1 **Supplementary Material 4.B**

2 **Table 4.B** Select adaptation options with mitigation synergies and trade-offs identified

Option	Synergies	Trade-offs
Power infrastructure resilience	Some options can help improve system efficiency	
Renewable energy	Besides reducing emissions, renewable energy can provide electricity and income and livelihood means to rural populations, improving their adaptive capacity (Ley, 2017). Options such as aquavoltaics (use of solar photovoltaic energy over water surfaces) has synergies for electricity generation and aquaculture (Pringle et al., 2017).	Without adequate consultation of Indigenous communities, large-scale mitigation projects and payments for ecosystem services can substantially disrupt social and environmental systems on a local level, with negative implications for Indigenous communities and community adaptive capacity (Dunlap, 2017; Ingty, 2017; Rodríguez-de-Francisco and Boelens, 2016). Without appropriate use of safety and quality codes and standards, renewable energy projects can increase vulnerability of populations they serve, especially in rural areas (Ley, 2017).
Indigenous knowledge	Revitalization of traditional management of agriculture may simultaneously increase resilience, improve biodiversity, and reduce emissions by eliminating agrochemical inputs production to food production (Altieri and Nicholls, 2017; Niggli et al., 2009; Nyong et al., 2007). Recognizing and supporting Indigenous management of blue carbon habitats (Vierros, 2017) and grasslands (Dong, 2017; Russell-Smith et al., 2017), and utilizing new technologies to revitalize traditional forms of energy provision (Thornton and Comberti, 2017), can provide mitigation and adaptation benefits.	
Ecosystem restoration and avoided deforestation	Can be coupled with biodiversity and conservation interventions to complement habitat provision (Felton et al., 2016) Forests (through REDD+) can support 'economies dependent on climate-sensitive sectors including agriculture, fisheries, and energy (Few et al., 2017; Somorin et al., 2016).	Potential conflict with biodiversity goals in habitat restoration and forest production efforts (Felton et al., 2016) Some projects world-wide don't target REDD+ projects on adaptation or resilience, nor local contexts, in some cases leaving negative livelihoods impacts (Few et al., 2017; McElwee et al., 2016). In some cases, there is a perception of the inability to reconcile development and environmental interests (Pham et al., 2017).
Sustainable Land-use and Urban planning	Potential for synergies in urban planning at policy, organizational, and practical levels (e.g. urban regeneration or retrofitting policies, urban greening) (Landauer et al., 2015). Spatial planning plays a central role in adaptation, mitigation, and sustainable development (Davidse et al., 2015;	Potential conflicts including the promotion of urban densification to reduce emissions which can intensify heat island effect and increase surface run-off (Di Gregorio et al., 2017; Endo et al., 2017; Landauer et al., 2015).

	Francesch-Huidobro et al., 2017; Hurlimann and March, 2012; King et al., 2016). Through the use of integrated approaches there is potential synergy in land use planning (e.g. maintenance of urban forests, urban greening).	
Sustainable water use	Strong co-benefits to the implementation of demand-side management measures, such as reducing leakages and water loss (Deng and Zhao, 2015; Wang et al., 2011), while minimizing the need to address the environmental and energy implications of supply measures such as desalination (Miller et al., 2015)	Increasing water quality is linked to increasing energy use in the water sector (Mamais et al., 2015; Rothausen and Conway, 2011), Increased biofuel production may strain water resources as consumption is dependent on the type of biofuel used (Hammond and Li, 2016). Some renewable energy technologies, carbon capture and storage (CCS), and concentrating solar power (CSP) technologies, have substantial water demand associated with their operation (Fricko et al., 2016).
Green infrastructure and ecosystem services	In urban gardens and parks, cover crops can be used to reduce erosion and improve soil health and adaptive management of precipitation and temperature change (Kaye and Quemada, 2017) Urban canopy is a cooling mechanism that can help decrease heat and water stress (Hines, 2017)	Not considering the role vegetation has within the heat-water-vegetation nexus can worsen heat and water stress (Hines, 2017)
Sustainable and resilient transport systems	Some evidence suggests cities are re-urbanizing in ways that coordinate transport sector adaptation and mitigation (Gota et al., 2017; Newman et al., 2017; Salvo et al., 2017). Cities that reduce the use of private cars, and develop sustainable transport systems can simultaneously benefit from reduced air pollution, congestion and road fatalities while reducing overall energy intensity in the urban transport sector (Goodwin and Van Dender, 2013; Newman and Kenworthy, 2015; Wee, 2015).	In middle and low income countries urban density of informal settlements is typically associated with a range of water and vector-borne health risks that undermine adaptive capacity and the benefits of energy efficiency, may provide a notable exception to the adaptive advantages of urban density (Lilford et al., 2017; Mitlin and Satterthwaite, 2013) unless new approaches using leapfrog technology are used to upgrade slums in situ (Teferi and Newman, 2017).
Built environment	Building codes can play a critical role to reduce carbon emissions and make the built environment more resilient to climate impacts	Codes and standards that aren't applied correctly can increase vulnerability
Energy use in industry	Some options can help improve system efficiency	
Disaster risk management	Incorporating environmental considerations into recovery decision-making (Amin Hosseini et al., 2016), implementing disaster risk management plans and increasing *ex-ante* resilience to disasters are important opportunities to reduce the extent of rebuilding following disasters, and the emissions associated with recovery. Post-disaster recovery can be an opportunity to rebuild in a more resilient and sustainable	The urgency of recovery and the surge in demand for construction materials have been observed to promote unsustainable behaviours, including deforestation (Chang et al., 2010; Nazara and Resosudarmo, 2007) or uncontrolled extraction of sand and gravel (Abrahams, 2014). 'Building back better' requires capacity, time, and mechanisms for balancing competing desires and perspectives that are not necessarily available after severe disasters, and may be challenged by

	way, or to “build back better”, particularly where immediate impact is substantial but not overwhelming (Guarnacci, 2012; Mochizuki and Chang, 2017).	both local and external influences in the rebuilding process (Abrahams, 2014; O’Hare et al., 2016; Paidakaki and Moulaert, 2017) The pre-disaster phase, disaster risk management measures may negatively impact local ecosystems; for instance, hard stabilization of coastlines using sea walls or other barriers may further degrade ecosystems already vulnerable to change (Dugan et al., 2017; Finkbeiner et al., 2017).
Finance - insurance	Where mitigation measures act to reduce health and property risks, there may be important synergies between adaptation and mitigation in insurance. In response to the substantial risk posed to the insurance industry by climate change (Bank of England, 2015; Glaas et al., 2017), insurance companies are mobilizing their role as investment manager to promote climate mitigation; for example, in 2014, insurance companies pledged to invest USD 420 billion over five years in renewable energy, energy efficiency, and sustainable agriculture projects (Fabian, 2015; Webster and Clarke, 2017).	Insurance companies only cover a particular subset of climatic risks and are ineffective at considering slow-onset and/or irreversible changes. Suggestion of some risk that is “beyond adaptation” (Linnerooth-Bayer and Hochrainer-Stigler, 2015); given that these risks are not well incorporated into insurance schemes, an overreliance on pricing mechanisms to motivate mitigation action could result in sub-optimal levels of mitigation.
Social safety nets	Public work programmes structured to address climate risks, for instance, Ethiopia’s Productive Safety Net Programme has been used to employ locals suffering from food insecurity to work on water-shed management interventions, sequestering carbon in the soil and reducing greenhouse gas emissions (Jirka et al., 2015). Increase in income supports the adaptive capacity of households to weather climate risks, and has been shown to improve food consumption at household-level, and for children (Debela et al., 2015; Mohamed, 2017).	Where cash transfers are unconstrained, limited increases in purchasing power can prompt families to invest in additional consumption, transport, or agricultural equipment as part of a general risk reduction strategy (Lemos et al., 2016; Nelson et al., 2016); Aggregated, these individual investments could lead to increased emissions.

References

Abrahams, D. (2014). The barriers to environmental sustainability in post-disaster settings: a case study of transitional shelter implementation in Haiti. *Disasters* 38, S25–S49. doi:10.1111/disa.12054.

Altieri, M. A., and Nicholls, C. I. (2017). The adaptation and mitigation potential of traditional agriculture in a changing climate. *Climatic Change* 140, 33–45. doi:10.1007/s10584-013-0909-y.

Amin Hosseini, S. M., de la Fuente, A., and Pons, O. (2016). Multi-criteria decision-making method for assessing the sustainability of post-disaster temporary housing units technologies: A case study in Bam, 2003. *Sustainable Cities and Society* 20, 38–51. doi:https://doi.org/10.1016/j.scs.2015.09.012.

Bank of England (2015). The impact of climate change on the UK insurance sector - A Climate Change Adaptation Report by the Prudential Regulation Authority. *Prudential Regulation Authority*, 1–87.

Chang, Y., Wilkinson, S., Potangaroa, R., and Seville, E. (2010). Resources and capacity: lessons learned from post-disaster reconstruction resourcing in Indonesia, China and Australia. in *The Construction* ,

Building and Real Estate Research Conference of the Royal Institution of Chartered Surveyors. (Paris).
Davidse, B. J., Othengrafen, M., and Deppisch, S. (2015). Spatial planning practices of adapting to climate change. *European Journal of Spatial Development* 57, 1–21.
Debela, B. L., Shively, G., and Holden, S. T. (2015). Does Ethiopia's Productive Safety Net Program improve child nutrition? *Food Security* 7, 1273–1289. doi:10.1007/s12571-015-0499-9.
Deng, X., and Zhao, C. (2015). Identification of Water Scarcity and Providing Solutions for Adapting to Climate Changes in the Heihe River Basin of China. *Advances in Meteorology* 2015, 1–13. doi:10.1155/2015/279173.
Di Gregorio, M., Nurrochmat, D. R., Paavola, J., Sari, I. M., Fatorelli, L., Pramova, E., et al. (2017). Climate policy integration in the land use sector: Mitigation, adaptation and sustainable development linkages. *Environmental Science & Policy* 67, 35–43. doi:10.1016/J.ENVSCI.2016.11.004.
Dong, S. (2017). "Himalayan Grasslands: Indigenous Knowledge and Institutions for Social Innovation BT - Environmental Sustainability from the Himalayas to the Oceans: Struggles and Innovations in China and India," in, eds. S. Dong, J. Bandyopadhyay, and S. Chaturvedi (Cham: Springer International Publishing), 99–126. doi:10.1007/978-3-319-44037-8_5.
Dugan, J. E., Emery, K. A., Alber, M., Alexander, C. R., Byers, J. E., Gehman, A. M., et al. (2017). Generalizing Ecological Effects of Shoreline Armoring Across Soft Sediment Environments. *Estuaries and Coasts*. doi:10.1007/s12237-017-0254-x.
Dunlap, A. (2017). Counterinsurgency for wind energy: the Bíi Hioxo wind park in Juchitán, Mexico. *The Journal of Peasant Studies*, 1–23. doi:10.1080/03066150.2016.1259221.
Endo, I., Magcale-Macandog, D. B., Kojima, S., Johnson, B. A., Bragais, M. A., Macandog, P. B. M., et al. (2017). Participatory land-use approach for integrating climate change adaptation and mitigation into basin-scale local planning. *Sustainable Cities and Society* 35, 47–56. doi:10.1016/J.SCS.2017.07.014.
Fabian, N. (2015). Economics: Support low-carbon investment. *Nature* 519, 27–29. doi:10.1038/519027a.
Felton, A., Gustafsson, L., Roberge, J., Ranius, T., Hjältén, J., Rudolphi, J., et al. (2016). How climate change adaptation and mitigation strategies can threaten or enhance the biodiversity of production forests: Insights from Sweden. *Biological Conservation* 194, 11–20. doi:10.1016/j.biocon.2015.11.030.
Few, R., Martin, A., and Gross-Camp, N. (2017). Trade-offs in linking adaptation and mitigation in the forests of the Congo Basin. *Regional Environmental Change* 17, 851–863. doi:10.1007/s10113-016-1080-6.
Finkbeiner, E. M., Micheli, F., J. Bennett, N., L. Ayers, A., Le Cornu, E., and N. Doerr, A. (2017). Exploring trade-offs in climate change response in the context of Pacific Island fisheries. *Marine Policy*. doi:10.1016/j.marpol.2017.09.032.
Francesch-Huidobro, M., Dabrowski, M., Tai, Y., Chan, F., and Stead, D. (2017). Governance challenges of flood-prone delta cities: integrating flood risk management and climate change in spatial planning. *Progress in Planning* 114, 1–27.
Fricko, O., Parkinson, S. C., Johnson, N., Strubegger, M., Vliet, M. T. van, and Riahi, K. (2016). Energy sector water use implications of a 2°C climate policy. *Environmental Research Letters* 11, 34011. doi:10.1088/1748-9326/11/3/034011.
Glaas, E., Keskitalo, E. C. H., and Hjerpe, M. (2017). Insurance sector management of climate change adaptation in three Nordic countries: the influence of policy and market factors. *Journal of Environmental Planning and Management* 60, 1601–1621. doi:10.1080/09640568.2016.1245654.
Goodwin, P., and Van Dender, K. (2013). "Peak Car" - Themes and Issues. *Transport Reviews* 33, 243–254. doi:10.1080/01441647.2013.804133.
Gota, S., Huizenga, C., Peet, K., Medimorec, N., and Bakker, S. (2017). Energy Efficiency Decarbonising Transport to Achieve Paris Agreement Targets. *Energy Efficiency*.
Guarnacci, U. (2012). Governance for sustainable reconstruction after disasters: Lessons from Nias, Indonesia. *Environmental Development* 2, 73–85. doi:10.1016/j.envdev.2012.03.010.
Hammond, G. P., and Li, B. (2016). Environmental and resource burdens associated with world biofuel production out to 2050: footprint components from carbon emissions and land use to waste arisings and water consumption. *GCB Bioenergy* 8, 894–908. doi:10.1111/gcbb.12300.
Hines, E. (2017). Recognition of potential heat and water tradeoffs in vegetation-based city-level climate adaptation policies in arid and semi-arid environments.
Hurlimann, A. C., and March, A. P. (2012). The role of spatial planning in adapting to climate change. *Wiley Interdisciplinary Reviews: Climate Change* 3, 477–488. doi:10.1002/wcc.183.

Ingty, T. (2017). High mountain communities and climate change: adaptation, traditional ecological knowledge, and institutions. *Climatic Change* 145, 41–55. doi:10.1007/s10584-017-2080-3.

Jirka, S., Woolf, D., Solomon, D., and Lehmann, J. (2015). Climate finance and carbon markets for Ethiopia's Productive Safety Net Programme (PSNP): Executive Summary for Policymakers. Cornell University.

Kaye, J. P., and Quemada, M. (2017). Using cover crops to mitigate and adapt to climate change. A review. *Agronomy for Sustainable Development* 37, 4.

King, D., Gurtner, Y., Firdaus, A., Harwood, S., and Cottrell, A. (2016). Land use planning for disaster risk reduction and climate change adaptation: Operationalizing policy and legislation at local levels. *International Journal of Disaster Resilience in the Built Environment* 7, 158–172. doi:10.1108/IJDRBE-03-2015-0009.

Landauer, M., Juhola, S., and Söderholm, M. (2015). Inter-relationships between adaptation and mitigation: a systematic literature review. *Climatic Change* 131, 505–517. doi:10.1007/s10584-015-1395-1.

Lemos, M. C., Lo, Y. J., Nelson, D. R., Eakin, H., and Bedran-Martins, A. M. (2016). Linking development to climate adaptation: Leveraging generic and specific capacities to reduce vulnerability to drought in NE Brazil. *Global Environmental Change* 39, 170–179. doi:10.1016/j.gloenvcha.2016.05.001.

Ley, D. (2017). "Sustainable Development, Climate Change, and Renewable Energy in Rural Central America," in *Evaluating Climate Change Action for Sustainable Development* (Cham: Springer International Publishing), 187–212. doi:10.1007/978-3-319-43702-6_11.

Lilford, R. J., Oyebode, O., D, S., GJ, M.-T., YF, C., B, M., et al. (2017). Improving the health and welfare of people who live in slums. *Lancet* 389, 559–570.

Linnerooth-Bayer, J., and Hochrainer-Stigler, S. (2015). Financial instruments for disaster risk management and climate change adaptation. *Climatic Change* 133, 85–100. doi:10.1007/s10584-013-1035-6.

Mamais, D., Noutsopoulos, C., Dimopoulou, A., Stasinakis, A., and Lekkas, T. D. (2015). Wastewater treatment process impact on energy savings and greenhouse gas emissions. *Water Science and Technology* 71, 303–308. doi:10.2166/wst.2014.521.

McElwee, P., Thi Nguyen, V., Nguyen, D., Tran, N., Le, H., Nghiem, T., et al. (2016). Using REDD+ Policy to Facilitate Climate Adaptation at the Local Level: Synergies and Challenges in Vietnam. *Forests* 8, 11. doi:10.3390/f8010011.

Miller, S., Shemer, H., and Semiat, R. (2015). Energy and environmental issues in desalination. *Desalination* 366, 2–8. doi:https://doi.org/10.1016/j.desal.2014.11.034.

Mitlin, D., and Satterthwaite, D. (2013). *Urban poverty in the global South: scale and nature*. Abingdon, UK and New York, NY, USA: Routledge.

Mochizuki, J., and Chang, S. E. (2017). Disasters as opportunity for change: Tsunami recovery and energy transition in Japan. *International Journal of Disaster Risk Reduction* 21, 331–339. doi:https://doi.org/10.1016/j.ijdrr.2017.01.009.

Mohamed, A. A. (2017). Impact of Ethiopia's Productive Safety Net Programme (PSNP) on the Household Livelihood: The Case of Babile District in Somali Regional State, Ethiopia. *International Journal of Economy, Energy and Environment* 2, 25–31. doi:10.11648/j.ijeee.20170202.12.

Nazara, S., and Resosudarmo, B. P. (2007). Aceh-Nias Reconstruction and Rehabilitation: Progress and Challenges at the End of 2006, 2007.

Nelson, D. R., Lemos, M. C., Eakin, H., and Lo, Y.-J. (2016). The limits of poverty reduction in support of climate change adaptation. *Environmental Research Letters* 11, 94011. doi:10.1088/1748-9326/11/9/094011.

Newman, P., Beatley, T., and Boyer, H. (2017). *Resilient Cities: Overcoming Fossil Fuel Dependence*. Second. Washington DC, USA: Island Press.

Newman, P., and Kenworthy, J. (2015). "The End of Automobile Dependence: A Troubling Prognosis?," in *The End of Automobile Dependence* (Washington DC, USA: Island Press/Center for Resource Economics), 201–226. doi:10.5822/978-1-61091-613-4_7.

Niggli, U., Fließbach, A., Hepperly, P., and Scialabba, N. (2009). Low greenhouse gas agriculture: Mitigation and adaptation potential of sustainable farming systems. Rome.

Nyong, A., Adesina, F., and Osman Elasha, B. (2007). The value of indigenous knowledge in climate change mitigation and adaptation strategies in the African Sahel. *Mitigation and Adaptation Strategies for Global Change* 12, 787–797. doi:10.1007/s11027-007-9099-0.

O'Hare, P., White, I., and Connelly, A. (2016). Insurance as maladaptation: Resilience and the "business as usual" paradox. *Environment and Planning C: Government and Policy* 34, 1175–1193. doi:10.1177/0263774X15602022.

Paidakaki, A., and Moulaert, F. (2017). Disaster Resilience into Which Direction(s)? Competing Discursive and Material Practices in Post-Katrina New Orleans. *Housing, Theory and Society*, 1–23. doi:10.1080/14036096.2017.1308434.

Pham, T. T., Moeliono, M., Brockhaus, M., LEa, N. D., and Katila, P. (2017). REDD+ and Green Growth: synergies or discord in Vietnam and Indonesia. *International Forestry Review* 19, 1.

Pringle, A. M., Handler, R. M., and Pearce, J. M. (2017). Aquavoltaics: Synergies for dual use of water area for solar photovoltaic electricity generation and aquaculture. *Renewable and Sustainable Energy Reviews* 80, 572–584. doi:10.1016/J.RSER.2017.05.191.

Rodríguez-de-Francisco, J. C., and Boelens, R. (2016). PES hydrosocial territories: de-territorialization and re-patterning of water control arenas in the Andean highlands. *Water International* 41, 140–156. doi:10.1080/02508060.2016.1129686.

Rothausen, S. G. S. A., and Conway, D. (2011). Greenhouse-gas emissions from energy use in the water sector. *Nature Climate Change* 1, 210–219. doi:10.1038/nclimate1147.

Russell-Smith, J., Monagle, C., Jacobsohn, M., Beatty, R. L., Bilbao, B., Millán, A., et al. (2017). Can savanna burning projects deliver measurable greenhouse emissions reductions and sustainable livelihood opportunities in fire-prone settings? *Climatic Change* 140, 47–61. doi:10.1007/s10584-013-0910-5.

Salvo, A., Brito, J., Artaxo, P., and Geiger, F. M. (2017). Reduced ultrafine particle levels in São Paulo's atmosphere during shifts from gasoline to ethanol use. *Nature Communications* 8.

Somorin, O. A., Visseren-Hamakers, I. J., Arts, B., Tiani, A.-M., and Sonwa, D. J. (2016). Integration through interaction? Synergy between adaptation and mitigation (REDD+) in Cameroon. *Environment and Planning C: Government and Policy* 34, 415–432. doi:10.1177/0263774X16645341.

Teferi, Z. A., and Newman, P. (2017). Slum Regeneration and Sustainability: Applying the Extended Metabolism Model and the SDGs. *Sustainability* 9, 2273.

Thornton, T. F., and Comberti, C. (2017). Synergies and trade-offs between adaptation, mitigation and development. *Climatic Change* 140, 5–18. doi:10.1007/s10584-013-0884-3.

Vierros, M. (2017). Communities and blue carbon: the role of traditional management systems in providing benefits for carbon storage, biodiversity conservation and livelihoods. *Climatic Change* 140, 89–100. doi:10.1007/s10584-013-0920-3.

Wang, X. J., Zhang, J. Y., He, R. M., Amgad, E., Sondoss, E., and Shang, M. T. (2011). A strategy to deal with water crisis under climate change for mainstream in the middle reaches of Yellow River. *Mitigation and Adaptation Strategies for Global Change* 16, 555–566. doi:10.1007/s11027-010-9279-1.

Webster, A. J., and Clarke, R. H. (2017). Insurance companies should collect a carbon levy. *Nature* 549, 152–154. doi:10.1038/549152a.

Wee, B. van (2015). Peak car: The first signs of a shift towards ICT-based activities replacing travel? A discussion paper. *Transport Policy* 42, 1–3. doi:10.1016/j.tranpol.2015.04.002.