The Research Pillar on Population, Environment, and Climate Change (PECC)

The research pillar on Population, Environment, and Climate Change (PECC) is dedicated to comprehensively examining the relationship between population dynamics and environment and climate change, with an emphasis on Asia. It explores whether, how, and where the changes in population size, compositions and spatial distribution affect the environment and climate systems on the one hand, and how environmental and climate changes influence the human population, on the other. While the conceptual framework of PECC retains a demographic focus, its research projects, methods, approaches, and model tools reflect the interdisciplinary and transdisciplinary nature of the research topic.

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Ongoing Projects:

1. One-Belt-One-Road Initiative and its implications for international migration

The implementation of the One-Belt-One-Road (OBOR) policies, initiated by the Chinese government in 2013, is indeed likely to have a significant impact on the regions along the land-based Silk Road Economic Belt across the Eurasian continent and the oceanic Maritime Silk Road linking Asia, Europe and Africa. Driven by large scale investments in infrastructure, improved transportation and communication facilities, economic collaborations and educational and cultural exchanges across countries and regions – leading to increasing international migration flows – have contributed to changes in population growth and population compositions (by age, education, rural/urban residence, religion, nationality), as well as in spatial distribution. This research project aims to understand the historical changes and assess plausible trends of international migration flows among the countries along the OBOR and of other global regions. We will explore the impact of international migration on population dynamics and human capital under the OBOR initiative and study the consequences of population movement on changes in labor productivity, consumption patterns and lifestyles, economic growth, social integration, resource use and environmental protection in both the origins and destinations of migration.

This project is supported by the National Social Science Foundation of the China National Key Project (16ZDA088, PI: Leiwen Jiang). The four sub-projects are: (1) Assessment and projection of international migration along the OBOR (led by Guy Abel); (2) Impacts of international migration on population dynamics and human capital of the OBOR countries (led by Samir KC); (3) The effects of international migration driven by OBOR initiative on the countries, communities and left-behind families in the origins (led by Yu Zhu); (4) International migrants in mega cities of China: comparative analysis between Shanghai and Hong Kong (led by Yuzhao Liu).

Other research team members: Chen Chen, Jianping Wang, Markus Speringer, Marcus Wurzer, Lin Liyue, Zhen Li, Wenqian Ke, Xiulin Sun, Amr Abdelwahed

Progress and output
- Abdelwahed, A., A. Goujon, L. Jiang, 2020. The migration intentions of young Egyptians. Sustainability 12 (23) 9803; https://doi.org/10.3390/su12239803.
- Supported the Asian Population Association SG Workshop "The One-Belt-One-Road Strategy and its Implications for International Migration and Socioeconomic Change", Oct. 10-11, 2017 in the Asian Demographic Research Institute (ADRI) at Shanghai University, Shanghai, China.
- Guy Abel: One-Belt-One-Road and international migration: quantifying past patterns and future scenarios. Presented at the Shanghai Forum, May 27, 2017, Shanghai; at the China Sociology Association Annual Meeting, July 10 2017, Shanghai; at Workshop "The One-Belt-One-Road Strategy and its Implications for International Migration and Socioeconomic Change", Oct. 10-11, 2017, Shanghai.
- Leiwen Jiang, Zhen Liu, Deborah Balk, Mark Montgomery, Brian O'Neill: The urbanization pathways and urbanward migration along the One-Belt-One-Road. Presented at the Shanghai Forum, May 27, 2017, Shanghai.
- Samir KC: Population and human capital dynamics in OBOR region: Challenges and opportunities. Presented at the China Sociology Association Annual Meeting, July 10 2017, Shanghai.
- Yuzhao Liu and Wei Chen: International migrants in Shanghai under OBOR policies. Presented at the Shanghai Forum, May 27, 2017, Shanghai; at the China Sociology

Association Annual Meeting, July 10 2017, Shanghai; at the workshop "The One-Belt-One-Road Strategy and its Implications for International Migration and Socioeconomic Change", Oct. 10-11, 2017, Shanghai.

- Leiwen Jiang, Zhen Liu, Martin Bell, Deborah Balk, Brian O'Neill, Mark Montgomery: Internal migration with urbanization along the One-Belt-One-Road. Presented at the Shanghai Forum, May 27, 2017, Shanghai; at the China Sociology Association Annual Meeting, July 10 2017, Shanghai; at the workshop "The One-Belt-One-Road Strategy and its Implications for International Migration and Socioeconomic Change", Oct. 10-11, 2017, Shanghai.
- Jing Gao and Leiwen Jiang: OBOR: Current social and ecological trends and anticipated impact assessment. Presented at the workshop "The One-Belt-One-Road Strategy and its Implications for International Migration and Socioeconomic Change", Oct. 10-11, 2017, Shanghai.

2. **Population dynamics, climate change, and Health**

We are living with a climate that is inevitably warming, while the world population also experiences rapid changes. Population dynamics play an important role in determining the exposure, vulnerability, and resilience of human societies to mitigate and adapt to increasing climate extremes. The changes in population size, compositions by age, gender, education, household size, urban-rural residence, and spatial distribution are all significant demographic factors that influence the interactions between human and climate systems. Building on existing knowledge, methods and models that have been developed by the population and climate change research communities, and collaborating with member institutes of the Asian MetaCentre for Population and Sustainable Development Analysis, we conduct comparative analysis at continental, regional, national, and subnational levels. The current research mainly focuses on the impacts of urbanization, migration, and spatial population change on wildfire risks, vegetation coverage, air pollution, and human health.

Progress and output:

- O'Neill, B.C., L. Jiang, S. KC, R. Fuchs, S. Pauchauri, E. Laidlaw, T. Zhang, W. Zhou, X. Ren. 2020. The effect of education on determinants of climate change risks. Nature Sustainability 3 520-528.
- Kakinuma, K., Puma, M.J., Hirabayashi, Y., Tanoue, M., Baptista, E.A., Kanae, S. 2020. Flood-induced population displacements in the world. Environmental Research Letters, 2020, 15 124029. doi: 10.1088/1748- 9326/abc586.
- Kakinuma K., Yanagawa A., Sasaki T., Rao M.P. and Kanae S. 2019. Socio-ecological interactions in a changing climate: A review of the Mongolian pastoral system. *Sustainability*, 11, 5883.
- LIMA, E.E.C.d., GAYAWAN, E., BAPTISTA, E.A.*, QUEIROZ, B.L. (2021) Spatial pattern of COVID-19 deaths and infections in small areas of Brazil. PLoS ONE 16(2): e0246808. https://doi.org/10.1371/ journal.pone.0246808.
- BAPTISTA, E.A.*, DEY, S., PAL, S. (2021). Chronic respiratory disease mortality and its associated factors in selected Asian countries: evidence from panel error correction model. BMC Public Health 21, 53. DOI: 10.1186/s12889-020-10042-7.
- ROTH, G.A., MENSAH, G.A.,…, BAPTISTA, E.A. (2020). "Global burden of cardiovascular diseases and risk factors, 1990-2019: update from the GBD 2019 Study." DOI:

10.1016/j.jacc.2020.11.010. Journal of the American College of Cardiology. 2020 Dec, 76 (25) 2982–3021.

- QUEIROZ, B.L., FREIRE, F., LIMA, E.E.C., GONZAGA, M., BAPTISTA, E.A.* (2020) "Patterns of geographic variation of mortality by causes of death for small areas in Brazil, 2010." In: Jivetti, B., Hoque M.N. (eds) Population Change and Public Policy. Applied Demography Series, vol 11. Springer, Cham. DOI: 10.1007/978-3-030-57069-9_20.

- BAPTISTA, E.A., KAKINUMA, K. & QUEIROZ, B.L. "Association between Cardiovascular Mortality and Economic Development: A Spatio-temporal Study for Prefectures in Japan." DOI: 10.3390/ijerph17041311. International Journal of Environmental Research and Public Health, 17(4), 1311.

- BAPTISTA, E.A. & QUEIROZ, B.L. "The relation between cardiovascular mortality and development: Study for small areas in Brazil, 2001–2015." DOI: 10.4054/DemRes.2019.41.51. Demographic Research, 41, 1437-1452.

- BAPTISTA, E.A. & QUEIROZ, B.L. "Spatial Analysis of Mortality by Cardiovascular Disease in the Adult Population: A Study for Brazilian Micro-Regions Between 1996 and 2015." DOI: 10.1007/s40980-019-00050-6. Spatial Demography, 1-19.

- K. Chen, AM Fiore, R. Chen, L. Jiang, B. Jones, A Schneider, A Peters, J. Bi, H. Kan, PL Kinney, 2018: Future ozone-related acute excess mortality under climate and population change scenarios in China: a modeling study. PLoS Medicine vol. 15 (7): e1002598.

- K Chen, RM Horton, DA Bader, C Lesk, L Jiang, B Jones, L Zhou, X Chen, J Bi, PL Kinney, 2017: Impact of climate change on heat-related mortality in Jiangsu Province, China. Environmental Pollution 224: 317-325.

- Knorr, W., F. Dentener, JF Lamarque, L. Jiang, and A. Arneth, 2017. Wildfire air pollution hazard during the 21st century. Atmos. Chem. Phys., 17(14): 9223-9236.

- Knorr, W., Dentener, F., Hantson, S., Jiang, L., Klimont, Z., and Arneth, A. 2016: Air quality impacts of European wildfire emissions in a changing climate, Atmos. Chem. Phys., 16 (9): 5685-5703.

- Muttarak, R., W. Lutz, and L. Jiang 2016. What can demographers contribute to the study of vulnerability? Vienna Yearbook of Population Research. (2015)13: 1-13.

- Knorr, W. A. Arneth, L. Jiang, 2016: Demographic controls of future global fire risks, Nature Climate Change 6:781-785.

- Knorr, W., Jiang, L., and Arneth, A. 2016: Climate, CO2 and human population impacts on global wildfire emissions, Biogeosciences, 13:267-282, doi:10.5194/bg-13-267-2016.

- Runfola D., Jiang L., Romero Lankao P., Hunter L., Nawrotzki R., Sanchez L., 2016: The influence of internal migration on exposure to extreme weather events in Mexico. Society & Natural Resources, 29(6) 750-754.

- Leiwen Jiang and Anping Chen: Urbanization, Migration, Climate Change and Vegetation Coverage in China. To be presented at Session 191: 191: Environmental change and migration: Models and methods

3. Household consumption patterns, economic growth, and energy use in Asia

Collaborating with the National Center for Atmospheric Research (NCAR), this project studies the income and consumption patterns of households by different demographic characteristics (age, gender, rural/urban, education, household size) and its associated emissions and environmental impacts across Asian countries. We collect and analyze income and expenditure household

survey data from different Asian countries in order to understand how the consumption behavior of household changes with economic growth and population dynamics.

Progress and output
- Sun, L. and L. Jiang: Household consumption patterns in China under demographic transition. Under review.
- Johansen, I. C., R. Luiz do Carmo, E. K. Laidlaw, and L. Jiang, 2019: An update of Brazilian household-level income and consumption patterns as an input to the iPETS model. NCAR Technical Note NCAR/TN-549+STR, 42 pp, doi:10.5065/D6S181BB.
- Laidlaw, E.K., Jiang, L., 2018. An update of Indonesian household-level income and consumption patterns as an input to the iPETS model. NCAR Technical Note NCAR/TN-543+STR, 46 pp. DOI: 10.5065/D6NV9H2Z.
- Tiantian Zhang, Emily Laidlaw, Wei Zhou, and Leiwen Jiang: Changing income and consumption patterns of Asian population – comparative analysis of household survey data in China, India, Korea, and Nepal. Presented at the Asian Population Forum, Oct. 9-12, 2016, Shanghai.
- Fatima: The impact of energy consumption on environmental sustainability: an extension of foreign direct investment induce pollution in Vietnam
- Fatima: Asymmetric linkages from tourism development and increasing population to CO2 emissions and Economic growth in developed countries
- Fatima, T., Karim, M. Z. A., & Meo, M. S. (2021). Sectoral CO2 emissions in China: asymmetric and time-varying analysis. Journal of Environmental Planning and Management, 64(4), 581-610
- Fatima, T., Shahzad, U., & Cui, L. (2020). Renewable and nonrenewable energy consumption, trade and CO2 emissions in high emitter countries: does the income level matter? Journal of Environmental Planning and Management, 1-25.
- Fatima, T., Xia, E., Cao, Z., Khan, D., & Fan, J. L. (2019). Decomposition analysis of energy-related CO2 emission in the industrial sector of China: Evidence from the LMDI approach. Environmental Science and Pollution Research, 26(21), 21736-21749.

4. Population and Urbanization projections for the Extended Shared Socioeconomic Pathways (SSPs)

Projections of urban growth are critical to the assessment of many social, economic and environmental issues, at global, national, and sub national levels. Environmental change studies require consistent sets of projections that span a full range of uncertainty and cover long time horizons. While a set of global alternative urbanization projections for all countries have recently become available, projections for subnational regions are not yet up to standard, especially for countries with large variations across subnational regions. Collaborating with NCAR and using the extended and improved NCAR-Urbanization Model, this study aims to make urbanization projections for subnational regions of large Asian countries, such as China and India, and contribute to the development of extended Shared Socioeconomic Pathways (SSPs) – the new IPCC socioeconomic scenarios– in the Asian regions.

Progress and output

- Jiang, L. B.C. O'Neill, H. Zoraghein, S. Dahlke, 2020. Population Scenarios for US state consistent with Shared Socioeconomic Pathways. Environmental Research Letters, 15 (19) 094097.
- 2020. CAMPOS, J., RIGOTTI, J.I.R., BAPTISTA, E.A.*, MONTEIRO, A.M.V., REIS, I.A. "Population Estimates from Orbital Data of Medium Spatial Resolution: Applications for a Brazilian Municipality." DOI: 10.3390/su12093565. Sustainability, 2020, 12(9), 3565.
- Striessnig, E., J. Gao, B. O'Neill, L. Jiang, 2019: Empirically based spatial projections of US population age structure consistent with the shared socioeconomic pathways. Environmental Research Letters 14 (11), 114038.
- Jiang, L. and B. O'Neill, 2018: Determinants of urban growth during demographic and mobility transitions: evidence from India, Mexico, and the US. Population and Development Review, vol. 44 (2): 363-389.
- 2018. BAPTISTA, E.A., ABEL, G.J. & CAMPOS, J. "Internal migration in Brazil using circular visualization." DOI: 10.1080/21681376.2018.1526649. Regional Studies, Regional Science.
- Jiang, L. and B.C. O'Neill, 2017: Global urbanization projections for the Shared Socioeconomic Pathways. Global Environmental Changes 42 (2017): 193-199.
- Jiang, L. and H. Zoraghein. Subnational population projections for China, India, and the US. Paper presented at Population Association of America annual meeting, April 10-13, 2019, Austin, Texas.
- Leiwen Jiang and Hamidreza Zoraghein: Urbanization projection for Chinese provinces. Presented at the workshop "Demographic methods and census data" June 13-14, 2017, Xi'An, China.
- Leiwen Jiang and Hamidreza Zoraghein: Urbanization projections for subnational regions of China and the US. To be presented at the IUSSP Conference 2017, Oct. 30-Nov. 4, 2017, Cape Town, South Africa.