

Modeling Biodiversity and Ecosystem Services in West Texas for Renewable Energy Siting Assessments

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Decarbonizing the electrical grid by 2050 is a key strategy to achieve carbon neutrality goals, a common benchmark for climate change policies. However, low-carbon electricity capacity expansion via new utility-scale wind and solar developments will require substantial tracts of land, particularly in the Trans-Pecos region of west Texas, imparting some opportunity costs and pose risks to other ecosystem services, including biodiversity, ecosystem services, and cultural heritages that are tied to land quality. In this study, we use quantitative models of biodiversity and ecosystem services (BES) as decision support tools in energy facility siting. InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs) is a free, open-source suite of ecosystem services models maintained by the Natural Capital Project. The area of interest includes 18 counties and roughly corresponds to the Far West region of ERCOT, spanning over 11.2 million hectares of the Edwards Plateau, High Plains, and Chihuahuan Desert ecoregions. Remotely sensed datasets (USGS GAP rasters, DEM rasters, mean annual precipitation, etc.), local and regional knowledge of conservation values (obtained from stakeholder discussions in an unrelated project), and future development scenarios were synthesized into a subset of InVEST models, yielding quantitative representations of variations in ecosystem services tied to land use/land cover (LULC) types. Services mapped include crop pollination, carbon storage and sequestration (from biomass and soil carbon), sediment retention, and habitat quality.

The normalized, equally-weighted valuation of the BES (habitat biodiversity and intactness, viewshed quality, dark sky ratings) are concentrated in the southern region of the study area, which is largely under state and federal protection. The top 10% of pollination values are concentrated in Midland, Crockett, Val Verde, and Jeff Davis counties; the top 25% of carbon storage values are in western Pecos and Reeves Counties and southern Val Verde and Terrell Counties, though substantial intra-county variability in ecosystem services exists, largely as a function of land cover types. Overall, BES valuations are higher for grassland and woodland LULC types and lower for disturbed and scrubby LULC. These lower-valued land cover classes comprise >90% of land in northeastern counties, where solar facilities are most likely to be sited, and >70% of land in eastern and northeastern counties, where wind facilities are most likely to be sited. Relocating electricity generating facilities and support infrastructure from higher- to lower-valued land cover types, in some cases by <10 km, can substantially mitigate impacts to high-valued landscapes, while preserving the energy generation and economic benefits yielded from new facilities. These results support using spatially-explicit BES models, and incorporating results into life-cycle analyses, yielding a more comprehensive costs/benefits assessment involved in energy production and siting decisions.



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