IPCC Land Report on Indigenous Peoples and Local Communities (IPLC)

Key Messages:

Land and carbon tenure

- "Land tenure, defined as "the terms under which land and natural resources are held by individuals, households or social groups", is a key dimension in any discussion of land-climate interactions, including the prospects for both adaptation and land-based mitigation, and possible impacts on tenure and thus land security of both climate change and climate action" (P 7-111).
- "Land tenure insecurity has been identified as a key driver of deforestation and land degradation leading to loss of sinks and creating sources of GHGs…"(P 7-115)
- "as much as 65% of the world's total land area is managed under some form of these local, customary or communal tenure systems, and only a small fraction of this (around 15%) is formally recognised by governments" (P 7-111).
- "where customary systems are unrecognised or weakened by governments or the rights from them undocumented or unenforced, tenure insecurity may result" (P 7-112).
- "Insecure land tenure affects the ability of people, communities and organisations to make changes to land that can advance adaptation and mitigation." (SPM C1.2)
- "Limited recognition of customary access to land and ownership of land can result in increased vulnerability and decreased adaptive capacity." (SPM C1.2)
- "A lack of formal (legal) ownership has often led to the loss of access rights to land, where these rights were also not formally enshrined in law, which especially affects indigenous communities…." (p 1-41).
- "Land tenure security is generally associated with less deforestation, regardless of whether the tenure form is private, customary or communal." (P 7-115)
- Secure rights to land and forest resources can facilitate efforts to stabilise shifting cultivation and promote more sustainable resource use if appropriate technical and market support are available. (P 7-115)
- "Land policies (including recognition of customary tenure, community mapping, redistribution, decentralisation, co-management, regulation of rental markets) can provide both security and flexibility response to climate change." (SPM C1.2)
- "Secure land rights, including through customary systems, can incentivise farmers to adopt long-term climate-smart practices, e.g., planting trees in mixed cropland/forest systems." (P 7-114)
- "Strengthening land tenure security is a major factor contributing to the adoption of soil conservation measures in croplands… thus, contributing to climate change adaptation and mitigation" (p. 3-56).
- "Secure and defendable land tenure, including modified customary tenure, has been positively correlated with food production increases." (P 7-114)
- "REDD+ programmes need to be integrated with national-level forest tenure reform." (P 7-115)
- The key to the success of REDD+ in the Amazon, has been the application of both, incentives and disincentives on key safeguard indicators, including land security, participation, and well-being… "insecure and overlapping land rights, as well as unclear and contradictory institutional responsibilities, are probably the major problems for REDD+ implementation" (P 7-55).
- "Much of the world's carbon is stored in the biomass and soil on the territories of customary landowners including indigenous peoples (Walker et al. 2014;…., making securing of these land

tenure regimes vital in land and climate protection. These lands are estimated to hold at least 293 GtC of carbon, of which around one-third (72 GtC) is located in areas where indigenous peoples and local communities lack formal recognition of their tenure rights." (P 7-112).

- "Including carbon in tenure and expanding the duration of tenure may provide stronger incentive for tenure holders to manage carbon as well as timber values" (P. 7-64).
- "For all the systems, an important finding is that land policies can provide both security and flexibility in the face of climate change, but through a diversity of forms and approaches (recognition of customary tenure, community mapping, redistribution, decentralisation, co-management, regulation of rental markets, strengthening the negotiating position of the poor) rather than sole focus on freehold title….Land administration systems have a vital role in providing land tenure security, especially for the poor, especially when linked to an expanded range of information relevant to mitigation and adaptation. Challenges to such a role include outdated and overlapping national land and forest tenure laws, which often fail to recognise community property rights and corruption in land administration…, as well as lack of political will and the costs of improving land administration programs" (P 7-116)

Large-scale Land Acquisition

- "Understanding of land tenure under climate change also has to take account of the growth in large-scale land acquisitions (LSLAs), also referred to as land-grabbing, in developing countries. These LSLAs are defined by acquisition of more than 200 ha per deal")… (P 7-112).
- "Since 2000, almost 50 million hectares of land, have been acquired, and there are no signs of stagnation in the foreseeable future." (1-17/18).
- "Reports suggest that recent land grabbing has affected 12 million people globally in terms of declines in welfare… (P 7-113).
- "LSLAs may be associated with monoculture and other unsustainable land use practices, have negative consequences for soil degradation and disincentivise more sustainable forms of agriculture." (P 7-114)
- "large-scale land acquisitions will a) result in types of farming less liable to reduce poverty than smallholder systems, b) increase local vulnerability to food price shocks by favouring export agriculture and c) accelerate the development of a market for land with detrimental impacts on smallholders and those depending on common property resources. Land grabbing can threaten not only agricultural lands of farmers, but also protected ecosystems, like forests and wetlands" (P 7-113).
- "evidence from biofuels expansion shows negative impacts on local livelihoods and loss of forest sinks where LSLAs override local land tenure." (P 7-115)
- "high levels of demand for land at the country level are statistically associated with weak recognition of land rights. Land grabs, where LSLAs occur despite local use of lands, are often driven by direct collaboration of politicians, government officials and land agencies… involving corruption of governmental land agencies, failures to register community land claims and illegal lands uses and lack of the rule of law and enforcement in resource extraction frontiers (P 7-112).
- "As demands on land are increasing, building governance capacity and securing land tenure becomes essential to attain sustainable land use, which has the potential to mitigate climate change, promote food security, and potentially reduce risks of climate-induced migration and associated risks of conflicts". (p. 1-17-18).

- "Secure land tenure, especially for communally managed lands, helps reduce arbitrary appropriations of land for large scale commercial farms" (p. 3-56).
- "The primary mechanisms for combatting LSLAs have included restrictions on the size of land sales…; pressure on agribusiness companies to agree to the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security, known as the VGGT, or similar principles…; attempts to repeal biofuels standards….; strengthening of existing land law and land registration systems…..; use of community monitoring systems (Sheil et al. 2015); and direct protests against the land acquisitions" (P 7-113).

Indigenous & community land tenure

- "land titling and recognition programs, particularly those that authorise and respect indigenous and communal tenure, can lead to improved management of forests, including for carbon storage…, primarily by providing legally secure mechanisms for exclusion of others. However, these titling programs are highly context-dependent and there is also evidence that titling can exclude community and common management, leading to more confusion over land rights, not less, where poorly implemented. (P 7-115).
- "land titling and recognition programs, particularly those that authorize and respect indigenous and communal tenure, can lead to improved management of forests, including for carbon storage." (P. 7-8).
- "There is strong empirical evidence of the links between secure communal tenure and lower deforestation rates, particularly in intact forests….Securing and recognising tenure for indigenous communities (such as through revisions to legal or policy frameworks) has been shown to be highly cost effective in reducing deforestation and improving land management in certain contexts, and is therefore also apt to help improve indigenous communities' ability to adapt to climate changes…(P 7-112).
- "key conditions for addressing deforestation and forest degradation (improved monitoring capacities, understanding of drivers, increased stakeholder involvement, and provided a platform to secure indigenous and community land rights)" (P 7-55).
- "Communal tenure systems may lower transaction costs for REDD+ schemes, though with risk of elite capture of payments." (P 7-115)
- "Carbon sequestration initiatives on rangelands may require clarification and maintenance of land rights…Where pastoralists' traditional land use does not have legal recognition, or where pastoralists are unable to exclude others from land use, this presents significant challenges for carbon sequestration initiatives." (P 7-114)

Women's land tenure

- "Women have often less formal access to land than men and less influence over decisions about land, even if they carry out many of the land management tasks" (P. 4-15).
- "Empowering women can bring synergies and co-benefits to household food security and sustainable land management." (SPM C4.4.)
- "Access to, and control over, land and land-based resources is essential in taking concrete action to land based mitigation, and inadequate access can affect women's rights and participation in land governance and management of productive assets." (p 1-39)

- “Secure land title and/or land access/control for women increases sustainable land management by increasing women’s conservation efforts, increasing their productive and environmentally-beneficial agricultural investments, such as willingness to engage in tree planting and sustainable soil management….as well as improving cash incomes”. (P 7-69).
- “if women had the same access to productive resources as men, the number of hungry people in the world could be reduced by 12-17%.”(P 7-69).
- “Policies promoting secure land title include legal reforms at multiple levels, including national laws on land ownership, legal education, and legal aid for women on land ownership and access” (P 7-69).
- “Even if women’s access to land is changing formally…the practical outcome is often limited due to several other factors related to both formal and informal institutional arrangements and value…access to land and other assets (e.g., education and training) is key in shaping land-use and land management strategies” (P. 4-15).
- “In 59% of 161 surveyed countries, customary, traditional and religious practices hinder women land rights” (p 1-39).

Community forestry (natural forests and restoration)

- “Poor management of state and open-access forests has been combatted in recent years by a move towards forest decentralisation and community co-management.” (P 7-115)
- “While land tenure systems interact with land-based mitigation actions in complex ways, forest decentralisation and community co-management has shown considerable success in slowing forest loss and contributing to carbon mitigation.” (P 7-115)
- “Community forestry comprises 22% of forests in tropical countries in contrast to large-scale industrial forestry….and is managed with informal institutions ensuring a sustainable flow of forest products and income utilising traditional ecological knowledge to determine access to resources” (P 7-71).
- “Around 521 million ha of forest land is estimated to be legally owned, recognised, or designated for use by indigenous and local communities as of 2017…., predominantly in Latin America, followed by Asia. However in India approximately million ha of forest land is managed under customary rights not recognised by the government….In 2005 only 1% of land in Africa was legally registered.” (P 7-111).
- “By providing long-term livelihoods for communities, sustainable forest management can reduce the extent of forest conversion to non-forest uses.” (SPM B5.3)
- “sustainable forest management aimed at providing timber, fiber, biomass and non-timber resources can provide long-term livelihood for communities, can reduce the risk of forest conversion to non-forest uses (settlement, crops, etc.), and can maintain land productivity, thus reducing the risks of land degradation” (Section 4.8.4)
- “Policies that create an open platform for local debates and allow actors their own active formulation of rules strengthen informal institutions. Case studies in Zambia, Mali, Indonesia and Bolivia confirm that enabling factors for advancing the local ownership of resources and crafting durability of informal rules require recognition in laws, regulations and policies of the state” (P 7-71).
- “studies strongly agree on the importance of engaging local populations in both sustainable land and forest management. Meta-analyses in tropical regions that examined both forests in protected

areas and community managed forests suggest that deforestation rates are lower, with less variation in deforestation rates presenting in community managed forests compared to protected forests" (P. 4-63).

- "to build on the new promising policy developments on forest rights and fiscal incentives for forest conservation in India,…further investments in monitoring…, decentralization… and promotion of diverse non-agricultural forest and range land based livelihoods (e.g., sustainable non-timber forest product extraction, regulated pastures, carbon credits for forest regeneration on marginal agriculture land and ecotourism revenues) as part of individual and community forest tenure and rights are ongoing concerns" (7-57).
- "Land restoration and rehabilitation efforts can be more effective when policies support local management of natural resources." (SPM C2.1)

Payment for Environmental Services (PES)

- "Payment for ecosystem services (PES) provide incentives for land restoration and SLM"
- "Payments for ecosystem services, subsidies for SLM, encouragement of community collective action can lead to a higher level of adoption of SLM and land restoration activities" (P. 3-53).
- "The effectiveness of PES schemes depends on land tenure security." (3-56).
- "the implementation of PES will be improved through decentralised approaches giving local communities a larger role in the decision-making process" (3-56).
- (In India)…"Decentralised sharing of CAMPA funds between government and local communities for forest restoration…and filling in implementation gaps could help reconcile climate change mitigation through forest conservation, REDD+ and environmental justice" (7-57).
- "…Strategies and policies that aggregate landowners or forest dwellers are needed to reduce the cost to individuals and payment for ecosystem services (PES) schemes can generate synergies". (P 7-89).
- "PES has not worked well in countries with fragile institutions" (3-56).

Participatory Governance

- "more benefits are derived when citizens actively participate in land and climate decision making, conservation, and policy formation" (P 7-106).
- "The effectiveness of decision-making and governance is enhanced by the involvement of local stakeholders (particularly those most vulnerable to climate change including indigenous peoples and local communities, women, and the poor and marginalised) in the selection, evaluation, implementation and monitoring of policy instruments for landbased climate change adaptation and mitigation." (SPM C 4).
- "Coordinated action across a range of actors including businesses, producers, consumers, land managers and policymakers in partnership with indigenous peoples and local communities enable conditions for the adoption of response options" (SPM C4.3.)
- Participation of people in land and climate decision making and policy formation allows for transparent effective solutions and the implementation of response options that advance synergies, reduce trade-offs in sustainable land management …, and overcomes barriers to adaptation and mitigation." (P 7-7).

- “Sustainable land management in the context of climate change is typically advanced by involving all relevant stakeholders in identifying land-use pressures and impacts…as well as preventing, reducing and restoring degraded land” (SPM C 4.1).
- “Inclusiveness in the measurement, reporting and verification of the performance of policy instruments can support sustainable land management...Involving stakeholders in the selection of indicators, collection of climate data, land modelling and land-use planning, mediates and facilitates integrated landscape planning and choice of policy” (SPM C 4.2).
- “Institutional arrangements to govern ecosystems are believed to synergistically influence maintenance of carbon storage and forest based livelihoods, especially when they incorporate local knowledge and decentralised decision making” (P 7-89).

Indigenous and local knowledge

- “A variety of terminology has been used to describe indigenous and local knowledge: “Indigenous knowledge”, “local knowledge”, “traditional knowledge”, “traditional ecological knowledge” and other terms are used in overlapping and often inconsistent ways (Naess 2013). The Special Report on Global Warming of 1.5°C (IPCC 2018a) reserves “indigenous knowledge” for culturally distinctive ways of knowing associated with “societies with long histories of interaction with their natural surroundings”, while using “local knowledge” for “understandings and skills developed by individuals and populations, specific to the places where they live”, but not all research studies observe this distinction. This Special Report generally uses “indigenous and local knowledge” (ILK) as a combined term for these forms of knowledge, but in some sections the terminology used follows that from the research literature assessed. (P 7-107).
- “ILK is strongly associated with sustainable management of natural resources, including land, and with autonomous adaptation to climate variability and change” (P 7-108).
- “Across diverse agro-ecological systems, ILK is the basis for traditional practices to manage the landscape and sustain food production, while delivering co-benefits in the form of biodiversity and ecosystem resilience at a landscape scale”(P 7-108).
- “ILK is also important in other forms of ecosystem management, such as forests and wetlands, which may be conserved by efforts such as sacred sites” (P 7-108).
- “(ILK) is an important element of participatory approaches of various kinds. ILK can be used in decision-making on climate change adaptation, Sustainable Land Management and food security at various scales and levels and is important for long-term sustainability.” (P 7-107).
- “(ILK) can play a key role in understanding climate processes and impacts, adaptation to climate change, sustainable land management across different ecosystems, and enhancement of food security...” (P. 7-7).
- “ILK can play a role in understanding climate change and other environmental processes, particularly where formal data collection is sparse…and can contribute to accurate predictions of impending environmental change” (P 7-108).
- “Opportunities exist for integration of ILK with scientific knowledge.” (P. 7-7).
- “The use of indigenous and local knowledge enhances the success of SLM and its ability to address desertification” (p. 3-51)
- Cultural ecosystem services, defined as the non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experiences…are closely linked to land and ecosystems…” (P. 4-15).

- “such knowledge systems are being threatened by multiple socio-economic and environmental drivers”….”ILK can support adaptation to land degradation but is threatened.” (P 7-107).
- “Use of ILK as a resource in responding to climate change can be constrained in at least three ways…the rate of climate change and the scale of its impacts may render incremental adaptation based on the ILK of smallholders and others, less relevant and less effective… Secondly, maintenance and transmission of ILK across generations may be disrupted by e.g.: formal education, missionary activity, livelihood diversification away from agriculture, and a general perception that ILK is outdated and unfavourably contrasted with scientific knowledge….ILK holders are experiencing difficulty in using ILK due to loss of access to resources, such as through large-scale land acquisition” (P 7-109).

RAW MATERIAL

Summary for Policy Makers

- B5.3 By providing long-term livelihoods for communities, sustainable forest management can reduce the extent of forest conversion to non-forest uses (e.g., cropland or settlements) (high confidence). Sustainable forest management aimed at providing timber, fibre, biomass, non-timber resources and other ecosystem functions and services, can lower GHG emissions and can contribute to adaptation. (high confidence). {2.6.1.2, 4.1.5, 4.3.2, 4.5.3, 4.8.1.3, 4.8.3, 4.8.4} (p. 24-25).

- C1.1 Land-use zoning, spatial planning, integrated landscape planning, regulations, incentives (such as payment for ecosystem services), and voluntary or persuasive instruments (such as environmental farm planning, standards and certification for sustainable production, use of scientific, local and indigenous knowledge and collective action), can achieve positive adaptation and mitigation outcomes (medium confidence). {Figure SPM.2; 3.4.2, 4.1.6, 4.7, 4.8.5, 5.1.2, 5.7.3, 7.3, 7.4.6, 7.4.7, 7.5} C1.2. (p.31)

- C1.2 Insecure land tenure affects the ability of people, communities and organisations to make changes to land that can advance adaptation and mitigation (medium confidence). Limited recognition of customary access to land and ownership of land can result in increased vulnerability and decreased adaptive capacity (medium confidence). Land policies (including recognition of customary tenure, community mapping, redistribution, decentralisation, co-management, regulation of rental markets) can provide both security and flexibility response to climate change (medium confidence). {3.6.1, 3.6.2, 5.3, 7.2.4, 7.6.4, Cross-Chapter Box 6 in Chapter 5} (p.31)

- C.2 The adoption of sustainable land management and poverty eradication can be enabled by improving access to markets, securing land tenure, factoring environmental costs into food, making payments for ecosystem services, and enhancing local and community collective action (high confidence). {1.1.2, 1.2.1, 3.6.3, 4.7.1, 4.7.2, 4.8, 5.5, 6.4, 7.4.6, 7.6.5} (p. 32).

- C2.1. Policies that enable and incentivise sustainable land management for climate change adaptation and mitigation include improved access to markets for inputs, outputs and financial services, empowering women and indigenous peoples, enhancing local and community collective action, reforming subsidies and promoting an enabling trade system (high confidence). Land restoration and rehabilitation efforts can be more effective when policies support local management of natural resources, while strengthening cooperation between actors and institutions, including at the international level. {3.6.3, 4.1.6, 4.5.4, 4.8.2, 4.8.4, 5.7, 7.2} (p. 32)

- C 4. The effectiveness of decision-making and governance is enhanced by the involvement of local stakeholders (particularly those most vulnerable to climate change including indigenous peoples and local communities, women, and the poor and marginalised) in the selection, evaluation, implementation and monitoring of policy instruments for landbased climate change adaptation and mitigation (high confidence). {1.4, 3.1, 3.6, 3.7, 4.8, 4.9, 5.1.3, Box 5.1, 7.4, 7.6} (p. 34).

- C4.1. Sustainable land management in the context of climate change is typically advanced by involving all relevant stakeholders in identifying land-use pressures and impacts (such as biodiversity decline, soil loss, over-extraction of groundwater, habitat loss, land-use change in agriculture, food production and forestry) as well as preventing, reducing and restoring degraded land (medium confidence). {1.4.1, 4.1.6, 4.8.7, 5.2.5, 7.2.4, 7.6.2, 7.6.4} (p.34)

- C4.2. Inclusiveness in the measurement, reporting and verification of the performance of policy instruments can support sustainable land management (medium confidence). Involving stakeholders in the selection of indicators, collection of climate data, land modelling and land-use planning, mediates and facilitates integrated landscape planning and choice of policy (medium confidence). {3.7.5, 5.7.4, 7.4.1, 7.4.4, 7.5.3, 7.5.4, 7.5.5, 7.6.4, 7.6.6} (p 34).

- C4.3. Agricultural practices that include indigenous and local knowledge can contribute to overcoming the combined challenges of climate change, food security, biodiversity conservation, and combating desertification and land degradation (high confidence). Coordinated action across a range of actors including businesses, producers, consumers, land managers and policymakers in partnership with indigenous peoples and local communities enable conditions for the adoption of response options (high confidence) {3.1.3, 3.6.1, 3.6.2, 4.8.2, 5.5.1, 5.6.4, 5.7.1, 5.7.4, 6.2, 7.3, 7.4.6, 7.6.4} (p.34-35)

- C4.4. Empowering women can bring synergies and co-benefits to household food security and sustainable land management (high confidence). Due to women's disproportionate vulnerability to climate change impacts, their inclusion in land management and tenure is constrained. Policies that can address land rights and barriers to women's participation in sustainable land management include financial transfers to women under the auspices of antipoverty programmes, spending on health, education, training and capacity building for women, subsidised credit and program dissemination through existing women's community-based organisations (medium confidence). {1.4.1, 4.8.2, 5.1.3, Box 5.1, Cross-Chapter Box 11 in Chapter 7}. (p. 35).

Chapter 1:

1.2.1.5 Challenges arising from land governance

An example of large-scale change in land ownership is the much-debated large-scale land acquisition (LSLA) by investors which peaked in 2008 during the food price crisis, the financial crisis, and has also been linked to the search for biofuel investments (Dell'Angelo et al. 2017a). Since 2000, almost 50 million hectares of land, have been acquired, and there are no signs of stagnation in the foreseeable future (Land Matrix 2018). The LSLA phenomenon, which largely targets agriculture, is widespread, including Sub-Saharan Africa, Southeast Asia, Eastern Europe and Latin America (Rulli et al. 2012; Nolte et al. 2016; Constantin et al. 2017). LSLAs are promoted by investors and host governments on economic grounds (infrastructure, employment, market development) (Deininger et al. 2011), but their social and environmental impacts can be negative and significant (Dell'Angelo et al. 2017a). Much of the criticism of LSLA focuses on their social impacts, especially the threat to local communities' land rights (especially indigenous people and women) (Anseeuw et al. 2011) and displaced communities creating secondary land expansion (Messerli et al. 2014; Davis et al. 2015). The promises that LSLAs would develop efficient

agriculture on non-forested, unused land (Deininger et al. 2011) has so far not been fulfilled. However, LSLAs is not the only outcome of weak land governance structures (Wang et al. 11 2016), other forms of inequitable or irregular land acquisition can also be home-grown pitting one community against a more vulnerable group (Xu 2018) or land capture by urban elites (McDonnell 2017). As demands on land are increasing, building governance capacity and securing land tenure becomes essential to attain sustainable land use, which has the potential to mitigate climate change, promote food security, and potentially reduce risks of climate-induced migration and associated risks of conflicts (see 16 Section 7.6). (p. 1-17-18).

1.4.2 Gender agency as a critical factor in climate and land sustainability outcomes

Germaine to the gender inequities are the unequal access to land-based resources. Women play a significant role in agriculture (Boserup 1989; Darity 1980) and rural economies globally (FAO 2011), but are well below their share of labour in agriculture globally (FAO 2011). In 59% of 161 surveyed countries, customary, traditional and religious practices hinder women land rights (OECD 2014)…. Large-scale development projects can erode rights, and lead to over-exploitation of natural resources. …Access to, and control over, land and land-based resources is essential in taking concrete action to land based mitigation, and inadequate access can affect women's rights and participation in land governance and management of productive assets. (p 1-39)

Empowering women and removing gender-based inequities constitutes a mechanism for greater participation in the adoption of sustainable practices of land management (Mello and Schmink 2017). (p 1-39).

1.4.3.3 Rights-based instruments and customary norms

Rights-based instruments and customary norms deal with the equitable and fair management of land resources for all people (IPBES 2018a). These instruments emphasise the rights in particular of indigenous peoples and local communities, including for example, recognition of the rights embedded in the access to, and use of, common land. Common land includes situations without legal ownership (e.g., hunter-gathering communities in south America or Africa and bushmeat), where the legal ownership is distinct from usage rights (Mediterranean transhumance grazing systems), or mixed ownership-common grazing systems (e.g., Crofting in Scotland). A lack of formal (legal) ownership has often led to the loss of access rights to land, where these rights were also not formally enshrined in law, which especially effects indigenous communities, for example, deforestation in the Amazon basin. Overcoming the constraints associated with common-pool resources (forestry, fisheries, water) are often of economic and institutional nature (Hinkel et al. 2014) and require tackling the absence or poor functioning of institutions and the structural constraints that they engender through access and control levers using policies and markets and other mechanisms (Schut et al. 2016). Other examples of rights-based instruments include the protection of heritage sites, sacred sites and peace parks (IPBES 2018a). Rights-based instruments and customary norms are consistent with the aims of international and national human rights, and the critical issue of liability in the climate change problem. (p 1-41).

CHAPTER 3: DESERTIFICATION

3.6.2.1. Socio-economic Responses for Combating Desertification Under Climate Change

The use of indigenous and local knowledge enhances the success of SLM and its ability to address desertification (Altieri and Nicholls, 2017; Engdawork and Bork, 2016). Using indigenous and local knowledge for combating desertification could contribute to climate change adaptation strategies (Belfer et al., 2017; Codjoe et al., 2014; Etchart, 2017; Speranza et al., 2010; Makondo and Thomas, 2018; Maldonado et al., 2016; Nyong et al., 2007). There are abundant examples of how indigenous and local knowledge, which are an important part of broader agroecological knowledge (Altieri, 32 2018), have allowed livelihood systems in drylands to be maintained despite environmental constraints…Although well adapted to resource sparse dryland environments, traditional practices are currently not able to cope with increased demand for food and environmental changes (Enfors and Gordon, 2008; Engdawork and Bork, 2016). Moreover, there is robust evidence documenting the marginalisation or loss of indigenous and local (p. 3-51)

knowledge (Dominguez, 2014; Fernández-Giménez and Fillat Estaque, 2012; Hussein, 2011; 2 Kodirekkala, 2017; Moreno-Calles et al., 2012). Combined use of indigenous and local knowledge and new SLM technologies can contribute to raising resilience to the challenges of climate change and desertification (high confidence) (Engdawork and Bork, 2016; Guzman et al., 2018).

Collective action has the potential to contribute to SLM and climate change adaptation (medium confidence) (Adger, 2003; Engdawork and Bork, 2016; Eriksen and Lind, 2009; Ostrom, 2009; 7 Rodima-Taylor et al., 2012). Collective action is a result of social capital… Social capital is more important for economic growth in settings with weak formal institutions, and less so in those with strong enforcement of formal institutions (Ahlerup et al., 2009). There are cases throughout the drylands showing that community bylaws and collective action successfully limited land degradation and facilitated SLM (Ajayi et al., 2016; Infante, 2017; Kassie et al., 2013; Nyangena, 2008; Willy and Holm-Müller, 2013; Wossen et al., 2015). However, there are also cases when they did not improve SLM where they were not strictly enforced (Teshome et al., 2016). Collective action for implementing responses to dryland degradation is often hindered by local asymmetric power relations and "elite capture" (Kihiu, 2016; Stringer et al., 2007). This illustrates that different levels and types of social capital result in different levels of collective action. (p. 3-52).

3.6.3. Policy Responses

Payments for ecosystem services, subsidies for SLM, encouragement of community collective action can lead to a higher level of adoption of SLM and land restoration activities (medium confidence) (Bouma and Wösten, 2016; Lambin et al., 2014; Reed et al., 2015; Schiappacasse et al., 2012; van Zanten et al., 2014; 3.6.3). (P. 3-53).

3.6.3.1. Policy Responses towards Combating Desertification under Climate Change

Strengthening land tenure security. Strengthening land tenure security is a major factor contributing to the adoption of soil conservation measures in croplands (high confidence) (Bambio and Bouayad Agha, 2018; Higgins et al., 2018; Holden and Ghebru, 2016; Paltasingh, 2018; Rao et al., 2016; Robinson et al., 2018) , thus, contributing to climate change adaptation and mitigation. Moreover, land tenure security can lead to more investment in trees (Deininger and Jin, 2006; Etongo et al., 12 2015). Land tenure recognition policies were found to lead to higher agricultural productivity and incomes, although with inter-regional variations, requiring an improved understanding of overlapping formal and informal land tenure rights (Lawry et al., 2017). For example, secure land tenure increased investments into SLM

practices in Ghana, however, without affecting farm productivity (Abdulai et al., 2011). Secure land tenure, especially for communally managed lands, helps reduce arbitrary appropriations of land for large scale commercial farms (Aha and Ayitey, 2017; Baumgartner, 2017; Dell'Angelo et al., 2017). In contrast, privatisation of rangeland tenures in Botswana and Kenya led to the loss of communal grazing lands and actually increased rangeland degradation (Basupi et al., 2017; 20 Kihiu, 2016) as pastoralists needed to graze livestock on now smaller communal pastures. Since food insecurity in drylands is strongly affected by climate risks, there is robust evidence and high agreement that resilience to climate risks is higher with flexible tenure for allowing mobility for pastoralist communities, and not fragmenting their areas of movement (Behnke, 1994; Holden and Ghebru, 2016; Liao et al., 2017; Turner et al., 2016; Wario et al., 2016). More research is needed on the optimal tenure mix, including low-cost land certification, redistribution reforms, market-assisted reforms and gender-responsive reforms, as well as collective forms of land tenure such as communal land tenure and cooperative land. (p. 3-56).

Payment for ecosystem services (PES) provide incentives for land restoration and SLM (medium confidence) (Lambin et al., 2014; Li et al., 2018; Reed et al., 2015; Schiappacasse et al., 2012)…. The effectiveness of PES schemes depends on land tenure security and appropriate design taking into account specific local conditions (Börner et al., 2017). However, PES has not worked well in countries with fragile institutions (Karsenty and Ongolo, 2012). Equity and justice in distributing the payments for ecosystem services were found to be key for the success of the PES programmes in Yunnan, China (He and Sikor, 2015). Yet, when reviewing the performance of PES programmes in the tropics, Calvet-Mir et al. (2015), found that they are generally effective in terms of environmental outcomes, despite being sometimes unfair in terms of payment distribution. It is suggested that the implementation of PES will be improved through decentralised approaches giving local communities a larger role in the decision making process (He and Lang, 2015). Empowering local communities for decentralised natural resource management. Local institutions often play a vital role in implementing SLM initiatives and climate change adaptation (high confidence) (Gibson et al., 2005; Smucker et al., 2015). Pastoralists involved in community-based natural resource management in Mongolia had greater capacity to adapt to extreme winter frosts (3-56).

Decreasing the power and role of traditional community institutions, due to top-down public policies, resulted in lower success rates in community-based programmes focused on rangeland management in Dirre, Ethiopia (Abdu and Robinson, 2017). Decentralised governance was found to lead to improved management in forested landscapes (Dressler et al., 2010; Ostrom and Nagendra, 2006). However, there are also cases when local elites were placed in control, decentralised natural resource management negatively impacted the livelihoods of the poorer and marginalised community members due to reduced access to natural resources (Andersson and Ostrom, 2008; Cullman, 2015; Dressler et al., 2010). The success of decentralised natural resource management initiatives depends on increased participation and empowerment of diverse set of community members, not only local leaders and elites, in the design and management of local resource management institutions (Kadirbeyoglu and Özertan, 2015; Umutoni et al., 2016), while considering the interactions between actors and institutions at different levels of governance (Andersson and Ostrom, 2008; Carlisle and Gruby, 2017; McCord et al., 2017).

CHAPTER 4 LAND DEGRADATION:

4.1.6 The human dimension of land degradation and forest degradation

Land users' own perceptions and knowledge about land conditions and degradation have often been neglected or ignored by both policy makers and scientists (Reed et al. 2007; Forsyth 1996; Andersson et al. 2011). A growing body of work is nevertheless beginning to focus on land degradation through the lens of local land users (Kessler and Stroosnijder 2006; Fairhead and Scoones 2005; Zimmerer 1993; Stocking et al. 2001) and the importance of local and indigenous knowledge within land management is starting to be appreciated (Montanarella et al. 2 2018). (P. 4-14&15)

The use and management of land is highly gendered and is expected to remain so for the foreseeable future (Kristjanson et al. 2017). Women have often less formal access to land than men and less influence over decisions about land, even if they carry out many of the land management tasks (Jerneck 2018a; Elmhirst 2011; Toulmin 2009; Peters 2004; Agarwal 1997; Jerneck 2018b)…Even if women's access to land is changing formally (Kumar and Quisumbing 2015), the practical outcome is often limited due to several other factors related to both formal and informal institutional arrangements and values (Lavers 2017; Kristjanson et al. 2017; Djurfeldt et al. 2018). …access to land and other assets (e.g., education and training) is key in shaping land-use and land management strategies (Liu et 19 al. 2018b; Lambin et al. 2001)… (P. 4-15).

Land rights differ between places and are dependent on the political-economic and legal context (Montanarella et al. 2018). This means there is no universally applicable best arrangement. Agriculture in highly erosion prone regions requires site specific and long lasting soil and water conservation measures, such as terraces…which may benefit from secure private land rights (Tarfasa et al. 2018; Soule et al. 2000). Pastoral modes of production and community based forest management systems are often dominated by communal land tenure arrangements, which may conflict with agricultural/forestry modernization policies implying private property rights (Antwi29 Agyei et al. 2015; Benjaminsen and Lund 2003; Itkonen 2016; Owour et al. 2011; Gebara 2018)

Cultural ecosystem services, defined as the non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experiences (Millennium Assessment 2005) are closely linked to land and ecosystems, although often underrepresented in the literature on ecosystem services (Tengberg et al. 2012; Hernández-Morcillo et al. 2013). Climate change interacting with land conditions can impact cultural aspects, such as sense of place and sense of belonging (Olsson et al. 2014). (P. 4-15).

6 4.8.2 Local and indigenous knowledge for addressing land degradation

In practice, responses are anchored both in scientific research, as well as local, indigenous and traditional knowledge and know-how. For example, studies in the Philippines Camacho et al. (2016) examine how traditional integrated watershed management by indigenous people sustain regulating services vital to agricultural productivity, while delivering co-benefits in the form of biodiversity and ecosystem resilience at a landscape scale. Although responses can be site specific and sustainable at a local scale, the multi-scale interplay of drivers and pressures can nevertheless cause practices that have been sustainable for centuries to become less so.

…interplay of these practices with other pressures (large-scale land acquisitions for oil palm plantation, logging and mining), risk their future sustainability.

Interest appears to be growing in understanding how indigenous and local knowledge inform land users' responses to degradation, as scientists engage farmers as experts in processes of knowledge co40 production and co-innovation (Oliver et al. 2012; Bitzer and Bijman 2015). This can help to introduce, implement, adapt and promote the use of locally appropriate responses (Schwilch et al. 42 2011). Indeed, studies strongly agree on the importance of engaging local populations in both sustainable land and forest management. Meta-analyses in tropical regions that examined both forests in protected areas and community managed forests suggest that deforestation rates are lower, with less variation in deforestation rates presenting in community managed forests compared to protected forests (Porter-Bolland et al. 2012). (P. 4-63).

4.8.4 Sustainable forest management and CO2 removal technologies

sustainable forest management aimed at providing timber, fiber, biomass and non-timber resources can provide long-term livelihood for communities, can reduce the risk of forest conversion to non forest uses (settlement, crops, etc.), and can maintain land productivity, thus reducing the risks of land degradation (Putz et al. 2012; Gideon Neba et al. 2014; Sufo Kankeu et al. 2016; Nitcheu Tchiadje et al. 2016; Rossi et al. 2017).

CHAPTER 5 Food Security

5.7.4.1 Indigenous and local knowledge

Recent discourse has a strong orientation towards scaling-up innovation and adoption by local farmers. However, autonomous adaptation, indigenous knowledge and local knowledge are both important for agricultural adaptation (Biggs et al. 2013)..These involve the promotion of farmer participation in governance structures, research, and the design of systems for the generation and dissemination of knowledge and technology, so that farmers needs and knowledge can be taken into consideration. Klenk et al. (2017) found that mobilisation of local knowledge can inform adaptation decision-making and may facilitate greater flexibility in government-funded research. As an example, rural innovation in terrace agriculture developed on the basis of a local coping mechanism and adopted by peasant farmers in Latin America may serve as an adaptation option or starting place for learning about climate change responses (Bocco and Napoletano 2017). Clemens et al. (2015) found that an open dialogue platform enabled horizontal exchange of ideas and alliances for social learning and knowledge-sharing in Vietnam. Improving local technologies in a participatory manner, through on-farm experimentation, farmer-to-farmer exchange, consideration of women and youths, is also relevant in mobilising knowledge and technologies.

CHAPTER 7: Risk management and decision making in relation to 2 sustainable development

Indigenous and local knowledge (ILK) can play a key role in understanding climate processes and impacts, adaptation to climate change, sustainable land management across different ecosystems, and enhancement of food security (high confidence). ILK is context-specific, collective, informally transmitted, and multi-functional, and can encompass factual information about the environment and guidance on management of resources and related rights and social behaviour. ILK can be used in decision-making at various scales and levels, and exchange of experiences with adaptation and mitigation that include ILK is both a requirement and an entry strategy for participatory climate

communication and action. Opportunities exist for integration of ILK with scientific knowledge. {7.4.1, 7.4.5, 7.4.6, 7.6.4, Cross-Chapter Box 13: in this chapter} (P. 7-7).

Participation of people in land and climate decision making and policy formation allows for transparent effective solutions and the implementation of response options that advance synergies, reduce trade-offs in sustainable land management (high confidence), and overcomes barriers to adaptation and mitigation (high confidence). Improvements to sustainable land management are achieved by: (1) engaging people in citizen science by mediating and facilitating landscape conservation planning, policy choice, and early warning systems (medium confidence); (2) involving people in identifying problems (including species decline, habitat loss, land use change in agriculture, food production and forestry), selection of indicators, collection of climate data, land modelling, agricultural innovation opportunities. When social learning is combined with collective action, transformative change can occur addressing tenure issues and changing land use practices (medium confidence).{3.7.5, 23 7.4.1, 7.4.9; 7.5.1, 7.5.4, 7.5.5, 7.5.7, 7.6.4, 7.6.6} (P 7-7).

Land tenure systems have implications for both adaptation and mitigation, which need to be understood within specific socio-economic and legal contexts, and may themselves be impacted by climate change and climate action (limited evidence, high agreement). Land policy (in a diversity of forms beyond focus on freehold title) can provide routes to land security and facilitate or constrain climate action, across cropping, rangeland, forest, fresh-water ecosystems and other systems. Large-scale land acquisitions are an important context for the relations between tenure security and climate change, but their scale, nature and implications are imperfectly understood. There is medium confidence that land titling and recognition programs, particularly those that authorize and (P. 7-7).

respect indigenous and communal tenure, can lead to improved management of forests, including for carbon storage. {7.6.2; 7.6.3; 4 7.6.4, 7.6.5} (P. 7-8).

Case Study: Forest conservation instruments: REDD+ in the Amazon and India

Over 50 countries have developed national REDD+ strategies, which have key conditions for addressing deforestation and forest degradation (improved monitoring capacities, understanding of drivers, increased stakeholder involvement, and provided a platform to secure indigenous and community land rights), however to achieve its original objectives and to be effective under current conditions, forest-based mitigation actions need to be incorporated in national development plans and official climate strategies, and mainstreamed across sectors and levels of government (Angelsen et al. 29 2018a).

In the Amazon, at the local level, a critical issue has been the incorporation of indigenous people in the planning and distribution of benefits of REDD+ projects. While REDD+, in some cases, has enhanced participation of community members in the policy-planning process, fund management, and carbon baseline establishment increased project reliability and equity (West 2016), it is clear that, in this region, insecure and overlapping land rights, as well as unclear and contradictory institutional responsibilities, are probably the major problems for REDD+ implementation (Loaiza et al. 2017). Despite legal and rhetoric recognition of indigenous land rights, effective recognition is still lacking (Aguilar-Støen 2017). The key to the success of REDD+ in the Amazon, has been the application of both, incentives and disincentives on key safeguard indicators, including land security, participation, and well-being (Duchelle et al. 2017). (P 7-55).

The other significant development related to forest land was the landmark legislation called the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 or Forest Rights Act passed by the Parliament of India in 2007. This is the largest forest tenure legal instrument in the world and attempted to undo a historical injustice to forest dwellers and forest dependent communities whose traditional rights and access were legally denied under forest and wildlife conservation laws. The FRA recognises the right to individual land titles on land already cleared as well as community forest rights such as collection of forest produce. Till November 2018, a total of 64,328 community forest rights and a total of 17,040,343 individual land titles had been approved and granted up to the end of 2017. Current concerns on policy and implementation gaps are about strengths and pitfalls of decentralisation, identifying genuine right holders, verification of land rights using technology and best practices, and curbing illegal claims (Sarap et al. 2013; Reddy et al. 2011; Aggarwal 2011; Ramnath 2008; Ministry of Environment and Forests and Ministry and Tribal Affairs, Government of India 2010). (P 7-56).

As per the FRA, the forest rights shall be conferred free of all encumbrances and procedural requirements. Furthermore, without implementation of the provision of FRA on getting the informed consent of local communities for both diversion of community forest land as well as for reforestation, it poses legal and administrative hurdles in using existing forest land for implementation of India's ambitious Green India Mission that aims to respond to climate change by a combination of adaptation and mitigation measures in the forestry sector. It aims to increase forest/tree cover to the extent of 5 million hectares (Mha) and improve quality of forest/tree cover on another 5 Mha of forest/non-forest lands and support forest based livelihoods of 3 million families and generate co-benefits through 9 ecosystem services (Government of India). Thus, the community forest land recognised under FRA can be used for the purpose of Compensatory Afforestation or restoration under REDD+ only with informed consent of the communities and a decentralised mechanism for using CAMPA funds. India's forest and forest restoration can potentially move away from a top-down carbon centric model with the effective participation of local 14 communities (Vijge and Gupta 2014; Murthy et al. 2018a). (7-57).

In order to build on the new promising policy developments on forest rights and fiscal incentives for forest conservation in India, incentivising ongoing protection, further investments in monitoring (Busch 2018), decentralisation (Somanathan et al. 2009) and promotion of diverse non-agricultural forest and range land based livelihoods (e.g., sustainable non-timber forest product extraction, regulated pastures, carbon credits for forest regeneration on marginal agriculture land and ecotourism revenues) as part of individual and community forest tenure and rights are ongoing concerns. Decentralised sharing of CAMPA funds between government and local communities for forest restoration as originally suggested and filling in implementation gaps could help reconcile climate change mitigation through forest conservation, REDD+ and environmental justice (Vijge and Gupta 39 2014; Temper and Martinez-Alier 2013; Badola et al. 2013; Sun and Chaturvedi 2016; Murthy et al. 40 2018b; Chopra 2017; Ministry of Environment and Forests and Ministry and Tribal Affairs, 41 Government of India 2010). (7-57).

7.4.9.2. Barriers to land based climate mitigation

Property rights may be a barrier when there is no clear single party land ownership to implement and manage changes (Smith et al. 2007). In forestry, tenure arrangements may not distribute obligations and incentives for carbon sequestration effectively between public management agencies and private agents with forest licenses. Including carbon in tenure and expanding the duration of tenure may provide

stronger incentive for tenure holders to manage carbon as well as timber values (Williamson and Nelson 2017). (P. 7-64).

Forest governance may not have the structure to advance mitigation and adaptation. Currently top down traditional modes do not have the flexibility or responsiveness to deal with the complex, dynamic, spatially diverse, and uncertain features of climate change (Timberlake and Schultz 2017; Williamson and Nelson 2017). …institutional barriers exist if institutions are not forward looking, do not enable collaborative adaptive management, promote flexible approaches that are reversible as new information becomes available, promote learning and allow for diversity of approaches that can be tailored to different local circumstances (Williamson and Nelson 2017). (P. 7-64).

Due to engrained patriarchal social structures and gendered ideologies, women may face multiple barriers to participation and decision-making in land-based adaptation and mitigation actions in response to climate change (high confidence) (Alkire et al. 2013a; Quisumbing et al. 2014). These barriers include: …(v) lack of ownership of productive assets and 16 resources (Kristjanson et al., 2014; Meinzen-Dick et al., 2010), including land. Constraints to land access include not only state policies, but also customary laws (Bayisenge 2018) based on customary norms and religion that determine women's rights (Namubiru-Mwaura 2014a). (P. 7-67).

Secure land title and/or land access/control for women increases sustainable land management by increasing women's conservation efforts, increasing their productive and environmentally-beneficial agricultural investments, such as willingness to engage in tree planting and sustainable soil management (high confidence) as well as improving cash incomes (Higgins et al. 2018; Agarwal 2010; Namubiru-Mwaura 2014b; Doss et al. 2015b; Van Koppen et al. 2013b; Theriault et al. 2017b; Jagger and Pender 2006). According FAO (2011b, p. 5), if women had the same access to productive resources as men, the number of hungry people in the world could be reduced by 12-17%. Policies promoting secure land title include legal reforms at multiple levels, including national laws on land ownership, legal education, and legal aid for women on land ownership and access (Argawal 2018). Policies to increase women's access to land could occur through three main avenues of land acquisition: inheritance/family (Theriault et al. 2017b), state policy, and the market (Agarwal 2018). Rao (2017) recommends framing land rights as entitlements rather than as instrumental means to sustainability. This reframing may address persistent, pervasive gender inequalities (FAO 2015d). (P 7-69).

Community forestry comprises 22% of forests in tropical countries in contrast to large-scale industrial forestry (Hajjar et al. 2013) and is managed with informal institutions ensuring a sustainable flow of forest products and income utilising traditional ecological knowledge to determine access to resources (Singh et al. 2018). Policies that create an open platform for local debates and allow actors their own active formulation of rules strengthen informal institutions. Case studies in Zambia, Mali, Indonesia and Bolivia confirm that enabling factors for advancing the local ownership of resources and crafting durability of informal rules require recognition in laws, regulations and policies of the state (Haller et 10 al. 2016). (P 7-71).

7.5.6.3. Forests and agriculture

Institutional arrangements to govern ecosystems are believed to synergistically influence maintenance of carbon storage and forest based livelihoods, especially when they incorporate local knowledge and decentralised decision making (Chhatre and Agrawal 2009). …Strategies and policies that aggregate

landowners or forest dwellers are needed to reduce the cost to individuals and payment for ecosystem services (PES) schemes can generate synergies (Bommarco et al. 2013; Chhatre and Agrawal 2009). (P 7-89).

7.6.2. Integration - Levels, Modes, and Scale of Governance for Sustainable Development

Expert thinking has evolved from implementing good governance at high levels of governance (with governments) to a decentred problem solving approach consistent with adaptive governance. This approach involves iterative bottom up and experimental mechanisms that might entail addressing tenure of land or forest management through a territorial approach to development, thereby supporting multi-sectoral governance in local, municipal, and regional contexts (FAO 2017b). (P 7-95).

Integrated land use planning coordinated through multiple government levels balances property rights, wildlife and forest conservation, encroachment of settlements and agricultural areas and can reduce conflict (*high confidence*) (Metternicht 2018). Land use planning can also enhance management of areas prone to natural disasters such as floods and resolve issues of competing land uses and land tenure conflicts (Metternicht 2018). (P 7-96).

7.6.3. Adaptive Climate Governance Responding to Uncertainty

There is *medium evidence and high agreement* that participatory processes in adaptive governance within and across policy regimes overcome limitations of polycentric governance allowing priorities to be set in sustainable development through rural land management and integrated water resource management (Rouillard et al. 2013). Adaptive governance addresses large uncertainties and their social amplification through differing perceptions of risk (Kasperson 2012; Fra.Paleo 2015) offering an approach to co-evolve with risk by implementing policy mixes and assessing effectiveness in an ongoing process, making mid-point corrections when necessary (Fra.Paleo 2015). …In comparison to other governance initiatives of ecosystem management aimed at conservation and sustainable use of natural capital, adaptive governance has visible effects on natural capital by monitoring, communicating and responding to ecosystem-wide changes at the landscape level (Schultz et al. 2015). Adaptive governance can be applied to manage drought assistance as a common property resource managing complex, interacting goals to create innovative policy options, facilitated through nested and polycentric systems of governance effected by areas of natural resource management including landscape care and watershed or catchment management groups (Nelson et al. 39 2008). (P 7-103).

7.6.4. Participation

It is recognised that more benefits are derived when citizens actively participate in land and climate decision making, conservation, and policy formation (*high confidence*) (Jansujwicz et al. 2013) (Coenen and Coenen 2009; Hurlbert and Gupta 2015)….Participation is an emerging quality of collective-action and social-learning processes (Castella et al. 2014) when barriers for meaningful participation are surpassed (Clemens et al. 2015). (P 7-106).

Recognition and use of indigenous and local knowledge (ILK) is an important element of participatory approaches of various kinds. ILK can be used in decision-making on climate change adaptation, Sustainable Land Management and food security at various scales and levels and is important for long-term sustainability *(high confidence).* (P 7-107).

The Summary for Policy-Makers of the Working Group II Contribution to the IPCC's Fifth Assessment Report (IPCC 2014b, p. 26) states that "Indigenous, local, and traditional knowledge systems and practices, including indigenous peoples' holistic view of community and environment, are a major resource for adapting to climate change, but these have not been used consistently in existing adaptation efforts. Integrating such forms of knowledge with existing practices increases the effectiveness of adaptation" (P 7-107).

The Special Report on Global Warming of 29 1.5 °C (IPCC 2018e; de Coninck et al. 2018) confirms the effectiveness and potential feasibility of adaptation options based on ILK but also raises concerns that such knowledge systems are being threatened by multiple socio-economic and environmental drivers (*high confidence*). The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) Land Degradation and Restoration Assessment (IPBES 2018) finds the same– that ILK can support adaptation to land degradation but is threatened. (P 7-107).

A variety of terminology has been used to describe indigenous and local knowledge: "Indigenous knowledge", "local knowledge", "traditional knowledge", "traditional ecological knowledge" and other terms are used in overlapping and often inconsistent ways (Naess 2013). The Special Report on Global Warming of 1.5°C (IPCC 2018a) reserves "indigenous knowledge" for culturally distinctive ways of knowing associated with "societies with long histories of interaction with their natural surroundings", while using "local knowledge" for "understandings and skills developed by individuals and populations, specific to the places where they live", but not all research studies observe this distinction. This Special Report generally uses "indigenous and local knowledge" (ILK) as a combined term for these forms of knowledge, but in some sections the terminology used follows that from the research literature assessed. (P 7-107).

ILK in understanding and responding to climate change impacts

ILK can play a role in understanding climate change and other environmental processes, particularly where formal data collection is sparse (Alexander et al. 2011a; Schick et al. 2018), and can contribute to accurate predictions of impending environmental change (Green and Raygorodetsky 2010; Orlove et al. 2010) (medium confidence). Both at global level (Alexander et al. 2011a; Green and Raygorodetsky 2010), and local level (Speranza et al. 2010; Ayanlade et al. 2017), strong correlations between local perceptions of climate change and meteorological data have been shown, as calendars, almanacs, and other seasonal and interannual systems knowledge embedded in ILK hold information about environmental baselines (Orlove et al. 2010; Cochran et al. 2016). (P 7-108).

ILK is strongly associated with sustainable management of natural resources, including land, and with autonomous adaptation to climate variability and change, while also serving as a resource for externally-facilitated adaptation (Stringer et al. 2009)…In dryland environments, populations have historically demonstrated remarkable resilience and innovation to cope with high climatic variability, manage dynamic interactions between local communities and ecosystems, and sustain livelihoods (Safriel and Adeel 2008; Davies 2017). There is high confidence that pastoralists have created formal and informal institutions based on ILK for regulating grazing, collection and cutting of herbs and wood, and use of forests across the Middle East and North Africa (Louhaichi and Tastad 2010; Domínguez 2014; Auclair et al. 2011), Mongolia (Fernandez-Gimenez 2000), The Horn of Africa (Oba 2013) and the Sahel (Krätli and Schareika 2010). Numerous traditional water harvesting techniques are used across the drylands to adapt to climate variability…(Biazin et al. 2012) (P 7-108).

Across diverse agro-ecological systems, ILK is the basis for traditional practices to manage the landscape and sustain food production, while delivering co-benefits in the form of biodiversity and ecosystem resilience at a landscape scale (high confidence). Flexibility and adaptiveness are hallmarks of such systems (Richards 1985; Biggs et al. 2013...Indigenous practices for enhanced soil fertility have been documented among South Asian farmers (Chandra et al. 2011; Dey and Sarkar 2011) and among Mayan farmers where management of carbon has positive impacts on mitigation (Falkowski et al. 2016). (P 7-108).

ILK is also important in other forms of ecosystem management, such as forests and wetlands, which may be conserved by efforts such as sacred sites (Ens et al. 2015; Pungetti et al. 2012) and ILK can play an important role in ecological restoration efforts, including for carbon sinks, through knowledge surrounding species selection and understanding of ecosystem processes, like fire (Kimmerer 2000). (P 7-108).

Constraints on the use of ILK

Use of ILK as a resource in responding to climate change can be constrained in at least three ways (high confidence). Firstly the rate of climate change and the scale of its impacts may render incremental adaptation based on the ILK of smallholders and others, less relevant and less effective (Lane and McNaught 2009; Orlowsky and Seneviratne 2012; Huang et al. 2016; Morton 2017). Secondly, maintenance and transmission of ILK across generations may be disrupted by e.g.: formal education, missionary activity, livelihood diversification away from agriculture, and a general perception that ILK is outdated and unfavourably contrasted with scientific knowledge (Speranza et 18 al. 2010), and by HIV-related mortality (White and Morton 2005). Urbanisation can erode ILK, although ILK is constantly evolving, and becoming integrated into urban environments (Júnior et al. 20 2016; Oteros-Rozas et al. 2013; van Andel and Carvalheiro 2013). Thirdly, ILK holders are experiencing difficulty in using ILK due to loss of access to resources, such as through large-scale land acquisition (Siahaya et al. 2016; Speranza et al. 2010; de Coninck et al. 2018) and the increasing globalisation of food systems and integration into global market economy also threatens to erode ILK (Gómez-Baggethun et al. 2010; Oteros-Rozas et al. 2013; McCarter et al. 2014).). (P 7-109).

Incorporation of ILK in decision-making

ILK can be used in decision-making on climate change adaptation, Sustainable Land Management and food security at various scales and levels and is important for long-term sustainability (high confidence). Respect for ILK is both a requirement and an entry strategy for participatory climate action planning and effective communication of climate action strategies (Nyong et al. 2007b). The nature, source, and mode of knowledge generation are critical to ensure that sustainable solutions are community-owned and fully integrated within the local context (Mistry and Berardi 2016). Integrating ILK with scientific information is a prerequisite for such community-owned solutions. Scientists can engage farmers as experts in processes of knowledge co-production (Oliver et al. 2012), helping to introduce, implement, adapt and promote locally appropriate responses (Schwilch et al. 2011). Specific approaches to decision-making that aim to integrate indigenous and local knowledge include some versions of decision support systems (Jones et al. 2014) as well as citizen science and participatory modelling (Tengö et al. 2014). (P 7-109).

ILK can be deployed in the practice of climate governance especially at the local level where actions are informed by the principles of decentralisation and autonomy (Chanza and de Wit 2016; Harmsworth and

Awatere 2013). International environmental agreements also are increasingly including attention to ILK and diverse cultural perspectives, for reasons of social justice and inclusive decision-making (Brondizio and Tourneau 2016). However, the context-specific, and dynamic nature of ILK and its embeddedness in local institutions and power relations needs consideration (Naess 50 2013). It is also important to take a gendered approach so as not to further marginalise certain knowledge, as men and women hold different knowledge, expertise and transmission patterns (Díaz-52 Reviriego et al. 2017). (P 7-109).

Participation, Collective Action, and Social Learning

Collective action in land use policy has been shown to be more effective when implemented as bundles of actions rather than as single-issue actions. For example, land tenure, food security, and market access can mutually reinforce each other when they are interconnected (Corsi et al. 2017). For example, (Liu and Ravenscroft 2017) found that financial incentives embedded in collective forest reforms in China have increased forest land and labour inputs in forestry. (P 7-110).

7.6.5. Land Tenure

Land tenure, defined as "the terms under which land and natural resources are held by individuals, households or social groups", is a key dimension in any discussion of land-climate interactions, including the prospects for both adaptation and land-based mitigation, and possible impacts on tenure and thus land security of both climate change and climate action (Quan and Dyer 2008) (*medium* 32 *evidence, high agreement*). . (P 7-111).

Discussion of land tenure in the context of land-climate interactions in developing countries needs to consider the prevalence of informal, customary and modified customary systems of land tenure: estimates range widely, but perhaps as much as 65% of the world's total land area is managed under some form of these local, customary or communal tenure systems, and only a small fraction of this (around 15%) is formally recognised by governments (Rights and Resources Initiative 2015a). These customary land rights can extend across many categories of land, but are difficult to assess properly due to poor reporting, lack of legal recognition, and lack of access to reporting systems by indigenous and rural peoples (Rights and Resources Initiative 2018a). Around 521 million ha of forest land is estimated to be legally owned, recognised, or designated for use by indigenous and local communities as of 2017 (Rights and Resources Initiative 2018b), predominantly in Latin America, followed by Asia. However in India approximately million ha of forest land is managed under customary rights not recognised by the government (Rights and Resources Initiative 2015b). In 2005 only 1% of land 45 in Africa was legally registered (Easterly 2008a). (P 7-111). (P 7-110).

Much of the world's carbon is stored in the biomass and soil on the territories of customary landowners including indigenous peoples (Walker et al. 2014; Garnett et al. 2018), making securing of these land tenure regimes vital in land and climate protection. These lands are estimated to hold at least 293 GtC of carbon, of which around one-third (72 GtC) is located in areas where indigenous peoples and local communities lack formal recognition of their tenure rights (Frechette et al. 2018). (P 7-112).

…informal or customary systems can provide secure tenure (Toulmin and Quan 2000). For smallholder systems, (Bruce and Migot-Adholla 1994) among other authors established that African customary tenure can provide the necessary security for long-term investments in farm fertility such as tree-planting. For pastoral systems, (Behnke 1994; Lane and Moorehead 1995) and other authors showed the rationality of communal tenure in situations of environmental variability and herd mobility. However,

where customary systems are unrecognised or weakened by governments or the rights from them undocumented or unenforced, tenure insecurity may result (Lane 1998; Toulmin and Quan 2000). There is strong empirical evidence of the links between secure communal tenure and lower deforestation rates, particularly in intact forests (Nepstad et al., 2006; Persha, Agrawal, & Chhatre, 2011; Vergara-Asenjo & Potvin, 2014). Securing and recognising tenure for indigenous communities (such as through revisions to legal or policy frameworks) has been shown to be highly cost effective in reducing deforestation and improving land management in certain contexts, and is therefore also apt to help improve indigenous communities' ability to adapt to climate changes(Suzuki 2012; Balooni et al. 2008; Ceddia et al. 2015; Pacheco et al. 2012; Holland et al. 2017). (P 7-112).

Understanding of land tenure under climate change also has to take account of the growth in large-scale land acquisitions (LSLAs), also referred to as land-grabbing, in developing countries. These LSLAs are defined by acquisition of more than 200 ha per deal (Messerli et al. 2014a). Klaus Deininger (2011) links the growth in demand for land to the 2007-2008 food price spike, and demonstrates that high levels of demand for land at the country level are statistically associated with weak recognition of land rights. Land grabs, where LSLAs occur despite local use of lands, are often driven by direct collaboration of politicians, government officials and land agencies (Koechlin et al. 34 2016), involving corruption of governmental land agencies, failures to register community land claims and illegal lands uses and lack of the rule of law and enforcement in resource extraction frontiers (Borras Jr et al. 2011). Though data is poor, overall, small and medium scale domestic investment has in fact been more important than foreign investment (Deininger 2011; Cotula et al. 2014). There are variations in estimates of the scale of large-scale land acquisitions:the Nolte et al. (2016) report concluded deals totalling 42.2 million ha worldwide. Cotula et al. (2014) using cross-checked data for completed lease agreements in Ethiopia, Ghana and Tanzania conclude they cover 1.9%, 1.9% and 41 1.1% respectively of each country's total land suitable for agriculture. The literature expresses different views on whether these acquisitions concern marginal lands or lands already in use thereby displacing existing users (Messerli et al. 2014b). Land-grabbing is associated with and may be motivated by the acquisition of rights to water, and erosion of those rights for other users such as those downstream (Mehta et al. 2012)… (P 7-112).

While some authors see LSLAs as investments that can contribute to more efficient food production at larger scales (World Bank 2011; Deininger and Byerlee 2012), others have warned that local food security may be threatened by them(Daniel 2011; Golay and Biglino 2013; Lavers 2012). Reports suggest that recent land grabbing has affected 12 million people globally in terms of declines in welfare (Adnan 2013; Davis et al. 2014). De Schutter (2011) argues that large-scale land acquisitions will a) result in types of farming less liable to reduce poverty than smallholder systems, b) increase local vulnerability to food price shocks by favouring export agriculture and c) accelerate the development of a market for land with detrimental impacts on smallholders and those depending on common property resources. Land grabbing can threaten not only agricultural lands of farmers, but also protected ecosystems, like forests and wetlands (Hunsberger et al. 2017; Carter et al. 2017; Ehara 6 et al. 2018). (P 7-113).

The primary mechanisms for combatting LSLAs have included restrictions on the size of land sales (Fairbairn 2015); pressure on agribusiness companies to agree to the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security, known as the VGGT, or similar principles (Collins 2014; Goetz 2013); attempts to repeal biofuels standards (Palmer 2014); strengthening of existing land law and land registration systems (Bebbington et al. 2018); use of community monitoring systems (Sheil et al. 2015); and direct protests against the land acquisitions (Hall et al. 2015; Fameree 2016). (P 7-113).

Table 7.7 Major Findings on the Interactions between Land Tenure and Climate Change

Smallholder cropland

In South Asia and Latin America the poor suffer from limited access including insecure tenancies, though this has been partially alleviated by land reform. In Africa informal/customary systems may provide considerable land tenure security and enable long-term investment in land management, but are increasingly weakened by demographic pressures on available land resources increase. However, creation of freehold rights through conventional land titling is not a necessary condition for tenure security and may be cost-ineffective or counter-productive. Alternative approaches utilising low cost technologies and participatory methods are available. Secure and defendable land tenure, including modified customary tenure, has been positively correlated with food production increases.

Insecure land rights are one factor deterring adaptation and accentuating vulnerability.
Specific dimensions of inequity in customary systems may act as constraints on adaptation in different contexts. LSLAs may be associated with monoculture and other unsustainable land use practices, have negative consequences for soil degradation and disincentivise more sustainable forms of agriculture.

Secure land rights, including through customary systems, can incentivise farmers to adopt long-term climate-smart practices, e.g., planting trees in mixed cropland/forest systems.16

Increased frequency and intensity of extreme weather can lead to displacement and effective loss of land rights.17 REDD+ programmes tend slightly to increase land tenure insecurity on agricultural forest frontier lands, - but not in forests.18

Landscape governance and resource tenure reforms at farm and community levels can facilitate and incentivise planning for landscape management and enable the integration of adaptation and mitigation strategies.11

Rangelands

Communal management of rangelands in pastoral systems is a rational and internally sustainable response to climate variability and the need for mobility. Policies favouring individual or small group land-tenure may have negative impacts on both ecosystems and livelihoods.19,20,21

Many pastoralists in lands at risk from desertification do not have secure land tenure, and erosion of traditional communal rangeland tenure has been identified as a determinant of increasing vulnerability to drought and climate change and as a driver of dryland degradation.

Where pastoralists' traditional land use does not have legal recognition, or where pastoralists are unable to exclude others from land use, this presents significant challenges for carbon sequestration initiatives.27,28

Increasing conflict on rangelands is a possible result of climate change and environmental pressures, but depends on local institutions.29 Where land use rights for pastoralists are absent or unenforced, demonstrated potential for carbon sequestration may assist advocacy.

Carbon sequestration initiatives on rangelands may require clarification and maintenance of land rights.27,28

(P 7-114)

Forests

Poor management of state and open-access forests has been combatted in recent years by a move towards forest decentralisation and community co-management.30,31,32,33,34,35 Land tenure systems have complex interactions with deforestation processes. Land tenure security is generally associated with less deforestation, regardless of whether the tenure form is private, customary or communal.33,36,37,38 Historical injustices towards forest dwellers can be ameliorated with appropriate policy, e.g., 2006 Forest Rights Act in India.39 (P 7-115)

Land tenure security can lead to improved adaptation outcomes40, 41,42,43 but land tenure policy for forests that focuses narrowly on cultivation has limited ability to reduce ecological vulnerability or enhance adaptation.39 Secure rights to land and forest resources can facilitate efforts to stabilise shifting cultivation and promote more sustainable resource use if appropriate technical and market support are available.44 (P 7-115)

Land tenure insecurity has been identified as a key driver of deforestation and land degradation leading to loss of sinks and creating sources of GHGs45,46,47,48,49 . While land tenure systems interact with land-based mitigation actions in complex ways,36 forest decentralisation and community co-management has shown considerable success in slowing forest loss and contributing to carbon mitigation. 30,31,32,33,34, 35 Communal tenure systems may lower transaction costs for REDD+ schemes, though with risk of elite capture of payments.16 (P 7-115)

Findings on both direction of change in tenure security and extent to which this has been influenced by REDD+ are very diverse. The implications of land-based mitigation (e.g., BECCS) on land tenure systems is currently understudied, but evidence from biofuels expansion shows negative impacts on local livelihoods and loss of forest sinks where LSLAs override local land tenure.50,51 (P 7-115)

Forest tenure policies under climate change need to accommodate and enable evolving and shifting boundaries linked to changing forest livelihoods.10 REDD+ programmes need to be integrated with national-level forest tenure reform.18 (P 7-115)

In drylands, weak land tenure security, either for households disadvantaged within a customary tenure system or more widely as such a system is eroded, can be associated with increased vulnerability and decreased adaptive capacity (*limited evidence, high agreement*). There is *medium evidence* and *medium agreement* that land titling and recognition programs, particularly those that authorise and respect indigenous and communal tenure, can lead to improved management of forests, including for carbon storage (Suzuki 2012; Balooni et al. 2008; Ceddia et al. 2015; Pacheco et al. 2012), primarily by providing legally secure mechanisms for exclusion of others (Nelson et al. 2001; Blackman et al. 7 2017). However, these titling programs are highly context-dependent and there is also evidence that titling can exclude community and common management, leading to more confusion over land rights, not less, where poorly implemented (Broegaard et al. 2017). For all the systems, an important finding is that land policies can provide both security and flexibility in the face of climate change, but through a diversity of forms and approaches (recognition of customary tenure, community mapping, redistribution,

decentralisation, co-management, regulation of rental markets, strengthening the negotiating position of the poor) rather than sole focus on freehold title (Quan & Dyer, 2008; K 14 Deininger & Feder, 2009; St. Martin, 2009) (*medium evidence, high agreement*). Land policy can be climate-proofed and integrated with national policies such as NAPAs (Quan and Dyer 2008). Land administration systems have a vital role in providing land tenure security, especially for the poor, especially when linked to an expanded range of information relevant to mitigation and adaptation (Quan and Dyer 2008; van der Molen and Mitchell 2016). Challenges to such a role include outdated and overlapping national land and forest tenure laws, which often fail to recognise community property rights and corruption in land administration (Monterrosso et al. 2017), as well as lack of political will and the costs of improving land administration programs (Deininger and Feder 2009). (P 7-116)