Background

- Biomass is used to produce renewable energy, thermal energy, or transportation fuels and is any living or dead organism and any byproducts of these organisms, whereas feedstock is a specific type of biomass.
- Biomass energy is becoming a popular global energy source providing 3% of the world’s transportation fuels and a mitigation effect on climate change, reducing CO2 at the source, and ultimately, reducing greenhouse gas emissions.1
- The U.S. Department of Energy (DOE) commissions national biomass resource assessments to collect data on biomass production while also assessing economic availability.2
- The location, type, and amount of biomass is important to analyze because these factors influence the cost of biofuels production.3

Objective

Design and create an interface which:
1. Projects where and how much certain biomass feedstocks are produced.
2. Visualizes multiple biomass feedstocks and their respective composition and products
3. Juxtaposes these features for further analysis

Methodology

Geographically Visualizing the Data
- Using shapefiles from BioAtlas4 with data provided by the DOE, necessary data is imported into Mathematica, the primary coding language of the interface.
- A method takes and overlays the data onto a blank U.S. map where the data is color coded with a legend to represent the amount of production.
- A pop-up menu runs the method for whichever feedstock is chosen, and displays the choropleth map with the respective biomass data.

Calculating Composition and Products of Biomass
- In a spreadsheet, production data by county from the DOE2 and regression models by Wengin L2 allows for the calculation of biomass properties, which consisted of: Organics, Char, Water, Non-Condensable Gases, Ash, Carbon, and Oxygen.
- Ultimate Analysis values for feedstocks in order to use the regression models are taken from the ECN Phyllis2 Database.

Graphing Dynamic Histograms
- A method takes imported composition and products spreadsheets, extracts the relevant data rows and columns, and creates a logarithmically-scaled histogram with a color-coded legend for the feedstocks.
- To select histogram features, there is a column of different feedstocks and a pop-up menu of production, composition, and products.
- The “Apply and Create Histogram” button analyzes the features chosen, runs the histogram method, and displays the histogram.

Conclusions + Further Work

- The interface allows you to holistically and comparatively see the production of biomass throughout the United States by county alongside a dynamic histogram displaying the distribution of biomass and its properties. The histogram allows for the choice of displaying multiple biomass at once in regards to a property: its composition, its products, or its production. Additionally, the histogram displays frequency in light of how many counties has such amount of biomass property. In a growing age of bioenergy models, comparatively analyzing biomass and its properties is key to finding cost efficient solutions towards cleaner fuel and a cleaner environment.

Acknowledgements

Special Thank You: to Jennifer Lillo for teaching us memorable leadership lessons and skills for our futures; to Dr. Adah Lesher for founding and continuing this internship program; to Dr. Mark M. Wright for letting me intern and sharing his profound knowledge and ideas; to Nataliya Apanovich for being a genuine mentor and source of support; to Tampion Duanggra for giving thoughtful advice and lab tours; to Qi Dang for the thought-provoking and informative lunchtime conversations; to Danedt Nzeombo for offering his tips through college; to Denis Bbosa for supporting my project; to Jake Lindstrom for letting me use your poster template; and to every other member of the Biorenewables Research Lab. You have all played a tremendous and beneficial role in influencing my decisions as I take the next steps into my future, and for that, I thank you all.

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