YUSUKE KUWAYAMA

University of Maryland, Baltimore County
1000 Hilltop Circle • Baltimore, MD 21250
Email: kuwayama@umbc.edu
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CURRENT APPOINTMENTS

School of Public Policy, University of Maryland, Baltimore County (UMBC)
Associate Professor and Graduate Program Director (2024 – Present)
Assistant Professor (2020 – 2024)

Resources for the Future (RFF)
Fellow (2011 – Present)

National Academies of Sciences, Engineering, and Medicine
Member, Water Science and Technology Board (2024 – Present)

Chesapeake Bay Program
At-Large Appointee, Scientific and Technical Advisory Committee (2023 – Present)

Association of Environmental and Resource Economists (AERE)
Member, Board of Directors (2026 – Present)

Northeastern Agricultural and Resource Economics Association (NAREA)
Member, Board of Directors (2025 – Present)

Public Policy Institute of California (PPIC) Water Policy Center Research Network
Member (2019 – Present)

EDUCATION

Ph.D., Agricultural and Applied Economics, University of Illinois at Urbana-Champaign (2011)

M.S., Economics, University of Illinois at Urbana-Champaign (2006)

A.B., Economics, Amherst College (2004)

PRIOR APPOINTMENTS

Consortium for the Valuation of Applications Benefits Linked with Earth Science (VALUABLES)
Director (2016 – 2023)

Center for Reinventing Aging Infrastructure for Nutrient Management (RAINmgt)
Deputy Director (2016 – 2017)

ARTICLES IN ECONOMICS AND POLICY JOURNALS

* Indicates co-authors who were students, research assistants, or summer interns when most of the work on the article was completed

Islam M. S., **Y. Kuwayama**, D. Entekhabi, K. M. Turner, C. Lu, F. M. Castillo, Z. Joao, V. F. Pereira, O. Porto, L. Lupedia, I. Rodrigues, D. Wood. 2026. A subnational Social Vulnerability Index for use in Drought Decision Support Systems. *Environmental Science and Policy*, 178, 104349.

Earnhart, D., S. Jacobson, **Y. Kuwayama**, and R. Woodward. 2023. Discretionary exemptions from environmental regulation: Flexibility for good or for ill. *Land Economics*, 99(2), 203-221.

Kuwayama, Y., S. Olmstead, and J. Zheng. 2022. A more comprehensive estimate of the value of water quality. *Journal of Public Economics*, 207, 104600.

Kroetz, K., **Y. Kuwayama**, and C. Vexler*. 2020. The economics of the joint management of water resources and aquatic species in the United States. *Review of Environmental Economics and Policy*, 14(2), 194–215.

Fitzgerald, T., **Y. Kuwayama**, S. Olmstead, and A. Thompson*. 2020. Dynamic impacts of U.S. energy development on agricultural land use. *Energy Policy*, 137, 11163.

Kuwayama, Y., A. Thompson*, R. Bernknopf, B. Zaitchik, and P. Vail*. 2019. Estimating the impact of drought on agriculture using the US Drought Monitor. *American Journal of Agricultural Economics*, 101(1): 193-210.

Walls, M., and **Y. Kuwayama**. 2019. Evaluating payments for forest watershed services programs in the United States. *Water Economics and Policy*, 5(4), 1950003.

Epanchin-Niell, R., **Y. Kuwayama**, and M. Walls. 2017. Spatial-dynamic complexities of the climate challenge for rural areas: Integrating resource and regional economic insights. *American Journal of Agricultural Economics*, 99(2): 447–463.

Kuwayama, Y., S. Roeshot*, A. Krupnick, N. Richardson, and J. Mares. 2017. Risks and mitigation options for on-site storage of wastewater from shale gas and tight oil development. *Energy Policy*, 101: 582–593.

Kuwayama, Y., and N. Brozović. 2017. Optimal management of environmental externalities with time lags and uncertainty. *Environmental and Resource Economics*, 68(3): 473-499.

Kuwayama, Y., and H. Kamen*. 2016. What drives the reuse of municipal wastewater? A county-level analysis of Florida. *Land Economics*, 92(4): 679–702.

Kuwayama, Y., and N. Brozović. 2013. The regulation of a spatially heterogeneous externality: Tradable groundwater permits to protect streams. *Journal of Environmental Economics and Management*, 66(2): 364–382.

ARTICLES IN NATURAL SCIENCE JOURNALS

* Indicates co-authors who were students, research assistants, or summer interns when most of the work on the article was completed

O'Hara, C., M. Baez-Schon, R. Chaplin-Kramer, S. Cheng, A. Echeverri, G. L. Galford, R. K. Gould, C. L. Mancilla, M. C. Mouldon, G. Singh, P. Baltezar, **Y. Kuwayama**, S. Polasky, A. D. Rodewald, R. P. Sharp, E. Tennant, J. Zhao, and B. S. Halpern. A systematic map of methods for assessing societal benefits of Earth science information. 2026. *Proceedings of the National Academy of Sciences*, 123(6): e2524370123.

Bernknopf, R., A. Steinkruger*, S. Pesek*, and **Y. Kuwayama**. Satellite-based remote sensing can enable cost-effective conservation of Eastern North Pacific blue whales: A value of information analysis. 2025. *Biological Conservation*, 309, 111328.

Bernknopf, R., **Y. Kuwayama**, B. Zaitchik, M. Rodell, A. Getirana, A. Thorstensen, and S. Shahreen*. An economic impact assessment of the use of Earth observation information in flood hazard communication. 2025. *Natural Hazards*, s11069-025-07499-3.

Sayyed, T. K.*, U. Ovienmhada, M. Kashani, K. Vohra, G. Kerr, C. O'Donnell, M. Harris, L. Gladson, A. Titus, S. Adamo, K. Fong, E. Gargulinski, A. Soja, S. Anenberg, and **Y. Kuwayama**. Satellite data for environmental justice: A scoping review of the literature in the United States. 2024. *Environmental Research Letters*, 19(3), 033001.

Ordway, E. M., A. J. Elmore, S. Kolstoe, J. E. Quinn, R. Swanwick, M. Cattau, D. Taillie, S. M. Guinn, K. D. Chadwick, J. W. Atkins, R. E. Blake, M. Chapman, K. Cobourn, T. Goulden, M. R. Helmus, K. Hondula, C. Hritz, J. Jensen, J. P. Julian, **Y. Kuwayama**, V. Lulla, D. O'Leary, D. R. Nelson, J. P. Ocon, S. Pau, G. E.

Ponce-Campos, C. Portillo-Quintero, N. G. Pricope, R. G. Rivero, L. Schneider, M. Steele, M. G. Tulbure, M. A. Williamson, and C. Wilson. 2021. Leveraging the NEON Airborne Observation Platform for socio-environmental systems research. *Ecosphere*, 12(6), e03640.

Stroming, S.*, M. Robertson*, B. Mabee, **Y. Kuwayama**, and B. Schaeffer. 2020. Quantifying the human health benefits of using satellite information to detect cyanobacterial harmful algal blooms and manage recreational advisories in U.S. lakes. *GeoHealth*, 4(9), e2020GH000254.

Kuwayama, Y., S. Olmstead, D. Wietelman*, and J. Zheng. 2020. Trends in nutrient pollution as a source of potential water quality damages: A case study of Texas, USA. *Science of the Total Environment*, 724, 137962.

Kuwayama, Y., and S. Olmstead. 2020. Hydroeconomic modeling of resource recovery from wastewater: Implications for water quality and quantity management. *Journal of Environmental Quality*, 49(3), 593-602.

Bernknopf, R., **Y. Kuwayama**, R. Gibson*, J. Blakely*, B. Mabee, T. J. Clifford, B. Quayle, J. Epting, T. Hardy, and D. Goodrich. 2020. Monetising the savings of remotely sensed data and information in Burn Area Emergency Response (BAER) wildfire assessment. *International Journal of Wildland Fire*, 30(1), 18–29.

Öberg, G., G. S. Metson, **Y. Kuwayama**, and S. A. Conrad. 2020. Conventional sewer systems are too time-consuming, costly and inflexible to meet the challenges of the 21st century. *Sustainability*. 12(16), 6518.

Virapongse, A., F. Pearlman, J. Pearlman, M. Murambadoro, **Y. Kuwayama**, and M. Glasscoe. 2020. Ten rules to increase the societal value of Earth Observations. *Earth Science Informatics*, 13(2), 233-247.

Metson, G., S. M. Powers, R. L. Hale, J. Sayles, G. Öberg, G. K. MacDonald, **Y. Kuwayama**, N. Springer, A. Weatherley, K. L. Hondula, K. Jones, R. B. Chowdhury, A. H. W. Beusen, and A. F. Bouwman. 2018. Socio-environmental consideration of phosphorus flows in the urban sanitation chain of contrasting cities. *Regional Environmental Change*, 18(5): 1387-1401.

Bernknopf, R., D. Brookshire, **Y. Kuwayama**, M. Macauley, M. Rodell, A. Thompson*, P. Vail*, and B. Zaitchik. 2018. The value of remotely sensed information: The case of GRACE-enhanced drought severity index. *Weather, Climate, and Society*, 10(1): 187-203.

Kuwayama, Y., S. Olmstead, and A. Krupnick. 2015. Water quality and quantity impacts of hydraulic fracturing. *Current Sustainable/Renewable Energy Reports*, 2(1): 17–24.

Kuwayama, Y., and N. Brozović. 2012. Analytical hydrologic models and the design of policy instruments for groundwater-quality management. *Hydrogeology Journal*, 20(5): 957–972.

BOOK CHAPTERS

Bernknopf, R., D. Brookshire, M. Macauley, G. Jakeman, **Y. Kuwayama**, H. Miller, L. Richardson, and A. Smart. 2019. Societal benefits: Methods and examples for estimating the value of remote sensing information. In S. Morain, M. Renslow, and A. Budge, editors, *Manual of Remote Sensing, 4th Edition* (pp. 869-910). American Society for Photogrammetry and Remote Sensing, Bethesda.

Kuwayama, Y., R. Young, and N. Brozović. 2016. Groundwater scarcity: Management approaches and recent innovations. In J. R. Ziolkowska and J. M. Peterson, editors, *Competition for Water Resources – Experiences and Management Approaches in the US and Europe* (pp. 332–350). Elsevier, Cambridge.

Kuwayama, Y., and S. Olmstead. 2015. Water quality and economics: Willingness to pay, efficiency, cost-effectiveness, and new research frontiers. In D. Layton and R. Halvorsen, editors, *The Handbook of Natural Resource Economics* (pp. 474–501). Edward Elgar Publishing, Amsterdam.

WORKING PAPERS

Kruczkiewicz, A., R. Bernknopf, Y. Kuwayama, H. Vergara, C. Hultquist, F. Ayala, J. Bazo, B. van den Bout, and M. van Aalst. Assessing the value of Earth observations in the humanitarian sector: A framework to analyze EO influence as benefit for some and increased risk for others. *Revisions requested*.

Kuwayama, Y., A. Calderwood, C. Speir, H. Dahlke, and E. Bruno. Intra-seasonal modeling of the hydrologic and economic impacts of managed aquifer recharge.

Cha, Y., D. Douglas, D. Friesen, J. Zheng, **Y. Kuwayama**, S. Olmstead, and D. Phaneuf. Estimating water quality benefits and distributional impacts in three U.S. regions.

Kuwayama, Y., J. Rayl, and T. Treakle. Does the Value of Reliability Capitalize in Water Markets?

Kuwayama, Y., K. Kroetz, T. Treakle, J. Ashander, and C. Speir. Optimal management of natural resources generating multiple ecosystem services.

OTHER PUBLICATIONS

Kuwayama, Y., and S. Aldy. 2021. *The Value of Science Explainer Series*. Resources for the Future.

Mount, J., B. Gray, K. Bork, J. E. Cloern, F. W. Davis, T. Grantham, L. Grenier, J. Harder, **Y. Kuwayama**, P. Moyle, M. W. Schwartz, A. Whipple, and S. Yarnell. 2019. *A Path Forward for California's Freshwater Ecosystems*. San Francisco, CA: Public Policy Institute of California.

Kuwayama, Y. 2019. Policy nook – Opportunities and challenges of using satellite data to inform water policy. *Water Economics and Policy*, 5(3), 1971001.

Kuwayama, Y. 2019. The economic impacts of drought on US agriculture. *Resources*, 200.

Kuwayama, Y., and B. Mabee. 2017. How do we measure the value of satellite data? *Resources*, 196.

Kuwayama, Y. 2017. Capturing the value of data from Earth observations. *Resources*, 194.

Kuwayama, Y., and H. Kamen. 2015. Commentary: Getting past the "yuck" factor: Recycled water in Florida and other states. *Resources*, 189: 10–12.

Kuwayama, Y. 2014. Groundwater markets: Managing a critical, hidden resource. *Resources*, 186.

Kuwayama, Y., S. Olmstead, and A. Krupnick. 2013. Water resources and unconventional fossil fuel development: Linking physical impacts to social costs. *RFF Discussion Paper* 13–34.

Kuwayama, Y. 2013. Book review – Water policy reform: Lessons in sustainability from the Murray-Darling Basin. *Journal of Natural Resources Policy Research*, 5 (4): 273–274.

GRANTS

D. Wood (PI), D. Entekhabi, K. Turner, E. Ashcroft, **Y. Kuwayama**, and Z. Joao (co-Is). 2022. "Supporting Drought Management in Angola using Integrated Modeling of the Environment, Vulnerability, Decision Making and Technology (EVDT)." *National Aeronautics and Space Administration*, $550,000.

S. Olmstead (PI), **Y. Kuwayama**, N. Miller, D. J. Phaneuf, and J. Zheng (co-PIs). 2022. "Estimating the Missing Benefits of Water Quality by Nesting Recreation Demand and Hedonic Modeling." *US Environmental Protection Agency*, $741,054.

Y. Kuwayama (PI). 2021. "Spatial Heterogeneity, Lags, and Uncertainty: Implications for Cost Effective Regulation of Water Pollution." *UMBC Summer Research Faculty Fellowship (SURFF)*, $6,000.

A. Krupnick, **Y. Kuwayama**, and S. Olmstead (co-PIs). 2019. "To Understand the Key Surface Water Quality Problems in Texas." *The Cynthia and George Mitchell Foundation*, $49,999.

A. Bartuska, J. Boyd, B. Epanchin-Niell, K. Kroetz, **Y. Kuwayama**, and M. Walls (co-PIs). 2018. "Advanced Economics and Ecological Systems Models and Data: An Expanded Partnership with RFF." *National Socio-Environmental Synthesis Center (SESYNC)*, $2,100,000.

Y. Kuwayama (PI) and R. Bernknopf (co-PI). 2016. "Quantitative Impact Assessment and Evaluation of Integrating GRACE and GRACE Follow On Data into Flood and Drought Forecasts." *National Aeronautics and Space Administration*, $158,988.

M. Macauley (PI), R. Bernknopf, J. Boyd, R. Cooke, J. Drapkin, C. Kousky, **Y. Kuwayama**, P. Nelson, J. Siikamäki, S. Wulf Tregar (co-Is). 2016. "Valuation of Applications Benefits Linked with Earth Science (VALUABLES) Consortium." *National Aeronautics and Space Administration,* $3,499,980.

R. Bernknopf, M. Macauley (co-PIs), D. Brookshire, **Y. Kuwayama**, M. Rodell, and B. Zaitchik (co-Is). 2013. "The Value of Information from a GRACE-Enhanced Drought Severity Index." *National Aeronautics and Space Administration,* $346,942.

Y. Kuwayama (PI) and J. Shih (co-PI). 2013. "Economic Modeling of Welfare Gains from Resource Recovery from Fecal Waste." *The Bill & Melinda Gates Foundation*, $56,887.

J. Mihelcic (PI), T. Boyer, E. Coney, J. Cunningham, A. Davis, S. Ergas, **Y. Kuwayama**, S. Olmstead, N. Richardson, J. Shih, M. Trotz, D. Yeh, Q. Zhang, and J. Zimmerman (co-PIs). 2013. "Center for Reinventing Aging Infrastructure for Nutrient Management (RAINmgt)." *US Environmental Protection Agency*, $2,499,235.

TEACHING EXPERIENCE

University of Maryland, Baltimore County

Instructor: Applied Multivariate Regression (Spring 2026; Spring 2024; Spring 2023; Spring 2022; Spring 2021); Statistical Analysis (Spring 2025; Fall 2024; Spring 2024; Fall 2023; Spring 2023; Fall 2022; Spring 2022; Fall 2021; Fall 2020); Microeconomics for Public Policy (Fall 2025); Cost-Benefit Analysis for Health, Education, and Environmental Policy (Fall 2025; Fall 2024; Fall 2023; Fall 2022); Benefit-Cost Evaluation (Fall 2021)

University of Illinois at Urbana-Champaign

Head Teaching Assistant: Principles of Macroeconomics (Fall 2006)
Teaching Assistant: Environmental Economics (Spring 2010); Agricultural, Consumer, and Resource Economics (Spring 2008); Principles of Macroeconomics (Spring 2005, Spring 2006); Principles of Microeconomics (Fall 2004)

Amherst College

Teaching Assistant: Microeconomics (Spring 2003, Spring 2004)

AWARDS AND FELLOWSHIPS

Recognition of Outstanding Service, Northeastern Agricultural and Resource Economics Association (Summer 2025)

Outstanding American Journal of Agricultural Economics Reviewer, The Agricultural and Applied Economics Association (Summer 2019)

Department of Agricultural and Consumer Economics Outstanding Dissertation Award, University of Illinois at Urbana-Champaign (Spring 2012)

Department of Agricultural and Consumer Economics Outstanding Ph.D. Student Award, University of Illinois at Urbana-Champaign (Spring 2011)

Graduate Student Travel Grant, The Agricultural and Applied Economics Association Foundation (Spring 2010)

List of Teachers Ranked as Excellent by Their Students, University of Illinois at Urbana-Champaign (Spring 2010, Spring 2008, Fall 2006, Spring 2006, Spring 2005, Fall 2004)

Graduate College Conference Travel Award, University of Illinois at Urbana-Champaign (Fall 2009, Fall 2010)

Program in Environmental and Resource Economics Graduate Student Travel Grant, University of Illinois at Urbana-Champaign (Spring 2009)

Program in Environmental and Resource Economics Fellowship, University of Illinois at Urbana-Champaign (Spring 2008)

Graduate Teaching Certificate, Center for Teaching Excellence (Spring 2005)

Roswell Dwight Hitchcock Fellowship, Amherst College (Spring 2004)

John M. Vine Fellowship, Amherst College (Spring 2003)

INVITED TALKS

2025: University of Rhode Island; University of Maryland, College Park

2024: Kansas State University; NESDIS Oceans and Water Satellite Symposium

2022: Cornell University; Georgetown University

2021: University of Rhode Island; GEO Week

2020: Planet Labs; National Socio-Environmental Synthesis Center (SESYNC); University of Maryland, Baltimore County; World Bank Development Research Group

2019: EPA National Center for Environmental Economics; George Mason University; Virginia Polytechnic Institute and State University; National Environmental Satellite, Data, and Information Service (NESDIS) Socioeconomic Benefits Workshop

2018: IEEE International Symposium on Technology and Society; International Food Policy Research Institute (IFPRI); NASA Goddard Space Flight Center; Salisbury University

2017: Federation of Earth Science Information Partners (ESIP) Winter Meeting; Group on Earth Observations (GEO) Side Event Workshop; Property and Environment Research Center (PERC)

2016: Association for Public Policy Analysis and Management (APPAM) Fall Research Conference

2015: George Washington University; The Bill & Melinda Gates Foundation; University of Florida; University of Nebraska-Lincoln

2014: Stanford Climate Change and Water Governance Workshop

2013: Colby College; Peking University; UNC Water and Health Conference; U.S. Water Alliance

2012: Annual Washington Energy Policy Conference; The Nature Conservancy

2011: Economic Research Service, USDA; Resources for the Future; Saint Mary's College of Maryland; University of Illinois at Urbana-Champaign; University of Wyoming

CONFERENCE PRESENTATIONS AND SEMINARS

2025: Northeastern Agricultural and Resource Economics Association (NAREA) Annual Meeting

2024: Northeastern Agricultural and Resource Economics Association (NAREA) Annual Meeting

2022: Association of Environmental and Resource Economists (AERE) Summer Conference

2021: American Geophysical Union (AGU) Fall Meeting; Northeastern Agricultural and Resource Economics Association (NAREA) Annual Meeting

2020: American Geophysical Union (AGU) Fall Meeting; Society for Benefit Cost Analysis Annual Conference

2019: Pecora 21/ISRSE-38; Center for Natural Resource Economics and Policy (CNREP); Ecological Forecasting Initiative (EFI) Conference; American Association of Geographers (AAG) Annual Meeting

2018: American Geophysical Union (AGU) Fall Meeting; Federation of Earth Science Information Partners (ESIP) Winter Meeting; Southern Economic Association (SEA) Annual Meeting

2017: American Geophysical Union (AGU) Fall Meeting; Association of Environmental and Resource Economists (AERE) Summer Conference

2016: Agricultural and Applied Economics Association (AAEA) Annual Meeting; Association of Environmental and Resource Economists (AERE) Summer Conference; Data to Decisions Workshop (GEOValue); Northeastern Agricultural and Resource Economics Association (NAREA) Annual Conference

2015: American Geophysical Union (AGU) Fall Meeting; Agricultural and Applied Economics Association (AAEA) Annual Meeting; Association of Environmental and Resource Economists (AERE) Summer Conference; Environment for Development (EfD) Annual Meeting

2014: American Geophysical Union (AGU) Fall Meeting

2013: American Geophysical Union (AGU) Fall Meeting; Association of Environmental and Resource Economists (AERE) Summer Conference

2012: American Geophysical Union (AGU) Fall Meeting; Resources for the Future

2010: Allied Social Science Associations (ASSA) Annual Meeting; Agricultural and Applied Economics Association (AAEA) Annual Meeting; CU Environmental and Resource Economics Workshop; NBER Summer Institute Environmental and Energy Economics (EEE) Workshop; World Congress of Environmental and Resource Economists (WCERE)

2009: Agricultural and Applied Economics Association (AAEA) Annual Meeting; Heartland Environmental and Resource Economics Workshop; Northeastern Agricultural and Resource Economics Association (NAREA) Annual Conference; Southern Economic Association (SEA) Annual Meeting; Universities Council on Water Resources and National Institutes for Water Resources (UCOWR/NIWR) Annual Conference

OTHER INFORMATION

Affiliations: American Economic Association (AEA), American Geophysical Union (AGU), Association of Environmental and Resource Economists (AERE), International Water Resource Economics Consortium (IWREC), Northeastern Agricultural and Resource Economics Association (NAREA), Society for Benefit-Cost Analysis (SBCA)

Editorial activities: Book Review Editor for *Water Economics and Policy* (2016 – 2017)

Referee service: *Agricultural Economics, Agricultural and Resource Economics Review*, *Agricultural Water Management*, *American Economic Journal – Economic Policy; American Journal of Agricultural Economics*, *Ecological Economics*, *Economics Bulletin*, *Environmental and Resource Economics*, *Environmental Modelling and Software*, *Food Policy, Hydrogeology Journal*, *Journal of Environmental Economics and Management*, *Journal of Political Economy Microeconomics, Journal of the Agricultural and Applied Economics Association, Journal of the Agricultural and Applied Economics Association, Journal of the Association of Environmental and Resource Economists*, *Land Economics*, *Nature, Proceedings of the National Academy of Sciences of the United States of America, Review of Environmental Economics and Policy, Technological Forecasting and Social Change, Water Economics and Policy, Water Resources and Economics*, *Water Resources Research*

Review panels: International Initiative for Impact Evaluation; National Academies of Sciences, Engineering, and Medicine; National Aeronautics and Space Administration; National Oceanic and Atmospheric Administration; National Science Foundation; Ohio Sea Grant; US Department of Agriculture; US Environmental Protection Agency; US Geological Survey

UMBC service: Center for Social Science Scholarship Advisory Board (2023 – Present); School of Public Policy Application Review Committee (2023 – Present); M.A. in Economic Policy Analysis (ECPA) Admissions Committee (2020 – Present); Special Sessions Policy Committee (2021 – 2025); Economics/Public Policy Seminar Series co-organizer (2020 – 2024)

Resources for the Future service: Organizer, Academic Seminar Series (2015 – 2016)

Other professional service: Chair, NAREA Diversity and Inclusion Committee (2020 – 2025); GEOAquaWatch Steering Committee (2020 – Present); Mammoth Water Advisory Board (2016 – 2022); NAREA Annual Meeting Local Arrangements Committee (2017); AERE Summer Conference Program Committee (2015, 2016, 2017, 2018); IWREC Meeting Organizing Committee (2014, 2016)

Computer programming: Stata; MATLAB; LaTeX

PERSONAL

Nationalities: United States and Canada

Languages: English (Native); Spanish (Native); Japanese (Intermediate)