DEVELOPING A PATH TO NET-ZERO CARBON EMISSIONS IN VIRGINIA

Rachel Holman, Grace Davenport, Lily Jarrett, Hana Nur

STAKEHOLDERS

Rachel Holman	Team member
Grace Davenport	Team member
Hana Nur	Team member
Lily Jarrett	Team member
Andrés Clarens	Sponsor
Majid Shafiee-Jood	Sponsor
Adam Tashman	Mentor

TABLE OF CONTENTS

PURPOSE AND BACKGROUND

- Carbon Removal: a broad set of approaches used to remove harmful CO2 gases from the atmosphere
  - Ex. reforestation, bioenergy crops
- Historical environmental policy impact on land use patterns, specifically renewable resources
  - Solar panels, wind turbines, etc.
- Predict future land-use patterns with ML model

PREVIOUS RESEARCH + MODELING

Departments at UVA:

- Environmental Engineering: Modeling CO2 sequestration techniques
- Biology: Reforestation modeling with i-Tree suite
- Politics: Public policy differences between VA counties
- Architecture: Socioeconomic status based on building materials
- Finance: Cost of biofuels implementation across public/private sector

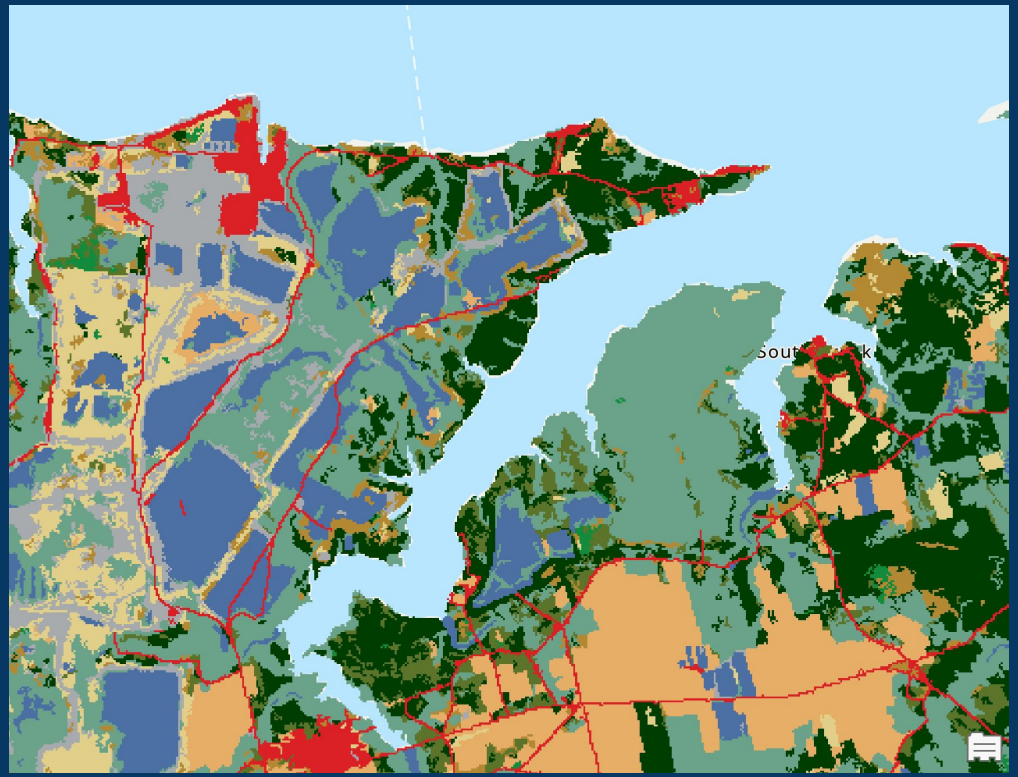
SUCCESS CRITERIA

SC1	Effectively model land use changes in the past 10-20 years, to predict land use in the future (crop, forest, etc.)
SC2	Compiling an accurate timeline of environmental policy changes to assess correlation between policy and land use.
SC3	Visualizations in land use change to aid environmentalists in creating a path to net-zero carbon emissions

DATA DISCUSSION

- Public ArcGIS land use datasets from Multi-Resolution Land Characteristics (MRLC) Consortium and USDA
- Environment policy data researched and consolidated to create a policy timeline
- ArcGIS .shp and .tif files will be converted to csv files for analysis in Python
- Some years must be supplemented with open source environmental data
- Environmental policy data limited to state-level
  - County-level policy data is inconsistent and difficult to obtain

NORTH AMERICAN LAND COVER, 2020 (LANDSAT, 30M)



- Temperate or sub-polar needleleaf forest
- Sub-polar taiga needleleaf forest
- Tropical or sub-tropical broadleaf evergreen forest
- Tropical or sub-tropical broadleaf deciduous forest
- Temperate or sub-polar broadleaf deciduous forest
- Mixed forest
- Tropical or sub-tropical shrubland
- Temperate or sub-polar shrubland
- Tropical or sub-tropical grassland
- Temperate or sub-polar grassland
- Sub-polar or polar shrubland-lichen-moss
- Sub-polar or polar grassland-lichen-moss
- Sub-polar or polar barren-lichen-moss
- Wetland
- Cropland
- Barren land
- Urban and built-up

HTTPS://WWW.MRLC.GOV/

VA POLICY TIMELINE FINDINGS

- General Findings
  - Budget fluctuations
  - EPA x VA environmental partnership (2003)
  - Agriculture harvesting peak (timber) – (2014-15)
- Focus on Fairfax County
  - CECAP
  - Resilient Fairfax Plan
  - FairFax County Site
- Master timeline

PROJECT PLAN

- Review research articles that implement ML techniques to assess carbon emissions and land use
  - Carbon removal, reforestation, renewable energy sources
- Learn and use ArcGIS to visualize and aggregate data
- Establish Virginia Policy Timeline (2002-2023) for reference
- Gather more data!
- Develop a Machine Learning Tool to forecast potential land use patterns for the next 10 years at the county scale

POTENTIAL CONCERNS AND BLOCKERS

- Concerns:
  - ArcGIS is not compatible with Mac computers
    - Can be navigated using online browser version
  - Data is in .shp and .tif form which makes for complicated combination and downloading as .csv
  - Policy change data is not documented in one location- requires tedious researching
  - Need more data for modeling (see next slide)

MORE DATA NEEDED

Potential Additional Predictor Variables:

a. Temperature
b. Precipitation
c. Humidity
d. Human Population
e. Sea level rise
f. Animal species

ADDITIONAL CONSIDERATIONS

- Scope:
  - Narrow to county scale vs. state scale based on policy data availability
- Project Clarity:
  - Need some clarification around the outcome and deliverables
- Data Sufficiency:
  - We will need to supplement data to allow for more modeling variables
- Policy Predictor Variable:
  - Unsure how to best treat policy as a variable (eg. binary)