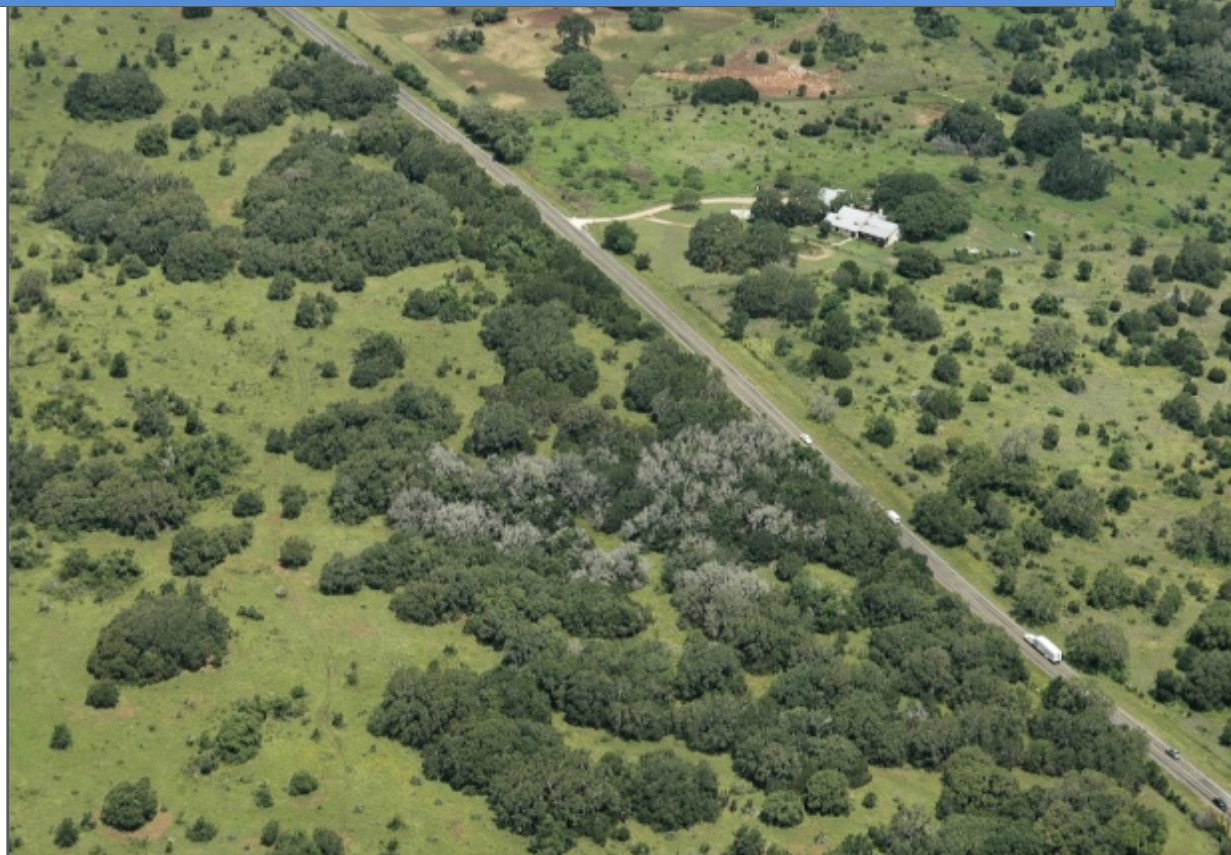


Spatially Quantifying Woody Biomass in Central and West Texas



Curtis L. VanderSchaaf
Forest Resource Analyst

and

Brad L. Barber
Geographic Information Systems Manager

Introduction

Trees provide many economic and environmental benefits including wood products, wildlife habitat, and soil protection. In East Texas, where the traditional timberland of Texas occurs, trees are most commonly used for wood products such as lumber and paper. In the last few years, factors such as oil price spikes and the need for energy security have driven an increased interest in using woody biomass for the production of energy. The vast forestland that Texas possesses has the potential to provide the resource this expanding market needs.

Little of the wood in the region outside of East Texas, referred to here as Central and West Texas, is being utilized. Of the 60 million acres of forestland in Texas, 48 million (80%) occur in Central and West Texas. Although the amount of biomass per acre in the region is generally less than that found in East Texas, almost all of the material is potentially available as a source of energy production since it is not being used for traditional wood products. In addition, most all of the land in Central and West Texas is privately owned and thus does not have restrictions on harvesting that often occur with publicly owned land.

A primary factor in optimally locating a bioenergy facility is knowing where the biomass occurs. By knowing how much and where woody biomass is available, informed decisions can be made on the economic feasibility of establishing a wood-using facility in particular locations.

This publication describes an analysis conducted to spatially quantify the amount of woody biomass on a dry-weight basis¹ in Central and West Texas. Total biomass is presented along with that for mesquite, Ashe juniper, and live oak, the top three ranked species in terms of amount of biomass.

Methods

Estimates of amounts and spatial distribution of biomass were derived using data from the Forest Inventory Analysis (FIA) program. Although FIA data have been obtained in East Texas since the 1930s, the forest inventory for Central and West Texas was not initiated until 2004. Data for the analyses described here includes only 40 percent of the plots for this region since it will take 10 years to complete a full measurement cycle.

Because FIA plots provide a point estimate of biomass, an interpolation procedure² within ESRI's ArcGIS 9.3 Geostatistical Analyst was used to estimate biomass surfaces across the region.

Since excessive slope can hinder the harvesting of woody biomass, slope was determined from the U.S. Geological Survey's National Elevation Dataset (NED)³ and included in the analysis. As a comparison and to verify the estimated biomass surfaces, tree canopy data from the National Land Cover Database 2001 (NLCD 2001)⁴ is presented.

Results and Conclusions

In examining the results of this analysis, one should be mindful that the biomass surfaces presented are predictions based on only 40 percent of the full complement of FIA plots in Central and West Texas. They are only representations of reality and thus are predictions subject to random error.

Portions of Central and West Texas contain a significant amount of woody biomass (Figures 1 to 4). Some of these areas are located near large cities that may have the potential to utilize this resource for bioenergy.

¹ Multiply dry weight by 2 to estimate green weight.

² Radial basis function using spline with tension and 15 neighbors.

³ Gesch et al. 2002.

⁴ Homer et al. 2004.

Mesquite and Ashe juniper are common in Central and West Texas (Figures 2 and 3). According to a recent survey conducted by Texas Forest Service of ranchers in this region⁵, 12 percent or less of respondents indicated these as desirable species. Many ranchers view these trees negatively because they can reduce forage yields for cattle.



Many forestlands in Central and West Texas contain large amounts of biomass on flat terrain that could provide easy access for harvest. Only a small portion of the biomass in this region (mainly in a few far easterly counties) is used to supply wood for large-scale operations such as paper, plywood, and lumber mills. Thus, currently, there is little competition for woody biomass in this region.

Enterprises interested in exporting wood pellets will need to know where the biomass is located in relation to ports. Major ports in the Central and West Texas region are Houston, Galveston, and Corpus Christi. Ports in East Texas include Beaumont, Port Arthur, and Orange.

With the exception of several counties adjacent to East Texas—Freestone, Lamar, and Rains—not much harvesting for traditional wood products occurs in Central and West Texas. A small amount of woody biomass is used for fencing, the manufacture of furniture, firewood, and specialty products. Some landowners also plant trees as windbreaks and for shade and thus are not likely to sell them for biomass. According to a recent survey of forestland owners in this region conducted as part of the National Woodland Owner Survey, the majority of tree removal in this region is to clear land for grazing and to enhance wildlife habitat.

Some areas in this region may contain more than 15 dry tons of woody biomass per acre, but on average across a localized landscape, most areas contain less. The range of estimated tons per acre shown in the figures provides a depiction of woody biomass in the region for planning purposes. One should also realize that other factors, such as species or form requirements, may limit the amount of biomass that a particular facility can utilize.

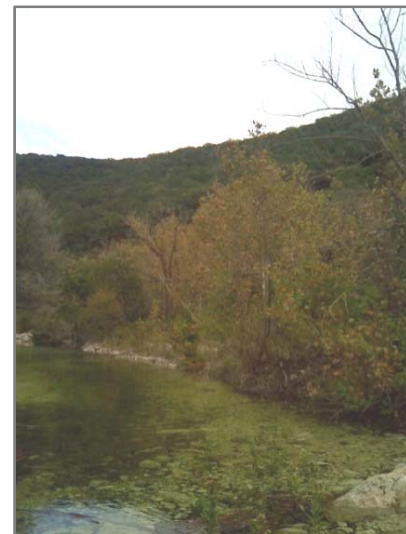
Interested investors should be aware of areas with significant slope, which may affect accessibility for harvest (Figure 5). For example, the area west of Austin and San Antonio—The Balcones Escarpment—may pose access issues due to the relatively rugged terrain. Figure 6 shows topographic relief in relation to biomass.

⁵ Xu et al. 2008.



Much of Central and West Texas lands are grazed by cattle and are used by large-scale domestic and exotic animal hunting clubs. Some landowners may not be willing to sell trees on their land because they provide shade to cattle and cover for wildlife. However, many landowners also periodically want to remove trees from their land to enhance grazing and wildlife habitat that can provide large amounts of low-cost biomass.

Other issues that might affect the availability of biomass include water quality in some watersheds, management restrictions due to endangered species (e.g. Recovery Credit System for golden-cheeked warbler or black-capped vireo), and incentive programs to promote removal of biomass by landowners (e.g. water quantity credits) that should produce a low-cost source of biomass.



Access issues, such as mountainous terrain and concerns about water quality, may be a restriction on some portion of forestlands in Central and West Texas.

NLCD 2001 tree canopy data verifies that areas predicted to have relatively large amounts of woody biomass using FIA data are valid (Figure 7). In addition, experienced Texas Forest Service personnel concur that areas with large estimates of biomass are reasonably depicted.

In conclusion, Central and West Texas contains a significant resource of woody biomass that has the potential to supply an expanding bioenergy market.

References

Gesch, D., M. Oimoen, S. Greenlee, C. Nelson, M. Steuck, and D. Tyler. 2002. The National Elevation Dataset: Photogrammetric Engineering and Remote Sensing, Vol. 68, No. 1, p. 5-11.

<http://ned.usgs.gov/Ned/faq.asp>

Homer, C., C. Huang, L. Yang, B. Wylie and M. Coan. 2004. Development of a 2001 National Landcover Database for the United States. Photogrammetric Engineering and Remote Sensing, Vol. 70, No. 7, July 2004, pp. 829-840.

http://www.asprs.org/publications/pers/scans/2004journal/jul/2004_jul_829-840.pdf

Xu, W., Y. Li, and B. Carraway. 2008. Estimation of woody biomass availability for energy in Texas. College Station: Texas Forest Service.

<http://texasforests.tamu.edu/main/article.aspx?id=100&ptaxid=146&dtaxid=168&taxid=240>

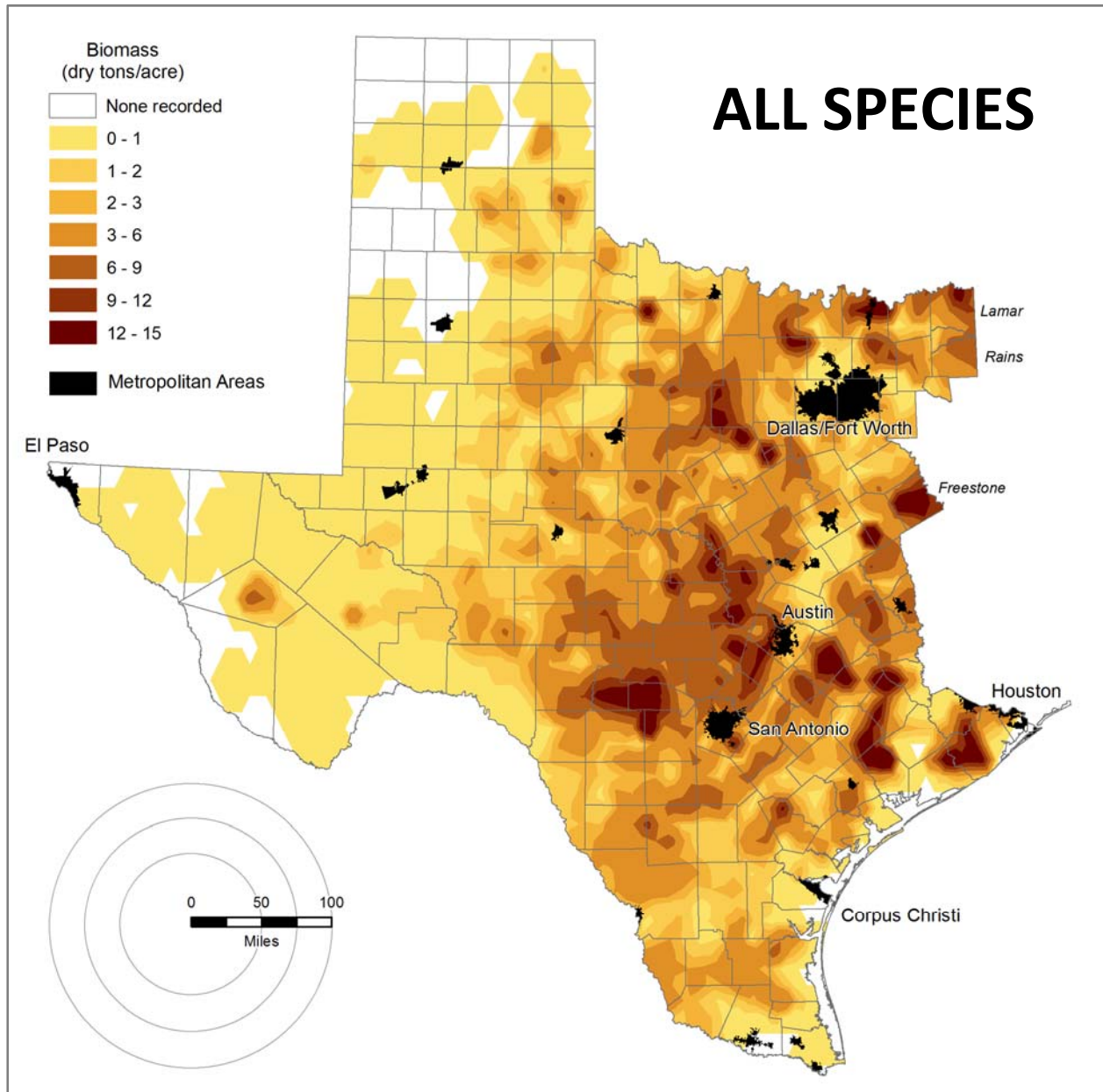


Figure 1. Estimate of standing woody biomass in dry tons per acre for all species across the Central and West Texas region. Black areas are metropolitan areas. Some trees in far eastern counties (e.g. Freestone, Lamar, and Rains) are harvested for the production of large-scale commercial timber products. Those interested in utilizing woody biomass for the production of bioenergy will likely want to take a percentage of the standing biomass (e.g., 30%, 40%, 50%) to produce an estimate of utilizable biomass for energy generation. “Bioshed” harvesting circles are shown for 50, 75, and 100 miles.

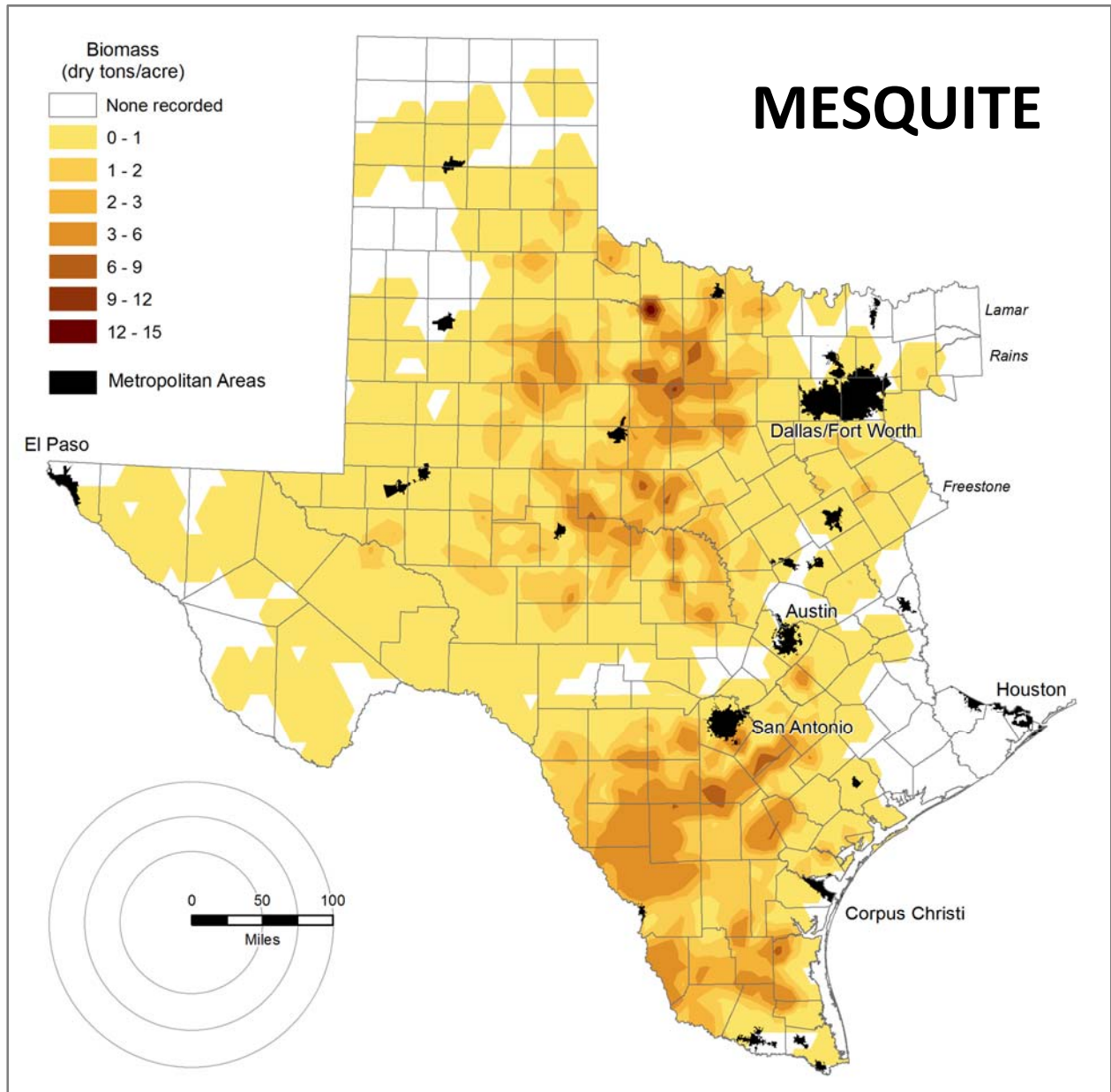


Figure 2. Estimate of standing woody biomass in dry tons per acre for mesquite across the Central and West Texas region. Black areas are metropolitan areas. Those interested in utilizing woody biomass for the production of bioenergy will likely want to take a percentage of the standing biomass (e.g., 30%, 40%, 50%) to produce an estimate of utilizable biomass for energy generation. “Bioshed” harvesting circles are shown for 50, 75, and 100 miles.

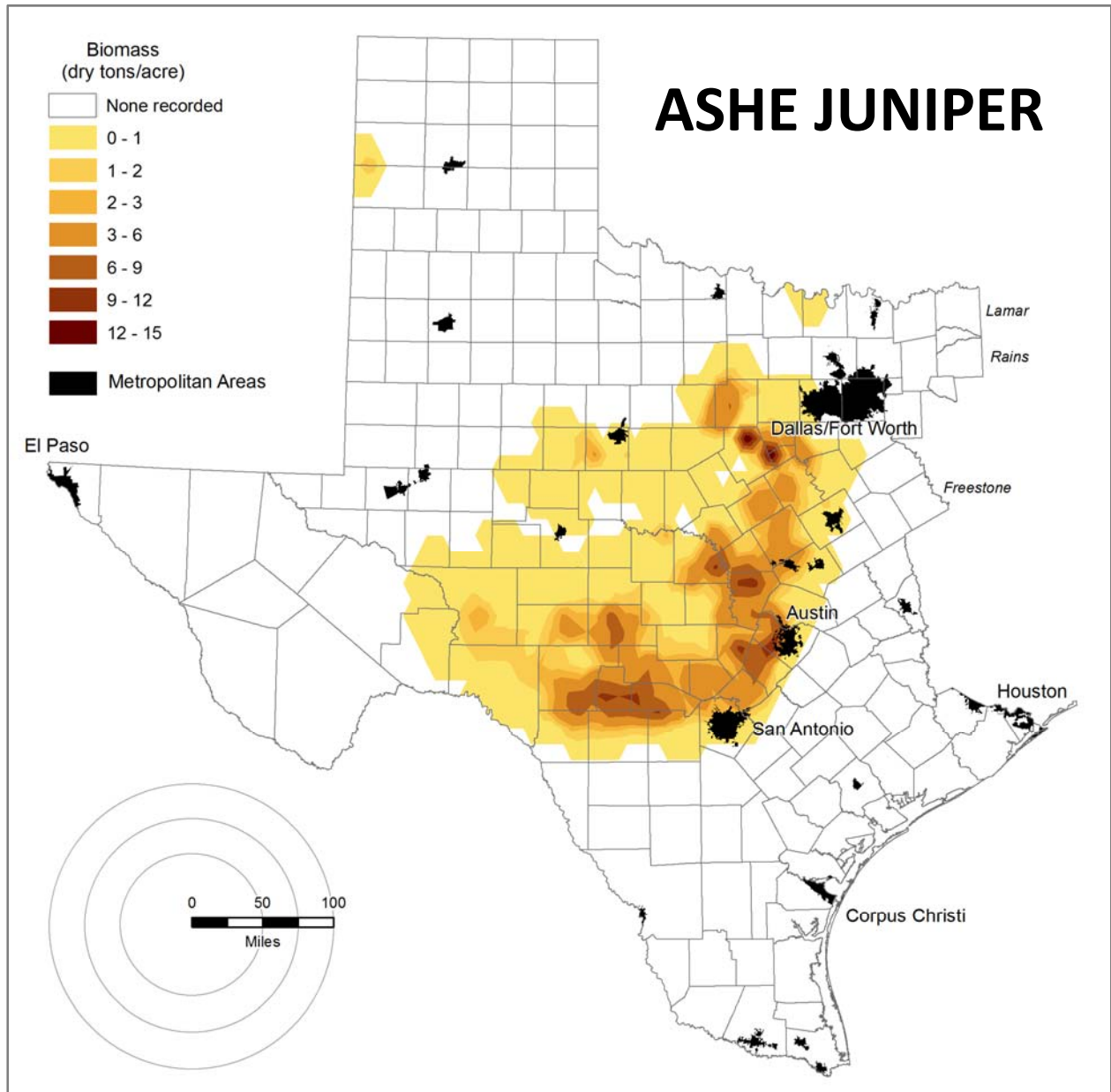


Figure 3. Estimate standing woody biomass in dry tons per acre for Ashe juniper (mountain cedar) across the Central and West Texas region. Black areas are metropolitan areas. Those interested in utilizing woody biomass for the production of bioenergy will likely want to take a percentage of the standing biomass (e.g., 30%, 40%, 50%) to produce an estimate of utilizable biomass for energy generation. “Bioshed” harvesting circles are shown for 50, 75, and 100 miles.

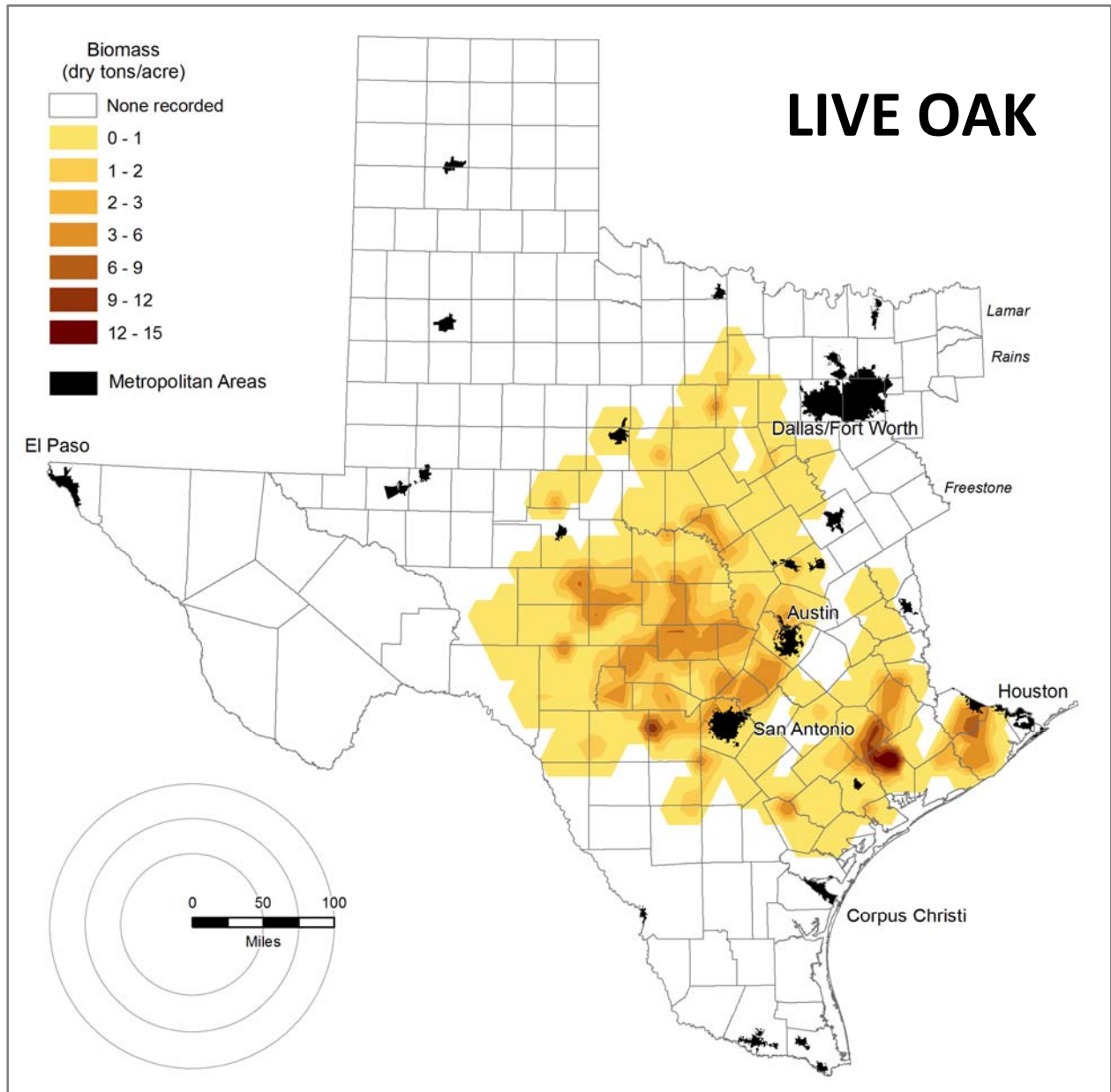


Figure 4. Estimate of standing woody biomass in dry tons per acre for live oak across the Central and West Texas region. Black areas are metropolitan areas. “Bioshed” harvesting circles are shown for 50, 75, and 100 miles.

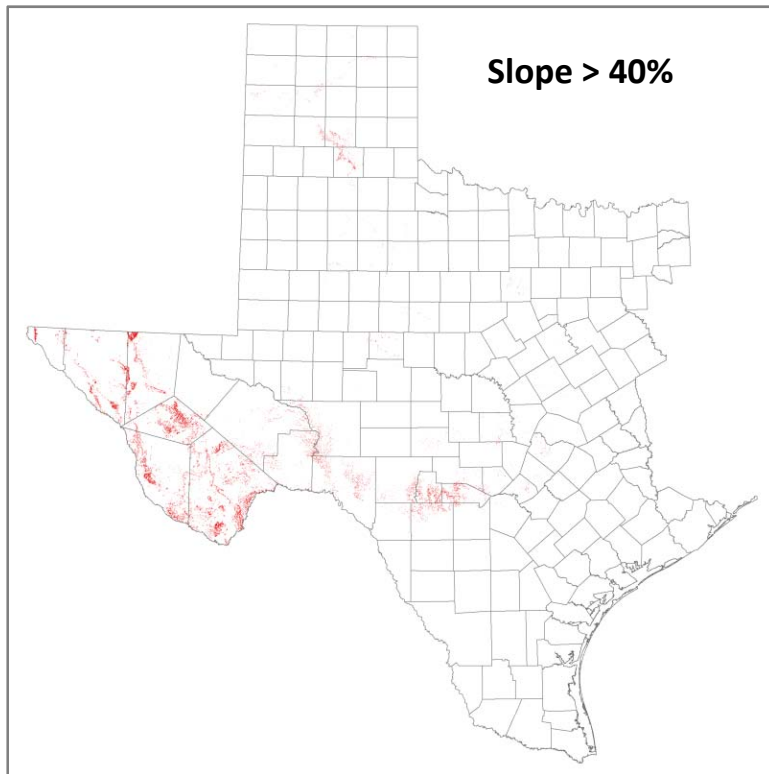
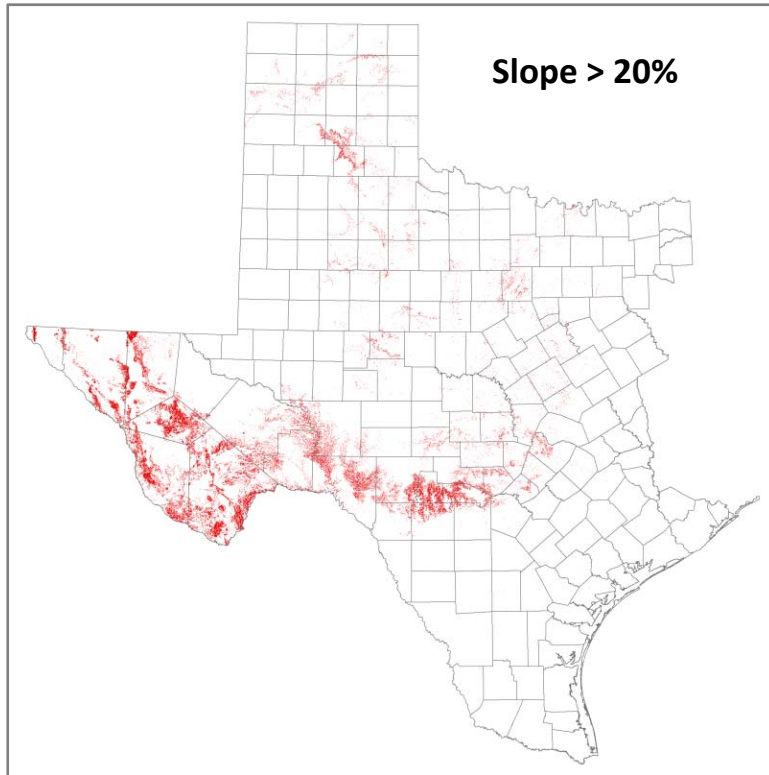


Figure 5. Areas where percent slopes are 20 percent or greater (top figure) and 40 percent or greater (bottom figure) in the Central and West Texas region.

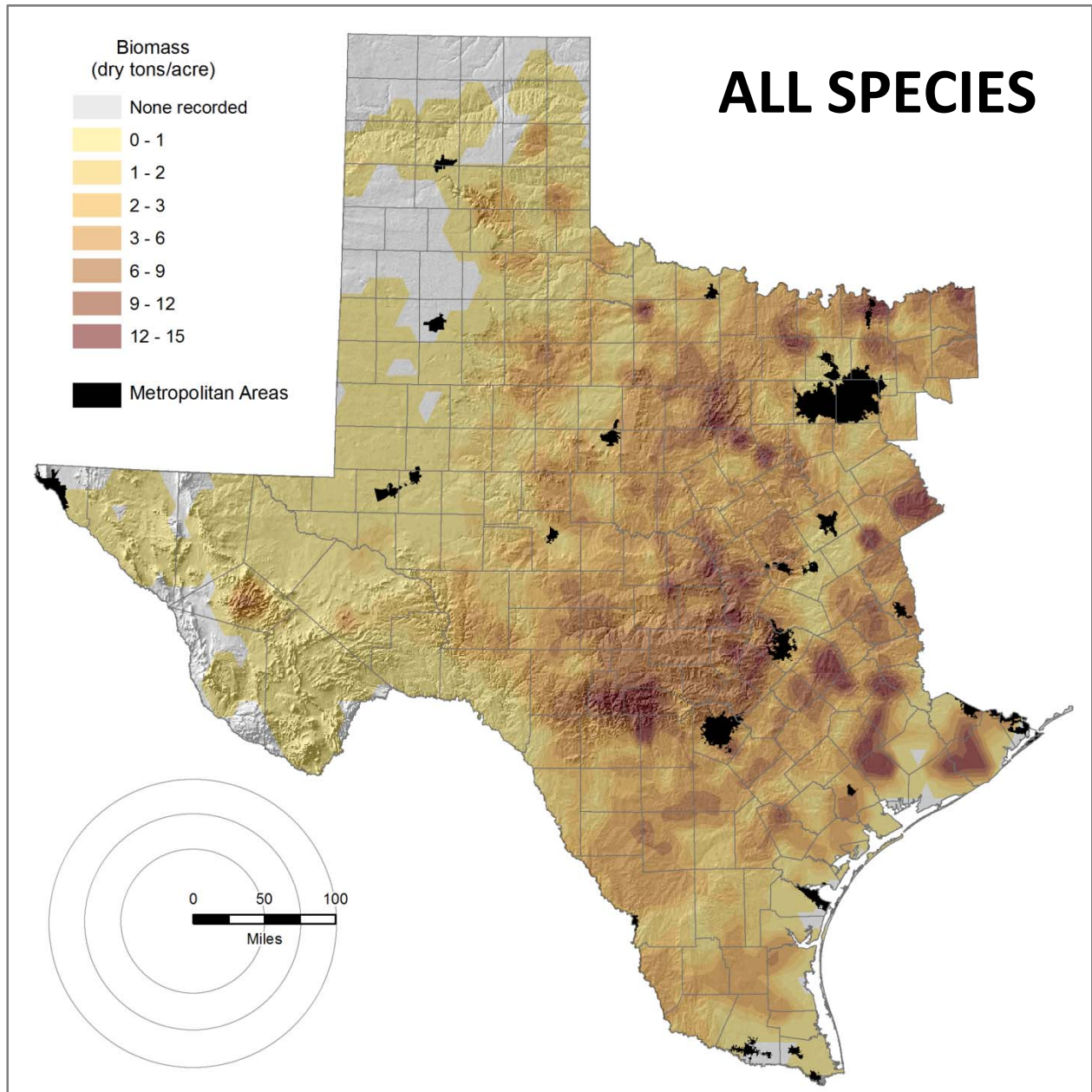


Figure 6. Estimate of woody biomass in dry tons per acres for all species over topographic relief across the Central and West Texas region. Black areas are metropolitan areas. “Bioshed” harvesting circles are shown for 50, 75, and 100 miles.

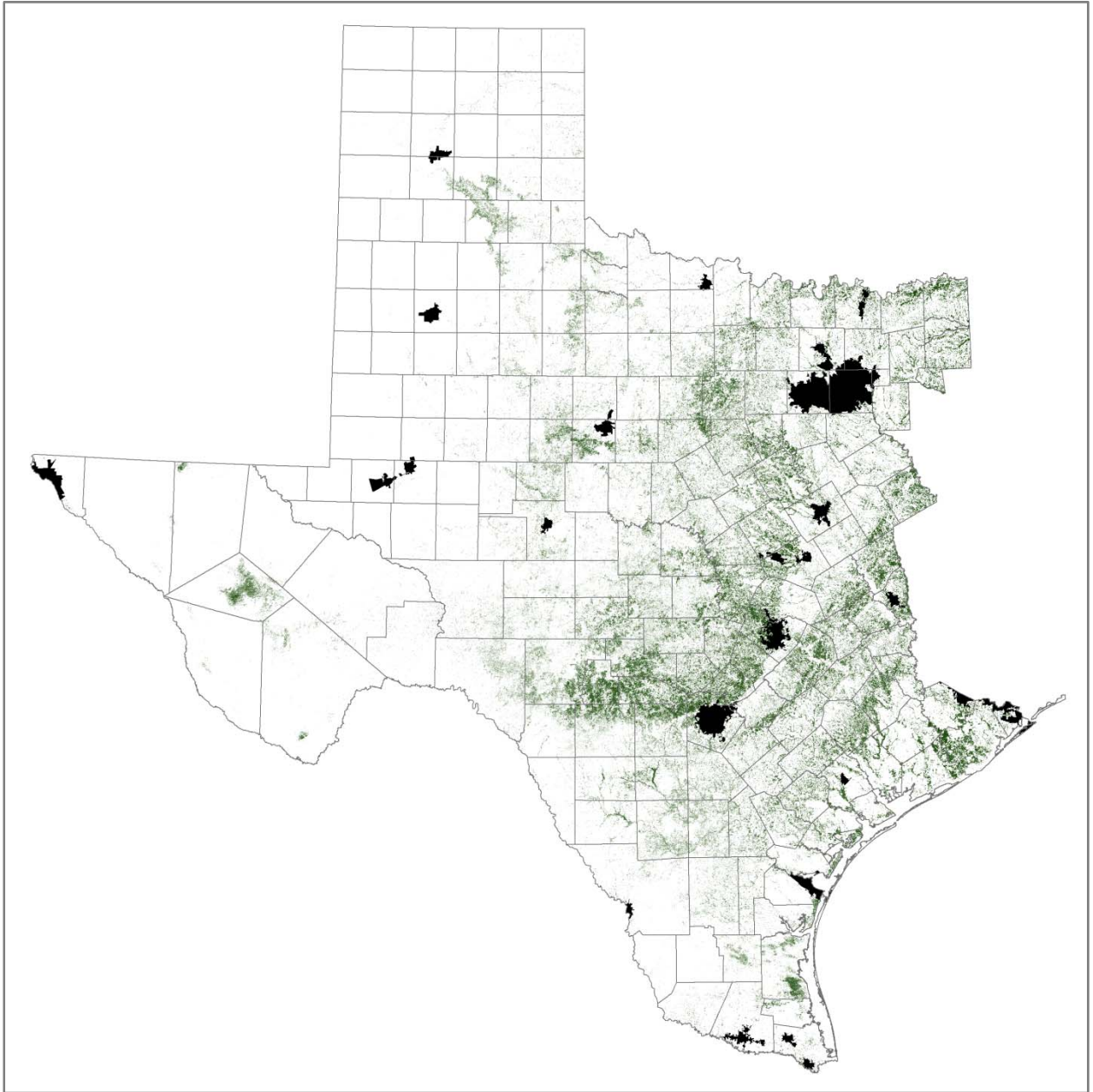


Figure 7. Estimate of percent tree canopy in the Central and West Texas region using the National Land Cover Database 2001. Black areas are metropolitan areas.