Remote Sensing for Forest Dynamics and Its Implications for Tree Outside Forest over Maryland, U.S.A.

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Objectives

- Estimate the forest extent, tree cover, and tree dynamics in Maryland, U.S.A
- Explore the consistency among high and medium resolution remote sensing forest datasets

Data and Methods

Dataset	Spatial Resolution	Temporal Resolution	Data Type	Source
CMS[1]	1-m	One-time	Tree cover	Abn. Lidar + NAIP[2]
GFW[3]	30-m	Annual	Forest Cover	Landsat
NAFD[4]	30-m	Annual	Forest Cover	Landsat
NLCD[5]	30-m	Every 2-3 years	Land Cover	Landsat

- Forest Extent Analysis
  - Tree cover to forest extent conversion using a 30% threshold
- Tree Cover Analysis
  - Tree outside forest (TOF) as tree cover detected by CMS but as non-forest in NAFD, GFW, and NLCD
- Forest Disturbance Analysis
  - Only NAFD, GFW, and NLCD involved
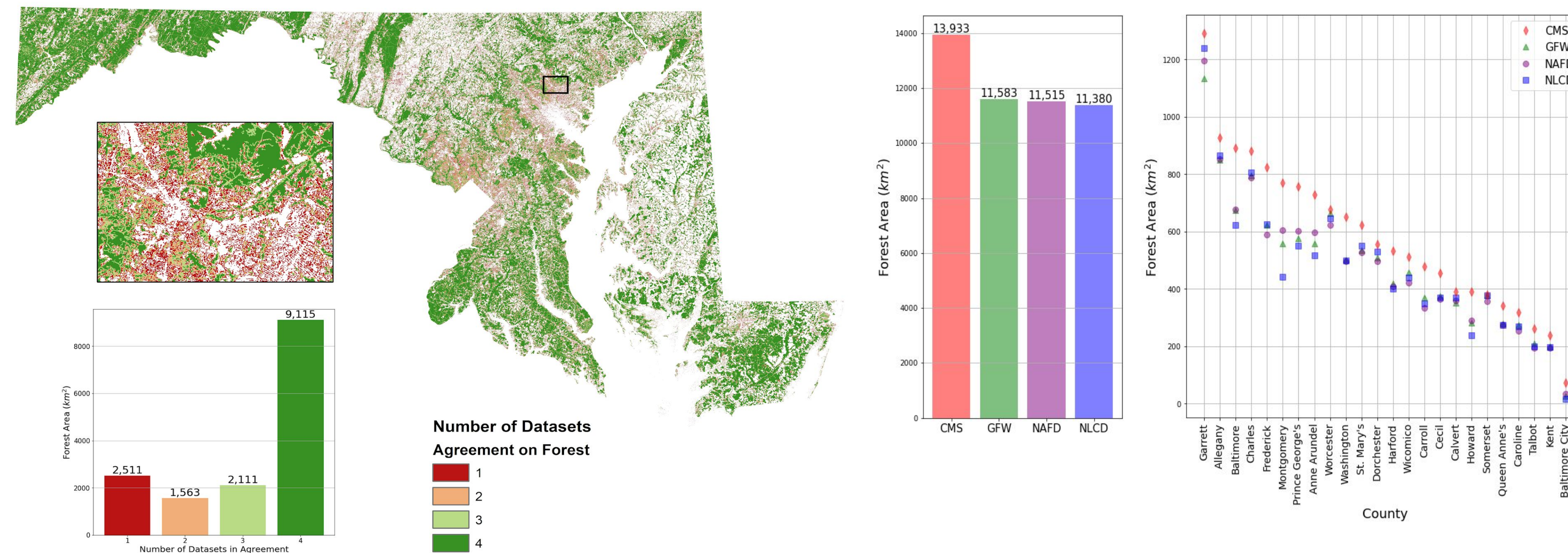 - Ten-years cumulative disturbance rates calculated

Footnotes:
1. Carbon Monitoring System
2. National Agriculture Imagery Program
3. Global Forest Watch
4. North American Forest Dynamics
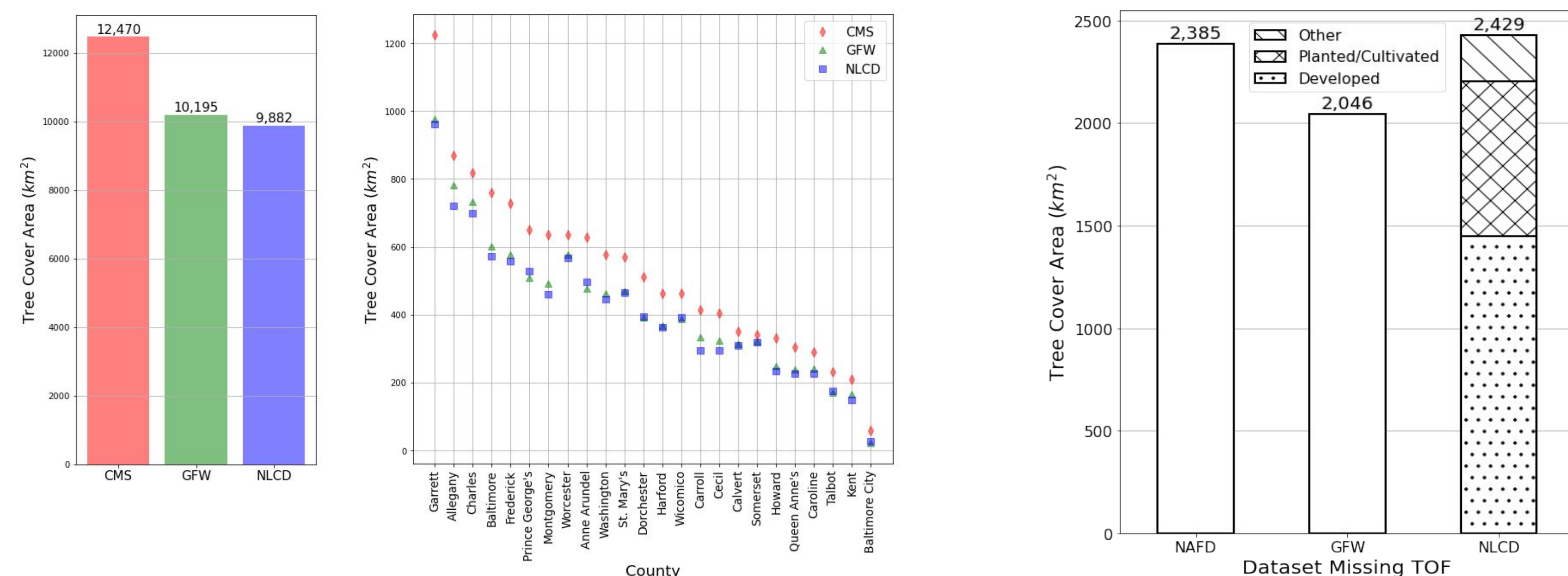5. National Land Cover Databases

Results

Forest Extent Analysis

- CMS, GFW, NAFD, NLCD agree on most forest extent
- CMS captures more forest area than GFW, NAFD, and NLCD
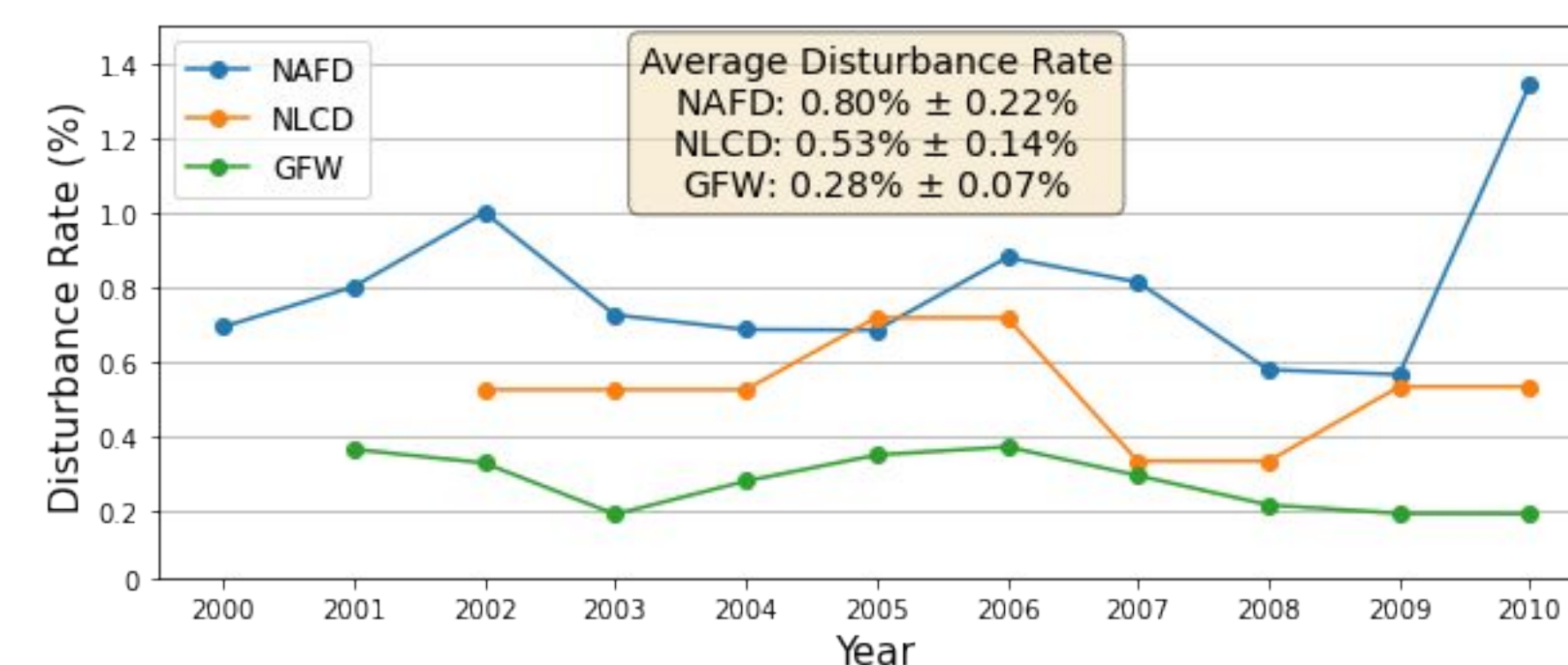

Tree Cover Analysis

- CMS detects more tree cover area than GFW or NLCD at both state and county levels
- The missed TOF mostly occur in agricultural and developed areas

Forest Disturbance Analysis

- NAFD disturbance rate is about three times higher than the GFW disturbance rate

Average Disturbance Rate
NAFD: 0.80% ± 0.22%
NLCD: 0.53% ± 0.14%
GFW: 0.28% ± 0.07%

Key Finding

The lidar-derived 1-m resolution dataset captures about 2,000 km² TOF area that is not included in the Landsat-based 30-m resolution datasets, but the dynamics of the TOF remain unknown.

Conclusion

- CMS detects 20% more forest and tree area than GFW, NAFD, and NLCD.
- GFW, NAFD, and NLCD have comparable forest and tree cover areas, but disagree on forest disturbance.
- The spatial resolution of the sensor is more influential than the algorithm regarding forest and tree cover detection.
- Future efforts are needed to Develop a high spatial and temporal products for comprehensive tree cover detection

Additional Information

- Future Work
  - Integrate the datasets with models to determine the consequences for carbon
  - Expand the study area