Pablo Venegas Garcia

CV - 2025

Current employment

2024 - present **Postdoctoral researcher and experimental & networking manager**, *Interdisciplinary Lab for Mathematical Ecology & Epidemiology (ILMEE)*, University of Alberta, Edmonton, Alberta.
Data-validated mathematical modeling of hydrocarbon biodegradation kinetics and gas emissions from oil sands tailings ponds in Alberta, Canada.

Education

2018-2024 **Ph.D. in Mathematical and Statistical Sciences, Applied Mathematics**, *University of Alberta*, Edmonton, Alberta.
Thesis titled: Modelling microbial processes of soil organic matter mineralization and methane production

2017 **M. Sc. Applied and Industrial Mathematics**, *Universidad Autónoma Metrolopolitana-Iztapalapa*, Ciudad de México, México.

2013 **B. Sc. Degree in Physics and Mathematics**, *Universidad Michoacana de San Nicolás de Hidalgo*, Morelia, Michoacán, México.

Expertise and Research Interests

- Mathematical modeling of hydrocarbon biodegradation and methane production in oil sands tailings ponds.
- Development of bioremediation strategies for oil sands tailings basins.
- Microbial processes in organic matter degradation.

Current Leading Research Projects

2023 - Present **Predicting methane emissions from Alberta oil sands regions using a holistic modeling and monitoring system (NSERC Alliance Mission)**, *Laboratory biogenesis data collection, modeling and monitoring sub-project HQP. P.I: Hao Wang*, University of Alberta, Edmonton, Alberta.

2018 - Present **Laboratory data collection and mathematical prediction of methane biogenesis from oil sands activities in Alberta**, University of Alberta, Edmonton, Alberta.

Publications

- Saha, E., Wang, O., Chakraborty, A., **Venegas Garcia, P.**, Milne, R., Wang H., Dispersion based Neural Network Model for Methane Monitoring in Albertan Tailings Ponds, Journal of Environmental Management, **in press.** (2025)
- Cheng, H., Hamidoglu, A., Sysoeva, L., **Garcia, P. V.**, Milne, R., Burkus, Z., & Wang, H. (2025). A novel evolutionary game-based low-methane application in three-echelon energy supply chains. Applied Energy, 401, 126777.
- Afzal, I., **Venegas Garcia, P.**, Kuznetsova, A., Foght, J., Wang, H., Ulrich, A., & Siddique, T. (2025). Mitigation of Methane Emissions from Oil Sands Tailings by Redox Amendment: Mathematical Modeling of Empirical Observations. ACS ES&T Engineering.
- Mondal, B., Mandal, S., Tiwari, P. K., Wang, H., & **Garcia, P. V**. (2025). Deterministic and stochastic plankton dynamics: Effects of contamination, refuge, and additional food sources. Ecological Complexity, 61, 101117.
- **Venegas Garcia, P.,** & Wang, H. (2023). A Data-Validated Stoichiometric Model for the Priming Effect. Bulletin of Mathematical Biology, 85(6), 53.
- Kirkow, V., Wang, H., **Garcia, P. V.**, Ahmed, S., & Heggerud, C. M. (2022). Impacts of a changing environment on a stoichiometric producer-grazer system: a stochastic modelling approach. Ecological Modelling, 469, 109971.
- Wang, H., **Garcia, P. V.**, Ahmed, S., & Heggerud, C. M. (2022). Mathematical comparison and empirical review of the Monod and Droop forms for resource-based population dynamics. Ecological Modelling, 466, 109887.

Submitted work and scientific advising

2025 (First Author) - Compelled methane mitigation in oil sands basins may result in a local catastrophe: Toxic hydrogen sulfide release, PNAS. **Status: Submitted**

2025 (ILMEE advisor) - Zambrano-Luna, B. A., Sysoeva, L., Gao, S., Milne, R., Burkus, Z., & Wang, H. (2025). Improved monitoring of methane emissions for the oil and gas sector with Sentinel-2 satellite observations. Atmospheric Environment, 121594.

2025 (ILMEE advisor) - Sysoeva, L., Bouderbala, I., Kent, M. H., Saha, E., Zambrano-Luna, B. A., Milne, R., & Wang, H. (2025). Decoding methane concentration in Alberta oil sands: A machine learning exploration. Ecological Indicators, 170, 112835.

Employment

2024 **Main instructor**, *Mathematical Biology Math 572 (Fall), University of Alberta.*, Edmonton, Alberta

2023 - 2024 **Graduate Research Assistant Fellowship**, *Supervisor: Hao Wang. University of Alberta.*, Edmonton, Alberta

2018 - 2023 **Graduate Teaching Asisstant**, *FGSR, University of Alberta*, Edmonton, Alberta

2017 **Lecturer**, *ENES (National School of Higher Education). Universidad Nacional Autónoma de México*, Morelia, Michoacán, México.

2013-2017 **Research Assistant**, *IIES (Ecosystems and Sustainability Research Institute). Universidad Nacional Autónoma de México*, Morelia, Michoacán, México
Algorithm Developer for Signal Processing. Led Field Campaigns.

Additional Projects and Mentorship

2023 - 2025 **ILMEE stoichiometry, biodegradation and ecotoxicology research subgroup leader**, *University of Alberta*, Edmonton, Alberta.
Supervisor: Hao Wang

Scholarships & Awards

2024 **Faculty of Science Dissertation Award**, *"Modelling microbial processes of soil organic matter mineralization and methane production"*, University of Alberta, Edmonton, Alberta.

2018 **University of Alberta Entry Scholarship**, *Valued at* $\$10,000$, University of Alberta, Edmonton, Alberta.

Extra Curricular Activities

2021 - 2023 **SIGMAS Social and Sports Coordinator**, *Society in Graduate Mathematics and Statistics*, University of Alberta, Edmonton, Alberta.

Laboratory Instructor

2022 **Ordinary Differential Equations**, *University of Alberta*, Edmonton, Alberta, Canada.
Fall Term.

2022 **Mathematical Biology, Ordinary Differential Equations**, *University of Alberta*, Edmonton, Alberta, Canada.
Winter Term.

2021 **Calculus II**, *University of Alberta*, Edmonton, Alberta, Canada.
Spring, and Fall Terms.

2021 **Mathematical Modeling I, Calculus II**, *University of Alberta*, Edmonton, Alberta, Canada.
Winter Term.

2020 **Calculus II**, *University of Alberta*, Edmonton, Alberta, Canada.
Winter, Spring, and Fall Terms.

2019 **Calculus II**, *University of Alberta*, Edmonton, Alberta, Canada.
Fall Term.

2019 **Mathematical Biology**, *University of Alberta*, Edmonton, Alberta, Canada.
Winter Term.

Teaching Assistant - Grading

2022 **Linear Algebra, Intermediate Calculus IV**, *University of Alberta*, Edmonton, Alberta, Canada.
Summer Term.

2020 **Mathematical Programming and Optimization I**, *University of Alberta*, Edmonton, Alberta, Canada.
Fall Term.

2019 **Graph Theory**, *University of Alberta*, Edmonton, Alberta, Canada.
Summer Term.

2019 **Introduction to Discrete Mathematics**, *University of Alberta*, Edmonton, Alberta, Canada.
Spring Term.

2019 **Elementary Calculus I**, *University of Alberta*, Edmonton, Alberta, Canada.
Winter Term.

2018 **Elementary Calculus I**, *University of Alberta*, Edmonton, Alberta, Canada.
Fall Term.

Patents

2016 Ruiz-Mercado I, **Venegas García P**, Guzmán Gómez SL. (2016). SoftSUMit Software. UNAM 03-2016-05271215-1700-01.

Past Research Experience

2016-2017 **Macroscopic models for two and three-phase traffic flow (M. Sc. Thesis)**, *Universidad Autónoma Metropolitana-Iztapalapa*, Ciudad de México, México.
Advisor: Patricia Saavedra Barrera.

2011-2013 **PDE Numerical solutions using the finite element method on irregular boundaries: UNAMalla and COMSOL-multiphysics applications (B. Sc. Thesis)**, *Universidad Michoacana de San Nicolás de Hidalgo*, Morelia, Michoacán, México.
Advisor: Mario César Suárez Arriaga.

Courses Taught and Developed

2017 **Mathematical Models in Ecology**, *Universidad Nacional Autónoma de México*, Morelia, Michoacán, México.
Lead Instructor and Curriculum Development. Ecology Undergraduate Program.

2011-2012 **Ordinary Differential Equations**, *Universidad Michoacana de San Nicolás de Hidalgo*, Morelia, Michoacán, México.
Instructor Assistant and Curriculum Development. Civil Engineering Undergraduate Program.

Conference and Seminars Presentations

2025 **Mathematical Biology Seminar** *"Risks of methane mitigation via human-driven microbial community shifts in oil sands tailings ".* University of Alberta, Edmonton, Canada.

2022 **Mathematical Biology Seminar** *"Mathematical Stoichiometry: Priming Effect ".* University of Alberta, Edmonton, Canada.

2016 **XLIX National Conference of the Mexican Mathematical Society.** *"Traffic Flow Modelling including In/Out Ramps and other variants".* Aguascalientes, México.

2014 **XXIV National School of Optimization and Numeric Analisis.** *"Use and Monitoring of Ecotechnologies in Rural Communities: A Numerical Approach".* Guanajuato, Gto. México.

2012 **Scientific Computing Laboratory Seminar.** *"PDE Numerical Solutions on Irregular Domains Using the Finite Element Method and UNAMalla".* UNAM, Ciudad de México, México.

2012 **XX Annual AGM Conference and I Latin American Geothermic Conference.** *"Finite Element Method Potential for Modelling Advanced Geothermic Systems".* Morelia, Mich. México.

2012 **XLV National Conference of the Mexican Mathematical Society.** *"Numerical Solutions of the Wave Equation on Irregular Domains Using Finite Element Method".* Querétaro. Qro. México.

2010 **Shenyang University of Technology Seminar.** *"Quaternion Algebra: Vector Rotation in $\mathbb{R}^3$, Applications in Object Positioning and Space Aircrafts".* Shenyang, China.

2010 **X International Mathematica Symposium.** *"Use of the Finite Element Method in Mathematica". With Ph.D. Mario César Suárez Arriaga.* Universidad de Tsinghua. Beijing, China.

2009 **XLII National Conference of the Mexican Mathematical Society.** *"Quaternion Algebra: Vector Rotation in $\mathbb{R}^3$".* Zacatecas, Zac. México.

Filed Campaigns and Monitoring Experience

2018 **Adoption Processes of Biodigesters and Biogas Stoves in the Yucatan Peninsula: Field Monitoring of Usage Patterns and Impacts**, *Collaborative project with the NGO International Renewable Resources Institute and the company Biobolsa*
Field deployment of electronic monitors on remote rural homes in the Mayan Jungle and algorithm development for signal analysis.

2015-2016 **Integral Evaluation of Efficient Cookstoves in San Luis Potosí and Intervention Design**, *Ecotechnology Adoption and Monitoring Laboratory. Dr. Ilse Ruiz-Mercado, UNAM*, Morelia, Michoacán, México.
Field deployment of electronic monitors on remote rural homes in the Huasteca Potosina (San Luis Potosí México) and in-field algorithm development for signal analysis.

2015 **Monitoring Documentation**, *Ecotechnology Adoption and Monitoring Laboratory. Dr. Ilse Ruiz-Mercado, UNAM*, Morelia, Michoacán, México.
Ruiz-Mercado, I., Eav, J., Venegas, P., Vaswani, M., Allen, T., Charron, D., & Smith, K. R. Wireless Stove Use Monitors (wSUMs) for Remotely Measuring Cookstove Usage.

2013-2014 **Wireless Stove Use Monitors (wSUMs)**, *UNAM-UC Berkeley Project*, Morelia, Michoacán, México.
Laboratory testing of sensor performance and field validation of fuel and stove usage metrics in rural Purépecha homes in Michoacán México.

Additional Information

Language	Spanish (Native Language), English, CELPIP-G (Average score: 10)
Modeling tools	XPP/AUTO, MATLAB, Phyton, R, Mathematica, OriginLab.