

Appendix 1. List of key references used for identifying variables and dimensions for characterizing the social-ecological system (SES).

Key references on SES conceptual frameworks:

Binder, C., J. Hinkel, P. Bots, and C. Pahl-Wostl. 2013. Comparison of Frameworks for Analyzing Social-ecological Systems. *Ecology and Society* 18(4).

Chapin, F. S., A. L. Lovecraft, E. S. Zavaleta, J. Nelson, M. D. Robards, G. P. Kofinas, S. F. Trainor, G. D. Peterson, H. P. Huntington, and R. L. Naylor. 2006. Policy strategies to address sustainability of Alaskan boreal forests in response to a directionally changing climate. *Proceedings of the National Academy of Sciences* 103(45):16637–16643.

Delgado-Serrano, M. del M., and P. Ramos. 2015. Making Ostrom's framework applicable to characterise social ecological systems at the local level. *International Journal of the Commons* 9(2):808–830.

MA. 2005. *Ecosystems and Human Well-being: Synthesis*. Island Press, Washington, DC.

McGinnis, M., and E. Ostrom. 2014. Social-ecological system framework: initial changes and continuing challenges. *Ecology and Society* 19(2).

Ostrom, E. 2009. A General Framework for Analyzing Sustainability of Social-Ecological Systems. *Science* 325(5939):419–422.

Redman, C. L., J. M. Grove, and L. H. Kuby. 2004. Integrating Social Science into the Long-Term Ecological Research (LTER) Network: Social Dimensions of Ecological Change and Ecological Dimensions of Social Change. *Ecosystems* 7(2):161–171.

Resilience Alliance. 2007. *Assessing resilience in social-ecological systems: Volume 2 supplementary notes to the practitioners workbook*.

Scholz, R., and C. Binder. 2004. Principles of Human-Environment Systems (HES) Research. Pages 791–796 *Complexity and integrated resources management*. International Environmental Modelling and Software Society, [2004]. Osnabrück.

Key references on SES mapping:

Alessa, L., A. Kliskey, and G. Brown. 2008. Social-ecological hotspots mapping: A spatial approach for identifying coupled social-ecological space. *Landscape and Urban Planning* 85(1):27–39.

Asselen, S. van, and P. H. Verburg. 2012. A Land System representation for global assessments and land-use modeling. *Global Change Biology* 18(10):3125–3148.

- Castellarini, F., C. Siebe, E. Lazos, B. de la Tejera, H. Cotler, C. Pacheco, E. Boege, A. R. Moreno, A. Saldivar, A. Larrazábal, C. Galán, J. M. Casado, and P. Balvanera. 2014. A social-ecological spatial framework for policy design towards sustainability: Mexico as a study case. *Investigación ambiental Ciencia y política pública* 6(2).
- Dittrich, A., R. Seppelt, T. Václavík, and A. F. Cord. 2017. Integrating ecosystem service bundles and socio-environmental conditions – A national scale analysis from Germany. *Ecosystem Services* 28:273–282.
- Dressel, S., G. Ericsson, and C. Sandström. 2018. Mapping social-ecological systems to understand the challenges underlying wildlife management. *Environmental Science & Policy* 84:105–112.
- Ellis, E. C., and N. Ramankutty. 2008. Putting people in the map: anthropogenic biomes of the world. *Frontiers in Ecology and the Environment* 6(8):439–447.
- Hamann, M., R. Biggs, and B. Reyers. 2015. Mapping social-ecological systems: Identifying ‘green-loop’ and ‘red-loop’ dynamics based on characteristic bundles of ecosystem service use. *Global Environmental Change* 34:218–226.
- Hamann, M., R. Biggs, and B. Reyers. 2016. An Exploration of Human Well-Being Bundles as Identifiers of Ecosystem Service Use Patterns. *PLOS ONE* 11(10):e0163476.
- Hanspach, J., J. Loos, I. Dorresteijn, D. J. Abson, and J. Fischer. 2016. Characterizing social-ecological units to inform biodiversity conservation in cultural landscapes. *Diversity and Distributions* 22(8):853–864.
- Levers, C., D. Müller, K. Erb, H. Haberl, M. R. Jepsen, M. J. Metzger, P. Meyfroidt, T. Plieninger, C. Plutzar, J. Stürck, P. H. Verburg, P. J. Verkerk, and T. Kuemmerle. 2018. Archetypical patterns and trajectories of land systems in Europe. *Regional Environmental Change* 18(3):715–732.
- Martín-López, B., I. Palomo, M. García-Llorente, I. Iniesta-Arandia, A. J. Castro, D. García Del Amo, E. Gómez-Baggethun, and C. Montes. 2017. Delineating boundaries of social-ecological systems for landscape planning: A comprehensive spatial approach. *Land Use Policy* 66:90–104.
- Queiroz, C., M. Meacham, K. Richter, A. V. Norström, E. Andersson, J. Norberg, and G. Peterson. 2015. Mapping bundles of ecosystem services reveals distinct types of multifunctionality within a Swedish landscape. *AMBIO* 44(1):89–101.
- Raudsepp-Hearne, C., G. D. Peterson, and E. M. Bennett. 2010. Ecosystem service bundles for analyzing tradeoffs in diverse landscapes. *Proceedings of the National Academy of Sciences* 107(11):5242–5247.
- Renard, D., J. M. Rhemtulla, and E. M. Bennett. 2015. Historical dynamics in ecosystem service bundles. *Proceedings of the National Academy of Sciences* 112(43):13411–13416.
- Rocha, J., K. Malmborg, L. Gordon, K. Brauman, and F. DeClerck. 2020. Mapping social-ecological systems archetypes. *Environmental Research Letters* 15(3):034017.

Sinare, H., L. J. Gordon, and E. Enfors Kautsky. 2016. Assessment of ecosystem services and benefits in village landscapes – A case study from Burkina Faso. *Ecosystem Services* 21:141–152.

Spake, R., R. Lasseur, E. Crouzat, J. M. Bullock, S. Lavorel, K. E. Parks, M. Schaafsma, E. M. Bennett, J. Maes, M. Mulligan, M. Mouchet, G. D. Peterson, C. J. E. Schulp, W. Thuiller, M. G. Turner, P. H. Verburg, and F. Eigenbrod. 2017. Unpacking ecosystem service bundles: Towards predictive mapping of synergies and trade-offs between ecosystem services. *Global Environmental Change* 47:37–50.

Václavík, T., S. Lautenbach, T. Kuemmerle, and R. Seppelt. 2013. Mapping global land system archetypes. *Global Environmental Change* 23(6):1637–1647.

Vallejos, M., S. Aguiar, G. Baldi, M. E. Mastrángelo, F. Gallego, M. Pacheco-Romero, D. Alcaraz-Segura, and J. M. Paruelo. 2020. Social-Ecological Functional Types: Connecting People and Ecosystems in the Argentine Chaco. *Ecosystems* 23(3): 471-484.

Other key references on SES science that inspired variable selection:

Arneth, A., C. Brown, and M. D. A. Rounsevell. 2014. Global models of human decision-making for land-based mitigation and adaptation assessment. *Nature Climate Change* 4(7):550–557.

Carpenter, S. R., H. A. Mooney, J. Agard, D. Capistrano, R. S. DeFries, S. Díaz, T. Dietz, A. K. Duraiappah, A. Oteng-Yeboah, H. M. Pereira, C. Perrings, W. V. Reid, J. Sarukhan, R. J. Scholes, and A. Whyte. 2009. Science for managing ecosystem services: Beyond the Millennium Ecosystem Assessment. *Proceedings of the National Academy of Sciences* 106(5):1305–1312.

Cumming, G. S., A. Buerkert, E. M. Hoffmann, E. Schlecht, S. von Cramon-Taubadel, and T. Tscharntke. 2014. Implications of agricultural transitions and urbanization for ecosystem services. *Nature* 515(7525):50–57.

Erb, K.-H. 2012. How a socio-ecological metabolism approach can help to advance our understanding of changes in land-use intensity. *Ecological Economics* 76–341:8–14.

Fischer-Kowalski, M., F. Krausmann, and I. Pallua. 2014. A sociometabolic reading of the Anthropocene: Modes of subsistence, population size and human impact on Earth. *The Anthropocene Review* 1(1):8–33.

Foster, K. A., and W. R. Barnes. 2012. Reframing Regional Governance for Research and Practice. *Urban Affairs Review* 48(2):272–283.

Frey, U. J. 2017. A synthesis of key factors for sustainability in social–ecological systems. *Sustainability Science* 12(4):507–519.

Haines-Young, R., and M. Potschin. 2013. Common International Classification of Ecosystem Services (CICES): Consultation on Version 4, August–December 2012.

Liu, J., T. Dietz, S. R. Carpenter, C. Folke, M. Alberti, C. L. Redman, S. H. Schneider, E. Ostrom, A. N. Pell, J. Lubchenco, W. W. Taylor, Z. Ouyang, P. Deadman, T. Kratz, and W. Provencher. 2007. Coupled Human and Natural Systems. *AMBIO* 36(8):639–650.

Shackleton, C. M., S. Ruwanza, G. K. Sinasson Sanni, S. Bennett, P. De Lacy, R. Modipa, N. Mtati, M. Sachikonye, and G. Thondhlana. 2016. Unpacking Pandora's Box: Understanding and Categorising Ecosystem Disservices for Environmental Management and Human Wellbeing. *Ecosystems* 19(4):587–600.