



Improving Urban Ecosystem Accounts in the United States Through Hyperparameterized Machine Learning

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November 30, 2022

Denver, CO

Status of Tree Canopy Data

U.S. National Land Cover Database 30 m (NLCD)

- Only available nation-wide product
- US Ecosystem Accounts (EA) rely on NLCD

High resolution Land Cover Data (1m)

- Better at capturing Tree Canopy Cover (TCC) in urban areas
- Only available for select cities

Underestimation of EA

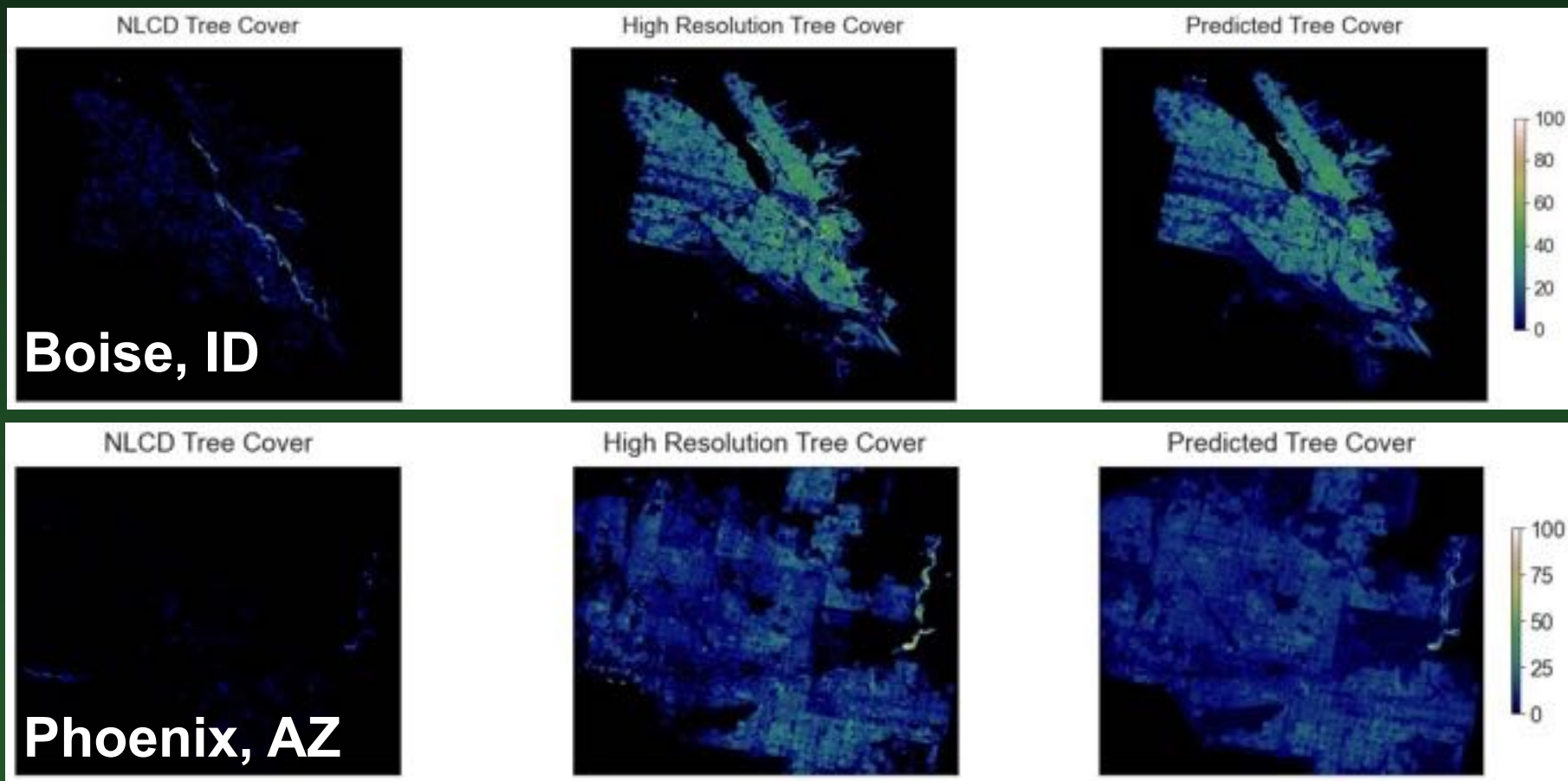
Ecosystem Accounting Area (EAA)	Ecosystem Service	Tree Cover Dataset (as the input)	Ecosystem types (Land cover)																% of High-Resolution Results
			Open Water	Developed - Open	Developed - Low	Developed - Medium	Developed - High	Barren	Deciduous Forest	Evergreen Forest	Mixed Forest	Scrub/ Shrub	Grassland/Herbaceous	Pasture/ Hay	Cultivated Crops	Woody Wetlands	Emergent Herbaceous Wetlands	Total	
Denver, CO	Intercepted water (1000 m ³)	Native NLCD-TC 2011	0	174	516	143	20	0	1	0	0	1	3	0	5	24	1	887	5%
		Corrected NLCD-TC	0	265	1,450	287	62	0	5	1	0	2	5	1	11	79	1	2,169	13%
		High-Resolution Tree Cover	32	3,157	10,064	3,172	432	2	7	4	1	4	37	3	37	222	5	17,178	100%
	Energy Savings (mWh)	Native NLCD-TC 2011	0	6,975	30,417	8,983	1,446	0	23	0	5	3	16	0	1	66	3	47,937	81%
		Corrected NLCD-TC	0	7,688	31,974	9,807	1,675	0	24	1	5	3	21	0	2	85	3	51,289	87%
		High-Resolution Tree Cover	0	6,586	38,125	12,476	1,881	0	14	0	2	4	6	0	3	41	2	59,140	100%
Seattle, WA	Intercepted water (1000 m ³)	Native NLCD-TC 2011	0	527	1,391	713	48	18	316	163	183	16	5	1	0	82	9	3,475	58%
		Corrected NLCD-TC	0	807	2,147	1,091	81	19	480	242	300	25	8	2	0	128	16	5,354	89%
		High-Resolution Tree Cover	0	908	2,363	1,290	84	22	549	293	319	27	10	2	0	141	16	6,035	100%
	Energy Savings (mWh)	Native NLCD-TC 2011	0	19,082	12,767	883	17	231	513	254	49	0	0	0	55	6	572	34,428	67%
		Corrected NLCD-TC	0	20,696	16,427	1,136	22	289	590	308	58	0	0	0	69	9	675	40,280	78%
		High-Resolution Tree Cover	0	22,189	25,083	1,504	406	210	577	354	71	0	0	0	100	11	838	51,345	100%

Pourpeikari Heris, M., Bagstad, K. J., Troy, A. R., & O’Neil-Dunne, J. P. (2022). Assessing the Accuracy and Potential for Improvement of the National Land Cover Database’s Tree Canopy Cover Dataset in Urban Areas of the Conterminous United States. *Remote Sensing*, 14(5), 1219.

Expanding TCC Corrections

- **Random Forest**
 - Feature Selection
 - Hyper-parameter selection
- **Additional Cities n = 48**
 - More US ecoregions
 - Increased variability in city-wide tree cover
- **Closer to nation-wide product for EA**
- **Assess the extent of TCC underestimation**

NLCD Tree Canopy vs High Res.



Earth Observation Opportunities

- **Planet Imagery?**
 - Add surface reflectance to improve model predictions?
- **Leveraging GEE for improved NDVI and ST?**
 - More robust and replicable for future analyses
- **Future sensitivity analysis**
 - 30m vs 10m vs 3m vs 1m