Geospatial assessment of the economic opportunity for reforestation in Maryland, USA

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Science Questions

- What is the economic opportunity for reforestation in Maryland?
- How can NASA CMS products be used to help quantify this opportunity at high spatial resolutions?
- How does carbon price and rental rate influence the amount of cropland area that becomes outcompeted by expected forest carbon revenue?

Method

- Utilizes NASA-CMS forest carbon growth trajectories (Hurtt et al. 2019).
- Annual forest carbon rental revenue calculated for each 90m by multiplying AGB by a given carbon price and rental rate. Baseline rental model is $20 USD / Mg C and 5% rental rate – consistent with recent trading prices.
- Annual cropland profit is equal to crop revenue minus production costs, plus crop subsidies. Profit is assessed for corn, soy, and wheat using data from USDA NASS, EWG, and UMD Extension Field Crop Budgets.
- Sensitivity of competition is tested using multiple carbon rental and crop pricing scenarios. Baseline crop pricing is decadal average for all three crops.

Result/ Significance

- Under the baseline scenario, nearly a quarter of all cropland is immediately outcompeted by forest carbon revenue; carbon stored is 3.4% of the remaining carbon sequestration potential in the state but 16 times that currently committed in the Maryland Greenhouse Gas Reduction Act plan.
- Changing the rental scenario does impact overall competition suggesting strategic selection of competitive rental scenario could anticipate portion of outcompeted lands and carbon sequestered for the cost.

Economically Outcompeted Cropland

For each year between 2011 and 2100, we compared the cumulative forest carbon revenue of every 90 m pixel against the cumulative cropland profit expected on that same pixel. Outcompeted cropland occurs when cumulative forest carbon revenue exceeds expected cropland profit (*Figure 1*).
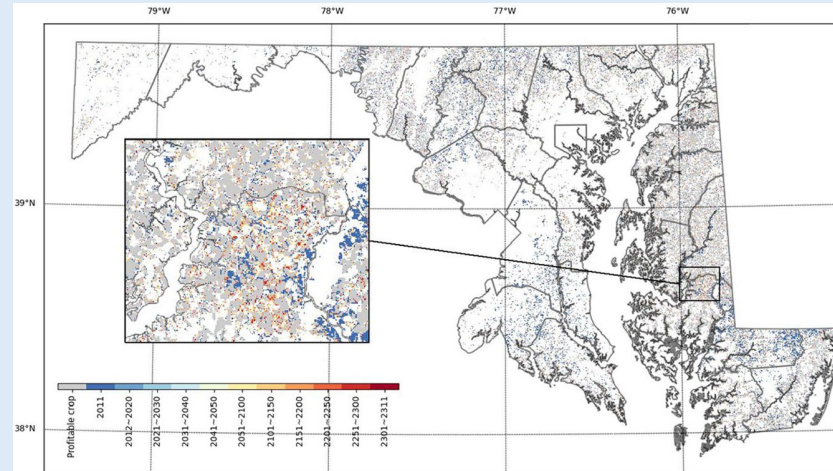

Figure 1: Spatial distribution of outcompeted cropland under the baseline economic scenario. Dark blue areas show where cropland is immediately outcompeted. Gray areas highlight cropland areas that remain profitable. All other colored areas respectively represent the decade within which forest carbon revenue exceeds expected crop profit.

Under the baseline scenario, an annual allocation of $5.8 million towards a carbon rental program could protect 6.93 Tg C on outcompeted cropland (*Figure 2*, red boxes on right panel).