

MAGGIE R. DAVIS

NATURAL RESOURCE DATA SCIENTIST

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With 13 years of experience, my research connects basic science to net-zero applications involving biomass:

- lead research on mobilizing biomass resources, including adaptive management of natural resource industries to leverage biomass for net-zero and bio-based circular economy markets;

Example of recent external impact: 1) Invited (virtual) hour-long seminar on BT23 forestry analysis (Davis et al., 2024) for the [Canadian Council of Forest Ministers](#) (July 18th, 2024; 95 participants); 2) Invited speaker at the [National Academy of Sciences](#), Biochar symposium (October 4th, 2023); 3) Lead crosscut forum on Timber, Building and Transportation Sciences Division (May 2024); 4) Co-lead workshop for Decarbonizing the Forest Products Industry, ESTD (June 2024)

- lead the data archive for distribution of flagship report (DOE 2024 Billion-Ton Report) on economic viability of biomass resources; modernizing and securing this data repository for future growth.

Example of recent external impact: 1) [EERE webinar](#) (virtual) on the BT23 release (Apr 16th, 2024, >200 participants): Speakers included: BETO Director Dr. Valerie Sarisky-Reed, BETO Technology Manager Dr. Mark Elless, ORNL, Dr. Matthew Langholtz, ORNL, Maggie Davis; 2) [Profiled by BETO: Trailblazing Foresters Contributing to the Future of Forestry Land-Based Biomass Resources](#)

Selected Current and Recently Completed Work:

- **PI managing >.5 million (avg.) annually:** <https://bioenergyKDF.ornl.gov> data repository: leveraging interoperable open-data initiatives to further the integrity and impact of bio-based industries in a global circular economy, for meeting mid-century decarbonization goals.
 - **Impact:** 225 new registrants to the bioenergyKDF since January 1st of 2024: 51% industry/consulting and 49% education/federal government.
- **PI (managing .25 million annually):** modeling and tool development to inform deployment of bioenergy crops for specific regions with known nature-based solutions (NbS) markets. Task collaborates with industry establishing NbS markets: hosted 4th largest landowner in US May 2024 (Rayonier Forestry).
- **Lead author:** Biomass resource assessment from the [forested land base](#) (part of [Billion Ton 2023](#)) and from the agricultural land base (e.g. in [BT16](#) and subsequent analyses and [papers](#))
- **Task lead:** NetZero-ARMADA (Scalable Multi-Sector Analysis Platform for the Energy Transition) Forest and Agriculture Resource and land allocation for decarbonized industries
- **Environmental Data Lead:** Centralized Health and Environment data Repository (C-HER)
- **Contributor:** [Circular Economy](#) (ISO 59020:2023(E)), strengthens connections with private industry measuring circularity and trade of products
- **Other Leadership, management:** Climate Change Science Institute; [ARM data center](#) (>2 PB spanning 30 years: Led a team of 3 to apply knowledge of data modeling and advanced computing to integrate and prepare metadata); Chairing Bioenergy, Climate Change & Carbon (E3 WG), Society of American Foresters | Washington, DC: increases cross-organization and interdisciplinary collaborations on forest carbon and bioenergy topics; Chairing the Women in Science and Engineering (WiSE) ERG for 650 staff.
- **Anticipated:** Invited, US Industrial Pellet Association, 2024 conference (Miami FL, November 2024); Organized session, Society of American Foresters Convention (Loveland CO, September 2024).

EDUCATION:

- In progress PhD in Systems Engineering, Colorado State University start Aug. 2023, completion 2026
- M.S., Forestry Wildlife and Fisheries Sciences, University of Tennessee, TN, USA 2011
- B.A., Economics and Geography, University of Tennessee, TN, USA 2007

PROFESSIONAL POSITIONS:

Oak Ridge National Laboratory, TN, USA

2011-present:

R&D Scientist (GS14 comp.), Mobility & Energy Transitions Analysis

Jan 2023 – present

Researching interdisciplinary decarbonization strategies using decision-science; leading R&D research on biomass availability for low-carbon strategies to meet US energy needs

- PI: modeling and tool development to inform deployment of bioenergy crops for specific regions with known nature-based solutions (NbS) markets that can enable cost competitiveness, *and* benefit marginalized communities. Task will collaborate with industry establishing NbS markets.
- Lead: forest-based biomass resource potential (economic assessment), DOE's next "Billion Ton" report
- Contributor: Biomass in a Circular Economy, International Standards Organization TC323, resulting in ISO/FDIS 59020:2023(E)
- Management: Atmospheric Radiation Measurement (arm.gov) metadata team for international networks of sensors and interoperability of data, utilizing open-source and AI tools.
- Leadership: Climate Change Science Institute, data and NbS
- Leadership: leveraging interoperable open-data initiatives to further the integrity and impact of bio-based industries in a global circular economy, for meeting mid-century decarbonization goals.
- Leadership: Scoping a Center of Excellence in Forest Products Decarbonization which includes developing guidelines and processes to improve product sustainability claims using accepted certifications and regulations
- Leadership: Building a team of Measurement Reporting and Verification (MRV) experts internal to ORNL and external collaborators to improve transparency, traceability and compliance with applicable sustainability standards and voluntary targets (e.g., SBTi, Science Based Targets; FSC, Forest Stewardship Council) of forest-based biomass products including energy and materials such as packaging.

R&D Scientist (GS13 comp.), Data Science & Integration: Atmospheric Radiation Measurement (ARM), Bioenergy Resources & Engineering Systems

2021 –2023

Leading data management at ARM, a DOE National User Facility, and leading R&D research on biomass availability for low-carbon strategies to meet US energy needs [3 Publications, 1 dataset to date]

- Lead author for forest-based biomass, DOE's next "Billion Ton" report (in development): modeling synthesis facilitates understanding of private industry interests and biomass market impact
- Drafting Team WG3, [TC323- Circular Economy](#): International Standards Organization: strengthens connections with private industry interested in measuring circularity and trade of products and services
- Coordinated data contributions from international field researchers for ARM's Data Center (ADC); incorporating standardized data management concepts (e.g., DublinCore) and pushing towards cutting edge technologies such as machine learning and graph database structures to support FAIR principles
- Modernized biomass resource assessment POLYSYS partial equilibrium model for high performance computing and moved manual analysis of data to automated Python workbooks, improving efficiency
- Managing a team of 3 responsible for all metadata for [ARM data](#): >2 PB spanning 30 years: Applied knowledge of statistics, mathematics, data modeling and high performance data architectures, and advanced computing to integrate and prepare data
- Chairing Bioenergy, Climate Change & Carbon (E3 WG), Society of American Foresters| Washington, DC: increases cross-organization and interdisciplinary collaborations on forest carbon and bioenergy topics
- Chairing the Women in Science and Engineering (WiSE) ERG for 650 women and allies

R&D Associate Scientist (GS12 comp.), ARM & Bioenergy Resources & Engineering Systems 2016 – 2021

Modernized ARM metadata management, led resource modeling and modernization of models on HPC, standards development and bioenergy sustainability assessments [10 Publications, 8 datasets]

- Lead modeling for ecosystem service valuation impact on feedstock markets: facilitates better data on the impact of valorizing water quality ES
- Billion Ton 2016: [Volume 1](#) Lead author and lead energy crop and agricultural residues modeler (POLYSYS); [Volume 2](#) author for Land Management (Ch 3) evaluating the impacts of biomass production

- Developed a trade module in POLYSYS, and improved data on impacts of bioenergy on commodity prices
- Developed International standards: [ASTM E3066, 2017](#): Standard Practice for Evaluating Relative Sustainability Involving Energy or Chemicals from Biomass
- Modernized the main portal to ARM data, [data discovery](#), including data epochs and recommendations
- Implemented automation and auditing for ARM metadata management, securing ADC expanded scope
- [Sustainability website](#) creator: Primary content developer, manager of UX design and implementation
- Lead for Data Management Planning for entire BioEnergy Technologies Office (BETO) portfolio
- Research Theme lead, Bioenergy, Climate Change & Carbon (E3) Working Group, Society of American Foresters | Washington, DC, US, 2020-2021. Chair the special session, Data for bioproduct assessments in November of 2021
- Lead author on [Regulation of Genetically Modified Trees](#), [Utilization of Woody Biomass for Energy](#), Committee on Forest Policy, Society of American Foresters
- Global Bioenergy Partnership participant:
- Award (Distinguished Achievement): Science Serving Society, Awarded May 2017
- Award (Service): Atmospheric Radiation Measurement (ARM): Awarded June 2021, Awarded June 2020

R&D Assistant Scientist (GS 11 comp.), Resource modeling, International trade of bioproducts 2014-2016

Supported 2 projects for assessments of sustainability and lead modeler on dedicated energy crops for BT16

- Demonstrated leadership and technical breadth as part of a small team leading modeling, visualizations, and stakeholder engagement to prepare content for the Billion Ton report, 2016.
- Secretariat (Working Group on Indirect Effects, ISO13065- Sustainability of Bioenergy): International Standards Organization | Geneva, CH; 2012-01-01 to 2015-09-30: Addressed key barriers, e.g., related to sustainability assessment methods, food security, land-use change (LUC), reference case and carbon measurement; Led final report, annotated bibliography, and 20 international webinars
- Contributed expertise in sustainability indicators to working group, [ISO](#) (The International Organization for Standardization). 2015. *13065:2015 - Sustainability criteria for bioenergy*. Paris, France: ISO.
- Lead investigator for report, "Bioenergy trade and Domestic Biomass Resource Implications"
- Contributing investigator for report, "Brief Perspectives on Expanding Advanced Energy Sources in Brazil: Part 1: Biofuels and Bioenergy" 2015. Office of intelligence and counterintelligence.
- Contributor to Brazil Bio-Energy, Science and Technology Conference - Communications, awareness, joint presentations on sustainability, food security, carbon accounting

Postmasters Research Associate (GS10 comp.)

2011–2014

Supported 2 projects for sustainability assessments of biomass for bioenergy, collaborating with Brazilian researchers on land use change assessments, bioenergy sustainability [3 Publications]

- Led 30 international webinars as Secretariat (Working Group on Indirect Effects, ISO13065- Sustainability of Bioenergy): International Standards Organization | Geneva, CH;
- US delegate to ISO13065: Working Group on Indicators of bioenergy sustainability
- International collaborations with Brazil researchers resulted in report: Comparison of Regions and Modeling of Land in the GTAP-DEPS and BLUM. Oladosu, G., M.M.R. Moreira, K. Kline, M. Davis, W. Kmura, 2014.

The University of Tennessee, Knoxville TN, USA

Institute for a Secure & Sustainable Environment, Research Specialist III (GS9 comp.):

2006-2010

Throughout my master's education, I supported 2 projects to develop science teacher training programs [1 Pub]

- Created ORNL STEM teacher training workshops, led reports to funders and tours at ORNL
- Environmental education program created for Tennessee Valley Authority and delivered to Alcoa school

Additional Training:

- Data Science & other training

(2016 to present)

- Continuing Forestry Education (CFE) SAF: Enhancing the precision of broad-scale forest growing stock and stock change estimates with small area estimation (2021); Data Science for Forestry (2018)
- Python (SciPy), annually since 2017
- Disciplined Agile Scrum Master training (Project Management Institute), 2020
- Modeling trade of bioproducts, Agricultural Economics (University of Tennessee)

RESEARCH SKILLS:

- Natural resource economics, carbon valuation, soil organic carbon (SOC) sequestration
- Data science, data archival standards & visualization,
- Biomass standards & certification development
- Bioenergy resource scenarios using Short Rotation Woody Crops (SRWCs)- e.g., BECCS
- Computer science: Python, SQL, Fortran, High Performance Computing (Linux), Git, Tableau, Power BI, GIS/remote sensing,
- Models: POLYSYS, ForSEAM

LANGUAGES:

Portuguese (Level 3 ILR), Spanish (Level 2 ILR)

REFEREED PUBLICATIONS:

[<https://tinyurl.com/yyfco6eg>]:

1. **Davis**, M., L. Lambert, R. Jacobson, D. Rossi, C. Brandeis, J. Fried, B. English, et al. 2024. "Chapter 4: Biomass from the Forested Land Base." In 2023 Billion-Ton Report. M. H. Langholtz (Lead). Oak Ridge, TN: Oak Ridge National Laboratory. doi: 10.23720/BT2023/2316170.
2. Quille RVE, de Almeida FV, Ohara MY, Corrêa PLP, de Freitas LG, Alves-Souza SN, de Almeida JR Jr., Davis M, Prakash G., 2023. Architecture of a Data Portal for Publishing and Delivering Open Data for Atmospheric Measurement. International Journal of Environmental Research and Public Health. 20(7):5374. <https://doi.org/10.3390/ijerph20075374>
3. Hossain, T., D. S. Jones, D. S. Hartley, D. N. Thompson, M. Langholtz, M. Davis, 2022. Nth-plant scenario for forest resources and short rotation woody crops: Biorefineries and depots in the contiguous US, Applied Energy, Volume 325, 2022, 119881, ISSN 0306-2619, <https://doi.org/10.1016/j.apenergy.2022.119881>.
4. Hossain, T., D.S. Jones, D. Hartley, M. Griffel, Y. Lin, P. Burli, D. Thompson, M Langholtz, M. Davis, C. Brandt. 2021. Locating nth-plants for biomass conversion and preprocessing nationwide: biorefineries and depots. Applied Energy. <https://doi.org/10.1016/j.apenergy.2021.116946>
5. Parish, E., V. Dale, M. Davis, R. Efrogmson, M. Hilliard, H. Jager, K. Kline, F. Xie. 2021. An Indicator-based Approach to Sustainable Management of Natural Resources. Chapter 14 of Data Science Applied to Sustainability Analysis. ISBN: 9780128179765.
6. Guntapally, K., K. Dumas, G. Prakash, R. Devarakonda, W. Darnell, M. Davis, R. Cederwall, 2021. Enabling modern data discovery for atmospheric measurements. Earth Science Informatics. <https://doi.org/10.1007/s12145-021-00635-0>
7. **Davis** M., D. Kainer, G. Tuskan, M. Langholtz, C. Hellwinckel, M. Shedden, L. Eaton, 2020. Modeled economic potential for Eucalyptus spp. production for jet fuel additives in the United States, Journal Biomass and Bioenergy, 143. <https://doi.org/10.1016/j.biombioe.2020.105807>
8. Langholtz, M., B. H. Davison, H. I. Jager, L. Eaton, L. M. Baskaran, M. Davis, Craig C. Brandt, 2020. Increased nitrogen use efficiency in crop production can provide economic and environmental benefits, Science of The Total Environment, 2020, 143602, ISSN 0048-9697, <https://doi.org/10.1016/j.scitotenv.2020.143602>.
9. Langholtz M., I. Busch, A. Kasturi, M. Hilliard, J. McFarlane, C. Tsouris, S. Mukherjee, O. Omitaomu, S. Kotikot, M. Ree Allen, C. DeRolph, M.R. Davis, E.S. Parish, 2020. The economic accessibility of CO2 sequestration through bioenergy with carbon capture and sequestration (BECCS) in the US. Land 2020, 9(9), 299; <https://doi.org/10.3390/land9090299>.
10. Langholtz, M., Eaton, L., Davis, M., ...Brandt, C., Hilliard, M. (2019), Cost and profit impacts of modifying stover harvest operations to improve feedstock quality. Biofuels, Bioproducts and biorefining, 2019, 13(4), pp. 1098-1105

11. Langholtz, M., Eaton, L., Davis, M., ... Volk, T., Richard, T. (2019). Economic comparative advantage of willow biomass in the Northeast USA. *Biofuels, Bioproducts and Biorefining*, 2019, 13(1), pp. 74-85
12. **Davis**, M.R.; Alves, B.J.R.; Karlen, D.L.; Kline, K.L.; Galdos, M.; Abulebdeh, D. Review of Soil Organic Carbon Measurement Protocols: A US and Brazil Comparison and Recommendation. *Sustainability* 2018, 10, 53.
13. Eaton L., M. Langholtz M. Davis, 2018. The impact of alternative land and yield assumptions in herbaceous biomass supply modeling: one-size-fits-all resource assessment? *Journal of Biofuels, Bioproducts and Biorefining*, 2018. Volume13, Issue1. P. 120-128. <https://doi.org/10.1002/bbb.1946>
14. Kline, K.L., M.R. Davis, J. Dunn, L. Eaton, R.A. Efroymsen, 2017. Land, crops, and landmanagement: Understanding potential direct and indirect “land-use change” (LUC) under BT16 simulations. 2016 Billion-Ton Report: Advancing Domestic Resources for a Thriving Bioeconomy, Volume 2: Environmental Sustainability Effects of Select Scenarios from Volume 1. doi: 10.2172/1338837
15. Brandt C., M. Langholtz, M. Davis, Bryce Stokes, Chad Hellwinkel, Keith Kline, and Laurence Eaton, 2017. Chapter 2 – BT16 Feedstock Assessment Methods and Focal Scenarios U.S. Department of Energy. Appearing in Volume 2: Environmental Sustainability Effects of Select Scenarios from Volume 1 (2016 Billion-Ton Report: Advancing Domestic Resources for a Thriving Bioeconomy). doi 10.2172/1338837
16. **Davis**, M.R., L.M. Eaton, M.H. Langholtz, A. Turhollow, C. Brandt, and M.H. Hillard, 2016. Agricultural residues and biomass crops at the farmgate. U.S. Department of Energy. 2016. 2016 Billion-Ton Report: Advancing Domestic Resources for a Thriving Bioeconomy, Volume 1: Economic Availability of Feedstocks. doi: 10.2172/1271651.
17. Dale V.H., Efroymsen R.A., Kline K.L., Langholtz M.H., Leiby P.N., Oladosu G.A., Davis M.R., Downing M.E., Hilliard M.R., 2013. Indicators for assessing socioeconomic sustainability of bioenergy systems: A short list of practical measures. *Ecological Indicators* 26: 87-102. <http://dx.doi.org/10.1016/j.ecolind.2012.10.014>
18. Oladosu G, Kline K, Leiby P, Uria-Martinez R, Davis M, Downing M and Eaton L. 2012. Global economic effects of US biofuel policy and the potential contribution from advanced biofuels. *Future Science – Biofuels* 3(6):703-723.
19. Peine, J., B. Jacobs, K. Franzreb, M. Stevens, 2011. *Ecosystem Management - The Law and Politics of Sustainability*, Berkshire Encyclopedia of Sustainability
20. Slayton, J.D., M.R. Stevens (**Davis**), H.D. Grissino-Mayer, and C.H. Faulkner, 2009. The Historical Dendroarchaeology of Two Log Structures At the Marble Springs Historic Site, Knox County, Tennessee, U.S.A *Tree-Ring Research* 65(1):23-36. 2009. doi: <http://dx.doi.org/10.3959/2007-5.1>

DATASETS

1. Davis, Maggie R. 2021. Integrated land management scenarios: regional demand of bioethanol for select counties (single refinery) and crops. <https://doi.org/10.11578/1797943>. Select [visualizations](#) available.
2. Davis, Maggie R., 2020. RegionalDemand-CornStover_INL_BT16BC1030-40-50 (data available 6/19/20) doi 10.11578/1633888
3. Davis, Maggie R., 2020. stovetillage2019-bc1040-060 (data available 6/9/20) doi 10.11578/1632327
4. Langholtz, Matthew; Busch, Ingrid; Kasturi, Abishek; Hilliard, Mike R.; McFarlane, Joanna; Tsouris, Costas; Mukherjee, Srijib; Omitaomu, Olufemi A.; Kotikot, Susan M.; Allen-Dumas, Melissa R.; DeRolph, Christopher R.; Davis, Maggie R; Paris, Esther S. Data and interactive visualization for "The economic accessibility of CO2 sequestration through bioenergy with carbon capture and sequestration (BECCS) in the US" submitted to the journal "Land", 2020 (data available 8/6/20) doi 10.11578/1647453
5. Davis, M. 2018. Dataset: NewBio_SwgMxgWillowOnly: Price Scenarios at \$54 and \$119 simulated for Switchgrass, Miscanthus and Willow production from 2017 to 2040. Feedstock Production, Supporting Data available on the BioKDF 01/01/2018. DOI 10.11578/1468424
6. Davis, MR. CH Hellwinkel, L. Eaton, MH Langholtz, A. Turhollow, C Brandt, A Myers, 2016. Agricultural Baseline (BLO) scenario of the 2016 Billion-Ton Report (data available 7/13/16) doi 10.11578/1337884
7. Davis, MR. CH Hellwinkel, L. Eaton, MH Langholtz, A. Turhollow, C Brandt, A Myers, 2016. Base-Case 1% Yield Increase (BC1), All Energy Crops scenario of the 2016 Billion Ton Report (data available 7/13/16) doi 10.11578/1340497

8. Davis, MR. CH Hellwinkel, L. Eaton, MH Langholtz, A. Turhollow, C Brandt, A Myers, 2016. 2% Yield Increase (HH2), All Energy Crops scenario of the 2016 Billion Ton Report (data available 7/13/16) doi 10.11578/1340541
9. Davis, MR. CH Hellwinkel, L. Eaton, MH Langholtz, A. Turhollow, C Brandt, A Myers, 2016. 3% Yield Increase (HH3), All Energy Crops scenario of the 2016 Billion Ton Report (data available 7/13/16) doi 10.11578/1340543
10. Davis, MR. CH Hellwinkel, L. Eaton, MH Langholtz, A. Turhollow, C Brandt, A Myers, 2016. 4% Yield Increase (HH4), All Energy Crops scenario of the 2016 Billion Ton Report (data available 7/13/16) doi 10.11578/1340546

SELECTED INVITED SYMPOSIA, PRESENTATIONS AND SEMINARS:

1. Davis, M. 2023. "Biomass available from the forested land base: a focus on wildfire crisis strategy residues for biochar applications." Invited speaker at the National Academy of Sciences, Biochar focused symposium. October 4th, 2023.
2. Davis, M. 2023. "[Forested Anthromes](#): providing an opportunity for net-zero goals through sustainable management" at Anthromes, CO₂, and Terrestrial Carbon: From the deep past to net-zero. Monday 27 March – Thursday 30 March 2023, Washington D.C. (Potomac Maryland), USA
3. Invited speaker, V Workshop on Data Science of Escola Politécnica da Universidade de São Paulo - Challenges in Brazilian context to promote atmospheric data management, 2020
4. Davis, M., Langholtz, M., Kainer, D. The potential for eucalyptus spp. production in the U.S, sustainability considerations. AIChE Bioenergy Sustainability Conference 2019, pp. 13-14
5. Davis, M. 2016. Chapter 4 of the Billion Ton assessment as presented by the chapter's lead authors in Breakout Session 1-A: Assessing America's Biomass Potential (2016 Billion-Ton Report). Bioenergy 2016: Mobilizing the Bioeconomy through Innovation. Washington, D.C., July 2016.
6. Davis, M. 2014. Indirect effects of bioenergy: International standards and science. RCN Conference on Pan American Biofuels and Bioenergy Sustainability 2014, pp. 264-276