4.SM Strengthening and implementing the global response Supplementary Material

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4.SM.1 Benchmark indicators for sectoral changes in emissions as presented in Table 4.1 (Section 4.2.1)

Integrated Assessment Models (IAMs) and other sector scenarios provide sectoral detail underpinning the declines in Greenhouse Gas (GHG) emissions by the middle of the century (Section 2.3 and Section 2.4). Table 4.SM.1 indicates the pace of the transitions that are deemed necessary in 2020, 2030 and 2050 at the sector level for 1.5°C-consistent pathways, and complements this with bottom-up studies from literature that give actionable policy targets (the lines in white). A summary of this table is presented in Section 4.2.1.

Table 4.SM.1: Benchmark indicators indicating the sectoral changes in emissions, fuels and technologies that would need to take place in 1.5°C-consistent pathways, based on selected IAM 1.5°C pathways assessed in Chapter 2 (with high and low overshoot (OS)) (dark grey rows), four archetype scenarios (light grey rows), and bottom-up studies (white rows).

		Energy			Buildings		Transport			Industry
		Share of renewable in primary energy [%]	Share of renewable in electricity [%]	Share of Fossil fuels in electricity generation [%]	Reduction of energy demand in buildings [% rel. to 2010]	Direct emissions reductions from buildings [% rel. to 2010]	Share of low carbon fuels (electricity, hydrogen and biofuel) in transport [%]	Share of electricity in transport [%]	Share of biofuels in transport [%]	Industrial emission reductions [% rel. to 2010]
2020	1.5°C low OS	15.31 (16.23, 14.03)	26.26 (28.83, 23.58)	61.08 (63.17, 58.74)	-10.86 (-7.53, -14.83)	-0.83 (6.62, -9.69)	4.39 (4.51, 3.59)	1.24 (1.79, 1.09)	1.97 (3.17, 1.55)	-11.81 (-1.66, -17.80)
2020	1.5°C high OS	15.08 (15.84, 14.44)	28.37 (29.24, 25.08)	61.58 (63.83, 59.70)	-12.49 (-10.75, -19.44)	-3.52 (6.62, -15.22)	3.59 (4.45, 3.27)	1.40 (1.53, 1.09)	2.18 (2.98, 1.72)	-15.50 (-12.70, -23.70)
2020	S1	12.46	23.24	63.72	-9.20	-0.83		0.95	1.69	4.46
2020	S2	16.61	27.00	60.11	-16.20	-0.25	2.18	0.97	1.22	-20.61
2020	S5	13.46	17.38	71.03			3.16	0.95	2.20	
2020	LED	15.63	24.61	54.11	-8.78	15.11		2.51		-32.87
2020	(Figueres et al., 2017)		30							
2020	(Kuramochi et al., 2017)					20-35				10
2020	(IEA, 2017a)	15	31	58	5	12	8	2	5	-9
2030	1.5°C low OS	28.75 (35.31, 25.45)	52.63 (58.90, 44.48)	31.54 (38.14, 23.14)	-2.61 (5.41, -7.73)	30.11 (43.16, 20.58)	9.71 (15.24, 8.44)	4.99 (6.84, 3.18)	5.06 (9.60, 2.12)	39.81 (49.58, 30.13)
2030	1.5°C high OS	23.65 (27.45, 20.03)	42.73 (53.78, 36.91)	42.02 (47.27, 32.61)	-16.64 (-12.07, -20.01)	8.15 (23.54, -0.61)	6.65 (8.32, 5.55)	3.46 (4.68, 2.54)	3.54 (3.85, 1.38)	17.67 (27.65, -12.81)

	S1	28.79	57.89	27.84	-7.68	35.32		3.92	5.06	49.09
	S2	28.72	47.89	35.37	-14.12	47.92	5.17	4.46	0.71	19.11
	S5	13.78	25.11	57.38			3.43	1.32	1.93	
	LED	37.42	59.64	17.14	30.42	59.81		20.93		42.10
	(Löffler et al., 2017)	50	78							
	(Rockström et al., 2017)	20								
	(Kuramochi et al., 2017)					60-70				20
	(IEA, 2017a)	20	47	38	7	43	16.4	6	11	22
	(WBCSD, 2017)				-11				10	
2050	1.5°C low OS	58.37 (66.65, 49.97)	75.98 (85.32, 68.54)	8.69 (13.59, 4.80)	-19.43 (2.17, -37.44)	68.30 (89.48, 54.32)	52.95 (65.14, 34.10)	22.63 (30.20, 16.74)	14.71 (21.73, 10.11)	78.69 (89.17, 70.60)
	1.5°C high OS	62.16 (67.51, 47.48)	82.39 (88.34, 63.65)	6.33 (16.06, 2.26)	-37.41 (-13.37, -51.04)	48.64 (59.49, 40.82)	38.38 (43.62, 27.01)	18.49 (22.88, 13.67)	14.96 (17.78, 5.10)	68.12 (80.61, 53.62)
	S1	58.37	81.26	10.15	-20.54	79.74		33.68	12.95	73.70
	S2	52.90	63.08	11.42	-24.59	89.65	25.65	22.67	2.98	72.81
	S5	67.04	70.27	6.69			53.36	9.54	35.46	
	LED	72.51	77.40	0.19	44.67	95.00		59.21		91.38
	(Löffler et al., 2017)	100	100	0			98			
	(Rockström et al., 2017)		100	0						
	(Figueres et al., 2017)					100				50
	(Kuramochi et al., 2017)		100			80 - 90				
	(IEA, 2017a)	29	74	10	11	81	59	31	27	57
	(WBCSD, 2017)								27	

Notes: Values for '1.5C low OS' and '1.5C high OS' indicate the median and the interquartile ranges for indicators for 1.5°C-consistent pathways distinguishing high and low overshoot, collected in the scenario database established for the assessment of this Special Report (see Section 2.1 and Annex 2.3). Four illustrative pathway archetypes were selected for comparison: S1 (AIM 2.0, SSP1-19), S2 (MESSAGE-GLOBIOM 1.0, SSP2-19), S5 (REMIND-MAgPIE 1.5, SSP5-19) and LED (MESSAGEix-GLOBIOM 1.0, LowEnergyDemand) (see Section 2.1) The selected studies indicate mitigation transitions in key sectors consistent with limiting warming to 1.5°C (Figueres et al., 2017; Kuramochi et al., 2017; Löffler et al., 2017; Rockström et al., 2017) or below 2°C (IEA, 2017a; WBCSD, 2017), grounded in published scenarios combined with expert judgment.

4.SM.2 Enabling conditions and constraints of overarching adaptation options as discussed in Section 4.3.5

Table 4.SM.2: Overarching adaptation options: enabling conditions and constraints. This table is underpinning Section 4.3.5.

Adaptation option	Feasibility	Enabling conditions	Constraints	Examples
Disaster risk management (DRM)	*Medium evidence (high agreement)*	Pools resources and expertise for risk reduction (Howes et al., 2015; Kelman et al., 2015; Wallace, 2017) Integrates adaptation into existing management (Howes et al., 2015) Supports post-disaster recovery and reconstruction (Kelman et al., 2015; Kull et al., 2016) Engagement of local and Indigenous knowledge can improve preparedness and response (McNamara and Prasad, 2014; Mawere and Mubaya, 2015; Kaya et al., 2016; Chambers et al., 2017; Granderson, 2017)	Uncertainty over projected climate impacts, absence of downscaled climate projections (van der Keur et al., 2016; de Leon and Pittock, 2017; Wallace, 2017) Limited institutional, technical, and financial capacity in frontline agencies (de Leon and Pittock, 2017; Kita, 2017; Wallace, 2017) Adaptation and DRM communities operate separately (Kelman et al., 2015; Serrao-Neumann et al., 2015; de Leon and Pittock, 2017)	*Glacial lake outburst floods (GLOFs)* 1.5°C will increase risk of GLOFs (Cogley, 2017; Kraaijenbrink et al., 2017). Infrastructural measures technically and economically unfeasible in many regions (Muñoz et al., 2016; Schwanghart et al., 2016; Watanabe et al., 2016; Haeberli et al., 2017) Early warning systems (Anacona et al., 2015), and monitoring of dangerous lakes and surrounding slopes (including using remote sensing) offer DRM opportunities (Emmer et al., 2016; Milner et al., 2017) Institutional leadership and community engagement essential for effectiveness (Anacona et al., 2015; Watanabe et al., 2016)
Risk sharing and spreading: insurance	*Medium evidence (medium agreement)*	Buffers climate risk (Wolfrom and Yokoi-Arai, 2015; O'Hare et al., 2016; Glaas et al., 2017; Jenkins et al., 2017; Patel et al., 2017). Shifts the mobilization of financial resources towards strategic approaches (Surminski et al., 2016) Incentivises investments and behavior that reduce exposure (Linnerooth-Bayer and Hochrainer-Stigler, 2015; Shapiro, 2016; Jenkins et al., 2017).	Can provide disincentives for reducing risk and can distort incentives for adaptation strategies (Annan and Schlenker, 2015; Nicola, 2015) Underwrites a return to the 'status-quo' rather than enabling adaptive behavior (O'Hare et al., 2016) Financial, social, and institutional barriers to implementation and uptake, especially in low income nations (García Romero and Molina, 2015; Joyette et al., 2015; Lashley and Warner, 2015; Jin et al., 2016)	*Crop insurance* In Kenya during the 2011 drought, index-based insurance pay-outs for livestock reduced distress sales by 64% among better-off pastoralist households and reduced the likelihood of rationing food intake by 43% among poorer households (Hansen et al., 2017) In USA, (Annan and Schlenker, 2015) found insured crops were significantly more sensitive to extreme heat because insured farmers were disincentivised from investing in costly adaptation strategies since their insurance compensated for potential losses

				In Bangladesh low institutional trust and financial literacy means that fewer women enrol in weather-based crop insurance (Akter et al., 2016) *World Bank Cat bond issuance in Caribbean* In 2007, the Caribbean Catastrophe Risk Insurance Facility was formed to pool risk from tropical cyclones, earthquakes, and excess rainfalls (Murphy et al., 2012; CCRIF, 2017) 36 payouts have been made to 13 governments, totalling 130.5 million USD and partially funded by CCRIF, within 14 days of the event (CCRIF, 2017). Speed of payment allows countries to finance immediate needs (Murphy et al., 2012) Though widely perceived to be successful, evidence of success remains limited (Teh, 2015)
Risk sharing and spreading: social protection programmes	*Medium evidence (medium agreement)*	Builds generic adaptive capacity and reduces social vulnerability (Weldegebriel and Prowse, 2013; Eakin et al., 2014; Lemos et al., 2016; Schwan and Yu, 2017). Must be complemented with a comprehensive climate risk management approach (Schwan and Yu, 2017) that also takes into account disaster risk management, adaptation, and vulnerability reduction goals (Davies et al., 2013).	Inadequate targeting, leakages, and lack of institutional architecture, especially in LDCs (Ravi and Engler, 2015; Schwan and Yu, 2017) Uncertainties about effectiveness of processes of delivering social protection (e.g. cash or "in-kind"). Necessary but insufficient to decrease households' vulnerability if standalone (Lemos et al., 2016) When delivered without emphasis on vulnerability reduction, investments may be maladaptive in long run (Nelson et al., 2016)	*Cash transfer programmes* In sub-Saharan Africa, cash transfer programmes targeting poor communities have proven successful in smoothing household welfare and food security during droughts, strengthening community ties, and reducing debt levels (del Ninno et al., 2016; Asfaw et al., 2017; Asfaw and Davis, 2018). In Brazil, higher levels of income due to cash transfer programs have been linked to food security, as households are able to invest in irrigation, but there have been limited long-term investments in reducing vulnerability among the poorest households (Lemos et al., 2016; Mesquita and Bursztyn, 2016; Nelson et al., 2016).
Education and learning	*Medium evidence (high agreement)*	Co-production of solutions strengthens adaptation implementation (Butler et al., 2016a; Thi Hong Phuong et al., 2017; Ford et al., 2018)	Not appropriate in all circumstances (e.g., highly marginalized locations) (Ford et al., 2016, 2018)	*Participatory scenario planning (PSP)* PSP is a process by which multiple stakeholders work together to envision future scenarios under a range of climatic conditions (Flynn et al., 2018).

		Social learning strengthens adaptation and affects longer-term change (Clemens et al., 2015; Ensor and Harvey, 2015; Henly-Shepard et al., 2015). International learning and cooperation mechanisms, supranational organizations (Vinke-de Kruijf and Pahl-Wostl, 2016), and international, collaborative projects (Cochrane et al., 2017; Harvey et al., 2017) can build adaptive capacity.	Education and learning on their own may not provide "enough adaptive capacity to respond to climate change" (Thi Hong Phuong et al., 2017) Participation in and of itself does not necessarily build capacity (Ford et al., 2016)	PSP has been observed to facilitate the interaction of multiple knowledge systems, resulting in learning and the co-production of knowledge on adaptation (Tschakert et al., 2014; Oteros-Rozas et al., 2015; Star et al., 2016; Flynn et al., 2018).
Population health and health system	*Medium evidence (high agreement)*	1.5°C will primarily exacerbate existing health challenges (Smith et al., 2014a), which can be targeted by enhancing health services. Age, pre-existing medical conditions and social deprivation are found to be the key (but not the only) factors that make people vulnerable and lead to more adverse health outcomes related to climate change impacts. This can be mainstreamed through existing health programing and service delivery (WHO, 2015; Paavola, 2017) Needs to be combined with iterative management involving regular monitoring of effectiveness in the light of climate impacts (Hess and Ebi, 2016; Ebi and del Barrio, 2017) Collaboration with local stakeholders, public education campaigns, and the tailoring of communication to local needs are essential (Berry and Richardson, 2016; van Loenhout et al., 2016).	Governance challenges: e.g. absence of coordination across scales, lack of mandate for action on adaptation (Austin et al., 2016; Ebi and del Barrio, 2017; Shimamoto and McCormick, 2017) Absence of information and understanding on climate impacts (Nigatu et al., 2014; Xiao et al., 2016; Sheehan et al., 2017) Many health services currently don't consider climate change (Hess and Ebi, 2016). Adaptation strategies based on individual preparedness, action and behaviour change may aggravate health and social inequalities due to their selective uptake, unless they are coupled with broad public information campaigns and financial support for undertaking adaptive measures (Paavola, 2017)	*Heat-wave early warning and response systems* Heat wave early warning and response systems coordinate the implementation of multiple measures in response to predicted extreme temperatures (e.g. public announcements, opening public cooling shelters, distributing information on heat stress symptoms) and have been shown to be effective in a wide variety of contexts (Knowlton et al., 2014; Takahashi et al., 2015; Nitschke et al., 2016, 2017).
Indigenous knowledge	*Medium evidence*	Indigenous knowledge underpins the adaptive capacity of Indigenous		*Cultural programming*

	(high agreement)	communities through the diversity and flexibility of Indigenous agro-ecological systems, collective social memory, repository of accumulated experience, and from social networks that are essential for disaster response and recovery (Hiwasaki et al., 2015; Pearce et al., 2015; Mapfumo et al., 2016; Sherman et al., 2016; Ingty, 2017; Ruiz-Mallén et al., 2017) Knowledge of environmental conditions helps communities detect and monitor change (Johnson et al., 2015; Mistry and Berardi, 2016; Williams et al., 2017) .	Acculturation, dispossession of land rights and land grabbing, colonization, and social change are challenging Indigenous knowledge systems (Ford, 2012; Nakashima et al., 2012; McNamara and Prasad, 2014; Pearce et al., 2015). Broader structural challenges, systemic inequality, and dominant governance systems prevent Indigenous epistemologies and worldviews from meaningfully being integrated into adaptation (Thornton and Manasfi, 2010; Mistry et al., 2016; Russell-Smith et al., 2017). Can promote conservative attitudes, limit uptake of new information and practices, and may not be sustainable in all circumstances given socio-cultural changes experienced (Granderson, 2017; Kihila, 2017; Mccubbin et al., 2017)	Options such as integration of Indigenous knowledge into resource management systems and school curricula, digital storytelling and filmmaking, cultural events, web-based knowledge banks, radio dramas, documentation of knowledge, are identified as potential adaptations (Cunsolo Willox et al., 2013; McNamara and Prasad, 2014; MacDonald et al., 2015b; Pearce et al., 2015; Chambers et al., 2017; Inamara and Thomas, 2017) but need to be carefully analysed for their potential to reduce vulnerability, including potential trade-offs (Granderson, 2017).
Human migration	*Low evidence* (but rapidly growing, *low agreement)*	Revising and adopting migration issues in national DRR policies, NAPs, and INDCs/NDCs (Kuruppu and Willie, 2015; Yamamoto et al., 2017), Utilizing existing social protection programmes to manage climate-induced migration (Schwan and Yu, 2017), Moving away from ad hoc approaches to migration and displacement (Thomas and Benjamin, 2018). Migration can serve as an important risk management strategy, leading to increased incomes (Cattaneo and Peri, 2016).	Research conducted on a "case by case" approach fails to provide the effective scaling of policy to national or international levels (Gemenne and Blocher, 2017; Grecequet et al., 2017). Few policies on migration exist at the national or sub-national scales (Yamamoto et al., 2017) Financial, social and ecological costs (Grecequet et al., 2017) Stress on urban system resources and services (Bhagat, 2017)	*Autonomous and planned relocation in SIDS and semi-arid regions* Migration is improving access to financial and social capital and reducing risk exposure in some locations (e.g., in the Solomon Islands (Birk and Rasmussen, 2014)). The ad hoc nature of migration and displacement can be overcome by integrating disaster risk reduction and climate change adaptation into national sustainable development plans (Thomas and Benjamin, 2018). In dryland India, populations in rural regions already experiencing 1.5°C warming are migrating to cities (Gajjar et al., 2018) but are inadequately covered by existing policies (Bhagat, 2017).

		Migration might become the only feasible adaptation option in highly vulnerable areas (Betzold, 2015; Wilkinson et al., 2016)	Migrants at risk of insecure tenure, unsafe living conditions, and exclusion in their destinations (Bettini et al., 2016; Gioli et al., 2016; Bhagat, 2017; Schwan and Yu, 2017)	
Climate services	*Medium evidence (high agreement)*	Rapid technical development, due to increased financial inputs and growing demand is enabling improved quality of climate information (Rogers and Tsirkunov, 2010; Clements et al., 2013; Perrels et al., 2013; Gasc et al., 2014; WMO, 2015; Roudier et al., 2016). Multiple stakeholder engagement and participatory processes to interpret climate information are effective to improve uptake and use (Mantilla et al., 2014; Sivakumar et al., 2014; Coulibaly et al., 2015; Gebru et al., 2015; Brasseur and Gallardo, 2016; Lourenço et al., 2016; Singh et al., 2016; Vaughan et al., 2016; Kihila, 2017; Lobo et al., 2017). Scaling climate services may occur through leveraging capacities of project champions, knowledge brokers, and intermediaries (Mantilla et al., 2014; Coulibaly et al., 2015), co-production of knowledge (Kirchhoff et al., 2013) that enables users to actively participate with valid expertise of the particularities of their decision-making context (Vaughan and Dessai, 2014), developing clear financial models to ensure sustainability (Webber and Donner, 2017), which includes multi-stakeholder engagement through iterative participatory processes (Girvetz et al., 2014; Dorward et al., 2015), and leveraging appropriate	Issues of timing of information provision and scale of information remain barriers (Dinku et al., 2014; Jancloes et al., 2014; Gebru et al., 2015; Weisse et al., 2015; Brasseur and Gallardo, 2016; Cortekar et al., 2016; Singh et al., 2016; Snow et al., 2016; Vaughan et al., 2016; Kihila, 2017) Lower uptake by women, remote communities, those without technical support (Carr and Onzere, 2017; Singh et al., 2017) Issues of trust and usability of information provided (Jones et al., 2016b; Singh et al., 2017; White et al., 2017a). Continued focus on supply-driven provision of climate in- formation rather than specific needs of end users (Lourenço et al., 2016)	Semi-arid regions in India and sub-Saharan Africa facing 1.5°C warming are seeing benefits of climate services in the agriculture planning, drought management, and flood warning (Vincent et al., 2015; Lobo et al., 2017; Singh et al., 2017; Vaughan et al., 2018a) Climate services are seeing wide application in sectors such as agriculture, health, disaster management, insurance (Lourenço et al., 2016; Vaughan et al., 2018a) with implications for adaptation decision-making. Several programmes aimed at using climate services for better decision making are showing signs of success: from various actors, at various scales, and using different forms of information delivery and uptake. These involve participatory analysis of seasonal forecasts in East Africa (Dorward et al., 2015), NGO-driven weather advisories in India (Lobo et al., 2017), innovations in government-led agriculture extension in various countries across sub-Saharan Africa and South Asia (Singh et al., 2016), and broadening the scope of climate services to directly inform spatial planning and adaptation interventions in the Netherlands (Goosen et al., 2013).

		communication channels such as mobile technology (Hampson et al., 2014; Gebru et al., 2015).		

4.SM.3 Carbon dioxide removal costs, deployment and side-effects: literature basis for Figure 4.2 (Section 4.3.7)

Table 4.SM.3: References supporting Figure 4.2 in Section 4.3.7: Evidence on Carbon Dioxide Removal (CDR) abatement costs, 2050 deployment potentials, and side effects.Based on systematic review (Fuss et al., 2018b).

Technology	Costs	Potentials
Afforestation and reforestation (AR)	(Myers and Goreau, 1991; van Kooten et al., 1992; Winjum et al., 1992; Dixon et al., 1993; Winjum et al., 1993; Swisher, 1994; Brown et al., 1995; Chang, 1999; Plantinga et al., 1999; van Kooten et al., 1999; Kooten, 2000; Sohngen and Alig, 2000; Plantinga and Mauldin, 2001; Ravindranath et al., 2001; Sohngen and Mendelsohn, 2003; van Vliet et al., 2003; Baral and Guha, 2004; Richards and Stokes, 2004; Koning et al., 2005; Lakyda et al., 2005; Lee et al., 2005; Olschewski and Benítez, 2005; Richards and Stavins, 2005; Yemshanov et al., 2005; Benítez and Obersteiner, 2006; Han et al., 2007; Ahn, 2008; Hedenus and Azar, 2009; Dominy et al., 2010; Rootzén et al., 2010; Ryan et al., 2010; Torres et al., 2010; Winsten et al., 2011; Paterson and Bryan, 2012; Townsend et al., 2012; Nijnik et al., 2013; Paul et al., 2013; Polglase et al., 2013; Carwardine et al., 2015; Evans et al., 2015; Maraseni and Cockfield, 2015; Haim et al., 2016)	(Dixon et al., 1994; Nilsson and Schopfhauser, 1995; Cannell, 2003; Richards and Stokes, 2004; Houghton et al., 2015)
Bioenergy with carbon dioxide capture and storage (BECCS)	(Möllersten et al., 2003, 2004, 2006; Keith et al., 2006; Azar et al., 2006; Luckow et al., 2010; Abanades et al., 2011; Gough and Upham, 2011; Laude and Ricci, 2011; Laude et al., 2011; Ranjan and Herzog, 2011; Carbo et al., 2011; De Visser et al., 2011; Fabbri et al., 2011; Koornneef et al., 2012b; Kärki et al., 2013; Fornell et al., 2013; Akgul et al., 2014; Johnson et al., 2014b; Arasto et al., 2014; Al-Qayim et al., 2015; Onarheim et al., 2015; Creutzig et al., 2015; Moreira et al., 2016; Rochedo et al., 2016; Sanchez and Callaway, 2016)	(Fischer and Schrattenholzer, 2001; Yamamoto et al., 2001; Hoogwijk et al., 2005; Moreira, 2006; Obersteiner et al., 2006; Smeets et al., 2007; Smeets and Faaij, 2007; Hakala et al., 2008; Hoogwijk et al., 2009; van Vuuren et al., 2009; Dornburg et al., 2010; Gregg and Smith, 2010; Thrän et al., 2010; Beringer et al., 2011; Haberl et al., 2011; Cornelissen et al., 2012; Erb et al., 2012; Rogner et al., 2012; Smith et al., 2012b; Lauri et al., 2014; Kraxner and Nordström, 2015; Searle and Malins, 2015; Buchholz et al., 2016; Calvin et al., 2016; Tokimatsu et al., 2017)
Biochar	(McCarl et al., 2009; Smith, 2016)	(Lehmann et al., 2006; Laird et al., 2009; Lee et al., 2010; Moore et al., 2010; Pratt and Moran, 2010; Woolf et al., 2010; Powell and Lenton, 2012; Hamilton et al., 2015; Lomax et al., 2015; Smith, 2016)
Soil carbon sequestration	(Smith et al., 2008)	(Batjes, 1998; Metting et al., 2001; Lal, 2003a, 2003b, 2004a, 2004c; Lal et al., 2007; Smith et al., 2008; Lal, 2010; Salati et al., 2010; Conant, 2011; Lal, 2011; Smith, 2012; Benbi, 2013; Lal, 2013; Lorenz

		and Lal, 2014; Powlson et al., 2014; Sommer and Bossio, 2014; Henderson et al., 2015; Lassaletta and Aguilera, 2015; Smith, 2016; Minasny et al., 2017; Zomer et al., 2017)
Direct air carbon dioxide capture and storage (DACCS)	(Zeman, 2003, 2014; Keith et al., 2006; Nikulshina et al., 2006; Stolaroff et al., 2008; Lackner, 2009; Simon et al., 2011; Socolow et al., 2011; House et al., 2011; Holmes and Keith, 2012a; Kulkarni and Sholl, 2012; Mazzotti et al., 2013; Zhang et al., 2014b; Geng et al., 2016; Sakwa-Novak et al., 2016; SEAB, 2016; Sinha et al., 2017; van der Giesen et al., 2017)	
Enhanced weathering (EW)	(Schuiling and Krijgsman, 2006; Hartmann and Kempe, 2008; Köhler et al., 2010; Renforth, 2012; Taylor et al., 2016; Strefler et al., 2018a)	(Hartmann and Kempe, 2008; Köhler et al., 2010, 2013; Renforth et al., 2011; Hauck et al., 2016; Taylor et al., 2016; Strefler et al., 2018a)
Ocean alkalinisation (OA)	(Rau and Caldeira, 1999; Rau et al., 2007; Harvey, 2008; Rau, 2008; Paquay and Zeebe, 2013; Renforth et al., 2013; Renforth and Kruger, 2013; Renforth and Henderson, 2017)	(Harvey, 2008; Paquay and Zeebe, 2013; González and Ilyina, 2016)
Reviews	(Lenton, 2010; McGlashan et al., 2012; McLaren, 2012; Lenton, 2014; Caldecott et al., 2015; NRC, 2015; UNEP, 2017b)	

4.SM.4 Guidance and assessment for feasibility assessment

4.SM.4.1 Guidance for feasibility assessment in Section 4.5.1

Table 4.SM.4: Guidance for conducting the feasibility assessment of mitigation and adaptation options. See 4.SM.4.2 for the assessment and literature basis of the assessment of mitigation options and 4.SM.4.3 for the assessment and literature basis of adaptation options.

<table>
<tr><th>Entry for indicator-option combination</th><th colspan="2">Guidance for conducting the feasibility assessment of mitigation and adaptation options</th></tr>
<tr><td>NA (not applicable)</td><td colspan="2">The indicator is not relevant to the option</td></tr>
<tr><td>NE (no evidence)</td><td colspan="2">• No peer-reviewed literature could be located supporting an assessment of whether this indicator would limit the option’s feasibility
• The peer-reviewed literature that mentions the issue is not robust enough</td></tr>
<tr><td>LE (limited evidence)</td><td colspan="2">• One or two papers make statements/present research that could be a basis for the assessment, but this evidence is considered too limited
• Two or more papers provide a basis for the assessment as a side-issue in the paper, not as a core issue</td></tr>
<tr><td>A</td><td rowspan="3">A feasibility assessment can be made:

• If there are one or two robust papers (or more) that contain references which also support the assessment
• If literature is plentiful
• If one or a number of meta-studies and reviews provide extensive treatment of the option/indicator combination</td><td>A = The indicator could block the feasibility of this option</td></tr>
<tr><td>B</td><td>B = The indicator does not have a positive, nor a negative effect on the feasibility of the option</td></tr>
<tr><td>C</td><td>C = The indicator does not pose any barrier to the feasibility of this option</td></tr>
</table>

Table 4.SM.5 Parameters used for the calculation of the overall feasibility of the dimension-option combinations

$\#indicators$	Number of indicators used to assess the overall feasibility of a dimension, typically two to five.
$\#NA$	Number of indicators that are not applicable (NA) to the option
$\#NE\&LE$	Total number of indicators for which there is no evidence (NE) or limited evidence (LE)
$\#A$	Number of indicators assessed as A
$\#B$	Number of indicators assessed as B
$\#C$	Number of indicators assessed as C

$\#effective\ indicators$	$\#effective\ indicators = \#indicators - \#NA$
AVG	$AVG = (1 * \#A + 2 * \#B + 3 * \#C)/\#effective\ indicators$

Table 4.SM.6: Legend criteria for the overall feasibility of the dimension-option combinations as shown in Table 4.11 for mitigation options and Table 4.12 or adaptation options.

Legend of Table 4.11 and Table 4.12	**Legend criteria for the overall feasibility of each of the dimension-option combinations**
	$\#indicators = \#NA$
	$\#NE\&LE > 0.5 * \#effective\ indicators$
	$AVG \leq 1.5$ $\#NE\&LE \leq 0.5 * \#effective\ indicators$
	$1.5 < AVG \leq 2.5$ $\#NE\&LE \leq 0.5 * \#effective\ indicators$
	$AVG > 2.5$ $\#NE\&LE \leq 0.5 * \#effective\ indicators$

4.SM.4.2 Feasibility assessment of mitigation options as presented in Section 4.5.2

4.SM.4.2.1 Feasibility assessment of mitigation options in energy system transitions

Table 4.SM.7: Feasibility assessment of energy system transition mitigation options: Wind (on-shore & off-shore); Solar PV; and Bioenergy. For methodology, see 4.SM.4.1.

		Wind (on-shore & off-shore)		Solar PV		Bioenergy	
	Evidence	Robust		Robust		Robust	
	Agreement	Medium		High		Medium	
Economic	Cost-effectiveness		(Silva Herran et al., 2016); (IRENA 2015); (IRENA, 2016); (WEC), 2016); (Shafiee et al., 2016); (Voormolen et al., 2016)		(Climate Council 2017b); (IRENA 2015); (IRENA, 2016); (Cengiz and Mamiş, 2015)		(Brown, 2015; Creutzig et al., 2015; Patel et al., 2016)
	Absence of distributional effects		(Greene and Geisken, 2013); (Corfee-Morlot et al., 2012)		(Toovey and Malin, 2016); (Corfee-Morlot et al., 2012)		(Arndt et al., 2011b; German and Schoneveld, 2012; Creutzig et al., 2013; Hunsberger et al., 2014; Buck, 2016; Robledo-Abad et al., 2017; Stevanović et al., 2017) (Popp et al., 2014; Persson, 2015; Kline et al., 2017; Searchinger et al., 2017), (German and Schoneveld, 2012) (Schoneveld et al., 2011)(Bernesson et al., 2004)(Grau et al., 2010) (Agoramoorthy et al., 2009)(Ewing and Msangi, 2009)
	Employment & productivity enhancement potential		(IEA 2017d); (IRENA 2017b); (Council, 2016); (Council, 2012)		(IEA) 2017d); (IRENA 2017b); (Council 2017b); (Council, 2016)		(Parcell and Westhoff, 2006; Gohin, 2008; Wicke et al., 2009; Arndt et al., 2011a) (Rathmann et al., 2012; Silalertruksa et al., 2012; Augusto Horta Nogueira and Silva Capaz, 2013; Ribeiro, 2013)

Technological	Technical scalability		(IRENA 2017b); (Al-Maghalseh and Maharmeh, 2016); (Silva Herran et al., 2016);(IRENA 2017a)		(IRENA 2017a)		(Soccol et al., 2009; Fiorese et al., 2014; Vimmerstedt et al., 2015; Humpenöder et al., 2017)
	Maturity		(UNEP 2017b); (IRENA 2017a)		(Despotou, 2012)		(Soccol et al., 2009; Corsatea, 2014; Fiorese et al., 2014; Creutzig et al., 2015; Strzalka et al., 2017)
	Simplicity		(IRENA, 2016)		(IRENA, 2016)		(Demirbas and Demirbas, 2007; Surendra et al., 2014)
	Absence of risk		(UNEP 2017b)		(UNEP 2017b); (Bahill and Chaves, 2013)		Carbon Neutrality - debate (Buchholz et al., 2016; Liu et al., 2018)
Institutional	Political acceptability		(UNEP 2017b); (WEC) 2016); (Borch et al., 2014); (Bistline, 2017); (Kar and Sharma, 2015) (Baker, 2015) (Furtado and Perrot, 2015)		(UNEP 2017b); (Shukla et al., 2018)(Baker, 2015)		(Longstaff et al., 2015; Favretto et al., 2017; Goetz et al., 2017) Suggestions for more focus on implementation challenges to avoid indirect Land Use Change, food price increases, land tenure conflicts (Timilsina et al., 2012; Broch et al., 2013; Montefrio and Sonnenfeld, 2013; Stattman et al., 2013; Aha and Ayitey, 2017)
	Legal & administrative acceptability		(UNEP 2017b); (Bistline, 2017); (Kar and Sharma, 2015); (Comello et al., 2017)		(UNEP 2017b); (Comello et al., 2017); (Shukla et al., 2018); (Shrimali and Rohra, 2012)		(Gamborg et al., 2014; Amos, 2016; Naiki, 2016)
	Institutional capacity		(UNEP 2017b); (Corfee-Morlot et al., 2012); (Goodale and Milman, 2016); (Bistline, 2017); (Kar and Sharma, 2015); (Comello et al., 2017)		(UNEP 2017b); (Corfee-Morlot et al., 2012); (Comello et al., 2017); (Shukla et al., 2018); (Shrimali and Rohra, 2012)	LE	(Gamborg et al., 2014) (Favretto et al., 2017)
	Transparency & accountability potential		(UNEP 2017b); (Bistline, 2017) (Eberhard et al., 2014) (Furtado and Perrot, 2015)(Swilling et al., 2016)		(UNEP 2017b) (Eberhard et al., 2014) (Swilling et al., 2016)		(Plevin et al., 2010; Creutzig et al., 2015) management (Pyörälä et al., 2014; Torssonen et al., 2016; Baul et al., 2017; Kilpeläinen et al., 2017)

							Carbon neutrality –feedstock and time frame (Zanchi et al., 2012; Hammar et al., 2015; Daioglou et al., 2017; Booth, 2018; Sterman et al., 2018) dLUC and iLUC challenges emissions (Schulze et al., 2012; Harris et al., 2015; Repo et al., 2015; DeCicco et al., 2016; Qin et al., 2016) (Buchholz et al., 2014; Röder et al., 2015; Röder and Thornley, 2016; Robledo-Abad et al., 2017)
Socio-cultural	Social co-benefits (health, education)		(Geels et al., 2017); (IEA 2017d); (UNEP 2017a); (UNEP 2017b); (Silva Herran et al., 2016); (Geels et al., 2017)		(Geels et al., 2017); (IEA) 2017d); (UNEP) 2017a); (UNEP 2017b)		(Kar et al., 2012; Anenberg et al., 2013; Knoblauch et al., 2014; Porter et al., 2015; Weldu et al., 2017)
	Public acceptance		(Geels et al., 2017); (IEA, 2017d); (UNEP 2017a); (UNEP 2017b); (Geraint and Gianluca, 2016); (Borch et al., 2014); (Kondili and Kaldellis, 2012); (Sütterlin and Siegrist, 2017); (Brennan et al., 2017); (Heidenreich, 2015)		(Geels et al. 2017); (IEA) 2017d); (UNEP 2017a); (UNEP 2017b); (Sütterlin and Siegrist, 2017); (Brennan et al., 2017)		(Khanal et al., 2010; Delshad and Raymond, 2013; Dragojlovic and Einsiedel, 2015; Moula et al., 2017) (Fytili and Zabaniotou, 2017; Goetz et al., 2017)
	Social & regional inclusiveness		(Geels et al., 2017); (IEA) 2017d); (UNEP 2017a); (UNEP 2017b)		(Geels et al., 2017); (IEA) 2017d); (UNEP 2017a); (UNEP 2017b)		(Creutzig et al., 2013, 2015; Favretto et al., 2017; Robledo-Abad et al., 2017)
	Intergenerational equity		(Geels et al., 2017); (IEA) 2017d); (UNEP 2017a); (UNEP 2017b)		(Geels et al., 2017); (IEA) 2017d); (UNEP 2017a); (UNEP 2017b)	NE	
	Human capabilities		(Geels et al., 2017); (IEA) 2017d); (UNEP) 2017a); (UNEP 2017b); (Bistline, 2017)		(Geels et al., 2017); (IEA) 2017d); (UNEP 2017a); (UNEP 2017b); (Shrimali and Rohra, 2012); (Shukla et al., 2018)	NE	
Environmental/ecological	Reduction of air pollution		(UNEP 2017a); (UNEP 2017b); (Council, 2012); (Kondili and Kaldellis, 2012)		(UNEP 2017a); (UNEP 2017b)	LE	(Kar et al., 2012; Anenberg et al., 2013; Knoblauch et al., 2014; Porter et al., 2015; Weldu et al., 2017)
	Reduction of toxic waste		(UNEP 2017a); (UNEP 2017b)		(UNEP 2017a); (UNEP 2017b)	NE	

	Reduction of water use		(UNEP 2017a); (UNEP 2017b); (Kondili and Kaldellis, 2012)		(UNEP 2017a); (UNEP 2017b)		(Smith et al., 2016) (Bonsch et al., 2016) (Gerbens-Leenes et al., 2009; Gheewala et al., 2011; Smith and Torn, 2013; Bonsch et al., 2016; Lampert et al., 2016; Mouratiadou et al., 2016; Wei et al., 2016; Mathioudakis et al., 2017)
	Improved biodiversity		(UNEP 2017a); (UNEP 2017b)		(UNEP, 2017a); (UNEP 2017b)		(Immerzeel et al., 2014; Dale et al., 2015; Holland et al., 2015; Kline et al., 2015; Santangeli et al., 2016; Tarr et al., 2017) (Holland et al., 2015; Santangeli et al., 2016) Mixed evidence pointing more to negative impacts for first-generation and sometimes even positive for second-generation.
Geophysical	Physical feasibility (physical potentials)		(UNEP 2017a); (UNEP 2017b); (Al-Maghalseh and Maharmeh, 2016)		(UNEP 2017a); (UNEP 2017b)		(Slade et al., 2014) (Beringer et al., 2011; Klein et al., 2014; Creutzig et al., 2015; Kraxner and Nordström, 2015; Searle and Malins, 2015; Smith et al., 2016; Boysen et al., 2017b; Tokimatsu et al., 2017; Heck et al., 2018)
	Limited use of land		(UNEP 2017a); (UNEP 2017b); (Silva Herran et al., 2016); (Mohan, 2017)		(UNEP 2017a); (UNEP 2017b); (Mohan, 2017)		(Popp et al., 2014; Creutzig et al., 2015; Williamson, 2016; Robledo-Abad et al., 2017) (Bonsch et al., 2016; Hammond and Li, 2016)
	Limited use of scarce (geo)physical resources		(UNEP 2017a); (UNEP 2017b)		(UNEP 2017a); (UNEP 2017b)	NA	

	Global spread		(UNEP 2017a); (UNEP 2017b)		(UNEP 2017a); (UNEP 2017b)		(Deng et al., 2015; Daioglou et al., 2017; Robledo-Abad et al., 2017)

Table 4.SM.8: Feasibility assessment of energy system transition mitigation options: Electricity storage; Power sector CCS; and Nuclear energy. For methodology, see 4.SM.4.1.

		Electricity storage		Power sector CCS		Nuclear energy	
	Evidence	Robust		Robust		Robust	
	Agreement	Medium		High		High	
Economic	Cost-effectiveness		(ACOLA, 2017); (Schmidt et al., 2017); (Quann, 2017); (IRENA 2015)		Studies indicate that CCS in the power sector is somewhere in the middle range of mitigation options. It's a significant additional cost but the scale is usually large so much CO_2 is reduced (Global CCS Institute, 2017) (Rubin et al., 2015) (IEA, 2017a)(Castrejón et al., 2018)		(Bruckner et al., 2014) (Lovering et al., 2016; Koomey et al., 2017) (Finon and Roques, 2013)
	Absence of distributional effects		(Corfee-Morlot et al., 2012; ACOLA, 2017)	NE		NE	
	Employment & productivity enhancement potential		(ACOLA, 2017); (Climate Council, 2017); (IEA 2017); (IRENA, 2017b)		Higher than coal/gas without CCS, on par with wind, geothermal, nuclear (IEA, 2017a)(Wei et al., 2010)(Koelbl et al., 2016)		(Wei et al., 2010) (Kenley et al., 2009)
Technological	Technical scalability		(ACOLA, 2017); (IRENA, 2017a)		(IPCC, 2005) (de Coninck and Benson, 2014)(Aminu et al., 2017)		(IAEA, 2018) (Bruckner et al., 2014) (for current-generation plants)
	Maturity		(ACOLA, 2017); (IRENA, 2017a)		(Zheng and Xu, 2014; Abanades et al., 2015; Bui et al., 2018; Qiu and Yang, 2018)		(Bruckner et al., 2014)
	Simplicity		(ACOLA, 2017); (IRENA, 2016)	LE	(Wei et al., 2010) (IEA GHG, 2012)		(Esteban and Portugal-Pereira, 2014)
	Absence of risk		(ACOLA, 2017); (UNEP, 2017a)		(IPCC, 2005) (de Coninck and Benson, 2014)(Boot-Handford et al., 2014)(Aminu et al., 2017)		(Wheatley et al., 2016) (Rose and Sweeting, 2016) (Hirschberg et al., 2016)

Institutional	Political acceptability		(ACOLA, 2017); (Nguyen et al., 2017); (UNEP, 2017a)		(de Coninck and Benson, 2014)(Boot-Handford et al., 2014)(Aminu et al., 2017)		(Bruckner et al., 2014) (IAEA, 2017)
	Legal & administrative acceptability		(ACOLA, 2017); (Nguyen et al., 2017); (UNEP, 2017a)		(Boot-Handford et al., 2014; de Coninck and Benson, 2014; Dixon et al., 2015)	NE	
	Institutional capacity		(ACOLA, 2017); (IEA 2017a); (Nguyen et al., 2017); (UNEP 2017b); (Corfee-Morlot et al., 2012)	LE	(Ashworth et al., 2015)		(Figueroa, 2016) (Juraku, 2016) (Tosa, 2015) (Vivoda and Graetz, 2015) (Taebi and Mayer, 2017) (Kim and Chung, 2018)
	Transparency & accountability potential		(ACOLA, 2017); (Nguyen et al., 2017); (UNEP, 2017a)	NE			(Figueroa, 2016)
Socio-cultural	Social co-benefits (health, education)		(ACOLA, 2017); (Geels et al., 2017); (IEA 2017d); (UNEP 2017a); (UNEP 2017b)	NE			(Bruckner et al., 2014) (Oe et al., 2016) (Suzuki et al., 2016) (WHO, 2011) (Ishikawa, 2014) (Nagataki et al., 2013) (Endo et al., 2012) (Kawaguchi and Yukutake, 2017) (Nakayachi et al., 2015) (Fridman et al., 2016) (Beresford et al., 2016) (Hirschberg et al., 2016)
	Public acceptance		(ACOLA, 2017); (Climate Council 2017a); (Geels et al., 2017); (IEA 2017d); (UNEP 2017a); (UNEP 2017b)		(Ashworth et al., 2015) (Aminu et al., 2017) (Seigo et al., 2014)		(Huhtala and Remes, 2017) (Diaz-Maurin and Kovacic, 2015) (Wu, 2017) (Kim et al., 2014) (Murakami et al., 2015) (Ho et al., 2018) (Tsujikawa et al., 2016) (Nishikawa et al., 2016) (Bruckner et al., 2014) (IAEA, 2017)
	Social & regional inclusiveness		(ACOLA, 2017); (Geels et al., 2017); (IEA 2017d); (UNEP 2017a); (UNEP 2017b)	NA		NE	
	Intergenerational equity		(ACOLA, 2017); (Geels et al., 2017); (IEA 2017d); (UNEP 2017a); (UNEP 2017b)		(Alcalde et al., 2018)		(Bruckner et al., 2014)
	Human capabilities		(ACOLA, 2017; Geels et al., 2017; (IEA 2017d); (UNEP 2017a);		(Shackley et al., 2009; IEA GHG, 2012)	NE	

			(UNEP 2017b) (Newman et al., 2017)				
Environmental/ecological	Reduction of air pollution		(ACOLA, 2017); (UNEP 2017a); (UNEP 2017b)		(Koornneef et al., 2008; Odeh and Cockerill, 2008; Pehnt and Henkel, 2009; Korre et al., 2010; Nie et al., 2011; Modahl et al., 2012; Corsten et al., 2013; Cuéllar-Franca and Azapagic, 2015; Gibon et al., 2017)		(Cheng and Hammond, 2017)
	Reduction of toxic waste		(ACOLA, 2017); (UNEP 2017a); (UNEP 2017b)		(Koornneef et al., 2008; Odeh and Cockerill, 2008; Pehnt and Henkel, 2009; Korre et al., 2010; Nie et al., 2011; Modahl et al., 2012; Corsten et al., 2013; Cuéllar-Franca and Azapagic, 2015; Gibon et al., 2017)		(Bruckner et al., 2014)
	Reduction of water use		(ACOLA, 2017); (UNEP 2017a); (UNEP 2017b)		, (Cooney et al., 2015) (Koornneef et al., 2012a) (Koornneef et al., 2008; Odeh and Cockerill, 2008; Pehnt and Henkel, 2009; Korre et al., 2010; Nie et al., 2011; Modahl et al., 2012; Corsten et al., 2013; Cuéllar-Franca and Azapagic, 2015; Gibon et al., 2017)		(Kato et al., 2012) (Ueda et al., 2013) (Tsumune et al., 2012) (Sakaguchi et al., 2012) (Bailly du Bois et al., 2012) (Bruckner et al., 2014)
	Improved biodiversity	NA			(Koornneef et al., 2012a) (Koornneef et al., 2008; Odeh and Cockerill, 2008; Pehnt and Henkel, 2009; Korre et al., 2010; Nie et al., 2011; Modahl et al., 2012; Corsten et al., 2013; Cuéllar-Franca and Azapagic, 2015; Gibon et al., 2017)		(Cheng and Hammond, 2017)
Geophysical	Physical feasibility (physical potentials)		(ACOLA, 2017); (UNEP 2017a); (UNEP 2017b)		(IPCC, 2005) (de Coninck and Benson, 2014) (Scott et al., 2015)		(Bruckner et al., 2014)
	Limited use of land		(ACOLA, 2017); (UNEP 2017a); (UNEP 2017b)		Non-controversial so not investigated.		(Cheng and Hammond, 2017)

	Limited use of scarce (geo)physical resources		(ACOLA, 2017); (UNEP 2017a); (UNEP 2017b) (Newman et al., 2017)		(Scott et al., 2015) (IPCC, 2005) (de Coninck and Benson, 2014) (on storage capacity, otherwise no issues)		(NEA, 2016) (Bruckner et al., 2014)
	Global spread		(ACOLA, 2017); (UNEP 2017a); (UNEP 2017b)		(IPCC, 2005) (de Coninck and Benson, 2014)		(IAEA, 2017)

4.SM.4.2.2 Feasibility assessment of mitigation options in land & ecosystem transitions

Table 4.SM.9: Feasibility assessment of the land and ecosystem transition mitigation options: Reduced food wastage and efficient food production; Dietary shifts; Sustainable intensification of agriculture; and Ecosystems restoration. For methodology, see 4.SM.4.1.

		Reduced food wastage and efficient food production		Dietary shifts		Sustainable intensification of agriculture		Ecosystems restoration	
	Evidence	Robust		Medium		Medium		Medium	
	Agreement	High		High		High		High	
Economic	Cost-effectiveness		(FAO, 2013a; Thyberg and Tonjes, 2016; Hebrok and Boks, 2017)	LE	(FAO, 2013b)	LE	(Havlik et al., 2014)		(Griscom et al., 2017; Phan et al., 2017) AD - (Kindermann et al., 2008) (Overmars et al., 2014)(Dang Phan et al., 2014) REDD+ (Rakatama et al., 2017) (Ickowitz et al., 2017)
	Absence of distributional effects		(Porpino et al., 2015; Thyberg and Tonjes, 2016; Alexander et al., 2017; Hebrok and Boks, 2017)	LE	(Żukiewicz-Sobczak et al., 2014)	LE	(Smith et al., 2017a)		Biofuels certification (German and Schoneveld, 2012) (Caplow et al., 2011) REDD+ tenure (Sunderlin et al., 2014)(Poudyal et al., 2016) (Howson and Kindon, 2015) AD - Food sec (Erb et al., 2016) (Atela et al., 2014)
	Employment & productivity enhancement potential		(Thyberg and Tonjes, 2016; Alexander et al., 2017; Popp et al., 2017) (Shepon et al., 2016)		(Haggblade et al., 2015; Tschirley et al., 2015; Berti and Mulligan, 2016; Blay-Palmer et al., 2016; Alexander et al., 2017;		(Foley et al., 2011; Harvey et al., 2014; Clark and Tilman, 2017; Griscom et al., 2017)		Wetlands - (Brander et al., 2013) Forest carbon (Neimark et al., 2016) Yields, income and capital (Fenger et al., 2017; Jena et

					Clark and Tilman, 2017)(Shepon et al., 2016)				al., 2017) but are not uncontested (Blackman and Rivera, 2011; Hidayat et al., 2015; Oya et al., 2017).
Technological	Technical scalability		(Högy et al., 2009; DaMatta et al., 2010; Lin et al., 2013; Challinor et al., 2014; Papargyropoulou et al., 2014; De Souza et al., 2015; Hebrok and Boks, 2017)		(Hallström et al., 2015; Alexander et al., 2017; Clark and Tilman, 2017)		(Harvey et al., 2014; Clark and Tilman, 2017; Griscom et al., 2017; Waldron et al., 2017; Ramankutty et al., 2018) (Pretty and Bharucha, 2014; Petersen and Snapp, 2015; Adhikari et al., 2018a)		(Smith et al., 2014b) – Table 11.2; (Houghton et al., 2015; Griscom et al., 2017; Houghton and Nassikas, 2018)
	Maturity	NE		NE		LE	(Pretty and Bharucha, 2014; Petersen and Snapp, 2015)		(McLaren, 2012; Smith et al., 2012a; Goetz et al., 2015)
	Simplicity	NE		NE		NE			Ecosystem restoration – (Smith et al., 2014b; Erb et al., 2017; Griscom et al., 2017)
	Absence of risk		(Lin et al., 2013; Papargyropoulou et al., 2014; Hebrok and Boks, 2017)		(Hallström et al., 2015; Alexander et al., 2017; Clark and Tilman, 2017; Röös et al., 2017)		(Harvey et al., 2014; Clark and Tilman, 2017; Griscom et al., 2017; Waldron et al., 2017; Ramankutty et al., 2018; Sparovek et al., 2018) (Adhikari et al., 2018a)		(Smith et al., 2014b) Table 11.9 *No major breakthroughs since AR5
Institutional	Political acceptability		(Refsgaard and Magnussen, 2009; Lin et al., 2013; Thornton and Herrero, 2014; Jones et al., 2016b; Thyberg and Tonjes, 2016; Singh et al., 2017; White et al., 2017a)	NE			(Smith and Gregory, 2013; Harvey et al., 2014; Sparovek et al., 2018) (Godfray and Garnett, 2014)		Legitimacy (Nantongo, 2017) REDD+ (Cronin et al., 2016) (Di Gregorio et al., 2017a)

	Legal & administrative acceptability	NE		NE			(Smith and Gregory, 2013; Harvey et al., 2014)		(Creutzig et al., 2013; Sunderlin et al., 2014)
	Institutional capacity		(Refsgaard and Magnussen, 2009; Thornton and Herrero, 2014; Briley et al., 2015; Jones et al., 2016b; Thyberg and Tonjes, 2016; Singh et al., 2017; White et al., 2017a)	NE			(Smith and Gregory, 2013; Harvey et al., 2014; Sparovek et al., 2018) (Lu et al., 2015; Petersen and Snapp, 2015; Mungai et al., 2016; Adhikari et al., 2018a)		(Unruh, 2011; Marion Suiseeya and Caplow, 2013) (Wylie et al., 2016)
	Transparency & accountability potential		(Briley et al., 2015; Jones et al., 2016b; Thyberg and Tonjes, 2016; Singh et al., 2017; White et al., 2017a)	NE		NE			(Neimark et al., 2016) (Strassburg et al., 2014)
Socio-cultural	Social co-benefits (health, education)		(Lin et al., 2013; Tilman and Clark, 2014; Wellesley et al., 2015; Thyberg and Tonjes, 2016; Hebrok and Boks, 2017; Popp et al., 2017)		(Alexander et al., 2016, 2017; Stoll-Kleemann and Schmidt, 2017; Ritchie et al., 2018)		(Smith and Gregory, 2013; Harvey et al., 2014; Ramankutty et al., 2018; Sparovek et al., 2018) (Pretty et al., 2011; Jones et al., 2012; Falconnier et al., 2018)		(Caplow et al., 2011; Spencer et al., 2017)
	Public acceptance		(Lin et al., 2013; Popp et al., 2017)		(Alexander et al., 2016, 2017; Stoll-Kleemann and Schmidt, 2017)		(Smith and Gregory, 2013; Harvey et al., 2014; Ramankutty et al., 2018; Sparovek et al., 2018) (Godfray and Garnett, 2014; Adhikari et al., 2018a)		AR, (Braun et al., 2017) Wetlands – (Scholte et al., 2016) Ecosystem services –(Lin et al., 2012; Kragt et al., 2016; Thompson et al., 2016)
	Social & regional inclusiveness		(Lin et al., 2013; Tilman and Clark, 2014; Hebrok and Boks, 2017; Popp et al., 2017)		(Khoury et al., 2014; Tilman and Clark, 2014; Alexander et al., 2016, 2017; Stoll-Kleemann and Schmidt, 2017; Ritchie et al., 2018)		(Smith and Gregory, 2013; Harvey et al., 2014; Ramankutty et al., 2018; Sparovek et al., 2018) (Pretty et al., 2011; Franke et al., 2014; Petersen and Snapp, 2015)(Pretty and		(Lyons and Westoby, 2014) (Ribot and Larson, 2012; Jagger et al., 2014; Brimont et al., 2015; Howson and Kindon, 2015)

							Bharucha, 2014; Struik and Kuyper, 2017)		
	Intergenerational equity	NE		LE	(Bajželj et al., 2014)	NE			(Unruh, 2011) (Pascuala et al., 2010) *No major breakthroughs since AR5
	Human capabilities		(Tilman and Clark, 2014; Thyberg and Tonjes, 2016; Hebrok and Boks, 2017)		(Tilman and Clark, 2014; Ritchie et al., 2018)	LE	(Pretty and Bharucha, 2014; Mungai et al., 2016)(Baltenweck et al., 2003)	LE	Social and human assets (Smith et al., 2014b) Table 11.5 *No major breakthroughs since AR5
Environmental/ ecological	Reduction of air pollution	LE	(Thyberg and Tonjes, 2016)		(Tilman and Clark, 2014; Hallström et al., 2015; Ritchie et al., 2018)	NE		NE	
	Reduction of toxic waste	NE		NE			(Pretty and Bharucha, 2014; Ramankutty et al., 2018) (Stevens and Quinton, 2009; Soussana and Lemaire, 2014; Lu et al., 2015) (Tilman et al., 2011a)	NE	
	Reduction of water use		(Bajželj et al., 2014; West et al., 2014; Westhoek et al., 2014)(Thyberg and Tonjes, 2016)		(Bajželj et al., 2014; West et al., 2014; Westhoek et al., 2014)	LE	(Pretty and Bharucha, 2014)		(van Noordwijk et al., 2016) AD - (Ellison et al., 2017) (Devaraju, Bala, & Modak, 2015) (Brander et al., 2013)
	Improved biodiversity		(Ramankutty et al., 2018)(Johnson et al., 2014a)		(Tilman and Clark, 2014; Hallström et al., 2015) (Ramankutty et al., 2018)(Clark and Tilman, 2017)		(Pretty and Bharucha, 2014; Waldron et al., 2017)		AD- (Jantz et al., 2014; Jantke et al., 2016) ES – pollination Kaiser Bunbury 2017; (Rey Benayas et al., 2009; Bullock et al., 2011; Veldman et al., 2015)
Geophysical	Physical feasibility (physical potentials)		(Cherubin et al., 2015; Ivy et al., 2017)	NE		NE			(Erb et al., 2017; Griscom et al., 2017) AD - (Canadell and Schulze, 2014; Erb et al., 2016)

				LE					Ecosystem restoration secondary forests – (Houghton et al., 2015; Houghton and Nassikas, 2018) REDD+ (Strassburg et al., 2014) Increased risk from climate change – (Canadell et al 2008)
	Limited use of land		(Ramankutty et al., 2018; Sparovek et al., 2018) (Thyberg and Tonjes, 2016)	LE	(Benton et al., 2018) (Ramankutty et al., 2018) (Shepon et al., 2016)		(Harvey et al., 2014; Clark and Tilman, 2017)		(Humpenöder et al., 2015) REDD+ (Strassburg et al., 2014) AD - restricts land onto which agriculture, grazing and bioenergy plantations can be deployed, which may lead to GHG emissions, increase food prices (Kreidenweis et al., 2016) (Erb et al., 2016)
	Limited use of scarce (geo)physical resources	NE		NE			(Foley et al., 2011)	NE	
	Global spread	LE	(Thyberg and Tonjes, 2016)	NE		LE	(Petersen and Snapp, 2015; Mungai et al., 2016) (Havlik et al., 2014) (Tilman et al., 2011b)		REDD+ (Strassburg et al., 2014); (Erb et al., 2017)

4.SM.4.2.3 Feasibility assessment of mitigation options in urban & infrastructure system transitions

Table 4.SM.10: Feasibility assessment of urban and infrastructure system transition mitigation options: Land-use & urban planning; Electric cars and buses; and Sharing schemes. For methodology, see 4.SM.4.1

		Land-use & urban planning		Electric cars and buses		Sharing schemes	
	Evidence	Robust		Medium		Limited	
	Agreement	Medium		High		Medium	
Economic	Cost-effectiveness		(Trubka et al., 2010); (Nahlika and Chester, 2014); (Lee and Erickson, 2017); (Sharma, 2018); (Ahlfeldt and Pietrostefani, 2017); (Ahlfeldt and Pietrostefani, 2017) ;		(Peterson and Micha lek, 2013); (IEA, 2017b)		(Ambrosino et al., 2016); (Cheyne and Imran, 2016); (Kent and Dowling, 2016)
	Absence of distributional effects		(Wiktorowicz et al., 2018); (Teferi and Newman, 2018); (Broekhoff et al., 2018); (Lwasa, 2017) (Colenbrander et al., 2015)		(Glazebrook and Newman, 2018); (Sivak and Schoettle, 2018)		(Gomez et al., 2015); (Ambrosino et al., 2016); (Kent and Dowling, 2016)
	Employment & productivity enhancement potential		(Han et al., 2018); (Ambrosino et al., 2016); (Ambrosino et al., 2016) ; (Gao and Newman, 2018); (Ahlfeldt and Pietrostefani, 2017) ; (Broto, 2017)		(Whitelegg, 2016); (IEA, 2017b)		((Cheyne and Imran, 2016) ; (Sweet, 2014)
Technological	Technical scalability		(Zhang et al., 2018a) (Sharma, 2018) (Broekhoff et al., 2018)		(Brown et al., 2010) (IEA, 2017b)		(Reis et al., 2016); (Ambrosino et al., 2016); (Broch et al., 2013); (Kent and Dowling, 2016)
	Maturity		(Newman et al., 2017); (Parnell, 2015)		(Whitelegg, 2016); (IEA, 2017b)		(Kent and Dowling, 2016); (Le Vine et al., 2014) ;
	Simplicity		(Newman et al., 2017); (Lilford et al., 2017) ;		(Glazebrook and Newman, 2018); (IEA, 2017b)		(Ambrosino et al., 2016); (Giuliano and Hanson, 2017)
	Absence of risk	LE	(Newman et al., 2017)		(Whitelegg, 2016); (IEA, 2017b)		(Ambrosino et al., 2016); (Kent and Dowling, 2016)
Instit ution al	Political acceptability		(Grandin et al., 2018) ; (Broekhoff et al., 2018)		(Bakker and Trip, 2013) ; (IEA, 2017b)		(Ambrosino et al., 2016) ; (Le Vine et al., 2014)

	Legal & administrative acceptability		(Grandin et al., 2018) ; (Broekhoff et al., 2018)		(Wirasingha et al., 2008) ; (IEA, 2017b)		(Le Vine et al., 2014) ; (Cannon and Summers, 2014)
	Institutional capacity		(Chau et al., 2018) ; (Geneletti et al., 2017)		(Wirasingha et al., 2008) ; (IEA, 2017b)		(Kent and Dowling, 2016); (Glazebrook and Newman, 2018)
	Transparency & accountability potential		(Moglia et al., 2018)		(Wirasingha et al., 2008); (IEA, 2017b)		(Newman et al., 2017) ; (Glazebrook and Newman, 2018)
Socio-cultural	Social co-benefits (health, education)		(Su et al., 2016); (Nahlika and Chester, 2014); (Chava et al., 2018a); (Chava et al., 2018b); (Chava and Newman, 2016); (Jillella et al., 2015)		(IEA, 2017b); (Newman et al., 2017)		(Rojas-Rueda et al., 2012); (Kent and Dowling, 2016); (Cheyne and Imran, 2016); (de Groot and Steg, 2007)
	Public acceptance		(Moglia et al., 2018) ; (Chava et al., 2018a); (Chava et al., 2018b); (Chava and Newman, 2016); (Jillella et al., 2015)		(Zhang et al., 2011) ; (Bockarjova and Steg, 2014) ; (Liao et al., 2017)		(Reis et al., 2016) ; (Ambrosino et al., 2016) ; (Le Vine et al., 2014) ; (Kent and Dowling, 2016) ; (de Groot and Steg, 2007)
	Social & regional inclusiveness		(Endo et al., 2017) ; (Teferi and Newman, 2018); (Broekhoff et al., 2018); (Chava et al., 2018a) ; (Chava et al., 2018b); (Chava and Newman, 2016) ; (Jillella et al., 2015); (Lwasa, 2017); (Colenbrander et al., 2017)	LE	(Newman et al., 2017)		(Kent and Dowling, 2016); (Cheyne and Imran, 2016)
	Intergenerational equity	LE	(Newman et al., 2017)		(Newman et al., 2017) ; (Kenworthy and Schiller, 2018)		(Le Vine et al., 2014); (Cheyne and Imran, 2016) ; (Glazebrook and Newman, 2018)
	Human capabilities		(Moglia et al., 2018)		(Newman et al., 2017); (Wirasingha et al., 2008)		(Reis et al., 2016) ; (Newman et al., 2017)
Environmental/ecological	Reduction of air pollution		(Zhang et al., 2018a) ; (Zubelzu et al., 2015) ; (Thomson and Newman, 2018) ; (Glazebrook and Newman, 2018); (Sharma, 2018)		(Sioshansi and Denholm, 2009) ; (Kenworthy and Schiller, 2018)		(Le Vine et al., 2014) ; (Nijland and van Meerkerk, 2017) ; (Newman and Kenworthy, 2015) ; (Glazebrook and Newman, 2018)
	Reduction of toxic waste	LE	(Thomson and Newman, 2018)	LE	(Hawkins et al., 2013)		(Newman et al., 2017) ; (Newman and Kenworthy, 2015) ; (Glazebrook and Newman, 2018)

	Reduction of water use		(Serrao-Neumann et al., 2017)	LE	(Glazebrook and Newman, 2018)		(Stephan and Crawford, 2016) (Newman et al., 2017)
	Improved biodiversity		(Huang et al., 2018)	LE	(Glazebrook and Newman, 2018)		(Newman et al., 2017) ; (Newman and Kenworthy, 2015) ; (Glazebrook and Newman, 2018)
Geophysical	Physical feasibility (physical potentials)		(Hsieh et al., 2017) ; (Wiktorowicz et al., 2018)		(Glazebrook and Newman, 2018) ; (Kenworthy and Schiller, 2018)		(Kent and Dowling, 2016) ; (Newman et al., 2017)
	Limited use of land		(Hsieh et al., 2017)		(Glazebrook and Newman, 2018); (Kenworthy and Schiller, 2018)		(Hamilton and Wichman, 2018) ; (Kent and Dowling, 2016) ; (Newman et al., 2017)
	Limited use of scarce (geo)physical resources	LE	(Thomson and Newman, 2018)		(Newman et al., 2017) ; (Kenworthy and Schiller, 2018)		(Newman et al., 2017) ; (Newman and Kenworthy, 2015) ; (Glazebrook and Newman, 2018)
	Global spread		(Pacheco-Torres et al., 2017) ; (Glazebrook and Newman, 2018)		(Newman et al., 2017); (Dhar et al., 2017); (Dhar et al., 2018)		(Kent and Dowling, 2016); (Le Vine et al., 2014)

Table 4.SM.11: Feasibility assessment of urban and infrastructure system transition mitigation options: Public transport; Non-motorised transport; and Aviation & shipping. For methodology, see 4.SM.4.1

		Public transport		Non-motorised transport		Aviation & shipping	
	Evidence	Robust		Robust		Medium	
	Agreement	Medium		High		Medium	
Economic	Cost-effectiveness		(Nahlika and Chester, 2014; Bouf and Faivre D'arcier, 2015; Lee and Erickson, 2017; Lin and Du, 2017; Glazebrook and Newman, 2018; Kenworthy and Schiller, 2018)		(Deenihan and Caulfield, 2014; Gössling and Choi, 2015; MacDonald Gibson et al., 2015; Brown et al., 2016b; Matan and Newman, 2016; Rajé and Saffrey, 2016; Litman, 2017, 2018)		(Corbett et al., 2009; Dessens et al., 2014; Cames et al., 2015b, 2015a)
	Absence of distributional effects		(Kenworthy and Schiller, 2018; Linovski et al., 2018; Yangka and Newman, 2018)		(Jensen et al., 2017); (Litman, 2018); (Lohmann and Gasparini, 2017); (Newman and Kenworthy, 2015); (Matan and Newman, 2016)	LE	(Cames et al., 2015a)
	Employment & productivity enhancement potential		(Hazledine et al., 2017; Gao and Newman, 2018; Kenworthy and Schiller, 2018)		(Rohani and Lawrence, 2017); (Litman, 2017); (Litman, 2018); (Matan and Newman, 2016)		(Cames et al., 2015a; Gencsü and Hino, 2015)
Technological	Technical scalability		(Kenworthy and Schiller, 2018; Yangka and Newman, 2018; Zhang et al., 2018a)		(Newman and Kenworthy, 2015; Matan and Newman, 2016; Reis et al., 2016; Stevenson et al., 2016)		(Dessens et al., 2014; Gencsü and Hino, 2015)
	Maturity		(Kenworthy and Schiller, 2018); (Newman et al., 2017)		(Newman et al., 2015; Matan and Newman, 2016; Stevenson et al., 2016; Jensen et al., 2017; Newman et al., 2017)		(Corbett et al., 2009; Cames et al., 2015b)
	Simplicity		(Kenworthy and Schiller, 2018); (Newman et al., 2017)		(Matan and Newman, 2016; Rajé and Saffrey, 2016; Stevenson et al., 2016; Litman, 2017, 2018)	LE	(Dessens et al., 2014)
	Absence of risk		(Kenworthy and Schiller, 2018); (Mohamed et al., 2017)		(Stevenson et al., 2016); (Lohmann and Gasparini, 2017); (Matan and Newman, 2016)	LE	(Dessens et al., 2014)

Institutional	Political acceptability		(Wijaya et al., 2017); (Yangka and Newman, 2018); (Sharma, 2018), (Gao and Newman, 2018); (Glazebrook and Newman, 2018); (Kenworthy and Schiller, 2018) (Mohamed et al., 2017)		(Giles-Corti et al., 2016); (Jensen et al., 2017); (Litman, 2017); (Litman, 2018); (McCosker et al., 2018); (Matan and Newman, 2016); (Newman and Kenworthy, 2015)		(Zhang, 2016); (Shi, 2016). (Smale et al., 2012); (Bows-Larkin, 2015); (Sikorska, 2015).
	Legal & administrative acceptability		(Kenworthy and Schiller, 2018); (Yangka and Newman, 2018)		(Litman, 2018); (Lohmann and Gasparini, 2017)		(Zhang, 2016); (Shi, 2016). (Smale et al., 2012); (Bows-Larkin, 2015); (Sikorska, 2015).
	Institutional capacity		(Sharma, 2018); (Newman et al., 2017) (Kenworthy and Schiller, 2018)		(Reis et al., 2016); (Litman, 2018)		(Zhang, 2016); (Shi, 2016). (Smale et al., 2012); (Bows-Larkin, 2015); (Sikorska, 2015).
	Transparency & accountability potential	LE	(Bouf and Faivre D'arcier, 2015); (Kenworthy and Schiller, 2018)		(Lah, 2017); (Matan and Newman, 2016); (Newman and Kenworthy, 2015)		(Zhang, 2016); (Shi, 2016). (Smale et al., 2012); (Bows-Larkin, 2015); (Sikorska, 2015)
Socio-cultural	Social co-benefits (health, education)		(Steg, 2003; Gatersleben and Uzzell, 2007; Nahlika and Chester, 2014; Lin and Du, 2017; Yangka and Newman, 2018);		(Maibach et al., 2009; Woodcock et al., 2009; Deenihan and Caulfield, 2014; Gilderbloom et al., 2015; MacDonald Gibson et al., 2015; Mansfield and Gibson, 2015; Matan et al., 2015; Brown et al., 2016b; Giles-Corti et al., 2016; Matan and Newman, 2016; Rajé and Saffrey, 2016; Stevenson et al., 2016; Jensen et al., 2017; Lah, 2017; Lohmann and Gasparini, 2017; Maizlish et al., 2017; Litman, 2018)	LE	(EEA, 2017)
	Public acceptance		(Steg, 2003; Wijaya et al., 2017)		(Jensen et al., 2017); (Lohmann and Gasparini, 2017); (Matan and Newman, 2016); (Newman et al., 2017); (Gatersleben and Uzzell, 2007)		(EEA, 2017); (Bows-Larkin, 2015); (Sikorska, 2015)

	Social & regional inclusiveness		(Nahlika and Chester, 2014); (Yangka and Newman, 2018)		(Stevenson et al., 2016); (Gilderbloom et al., 2015); (Jensen et al., 2017)	LE	(EEA, 2017)
	Intergenerational equity		(Kenworthy and Schiller, 2018); (Yangka and Newman, 2018); (Newman et al., 2017)		(Litman, 2018); (Rajé and Saffrey, 2016)	LE	(Gencsü and Hino, 2015)
	Human capabilities		(Kenworthy and Schiller, 2018); (Newman et al., 2017)		(Reis et al., 2016); (Newman et al., 2017)		European Environment Agency. (2017); (Bows-Larkin, 2015); (Sikorska, 2015)
Environmental/ecological	Reduction of air pollution		(Zhang et al., 2018a); (Glazebrook and Newman, 2018); (Yangka and Newman, 2018); (Kenworthy and Schiller, 2018)		(Stevenson et al., 2016); (Maizlish et al., 2017); (Woodcock et al., 2009)		(EEA, 2017); (Bouman et al., 2017); (Cames et al., 2015a) (Dessens et al., 2014)
	Reduction of toxic waste	LE	(Newman et al., 2017)	LE	(Newman et al., 2017)		(EEA, 2017); (Maragkogianni et al., 2016)
	Reduction of water use	LE	(Newman et al., 2017)	LE	(Newman et al., 2017)		(EEA, 2017); (Maragkogianni et al., 2016)
	Improved biodiversity		(Newman et al., 2017; Kenworthy and Schiller, 2018)	LE	(Newman et al., 2017)		(EEA, 2017); (Maragkogianni et al., 2016)
Geophysical	Physical feasibility (physical potentials)		(Kenworthy and Schiller, 2018; Yangka and Newman, 2018)		(Lah, 2017); (Panter et al., 2016)		(EEA, 2017); (Bows-Larkin, 2015); (Sikorska, 2015)
	Limited use of land		(Ahmad et al., 2016; Kenworthy and Schiller, 2018)		(Stevenson et al., 2016); (McCormack and Shiell, 2011); (Litman, 2017); (Ye et al., 2018); (Newman et al., 2017)	LE	(EEA, 2017)
	Limited use of scarce (geo)physical resources		(Lin and Du, 2017; Kenworthy and Schiller, 2018)		(Newman et al., 2017; Ye et al., 2018)		(de Jong et al., 2017; EEA, 2017)
	Global spread		(Bouf and Faivre D'arcier, 2015; Glazebrook and Newman, 2018; Kenworthy and Schiller, 2018)		(Stevenson et al., 2016; Litman, 2017; Lohmann and Gasparini, 2017)		(Maragkogianni et al., 2016; EEA, 2017)

Table 4.SM.12: Feasibility assessment of urban and infrastructure system transition mitigation options: Smart grids; Efficient appliances; and Low/zero-energy buildings. For methodology, see 4.SM.4.1

		Smart grids		Efficient appliances		Low/zero-energy buildings	
	Evidence	Medium		Medium		Medium	
	Agreement	Medium		High		High	
Economic	Cost-effectiveness		(Crispim et al., 2014; Hall and Foxon, 2014; Marques et al., 2014; Muench et al., 2014; Foxon et al., 2015; Bigerna et al., 2016; Ramos et al., 2016; Schachter and Mancarella, 2016)		(McNeil and Bojda, 2012; Garg et al., 2017; Gerke et al., 2017)		(Neroutsou and Croxford, 2016; Balaban and Puppim de Oliveira, 2017; Ballarini et al., 2017; Stocker and Koch, 2017; Carlson and Pressnail, 2018)
	Absence of distributional effects		(Green and Newman, 2017), (Wiktorowicz et al., 2018) (Neureiter, 2017)		(Rao, 2013; Rao et al., 2016; McInnes, 2017; Rao and Ummel, 2017)		(Figus et al., 2017); (McInnes, 2017)
	Employment & productivity enhancement potential		(Naus et al., 2014); (Foxon et al., 2015); (Shomali and Pinkse, 2016).		(Ryan and Campbell, 2012; Cambridge Econometrics, 2015; Garrett-Peltier, 2017; Hartwig et al., 2017)		(Scott et al., 2008; Ryan and Campbell, 2012; Urge-Vorsatz et al., 2012; Mirasgedis et al., 2014; Cambridge Econometrics, 2015; Hartwig et al., 2017; Krarti and Dubey, 2018)
Technological	Technical scalability		(Crispim et al., 2014); (Zheng et al., 2014); (Connor et al., 2014); (Ramos et al., 2016); (Derakhshan et al., 2016).		(Roland and Wood, 2009); (Parikh and Parikh, 2016); (Rao et al., 2016); (Rao and Ummel, 2017); (Salleh et al., 2018)		(Hartwig et al., 2017); (Krarti et al., 2017)
	Maturity		(Crispim et al., 2014); (Clerici et al., 2015); (Abi Ghanem and Mander, 2014); (Zheng et al., 2014); (Ramos et al., 2016); (Otuoze et al., 2018); (Derakhshan et al., 2016).		(Zogg et al., 2009); (Diczfalusy and Taylor, 2011); (Rao and Ummel, 2017); (Rao et al., 2016)		(González et al., 2017); (Diczfalusy and Taylor, 2011); (Jain et al., 2017b)

	Simplicity		(Crispim et al., 2014); (Clerici et al., 2015); (Abi Ghanem and Mander, 2014); (Zheng et al., 2014); (Ramos et al., 2016); (Otuoze et al., 2018); (Derakhshan et al., 2016); (Giannantoni, 2014).		(Reyna and Chester, 2017)	LE	(Salvalai et al., 2017)
	Absence of risk		(Naus et al., 2014); (Crispim et al., 2014); (Clerici et al., 2015); (Ramos et al., 2016); (Bigerna et al., 2016); (Otuoze et al., 2018);	NE		NE	
Institutional	Political acceptability		(Naus et al., 2014); (Crispim et al., 2014); (Meadowcroft et al., 2018); (Shomali and Pinkse, 2016); (Marques et al., 2014); (Hall and Foxon, 2014); (Vesnic-Alujevic et al., 2016); (Bulkeley et al., 2016).		(Pereira and da Silva, 2017); (Ringel, 2017)		(Pereira and da Silva, 2017); (Ringel, 2017)
	Legal & administrative acceptability		(Crispim et al., 2014); (Bigerna et al., 2016); (Marques et al., 2014); (Foxon et al., 2015);		(Pereira and da Silva, 2017)		(Pereira and da Silva, 2017); (Chandel et al., 2016); (Jain et al. 2017)
	Institutional capacity		(Crispim et al., 2014); (Clerici et al., 2015); (Ramos et al., 2016); (Otuoze et al., 2018); (Meadowcroft et al., 2018); (Marques et al., 2014); (Muench et al., 2014). (Foxon et al., 2015);		(Pereira and da Silva, 2017); (Shah et al., 2015)		(Pereira and da Silva, 2017); (Yu et al., 2017)
	Transparency & accountability potential		(Naus et al., 2014); (Bigerna et al., 2016); (Otuoze et al., 2018); (Naus et al., 2014); (Hall and Foxon, 2014); (Hansen and Hauge, 2017).	LE	(Gentile et al., 2015);	LE	(Meyers and Kromer, 2008)
Socio -	Social co-benefits (health, education)		(Naus et al., 2014; Foxon et al., 2015; Shomali and Pinkse, 2016;		(Payne et al., 2015);		(Payne et al., 2015); (Ryan and Campbell, 2012);

			Hansen and Hauge, 2017; Meadowcroft et al., 2018; Otuoze et al., 2018);		(Ryan and Campbell, 2012)		(Balaban and Puppim de Oliveira, 2017); (Xiong et al., 2015)
	Public acceptance		(Hall and Foxon, 2014; Naus et al., 2014; Bigerna et al., 2016; Hansen and Hauge, 2017) (Green and Newman, 2017)		(Jain et al., 2018); (Swim et al., 2014); (Winward et al., 1998); (Boardman, 2004); (Reyna and Chester, 2017)	NE	
	Social & regional inclusiveness		(Wiktorowicz et al., 2018); (Green and Newman, 2017); (Neureiter, 2017)		(Rao and Pachauri, 2017); (Rao et al., 2016); (Rao and Ummel, 2017)	NE	
	Intergenerational equity		(Schlör et al., 2015); (Green and Newman, 2017)	NA	energy efficiency saves natural resources and therefore it is fair for future generations	NA	N/A energy efficiency saves natural resources and therefore it is fair for future generations
	Human capabilities		(Naus et al., 2014; Hansen and Hauge, 2017)	NA		NE	
Environmental/ecological	Reduction of air pollution		(Clerici et al., 2015); (Newman et al., 2017)		(Zhou et al., 2018); (Ryan and Campbell, 2012)		(Zhou et al., 2018); (Ryan and Campbell, 2012); (Balaban and Puppim de Oliveira, 2017); (Xiong et al., 2015)
	Reduction of toxic waste		(Newman et al., 2017); (Foxon et al., 2015);		(Ryan and Campbell, 2012)		(Ryan and Campbell, 2012)
	Reduction of water use		(Newman et al., 2017); (Wiktorowicz et al., 2018)		(Zhou et al., 2018)		(Loiola et al., 2018)
	Improved biodiversity		(Newman et al., 2017); (Wiktorowicz et al., 2018)	NA		NA	
Geop hysic	Physical feasibility (physical potentials)		(Foxon et al., 2015);		(Heidari et al., 2018);		(Laitner, 2013)

			(Wiktorowicz et al., 2018); (Green and Newman, 2017)		(Laitner, 2013)		
	Limited use of land	NA		NA	N/A energy efficient appliances do not take up more land than inefficient appliances	NA	Existing buildings refurbishment do not use additional land New buildings use more land if not rebuilt over demolished buildings
	Limited use of scarce (geo)physical resources		(Newman et al., 2017); (Wiktorowicz et al., 2018)	LE	(Needhidasan et al., 2014) possible that upgrades lead to landfill contamination	NA	N/A limited impact and limited use of scarce resources
	Global spread		(Crispim et al., 2014; Foxon et al., 2015; Ramos et al., 2016)	NA	N/A efficient appliances available everywhere where access to electricity or energy is available	NA	

4.SM.4.2.4 Feasibility assessment of mitigation options in industrial system transitions

Table 4.SM.13: Feasibility assessment of industrial system transition mitigation options: Energy efficiency; Bio-based & circularity; Electrification & hydrogen; and Industrial CCUS. For methodology, see 4.SM.4.1.

		Energy efficiency		Bio-based & circularity		Electrification & hydrogen		Industrial CCUS	
	Evidence	Robust		Medium		Medium		Robust	
	Agreement	High		Medium		High		High	
Economic	Cost-effectiveness		(Hasanbeigi et al., 2014; Napp et al., 2014; Forman et al., 2016; Wesseling et al., 2017)		(Taibi et al., 2012; Ali et al., 2017; Wesseling et al., 2017)		(Åhman et al., 2016; Philibert, 2017; Wesseling et al., 2017; Bataille et al., 2018)		(Mikunda et al., 2014)(Rubin et al., 2015)(Irlam, 2017)
	Absence of distributional effects	LE	(Zha and Ding, 2015)	NE		LE	(Nabernegg et al., 2017)	NE	
	Employment & productivity enhancement potential		(He et al., 2013; Zhang et al., 2015; Henriques and Catarino, 2016; Färe et al., 2018)		(Nabernegg et al., 2017)(Fuentes-Saguar et al., 2017)	LE	(Nabernegg et al., 2017)		(Koelbl et al., 2016)
Technological	Technical scalability		(Fischedick et al., 2014; Bataille et al., 2018)		(de Besi and McCormick, 2015; Wesseling et al., 2017)		(Fischedick et al., 2014; Bataille et al., 2018)(Wang et al., 2017b)		(Boot-Handford et al., 2014; Global CCS Institute, 2017; Bui et al., 2018)
	Maturity		(Hasanbeigi et al., 2014; Napp et al., 2014; Forman et al., 2016; Wesseling et al., 2017)		(Quader et al., 2016)(Wesseling et al., 2017)		(Quader et al., 2016; Philibert, 2017)		(Boot-Handford et al., 2014; Mikunda et al., 2014; Abanades et al., 2015; Global CCS Institute, 2017; Bui et al., 2018)
	Simplicity		(Fernández-Viñé et al., 2010; Wakabayashi, 2013)		(Wesseling et al., 2017)(Henry et al., 2006)	NE			(IEA GHG, 2012)

	Absence of risk	NA		LE	(Ali et al., 2017)	NE			(IPCC, 2005) (de Coninck and Benson, 2014)(Boot-Handford et al., 2014)(Aminu et al., 2017)
Institutional	Political acceptability		(Zhang et al., 2015; Åhman et al., 2016; Henriques and Catarino, 2016)	LE	(Sleenhoff and Osseweijer, 2016)(Goetz et al., 2017)(Longstaff et al., 2015)		(Åhman et al., 2016; Philibert, 2017; Wesseling et al., 2017; Bataille et al., 2018)		(Mikunda et al., 2014) (Aminu et al., 2017)
	Legal & administrative acceptability		(Zhang et al., 2015; Åhman et al., 2016; Henriques and Catarino, 2016)		(Wesseling et al., 2017)	NE			(de Coninck and Benson, 2014; Dixon et al., 2015; Bui et al., 2018)
	Institutional capacity		(Fernández-Viñé et al., 2010; Wakabayashi, 2013; Henriques and Catarino, 2016)		(Lewandowski, 2016) (Henry et al., 2006)	NE			(Boot-Handford et al., 2014; de Coninck and Benson, 2014; Dixon et al., 2015; Bui et al., 2018)
	Transparency & accountability potential	NA		LE	(Schulze et al., 2012; Harris et al., 2015; Lewandowski, 2015; Repo et al., 2015; DeCicco et al., 2016; Qin et al., 2016)	NA		NE	
Socio-cultural	Social co-benefits (health, education)	NA		NE		NA		NA	
	Public acceptance		(Fischedick et al., 2014)		(Khanal et al., 2010; Delshad and Raymond, 2013; Pfau et al., 2014; Dragojlovic and Einsiedel, 2015; Lewandowski, 2015; Sleenhoff and Osseweijer, 2016; Moula et al., 2017)	LE	(Åhman et al., 2016; Wesseling et al., 2017)		(Wallquist et al., 2012; Seigo et al., 2014; Ashworth et al., 2015) (Aminu et al., 2017)

	Social & regional inclusiveness	NA			(Creutzig et al., 2013, 2015; Robledo-Abad et al., 2017)(Knoblauch et al., 2014; Porter et al., 2015)	NA		NE	
	Intergenerational equity	NA		NE		NA		NE	
	Human capabilities		(Cagno et al., 2013; Brunke et al., 2014; Wesseling et al., 2017)	LE	(Henry et al., 2006)	NE		LE	(IEA GHG, 2012)
Environmental/ ecological	Reduction of air pollution		(Brunke et al., 2014; Rasmussen, 2017; Zhang et al., 2018b)	NE		NE			(IPCC, 2005) (Koornneef et al., 2012a)
	Reduction of toxic waste	NE		NE		NE		NE	
	Reduction of water use		(Gu et al., 2014)(Kubule et al., 2016)(Walker et al., 2013)	NE		NE			(Hylkema and Rand, 2014) (Koornneef et al., 2012a)
	Improved biodiversity	NE		NE		NE		LE	(Koornneef et al., 2012a)
Geophysical	Physical feasibility (physical potentials)		(Napp et al., 2014; Åhman et al., 2016; Wesseling et al., 2017)		(Slade et al., 2014) (Beringer et al., 2011; Klein et al., 2014; Creutzig et al., 2015; Kraxner and Nordström, 2015; Searle and Malins, 2015; Smith et al., 2016; Boysen et al., 2017b; Tokimatsu et al., 2017; Heck et al., 2018)		(Philibert, 2017)		(IPCC, 2005; de Coninck and Benson, 2014; Scott et al., 2015)
	Limited use of land	NA			(Popp et al., 2014; Creutzig et al., 2015; Williamson, 2016;	NE		NE	

					Robledo-Abad et al., 2017) (Bonsch et al., 2016; Hammond and Li, 2016)(Henry et al., 2018)				
	Limited use of scarce (geo)physical resources		(Zhang et al., 2014a; Rasmussen, 2017)	NE		NE		NE	
	Global spread		(Worrell et al., 2008; Fischedick et al., 2014; Åhman et al., 2016; Bataille et al., 2018)		(Taibi et al., 2012)(Fischedick et al., 2014; Wesseling et al., 2017)		(Taibi et al., 2012) (Fischedick et al., 2014; Wesseling et al., 2017)		(Kuramochi et al., 2012; Mikunda et al., 2014; Bui et al., 2018)

4.SM.4.2.5 Feasibility assessment of carbon dioxide removal mitigation options

Table 4.SM.14: Feasibility assessment of carbon dioxide removal mitigation options: Bioenergy with carbon dioxide capture and storage (BECCS); and Direct air carbon dioxide capture and storage (DACCS). For methodology, see 4.SM.4.1.

		BECCS		DACCS	
	Evidence	Robust		Medium	
	Agreement	Medium		Medium	
Economic	Cost-effectiveness		Reviews - (McLaren, 2012; Caldecott et al., 2015; NRC, 2015) (Honegger and Reiner, 2018) (Luckow et al., 2010; Koornneef et al., 2012b; Arasto et al., 2014) Ethanol – (De Visser et al., 2011; Fabbri et al., 2011; Fornell et al., 2013; Johnson et al., 2014b; Rochedo et al., 2016) Combustion – (Kärki et al., 2013; Akgul et al., 2014; Al-Qayim et al., 2015; Onarheim et al., 2015; Sanchez and Callaway, 2016) (Fuss et al., 2018b) (Bhave et al. 2017)		(Keith et al., 2006; Pielke, 2009; House et al., 2011; Ranjan and Herzog, 2011; Simon et al., 2011; Holmes and Keith, 2012b; Zeman, 2014; Sanz-Pérez et al., 2016; Sinha et al., 2017)
	Absence of distributional effects		Bioenergy - (Creutzig et al., 2013, 2015; Hunsberger et al., 2014; Buck, 2016; Robledo-Abad et al., 2017) (Arndt et al., 2011b; German and Schoneveld, 2012; Creutzig et al., 2013; Hunsberger et al., 2014; Buck,	NA	

			2016; Robledo-Abad et al., 2017; Stevanović et al., 2017) (Popp et al., 2014; Persson, 2015; Kline et al., 2017; Searchinger et al., 2017)		
	Employment & productivity enhancement potential	NE		NA	
Technological	Technical scalability		(Azar et al., 2010, 2013; Gough and Upham, 2011) (Nemet et al., 2018)		(Lackner, 2009; Pielke, 2009; Lackner et al., 2012; Nemet and Brandt, 2012; Pritchard et al., 2015) (Nemet et al., 2018)
	Maturity		(McGlashan et al., 2012; McLaren, 2012; Kemper, 2015; Pang et al., 2017) (Boucher et al., 2014; Fuss et al., 2014; Anderson and Peters, 2016; Vaughan and Gough, 2016; Minx et al., 2017; Strefler et al., 2018c; Vaughan et al., 2018b) (Nemet et al., 2018)		(McLaren, 2012; Boot-Handford et al., 2014; NRC, 2015; Nemet et al., 2018) Demos – (Holmes et al., 2013; Rau et al., 2013; Agee et al., 2016) (Nemet et al., 2018)
	Simplicity		Niche markets – (Möllersten et al., 2003; Sanna et al., 2012)		Niche markets – (Lackner et al., 2012; Hou et al., 2017; Ishimoto et al., 2017)
	Absence of risk		(Boysen et al., 2017b) (Anderson and Peters, 2016; Vaughan and Gough, 2016) (IPCC, 2005) (de Coninck and Benson, 2014)(Boot-Handford et al., 2014)(Aminu et al., 2017)		(IPCC, 2005) (de Coninck and Benson, 2014)(Boot-Handford et al., 2014)(Aminu et al., 2017)
Institutional	Political acceptability		BECCS features rarely in policy debates (Fridahl, 2017) (Boysen et al., 2017a)	NE	

	Legal & administrative acceptability	LE	(Honegger and Reiner, 2018)(Kemper, 2015)		(Boot-Handford et al., 2014; de Coninck and Benson, 2014; Dixon et al., 2015)
	Institutional capacity		(McLaren, 2012) (Frank et al., 2013) (Burns and Nicholson, 2017) (Kemper, 2015)	NE	(McLaren, 2012)
	Transparency & accountability potential	LE	(McLaren, 2012; NRC, 2015; Nemet et al., 2018)	LE	(McGlashan et al., 2012; McLaren, 2012; Nemet et al., 2018)
Socio-cultural	Social co-benefits (health, education)		(Knoblauch et al., 2014; Porter et al., 2015; Weldu et al., 2017)	NA	
	Public acceptance		(Thornley et al., 2009; Gough and Upham, 2011; Wallquist et al., 2012; Mabon et al., 2013; Boot-Handford et al., 2014; Gough et al., 2014; Dowd et al., 2015; Lomax et al., 2015; Boysen et al., 2017b; Fridahl, 2017; Robledo-Abad et al., 2017)		(Lackner and Brennan, 2009; Mabon et al., 2013; Boot-Handford et al., 2014; Gough et al., 2014; Lomax et al., 2015)
	Social & regional inclusiveness	LE	(Creutzig et al., 2013, 2015; Robledo-Abad et al., 2017)	NE	
	Intergenerational equity	NE		NE	
	Human capabilities	LE	(IEA GHG, 2012)	LE	(IEA GHG, 2012)
	Impact on landscapes	NE		NE	
Environmental/ecological	Reduction of air pollution		(Knoblauch et al., 2014; Porter et al., 2015; Weldu et al., 2017)	NA	
	Reduction of toxic waste	NA		NA	

	Reduction of water use		(Smith and Torn 2013, Smith 2016, Fajardy and MacDowell 2017). (Gerbens-Leenes et al., 2009; Gheewala et al., 2011; Smith and Torn, 2013; Bonsch et al., 2016; Lampert et al., 2016; Mouratiadou et al., 2016; Wei et al., 2016; Mathioudakis et al., 2017) (Hylkema and Rand, 2014) (Koornneef et al., 2012a)	NE	
	Improved biodiversity		(Lindenmayer and Hobbs, 2004; Barlow et al., 2007; Immerzeel et al., 2014; Creutzig et al., 2015) (Holland et al., 2015; Santangeli et al., 2016) (Dale et al., 2015; Kline et al., 2015; Tarr et al., 2017)	NA	
Geophysical	Physical feasibility (physical potentials)		Bioenergy - (Beringer et al., 2011; Klein et al., 2014; Creutzig et al., 2015; Kraxner and Nordström, 2015; Searle and Malins, 2015; Smith et al., 2016; Boysen et al., 2017b; Tokimatsu et al., 2017; Heck et al., 2018) CCS – (Dooley, 2013; Selosse and Ricci, 2017)		CCS – (Dooley, 2013; Selosse and Ricci, 2017) (McLaren, 2012; NRC, 2015; Smith et al., 2016; Fuss et al., 2018a)
	Limited use of land		(Beringer et al., 2011; Creutzig et al., 2015; NRC, 2015; Smith et al., 2016; Heck et al., 2018)		(Keith, 2009; Holmes and Keith, 2012b; Lackner et al., 2012; NRC, 2015)
	Limited use of scarce (geo)physical resources	NE		NE	

	Global spread		(Bright et al., 2015; Robledo-Abad et al., 2017)		(Clarke et al., 2014)

Table 4.SM.15: Feasibility assessment of carbon dioxide removal mitigation options: Afforestation & reforestation; Soil carbon sequestration & biochar; and Enhanced weathering. For methodology, see 4.SM.4.1.

		Afforestation & reforestation		Soil carbon sequestration & biochar		Enhanced weathering	
	Evidence	Robust		Robust		Medium	
	Agreement	High		High		Low	
Economic	Cost-effectiveness		(Sohngen and Mendelsohn, 2003; Richards and Stokes, 2004; Richards and Stavins, 2005; Nijnik and Halder, 2013; Humpenöder et al., 2014) Reviews - (McLaren, 2012; Caldecott et al., 2015; NRC, 2015)		Reviews - (McGlashan et al., 2012; McLaren, 2012; Caldecott et al., 2015; Smith et al., 2016; Fuss et al., 2018a) BC – (Roberts et al., 2010; Shackley et al., 2011) SCS – (Smith, 2016)		Reviews - (McLaren, 2012; NRC, 2015) (Schuiling and Krijgsman, 2006; Hartmann and Kempe, 2008; Köhler et al., 2010; Renforth, 2012; Hartmann et al., 2013; Taylor et al., 2016; Strefler et al., 2018a) OA – (Renforth and Henderson, 2017)
	Absence of distributional effects		Locatelli et al 2015, Renner et al 2008 (Lyons and Westoby, 2014)		world poor stand to benefit (Stringer et al., 2012)	NE	
	Employment & productivity enhancement potential		(Smith et al., 2014b)		(Lal, 2004c; Van Straaten, 2006; Pan et al., 2009; Jeffery et al., 2011) (Jeffery et al., 2011)	NE	
Technological	Technical scalability		(Shvidenko et al., 1997; Polglase et al., 2013; Cunningham et al., 2015; Zhang and Yan, 2015) (Nemet et al., 2018)		(Jiang et al., 2014; Novak et al., 2016; Kammann et al., 2017) (Nemet et al., 2018) BC – (Roberts et al., 2010; Shackley et al., 2011)		(Hangx and Spiers, 2009; Taylor et al., 2016) (Nemet et al., 2018)

	Maturity		(McLaren, 2012; NRC, 2015; Nemet et al., 2018) Demons – (Gong et al., 2013; Zinda et al., 2017) (Nemet et al., 2018)		(McLaren, 2012; Olson, 2013; Olson et al., 2014; Piccoli et al., 2016; Triberti et al., 2016; Vochozka et al., 2016) (Nemet et al., 2018)		(McLaren, 2012; Hartmann et al., 2013; NRC, 2015) (Nemet et al., 2018)
	Simplicity	NE		NE		NE	
	Absence of risk	NE		NE		NE	
Institutional	Political acceptability	NE		NE		NE	
	Legal & administrative acceptability	NE		NE		NA	
	Institutional capacity		(McLaren, 2012) (Wang et al., 2016; Wehkamp et al., 2018b) (Wehkamp et al., 2018a) – Meta analysis until Feb 2016	LE	(Whitman and Lehmann, 2009; Dilling and Failey, 2013; Stavi and Lal, 2013)	LE	(McLaren, 2012; Moosdorf et al., 2014; Buck, 2016)
	Transparency & accountability potential	LE	(McLaren, 2012)		Accounting -(Sanderman and Baldock, 2010; McLaren, 2012; Downie et al., 2014; Nemet et al., 2018) (Smith et al., 2012a; Jandl et al., 2014)	NE	(McLaren, 2012)
Socio-cultural	Social co-benefits (health, education)		(Genesio et al., 2016; Ravi et al., 2016)	NE		NE	(Schuiling and Krijgsman, 2006; Taylor et al., 2016)
	Public acceptance		Private landholders – (Nijnik and Halder, 2013; Schirmer and Bull, 2014; Trevisan et al., 2016)		(Glenk and Colombo, 2011; Lomax et al., 2015; Jørgensen and Termansen, 2016)	LE	(Wright et al., 2014b)
	Social & regional inclusiveness		(Atela et al., 2014; Sunderlin et al., 2014; Brugnach et al., 2017; Ngendakumana et al., 2017; Turnhout et al., 2017)	NE		NE	

	Intergenerational equity	LE	(Smith et al., 2014b)	NE		NE	
	Human capabilities	NE		NE		NE	
Environmental/ecological	Reduction of air pollution	NA		NA			(Schuiling and Krijgsman, 2006; Taylor et al., 2016)
	Reduction of toxic waste	NA		NE		LE	(Schuiling and Krijgsman, 2006; Hartmann et al., 2013)
	Reduction of water use		(Jackson et al., 2005; Smith and Torn, 2013; Deng et al., 2017)		(Lal, 2004b; Bamminger et al., 2016; Smith, 2016)	LE	(Kheshgi, 1995; Rau and Caldeira, 1999; Harvey, 2008; Köhler et al., 2013; NRC, 2015)
	Improved biodiversity		(Díaz et al., 2009; McKinley et al., 2011; Hall et al., 2012; Venter et al., 2012; Greve et al., 2013; Cunningham et al., 2015; Locatelli et al., 2015a; Paul et al., 2016)	NE		NA	
Geophysical	Physical feasibility (physical potentials)		(Sohngen and Mendelsohn, 2003; Canadell and Raupach, 2008; Strengers et al., 2008; Thomson et al., 2008; van Minnen et al., 2008; Houghton et al., 2015; Sonntag et al., 2016; Griscom et al., 2017)		BC –(Lehmann et al., 2006; Laird et al., 2009; Lee et al., 2010; Woolf et al., 2010; Lenton, 2010; Moore et al., 2010; Pratt and Moran, 2010; McLaren, 2012; Powell and Lenton, 2012; Lomax et al., 2015; Smith, 2016; Paustian et al., 2016) SCS – (Batjes, 1998; Metting et al., 2001; Lal, 2013, 2003a, 2003b, 2004a, 2004c, 2010, 2011; Lal et al., 2007; Smith et al., 2008; Salati et al., 2010; Conant, 2011; Smith, 2012, 2016; Benbi, 2013; Lorenz and Lal,		(House et al., 2007; Hartmann and Kempe, 2008; Hangx and Spiers, 2009; Wilson et al., 2009; Köhler et al., 2010, 2013; Morales-Florez et al., 2011; Renforth et al., 2011; Manning and Renforth, 2013; Taylor et al., 2016; Hauck et al., 2016; Strefler et al., 2018a)

					2014; Powlson et al., 2014; Sommer and Bossio, 2014; Lassaletta and Aguilera, 2015; Henderson et al., 2015; Minasny et al., 2017; Zomer et al., 2017)		
	Limited use of land		(Smith and Torn, 2013; Houghton et al., 2015)		(Smith, 2016; Fuss et al., 2018a)		(Hartmann et al., 2013; Strefler et al., 2018b) Could enhance yields reducing land competition pressure – (Edwards et al., 2017; Kantola et al., 2017)
	Limited use of scarce (geo)physical resources	LE	(Smith and Torn, 2013)	NA		LE	(NRC, 2015)
	Global spread		(Anderson et al., 2011; Arora and Montenegro, 2011; Wang et al., 2014)		Permanence diff areas – BC - (Zimmermann et al., 2012; Sheng et al., 2016)		(Garcia et al., 2018; Strefler et al., 2018a)

4.SM.4.3 Feasibility assessment of adaptation options as presented in Section 4.5.3

4.SM.4.3.1 Feasbility assessment of adaptation options in energy system transitions

Table 4.SM.16: Feasibility assessment of energy system transition adaptation option: Power infrastructure, including water. For methodology, see 4.SM.4.1.

		Power infrastructure, including water	
	Evidence	Medium	
	Agreement	High	
Economic	Micro-economic viability		(Kopytko and Perkins, 2011; Inderberg and Løchen, 2012; Brouwer et al., 2015)
	Macro-economic viability		(Koch and Vögele, 2009; Kopytko and Perkins, 2011; Soito and Freitas, 2011; Inderberg and Løchen, 2012; Schaeffer et al., 2012; Jahandideh-Tehrani et al., 2014; Brouwer et al., 2015; Cortekar and Groth, 2015; Panteli and Mancarella, 2015; van Vliet et al., 2016)
	Socio-economic vulnerability reduction potential		(Koch and Vögele, 2009; Soito and Freitas, 2011; Cortekar and Groth, 2015; van Vliet et al., 2016)
	Employment & productivity enhancement potential		(Inderberg and Løchen, 2012; Cortekar and Groth, 2015; Panteli and Mancarella, 2015; van Vliet et al., 2016)
Technological	Technical resource availability		(Koch and Vögele, 2009; Soito and Freitas, 2011; Inderberg and Løchen, 2012; Jahandideh-Tehrani et al., 2014; Cortekar and Groth, 2015; Murrant et al., 2015; Panteli and Mancarella, 2015; Parkinson and Djilali, 2015; van Vliet et al., 2016)
	Risks mitigation potential (stranded Assets, unforeseen Impacts)		(Koch and Vögele, 2009; Inderberg and Løchen, 2012; Schaeffer et al., 2012; Jahandideh-Tehrani et al., 2014; Cortekar and Groth, 2015; Murrant et al., 2015; Panteli and Mancarella, 2015; Parkinson and Djilali, 2015; van Vliet et al., 2016)
Institutional	Political acceptability		(Soito and Freitas, 2011; Inderberg and Løchen, 2012; Cortekar and Groth, 2015; Murrant et al., 2015)
	Legal & regulatory acceptability		(Soito and Freitas, 2011; Inderberg and Løchen, 2012; Cortekar and Groth, 2015; Benson, 2018)
	Institutional capacity & Administrative feasibility		(Eisenack and Stecker, 2012; Inderberg and Løchen, 2012; Cortekar and Groth, 2015; Murrant et al., 2015)
	Transparency & accountability potential	LE	(Inderberg and Løchen, 2012; Cortekar and Groth, 2015)
Socio -	Social co-benefits (health, education)	NA	(Soito and Freitas, 2011)

	Socio-cultural acceptability	NE	(Soito and Freitas, 2011; Inderberg and Løchen, 2012)
	Social & regional inclusiveness	LE	(Soito and Freitas, 2011)
	Intergenerational equity	LE	(Soito and Freitas, 2011)
Environmental/ecolog	Ecological capacity		(Koch and Vögele, 2009; Soito and Freitas, 2011; Inderberg and Løchen, 2012; Schaeffer et al., 2012; Jahandideh-Tehrani et al., 2014; Murrant et al., 2015; Parkinson and Djilali, 2015)
	Adaptive capacity/resilience		(Koch and Vögele, 2009; Soito and Freitas, 2011; Inderberg and Løchen, 2012; Schaeffer et al., 2012; Jahandideh-Tehrani et al., 2014; Cortekar and Groth, 2015; Murrant et al., 2015; Parkinson and Djilali, 2015; van Vliet et al., 2016)
Geophysical	Physical feasibility		(Koch and Vögele, 2009; Eisenack and Stecker, 2012; Schaeffer et al., 2012; Jahandideh-Tehrani et al., 2014; Brouwer et al., 2015; Cortekar and Groth, 2015; Murrant et al., 2015; Panteli and Mancarella, 2015; Parkinson and Djilali, 2015; van Vliet et al., 2016)
	Land use change enhancement potential		(Schaeffer et al., 2012; Jahandideh-Tehrani et al., 2014; Parkinson and Djilali, 2015)
	Hazard risk reduction potential		(Inderberg and Løchen, 2012; Schaeffer et al., 2012; Jahandideh-Tehrani et al., 2014; Brouwer et al., 2015; Cortekar and Groth, 2015; Murrant et al., 2015; Panteli and Mancarella, 2015; Parkinson and Djilali, 2015; van Vliet et al., 2016)

4.SM.4.3.2 Feasbility assessment of adaptation options in land & ecosystem transitions

Table 4.SM.17: Feasibility assessment of land and ecosystem transition adaptation options: Conservation agriculture; Efficient irrigation; Efficient livestock; Agroforestry; and Community-based adaptation. For methodology, see 4.SM.4.1.

		Conservation agriculture		Efficient irrigation		Efficient livestock		Agroforestry		Community-based adaptation	
	Evidence	Medium		Medium		Limited		Medium		Medium	
	Agreement	Medium		Medium		High		High		High	
Economic	Micro-economic viability		(Grabowski and Kerr, 2014; Jat et al., 2014; Pittelkow et al., 2014; Thierfelder et al., 2015, 2017; Smith et al., 2017b)		(Olmstead, 2014; Roco et al., 2014; Venot et al., 2014; Varela-Ortega et al., 2016; Bjornlund et al., 2017; Herwehe and Scott, 2017; Mdemu et al., 2017)		(Thornton and Herrero, 2014; Herrero et al., 2015; Weindl et al., 2015; Ghahramani and Bowran, 2018)		(Valdivia et al., 2012; K Murthy, 2013; Lasco et al., 2014; Mbow et al., 2014a, 2014b; Brockington et al., 2016; Iiyama et al., 2017; Jacobi et al., 2017; Hernández-Morcillo et al., 2018)		(Mannke, 2011; Archer et al., 2014; Wright et al., 2014a; Fernández-Giménez et al., 2015; Dodman et al., 2017a)
	Macro-economic viability		(Ndah et al., 2015; Thierfelder et al., 2015; Smith et al., 2017b)		(Elliott et al., 2014; Kirby et al., 2014; Olmstead, 2014; Girard et al., 2015; Kahil et al., 2015; Varela-Ortega et al., 2016; Bjornlund et al., 2017; Herwehe and Scott, 2017)		(Herrero et al., 2015; Weindl et al., 2015; García de Jalón et al., 2017)		(Valdivia et al., 2012; Lasco et al., 2014; Jacobi et al., 2017; Hernández-Morcillo et al., 2018)	NE	
	Socio-economic vulnerability reduction potential		(Bhan and Behera, 2014; Pittelkow et al., 2014; Stevenson et al., 2014; Prosdocimi et al., 2016; Smith et al., 2017b)		(Burney and Naylor, 2012; Levidow et al., 2014; Roco et al., 2014; Venot et al., 2014; Ashofteh et al., 2017; Bjornlund et al., 2017)		(Herrero et al., 2015; García de Jalón et al., 2017; Thornton et al., 2018)		(Valdivia et al., 2012; Brockington et al., 2016; Coq-Huelva et al., 2017; Coulibaly et al., 2017; Iiyama et al., 2017; Jacobi et al., 2017; Quandt et al., 2017)		(Mannke, 2011; Archer et al., 2014; Reid and Huq, 2014; Wright et al., 2014a; Fernández-Giménez et al., 2015; Ensor et al., 2016, 2018; Ford et al., 2018)

	Employment & productivity enhancement potential		(Bhan and Behera, 2014; Grabowski and Kerr, 2014; Kirkegaard et al., 2014; Pittelkow et al., 2014; Stevenson et al., 2014)		(Burney and Naylor, 2012; Burney et al., 2014; Kirby et al., 2014; Levidow et al., 2014)		(Briske et al., 2015; García de Jalón et al., 2017)	LE	(Verchot et al., 2007; Buckeridge et al., 2012)		(Mannke, 2011; Reid and Huq, 2014; Fernández-Giménez et al., 2015)
Technological	Technical resource availability		(Palm et al., 2014; Stevenson et al., 2014; Adenle et al., 2015; Smith et al., 2017b)		(Venot et al., 2014; Esteve et al., 2015; Fishman et al., 2015; Azhoni et al., 2017; Mdemu et al., 2017)		(Descheemaeker et al., 2016; Thornton et al., 2018)		(Verchot et al., 2007; Valdivia et al., 2012; Mbow et al., 2014a; Iiyama et al., 2017; Jacobi et al., 2017; Hernández-Morcillo et al., 2018)	LE	(Wright et al., 2014a; Fernández-Giménez et al., 2015)
	Risks mitigation potential		(Bhan and Behera, 2014; Palm et al., 2014; Pittelkow et al., 2014)		(Burney et al., 2014; Fishman et al., 2015; Jägermeyr et al., 2015; Blanc et al., 2017)		(Briske et al., 2015; Thornton and Herrero, 2015; Thornton et al., 2018)		(Verchot et al., 2007; Jacobi et al., 2017; Abdulai et al., 2018; Hernández-Morcillo et al., 2018; Sida et al., 2018)	NA	
Institutional	Political acceptability		(Adenle et al., 2015; Dougill et al., 2017; Westengen et al., 2018)		(Burney and Naylor, 2012; Esteve et al., 2015)	NE			(Buckeridge et al., 2012; Mbow et al., 2014b; Jacobi et al., 2017)	NA	
	Legal & regulatory acceptability	NE		NA		NE			(Place et al., 2012; Mbow et al., 2014a, 2014b; Jacobi et al., 2017; Hernández-Morcillo et al., 2018)	NA	
	Institutional capacity & Administrative feasibility		(Bhan and Behera, 2014; Harvey et al., 2014; Kassam et al., 2014; Adenle et al., 2015; Baudron et al., 2015; Ndah et al., 2015; Li et al., 2016; Dougill et al., 2017; Smith et al., 2017b)		(Burney and Naylor, 2012; Burney et al., 2014; Levidow et al., 2014; Venot et al., 2014; Kahil et al., 2015; Azhoni et al., 2017; Mdemu et al., 2017)		(Herrero et al., 2015; Descheemaeker et al., 2016)		(Buckeridge et al., 2012; Place et al., 2012; Jacobi et al., 2017; Hernández-Morcillo et al., 2018)		(Mannke, 2011; Archer et al., 2014; Ayers et al., 2014; Wright et al., 2014a; Reid and Huq, 2014; Sovacool et al., 2015; Fernández-Giménez et al., 2015; Scolobig et al., 2015; Ensor et al., 2016,

										2018; Reid, 2016; Ford et al., 2018)
	Transparency & accountability potential	LE	(Brouder and Gomez-Macpherson, 2014; Palm et al., 2014; Challinor et al., 2018)		(Levidow et al., 2014; Azhoni et al., 2017)	NA		NE		(Archer et al., 2014; Reid and Huq, 2014; Fernández-Giménez et al., 2015; Sovacool et al., 2015)
Socio-cultural	Social co-benefits (health, education)		(Pittelkow et al., 2014; Smith et al., 2017b; Pradhan et al., 2018)	LE	(Venot et al., 2014; Mdemu et al., 2017)		(Herrero et al., 2015; Thornton and Herrero, 2015; Thornton et al., 2018)		(Clark and Tilman 2017b; Thierfelder et al. 2017; Varela-Ortega et al. 2016; Hernández-Morcillo et al. 2018; Coq-Huelva et al. 2017; Coulibaly et al. 2017; Quandt et al. 2017; Jacobi et al. 2017; Brockington et al. 2016)		(Mannke, 2011; Archer et al., 2014; Ayers et al., 2014; Wise et al., 2014; Wright et al., 2014a; Fernández-Giménez et al., 2015; Sovacool et al., 2015; Ensor et al., 2016, 2018; Ford et al., 2018)
	Socio-cultural acceptability		(Giller et al., 2015; Ndah et al., 2015; Thierfelder et al., 2015)		(Roco et al., 2014; Venot et al., 2014; Girard et al., 2015; Mdemu et al., 2017)		(Herrero et al., 2015; Ghahramani and Bowran, 2018; Thornton et al., 2018)		(Jarvis et al., 2008; Valdivia et al., 2012; Coq-Huelva et al., 2017; Iiyama et al., 2017; Jacobi et al., 2017; Hernández-Morcillo et al., 2018)		(Mannke, 2011; Green et al., 2014; Reid and Huq, 2014; Wise et al., 2014; Wright et al., 2014a; Fernández-Giménez et al., 2015; Ensor et al., 2016, 2018; Ford et al., 2018)
	Social & regional inclusiveness		(Brouder and Gomez-Macpherson, 2014; Pittelkow et al., 2014; Ndah et al., 2015; Smith et al., 2017b)		(Burney and Naylor, 2012; Jägermeyr et al., 2015)		(Briske et al., 2015; García de Jalón et al., 2017; Thornton et al., 2018)		(Valdivia et al., 2012; Iiyama et al., 2017; Jacobi et al., 2017)		(Archer et al., 2014; Wright et al., 2014a; Fernández-Giménez et al., 2015; Sovacool et al., 2015; Ensor et al., 2016, 2018; Ford et al., 2018)
	Intergenerational equity	NA		NA		NA		NE			(Wright et al., 2014a; Fernández-Giménez et al., 2015)
Environ	Ecological capacity		(Bhan and Behera, 2014; Palm et al., 2014; Thierfelder et		(Kirby et al., 2014; Pfeiffer and Lin, 2014; Fishman et		(Lemaire et al., 2014; Herrero et al., 2015;		(Lusiana et al., 2012; K Murthy, 2013; Lasco et al., 2014; Barral et al.,	LE	(Wright et al., 2014a; Fernández-Giménez et al., 2015)

			al., 2015; Prosdocimi et al., 2016)		al., 2015; Jägermeyr et al., 2015)		Thornton et al., 2018)		2015; Coq-Huelva et al., 2017; Quandt et al., 2017; Hernández-Morcillo et al., 2018; Sida et al., 2018)		
	Adaptive capacity/resilience		(Aleksandrova et al., 2014; Grabowski and Kerr, 2014; Kirkegaard et al., 2014; Pittelkow et al., 2014; Stevenson et al., 2014; Thierfelder et al., 2015; Li et al., 2016; Smith et al., 2017b; Pradhan et al., 2018)		(Burney and Naylor, 2012; Burney et al., 2014; Levidow et al., 2014; Jägermeyr et al., 2015; Fader et al., 2016; Varela-Ortega et al., 2016; Ashofteh et al., 2017; Hong and Yabe, 2017)		(Bell et al., 2014; Havet et al., 2014; Lemaire et al., 2014; Thornton and Herrero, 2014; Briske et al., 2015; Herrero et al., 2015; Weindl et al., 2015; Ghahramani and Bowran, 2018)		(Sendzimir et al., 2011; Lusiana et al., 2012; K Murthy, 2013; Lasco et al., 2014; Mbow et al., 2014a; Varela-Ortega et al., 2016; Clark and Tilman, 2017; Coq-Huelva et al., 2017; Coulibaly et al., 2017; Quandt et al., 2017; Thierfelder et al., 2017; Hernández-Morcillo et al., 2018)		(Mannke, 2011; Archer et al., 2014; Ayers et al., 2014; Wright et al., 2014a; Reid and Huq, 2014; Wise et al., 2014; Fernández-Giménez et al., 2015; Ensor et al., 2016, 2018; Ford et al., 2018; Singh, 2018)
Geophysical	Physical feasibility		(Stevenson et al., 2014; Giller et al., 2015; Thierfelder et al., 2017)		(Levidow et al., 2014; Fishman et al., 2015; Jägermeyr et al., 2015)		(Weindl et al., 2015; Thornton et al., 2018)		(Coulibaly et al., 2017; Hernández-Morcillo et al., 2018)	NA	
	Land use change enhancement potential		(Grabowski and Kerr, 2014; Stevenson et al., 2014; Giller et al., 2015; Prosdocimi et al., 2016; Cui et al., 2018; Pradhan et al., 2018)		(Fader et al., 2016)		(Briske et al., 2015; Weindl et al., 2015)		(Lasco et al., 2014; Mbow et al., 2014a; Coulibaly et al., 2017; Hernández-Morcillo et al., 2018)	LE	(Wright et al., 2014a)
	Hazard risk reduction potential	NE		NA		NA			(Lasco et al., 2014; Mbow et al., 2014a; Coulibaly et al., 2017; Abdulai et al., 2018; Hernández-Morcillo et al., 2018)		(Mannke, 2011; Archer et al., 2014; Wright et al., 2014a; Fernández-Giménez et al., 2015; Ensor et al., 2016, 2018; Ford et al., 2018)

Table 4.SM.18: Feasibility assessment of land and ecosystem transition adaptation options: Ecosystem restoration & avoided deforestation; Biodiversity management; Coastal defense and hardening; and Sustainable aquaculture. For methodology, see 4.SM.4.1.

		Ecosystem restoration & avoided deforestation		Biodiversity management		Coastal defense and hardening		Sustainable aquaculture	
	Evidence	Robust		Medium		Robust		Limited	
	Agreement	Medium		Medium		Medium		Medium	
Economic	Micro-economic viability		(Dang Phan et al., 2014; Ingalls and Dwyer, 2016; Rakatama et al., 2017; Spencer et al., 2017)		(Rodrigues et al., 2009; Alagador et al., 2014; Mantyka-Pringle et al., 2016; Gómez-Aíza et al., 2017; Reside et al., 2017b; Monahan and Theobald, 2018)		(Firth et al., 2014; Barbier, 2015a; Elliott and Wolanski, 2015; Diaz, 2016; Betzold and Mohamed, 2017)		(Boonstra and Hanh, 2015; Joffre et al., 2015; FAO, 2016; FAO et al., 2017; Pérez-Escamilla, 2017)
	Macro-economic viability		(Dang Phan et al., 2014; Rakatama et al., 2017; Spencer et al., 2017; Turnhout et al., 2017; Well and Carrapatoso, 2017)	NE		LE	(Hinkel et al., 2014; Estrada et al., 2017)	LE	(UNEP, 2013; Edwards, 2015; Moffat, 2017)
	Socio-economic vulnerability reduction potential		(Atela et al., 2015; Elmqvist et al., 2015; Camps-Calvet et al., 2016; Ingalls and Dwyer, 2016; McPhearson et al., 2016; Collas et al., 2017; Ngendakumana et al., 2017; Spencer et al., 2017)		(Rodrigues et al., 2009; Berrang-Ford et al., 2012; Pullin et al., 2013; Brockington and Wilkie, 2015; Newbold et al., 2015; Oldekop et al., 2016; Griscom et al., 2017; Milman and Jagannathan, 2017; Terraube et al., 2017; Essl and Mauerhofer, 2018)		(Rabbani et al., 2010b, 2010a; Gutiérrez et al., 2012; Arkema et al., 2013, 2017; Neumann et al., 2015; Sovacool et al., 2015; Sutton-Grier et al., 2015; Betzold and Mohamed, 2017)		(Bell et al., 2011; Smith et al., 2013; Orchard et al., 2015; Béné et al., 2016; Jennings et al., 2016; Mycoo, 2017; Ahmed et al., 2018)
	Employment & productivity enhancement potential		(Ingalls and Dwyer, 2016; Spencer et al., 2017; Turnhout et al., 2017)	NE		NE			(Sánchez et al., 2002; De Silva and Davy, 2010; Ahmed et al., 2014; Boonstra and Hanh, 2015; Lacoue-Labarthe et al., 2016; Asiedu et al., 2017a)

Technological	Technical resource availability		(Ingalls and Dwyer, 2016; Spencer et al., 2017; Turnhout et al., 2017)		(Nadeau et al., 2015; Schmitz et al., 2015; Thomas and Gillingham, 2015; Jones et al., 2016a; Urban et al., 2016; Milman and Jagannathan, 2017; Reside et al., 2017b)		(Arkema et al., 2013; Bosello and De Cian, 2014; Smajgl et al., 2015; Hauer et al., 2016; Betzold and Mohamed, 2017; Williams et al., 2018)		(UNEP, 2013; Ahmed et al., 2014, 2018; Brillant, 2014; Edwards, 2015; Lucas, 2015; Fidelman et al., 2017)
	Risks mitigation potential	LE	(Spencer et al., 2017; Turnhout et al., 2017)	LE			(Firth et al., 2014; Sovacool et al., 2015; André et al., 2016; Cashman and Nagdee, 2017; Brown et al., 2018; Storlazzi et al., 2018; Williams et al., 2018)		(Boonstra and Hanh, 2015; Blanchard et al., 2017)
Institutional	Political acceptability		(Sunderlin et al., 2014; Ingalls and Dwyer, 2016; Ngendakumana et al., 2017)	LE	(Milman and Jagannathan, 2017; Essl and Mauerhofer, 2018)		(Duvat, 2013; Nordstrom, 2014; Sovacool et al., 2015; Betzold and Mohamed, 2017)		(Brander, 2007; Bell et al., 2011; Bell and Taylor, 2015; FAO, 2016; Weatherdon et al., 2016; Asiedu et al., 2017a; Ertör and Ortega-Cerdà, 2017)
	Legal & regulatory acceptability	LE	(Sunderlin et al., 2014; Turnhout et al., 2017)		(Dallimer and Strange, 2015; Jones et al., 2016a; Drielsma et al., 2017; Essl and Mauerhofer, 2018; Monahan and Theobald, 2018; Triviño et al., 2018)	NE		LE	(Broitman et al., 2017; Fidelman et al., 2017)
	Institutional capacity & Administrative feasibility		(Jagger et al., 2014; Sunderlin et al., 2014; Wallbott, 2014; Atela et al., 2015; Ingalls and Dwyer, 2016; Ngendakumana et al., 2017; Spencer et al., 2017; Turnhout et al., 2017; Well and Carrapatoso, 2017; Wehkamp et al., 2018a)		(Dallimer and Strange, 2015; Thomas and Gillingham, 2015; Jones et al., 2016a; Essl and Mauerhofer, 2018; Monahan and Theobald, 2018)		(Hallegatte et al., 2013; Spalding et al., 2014; Mills et al., 2016; Estrada et al., 2017)	LE	(Ahmed et al., 2014; Broitman et al., 2017; Fidelman et al., 2017)
	Transparency & accountability potential		(Jagger et al., 2014; Sunderlin et al., 2014; Atela et al., 2015; Ingalls and Dwyer, 2016; Ngendakumana et al., 2017;	LE		NE		NE	

			Turnhout et al., 2017; Well and Carrapatoso, 2017; Wehkamp et al., 2018a)						
Socio-cultural	Social co-benefits (health, education)		(Sunderlin et al., 2014; Jagger et al., 2014; Atela et al., 2015; Elmqvist et al., 2015; Camps-Calvet et al., 2016; Ingalls and Dwyer, 2016; McPhearson et al., 2016; Turnhout et al., 2017; Collas et al., 2017; Li et al., 2017; Ngendakumana et al., 2017; Spencer et al., 2017)		(Rodrigues et al., 2009; Berrang-Ford et al., 2012; Pullin et al., 2013; Brockington and Wilkie, 2015; Oldekop et al., 2016; Clark and Tilman, 2017; Terraube et al., 2017; Essl and Mauerhofer, 2018)		(Sovacool et al., 2015; Sutton-Grier et al., 2015; Arkema et al., 2017; Betzold and Mohamed, 2017)	LE	(Weatherdon et al., 2016; Fidelman et al., 2017)
	Socio-cultural acceptability		(Sunderlin et al., 2014; Wallbott, 2014; Atela et al., 2015; Ingalls and Dwyer, 2016; Ngendakumana et al., 2017; Spencer et al., 2017)		(Pullin et al., 2013; Brockington and Wilkie, 2015; Oldekop et al., 2016; Milman and Jagannathan, 2017)		(Sovacool et al., 2015; Gibbs, 2016; Morris et al., 2016; Betzold and Mohamed, 2017; Marengo et al., 2017)	LE	(Asiedu et al., 2017a; Fidelman et al., 2017)
	Social & regional inclusiveness	LE	(Ingalls and Dwyer, 2016; Spencer et al., 2017)		(Pullin et al., 2013; Brockington and Wilkie, 2015; Oldekop et al., 2016; Milman and Jagannathan, 2017; Terraube et al., 2017)	NA		NE	
	Intergenerational equity		(Ingalls and Dwyer, 2016; Ngendakumana et al., 2017; Spencer et al., 2017)	NE		NE		NA	
Environmental/ ecological	Ecological capacity		(Sunderlin et al., 2014; Spencer et al., 2017; Turnhout et al., 2017)		(Rodrigues et al., 2009; Virkkala et al., 2014; Thomas and Gillingham, 2015; Gillingham et al., 2015; Nadeau et al., 2015; Schmitz et al., 2015; Feeley and Silman, 2016; Gaüzère et al., 2016; Greenwood et al., 2016; Gómez-Aíza et al., 2017; Mingarro and		(Bilkovic and Mitchell, 2013; Spalding et al., 2014; Joffre et al., 2015; Sutton-Grier et al., 2015)		(David et al., 2015; Joffre et al., 2015; Blanchard et al., 2017; Broitman et al., 2017; Ahmed et al., 2018)

					Lobo, 2018; Monahan and Theobald, 2018)				
	Adaptive capacity/resilience		(Sunderlin et al., 2014; Ingalls and Dwyer, 2016; Ngendakumana et al., 2017; Spencer et al., 2017; Turnhout et al., 2017)		(Rodrigues et al., 2009; Pullin et al., 2013; Oldekop et al., 2016; Gómez-Aíza et al., 2017; Terraube et al., 2017; Monahan and Theobald, 2018)	LE	(Spalding et al., 2014; Orchard et al., 2015; Fidelman et al., 2017)		(Boonstra and Hanh, 2015; Orchard et al., 2015; Blanchard et al., 2017; Fidelman et al., 2017; Cinner et al., 2018)
Geophysical	Physical feasibility		(Dang Phan et al., 2014; Sunderlin et al., 2014; Ngendakumana et al., 2017; Spencer et al., 2017; Turnhout et al., 2017)	NE			(Duvat, 2013; Hinkel et al., 2014; Smith et al., 2015; André et al., 2016; Cooper et al., 2016; Vousdoukas et al., 2016; Arkema et al., 2017)		(David et al., 2015; Adhikari et al., 2018b; Ahmed et al., 2018)
	Land use change enhancement potential		(Dang Phan et al., 2014; Sunderlin et al., 2014; Ingalls and Dwyer, 2016; Ngendakumana et al., 2017; Turnhout et al., 2017; Houghton and Nassikas, 2018; Wehkamp et al., 2018a)	LE	(Schmitz et al., 2015; Reside et al., 2017b, 2017a)	LE	(Sutton-Grier et al., 2015)	LE	(Mialhe et al., 2016)
	Hazard risk reduction potential		(Ingalls and Dwyer, 2016; Spencer et al., 2017)	NE			(Luisetti et al., 2013; Firth et al., 2014; Spalding et al., 2014; Barbier, 2015b; Sutton-Grier et al., 2015; André et al., 2016; Narayan et al., 2016; Arkema et al., 2017; Fu and Song, 2017)		(Joffre et al., 2015; Blanchard et al., 2017; Daly et al., 2017; Hung et al., 2018)

4.SM.4.3.3 Feasbility assessment of adaptation options in urban & infrastructure system transitions

Table 4.SM.19: Feasibility assessment of urban and infrastructure transition adaptation options: Sustainable land-use & urban planning; and Sustainable water management. For methodology, see 4.SM.4.1.

		Sustainable land-use & urban planning		Sustainable water management	
	Evidence	Medium		Robust	
	Agreement	Medium		Medium	
Economic	Micro-economic viability		(Eberhard et al., 2011; Kiunsi, 2013; Watkins, 2015; Archer, 2016; Eberhard et al., 2016; Eisenberg, 2016; Ewing et al., 2016; Ziervogel et al., 2016a; Hess and Kelman, 2017; Mavhura et al., 2017; Ziervogel et al., 2017)		(Liu et al., 2014; Lamond et al., 2015; Voskamp and Van de Ven, 2015; Xue et al., 2015; Costa et al., 2016; Mguni et al., 2016; Poff et al., 2016; Ossa-Moreno et al., 2017; Vincent et al., 2017; Xie et al., 2017)
	Macro-economic viability		(Eberhard et al., 2011; Measham et al., 2011; Aerts et al., 2014; Jaglin, 2014; Beccali et al., 2015; Boughedir, 2015; Watkins, 2015; Eberhard et al., 2016; Ziervogel et al., 2016a; Chu et al., 2017; Hess and Kelman, 2017; Ziervogel et al., 2017)	NE	
	Socio-economic vulnerability reduction potential		(Measham et al., 2011; Eberhard et al., 2011, 2016; Kiunsi, 2013; Aerts et al., 2014; Jaglin, 2014; Boughedir, 2015; Broto et al., 2015; Carter et al., 2015; Archer, 2016; Shi et al., 2016; Ziervogel et al., 2016a, 2017; Hetz, 2016; Mavhura et al., 2017)		(Villarroel Walker et al., 2014; Ziervogel and Joubert, 2014; Brown and McGranahan, 2016; Chu et al., 2016; Chant et al., 2017; Dodman et al., 2017b, 2017a; Ossa-Moreno et al., 2017; Gunasekara et al., 2018)
	Employment & productivity enhancement potential		(Eberhard et al., 2011; Measham et al., 2011; Watkins, 2015; Archer, 2016; Eberhard et al., 2016; Ziervogel et al., 2016a)	NE	
Technological	Technical resource availability		(Aerts et al., 2014; Kettle et al., 2014; Beccali et al., 2015; Boughedir, 2015; Archer, 2016; Woodruff and Stults, 2016; Mavhura et al., 2017; Siders, 2017; Stults and Woodruff, 2017)		(Liu et al., 2014; Lamond et al., 2015; Voskamp and Van de Ven, 2015; Costa et al., 2016; Mguni et al., 2016; Soz et al., 2016; Xie et al., 2017)
	Risks mitigation potential		(Measham et al., 2011; Kiunsi, 2013; Aerts et al., 2014; Boughedir, 2015; Eisenberg, 2016; Siders, 2017; Stults and Woodruff, 2017)		(Liu et al., 2014; Lamond et al., 2015; Voskamp and Van de Ven, 2015; Costa et al., 2016; Mguni et al., 2016; Xie et al., 2017; Gunasekara et al., 2018)

Institutional	Political acceptability		(Measham et al., 2011; Aerts et al., 2014; Rivera and Wamsler, 2014; Boughedir, 2015; Carter et al., 2015; Landauer et al., 2015; Araos et al., 2016b; Woodruff and Stults, 2016; Hetz, 2016; Siders, 2017; Chu et al., 2017; Di Gregorio et al., 2017b; Mahlkow and Donner, 2017)		(Leck et al., 2015; Padawangi and Douglass, 2015; Chen and Chen, 2016; Mguni et al., 2016)
	Legal & regulatory acceptability		(Eberhard et al., 2011; Measham et al., 2011; Aerts et al., 2014; Rivera and Wamsler, 2014; Boughedir, 2015; Carter et al., 2015; Landauer et al., 2015; Eberhard et al., 2016; Eisenberg, 2016; King et al., 2016; Dhar and Khirfan, 2017; Di Gregorio et al., 2017b; Francesch-Huidobro et al., 2017; Hess and Kelman, 2017)		(Padawangi and Douglass, 2015) (Bettini et al., 2015; Deng and Zhao, 2015; Hill Clarvis and Engle, 2015; Leck et al., 2015; Lemos, 2015; Margerum and Robinson, 2015; Chen and Chen, 2016)
	Institutional capacity & Administrative feasibility		(Eberhard et al., 2011, 2016; Measham et al., 2011; Kiunsi, 2013; Aerts et al., 2014; Jaglin, 2014; Rivera and Wamsler, 2014; Archer et al., 2014; Landauer et al., 2015; Boughedir, 2015; Broto et al., 2015; Carter et al., 2015; Araos et al., 2016b; Hetz, 2016; Archer, 2016; Shi et al., 2016; Woodruff and Stults, 2016; Ziervogel et al., 2016a; Campos et al., 2016; Di Gregorio et al., 2017b; Francesch-Huidobro et al., 2017; Mahlkow and Donner, 2017; Mavhura et al., 2017; Siders, 2017; Tait and Euston-Brown, 2017; Chu et al., 2017; Dhar and Khirfan, 2017)		(Ziervogel and Joubert, 2014; Bettini et al., 2015; Deng and Zhao, 2015; Hill Clarvis and Engle, 2015; Lamond et al., 2015; Lemos, 2015; Margerum and Robinson, 2015)
	Transparency & accountability potential		(Eberhard et al., 2011, 2016; Measham et al., 2011; Kettle et al., 2014; Broto et al., 2015; Landauer et al., 2015; Shi et al., 2016; Woodruff and Stults, 2016; Chu et al., 2017; Stults and Woodruff, 2017)	NE	
Socio-cultural	Social co-benefits (health, education)		(Eberhard et al., 2011; Archer et al., 2014; Kettle et al., 2014; Beccali et al., 2015; Landauer et al., 2015; Parnell, 2015; Watkins, 2015; Archer, 2016; Campos et al., 2016; Eberhard et al., 2016; Ziervogel et al., 2016a; Hess and Kelman, 2017; Ziervogel et al., 2017; Chu et al., 2018)		(Liu et al., 2014; Lamond et al., 2015; Leck et al., 2015; Padawangi and Douglass, 2015; Voskamp and Van de Ven, 2015; Costa et al., 2016; Mguni et al., 2016; Nur and Shrestha, 2017; Xie et al., 2017; Gunasekara et al., 2018)
	Socio-cultural acceptability		(Kiunsi, 2013; Aerts et al., 2014; Archer et al., 2014; Jaglin, 2014; Kettle et al., 2014; Broto et al., 2015; Carter et al., 2015; Parnell, 2015; Watkins, 2015; Archer, 2016; Campos et al., 2016; Eberhard et al., 2016; Ewing et al., 2016; Newman et al., 2016; Shi et al., 2016; Ziervogel et al., 2016a; Chu et al., 2017; Siders, 2017; Stults and Woodruff, 2017; Ziervogel et al., 2017; Chu et al., 2018)		(Lamond et al., 2015; Leck et al., 2015; Padawangi and Douglass, 2015; Nur and Shrestha, 2017; Xie et al., 2017)

	Social & regional inclusiveness		(Eberhard et al., 2011; Archer et al., 2014; Jaglin, 2014; Kettle et al., 2014; Broto et al., 2015; Parnell, 2015; Watkins, 2015; Araos et al., 2016b; Archer, 2016; Campos et al., 2016; Eberhard et al., 2016; King et al., 2016; Shi et al., 2016; Ziervogel et al., 2016a; Chu et al., 2017; Dhar and Khirfan, 2017; Mahlkow and Donner, 2017; Mavhura et al., 2017; Ziervogel et al., 2017; Chu et al., 2018)		(Rasul and Sharma, 2016)
	Intergenerational equity		(Parnell, 2015; King et al., 2016; Shi et al., 2016; Chu et al., 2017; Ziervogel et al., 2017)		(Tacoli et al., 2013; Xue et al., 2015; Poff et al., 2016)
Environmental/ ecological	Ecological capacity		(Kiunsi, 2013; Aerts et al., 2014; Kettle et al., 2014; King et al., 2016; Ziervogel et al., 2016a; Mavhura et al., 2017)		(Ziervogel and Joubert, 2014; Lamond et al., 2015; Soz et al., 2016)
	Adaptive capacity/ resilience		(Eberhard et al., 2011; Kiunsi, 2013; Aerts et al., 2014; Archer et al., 2014; Jaglin, 2014; Kettle et al., 2014; Rivera and Wamsler, 2014; Carter et al., 2015; Parnell, 2015; Watkins, 2015; Archer, 2016; Eberhard et al., 2016; Hetz, 2016; King et al., 2016; Shi et al., 2016; Ziervogel et al., 2016a; Chu et al., 2017; Hess and Kelman, 2017; Stults and Woodruff, 2017; Ziervogel et al., 2017)		(Angotti, 2015; Bell et al., 2015; Biggs et al., 2015; Gwedla and Shackleton, 2015; Lwasa et al., 2015; Chen and Chen, 2016; Yang et al., 2016; Sanesi et al., 2017; Gunasekara et al., 2018)
Geophysical	Physical feasibility		(Aerts et al., 2014; Boughedir, 2015; Hetz, 2016; King et al., 2016; Newman et al., 2016; Woodruff and Stults, 2016; Ziervogel et al., 2016a; Stults and Woodruff, 2017)		(Ziervogel and Joubert, 2014; Lamond et al., 2015; Soz et al., 2016)
	Land use change enhancement potential		(Kiunsi, 2013; Landauer et al., 2015; Parnell, 2015; Hetz, 2016; Newman et al., 2016; Mavhura et al., 2017)		(Lamond et al., 2015; Leck et al., 2015; Padawangi and Douglass, 2015; Rasul and Sharma, 2016; Soz et al., 2016)
	Hazard risk reduction potential		(Kiunsi, 2013; Aerts et al., 2014; Watkins, 2015; Boughedir, 2015; Archer, 2016; Woodruff and Stults, 2016; Eisenberg, 2016; Hetz, 2016; King et al., 2016; Mahlkow and Donner, 2017; Mavhura et al., 2017; Stults and Woodruff, 2017)		(Liu et al., 2014; Angotti, 2015; Bell et al., 2015; Voskamp and Van de Ven, 2015; Biggs et al., 2015; Gwedla and Shackleton, 2015; Lamond et al., 2015; Lwasa et al., 2015; Mguni et al., 2016; Yang et al., 2016; Chen and Chen, 2016; Costa et al., 2016; Sanesi et al., 2017; Xie et al., 2017; Gunasekara et al., 2018)

Table 4.SM.20: Feasibility assessment of urban and infrastructure transition adaptation options: Green infrastructure and ecosystem services; and Building codes and standards. For methodology, see 4.SM.4.1.

		Green infrastructure and ecosystem services		Building codes and standards	
	Evidence	Medium		Limited	
	Agreement	High		Medium	
Economic	Micro-economic viability		(Elmqvist et al., 2015; Soderlund and Newman, 2015; McPhearson et al., 2016; Zinia and McShane, 2018)		(Steenhof and Sparling, 2011; Bendito and Barrios, 2016; Ruparathna et al., 2016; Mavhura et al., 2017; Wells et al., 2018)
	Macro-economic viability	LE	(Culwick and Bobbins, 2016)		(Steenhof and Sparling, 2011; Aerts et al., 2014; Späth and Rohracher, 2015; Chandel et al., 2016; Shapiro, 2016; Hess and Kelman, 2017; Wells et al., 2018)
	Socio-economic vulnerability reduction potential		(Tallis et al., 2011; Elmqvist et al., 2015; Soderlund and Newman, 2015; Camps-Calvet et al., 2016; McPhearson et al., 2016; Panagopoulos et al., 2016; Stevenson et al., 2016; Li et al., 2017; White et al., 2017b; Zinia and McShane, 2018)		(Steenhof and Sparling, 2011; FEMA, 2014; Bendito and Barrios, 2016; Hess and Kelman, 2017; Reckien et al., 2017)
	Employment & productivity enhancement potential	NE		NE	
Technological	Technical resource availability	NA			(Steenhof and Sparling, 2011; Aerts et al., 2014; Bendito and Barrios, 2016; Chandel et al., 2016; Ruparathna et al., 2016; Garsaball and Markov, 2017; Tait and Euston-Brown, 2017; Wells et al., 2018)
	Risks mitigation potential (stranded Assets, unforeseen Impacts)		(Tallis et al., 2011; Elmqvist et al., 2013b; Buckeridge, 2015; Elmqvist et al., 2015; Soderlund and Newman, 2015; Camps-Calvet et al., 2016; McPhearson et al., 2016; Panagopoulos et al., 2016; Stevenson et al., 2016; Li et al., 2017; White et al., 2017b; Zinia and McShane, 2018)		(Aerts et al., 2014; Ruparathna et al., 2016)
Institutional	Political acceptability	LE	(Brown and McGranahan, 2016; Ziervogel et al., 2016b)		(Aerts et al., 2014; Späth and Rohracher, 2015; Chandel et al., 2016; Eisenberg, 2016; Shapiro, 2016; Tait and Euston-Brown, 2017; Wells et al., 2018)
	Legal & regulatory acceptability		(Brown and McGranahan, 2016; Ziervogel et al., 2016b; Collas et al., 2017; Li et al., 2017; Sirakaya et al., 2018)		(Steenhof and Sparling, 2011; Burch et al., 2014; Späth and Rohracher, 2015; Eisenberg, 2016; Ruparathna et al., 2016; Shapiro, 2016; Hess and Kelman, 2017; Stults and Woodruff, 2017)

	Institutional capacity & Administrative feasibility		(Brown and McGranahan, 2016; Culwick and Bobbins, 2016; Ziervogel et al., 2016b; Collas et al., 2017; Li et al., 2017; Prudencio and Null, 2018)		(Aerts et al., 2014; Chandel et al., 2016; Eisenberg, 2016; Shapiro, 2016; Garsaball and Markov, 2017; Hess and Kelman, 2017; Mavhura et al., 2017; Stults and Woodruff, 2017; Tait and Euston-Brown, 2017)
	Transparency & accountability potential	LE	(Li et al., 2017)		(Steenhof and Sparling, 2011; Aerts et al., 2014; Späth and Rohracher, 2015; Chandel et al., 2016; Shapiro, 2016)
Socio-cultural	Social co-benefits (health, education)		(Beatley, 2011; Tallis et al., 2011; Elmqvist et al., 2013b; Demuzere et al., 2014; Liu et al., 2014; Buckeridge, 2015; Elmqvist et al., 2015; Lamond et al., 2015; Mullaney et al., 2015; Norton et al., 2015; Skougaard Kaspersen et al., 2015; Soderlund and Newman, 2015; Voskamp and Van de Ven, 2015; Beaudoin and Gosselin, 2016; Brown and McGranahan, 2016; Camps-Calvet et al., 2016; Costa et al., 2016; Culwick and Bobbins, 2016; Green et al., 2016; McPhearson et al., 2016; Mguni et al., 2016; Panagopoulos et al., 2016; Stevenson et al., 2016; Collas et al., 2017; Li et al., 2017; Lin et al., 2017; Xie et al., 2017; Zinia and McShane, 2018)	NE	
	Socio-cultural acceptability		(Beatley, 2011; Elmqvist et al., 2015; Beaudoin and Gosselin, 2016; Brown and McGranahan, 2016; Camps-Calvet et al., 2016; McPhearson et al., 2016; Ziervogel et al., 2016b; Collas et al., 2017; Li et al., 2017; Zinia and McShane, 2018)		(Späth and Rohracher, 2015; Bendito and Barrios, 2016; Eisenberg, 2016; Tait and Euston-Brown, 2017)
	Social & regional inclusiveness		(Tallis et al., 2011; Elmqvist et al., 2013b; Buckeridge, 2015; Elmqvist et al., 2015; Beaudoin and Gosselin, 2016; Brown and McGranahan, 2016; Camps-Calvet et al., 2016; Culwick and Bobbins, 2016; McPhearson et al., 2016; Panagopoulos et al., 2016; Stevenson et al., 2016; Ziervogel et al., 2016b; Collas et al., 2017; Li et al., 2017; White et al., 2017b; Prudencio and Null, 2018)		(Parnell, 2015; Shapiro, 2016; Mavhura et al., 2017; Reckien et al., 2017)
	Intergenerational equity		(Elmqvist et al., 2013b; Liu et al., 2014; Elmqvist et al., 2015; Lamond et al., 2015; Skougaard Kaspersen et al., 2015; Voskamp and Van de Ven, 2015; Costa et al., 2016; McPhearson et al., 2016; Mguni et al., 2016; Xie et al., 2017)	NE	
Environmental / ecological	Ecological capacity		(Liu et al., 2014; Lamond et al., 2015; Skougaard Kaspersen et al., 2015; Costa et al., 2016; Mguni et al., 2016; Xie et al., 2017)	NE	
	Adaptive capacity/ resilience		(Beatley, 2011; Elmqvist et al., 2013b, 2015; Voskamp and Van de Ven, 2015; Beaudoin and Gosselin, 2016; Brown and		(Steenhof and Sparling, 2011; Aerts et al., 2014; Bendito and Barrios, 2016)

			McGranahan, 2016; Camps-Calvet et al., 2016; McPhearson et al., 2016; Panagopoulos et al., 2016; Collas et al., 2017; Li et al., 2017; Zinia and McShane, 2018)		
Geophysical	Physical feasibility		(Liu et al., 2014; Lamond et al., 2015; Skougaard Kaspersen et al., 2015; Voskamp and Van de Ven, 2015; Costa et al., 2016; Mguni et al., 2016; Collas et al., 2017; Xie et al., 2017)	NE	
	Land use change enhancement potential		(Tallis et al., 2011; Elmqvist et al., 2013b; Buckeridge, 2015; Culwick and Bobbins, 2016; Panagopoulos et al., 2016; Stevenson et al., 2016; Collas et al., 2017; White et al., 2017b)		(Bendito and Barrios, 2016; Reckien et al., 2017)
	Hazard risk reduction potential		(Nowak et al., 2006; Tallis et al., 2011; Elmqvist et al., 2013b; Buckeridge, 2015; Elmqvist et al., 2015; Soderlund and Newman, 2015; Brown and McGranahan, 2016; Camps-Calvet et al., 2016; Culwick and Bobbins, 2016; McPhearson et al., 2016; Panagopoulos et al., 2016; Stevenson et al., 2016; Ziervogel et al., 2016b; Collas et al., 2017; Li et al., 2017; White et al., 2017b; Zinia and McShane, 2018)		(Steenhof and Sparling, 2011; FEMA, 2014; Bendito and Barrios, 2016; Garsaball and Markov, 2017; Reckien et al., 2017)

4.SM.4.3.4 Feasbility assessment of adaptation options in industrial system transitions

Table 4.SM.21: Feasibility assessment of industrial system transition adaptation option: Intensive industry infrastructure resilience and water management. For methodology, see 4.SM.4.1.

		Intensive industry infrastructure resilience and water management	
	Evidence	Limited	
	Agreement	High	
Economic	Micro-economic viability	NE	
	Macro-economic viability	NE	
	Socio-economic vulnerability reduction potential		
	Employment & productivity enhancement potential	NE	
Technological	Technical resource availability		(Koch and Vögele, 2009; Jahandideh-Tehrani et al., 2014; Murrant et al., 2015; Parkinson and Djilali, 2015)
	Risks mitigation potential		(Jahandideh-Tehrani et al., 2014; Murrant et al., 2015; Parkinson and Djilali, 2015)
Institutional	Political acceptability	LE	(Murrant et al., 2015)
	Legal & regulatory acceptability	NE	
	Institutional capacity & Administrative feasibility	LE	(Eisenack and Stecker, 2012; Murrant et al., 2015)
	Transparency & accountability potential	NE	
Socio-cultural	Social co-benefits (health, education)	NA	
	Socio-cultural acceptability	NE	
	Social & regional inclusiveness	NA	

	Intergenerational equity	NA	
Environmental/ ecological	Ecological capacity		(Jahandideh-Tehrani et al., 2014; Murrant et al., 2015; Parkinson and Djilali, 2015)
	Adaptive capacity/resilience		(Jahandideh-Tehrani et al., 2014; Murrant et al., 2015; Parkinson and Djilali, 2015)
Geophysical	Physical feasibility		(Eisenack and Stecker, 2012; Jahandideh-Tehrani et al., 2014; Murrant et al., 2015; Parkinson and Djilali, 2015)
	Land use change enhancement potential	LE	(Jahandideh-Tehrani et al., 2014; Parkinson and Djilali, 2015)
	Hazard risk reduction potential		(Jahandideh-Tehrani et al., 2014; Murrant et al., 2015; Parkinson and Djilali, 2015)

4.SM.4.3.5 Feasbility assessment of overarching adaptation options

Table 4.SM.22: Feasibility assessment of overarching adaptation options: Disaster risk management; Risk spreading and sharing; Climate services; and Indigenous knowledge. For methodology, see 4.SM.4.1.

		Disaster risk management		Risk spreading and sharing		Climate services			Indigenous knowledge	
	Evidence	Medium		Medium		Medium			Medium	
	Agreement	High		Medium		High			High	
Economic	Micro-economic viability		(IPCC, 2012; Mavhura et al., 2013; Yu and Gillis, 2014; Johnson and Abe, 2015; Mawere and Mubaya, 2015; Archer, 2016; Kull et al., 2016; Rose, 2016; Watanabe et al., 2016)		(Panda et al., 2013; Weinhofer and Busch, 2013; Falco et al., 2014; Thornton and Herrero, 2014; Annan and Schlenker, 2015; Bogale, 2015; García Romero and Molina, 2015; Greatrex et al., 2015; Lashley and Warner, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Nicola, 2015; Akter et al., 2016; Jin et al., 2016; Surminski et al., 2016; Akter et al., 2017; Farzaneh et al., 2017; Glaas et al., 2017; Jensen and Barrett, 2017; Patel et al., 2017; Shively, 2017)		(Vaughan and Dessai, 2014; Snow et al., 2016; Lechthaler and Vinogradova, 2017; Webber, 2017; Ouédraogo et al., 2018)			(Berkes et al., 2000; Nakashima et al., 2012; Leonard et al., 2013; McNamara and Prasad, 2014; Pearce et al., 2015; Mapfumo et al., 2016; Altieri and Nicholls, 2017; Nunn et al., 2017; Ruiz-Mallén et al., 2017; Crate et al., 2017; Ingty, 2017; Kihila, 2017; Magni, 2017)
	Macro-economic viability		(IPCC, 2012; Hinkel et al., 2014; Anacona et al., 2015; Boughedir, 2015;		(Cook and Dowlatabadi, 2011; Falco et al., 2014;		(Brasseur and Gallardo, 2016;			(Berkes et al., 2000; Leonard et al., 2013; Mapfumo et al., 2016;

			Howes et al., 2015; Johnson and Abe, 2015; Archer, 2016; Diaz, 2016; Haeberli et al., 2016; Kull et al., 2016; Rose, 2016; de Leon and Pittock, 2017; Haeberli et al., 2017; Kelman, 2017)		García Romero and Molina, 2015; Joyette et al., 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Wolfrom and Yokoi-Arai, 2015; Surminski et al., 2016; Glaas et al., 2017; Jenkins et al., 2017; Jensen and Barrett, 2017)		Rodrigues et al., 2016)			Ingty, 2017; Magni, 2017; Nunn et al., 2017; Ruiz-Mallén et al., 2017)
	Socio-economic vulnerability reduction potential		(IPCC, 2012; Mavhura et al., 2013; Boeckmann and Rohn, 2014; McNamara and Prasad, 2014; Anacona et al., 2015; Boughedir, 2015; Howes et al., 2015; Johnson and Abe, 2015; Kelman et al., 2015; Mawere and Mubaya, 2015; Archer, 2016; Diaz, 2016; Haeberli et al., 2016; Kull et al., 2016; Muñoz et al., 2016; Rose, 2016; Watanabe et al., 2016; de Leon and Pittock, 2017; Granderson, 2017; Haeberli et al., 2017; Wallace, 2017; Brundiers, 2018; Nahayo et al., 2018)		(Mills, 2007; Panda et al., 2013; Falco et al., 2014; Thornton and Herrero, 2014; Annan and Schlenker, 2015; Bogale, 2015; García Romero and Molina, 2015; Greatrex et al., 2015; Lashley and Warner, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Nicola, 2015; Wolfrom and Yokoi-Arai, 2015; Jin et al., 2016; O'Hare et al., 2016; Surminski et al., 2016; Akter et al., 2017; Farzaneh et al., 2017; Glaas et al., 2017; Hansen et al., 2017; Jensen and Barrett, 2017; Patel et al., 2017; Surminski and Thieken, 2017)		(Kadi et al., 2011; Jancloes et al., 2014; Vaughan and Dessai, 2014; Lobo et al., 2017)			(Berkes and Jolly, 2002; Forbes et al., 2009; Nakashima et al., 2012; Leonard et al., 2013; McNamara and Prasad, 2014; Ford et al., 2014; MacDonald et al., 2015b; Pearce et al., 2015; Harper et al., 2015; Mapfumo et al., 2016; Mistry and Berardi, 2016; Clark et al., 2016; Altieri and Nicholls, 2017; Archer et al., 2017; Magni, 2017; Nunn et al., 2017; Ruiz-Mallén et al., 2017; Russell-Smith et al., 2017; Thornton and Comberti, 2017; Williams et al., 2017; Ingty, 2017; Kihila, 2017)

	Employment & productivity enhancement potential		(Terrier et al., 2011; IPCC, 2012; Mavhura et al., 2013; Yu and Gillis, 2014; Johnson and Abe, 2015; Mawere and Mubaya, 2015; Terrier et al., 2015; Archer, 2016; Haeberli et al., 2016; Kull et al., 2016; Rose, 2016; Haeberli et al., 2017)		(Panda et al., 2013; Falco et al., 2014; Thornton and Herrero, 2014; Bogale, 2015; Greatrex et al., 2015; Lashley and Warner, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Nicola, 2015; Hansen et al., 2017; Jensen and Barrett, 2017)	NE				(Berkes et al., 2000; Nakashima et al., 2012; Leonard et al., 2013; Pearce et al., 2015; Harper et al., 2015; Clark et al., 2016; Altieri and Nicholls, 2017; Archer et al., 2017; Ruiz-Mallén et al., 2017; Russell-Smith et al., 2017; Ingty, 2017; Kihila, 2017; Magni, 2017)
Technological	Technical resource availability		(IPCC, 2012; Mavhura et al., 2013; Boeckmann and Rohn, 2014; McNamara and Prasad, 2014; Yu and Gillis, 2014; Anacona et al., 2015; Boughedir, 2015; Howes et al., 2015; Johnson and Abe, 2015; Mawere and Mubaya, 2015; Allen et al., 2016; Archer, 2016; Diaz, 2016; Haeberli et al., 2016; Kaya et al., 2016; Kull et al., 2016; Muñoz et al., 2016; Haeberli et al., 2017; Wang et al., 2018)		(Falco et al., 2014; García Romero and Molina, 2015; Joyette et al., 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Akter et al., 2016; Surminski et al., 2016; Adiku et al., 2017; Jensen and Barrett, 2017)		(Dinku et al., 2014; Jancloes et al., 2014; Gebru et al., 2015; Weisse et al., 2015; Brasseur and Gallardo, 2016; Cortekar et al., 2016; Singh et al., 2016; Snow et al., 2016; Vaughan et al., 2016; Kihila, 2017)			(Berkes et al., 2000; Ford et al., 2010; Nakashima et al., 2012; Cunsolo Willox et al., 2013; Leonard et al., 2013; Pearce et al., 2015; Johnson et al., 2015; MacDonald et al., 2015a; Sherman et al., 2016; Altieri and Nicholls, 2017; Magni, 2017; Nunn et al., 2017; Russell-Smith et al., 2017; Inamara and Thomas, 2017; Ingty, 2017; Kihila, 2017)
	Risks mitigation potential		(IPCC, 2012; Mavhura et al., 2013; Yu and Gillis, 2014; Boughedir, 2015; Howes et al., 2015; Johnson and Abe, 2015; Kelman et al.,		(Mills, 2007; Cook and Dowlatabadi, 2011; Panda et al., 2013; Weinhofer and Busch, 2013; Falco et al., 2014; Thornton		(Rogers and Tsirkunov, 2010; WMO, 2015)			(Nakashima et al., 2012; McNamara and Prasad, 2014; Mapfumo et al., 2016; Kihila, 2017; Magni, 2017)

			2015; Mawere and Mubaya, 2015; Archer, 2016; Haeberli et al., 2016; Kull et al., 2016; Muñoz et al., 2016; Rose, 2016; Haeberli et al., 2017; Kita, 2017; Wallace, 2017)		and Herrero, 2014; Annan and Schlenker, 2015; Fabian, 2015; García Romero and Molina, 2015; Greatrex et al., 2015; Lashley and Warner, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Nicola, 2015; Wolfrom and Yokoi-Arai, 2015; Jin et al., 2016; Surminski et al., 2016; Farzaneh et al., 2017; Hansen et al., 2017; Jensen and Barrett, 2017; Surminski and Eldridge, 2017; Surminski and Thieken, 2017)					
Institutional	Political acceptability		(Carey, 2005, 2008; IPCC, 2012; Boughedir, 2015; Johnson and Abe, 2015; Archer, 2016; Haeberli et al., 2016; Kull et al., 2016; Muñoz et al., 2016; Granderson, 2017; Kelman, 2017; Kita, 2017; Ruiz-Rivera and Lucatello, 2017; Rosendo et al., 2018)		(García Romero and Molina, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Glaas et al., 2017; Jenkins et al., 2017; Jensen and Barrett, 2017)		(Gebru et al., 2015; Vincent et al., 2015; Cortekar et al., 2016; Singh et al., 2016; Snow et al., 2016; Harjanne, 2017; Webber, 2017)			(Nakashima et al., 2012; Leonard et al., 2013; Ford et al., 2015; Hooli, 2016; Mistry and Berardi, 2016; Fernández-Llamazares et al., 2017; Russell-Smith et al., 2017; Williams et al., 2017; Ingty, 2017; Kihila, 2017; Magni, 2017; Ruiz-Mallén et al., 2017)
	Legal & regulatory acceptability		(IPCC, 2012; Boughedir, 2015; Howes et al., 2015; Johnson and Abe,		(Falco et al., 2014; Thornton and Herrero, 2014; García		(Mantilla et al., 2014; Coulibaly et			(Berkes et al., 2000; Nakashima et al., 2012; Leonard et al.,

			2015; Kelman et al., 2015; Haeberli et al., 2016; Kaya et al., 2016; Kull et al., 2016; Muñoz et al., 2016; van der Keur et al., 2016; de Leon and Pittock, 2017; Haeberli et al., 2017; Kelman, 2017; Kita, 2017; Ruiz-Rivera and Lucatello, 2017; Serrao-Neumann et al., 2017; Wallace, 2017; Rosendo et al., 2018)		Romero and Molina, 2015; Joyette et al., 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Wolfrom and Yokoi-Arai, 2015; Surminski et al., 2016; Adiku et al., 2017; Glaas et al., 2017; Hansen et al., 2017; Jenkins et al., 2017; Jensen and Barrett, 2017)		al., 2015; Lobo et al., 2017)				2013; Hiwasaki et al., 2014; Ford et al., 2015; Hooli, 2016; Ruiz-Mallén et al., 2017; Russell-Smith et al., 2017; Ingty, 2017; Kihila, 2017; Magni, 2017; Mccubbin et al., 2017)
	Institutional capacity & Administrative feasibility		(Carey, 2008; IPCC, 2012; Mavhura et al., 2013; McNamara and Prasad, 2014; Boughedir, 2015; Howes et al., 2015; Johnson and Abe, 2015; Kelman et al., 2015; Mawere and Mubaya, 2015; Archer, 2016; Haeberli et al., 2016; Kull et al., 2016; Muñoz et al., 2016; Rose, 2016; van der Keur et al., 2016; Watanabe et al., 2016; Granderson, 2017; Haeberli et al., 2017; Kelman, 2017; Kita, 2017; Ruiz-Rivera and Lucatello, 2017; Serrao-Neumann et al., 2017; Wallace, 2017; Nahayo et al., 2018; Rosendo et al., 2018)		(Cook and Dowlatabadi, 2011; Weinhofer and Busch, 2013; Falco et al., 2014; Thornton and Herrero, 2014; García Romero and Molina, 2015; Greatrex et al., 2015; Joyette et al., 2015; Lashley and Warner, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Wolfrom and Yokoi-Arai, 2015; Akter et al., 2016; Surminski et al., 2016; Adiku et al., 2017; Glaas et al., 2017; Hansen et al., 2017; Jenkins et al., 2017; Jensen and Barrett, 2017;		(Dinku et al., 2014; Jancloes et al., 2014; Vaughan and Dessai, 2014; Wood et al., 2014; Vincent et al., 2015; Brasseur and Gallardo, 2016; Lourenço et al., 2016; Snow et al., 2016; Trenberth et al., 2016; Vaughan et al., 2016; Harjanne, 2017; Räsänen et al., 2017; Singh et al., 2017)				(Berkes et al., 2000; Nakashima et al., 2012; Hiwasaki et al., 2014, 2015; Oteros-Rozas et al., 2015; Ford et al., 2015; Johnson et al., 2015; Sherman et al., 2016; Mistry and Berardi, 2016; Fernández-Llamazares et al., 2017; Ruiz-Mallén et al., 2017; Russell-Smith et al., 2017; Williams et al., 2017; Granderson, 2017; Kihila, 2017; Magni, 2017)

					Surminski and Eldridge, 2017)					
	Transparency & accountability potential		(Carey, 2005; IPCC, 2012; Howes et al., 2015; Johnson and Abe, 2015; Kaya et al., 2016; Kita, 2017; Ruiz-Rivera and Lucatello, 2017; Rosendo et al., 2018)		(Thornton and Herrero, 2014; García Romero and Molina, 2015; Greatrex et al., 2015; Joyette et al., 2015; Lashley and Warner, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Jin et al., 2016; Adiku et al., 2017; Hansen et al., 2017; Jensen and Barrett, 2017)		(Vaughan and Dessai, 2014; Harjanne, 2017; Hewitson et al., 2017)			(Berkes et al., 2000; Nakashima et al., 2012; Leonard et al., 2013; Green and Minchin, 2014; Hiwasaki et al., 2014; Ford et al., 2015; Johnson et al., 2015; Oteros-Rozas et al., 2015; Mistry and Berardi, 2016; Russell-Smith et al., 2017; Magni, 2017; Rapinski et al., 2018)
Socio-cultural	Social co-benefits (health, education)		(IPCC, 2012; Mavhura et al., 2013; McNamara and Prasad, 2014; Mawere and Mubaya, 2015; Samaddar et al., 2015; Archer, 2016; Haeberli et al., 2016; Kull et al., 2016; Rose, 2016; Watanabe et al., 2016; Brundiers, 2018; Nahayo et al., 2018)		(Panda et al., 2013; Thornton and Herrero, 2014; Greatrex et al., 2015; Lashley and Warner, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Adiku et al., 2017; Glaas et al., 2017; Hansen et al., 2017; Jensen and Barrett, 2017)		(Rogers and Tsirkunov, 2010; Kadi et al., 2011; Hunt et al., 2017)			(Ford, 2012; Leonard et al., 2013; McNamara and Prasad, 2014; Ford et al., 2014; Green and Minchin, 2014; Cunsolo Willox et al., 2015; Durkalec et al., 2015; MacDonald et al., 2015a, 2015b; Harper et al., 2015; Hiwasaki et al., 2015; Mapfumo et al., 2016; Mistry and Berardi, 2016; Hooli, 2016; Magni, 2017; Kihila, 2017)
	Socio-cultural acceptability		(Carey, 2005; IPCC, 2012; Mavhura et al., 2013; McNamara and Prasad, 2014; Anacona et al., 2015; Mawere and		(Bogale, 2015; García Romero and Molina, 2015; Greatrex et al., 2015; Lashley and Warner, 2015;		(Sivakumar et al., 2014; Vincent et al., 2015; Brasseur and Gallardo, 2016; Cortekar et al.,			(Natcher et al., 2007; Ford et al., 2010; Cunsolo Willox et al., 2012; Nakashima et al., 2012; Adger et al.,

			Mubaya, 2015; Samaddar et al., 2015; Archer, 2016; Kaya et al., 2016; Kull et al., 2016; Muñoz et al., 2016; Rose, 2016; van der Keur et al., 2016; Watanabe et al., 2016; de Leon and Pittock, 2017; Granderson, 2017; Kita, 2017; Serrao-Neumann et al., 2017)		Linnerooth-Bayer and Hochrainer-Stigler, 2015; Jin et al., 2016; Adiku et al., 2017; Akter et al., 2017; Farzaneh et al., 2017; Glaas et al., 2017; Hansen et al., 2017; Jensen and Barrett, 2017)		2016; Carr and Onzere, 2017; Singh et al., 2017; Webber and Donner, 2017; Guido et al., 2018)			2013; Leonard et al., 2013; Green and Minchin, 2014; MacDonald et al., 2015a; Hiwasaki et al., 2015; Johnson et al., 2015; Mapfumo et al., 2016; Hooli, 2016; Tschakert et al., 2017; Kihila, 2017; Flynn et al., 2018)
	Social & regional inclusiveness		(Carey, 2005; IPCC, 2012; Mavhura et al., 2013; McNamara and Prasad, 2014; Mawere and Mubaya, 2015; Samaddar et al., 2015; Archer, 2016; Kaya et al., 2016; Kull et al., 2016; Rose, 2016; Watanabe et al., 2016; de Leon and Pittock, 2017; Granderson, 2017; Kita, 2017; Nahayo et al., 2018)		(Falco et al., 2014; Bogale, 2015; García Romero and Molina, 2015; Greatrex et al., 2015; Joyette et al., 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Akter et al., 2016; Jin et al., 2016; Surminski et al., 2016; Farzaneh et al., 2017; Hansen et al., 2017; Jensen and Barrett, 2017; Shively, 2017)		Expert judgement (Sivakumar et al., 2014; Carr and Onzere, 2017; Webber and Donner, 2017)			(Berkes et al., 2000; Nakashima et al., 2012; Adger et al., 2013; Leonard et al., 2013; Green and Minchin, 2014; McNamara and Prasad, 2014; MacDonald et al., 2015a; Mistry and Berardi, 2016; Hooli, 2016; Nunn et al., 2017; Ruiz-Mallén et al., 2017; Ingty, 2017; Magni, 2017; Flynn et al., 2018)
	Intergenerational equity		(IPCC, 2012; Mavhura et al., 2013; McNamara and Prasad, 2014; Mawere and Mubaya, 2015; Archer, 2016; Kaya et al., 2016; Granderson, 2017; Nahayo et al., 2018)		(Linnerooth-Bayer and Hochrainer-Stigler, 2015; O'Hare et al., 2016; Jensen and Barrett, 2017)	NA				(Berkes et al., 2000; Ford et al., 2010; Nakashima et al., 2012; Leonard et al., 2013; McNamara and Prasad, 2014; Hiwasaki et al., 2015; MacDonald et al., 2015a; Tschakert et al., 2017; Kihila,

										2017; Magni, 2017; Nunn et al., 2017)
Environmental/ ecological	Ecological capacity		(IPCC, 2012; Mavhura et al., 2013; McNamara and Prasad, 2014; Kelman et al., 2015; Mawere and Mubaya, 2015; Archer, 2016; Haeberli et al., 2016; Kull et al., 2016)	NA		NA				(Berkes et al., 2000; Forbes et al., 2009; Leonard et al., 2013; McNamara and Prasad, 2014; MacDonald et al., 2015b; Altieri and Nicholls, 2017; Russell-Smith et al., 2017; Tschakert et al., 2017; Ingty, 2017; Kihila, 2017; Magni, 2017; Nunn et al., 2017)
	Adaptive capacity/ resilience		(IPCC, 2012; Mavhura et al., 2013; Boeckmann and Rohn, 2014; McNamara and Prasad, 2014; Yu and Gillis, 2014; Anacona et al., 2015; Howes et al., 2015; Johnson and Abe, 2015; Kelman et al., 2015; Mawere and Mubaya, 2015; Archer, 2016; Haeberli et al., 2016; Kaya et al., 2016; Kull et al., 2016; Muñoz et al., 2016; Rose, 2016; Watanabe et al., 2016; de Leon and Pittock, 2017; Granderson, 2017; Haeberli et al., 2017; Kelman, 2017; Wallace, 2017; Brundiers, 2018)		(Mills, 2007; Panda et al., 2013; Falco et al., 2014; Thornton and Herrero, 2014; Bogale, 2015; García Romero and Molina, 2015; Greatrex et al., 2015; Lashley and Warner, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Nicola, 2015; Wolfrom and Yokoi-Arai, 2015; Jin et al., 2016; O'Hare et al., 2016; Surminski et al., 2016; Adiku et al., 2017; Hansen et al., 2017; Jenkins et al., 2017; Jensen and Barrett, 2017)		(Jones et al., 2016b; Lourenço et al., 2016; Singh et al., 2017; White et al., 2017a)			(Berkes et al., 2000; Forbes et al., 2009; Ford et al., 2010; Nakashima et al., 2012; Leonard et al., 2013; McNamara and Prasad, 2014; Pearce et al., 2015; Hiwasaki et al., 2015; Savo et al., 2016; Sherman et al., 2016; Mapfumo et al., 2016; Altieri and Nicholls, 2017; Nunn et al., 2017; Russell-Smith et al., 2017; Kihila, 2017; Magni, 2017; Mccubbin et al., 2017)

Geophysical	Physical feasibility		(IPCC, 2012; McNamara and Prasad, 2014; Yu and Gillis, 2014; Anacona et al., 2015; Boughedir, 2015; Kelman et al., 2015; Archer, 2016; Diaz, 2016; Haeberli et al., 2016; Kull et al., 2016; Muñoz et al., 2016; Haeberli et al., 2017)	NA			(Sivakumar et al., 2014; Snow et al., 2016; White et al., 2017a)		NE	
	Land use change enhancement potential	NA			(Panda et al., 2013; Annan and Schlenker, 2015; Greatrex et al., 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Hansen et al., 2017; Jenkins et al., 2017; Jensen and Barrett, 2017)	NA				(Berkes et al., 2000; Nakashima et al., 2012; Leonard et al., 2013; McNamara and Prasad, 2014; Pearce et al., 2015; Hiwasaki et al., 2015; MacDonald et al., 2015b; Reyes-García et al., 2016; Mistry and Berardi, 2016; Altieri and Nicholls, 2017; Kihila, 2017; Magni, 2017)
	Hazard risk reduction potential		(Carey, 2005, 2008; IPCC, 2012; Mavhura et al., 2013; Boeckmann and Rohn, 2014; McNamara and Prasad, 2014; Yu and Gillis, 2014; Anacona et al., 2015; Howes et al., 2015; Johnson and Abe, 2015; Kelman et al., 2015; Mawere and Mubaya, 2015; Boughedir, 2015;		(Mills, 2007; Falco et al., 2014; Annan and Schlenker, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Wolfrom and Yokoi-Arai, 2015; García Romero and Molina, 2015; Greatrex et al., 2015; Lashley and Warner, 2015; Surminski et al., 2016; Jin et al.,		(Rogers and Tsirkunov, 2010; Lourenço et al., 2016; Singh et al., 2017)			(Berkes et al., 2000; Nakashima et al., 2012; Leonard et al., 2013; Mistry and Berardi, 2016; Altieri and Nicholls, 2017; Magni, 2017; Nunn et al., 2017; Russell-Smith et al., 2017)

			Archer, 2016; Kaya et al., 2016; Kull et al., 2016; Muñoz et al., 2016; Rose, 2016; Watanabe et al., 2016; Diaz, 2016; Haeberli et al., 2016, 2017; Kelman, 2017; Kita, 2017; Milner et al., 2017; Wallace, 2017; Brundiers, 2018)		2016; Patel et al., 2017; Surminski and Eldridge, 2017; Surminski and Thieken, 2017; Farzaneh et al., 2017; Glaas et al., 2017; Hansen et al., 2017; Jensen and Barrett, 2017)					

Table 4.SM.23: Feasibility assessment of overarching adaptation options: Education and learning; Population health and health system adaptation; Social safety nets; and Human Migration. For methodology, see 4.SM.4.1.

		Education and learning		Population health and health system adaptation		Social safety nets		Human migration	
	Evidence	Medium		Medium		Medium		Medium	
	Agreement	High		High		Medium		Low	
Economic	Micro-economic viability		(Rumore et al., 2016; Lutz and Muttarak, 2017)		(Toloo et al., 2013; Burton et al., 2014; Hoy et al., 2014; Paterson et al., 2014; Smith et al., 2014a; Confalonieri et al., 2015; Araos et al., 2016a; Hess and Ebi, 2016; Ebi and del Barrio, 2017; Gilfillan et al., 2017; Paavola, 2017)		(Shiferaw et al., 2014; Devereux et al., 2015)		(Birk and Rasmussen, 2014; Betzold, 2015; Ionesco et al., 2016; Musah-Surugu et al., 2018)
	Macro-economic viability		(Hoffmann and Muttarak, 2017; Lutz and Muttarak, 2017)		(Ebi et al., 2004; Hess et al., 2012; Hosking and Campbell-Lendrum, 2012; Bowen et al., 2013; Lesnikowski et al., 2013; Toloo et al., 2013; Hoy et al., 2014; Smith et al., 2014a; Austin et al., 2015; Watts et al., 2015; WHO, 2015; Araos et al., 2016a; Hess and Ebi, 2016; Paz et al., 2016; Ebi and del Barrio, 2017; Gilfillan et al., 2017; Nitschke et al., 2017; Paavola, 2017)		(Devereux et al., 2015)		(Grecequet et al., 2017; Hino et al., 2017)
	Socio-economic vulnerability reduction potential		(Frankenberg et al., 2013; K.C., 2013; Striessnig et al., 2013; van der Land and Hummel, 2013; Muttarak and Lutz, 2014; Rumore et al., 2016; Hoffmann and Muttarak, 2017; Lutz and Muttarak, 2017)		(Ebi et al., 2004; Hess et al., 2012; Hosking and Campbell-Lendrum, 2012; Bowen et al., 2013; Panic and Ford, 2013; Toloo et al., 2013; Boeckmann and Rohn, 2014; Smith et al., 2014a; Austin et al., 2015; Confalonieri et al., 2015; Watts et al., 2015; WHO, 2015; Araos et al., 2016a; Benmarhnia et al., 2016; Ebi et al., 2016; Hess and Ebi, 2016; Paz et al., 2016; Ebi and del Barrio, 2017; Ebi and Hess, 2017; Gilfillan		(Davies et al., 2013; Weldegebriel and Prowse, 2013; Berhane et al., 2014; Eakin et al., 2014; Leichenko and Silva, 2014; Devereux, 2016; Lemos et al., 2016; Godfrey-Wood and Flower, 2017; Schwan and Yu, 2017)		(Birk and Rasmussen, 2014; Adger et al., 2015; Betzold, 2015; Grecequet et al., 2017; Melde et al., 2017; World Bank, 2017)

					et al., 2017; Nitschke et al., 2017; Paavola, 2017; Sen et al., 2017)				
	Employment & productivity enhancement potential		(van der Land and Hummel, 2013; Muttarak and Lutz, 2014; Lutz and Muttarak, 2017)		(Bowen et al., 2013; Toloo et al., 2013; Burton et al., 2014; Hoy et al., 2014; Smith et al., 2014a; Benmarhnia et al., 2016; Paz et al., 2016; Gilfillan et al., 2017; Nitschke et al., 2017)		(Davies et al., 2013; Berhane et al., 2014; Shiferaw et al., 2014)	NA	
Technological	Technical resource availability		(Chaudhury et al., 2013; Baird et al., 2014; Cloutier et al., 2015; Rumore et al., 2016)		(Hess et al., 2012; Bowen et al., 2013; Lesnikowski et al., 2013; Panic and Ford, 2013; Toloo et al., 2013; Burton et al., 2014; Hoy et al., 2014; Paterson et al., 2014; Rumsey et al., 2014; Smith et al., 2014a; Austin et al., 2015; Confalonieri et al., 2015; WHO, 2015; Araos et al., 2016a; Benmarhnia et al., 2016; Ebi et al., 2016; Hess and Ebi, 2016; Paz et al., 2016; Ebi and del Barrio, 2017; Ebi and Hess, 2017; Nitschke et al., 2017; Paavola, 2017; Sheehan et al., 2017)		(Kim and Yoo, 2015)		(Birk and Rasmussen, 2014; Gemenne and Blocher, 2017; Melde et al., 2017)
	Risks mitigation potential		(Wamsler et al., 2012; Frankenberg et al., 2013; K.C., 2013; Striessnig et al., 2013; van der Land and Hummel, 2013; Muttarak and Lutz, 2014; Harteveld and Suarez, 2015; Lutz and Muttarak, 2017)		Benmarhnia et al. 2016; Boeckmann and Rohn 2014; Hess and Ebi 2016; Nitschke et al. 2016; Paterson et al. 2014; Ebi and del Barrio 2017; Ebi and Hess 2017)		(Davies et al., 2013; Rurinda et al., 2014; Shiferaw et al., 2014; Devereux, 2016)		(Adger et al., 2015; Grecequet et al., 2017) (Tadgell et al., 2017)
Institutional	Political acceptability	LE	(Butler et al., 2015, 2016b; Cloutier et al., 2015)		(Hess et al., 2012; Bowen et al., 2013; Lesnikowski et al., 2013; Burton et al., 2014; Hoy et al., 2014; Rumsey et al., 2014; Smith et al., 2014a; Austin et al., 2015; Confalonieri et al., 2015; Watts et		(Porter et al., 2014; Rurinda et al., 2014; Wilhite et al., 2014; Brooks, 2015; Kim and Yoo, 2015; Ravi and		(Kothari, 2014; Methmann and Oels, 2015; Brzoska and Fröhlich, 2016; Gemenne and Blocher, 2017; Grecequet et al., 2017; Yamamoto et al.,

					al., 2015; WHO, 2015; Araos et al., 2016a; Benmarhnia et al., 2016; Ebi et al., 2016; Hess and Ebi, 2016; Ebi and del Barrio, 2017; Gilfillan et al., 2017; Green et al., 2017; Sen et al., 2017)		Engler, 2015; Schwan and Yu, 2017)		2017; Matthews and Potts, 2018)
	Legal & regulatory acceptability	NE			(Hess et al., 2012; Lesnikowski et al., 2013; Burton et al., 2014; Austin et al., 2015; Watts et al., 2015; WHO, 2015; Araos et al., 2016a; Ebi et al., 2016; Hess and Ebi, 2016; Paz et al., 2016; Ebi and del Barrio, 2017; Gilfillan et al., 2017; Shimamoto and McCormick, 2017)		(Rurinda et al., 2014; Devereux et al., 2015)		(Wilmsen and Webber, 2015; Tadgell et al., 2017; Ahmed, 2018; World Bank, 2018)
	Institutional capacity & Administrative feasibility		(Wamsler et al., 2012; Chaudhury et al., 2013; Odemerho, 2014; Cloutier et al., 2015; Butler et al., 2016b, 2016a)		(Ebi et al., 2004; Hess et al., 2012; Bowen et al., 2013; Lesnikowski et al., 2013; Panic and Ford, 2013; Toloo et al., 2013; Burton et al., 2014; Hoy et al., 2014; Nigatu et al., 2014; Paterson et al., 2014; Rumsey et al., 2014; Austin et al., 2015; Confalonieri et al., 2015; Watts et al., 2015; WHO, 2015; Araos et al., 2016a; Benmarhnia et al., 2016; Ebi et al., 2016; Hess and Ebi, 2016; Paz et al., 2016; Xiao et al., 2016; Ebi and del Barrio, 2017; Ebi and Hess, 2017; Gilfillan et al., 2017; Green et al., 2017; Nitschke et al., 2017; Sheehan et al., 2017; Shimamoto and McCormick, 2017)		(Davies et al., 2013; Rurinda et al., 2014; Wilhite et al., 2014; Ravi and Engler, 2015; Schwan and Yu, 2017)		(Betzold, 2015; Methmann and Oels, 2015; Brzoska and Fröhlich, 2016; Gemenne and Blocher, 2017; Grecequet et al., 2017; Yamamoto et al., 2017; Matthews and Potts, 2018; Thomas and Benjamin, 2018)
	Transparency & accountability potential		(Chaudhury et al., 2013; Odemerho, 2014; Ensor and Harvey, 2015; Harteveld and Suarez, 2015; Chung Tiam Fook, 2017; Myers et al., 2017; Flynn et al., 2018)		(Hess et al., 2012; Hosking and Campbell-Lendrum, 2012; Lesnikowski et al., 2013; Panic and Ford, 2013; Hoy et al., 2014; Boeckmann and Rohn, 2014; Austin et al., 2015; Araos et al., 2016a; Benmarhnia et al., 2016; Ebi et al.,		(Masud-All-Kamal and Saha, 2014; Devereux et al., 2015; Masiero, 2015; Ravi and Engler, 2015; Schwan and Yu, 2017)		(Methmann and Oels, 2015; Brzoska and Fröhlich, 2016; Tadgell et al., 2017)

					2016; Sheehan et al., 2017; Ebi and del Barrio, 2017; Ebi and Hess, 2017; Gilfillan et al., 2017)				
Socio-cultural	Social co-benefits (health, education)		(Wamsler et al., 2012; Frankenberg et al., 2013; K.C., 2013; van der Land and Hummel, 2013; Muttarak and Lutz, 2014; Chung Tiam Fook, 2017; Hoffmann and Muttarak, 2017; Lutz and Muttarak, 2017)		(Bowen et al., 2013; Hoy et al., 2014; Smith et al., 2014a; Austin et al., 2015; Confalonieri et al., 2015; Watts et al., 2015; Ebi et al., 2016; Hess and Ebi, 2016; Paz et al., 2016; Ebi and del Barrio, 2017; Paavola, 2017; Shimamoto and McCormick, 2017)		(Berhane et al., 2014; Leichenko and Silva, 2014; Rurinda et al., 2014; Shiferaw et al., 2014; Verguet et al., 2015; Devereux, 2016; Lemos et al., 2016)		(Kothari, 2014; Bettini et al., 2016; Gioli et al., 2016; Bhagat, 2017; Melde et al., 2017; Schwan and Yu, 2017; World Bank, 2018)
	Socio-cultural acceptability		(Chaudhury et al., 2013; Sharma et al., 2013; Demuzere et al., 2014; Odemerho, 2014; Ensor and Harvey, 2015; Butler et al., 2016a; Myers et al., 2017; Flynn et al., 2018)		(Hess et al., 2012; Bowen et al., 2013; Toloo et al., 2013; Hoy et al., 2014; Smith et al., 2014a; Confalonieri et al., 2015; Watts et al., 2015; WHO, 2015; Ebi et al., 2016; Hess and Ebi, 2016; Paz et al., 2016; Ebi and del Barrio, 2017; Nitschke et al., 2017; Sen et al., 2017)	LE	(Rurinda et al., 2014; Wilhite et al., 2014)		(Martin et al., 2014; Brzoska and Fröhlich, 2016; Jha et al., 2017; Kelman et al., 2017; Huntington et al., 2018)
	Social & regional inclusiveness		(Wamsler et al., 2012; Muttarak and Lutz, 2014; Suarez et al., 2014; Ensor and Harvey, 2015; Ford et al., 2016, 2018)		(Hosking and Campbell-Lendrum, 2012; Bowen et al., 2013; Panic and Ford, 2013; Toloo et al., 2013; Burton et al., 2014; Hoy et al., 2014; Smith et al., 2014a; Confalonieri et al., 2015; Watts et al., 2015; WHO, 2015; Benmarhnia et al., 2016; Ebi et al., 2016; Hess and Ebi, 2016; Paz et al., 2016; Ebi and del Barrio, 2017; Paavola, 2017; Sen et al., 2017)	NA			(Kothari, 2014; Kelman, 2015; Schwan and Yu, 2017; Matthews and Potts, 2018; World Bank, 2018)
	Intergenerational equity	LE	(Striessnig et al., 2013)		(Ebi et al., 2004; Confalonieri et al., 2015; Benmarhnia et al., 2016; Ebi and del Barrio, 2017; Paavola, 2017)	NA			(Wilmsen and Webber, 2015)
Environmenta	Ecological capacity	NA		NA		NA			(Niven and Bardsley, 2013; Birk and Rasmussen, 2014)
	Adaptive capacity/resilience		(K.C., 2013; Sharma et al., 2013; Striessnig et al., 2013; Frankenberg et al., 2013;		(Hess et al., 2012; Toloo et al., 2013; Smith et al., 2014a; Confalonieri et al., 2015; Watts et al., 2015; WHO,		(Davies et al., 2013; Weldegebriel and Prowse, 2013; Eakin et		(Birk and Rasmussen, 2014; Adger et al., 2015; Grecequet et al., 2017;

			Baird et al., 2014; Lutz et al., 2014; Muttarak and Lutz, 2014; Suarez et al., 2014; Tschakert et al., 2014; Butler and Adamowski, 2015; Oteros-Rozas et al., 2015; Pearce et al., 2015; Ensor and Harvey, 2015; Janif et al., 2016; Butler et al., 2016b; Star et al., 2016; Vinke-de Kruijf and Pahl-Wostl, 2016; Butler et al., 2016a; Harvey et al., 2017; Hoffmann and Muttarak, 2017; Lutz and Muttarak, 2017; Myers et al., 2017; Chung Tiam Fook, 2017; Cochrane et al., 2017; Flynn et al., 2018; Ford et al., 2018)		2015; Benmarhnia et al., 2016; Hess and Ebi, 2016; Paz et al., 2016; Ebi and del Barrio, 2017; Nitschke et al., 2017; Paavola, 2017; Sen et al., 2017)		al., 2014; Rurinda et al., 2014; Shiferaw et al., 2014; Lemos et al., 2016; Schwan and Yu, 2017)		Melde et al., 2017; Tadgell et al., 2017; World Bank, 2018)
Geophysical	Physical feasibility	NA		NA		NA			(Niven and Bardsley, 2013; Hino et al., 2017; Matthews and Potts, 2018)
	Land use change enhancement potential	NA		NA		NA		LE	(Matthews and Potts, 2018)
	Hazard risk reduction potential		(Wamsler et al., 2012; Frankenberg et al., 2013; K.C., 2013; Striessnig et al., 2013; Muttarak and Lutz, 2014; Suarez et al., 2014; Harteveld and Suarez, 2015; Hoffmann and Muttarak, 2017; Lutz and Muttarak, 2017)	NA			(Jones et al., 2010; Davies et al., 2013)		(Birk and Rasmussen, 2014; Cattaneo and Peri, 2016; Grecequet et al., 2017; Tadgell et al., 2017; Crnčević and Orlović Lovren, 2018; World Bank, 2018)

4.SM.5 Adaptation and mitigation synergies and trade-offs as discussed in Section 4.5.4

Mitigation options may affect the feasibility of adaptation options, and the other way around. Table 4.SM.24 provides examples of possible positive impacts (synergies) and negative impacts (trade-offs) of mitigation options for adaptation. Table 4.SM.251 lists examples of synergies and trade-offs of adaptation options for mitigation.

4.SM.5.1 Mitigation options with adaptation synergies and trade-offs

Table 4.SM.24: Mitigation options with adaptation synergies and trade-offs identified

System	Mitigation option	Synergies	Trade-offs
Energy system transitions	Wind energy (on-shore & off-shore)	Resilience can be increased by wind, solar and bioenergy due to distributed grids (Parkinson and Djilali, 2015), given that energy security standards are in place (Almeida Prado et al., 2016). The use of residential batteries can increase resiliency, especially after extreme weather events (Qazi and Young Jr., 2014; Liu et al., 2017). A shift from coal-generated to natural gas-generated electricity could decrease water consumption (DeNooyer et al., 2016).	Renewable energy infrastructure that does not follow security standards can increase vulnerability (Ley, 2017).
	Solar PV		
	Bioenergy		
	Electricity storage		
	Power sector CCS	NE	Some renewable energy technologies, carbon dioxide capture and storage (CCS), and concentrating solar power (CSP) technologies have substantial water demand associated with their operation (Fricko et al., 2016). In particular, lower power plant efficiency due to CCS increases the vulnerability to water constraints in most regions (McCollum et al., 2013; van Vliet et al., 2016)
	Nuclear energy	Increased safety and protection standards can improve the climate risk profiles (Schneider et al., 2017).	Increased safety and protection standards will increase costs making some electricity systems less reliable (Jacobson and Delucchi, 2009; Lovins et al., 2018).
Land & ecosystem transitions	Reduced food wastage & efficient food production	Reducing food loss and waste can decrease pressure of deforestation (FAO, 2013a), pressure on land use for agriculture (Foley et al., 2011; Hiç et al., 2016), and provide long-term food security (Bajželj et al., 2014).	NA
	Dietary shifts	Shift from animal- to plant-related diets can significantly decrease land use and biodiversity loss due to a decrease in pressure on land use by livestock production (Newbold et al., 2015; Ramankutty et al., 2018;	Shift from animal- to plant-related diets will require improvement of mixed crop-livestock systems, which are more difficult to manage well and need and higher capital to be

		Sparovek et al., 2018) along with health benefits (Tilman and Clark, 2014; Westhoek et al., 2014; Hallström et al., 2017; Song et al., 2017).	established (Ramankutty et al., 2018)
	Sustainable intensification of agriculture	Agroforestry practices increase soil carbon stocks and above-ground biomass as well as diversify incomes, reducing financial risk, and provide shade for protection from rising temperatures (Harvey et al., 2014). Agroforestry can sustain or increase food production in some systems, increasing farmers' resilience to climate change (Jones et al., 2012). Mixed agroforestry systems may simultaneously meet the water, food, energy and income needs of densely populated rural and peri-urban areas (van Noordwijk et al., 2016).	Sustainable intensification can increase offsite impacts from fertiliser, herbicide and pesticide use (Stevens and Quinton 2009), increase costs and increase climate risk. No-tillage without pairing with other agronomic practices can reduce crop yields. No till agriculture can reduce GHG emissions but increase pesticide concentrations (Stevens and Quinton, 2009) Adaptation gains made through improved irrigation efficiency can be undermined by shifts to water-intensive crops for mitigation (e.g. shifting to bioenergy crops) (Chaturvedi et al., 2015) Conservation agriculture agricultural reduces yields 3–5 years after adoption, but enhances productivity and carbon sequestration over longer periods (Harvey et al., 2014). Agroforestry can, in some dry environments, increase competition with crops and pastures decreasing productivity and reduce catchment water yield (Schrobback et al., 2011). Fast-growing tree monocultures or biofuel crops may enhance carbon stocks but reduce downstream water availability and decrease availability of agricultural land (Harvey et al., 2014). Agricultural intensification that improves crop productivity can increase incomes but undermine local livelihoods and wellbeing as seen in shifts to intensified sugarcane production in Ethiopia or more intensive land use in Southeast Asia (Liao and Brown, 2018).
	Ecosystem restoration	Sustainable water management – restored/healthy ecosystems provide water storage, and filtration services (Jones et al., 2012). Restoration of mangroves and coastal wetlands to sequester (blue) carbon increases carbon sinks, reduces coastal erosion, and protects from storm surges and otherwise mitigates impacts of sea level rise and	A focus on mitigation, e.g. through REDD+, can result in conservation-priority sites with lower carbon densities to end up without REDD+ protection (Phelps et al., 2012; Murray et al., 2015; Reside et al., 2017a; Turnhout et al., 2017). Potential conflict with biodiversity goals in habitat restoration

		extreme weather along the coast line (Alongi, 2008; Siikamäki et al., 2012; Romañach et al., 2018). Blue biofuels do not compete for land, water and are not global food staples (posing less of a food security issue). Most farms do not use fertilizer and could even remove excess nutrients, decreasing eutrophication (Turner et al., 2009; Duarte et al., 2013). Stabilization and support of fisheries can add value to marine biodiversity (Turner et al., 2009). Carbon offset funds provide opportunities for protection and restoration of native ecosystems, with corresponding gains for biodiversity and reductions in carbon (Reside et al., 2017). Coupled with biodiversity and conservation interventions, ecosystem restoration and avoided deforestation can complement habitat provision (Felton et al., 2016). Forests (through REDD+) can support economies dependent on climate-sensitive sectors including agriculture, fisheries, and energy (Somorin et al., 2016; Few et al., 2017). REDD+ has the potential to promote sustainable development activities through the cash-flow from donors/international funds to local forest stakeholders (West, 2016) Tropical reforestation for climate change mitigation can help to protect rural economies from impacts of climate variation, reduce impacts of climatic variation on water cycle and associated human uses, reduce local impacts of extreme weather events and reduce climate impacts on biodiversity (Locatelli et al., 2015a).	and forest production efforts (Felton et al., 2016) Some projects world-wide do not target REDD+ projects on adaptation or resilience, nor local contexts, in some cases leaving negative livelihoods impacts (McElwee et al., 2016; Few et al., 2017). In some cases, there is a perception of the inability to reconcile development and environmental interests (Pham et al., 2017). Local benefits, especially for indigenous communities, will only be accrued if land tenure is respected and legally protected, which is not often the case for Indigenous communities (Brugnach et al., 2017).
	Novel technologies	Breeding animals with lower emissions per unit of dry matter intake can reduce GHG emissions; when integrated within broader breeding programmes, can offer synergies with breeding for improved adaptation to local conditions (Pickering et al., 2015; Nguyen et al., 2016)	May have consumer health concerns that need evaluation and addressing (Barrows et al., 2014; Fraser et al., 2016).

Urban & infrastructure system transitions	Land-use & urban planning	Potential for synergies in urban planning at policy, organizational, and practical levels (e.g. urban regeneration, retrofitting, urban greening) (Landauer et al., 2015). Spatial planning can enhance adaptation, mitigation, and sustainable development (Hurlimann and March, 2012; Davidse et al., 2015; King et al., 2016; Francesch-Huidobro et al., 2017). Through the use of integrated approaches there is potential synergy in land use planning (e.g. maintenance of urban forests, urban greening) (Newman et al., 2017). Urban densification to reduce emissions can go along with regenerative qualities for green spaces, reduced urban heat island and flooding impacts by employing biophilic urbanism design (Beatley, 2011; Newman et al., 2017).	Potential conflicts including urban densification to reduce emissions which can intensify heat island effect and increase surface run-off, and may compete with a desire to expand green space, restore local ecosystems, (Landauer et al., 2015; Di Gregorio et al., 2017b; Endo et al., 2017; Ürge-Vorsatz et al., 2018) though demonstrations of biophilic urbanism show this can be managed (Beatley, 2011; Newman et al., 2017). In water-scarce regions, there may be trade-offs between mitigation measures that require water – such as localized cooling – and the population's water needs (Georgescu et al., 2015).
	Sustainable and resilient transport systems	Cities can re-urbanise in ways that promote transport sector adaptation and mitigation (Newman et al., 2017; Salvo et al., 2017; Gota et al., 2018). 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). Non-motorized transport use is associated with lower emissions and better public health in cities. Urbanisation and improved access to basic services correlate with lower short-term morbidity (STM), such as fever, cough and diarrhea (Ahmad et al., 2017). Promoting energy-efficient mobility systems, for instance by a 10% increase in bicycling, could lower chronic conditions like diabetes and cardio-vascular diseases for 0.3 million people while also abating emissions. (Ahmad et al., 2017).	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 benefits of energy efficiency, may provide a notable exception to the adaptive advantages of urban density (Mitlin and Satterthwaite, 2013; Lilford et al., 2017) unless new approaches using leapfrog technology are used to upgrade slums in situ (Teferi and Newman, 2017).
	Sharing schemes in transportation	Greater use of sharing schemes can make transport out of vulnerable areas more equitable and ordered (Gomez et al., 2015; Ambrosino et al., 2016; Kent and Dowling, 2016).	Highly ICT dependent sharing schemes may not be resilient during disasters, but this can be managed via local shared

			mobility systems related to local social capital (Mathbor, 2007; Bhakta Bhandari, 2014; McCloud et al., 2014).
	Public transport	Greater use of public transport enables more mass exit strategies from disasters (Wolshon et al., 2013).	Highly ICT dependent public transport may not be resilient during disasters but this can be managed via local shared mobility systems related to local social capital (Mathbor, 2007; Bhakta Bhandari, 2014; McCloud et al., 2014).
	Smart grids	Greater resiliency in electricity due to system feedback to damaged areas and other grid enhancements due to more localised data (Blaabjerg et al., 2004; IRENA, 2013; IEA, 2017c; Majzoobi and Khodaei, 2017).	NA
	Efficient appliances	Energy efficiency appliances (including lighting and ICT) reduce energy consumption and improve grid reliability (Chaturvedi and Shukla, 2014). They can provide demand response to absorb variation in the electricity supply due to disruption. In addition, when coupled with PV and storage, efficient appliances can secure energy supply when energy network are down due to storm, hurricane and other climate induced events.	NA
	Low/zero-energy buildings	Building codes not only improve energy efficiency through insulation and air-tightness in buildings, but also make buildings more capable of maintaining indoor temperature during heatwave or power losses, shelter people for heat waves and provide structural capability to withstand extreme weather and flooding (Houghton, 2011; King et al., 2016). Other examples of synergies are green roofs that provide both insulation, cooling and rain water harvesting (Razzaghmanesh et al., 2016).	NE
Industrial system transitions	Energy efficiency	Reduced competition for resources (Hennessey et al., 2017)	Water -energy tradeoffs exist in the production process adjustment, which is conventionally promoted as a key energy-saving measure in iron and steel industry (Wang et al., 2017a).
	Bio-based & circularity	Reduced competition for resources (Hennessey et al., 2017) Biomass production for industry, if well managed, can diversify local livelihoods, enhance incomes and strengthen local institutions (Locatelli et al., 2015a).	NE
	Electrification & hydrogen	NA	Greater reliance on variable and weather-dependent sources of electricity (Philibert, 2017)
	Industrial CCUS	NA	Cooling requirements for CO_2 capture put pressure on adaptation (Magneschi et al., 2017)
Carbon dioxide	Bioenergy with CCS	Bioenergy if well managed can diversify local livelihoods, enhance incomes and strengthen local institutions (Locatelli et al., 2015a).	Bioenergy plantations can decrease food security, compete for land and provide short-term benefits for only a few stakeholders

removal	(BECCS)	Combining BECCS with soil carbon management, agroforestry and afforestation can remove CO_2, while limiting adverse impacts on water, food and biodiversity (Burns and Nicholson, 2017; Stoy et al., 2018).	(Locatelli et al., 2015b).
	Afforestation & reforestation	Reforestation connecting fragmented forests reduces exposure to forest edge disturbances (Pütz et al., 2014). Reforestation and coastal restoration are associated with improved water filtration, ground water recharge and flood control (Ellison et al., 2017; Griscom et al., 2017) Reduce flooding through decreased peak river flow, improved water quality and groundwater recharge (Berry et al., 2015) Increase diversity and habitat availability (when properly managed) (Berry et al., 2015) Tree planting led to more resilient livestock by providing shade and shelter (Hayman et al., 2012) Forestry if well managed can diversify local livelihoods, enhance incomes and strengthen local institutions (Locatelli et al., 2015b) Afforestation of degraded areas can produce large synergies between mitigation and adaptation through their impact on farmer livelihoods (Rahn et al., 2014).	Water - increase water demand reducing catchment yield (Berry et al 2014) Biodiversity - species and habitat loss due to monocultures, chemical inputs or forest management (Berry et al., 2015) Loss of agricultural land (Berry et al., 2015) Forest plantations can decrease food security, compete for land and provide short-term benefits for only a few stakeholders (Locatelli et al., 2015b). Local benefits, especially for indigenous communities, will only be accrued if land tenure is respected and legally protected, which is not often the case for Indigenous communities (Brugnach et al., 2017).
	Soil carbon sequestration & biochar	With agroforestry, CO_2 is sequestered in trees and soils additionally planted, while tree products provide livelihood to communities (Verchot et al., 2007; Nair et al., 2009; Branca et al., 2013; Lasco et al., 2014; Mbow et al., 2014a; Smith et al., 2014b) Soil organic carbon may foster crop resilience to climate change (Aguilera et al., 2013). Biochar application to soil sequesters CO_2 and at the same time increases crop productivity by up to 10% (Jeffery et al., 2011) and can improve the soil's water balance (Bamminger et al., 2016).	Biochar amendments lead to plant growth and thus, may down-regulate plant defense genes increasing the vulnerability against insects, pathogens, and drought (Viger et al., 2015).
	Enhanced weathering	NE	Potential adverse health effects because of air particles (Taylor et al., 2016)

4.SM.5.2 Adaptation options with mitigation synergies and trade-offs

Table 4.SM.25: Adaptation options with mitigation synergies and trade-offs identified

System	Adaptation option	Synergies	Trade-offs
Energy system transitions	Power infrastructure, including water	Some adaptation options can help improve system efficiency and reliability (Cortekar and Groth, 2015; van Vliet et al., 2016) Synergies with Sustainable Development Goals, poverty, and well being (Dagnachew et al., 2018; Fuso Nerini et al., 2018; Gi et al., 2018).	A shift from open-loop to closed-loop cooling technologies could decrease withdrawals, with the trade-off of increasing water consumption for power generation (DeNooyer et al., 2016)
Land & ecosystem transitions	Conservation agriculture	Agro-ecological practices can reduce farm-scale carbon footprint significantly (Rakotovao et al., 2017). Practices such as improved soil conservation practices in coffee agroforestry systems and improved slash and mulch agroforestry in bean-maize cultivation, have low carbon footprint reduction potential (CFRP) and medium carbon sequestration potential (CSP) (Rahn et al., 2014). Land and water management adaptation measures have mitigation co-benefits through soil/atmospheric carbon sequestration, reduced emissions, soil nitrification and reduced use of inorganic fertilisers (Chandra et al., 2016). Conservation agriculture agricultural reduces yields 3–5 years after adoption, but enhances productivity and carbon sequestration over longer periods (Harvey et al., 2014). For conservation agriculture and efficient irrigation, synergies are regionally differentiated: (Lobell et al., 2013).	Technologies enhancing farm productivity (such as adding fertilizers) might improve adaptive capacity through higher incomes but at the same time drive GHG emissions (Harvey et al., 2014; Thornton et al., 2017). In some cases, conservation agriculture practices can increase emissions (Gupta et al., 2016).
	Efficient irrigation	Improving irrigation efficiency have adaptation and mitigation co-benefits (Zou et al., 2012; Adenle et al., 2015; Suckall et al., 2015; Win et al., 2015). Efficient irrigation practices such as drip-irrigation has, on average, 80% lower N_2O emissions than sprinkler systems. Drip-irrigation combined with optimized fertilization reduces direct N_2O emissions up to 50% (Sanz-Cobena et al., 2017). Solar-powered drip irrigation significantly increases household income and	Micro-irrigation technologies such as drip and sprinkler irrigation increase irrigation efficiency but increase energy demand (Rasul and Sharma, 2016). Biomass production for biofuels may contribute to regional water shortages, salinization and water logging (Beringer et al., 2011).

		nutritional intake, enable households to meet daily water needs, and save 0.86 tons of carbon emissions each year against a liquid fuel (e.g. kerosene) alternative (Suckall et al., 2015).	
	Efficient livestock	Strong synergies between climate change adaptation and mitigation in the livestock sector (Weindl et al., 2015; Rivera-Ferre et al., 2016) but these are differentiated by region and type of livestock system (Locatelli et al., 2015b; Thornton et al., 2017). For example, shifting from grazing to mixed livestock systems increase productivity while reducing GHG emissions, by gains in feed and forage productivity through more intensive inputs and management (Rivera-Ferre et al., 2016). Shifting towards mixed crop-livestock systems is a resource- and cost-efficient option (Herrero et al., 2015; Weindl et al., 2015; Thornton et al., 2018). Reducing livestock diseases can improve the productivity of livestock systems and increase their resilience to stresses while reducing the emissions intensity of livestock production (Bartley et al., 2016; FAO & NZAGRC, 2017). Adaptation through livestock supplementation and reducing stocking densities can reduce methane emissions (Locatelli et al., 2015b). Improved grassland management and appropriate stocking density can help to increase soil carbon stocks (Rivera-Ferre et al., 2016; Thornton et al., 2017).	Increased productivity of livestock systems generally increases overall food production and absolute GHG emissions, albeit at lower emissions per unit of food (Gerber et al., 2013; FAO & NZAGRC, 2017). Shifting to rangeland for feed can strongly increase tropical deforestation (Weindl et al., 2015). Shifting to mixed crop-livestock systems is expected to cause additional GHG emissions (Weindl et al., 2015),. Providing cooling and ventilation systems for livestock (as an adaptation to higher temperatures) can increase GHG emissions (Locatelli et al., 2015b). Some adaptation options such as inter-regional livestock trading can increase CO_2 emissions through transportation (Rivera-Ferre et al., 2016).
	Agroforestry	Sequesters carbon through accumulation in woody biomass and soil (Lasco et al., 2014) Reduce GHG emission through reduced deforestation and fossil fuel consumption (Lasco et al., 2014) Coupling native forest regeneration in concert with sugarcane bioethanol production can significantly increase carbon storage in the bioenergy production system and preserve biodiversity (Rodrigues et al., 2009; Buckeridge et al., 2012). The use of fertilizer trees can improve soil fertility through nitrogen fixation, by increasing supply of nutrients for crop production (Coulibaly et al., 2017). Integrating crop, livestock and forestry systems – like in Brazil (Gil et al.,	Lower carbon sequestration potential compared with natural forest and secondary forest (Lasco et al., 2014)

		2015) – can come with significant benefits for local farmers and ecosystems, e.g. by rehabilitation of degraded pasturelands, which can decrease emissions as well.	
	Food loss & waste management	Waste materials can be transformed into products with marketable value (Papargyropoulou et al., 2014), improving economic gain and stimulating decrease of food waste and loss.	NA
	Community-based adaptation	NE – Most literature addresses synergies with sustainable development, poverty and equity	NE - Most literature addresses trade-offs with sustainable development, poverty and equity
	Ecosystem restoration & avoided deforestation	Tropical reforestation as an adaptation measure can also result in significant carbon storage under climate-smart strategies (Locatelli et al., 2015a). Habitat restoration, afforestation & reforestation and urban trees and greenspace all lead to carbon sequestration as well (Berry et al., 2015)	Failure to consider mitigation in adaptation initiatives may lead to adaptation measures that increase greenhouse gas emissions, which is one type of maladaptation.(Porter and Xie, 2014; Kongsager et al., 2016)
	Biodiversity management	Biodiversity has value in terms of ecosystem services as well protection/defence against invading species and disease organisms. Maintaining for high levels of biodiversity also recognises the fact that many species, biological processes and molecules in nature are as yet unexplored yet have potential to provide enormous benefits to human beings (Knowlton et al., 2010; Pereira et al., 2010; Onaindia et al., 2013; Pistorious and Kiff, 2017; Price et al., 2018).	Areas with greatest potential for protecting biodiversity may not overlap with areas with most potential for carbon sequestration (Essi and Mauerhofer 2018(Phelps et al., 2012)).
	Coastal defense & hardening	NE	An alternative strategy is not to 'defend' using harden structures along coastlines, but rather to retreat as sea levels rise and storm surge goes further inland. The strategy of 'retreat' tends to make economic sense while at the same time accommodating the transition from terrestrial to marine systems (e.g. migration of salt marsh, mangroves and seagrass towards the land as sea levels rise (Brown et al., 2016a; Mills et al., 2016). There has been an increasing focus on natural barriers to storm surge and erosion, such as mangroves, oyster banks, coral reefs and seagrass meadows. Within these broad options, there are trade-offs that involve direct human intervention (e.g. coastal hardening, seawalls and artificial reefs) (Rinkevich, 2014, 2015; André et al., 2016; Cooper et al., 2016; Narayan et al., 2016), while there are others that exploit the opportunities for increasing coastal protection by involving a naturally occurring oyster banks, coral reefs, mangroves, seagrass, and other ecosystems (UNEP-WCMC, 2006; Scyphers et al.,

			2011; Zhang et al., 2012; Ferrario et al., 2014; Cooper et al., 2016). Protection using materials such as concrete to provide a barrier against the ocean. These structures can be installed quickly but the trade-off is that they have a range of negative consequences such as being expensive, interrupting natural ecosystems (Mills et al., 2016; Wernberg et al., 2016), being ultimately short-term solutions to the long-term problem of sea level rise and intensifying storm systems (Brooke et al., 1992; Wescott, 2010; Mills et al., 2016).
	Sustainable aquaculture	NE	Regulating and avoiding next loss of coastal ecosystems such as mangroves and seagrass, while the same time as developing food materials that have much lower impact on the environment (Schlag, 2010; Asiedu et al., 2017b, 2017a).
	Fisheries restoration	Development of more sustainable practices also has benefits for ocean ecosystems in general. Fish play a crucial role in everything from maintaining ecological balances through their feeding habits to playing important roles within nutrient cycles in a range of habitats (Holmlund and Hammer, 1999).	NE
	Coastal & marine biodiversity management	NE	Planning for multiple objectives (e.g. biodiversity protection and carbon sequestration) increases the complexity of planning processes and data needs, an accompanying increase in technical capacity by planners (Reside et al., 2018)
	Integrated coastal zone management	Mangroves serve as sinks for carbon, through accumulation of living biomass and through litter and dead wood deposition, including the trapping of sediments delivered from the uplands (Romañach et al., 2018).	NE
Urban & infrastructure system transitions	Sustainable land-use & 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; Ürge-Vorsatz et al., 2018), including generating a shared sense of risks and promotion of local participation (Archer et al., 2014; Kettle et al., 2014; Campos et al., 2016; Siders, 2017)) Urban planning can enhance adaptation, mitigation, and sustainable development (Hurlimann and March, 2012; Davidse et al., 2015; King et al., 2016; Francesch-Huidobro et al., 2017). Land use management for co-benefits can result in carbon sequestration (Duguma et al., 2014; Woolf et al., 2018)	Promotion of green spaces to reduce flood risk and heat island effects may reduce potential for the promotion of urban densification (Landauer et al., 2015; Di Gregorio et al., 2017b; Endo et al., 2017; Ürge-Vorsatz et al., 2018).
	Sustainable	Strong co-benefits to the implementation of demand-side management	Increasing water quality is linked to increasing energy use in the

	water management	measures, such as reducing leakages and water loss (Wang et al., 2011; Deng and Zhao, 2015), while minimizing the need to address the environmental and energy implications of supply measures such as desalination (Miller et al., 2015)	water sector (Rothausen and Conway, 2011; Mamais et al., 2015),
	Green infrastructure & ecosystem services	Urban canopy is a cooling mechanism that can help decrease heat and water stress (Hines, 2017)	Not considering the role green cover and vegetation has within the heat-water-vegetation nexus can worsen heat and water stress (Hines, 2017)
	Building codes & standards	Sustainable construction materials, reduced building energy consumption, and construction designed to reduce the urban heat island effect can have adaptation and mitigation benefits (Steenhof and Sparling, 2011; Aerts et al., 2014; Stewart, 2015; Shapiro, 2016; Ürge-Vorsatz et al., 2018)	NE
Industrial system transitions	Intensive industry infrastructure resilience and water management	Some adaptation options can help improve system efficiency when implementing water management and cooling practices.	NE
Overarching adaptation options	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 to reduce the extent of rebuilding following disasters, and the emissions associated with recovery. Post-disaster recovery can help rebuild in a more resilient way with less GHG emissions, or to “build back better”, particularly where immediate impact is substantial but not overwhelming (Guarnacci, 2012; Mochizuki and Chang, 2017). Effective disaster risk management may reduce the need for international transport of materials and other forms of aid, which can be emissions-intensive (Abrahams 2014).	The urgency of recovery and the surge in demand for construction materials have been observed to promote unsustainable behaviours, including deforestation (Nazara and Resosudarmo, 2007; Chang et al., 2010) 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 both local and external influences in the rebuilding process (Abrahams, 2014; O’Hare et al., 2016; Paidakaki and Moulaert, 2017).
	Risk spreading and sharing	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).	Agricultural insurance may have unintended impacts, promoting the intensification of land use in some cases (Annan and Schlenker, 2015; Müller and Kreuer, 2016; Müller et al., 2017).
	Climate	Climate services aid adaptation decision-making and can help mitigate GHGs	NE

	services	through improving farm practices (e.g. matching fertilizer use with existing weather conditions so that less GHGs are emitted) (Thornton et al., 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 (Nyong et al., 2007; Niggli et al., 2009; Altieri and Nicholls, 2017). 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.	Projects that use a single dimension of Indigenous knowledge (e.g. savannah burning for carbon sequestration) without considering the full context of that knowledge risk limiting associated adaptation-mitigation synergies and losing the complexities of Indigenous knowledge systems (Mistry et al., 2016).
	Population health and health system	Forest retention and urban agricultural land are forms of urban green infrastructure that can simultaneously mediate floods, promote healthy lifestyles, and reduce emissions and air pollution. (Nowak et al., 2006; Tallis et al., 2011; Elmqvist et al., 2013a; Buckeridge, 2015; Culwick and Bobbins, 2016; Panagopoulos et al., 2016; Stevenson et al., 2016; White et al., 2017b)	The use of air conditioners to meet health standards could result in increased emissions (Ürge-Vorsatz et al., 2018).
	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).	Where cash transfers to households to build adaptive capacity are not conditional, 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.

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