

Spatial Analysis of Woodlot Feasibility in Providing Fuel to Colby College Biomass Facility

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Abstract:

This project analyzes woodlot feasibility in providing fuel for the biomass facility being built at Colby College in the spring of 2012. The demand for fuel is estimated at 22,000 tons of wood chips annually, fluctuating monthly due to consumption demand. This project identifies the most feasible woodlots for supplying Colby College based on size and distance from the plant on campus. Categorized, the ranking of woodlots may be applied to decisions about where to get fuel as demand rises. Minimum and maximum thresholds can be derived and scaled based on demand.

Introduction:

In a campaign to become carbon neutral, Colby College is building a biomass burning plant to produce heat and electricity for the campus. The plant will supply the campus with 90% of the steam for heat, hot water, and cooking, as well as produce 10% of Colby's electrical need. The plant is due to complete construction in the spring of 2012, and fuel sources are a major issue surrounding the neutrality of the project. The college anticipates its sources to be within a 50 mile radius of campus as the crow flies. This project analyzes these woodlots based on their size (extrapolated into greater potential to supply fuel) and distance from Colby (<50 mile radius).

Methods:

Woodlots are derived from a 2007 survey from the Maine Office of GIS. I used ArcGIS to analyze the data based on size and distance from Colby in order to classify the most suitable lots as fuel sources. Size was determined by calculating the area of individual polygons of woodlots. Distance is based on a Euclidean distance calculation and is categorized into concentric circles centered on Colby College campus. It is therefore possible to index woodlots within certain distances from Colby against their relative size and derive the most and least desirable woodlots to supply Colby College with their demand for biomass fuel. The categories for a woodlot's viability can be adjusted based on the fluctuations in demand over the various months of the year; as demand changes sources will either expand out from or recede in towards Colby College campus.

Season	Woodlot Count (sum)	Woodlot Area (acres)	Mean Woodlot Size (acres)
Summer-10mi	11	698,766	63,524
Fall and Spring-25mi	126	2,591,026	20,563
Winter-50mi	502	24,972,434	49,745

Results:

The categories for a woodlot's viability can be adjusted based on the fluctuations in demand over the various months of the year; as demand changes sources will either expand out from or recede in towards Colby College campus. This will allow Colby to reduce their carbon neutrality even more by diminishing emissions from transportation of fuel; the closer the source of fuel the more cost-effective the delivery (on emissions as well as economic terms). The Physical Plant Department estimates the variation approximated at 8 tons/day during the hottest days and 75 tons/day during the coldest. In the summer, Colby College may take advantage of 11 different woodlots with a mean size of 63,524 acres and totaling 698,766 acres. During the fall and spring Colby may expand to 126 woodlots with a mean size of 20,563 and totaling 2,591,026 acres. During the winter (with the most demand) Colby may expand to use 502 potential woodlots with a mean size of 49,745 acres totaling 24,972,434 acres in all.

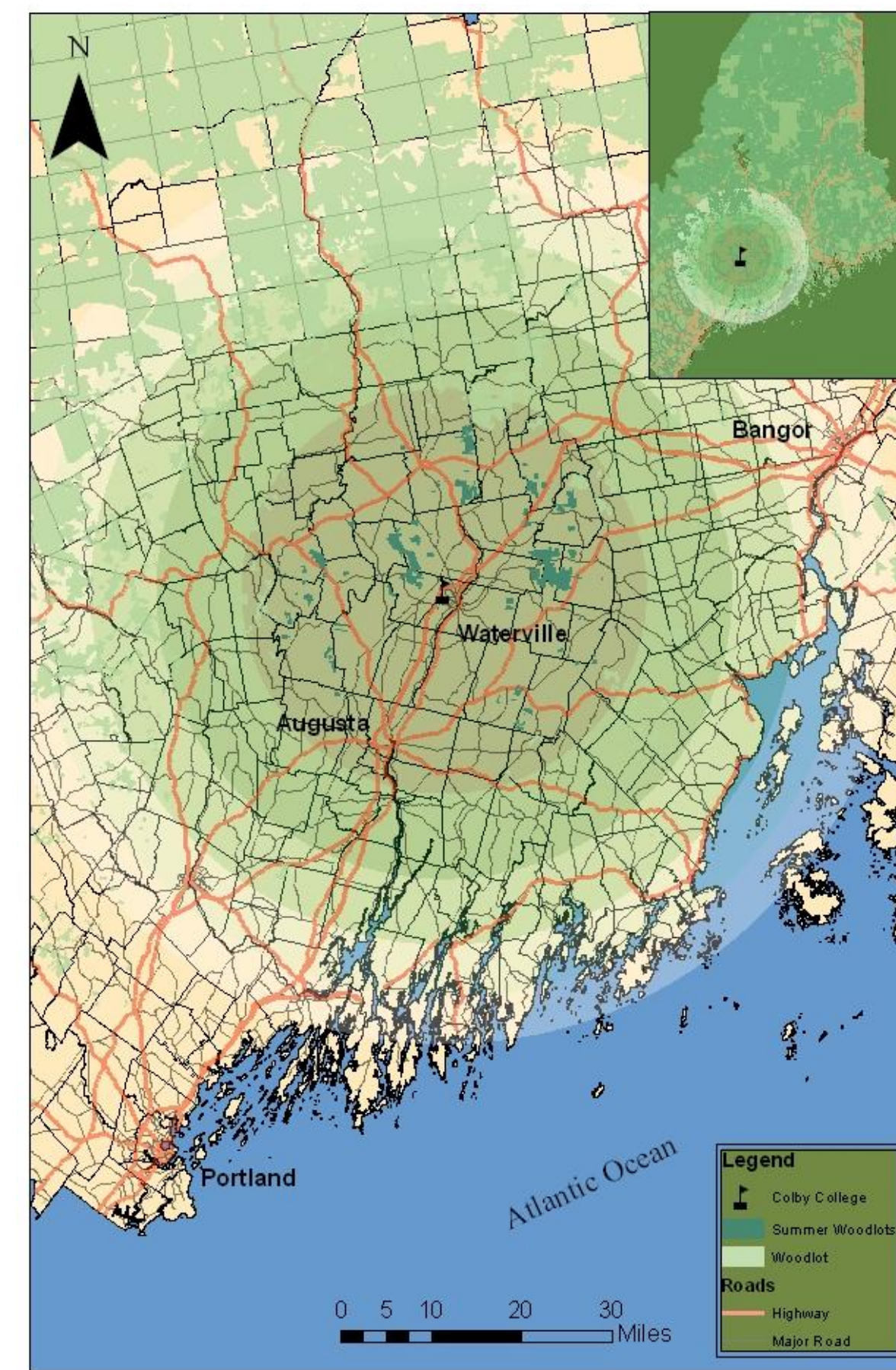


Figure 1: Displays potential woodlots for use during the summer months. These woodlots are displayed in dark green, remaining woodlots are in light green.

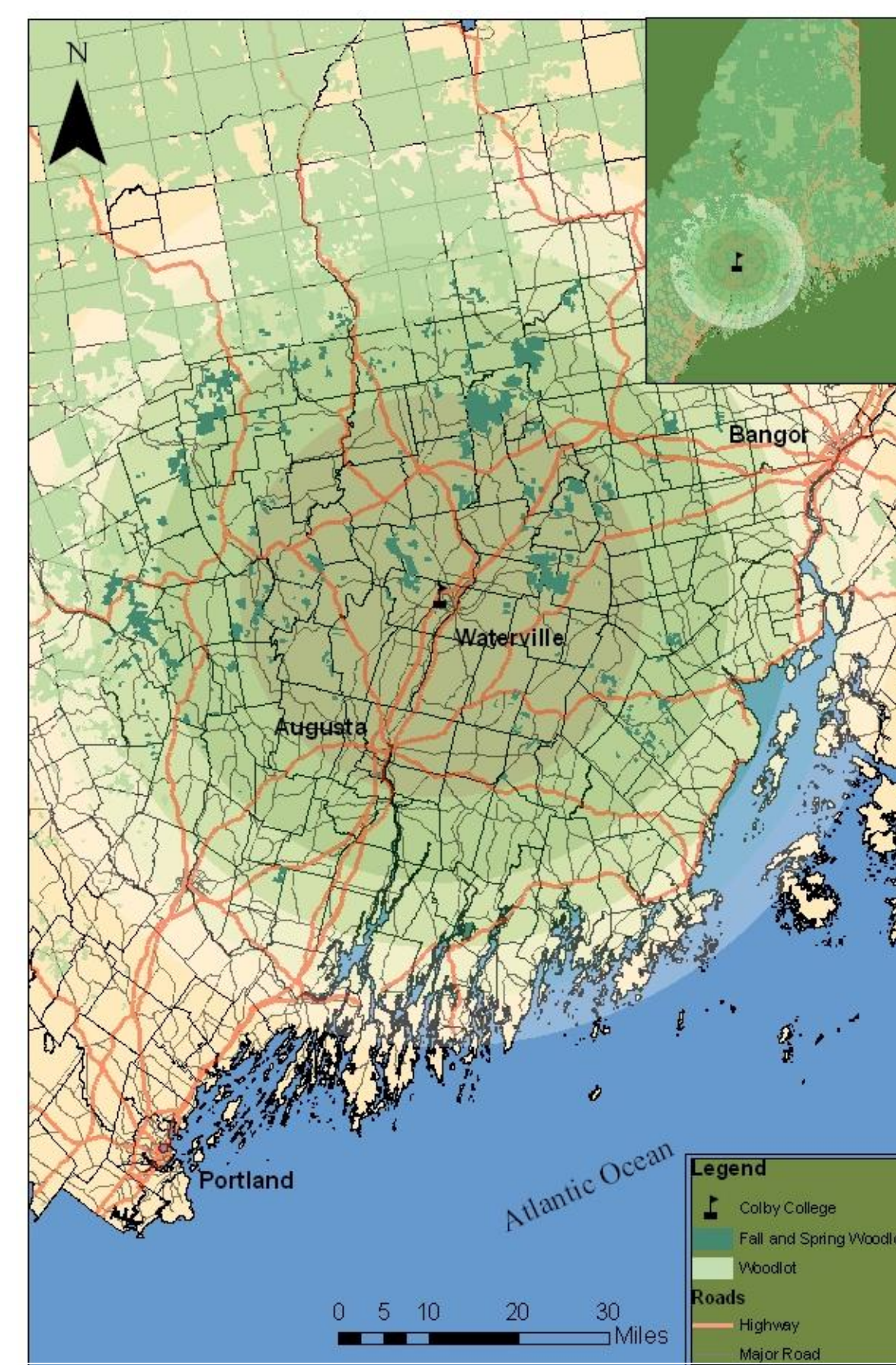


Figure 2: Displays potential woodlots for use during the fall and spring months. These woodlots are displayed in dark green, remaining woodlots are in light green.

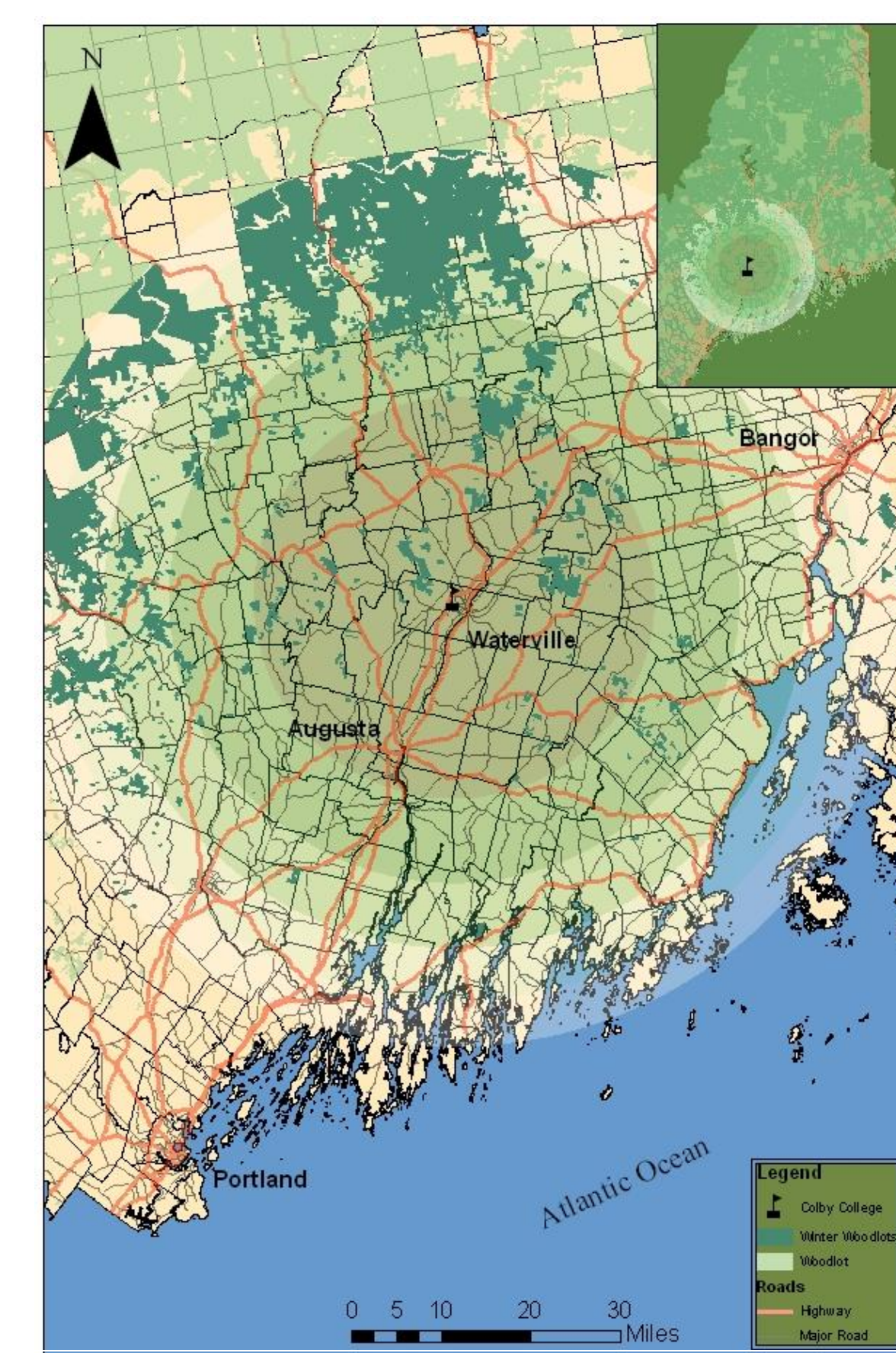
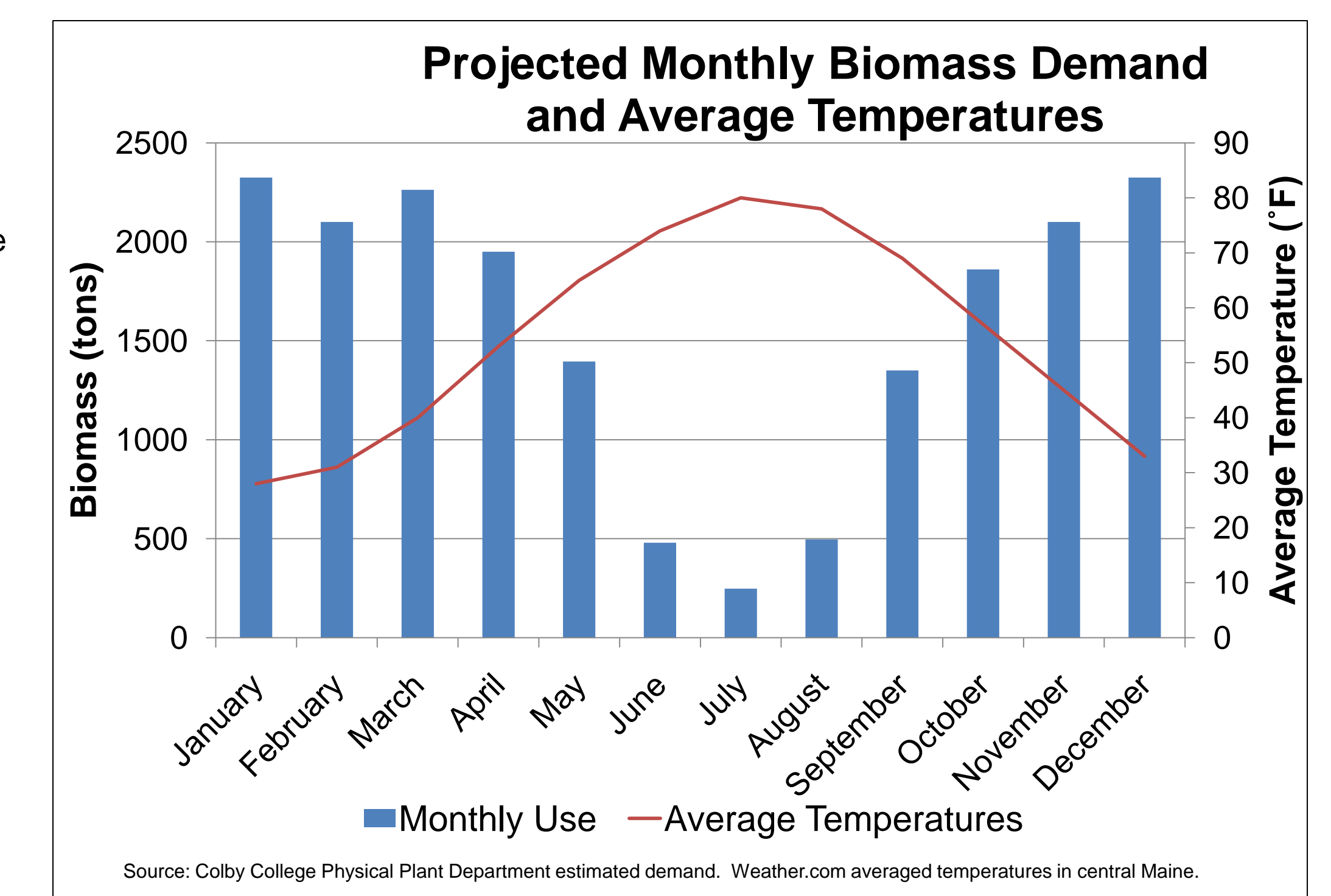


Figure 3: Displays potential woodlots for use during the winter months. These woodlots are displayed in dark green, remaining woodlots are in light green.



Discussion and Conclusion:

This study includes all woodlots currently available without discrimination. Colby College may have specific circumstances or criteria for the sites chosen other than ease of delivery (as defined under this study as a function of size and distance from campus). Expansions upon this will include classification and application of these criteria. Woodlots are abundant in the state of Maine, and Colby has a number of options for the supply of biomass used in the plant. Fluctuations in demand for fuel can be extrapolated from this project based on the categorizing of the woodlots; as demand increases during winter supply may come from more or further woodlots and fewer or closer woodlots during the summer.



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