# Supplementary File: Readings to Accompany the Game

Instructors may wish to have their participants read some relevant articles and reports before or after the class session, and may also wish to make some optional readings available to those who want to learn more. We gather here some useful readings for these purposes or the instructor’s engagement with the subject. The majority of this appendix is organized by topic; however, we also include a section in which we specifically address settings in which participants, be they students or professionals, have less economics and quantitative background.

Climate change in general:

* IPCC “AR5 Climate Change 2014: Impacts, Adaptation, and Vulnerability” (IPCC, 2014) <https://www.ipcc.ch/report/ar5/wg2/> - all components available in several languages; dense but accessible to a lay audience; particularly helpful components:
  + “Summary for Policymakers” (IPCC, 2014) comprehensive
  + Chapter 17, “The Economics of Adaptation” (Chambwera, et al., 2014) and other chapters on adaptation
  + Regional chapters, which also include discussions of impacts and adaptation
* The Secretariat of the Convention on Biological Diversity (2009) also discusses a variety of relevant issues with a particular focus on biodiversity; section 2.3 (which is quite brief) of this report specifically addresses ecosystem-based adaptation.
* Various countries’ websites have excellent and accessible resources on climate change and its impacts; for example, the United States’ is <https://www.globalchange.gov/>

Ecosystem services and payment for ecosystem services programs:

* Any environmental economics textbook, such as Hanley, et al. (2013) or Tietenberg and Lewis (2016), will provide a comprehensive treatment accessible to people who have had at least basic introductory microeconomics.
* There are many policy briefs on ecosystem services that are non-technical and practical (rather than theoretical), such as the very short Wunder (2005) and the slightly-longer Khanal, et al. (2013), which focuses on Nepal.
* A more general discussion of the state of global ecosystems can be found in the MEA (2005); the synthesis report is quite long, but the summary for decision-makers is only 24 pages and contains useful visuals.
* The Economics of Ecosystem Services and Biodiversity (TEEB, 2010) efforts bring together the economics aspects of ecosystem services; the full set of publications they provide is large, but the synthesis report is only 38 pages and provides a comprehensive overview of how economics links to ecosystem services and biodiversity.
* Participants may also find the Handbook on TEEB (Nunes, et al., 2014) to be a useful collection of case studies and research papers highlighting the use of economics methods to better understand and provide ecosystem services.

Adaptation and ecosystem-based adaptation:

* Daigneault, et al. (2016) performs cost-benefit analysis for hard and ecosystem-based adaptation measures as protection against flooding.
* A report by Rizvi, et al. (2015) summarizing the cost-benefit analysis of ecosystem-based adaptation programs is a bit longer than would be appropriate for students to be required to read. However, specific sections of the report can be shared based on some of the six different country experiences presented. The level of technical detail is broadly accessible.
* Wertz-Kanounnikoff, et al. (2011) is an accessible interdisciplinary journal article that assesses how well payments for ecosystem services may work in promoting ecosystem-based adaptation.
* Also suggest that participants browse websites that discuss ecosystem-based adaptation initiatives, such as:
  + <https://www.adaptation-undp.org/ecosystem-based-adaptation>
  + <http://adaptation-undp.org/projects/mountain-eba>
  + <https://www.unenvironment.org/explore-topics/climate-change/what-we-do/adaptation-and-resilience/ecosystem-based-adaptation>
  + <https://www.iucn.org/theme/ecosystem-management/our-work/ecosystem-based-approaches-climate-change-adaptation>
  + <https://www.iucn.org/resources/issues-briefs/ecosystem-based-adaptation>

Sustainable Development (note that all of these organizations have supported governments in the implementation of ecosystem-based adaptation projects):

* UN Sustainable Development Goals (<https://sustainabledevelopment.un.org/>)
* United Nations Development Programme (<http://www.undp.org/content/undp/en/home.html>)
* United Nations Environment Programme (<http://drustage.unep.org/>)
* International Union for Conservation of Nature (<https://www.iucn.org/>).

Technology adoption and diffusion in agriculture:

* Jack and Tobias (2017) is a short, non-technical report that discusses issues of information and technology adoption in agriculture in developing countries, with evidence-based policy suggestions.
* Scholarly articles that empirically study elements of technology diffusion, uncertainty, and learning as applied to agricultural technology in developing countries include Raeburn, et al. (2016), Crane-Droesch (2017), Beaman and Dillon (2017), Caeiro (2019), Pates and Hendricks (2020), and Gupta, et al. (2020). These are economic journal articles and, as such, are technical enough that they are best suited to graduate or advanced undergraduate classes.

Risk and uncertainty:

* You can find a general treatment in just about any microeconomic textbook at your desired level.
* Behavioral economics texts will cover additional related topics such as prospect theory and loss aversion, subjective expected utility and ambiguity aversion, and risk perception.
* The aforementioned article by Raeburn, et al. (2016) explores ambiguity (and how its resolution can be a public good) using a lab-in-field experiment; again, this is better suited to participants with more advanced economics backgrounds.
* There are innumerable journal articles on topics related to risk.
* It is also easy to find journalistic articles that emphasize risk in relevant situations; for example, Cornish (2018) discusses the uncertainties and factors that drive the adoption of genetically modified organisms in agriculture in developing countries.

Auctions, especially conservation auctions:

* Many microeconomics textbooks at the intermediate undergraduate level (e.g., Perloff, 2020) and higher have sections on auctions
* There are countless journal articles in economics that look at aspects of auctions in general and conservation auctions in particular; Hellerstein (2017), about the United States Conservation Reserve Program, is particularly relevant and accessible

For participants with more limited economics and quantitative backgrounds, in addition to less technical options interspersed above (especially websites from governments and non-governmental organizations), the following may be particularly helpful:

* If the game is played in the context of a course, the course textbook may have useful sections on elements in the game that relate to topics in the course (e.g., climate change, ecosystem services or payment for ecosystem services, adaptation, ecosystem-based adaptation, subsistence agriculture, sustainable development, risk)
* The Economics of Ecosystems & Biodiversity (TEEB), referred to above, provides resources to help policymakers and participants with limited economics and quantitative backgrounds understand environmental economics principles. For example, the training package for national implementers and practitioners has five modules including a module on conceptual frameworks in environmental economics and another module on valuation. <http://teebweb.org/news-and-training/training-resources/training-package-national/>
* The Wikipedia entries for many of these topics also tend to be of reasonably high quality; search Wikipedia for ecosystem services, payments for ecosystem services, climate change adaptation, ecosystem-based adaptation, subsistence agriculture, or sustainable development. There are also useful pages for specific topics in risk and uncertainty, such as expected value, risk aversion, and the expected utility hypothesis
* Journalistic articles on any of these topics; we simply searched news.google.com for “ecosystem-based adaptation” and found many recent articles from all over the world from the last six months, many of them much more recent
* An accessible assessment of the research on payments for ecosystem services is this 2017 article from Mongabay: <https://news.mongabay.com/2017/10/cash-for-conservation-do-payments-for-ecosystem-services-work/> (Gaworecki, 2017)

# References

Beaman, L., and A. Dillon. 2017. "Diffusion of Agricultural Information within Social Networks: Evidence on Gender Inequalities from Mali."

Caeiro, R.M. 2019. "From Learning to Doing: Diffusion of Agricultural Innovations in Guinea-Bissau." *National Bureau of Economic Research Working Paper Series* No. 26065.

Chambwera, M., G. Heal, C. Dubeux, S. Hallegatte, L. Leclerc, A. Markandya, B.A. McCarl, R. Mechler, and J.E. Neumann (2014) "Economics of adaptation." In C.B. Field, V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, L.L. White ed. *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge, United Kingdom and New York, NY, USA, Cambridge University Press, pp. 945-977.

Cornish, L. "What are the policital drivers for GMOs in developing countries?" *devex*, May 1, 2018.

Crane-Droesch, A. 2017. "Technology Diffusion, Outcome Variability, and Social Learning: Evidence from a Field Experiment in Kenya." *American Journal of Agricultural Economics*.

Daigneault, A., P. Brown, and D. Gawith. 2016. "Dredging versus hedging: Comparing hard infrastructure to ecosystem-based adaptation to flooding." *Ecological Economics* 122:25-35.

Gaworecki, M. "Cash for conservation: Do payments for ecosystem services work?" *Mongabay*, 10/12/2017.

Gupta, A., J. Ponticelli, and A. Tesei. 2020. "Information, Technology Adoption and Productivity: The Role of Mobile Phones in Agriculture." *National Bureau of Economic Research Working Paper Series* No. 27192.

Hanley, N., J. Shogren, and B. White. 2013. *Introduction to environmental economics*: Oxford University Press.

Hellerstein, D.M. 2017. "The US Conservation Reserve Program: The evolution of an enrollment mechanism." *Land Use Policy* 63:601-610.

IPCC. 2014. *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.

--- (2014) "Summary for Policmakers." In V.R.B. C.B. Field, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, L.L. White ed. *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge, United Kingdom and New York, NY, USA, Cambridge University Press Cambridge, pp. 1-32.

Jack, K., and J. Tobias. "Seeding success: Increasing agricultural technology adoption through information." International Growth Centre.

Khanal, R., S. Baral, A. Adhikari, Y. Malla, and B. Basnyat. 2013. *Localized Payment for Ecosystem Service Implementation Mechanism.* Kathmandu.

MEA. 2005. *Millennium Ecosystem Assessment General Synthesis Report: Ecosystems and Human Well-being*: Millennium Ecosystem Assessment.

Nunes, P.A., P. Kumar, and T. Dedeurwaerdere. 2014. *Handbook on the economics of ecosystem services and biodiversity*: Edward Elgar Publishing.

Pates, N.J., and N.P. Hendricks. 2020. "Additionality from Payments for Environmental Services with Technology Diffusion." *American Journal of Agricultural Economics* 102:281-299.

Perloff, J.M. 2020. *Microeconomics: Theory and Applications with Calculus*. 5th ed. Boston, MA: Pearson Education.

Raeburn, K., J. Engle-Warnick, and S. Laszlo. "Resolving Ambiguity as a Public Good: Experimental Evidence from Guyana." CIRANO.

Rizvi, A.R., S. Baig, and M. Verdone. 2015. "Ecosystems based adaptation: knowledge gaps in making an economic case for investing in nature based solutions for climate change." *Gland, Switzerland: IUCN* 48.

Secretariat of the Convention on Biological Diversity (2009) "Connecting biodiversity and climate change mitigation and adaptation: Report of the Second Ad Hoc Technical Expert Group on biodiversity and climate change, Montreal." In *Convention on Biological Diversity Technical Series.*

TEEB. 2010. *The economics of ecosystems and biodiversity: ecological and economic foundations*. London and Washington: Earthscan.

Tietenberg, T.H., and L. Lewis. 2016. *Environmental and natural resource economics*: Routledge.

Wertz-Kanounnikoff, S., B. Locatelli, S. Wunder, and M. Brockhaus. 2011. "Ecosystem-based adaptation to climate change: What scope for payments for environmental services?" *Climate and Development* 3:143-158.

Wunder, S. "Payments for environmental services: some nuts and bolts." Center for International Forestry Research.