# Daniel Hardesty Lewis

## Education

2017 Dec. **B.S., Mathematics**, *University of Texas*, Austin, United States.

2017 Dec. **Certificate, Scientific Computation**, *University of Texas*, Austin, United States.

## Experience

### Research

2021 Aug. – Present **Engineering scientist associate**, *Texas Advanced Computing Center*, Austin, United States.
Detailed accomplishments:
- Design and implement intelligent decision support systems to support computational science, disaster mitigation and response, and resiliency research projects
- Design and maintain a publicly available Python library of functions supporting high-scale manipulation of Texas's 40TB Lidar DEM dataset
- Help mentor and teach a wide array of graduate students from UT Austin, University of Cambridge, & Texas A&M - Galveston

2018 Feb. – 2021 July **Research engineering / scientist associate I**, *Texas Advanced Computing Center*, Austin, United States.
Detailed accomplishments:
- Contributed research in integrated modelling and water resource management in Texas and abroad
- Collaborating to develop a unified data representation of Texas's water resources for integrated hydrology modellers
- Helped teach courses in data informatics and machine learning in the geosciences

2017 May – 2017 Aug. **Undergraduate research assistant**, *Texas Advanced Computing Center*, Austin, United States.
Equipped with a fellowship from the University of Texas's College of Natural Sciences, improved interoperability amongst groundwater flow models using high-performance computing methods
Detailed accomplishments:
- Updated decades-old groundwater modelling software's data conversion utilities in their original languages, Fortran 66 and 90
- Retrieved matching variables between groundwater modelling softwares using term frequency - inverse document frequency (TF-IDF)
- Led a workshop on modern programming technologies for grounwater modelling

2016 June – 2016 July **Foreign exchange student**, *Intelligent Systems in Geosciences*, San Miguel de Allende, Mexico*; then* Mexico City, Mexico*; then* Austin, United States.
Developed conversion utilities between groundwater flow models
Detailed accomplishments:
- Developed a data conversion API in Perl for the groundwater modelling software, MODFLOW-96
- Used regular expressions to parse these variables
- Independently developed similar functionality to the then-unreleased Python package for MODFLOW data conversion, FloPy

2013 May – 2013 Dec. **Undergraduate research assistant**, *Dept. of Astronomy, University of Texas*, Austin, United States.
Tested boundaries of the stellar evolution code, MESA, by extensive simulation
Detailed accomplishments:
- Discovered that MESA successfully simulated O/Ne white dwarf stellar evolution
- Found the model's bounds for such stellar evolution
- Demonstrated the accuracy of these simulations against peer-reviewed observations of similar stars

### Teaching

2020 Aug. – 2020 Dec. **Co-instructor**, *University of Texas*, Austin, United States.
*Scientific computation* As part of a team of TACC co-instructors, consulted with students for their homework and class projects

*1915 Santa Clara st – Austin, TX 78757 – United States*
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*dhl* • *researchgate.net/profile/Daniel-Hardesty-Lewis*

2018 June – 2018 Aug. **Teaching assistant**, *Texas Advanced Computing Center*, Austin, United States.
*Machine learning for the geosciences* Recommended efficient uses of TACC's supercomputers, as well as specific performance optimisations for Petrobras's code developed during the course

2018 Feb. – 2018 May **Co-instructor**, *University of Texas*, Austin, United States.
*Data informatics and intelligent systems for the geosciences* Designed and instructed the technical half of this graduate course: intermediate programming techniques, Linux, and introductory high-performance computing

### Professional

2014 Sep. – 2020 Aug. **Systems designer**, *Inter-Cooperative Council*, Austin, United States.
Completely redesigned internet infrastructures for 9 buildings housing 115 students
Detailed accomplishments:
- Completely gutted and redesigned from scratch their internet infrastructures
- Analysed each house's floor-plans and building materials to best locate the new high-speed wireless access points
- Trained organization staff in the new information technology, so they could continue to maintain it themselves to the present day

2016 Oct. – 2017 Jan. **Information technology intern**, *Mission Interuniversitaire de Coordination Échanges Franco-Américains*, Paris, France.
Developed Bash workflow that transforms antiquated, proprietary database into contemporary, SQL one

2015 June – 2018 Aug. **Conflict mediator**, *Inter-Cooperative Council*, Austin, United States.
Fairly enforced contracts as neutral arbiter between members and their respective cooperative houses
Detailed accomplishments:
- Familiar with all of the relevant house policies and the housing cooperative's by-laws
- On-call to mediate when conflicts between members arose
- Brought parties to mutually agreed-upon solutions

2014 Sep. – 2018 Aug. **Maintenance & technology officers**, *Avalon*, *Helios*, then *Royal Co-operatives*, ICC, Austin, United States.
Redeveloped the internet infrastructures for these co-operative houses
Detailed accomplishments:
- Implemented SFTP server accessible remotely by house's residents
- Made multiple GNU/Linux desktop computers available for residents' use
- Laid ethernet wire and installed routers and access points tailored with OpenWRT

## Peer-reviewed articles

2021 July Gil, Y., D. Garijo, D. Khider, C. A. Knoblock, M. Osorio, H. Vargas, M. Pham, J. Pujara, B. Shbita, B. Vu, Y. Chiang, D. Feldman, Y. Lin, H. Song, V. Kumar, A. Khandelwal, M. Steinbach, K. Tayal, S. Xu, S. A. Pierce, L. Pearson, *D. Hardesty Lewis*, E. Deelman, R. F. da Silva, R. Mayani, A. R. Kemanian, Y. Shi, L. Leonard, S. .D. Peckham, M. Stoica, K. M. Cobourn, Z. Zhang, C. Duffy, L. Shu. "Artificial Intelligence for Modeling Complex Systems: Taming the Complexity of Expert Models to Improve Decision Making". The ACM Transactions on Interactive Intelligent Systems 11(2):11.

## Conference papers

2019 Mar. Garijo, D., J. Pujara, B. Vu, D. Feldman, R. Mayani, K. Cobourn, C. Duffy, A. R. Kemanian, L. Shu, V. Kumar, A. Khandelwal, D. Khider, K. Tayal, S. D. Peckham, M. Stoica, A. Dabrowski, *D. Hardesty Lewis*, S. A. Pierce, V. Ratnakar, Y. Gil, E. Deelman, R. F. da Silva, C. Knoblock, Y. Chiang, M. Pham. "An intelligent interface for integrating climate, hydrology, agriculture, and socioeconomic models". ACM 24th International Conference on Intelligent User Interfaces (IUI'19).

2018 June Garijo, D., D. Khider, Y. Gil, L. A. M. C. Carvalho, B. T. Essawy, S. A. Pierce, *D. Hardesty Lewis*, V. Ratnakar, S. D. Peckham, C. Duffy, J. L. Goodall. "A Semantic Model Catalog to Support Comparison and Reuse". 9th International Congress on Environmental Modelling and Software.

## Technical reports

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2021 Mar. Sun, A., M. H. Young, S. A. Pierce, J. Thompson, *D. Hardesty Lewis*, B. R. Scanlon. "Development of a Framework of Data Interpolation, Scaling, and Homogenization (DISH) for Mapping Natural Resources and Socioeconomic Data in Texas".

2019 Oct. Khider, D., Y. Gil, D. Garijo, K. M. Cobourn, C. Duffy, A. R. Kemanian, S. D. Peckham, B. Watkins, A. Campion, C. Preager, S. A. Pierce, *D. Hardesty Lewis*, A. Dabrowski, C. H. Porter, M. Landsfeld, M. Puma, B. Schauberger, A. Sliva, C. T. Morrison. "Towards a Shared Modeling Terminology and Problem Specification Framework".

## Presentations

2021 May Passalacqua, P., F. R. Salas, R. Schomp, A. Carruthers, *D. Hardesty Lewis*. "Estimating Inundation Extent and Depth from National Water Model Outputs and High Resolution Topographic Data". Presented to the National Oceanographic and Atmospheric Administration.

2020 Dec. Sun, A., J. Thompson, *D. Hardesty Lewis*, J. Powell, M. H. Young, B. R. Scanlon, S. A. Pierce. "Development of a Framework of Data Interpolation, Scaling, and Homogenization (DISH) for Mapping Natural Resources in Texas". Presented at the 2020 annual Fall Research Showcase of Planet Texas 2050.

2020 Sep. Passalacqua, P., D. R. Maidment, D. Arctur, H. Evans, C. Thies, A. Carruthers, R. Schomp, *D. Hardesty Lewis*, S. A. Pierce. "From Rain Forecasts to Stream Flow to Flood Modelling". Presented at the 2020 annual Fall Research Showcase of Planet Texas 2050.

2020 Aug. *Hardesty Lewis, D.*. "Vector and Raster GIS Processing with Python in Jupyter Notebooks". Presented at the 2020 annual TACC Institute of Planet Texas 2050.

2019 Sep. *Hardesty Lewis, D.*, A. Dabrowski, J. Powell, S. A. Pierce. "DataX and MINT Overview". Presented at the 2019 annual Fall Research Showcase of Planet Texas 2050.

## Posters

2019 Dec. Khider, D., Y. Gil, K. M. Cobourn, E. Deelman, C. Duffy, R. F. da Silva, A. R. Kemanian, C. A. Knoblock, V. Kumar, S. D. Peckham, Y. Chiang, D. Feldman, D. Garijo, *D. Hardesty Lewis*, A. Khandelwal, R. Mayani, M. Osorio, M. Pham, S. A. Pierce, J. Pujara, V. Ratnakar, L. Shu, H. J. Song, B. Shbita, M. Stoica, B. Vu, L. Pearson. "MINT: An intelligent interface for understanding the impacts of climate change on hydrological, agricultural and economic systems". Poster presented at the 2019 annual fall meeting of the American Geophysical Union.

2019 June *Hardesty Lewis, D.*, J. C.Thompson, E. Pease, Q. Yang, M. H. Young, S. A. Pierce. "A unified data representation of Texas water resources". Poster presented at the 2019 annual meeting of the Earthcube community.

2019 June Pierce, S. A., J. Powell, A. Karpatne, D. Garijo, J. Martin, *D. Hardesty Lewis*, P. Marchetto, S. Cleveland, M. Daniels, I. Athanasiadis, P. Keys, I. Demir, D. Fuka, S. Peckham, M. Hill, I. Ebert-Uphoff, D. Pennington, G. Jacobs, Y. Gil. "Intelligent Systems and Geosciences". Poster presented at the 2019 annual meeting of the Earthcube community.

2019 June Powell J., A. Karpatne, D. Garijo, J. Martin, *D. Hardesty Lewis*, P. Marchetto, S. Cleveland, M. Daniels, I. N. Athanasiadis, P. W. Keys, I. Demir, S. D. Peckham, M. Hill, I. Ebert-Uphoff, D. Pennington, G. Jacobs, Y. Gil, S. A. Pierce. "Creating Sustainable Knowledge Centric Communities with Artificial Intelligence Applications to Earth Science Problems". Poster presented at the 2019 annual meeting of the Earthcube community.

2019 June Pease, E., J. C. Thompson, *D. Hardesty Lewis*, Q. Yang, S. A. Pierce, M. H. Young. "Integrated Modeling of Texas Water Resources". Poster presented at the 2019 annual meeting of the MODFLOW and More conference series.

2018 Dec. Pease, E., A. Pfeil, V. Ibarra, S. Siddique, F. Apango, O. Ramirez, E. Collado, *D. Hardesty Lewis*, N. Freed, S. A. Pierce. "Groundwater Modeling with Informatics and Automated Workflows for Water Resource Management: A Case Study from the Northern Trinity Aquifer". Poster presented at the 2018 annual fall meeting of the American Geophysicial Union.

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2018 Sep. Martin, J., *D. Hardesty Lewis*, N. Freed, S. A. Pierce. "The IS-GEO Gateway: A community portal to facilitate AI and knowledge centered earth discoveries". Poster presented at the 13th annual conference of Gateway Computing Environments.

2018 June Martin, J., D. Garijo, N. Freed, S. A. Pierce, Y. Gil, D. R. Thompson, I. Demir, I. Ebert-Uphoff, D. Pennington, *D. Hardesty Lewis*, M. Hill, D. Fuka. "IS-GEO: A Research Coordination Network on Intelligent Systems Research to Support he Geosciences". Poster presented at the 2018 annual meeting of the EarthCube community.

2017 Dec. *D. Hardesty Lewis*, S. A. Pierce. "From MODFLOW-96 to MODFLOW-2005, ParFlow, and Others". Poster presented at the 2017 annual fall meeting of the American Geophysical Union.

2017 Dec. Kejriwal, M., S. A. Pierce, P. I. Q. Houser, S. D. Peckham, Z. Stanko, *D. Hardesty Lewis*. "Semi-automatic Data Integration using Karma". Poster presented at the 2017 annual fall meeting of the American Geophysical Union.

2016 July Cantu, A., S. A. Pierce, O. Rivera, A. Ramirez, *D. Hardesty Lewis*, J. Gentle, G. Fuentes-Pineda. "Big Data Analysis for Determining Sustainable Yield and Negotiation Space for an Aquifer System". Poster presented at the 51st annual meeting of the South-Central Section of the Geological Society of America.

2016 Apr. *Hardesty Lewis, D.* "On smoothness and Poisson's Equation". Presented at the 2016 annual DRP Undergraduate Project Symposium at the University of Texas at Austin.

## Academic projects

2020 Dec. – Present
Museum of South Texas History Sunday Speaker Series
Provide Dash-enabled website to facilitate geolocation of archival imagery by museum visitors

2020 Sep. – Present
Real-time flood inundation mapping to improve community resilience
Provide simple, computationally efficient, high-resolution flood inundation maps to emergency response personnel

2020 Jan. – Present
Estimating Inundation Extent and Depth from National Water Model Outputs and High Resolution Topographic Data
Improving the accuracy of flood inundation estimation products from 10m to 1m resolution

2017 Dec. – Present
MINT: Model INTegration Through Knowledge-Rich Data and Process Composition
Integrate geoscience models MODFLOW, HAND, & SWAT with models from widely separate disciplines including agriculture, economics, and social sciences

2016 Aug. – Present
Intelligent Systems for Geosciences
Used natural language processing and ETL pipelines to capture geoscientific variables' metadata to integrate with intelligent systems

2019 Sep. – 2020 Aug.
Improving the Estimation of Inundation Extent and Depth with High Resolution Terrain Data Over the State of Texas
Provided utilities to scale up the flood modelling toolset, GeoFlood, to statewide applicability across Texas

2018 July – 2019 Dec.
Optimal Averaging of Water Resources in Texas
Indentified Texas water data sources, described their spatio-temporal scales and locations, estimated volume of all water in Texas its uncertainty, determined best methods to up-/down-scale all date to a common resolution and grid and minimise error

2017 May – 2017 Aug.
From MODFLOW-96 to MODFLOW-2005, ParFlow, and Others
Brought a common groundwater flow model to scale on a supercomputer by updating its own Fortran code, using Perl natural language processing to extract and transform useful metadata from its user manual, and helping to get that metadata incorporated into a widely used scientific ontology

2016 July
Big Data Analysis for Determining Sustainable Yield and Negotiation Space for an Aquifer System
Developed some Perl transformation routines between input file formats of groundwater models, MODFLOW-96 and ParFlow

2014 Oct. – 2014 Dec.
Stochastic Differential Equations and Monte Carlo Simulation
Drafted Fortran routine that could run arbitrary equations of this type with arbitrary parameters

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2013 May – 2013 Dec. Region of Calculated Existence for O/Ne-Core Stars with H/He Envelopes
Verified known observations, discovering that MESA accurately models this type of star under its default parameters

## Professional projects

2019 Nov. – Present **Board member**, *Austin Community Reinvestment Cooperative (ACRC)*, Austin, United States.
Helped establish cooperative real estate investment firm
Detailed accomplishments:
- Shaped bylaws and business plan, having consulted with advisors who've had 40+ years in cooperative development experience
- Provide GIS maps of specific properties to follow for a potential purchase, having selected them from criteria applied across parcel-level data
- Provide heat maps to help determine the best neighborhoods for investment based on parcel-level zoning, existing building characteristics, and simple Python pro formas
- Develop fully detailed real estate development pro formas for specific properties
- Develop and maintain relationships with Central Austin property owners interested in a collaboration
- Develop and submit options-to-purchase to interested property owners

2019 May – Present **Member-owner**, *Hardy Cooperative*, Austin, United States.
Helped establish Central Austin affordable housing cooperative
Detailed accomplishments:
- Helped establish affordable housing cooperative of 7+ households in Central Austin, generating $60,000+ in annual revenue while providing rents 35% more affordable than nearby alternatives
- Collaborated with Dave Sullivan, former long-time chair of Austin planning commission, to determine that we met all zoning requirements for our use
- Secured 3 guarantors willing to front $40,000-$80,000 in liability for our commercial lease and new venture
- Drafted and implemented business prospectus, operational pro forma, resident lease applications, resident lease agreements, guarantor agreements, loan agreements, etc
- Maintained good relationships with 2 separate pro bono attorneys who have extensively reviewed, provided feedback, and largely rubber-stamped the contracts I have written
- Secured $30,000+ in lending, as well as conditional approval for another $40,000
- Received 150+ applicants for only 7 spaces in just 2 years of operation
- Established and maintained relationships with a 20+-year old housing coop and the ACRC in order to secure the long-term future of this venture

2019 May – 2020 Apr. **Member, housing committee**, *Austin Cooperative Business Association*, Austin, United States.
Austin Land Development Code (LDC) Revision
Detailed accomplishments:
- Reviewed cumulative 3000+ pages of 6 different Austin LDCs (1972, 1984, current, and LDC drafts 1, 2, & 3)
- Developed ACBA policy positions from understanding of these codes
- Distributed GIS maps depicting impact of each proposed LDC draft and our proposed LDC amendments on current and future affordable housing cooperative development
- Secured meeting with Mayor Steve Adler
- Advocated ACBA's position in direct meetings with Mayor Steve Adler, CM Greg Casar, CM Harper-Madison's policy director, CM Leslie Pool's chief of staff, and City Staff LDC drafters
- Notified co-ops impacted by potential code changes and put them in touch with relevant City Council and City Staff members
- Helped advance ACBA positions through different City Councilmember offices and conducted vote-counts of each position before and after each vote
- Succeeded in getting amendments adopted into draft LDC

## Technology skills

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|---|---|---|---|
| Programming Languages | Fortran, Perl, R, Python, Bash, Octave (*i.e.* MATLAB) | Operating Systems | GNU/Linux (Arch, Debian, Fedora), OpenWrt, macOS, Windows |
| Virtualization | Docker, Singularity, chroot | Word Processors | LaTeX, LibreOffice |

## Pertinent coursework

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- *Mathematics* Advanced Calculus for Applications, Linear Algebra and Matrix Theory, Differential Equations, Real Analysis I, Probability I, Partial Differential Equations and Applications, Topology I, Algebraic Structures I, Complex Analysis, Vector Calculus
- *Scientific computing* Introduction to Scientific & Technical Computing, Artificial Intelligence *(audited)*, Mathematical Modelling in Science and Engineering, Introduction to Stochastic Processes, Applied Statistics
- *Political and social sciences* Intro to Network Analysis, Machine Learning, Math for Social Sciences III

## Professional affiliations

- *Mathematical Association of America* Member
- *North American Students of Cooperation* Member
- *American Geophysical Union* Member

## Extracurricular activities

- *Austin Transportation Equity Analysis Zones Advisory Team* Member, one of 30 members selected from a pool of 177 applicants to advise Austin Transportation on equitable geographic allocation of Project Connect's anti-displacement bond
- *Austin Community Reinvestment Cooperative (ACRC)* Board member
- *Austin Cooperative Business Assocation (ACBA)* Member, Development committee
- *Evolve Austin* Member, affiliate organization
- *AURA* Member
- *Brentwood Neighborhood Association* Member, provided PIR of full set of Affordability Unlocked applications
- *Hardy Cooperative* Founder, member-owner
- *Austin Cooperative Business Assocation (ACBA)* Member, Housing committee
- *Mission Interuniversitaire de Coordination Échanges Franco-Américains* Foreign exchange
- *Directed Reading Program* Graduate mathematical readings under individual guidance of doctoral students
- *Mathematics Club* Attended student- and professor-led talks
- *Inter-Cooperative Council (ICC) Austin* Member
- *College Houses Cooperatives* Member
- *Emerging Scholars Program, Calculus* Explored calculus outside of course material

## Languages

French Professional working

Spanish Native

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