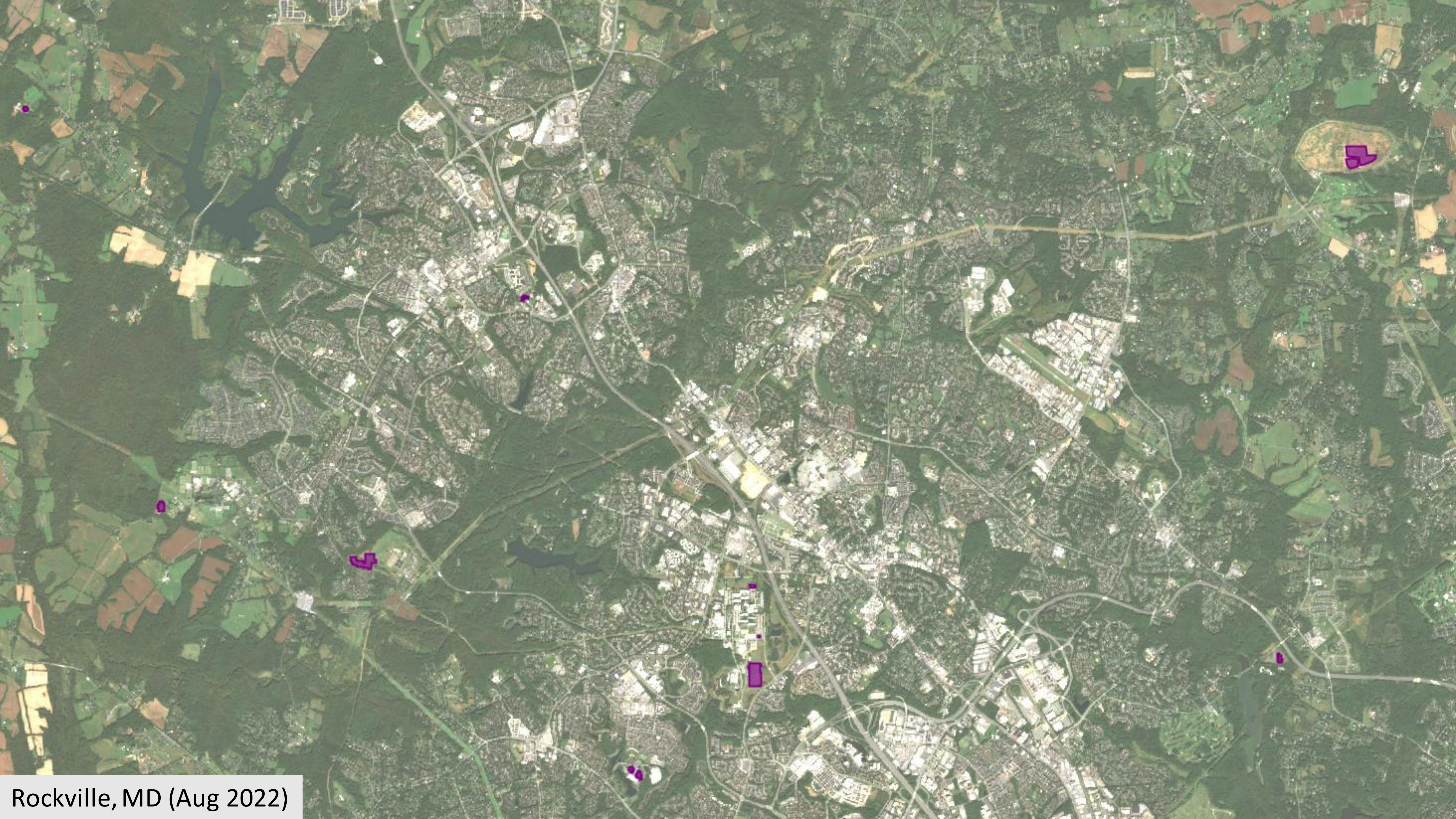
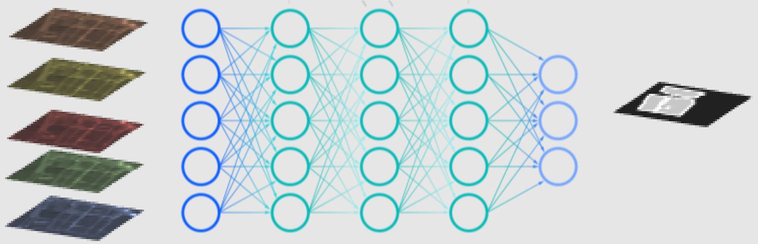


Fig. 1. U-net architecture (example for 32x32 pixels in the lowest resolution). Each blue box corresponds to a multi-channel feature map. The number of channels is denoted on top of the box. The x-y-size is provided at the lower left edge of the box. White boxes represent copied feature maps. The arrows denote the different operations.

Ronneberger et al. 2015


Rockville, MD (Aug 2022)

Mapping solar



Recall: 90.2%

Precision: 90.1%

IoU: 85.6%

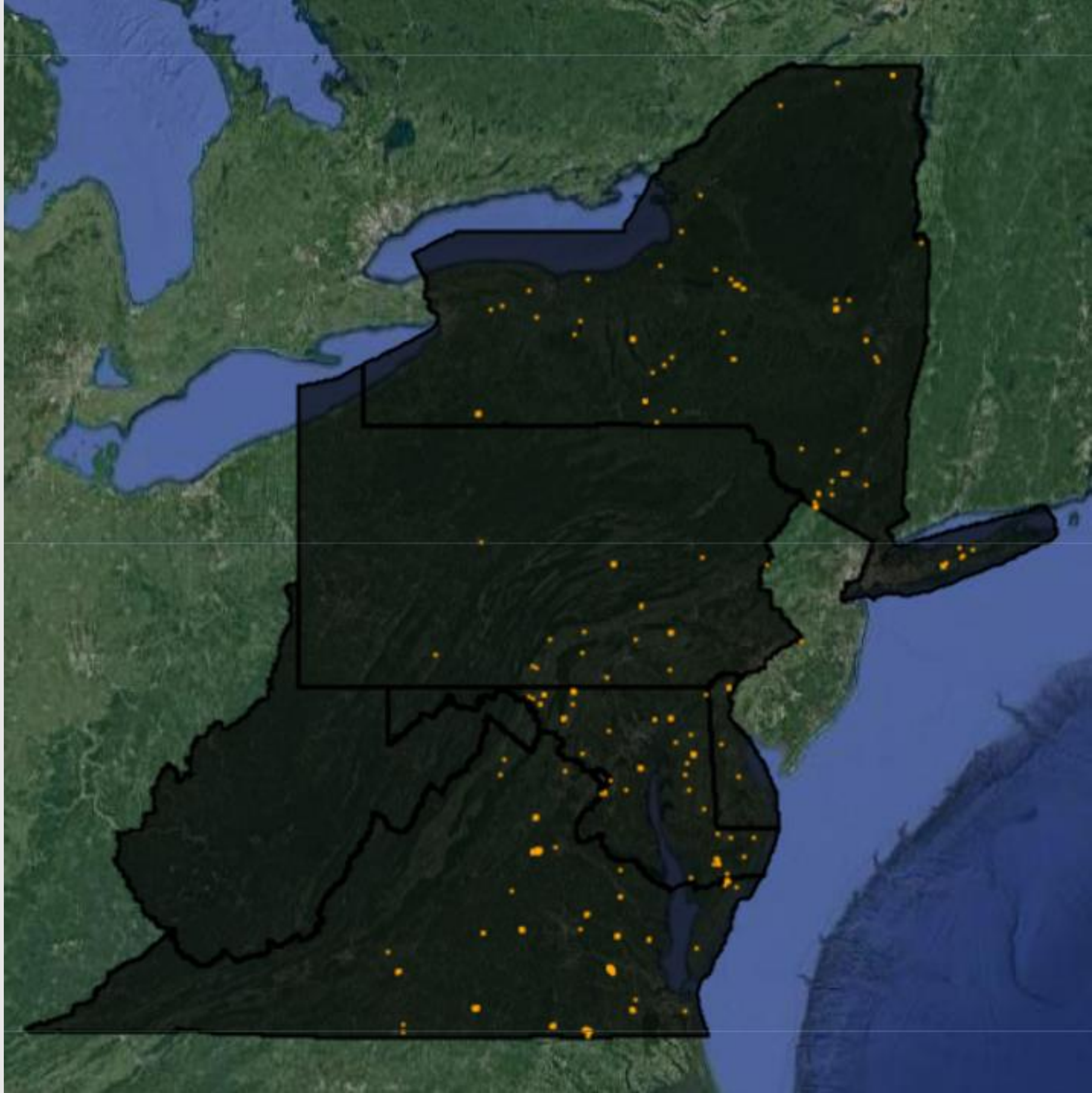
Map all solar arrays in DC, DE, MD, PA, NY, VA, WV

Each year from 2017 - 2021

By 2021:

958 arrays detected*

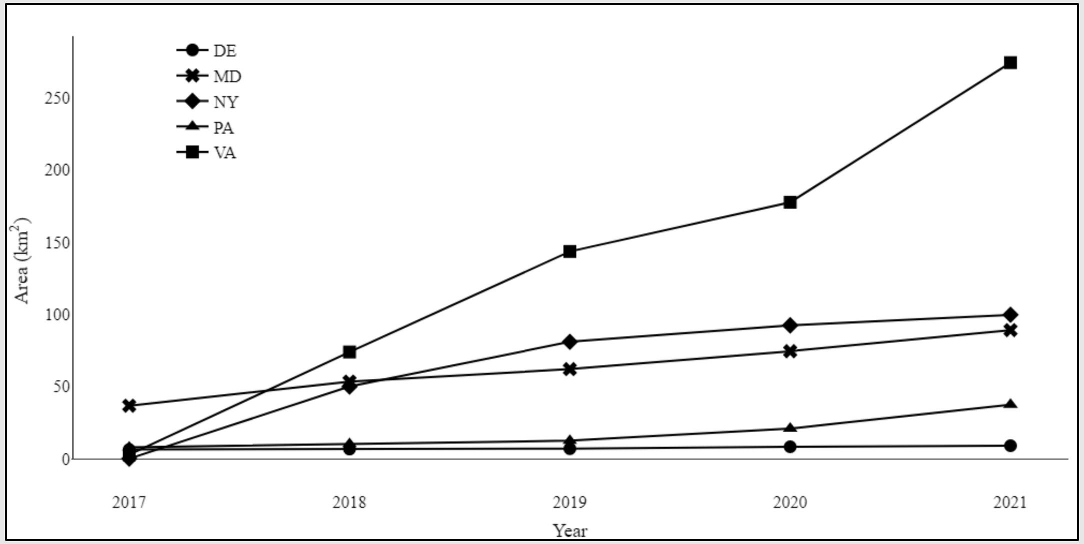
52.3 km²

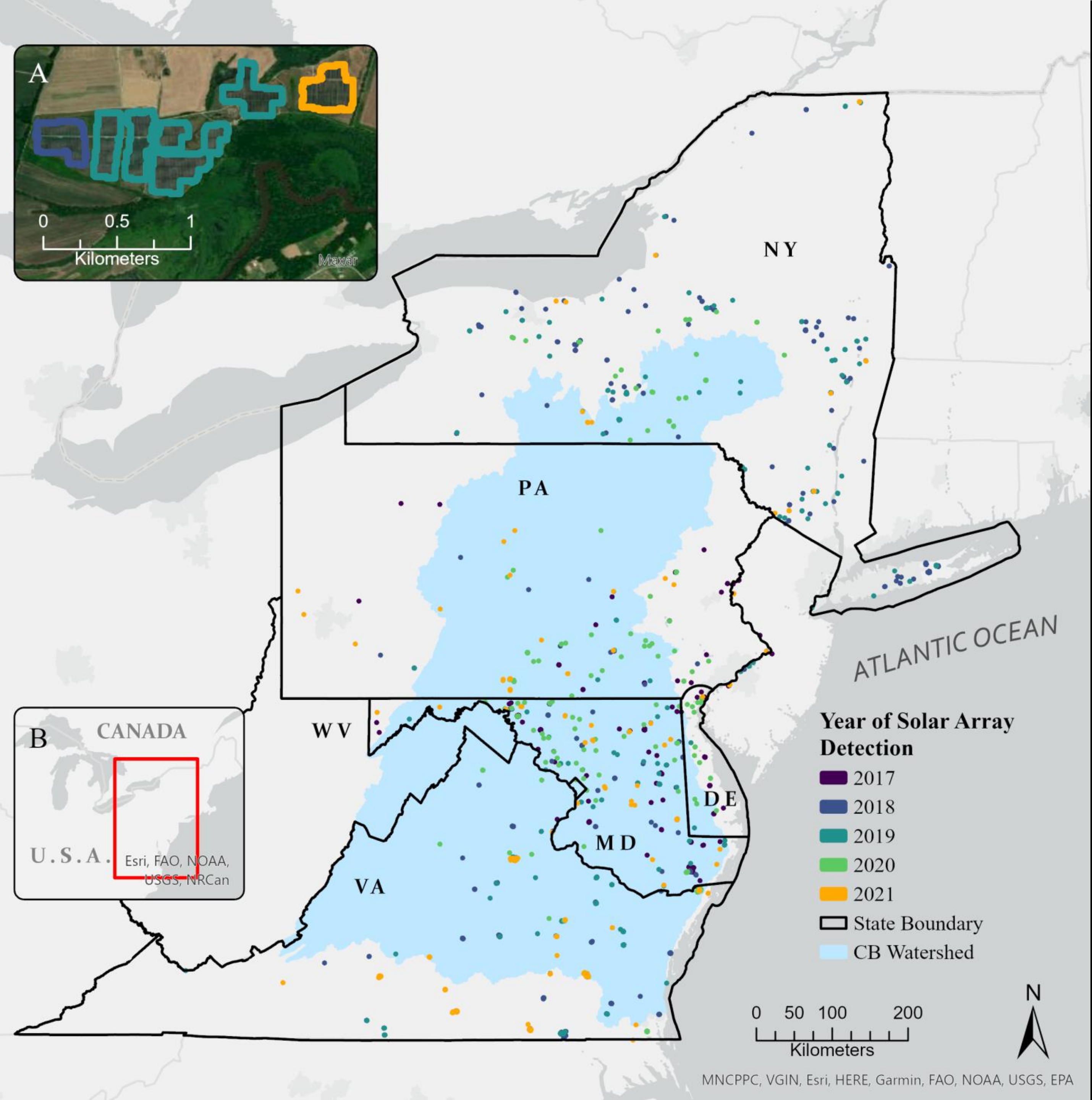


Mapping solar

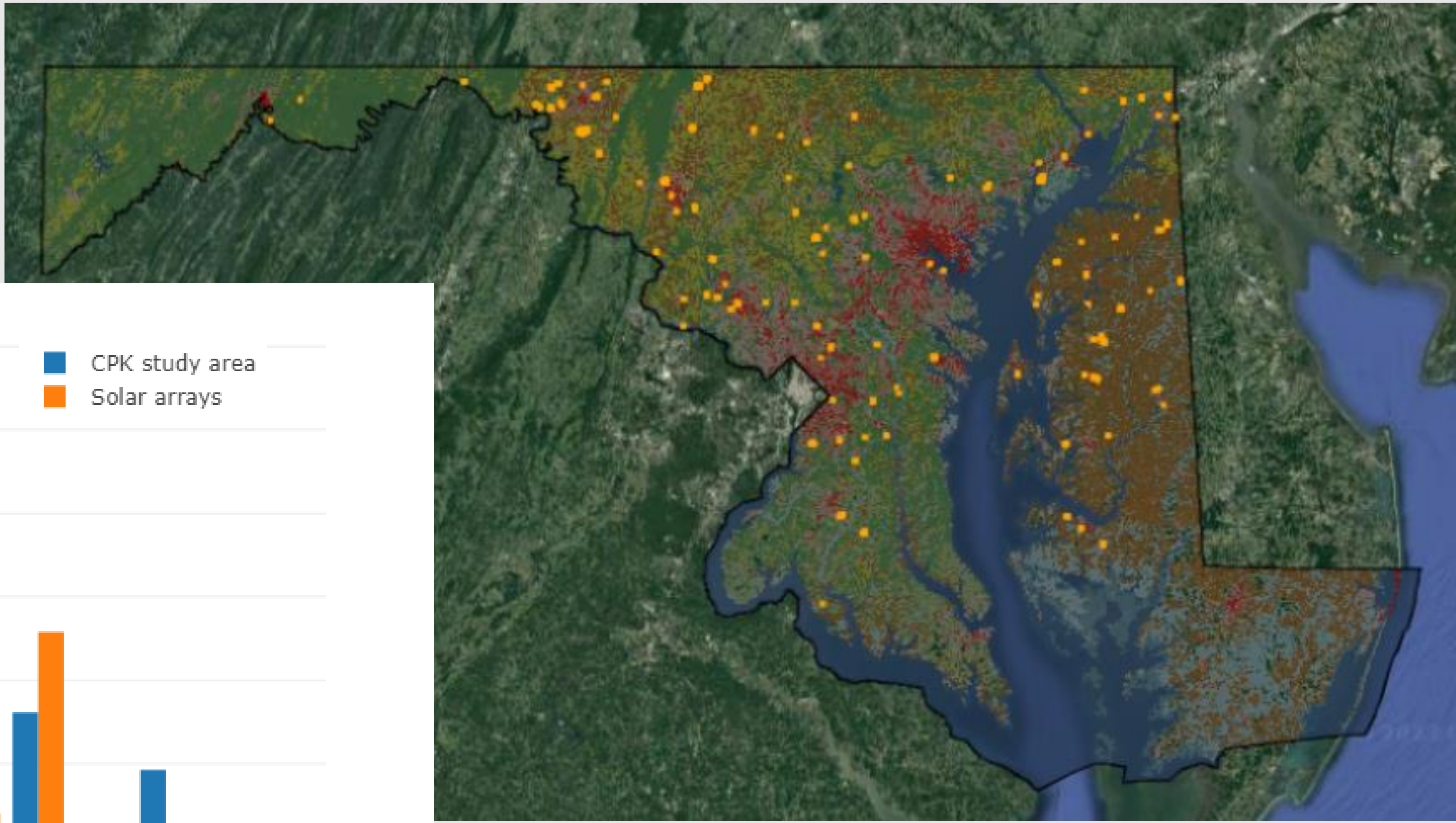
2017 - 2021

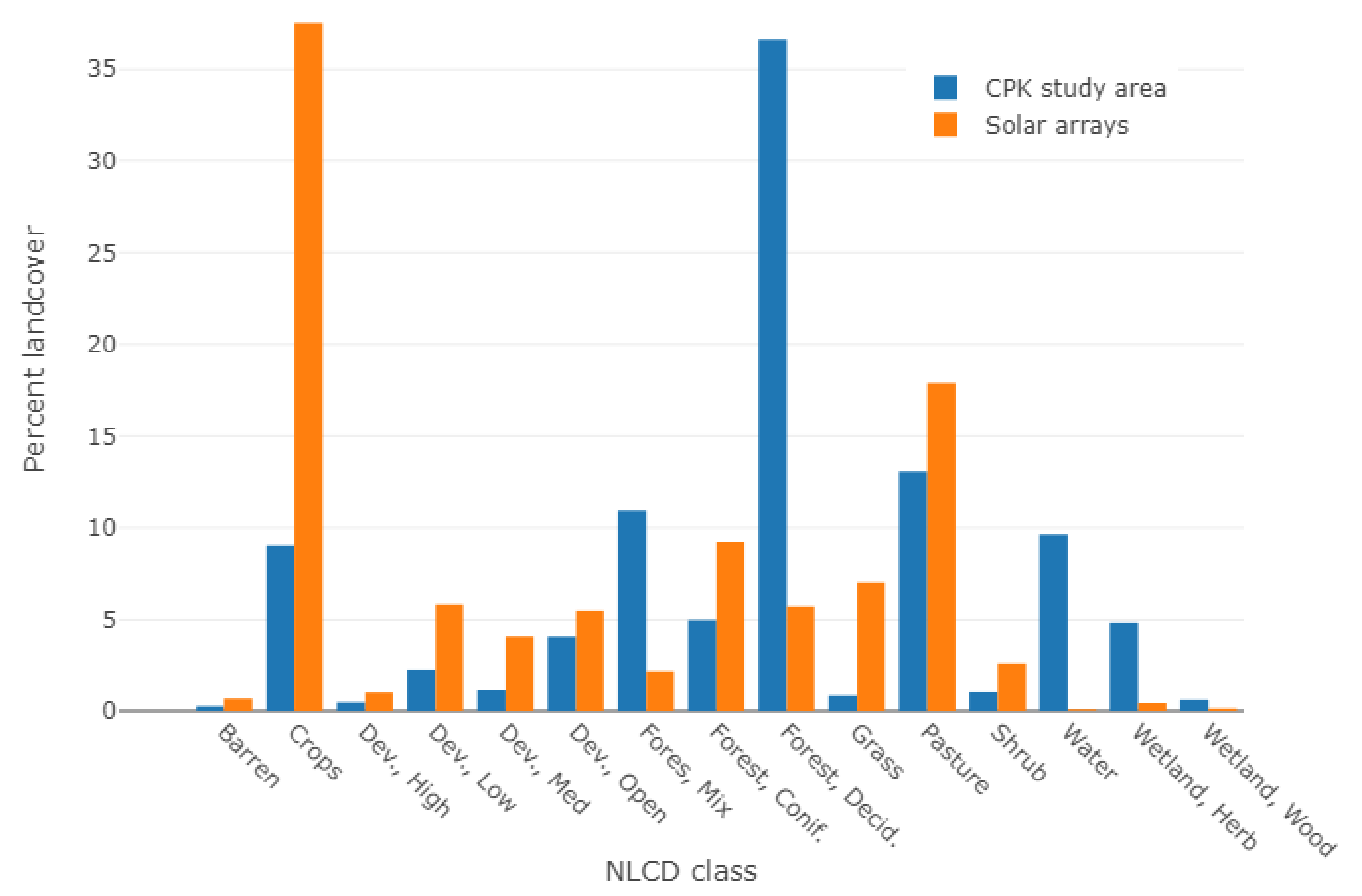
State	Area (%)	Rate of increase
DE	0.9 (1.79E-04)	1.40 ± 0.34E-03
MD	8.9 (3.54E-04)	**5.00 ± 0.34E-03**
NY	9.9 (0.82E-04)	1.33 ± 0.48E-03
PA	3.7 (0.32E-04)	0.61 ± 0.34E-03
VA	27.4 (2.69E-04)	**6.27 ± 0.34E-03**





Land cover transitions



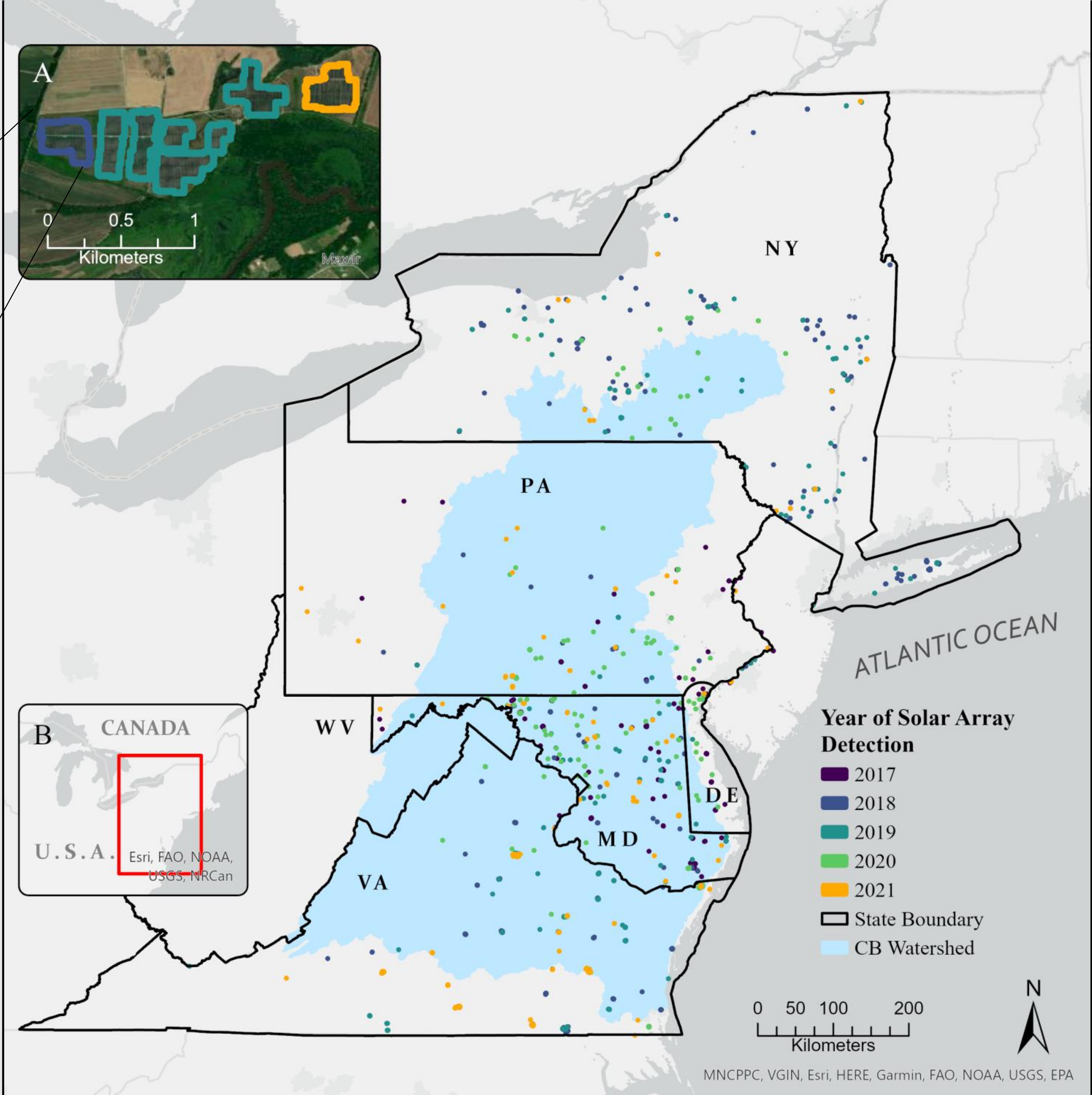


Land cover transitions

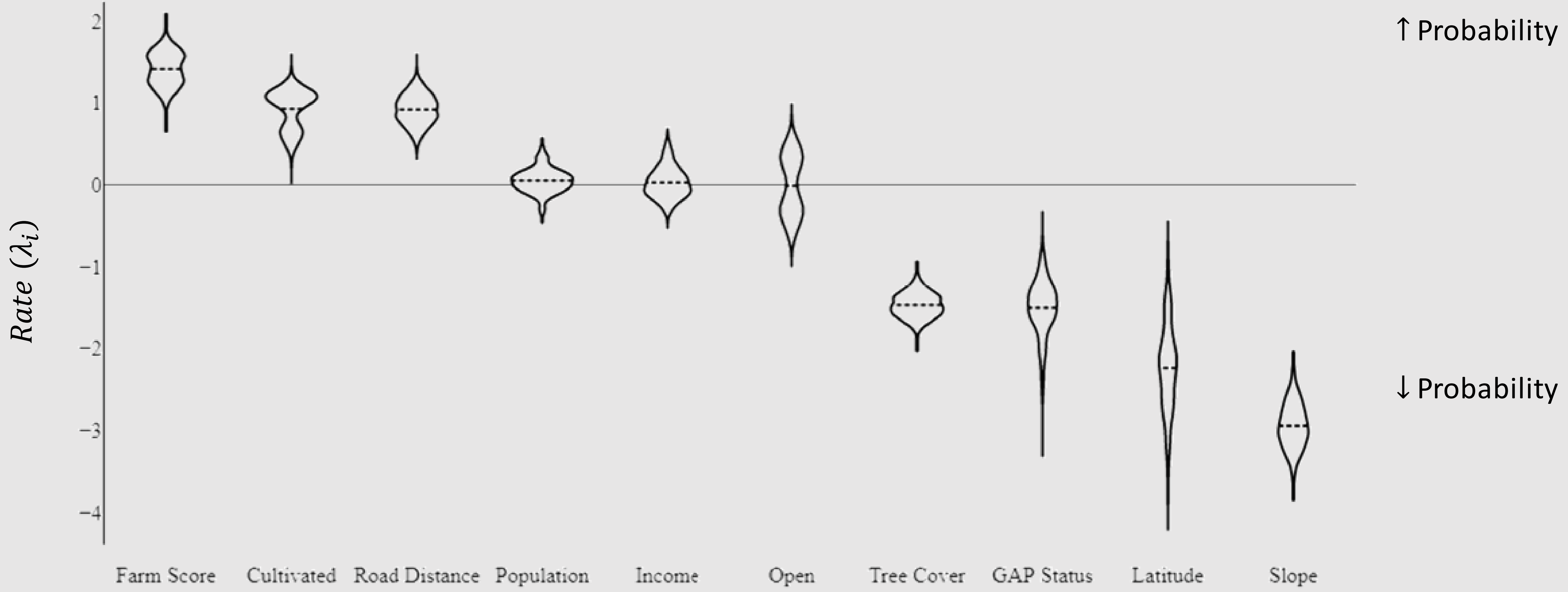
Predicting solar development

d_i = solar developed?
$y_i | d_i$ = years to development

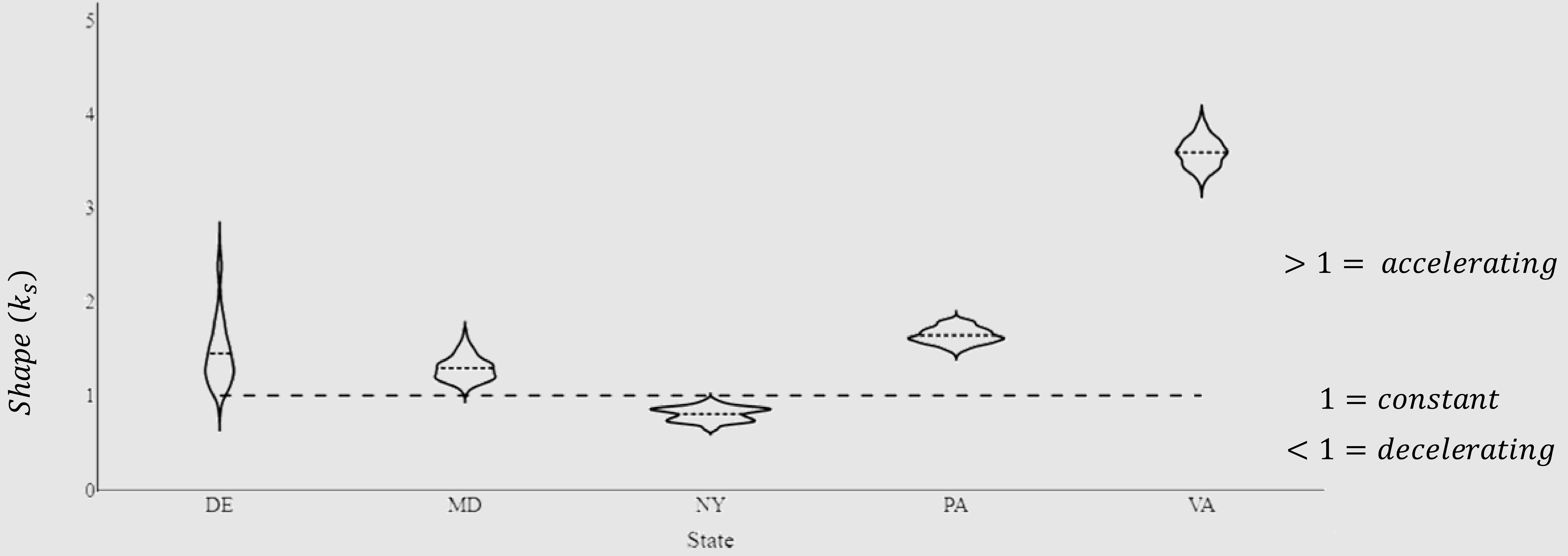
- Impervious surface
- Tree cover
- Open space
- Cultivated
- Farm Score
- Distance to Transmission
- Distance to Road
- Population
- Income
- GAP Status
- Slope
- Latitude



Predicting solar development

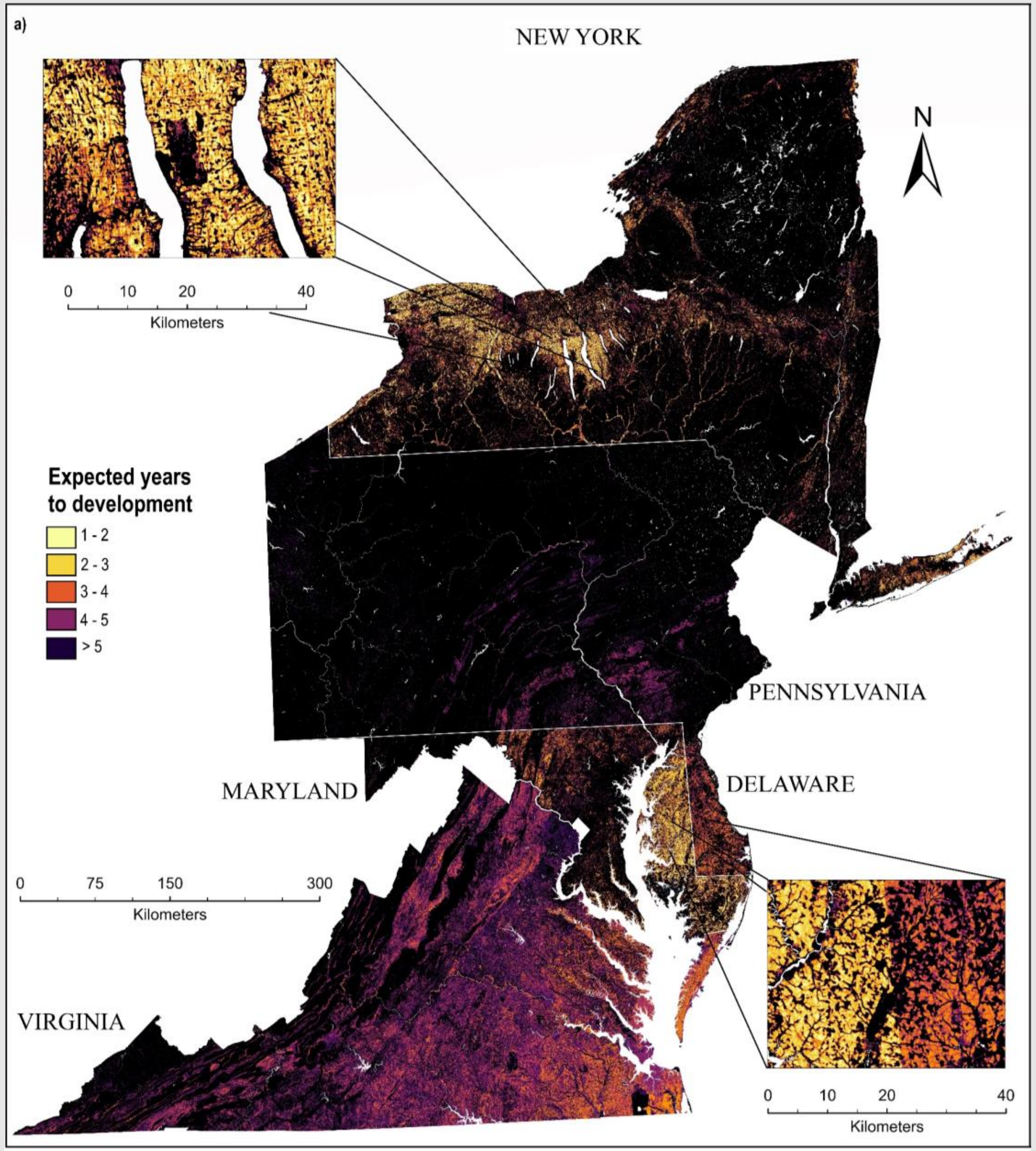


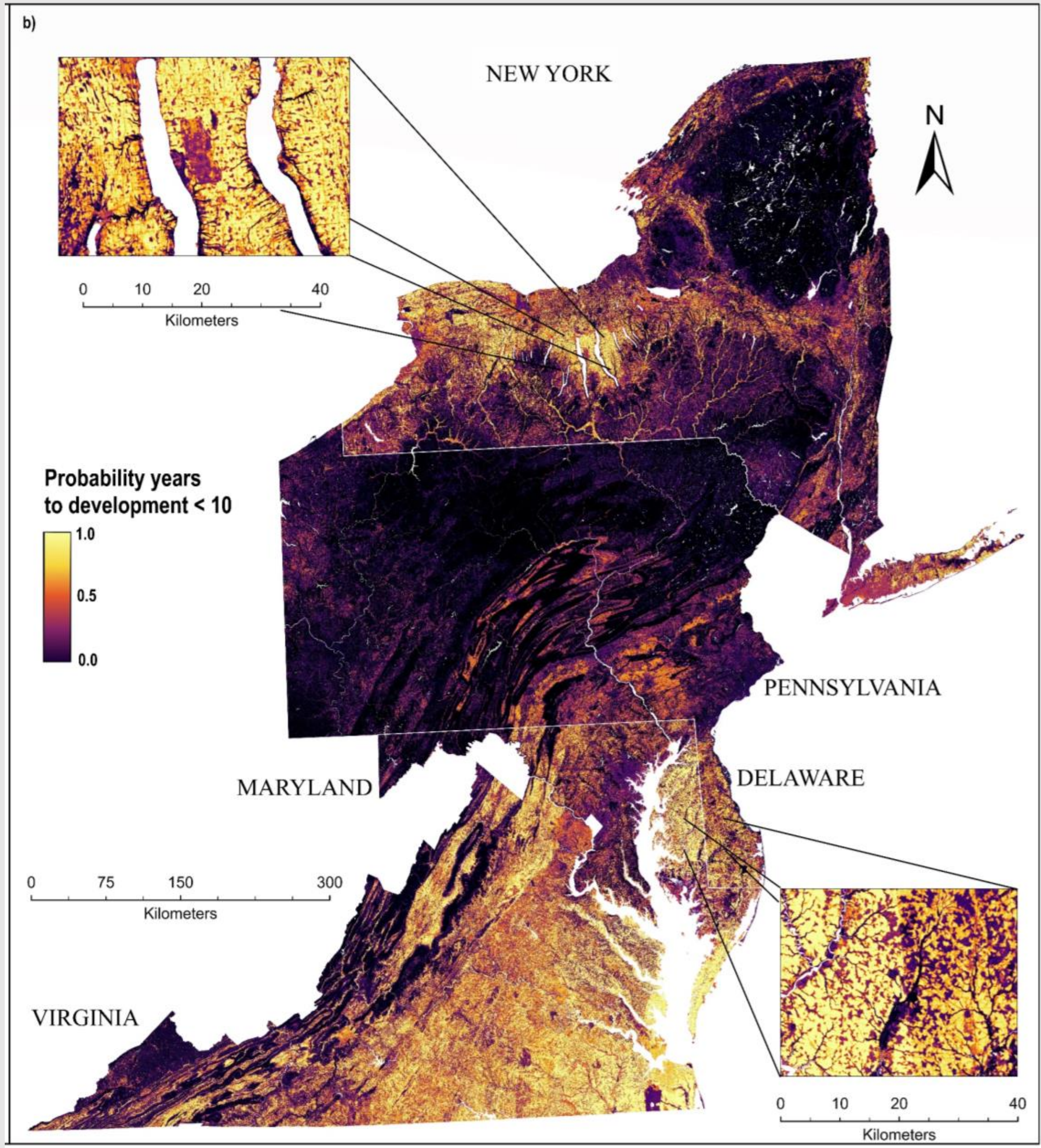
Predicting solar development



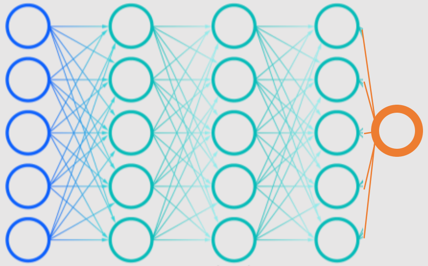
Predicting solar development

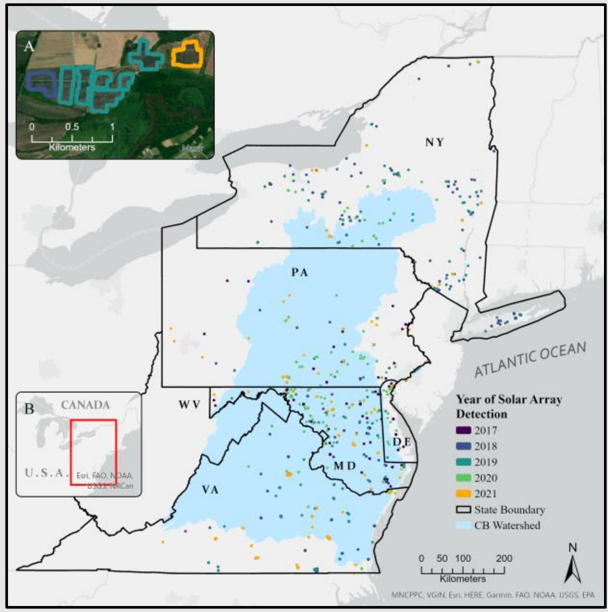
https://cicapps.org/ches-bay-solar/



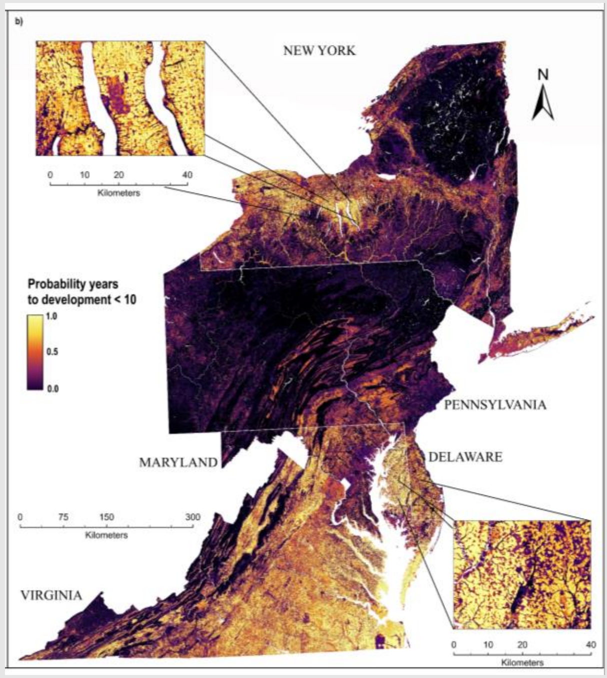


Next Steps





1. System for automatically producing updated maps
2. Incorporate grid capacity data
3. Anticipate most and least likely places for future buildout
4. Opportunities for restoration if we're intentional?



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EXPLORE. CONSERVE. INNOVATE.

Optimal Solar Siting for Maryland & Nature Positive Solar

Susan Minnemeyer, Environmental Consultant
Nature Plus

Land use conflicts

Competes with desirable land uses

Prime farmland loss removes the best land from food production

Loss of forest and important lands for wildlife and climate

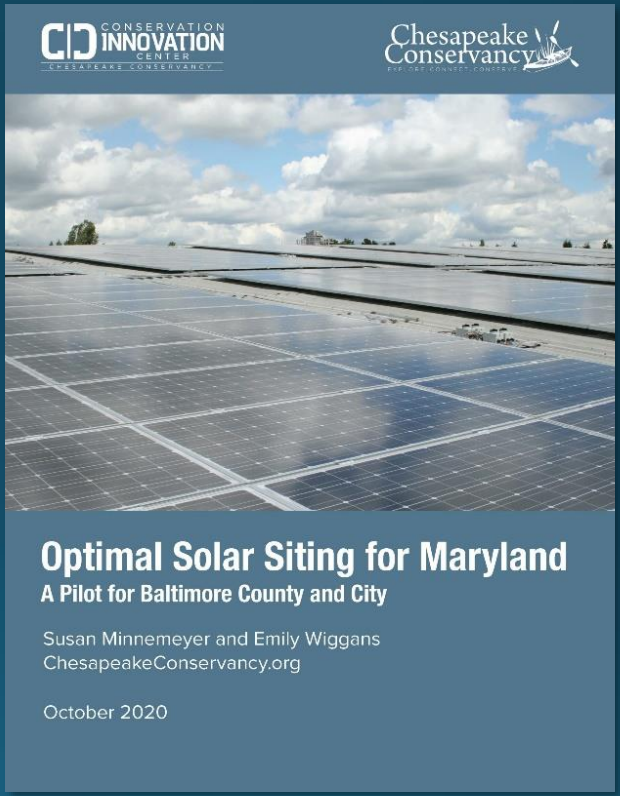
Solar Siting

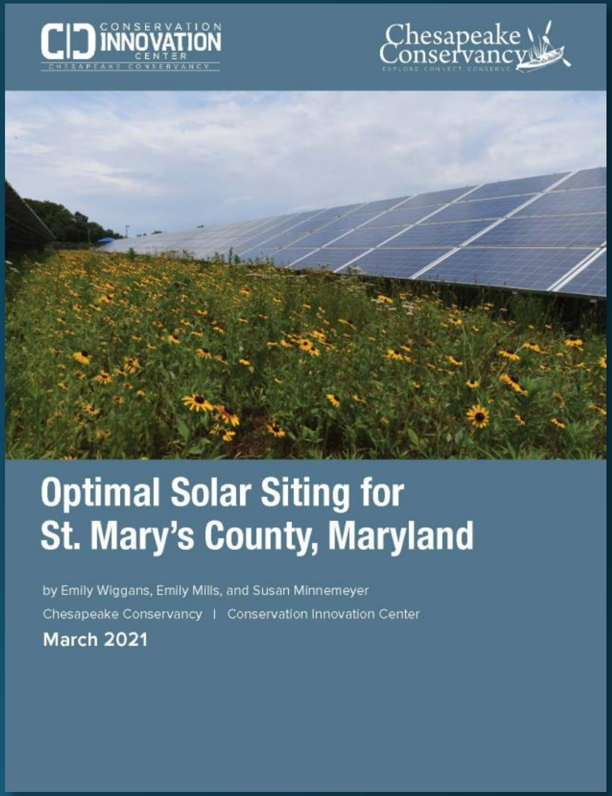
Optimal solar siting

Principles

- Solar energy expansion is required
- Optimal siting can reduce tradeoffs
- Equitable distribution of benefits
- Policies and incentives to guide solar to preferred sites

Key question: Are optimal sites sufficient to meet renewable energy goals ?





Recommendations

- Degraded lands offer a significant contribution to optimal solar siting
- Brownfield opportunities: Landfills, Industrial sites, coal energy transition
- Provide incentives & policies to encourage solar development on brownfields
  Lead by example on public facilities

Annapolis Solar Park

Largest closed landfill project in North America - 80 acres – 18MW

Source: EDF Renewables

Nature Positive Solar Concept

Nature positive solar implements additional measures to generate environmental benefit:

- Site Selection
- Construction and Vegetation Management Best Practices
- On-site Conservation Practices
- Wetland Restoration
- Conservation & Future Land Use

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Questions?

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