

Nitrogen Group

Decarbonization+ Academy

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Research Question

How does land use affect the N-print* of the UVA-Charlottesville-Albemarle community?

City

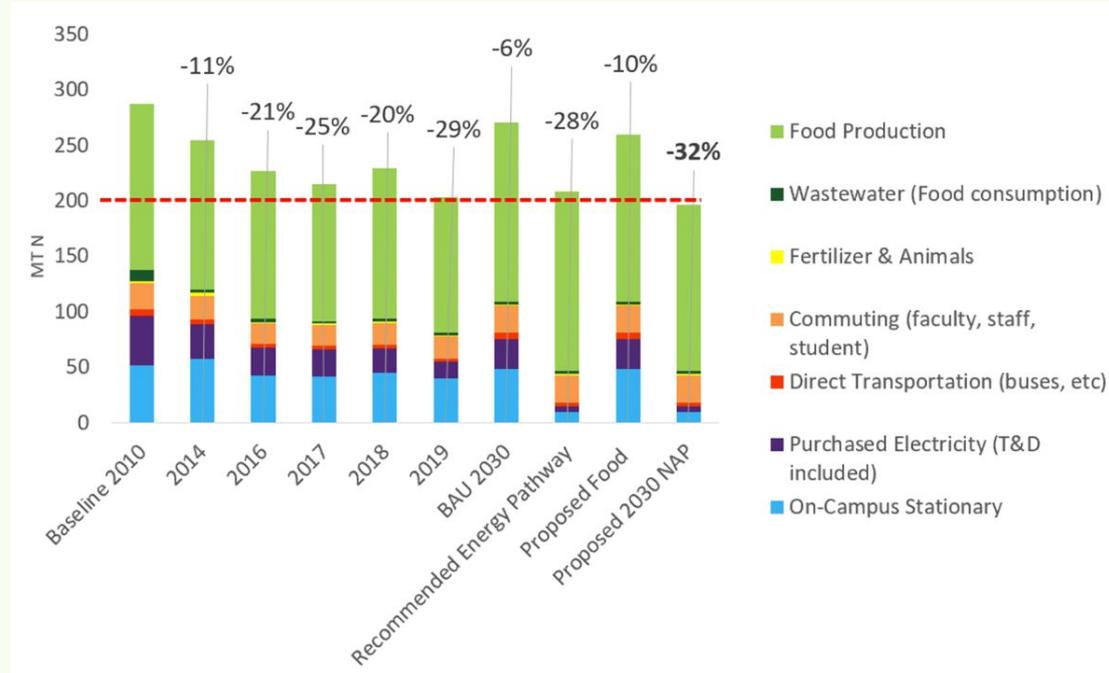
Residential

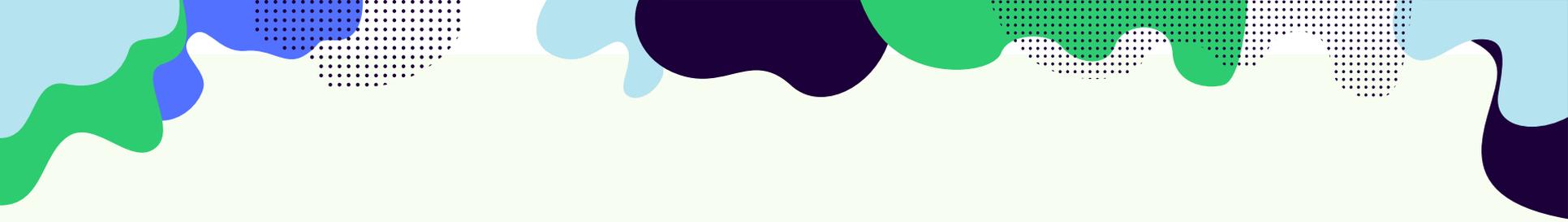
Rural

*N-print: Nitrogen Footprint

Nitrogen Action Plan (NAP)

- The proposed 2030 NAP provides a pathway for UVA's 30% N-print reduction goal to be met
- Our project aims to provide a fuller picture of UVA's footprint by including associated entities that are not currently included in the plan





01

City

Two scenarios

01

Energy Efficiency

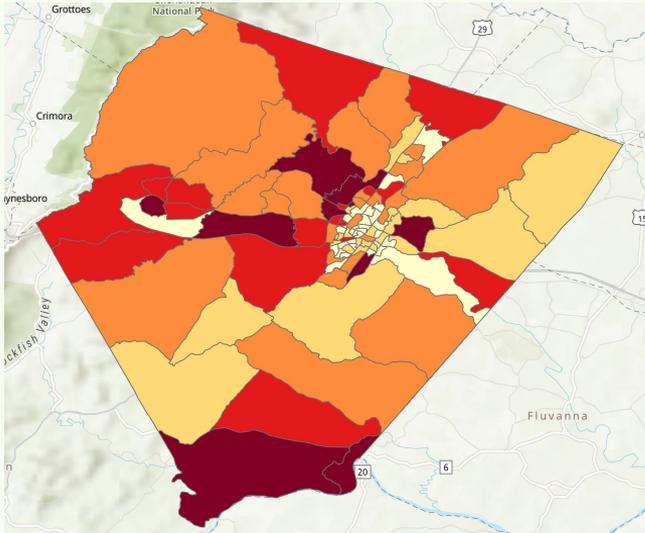
- Reducing business energy consumption by 35%
- Both natural gas and electricity

02

Electrification

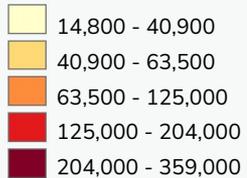
- Convert natural gas usage to electricity

Efficiency

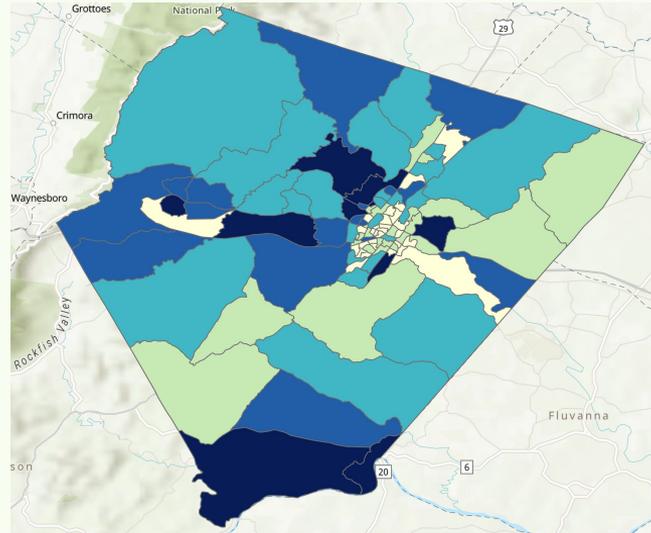


Efficiency

TOTAL per BG: (Kg N)



Electrification

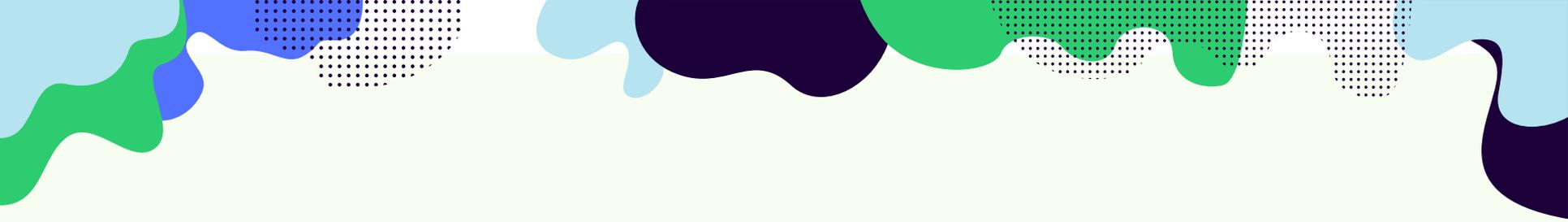


Electrification

TOTAL per BG: (Kg N)



- Efficiency is **more** effective at reducing the nitrogen footprint

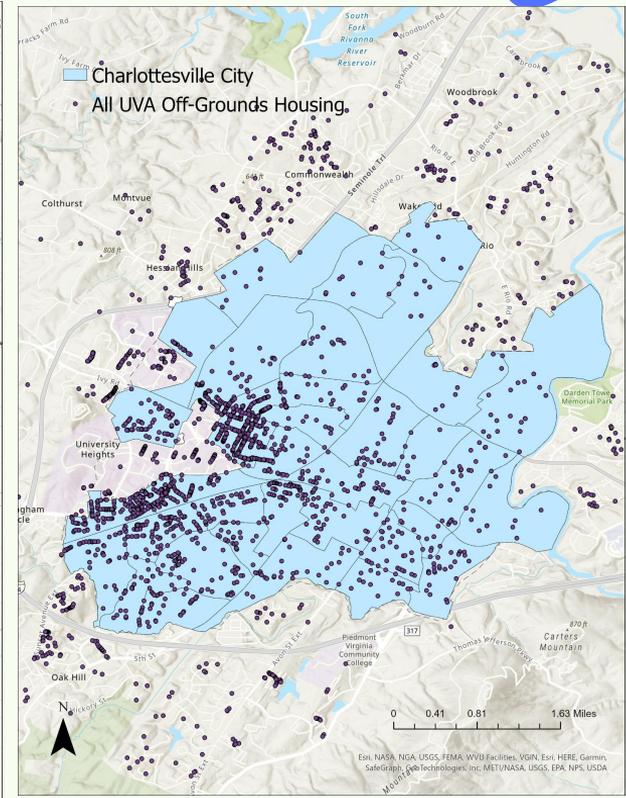
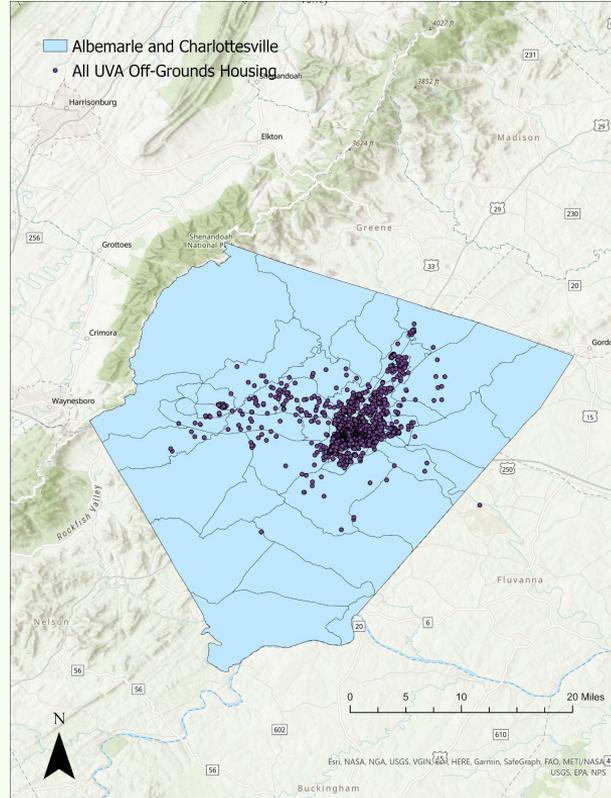


02

Residential

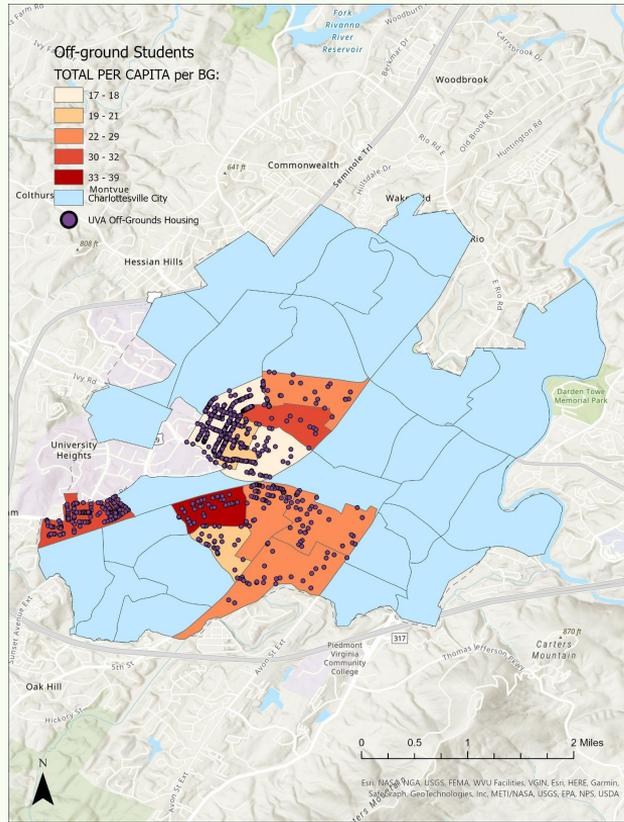
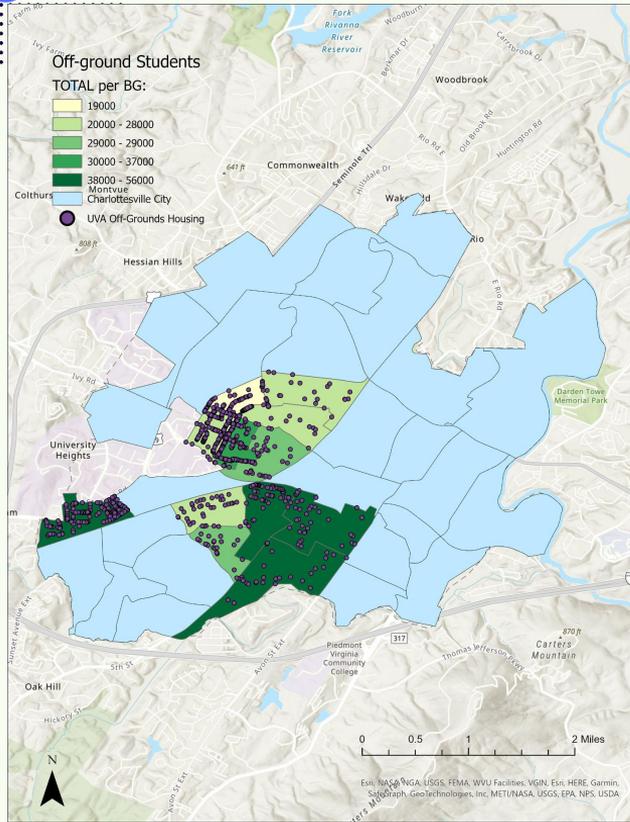
Off-Grounds Student Housing

- Most students reside in Charlottesville City
- Of those students living in Charlottesville, most live in block groups adjacent to UVA



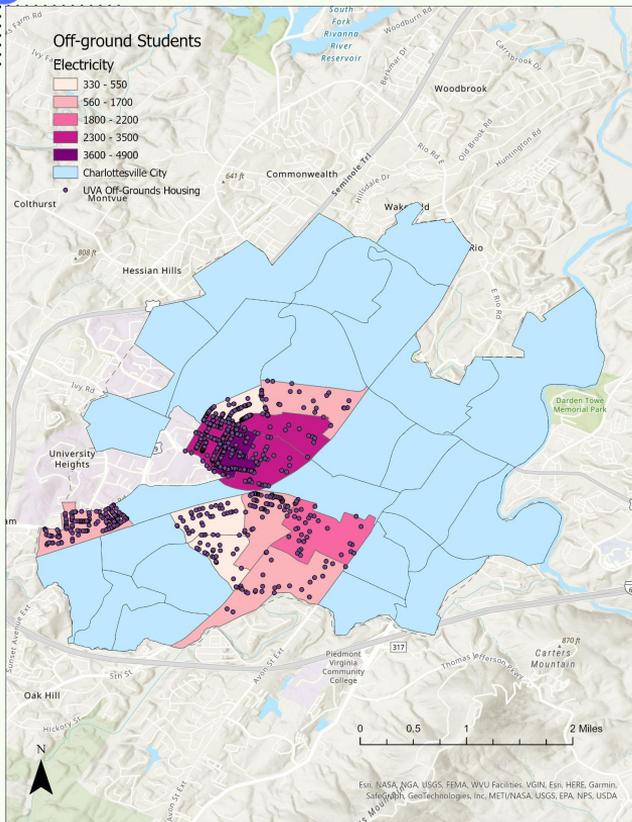
Total kg N

Kg N Per Capita

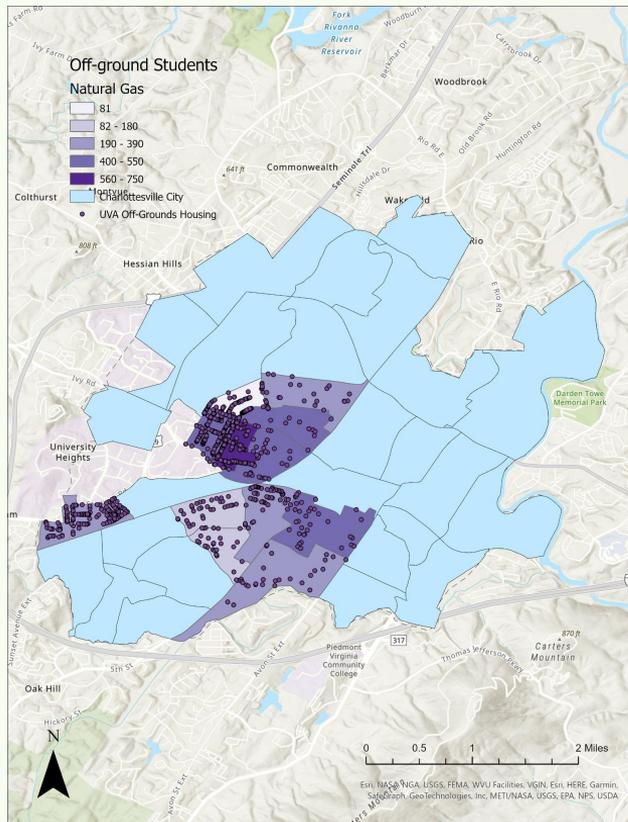


- Block groups (BGs) with a large total N footprint doesn't necessarily indicate large per capita N
- Total N footprint doesn't fully represent student dominated BGs

Electricity



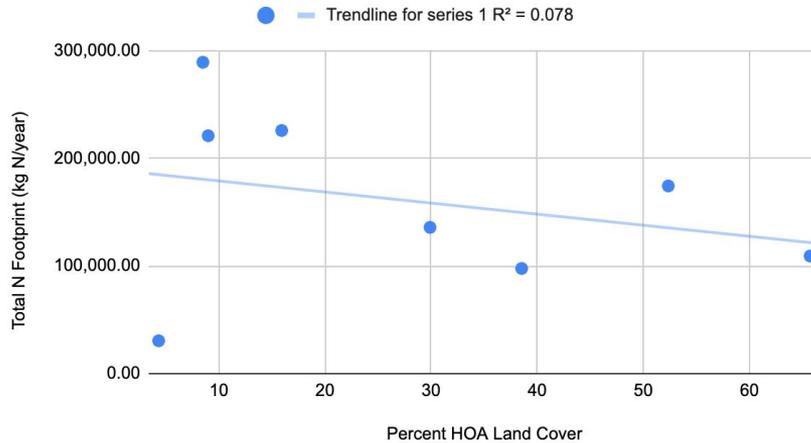
Natural Gas



- Energy can act as an accurate indicator of N emissions from UVA students
- There are higher footprints in BGs that have more students

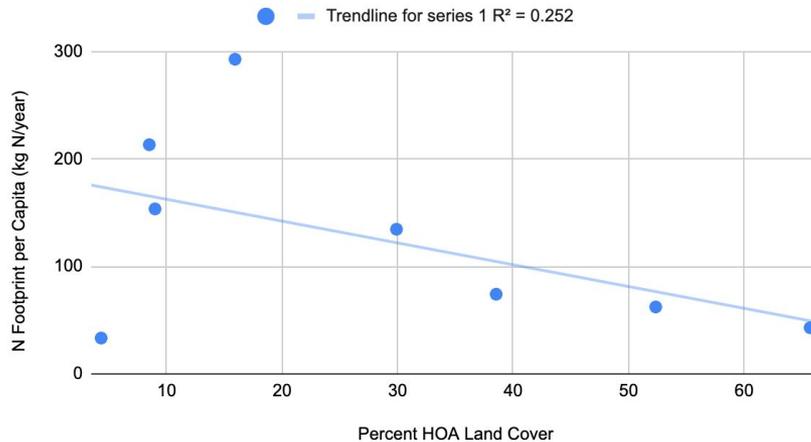
Total N Footprint vs HOA Land Cover

P-value: 0.5



N Footprint per Capita vs HOA Land Cover

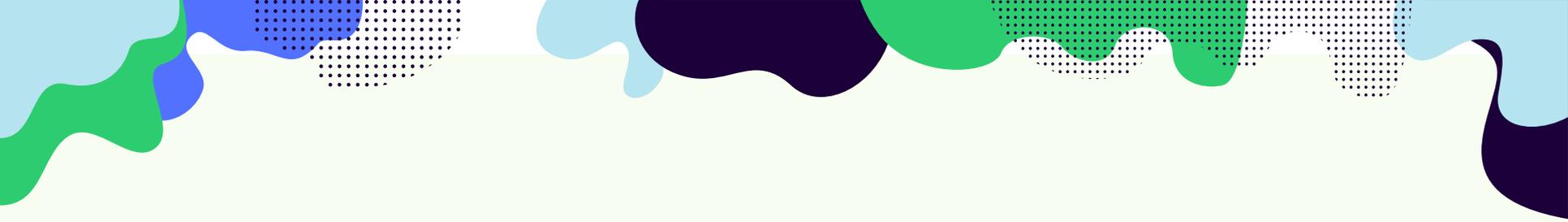
P-value: 0.2



HOAs

(Homeowners Associations)

- Non-significant
- Assumptions/Errors:
 - Small sample size
 - Land use
 - More HOAs in new developments
 - Counting discrepancies
- Provides the baseline for future research about HOAs
 - Great opportunity to connect with the community



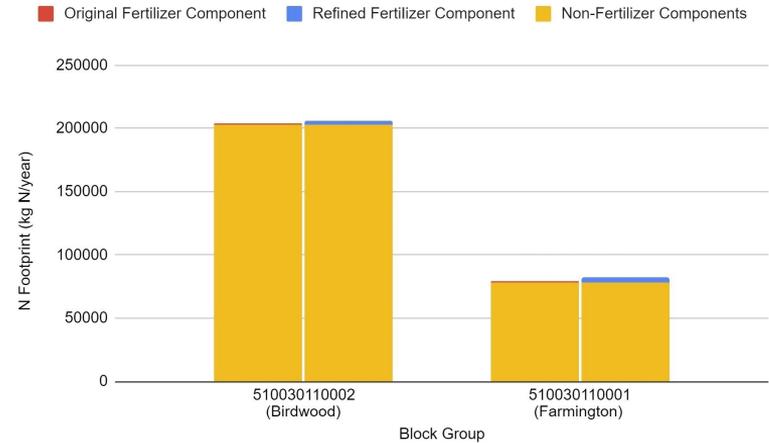
03

Rural

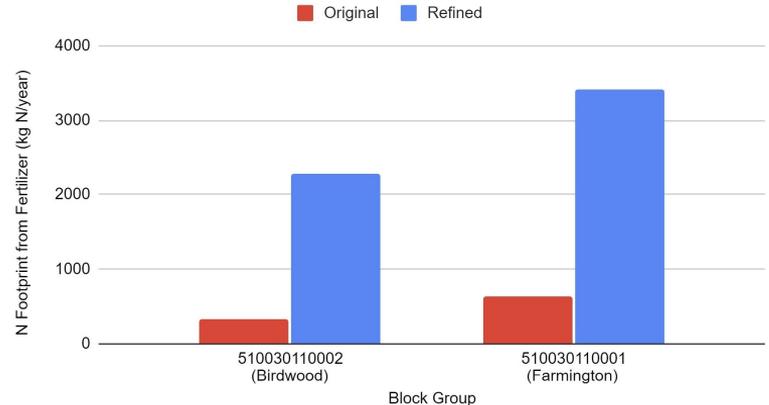
Golf Courses

- Block groups with golf courses have higher N-prints than previously calculated
 - Small overall impact, large impact in the fertilizer sector
- Birdwood: 204,000 → 206,000 kg N/year
 - Fertilizer: 340 → 2,280 kg N/year
- Farmington: 79,500 → 82,200 kg N/year
 - Fertilizer: 640 → 3,420 kg N/year

Change in N Footprint by Block Group



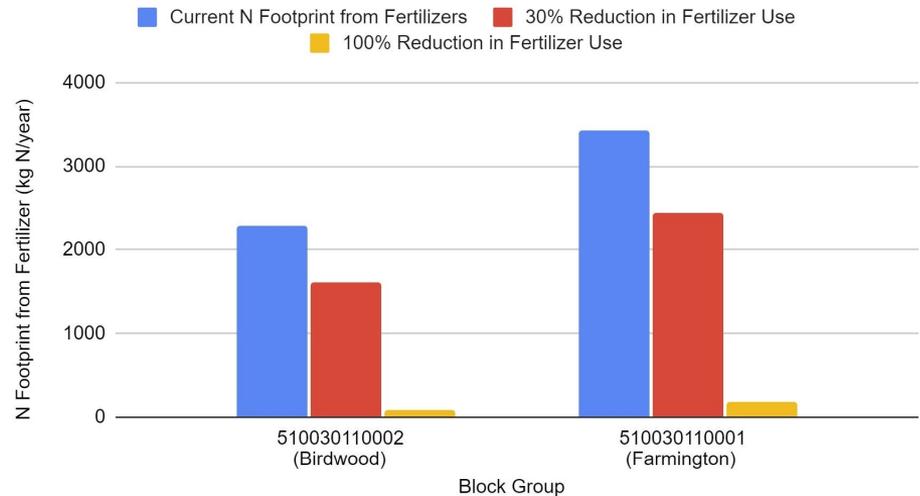
Change in Fertilizer Component of N Footprint by Block Group



Golf Courses

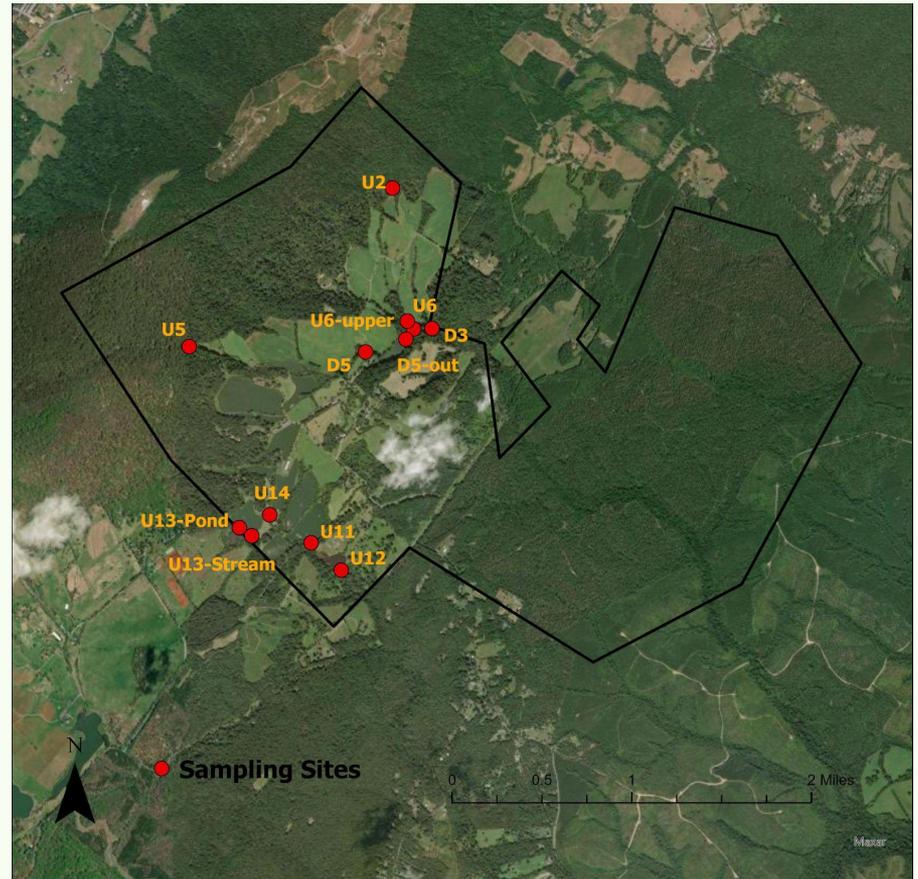
- 30% and 100% scenarios for context
- 30% reduction in fertilizer use:
 - Birdwood: -0.321% total block group N-print reduction
 - Farmington: -1.18% total block group N-print reduction
- Further research on best practices needed to create realistic reduction scenarios

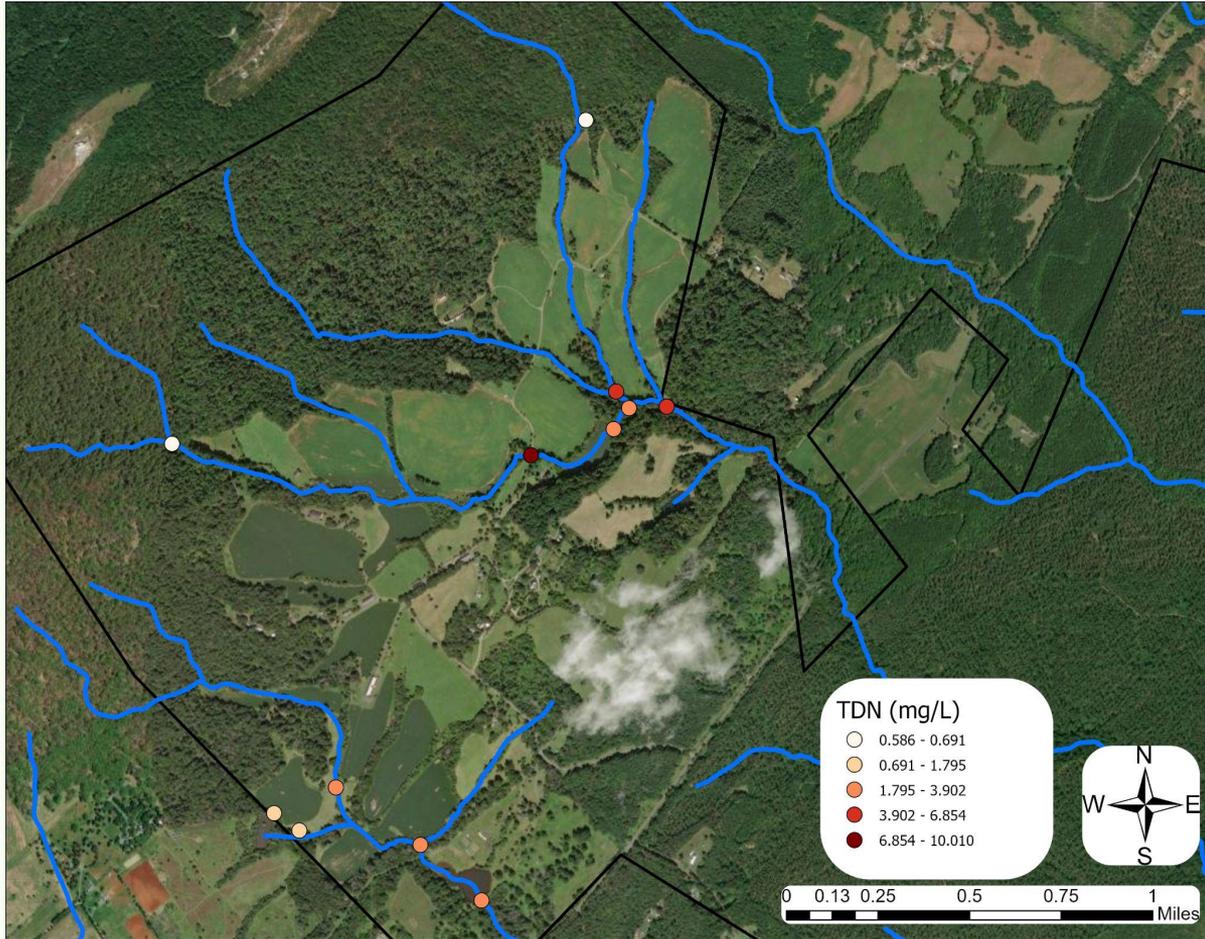
Fertilizers' N Footprint Reduction Scenarios



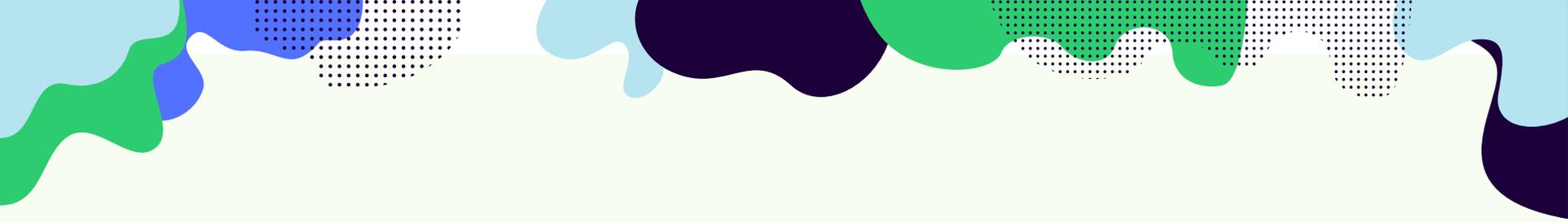
Morven

- Collected water samples at different sites based on location relative to agriculture & fertilizer
- Goal to view Morven's impact on N pollution of the environment
- Determined nitrate, ammonium, organic nitrogen concentrations



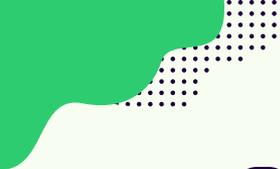


- Total dissolved nitrogen (TDN) concentration increases along streams
- Morven is leaching N to the environment
- Points are representative of upstream land use



04

Conclusions



Conclusions & Recommendations

- It is crucial to consider the type of land use in the calculation and reduction of an entity's N footprint, as areas with different purposes have different effects and different potentials to improve their impact.
- UVA should consider incorporating its off-grounds components into its environmental footprint calculations to fully capture its impact on the environment and encapsulate its emissions that are not presently included. Such components can include off-grounds housing and foundation lands like Morven Farm and Birdwood Golf Course.
- UVA should consider the effect of its presence on the environmental footprints of Albemarle county and Charlottesville city in the calculation of its own environmental impact, as the three communities are inextricably linked.

Future Work

1. City

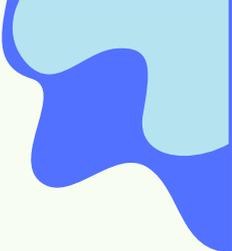
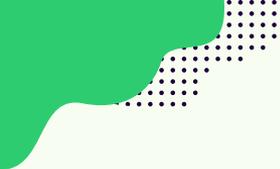
- Improve data collection on student income to accurately analyze energy burden on students

2. Residential

- Student Housing
 - i. Improve N-print calculations to better encapsulate students by looking at food production overlaps in the Charlottesville and UVA footprints
 - ii. Incorporate faculty and staff in data collection
- HOAs
 - i. Refine data on HOAs and determine factors driving the relationship between HOAs and the N-print
 - ii. Test for significance with a larger sample size and better data

3. Rural

- Golf Courses
 - i. Recommend golf courses to follow best management practices currently known
 - ii. Use Birdwood as a research site to better understand its contribution to UVA's N-print
- Morven
 - i. Sample water quality on a quarterly basis to track changes from sustainability and management practices



Acknowledgements

- Jim Galloway
- Libby Dukes
- Andrew DiSanto
- Elton Oliver & the Morven Team
- Owen Shaffer
- Ami Riscassi
- Susie Maben
- Meg Miller
- Larry Band
- Ethan Heil
- Caetano de Campos Lopes
- Gabe Dayley, Emily Irvine, & Jamie Powers from Cville/Alb Sustainability
- Birdwood and Farmington Golf Courses