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A Role for Drylands in a Carbon Neutral World?

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Drylands are a critical part of the earth system in terms of total area, socioeconomic and ecological importance. However, while drylands are known for their contribution to inter-annual atmospheric CO_2 variability, they are sometimes overlooked in discussions of global carbon stocks. Here, in preparation for the November 2021 UN Climate Change Conference (COP26), we review dryland systems with emphasis on their role in current and future carbon storage, response to climate change and potential to contribute to a carbon neutral future. Current estimates of carbon in dryland soils and vegetation suggest they are significant at global scale, containing approximately 30% of global carbon in above and below-ground biomass, and surface-layer soil carbon (top 30 cm). As ecosystems that are limited by water, the drylands are vulnerable to climate change. Climate change impacts are, however, dependent on future trends in rainfall that include both drying and wetting trends at regional scales. Regional rainfall trends will initiate trends in dryland productivity, vegetation structure and soil carbon storage. However, while management of fire and herbivory can contribute to increased carbon sequestration, impacts are dependent on locally unique ecosystem responses and climate-soil-plant interactions. Similarly, while community based agroforestry initiatives have been successful in some areas, large-scale afforestation programs are logistically infeasible and sometimes ecologically inappropriate at larger scales. As climate changes, top-down prescriptive measures designed to increase carbon storage should be avoided in favour of locally-adapted approaches that balance carbon management priorities with local livelihoods, ecosystem function, biodiversity and cultural, social and economic priorities.

Keywords: drylands, carbon cycle, climate change, soil carbon (C) sequestration, vegetation carbon

1 INTRODUCTION

1.1 Drylands in the Earth System

The term "dryland" is used to describe water-limited ecosystems where the amount of precipitation (P, mm) is consistently less than the potential evapotranspiration (PET, mm). The balance between water supply and water demand can be conveniently represented using the ratio P/PET (**Figure 1**), with drylands typically defined for P/PET <0.65. Historically, drylands have been estimated to cover ~40% of the earth's land surface (excluding Greenland and Antarctica) (UNCCD 2017), but recent studies suggest that the bioclimatic conditions supporting dryland areas has increased in recent decades (Prăvălie et al., 2019; Huang et al., 2015; Yao et al., 2020; Feng & Fu, 2013). Drylands can be found in every continent, with the largest areas in Eurasia and Africa and significant drylands in Africa north and south of the equator, across most of Australia, parts of South America and western

FIGURE 1 | Location of the drylands based on annual precipitation (P) and potential evapotranspiration (PET), with hyper-arid (HA, P/PET <0.05), arid (A, 0.05 < P/PET <0.2), semi-arid (SA, 0.2 < P/PET <0.5) and dry sub-humid (DS, 0.5 < P/PET <0.65). Data used to construct this map derived from the Global Aridity and Potential Evapotranspiration (ETO) Climate Database (V2; Trabucco and Zomer, 2019) and the WorldClim historical climate data (V1; Fick and Hijmans, 2017).

North American (**Figure 1**; Trabucco and Zomer, 2019). Rainfall in dryland areas can be highly variable, both temporally and spatially, increasing variability in vegetation production, and increasing uncertainty and risk for the rural and often marginalized communities that depend on the drylands (Global Mechanism of the UNCCD, Conservation International, 2019).

Projections for future rainfall trends in global drylands vary between and within continents, with reduced annual rainfall totals projected in some areas, but increases possible in others (Asadi Zarch et al., 2017; Ross et al., 2021). However, the net impact of climate change in most drylands will be towards increasing aridity as temperatures and evaporative demands increase (Prăvălie et al., 2019). Here we review what is known about the current role of the drylands in the global carbon cycle and climate regulation, potential changes with climate change, and strategies for the drylands to contribute to a carbon neutral future.
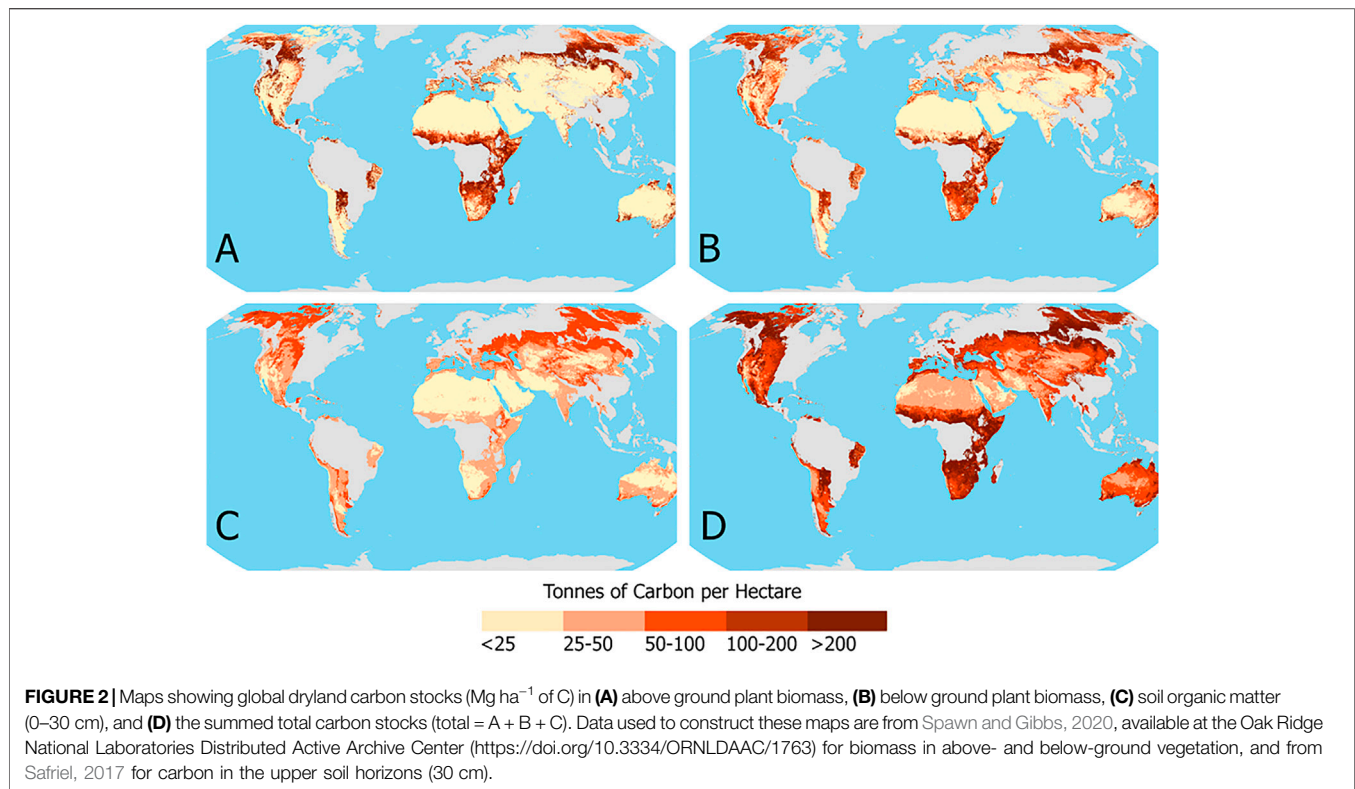
1.2 Dryland Livelihoods

Drylands are home to more than 2 billion people, the majority of whom rely directly on the ecosystems in which they live for food production and incomes (FAO, 2011). Drylands are predominantly grasslands, but include savanna and drought seasonal shrublands, drought-seasonal woodlands, cold deserts of high latitude and high altitude, and hot deserts of the mid-latitudes (FAO 2011). Human land use in the drylands is dominated by livestock grazing, but with significant areas devoted to small-grain rain-fed agriculture in the dry sub-humid zones and irrigated crop production in areas with available water (Plaza et al., 2018). Over the last decades, land use in drylands has undergone significant change, particularly in tropical and mid-latitude drylands. Increasing population numbers, migration and other political and socio-economic drivers have reduced mobility, reducing prevalence of transhumant and nomadic herding systems, and shifting land use and tenure systems towards a greater reliance on settled grazing systems and more permanent cropland (Herrera et al., 2014). The move away from traditional land use systems, which in many regions use mobility as an effective adaptation to rainfall fluctuations, has contributed to increased incidence of land degradation and loss of vegetation cover (Reid et al., 2016).

1.3 Dryland Biodiversity

Drylands include a range of biomes from desert and arid steppe, to dry savannas and shrublands and seasonal woodlands, each with unique communities of flora and fauna (Maestre et al., 2021). Dryland species have adapted to a range of environmental extremes (particularly drought, herbivory and fire) which in some areas has led to high levels of diversification and hotspots of plant biodiversity, including the dry shrublands and forests of South and Central America, interior Australia and the Cape Floristic Region of South Africa. Indeed, about one third of global hotspots for biodiversity can be found in drylands (Davies et al., 2012). The association between grasses and large mammalian herbivores has also supported high faunal diversity in many drylands, including the mega-fauna, large mammalian grazers and diverse carnivore guilds that persist today in the savannas of Africa and Asia (Olff et al., 2002; Hempson et al., 2015). Many traditional land use systems practiced in drylands maintain the biodiversity on which

FIGURE 2 | Maps showing global dryland carbon stocks (Mg ha^{-1} of C) in **(A)** above ground plant biomass, **(B)** below ground plant biomass, **(C)** soil organic matter (0–30 cm), and **(D)** the summed total carbon stocks (total = A + B + C). Data used to construct these maps are from Spawn and Gibbs, 2020, available at the Oak Ridge National Laboratories Distributed Active Archive Center (https://doi.org/10.3334/ORNLDAAC/1763) for biomass in above- and below-ground vegetation, and from Safriel, 2017 for carbon in the upper soil horizons (30 cm).

they rely. For example, transhumance and nomadic livestock systems that emerged in many parts of the world in response to drought and cold-seasonality, use mobility as a strategy that not only reduces overgrazing and degradation, but also enhances coexistence with wild herbivores (Niamir-Fuller et al., 2012).
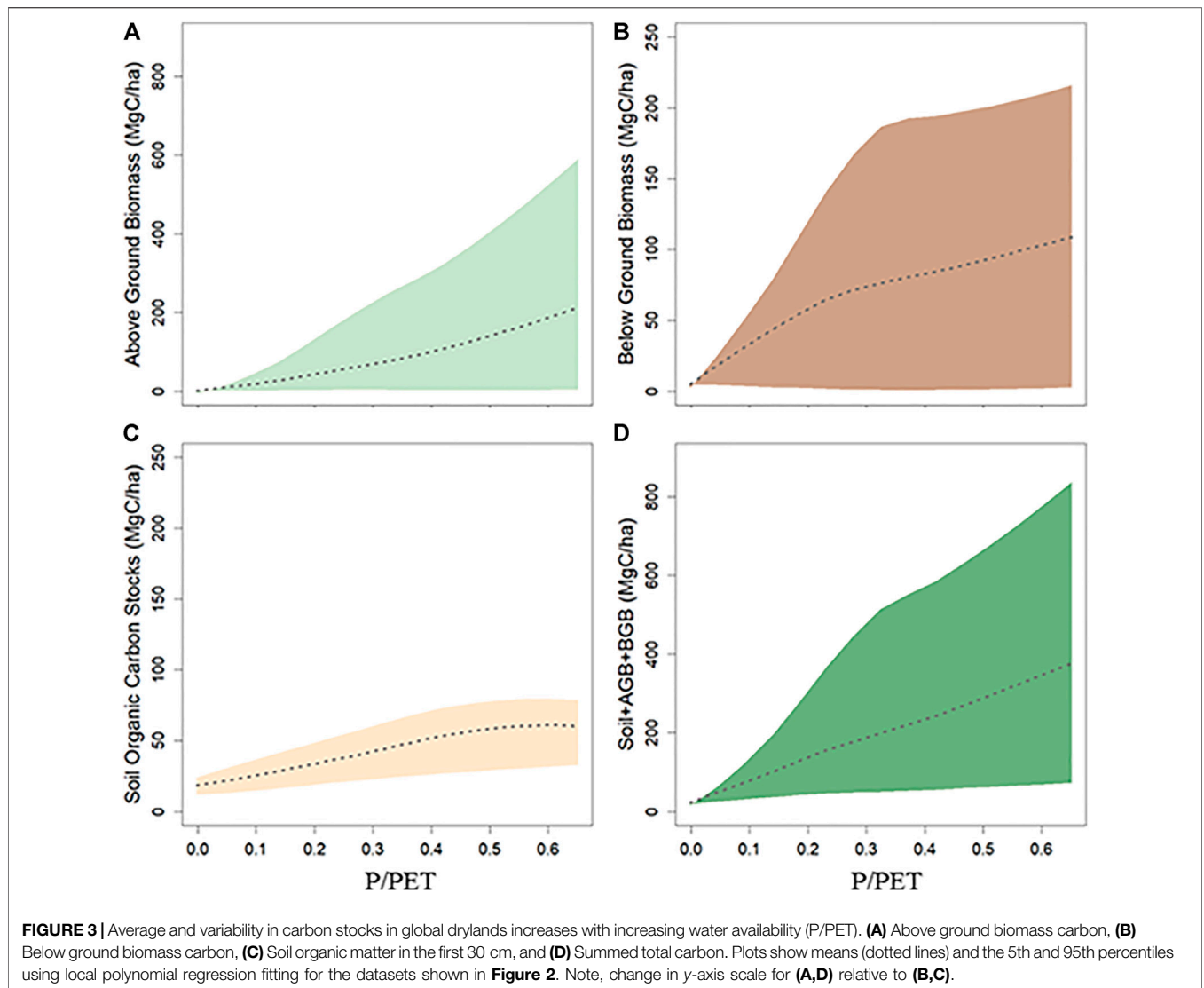
1.4 Dryland Carbon

Carbon stocks in drylands soils and vegetation are generally low, when expressed as carbon per unit area, relative to forested ecosystems, due to the constraints that temperature, moisture and coarse textured sandy soils place on annual primary productivity. Thus, for example, carbon stocks in above- and below-ground plant biomass are generally less than 100 Mg ha^{-1} C, except in the wetter dry subhumid regions (**Figures 2A, B**). Similarly, organic carbon stocks in the top 30 cm of soil (**Figure 2C**) are generally less than 50 Mg ha^{-1} in tropical (hot) drylands, but can be much higher in the high latitude (cold) drylands and mesic grasslands (Bardgett et al., 2021). In combination, however, total carbon (the sum of above and below-ground plant biomass and soil organic matter) can be considerable (e.g. > 200 Mg ha^{-1}) across a large fraction of the drylands.

Global dryland carbon stock approximations, based on the data shown in **Figures 2, 3**, suggest that above- and below-ground biomass in the drylands sum to 790 Pg and 614 Pg, respectively, representing approximately 22 and 38% of global totals in these pools (**Table 1**). These biomass numbers for the drylands are high, relative to more conventional global carbon

pool estimates (e.g. Friedlingstein et al., 2020), in part because tree biomass in the drylands is often assumed to be at or near zero (i.e. under-counted), and in part because the data in **Figure 2** includes estimates for annual average herbaceous carbon stocks, which are a feature of dryland systems and not generally included in global carbon pool analyses. **Table 1** also shows that soil organic matter carbon (SOMc) in shallow, more active, soil layers (0–30 cm) totals ~407 Pg across the drylands, equivalent to ~44% of global SOMc in surface soils. Independent estimates, including organic matter in deeper soils (0–200 cm), suggest total soil organic matter carbon (SOMc) in drylands on the order of 646 Pg, equivalent to approximately 32% of global shallow and deep soil carbon (Plaza et al., 2018). Further, soil inorganic carbon stocks tend to be higher in drylands, representing ~79% of global inorganic soil carbon (1,558 Pg; Plaza et al., 2018).

While the estimates in **Figures 2, 3** and **Table 1** provide only broad approximations, the take-home message is clear: dryland carbon stocks are significant and should be considered a central, and essential, part of global carbon cycle calculations. It is critical to assess how climate and land use change in the coming decades will impact dryland ecosystems, altering rainfall and temperature in ways that may change vegetation dynamics and interact with changing land use, producing regions of net loss or accumulation of carbon in vegetation and both organic and inorganic carbon in soils. In particular, preservation of existing carbon stocks and restoration of degraded carbon stocks may, in some places, have the potential to play a significant role in climate change

FIGURE 3 | Average and variability in carbon stocks in global drylands increases with increasing water availability (P/PET). **(A)** Above ground biomass carbon, **(B)** Below ground biomass carbon, **(C)** Soil organic matter in the first 30 cm, and **(D)** Summed total carbon. Plots show means (dotted lines) and the 5th and 95th percentiles using local polynomial regression fitting for the datasets shown in **Figure 2**. Note, change in *y*-axis scale for **(A,D)** relative to **(B,C)**.

TABLE 1 | Estimates of total carbon (C) in global drylands, summarizing data from **Figure 2** for the aridity zones identified in **Figure 1**. The Spawn and Gibbs, 2020 biomass analyses are derived from data on above-ground wood and below-ground root biomass, with modelled/calibrated estimates of average carbon in herbaceous vegetation. Soil organic carbon estimates (Safriel, 2017) are for the top 30 cm of soil only, representing the more active layers. Carbon estimates for humid terrestrial systems (P/PET >0.65) and total terrestrial systems are from the same datasets (note that humid systems were not shown in **Figures 1, 2** to emphasize the drylands).

Zone	Aboveground biomass (pg C)	Belowground biomass (pg C)	Soil organic matter (pg C)	All stocks (pg C)
Hyperarid	7.2	16.8	31.3	55.3
Arid	55.2	88.7	67.3	211.2
Semiarid	334.7	285.6	175.9	796.1
Dry subhumid	393.0	222.7	133.3	748.9
All drylands	790.0	613.8	407.7	1,811.5
Humid	2,773.5	1,006,7	512.7	4,292.8
Global	3,563.5	1,620.5	920.4	6,104.3
Dryland/Global	22.1%	37.9	44.3%	29.7%
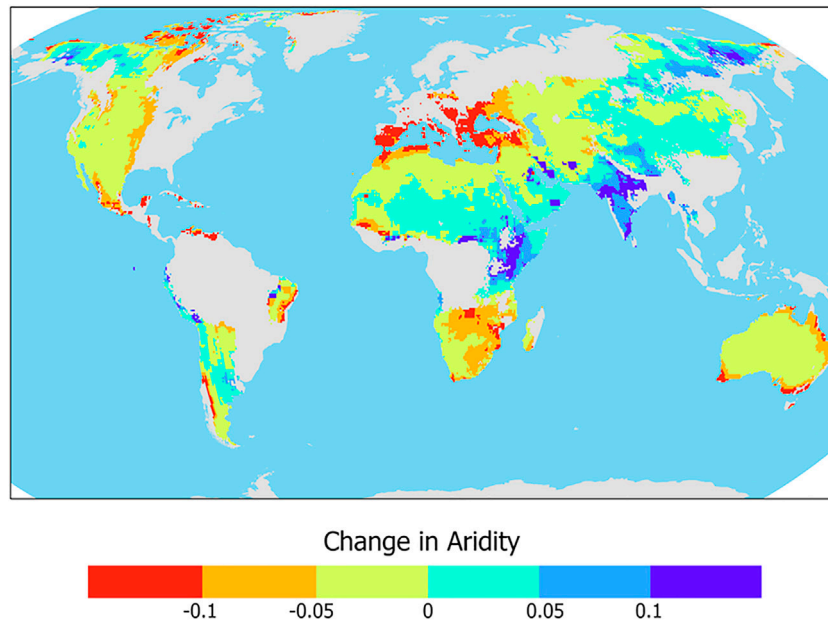
FIGURE 4 | Change in aridity (P/PET) projected for 2076–2100 relative to 2006–2025 averaged across 22 GCM participating in the climate model inter-comparison project (CMIP5) for continued greenhouse gas emissions and a cumulative 8.5 W additional radiative forcing (RCP 8.5). Figure reproduced from original analysis of Zarch et al., 2017.

mitigation and national and international goals for a carbon neutral future.

2 IMPACTS OF CLIMATE CHANGE ON DRYLANDS

2.1 Changing Climates
Inter-annual variability in rainfall, primary production and subsequent wild-fires in global drylands are the dominant contributors to inter-annual fluctuations in atmospheric CO_2 concentrations (Williams et al., 2007; Ahlström et al., 2015). However, the long-term role of the drylands in mitigating carbon emissions will depend, not on inter-annual variability, but on long-term trajectories of carbon storage in vegetation (above and below ground) and soil organic and inorganic carbon. The recently released IPCC A6 Climate Change report found an increase in the incidence of hot extremes and agricultural drought in almost all dryland areas, meaning current land management strategies will need to be adapted in many drylands if they are to remain productive and habitable (IPCC 2019). For example, Prăvălie et al. (2019) used two databases of aridity to estimate the current extent of drylands and how this changed between 1950 and 2000. They found that dryland regions have already increased in all continents, with the exception of Europe and South America, with changes in bioclimatic conditions in China accounting for more than 30% of new arid land areas (Prăvălie et al., 2019). On a global scale, they attributed the expansion of dryland bioclimates to climate change experienced after 1980.

The analysis of climate change trajectories for the 21st century by Asadi Zarch et al., 2017 indicates widespread, but spatially variable, changes in aridity (P/PET; **Figure 4**). Their analysis used 22 general circulation models (GCM) and the "business as usual" emission scenario (i.e. assuming that effective international greenhouse emission reductions do not occur). The projections indicate that many dryland regions in North and South America, West and southern Africa, southern Europe, Central Asia and Australia will become more arid. However, significant regions in East Africa, South and East Asia, Siberia and Alaska may experience net increases in water availability. These interpretations are in substantial agreement with the earlier analysis of Feng and Fu (2013).

These regional differences in climate change trajectories represent both challenges and opportunities for carbon sequestration, with divergent responses to climate change signals between tropical, temperate and arctic drylands. In the tropics and most temperate drylands, increases in water availability will generally be correlated with increasing carbon in both soils and vegetation, while increasing aridity will tend to reduce carbon stocks (**Figure 2**). In arctic systems, however, increasing temperatures and melting permafrost, regardless changing rainfall, risk mobilizing huge reservoirs of ancient carbon hitherto immobilized in the permafrost (Turetsky et al., 2019).

2.2 Changing Vegetation
The impacts of climate change on dryland vegetation are both indirect and direct. Direct effects include increases in hot extremes and meteorological droughts that could push

grassland and savanna systems beyond tipping points leading to dryland degradation (Bernardino et al., 2020). Indeed, recent analyses suggests that 20–35% of drylands are degraded (IUCN 2019). According to the IPCC Special Report on Climate and Land (IPCC 2019), climate change-induced degradation has reduced pastoral productivity in dryland areas of Africa, with associated reductions in livestock productivity. This is a trend that is likely to continue in drylands in Africa and Asia (IPCC 2019). Indirectly, climate change will also impact land use options and, in low-income drylands, contribute to migration, urban expansion and conversion of drylands to cropland (Fu et al., 2021).

At global and continental scales, changing rainfall patterns could lead to decreasing or increasing vegetation production and carbon stocks in woody biomass. For example, recent analysis of impacts of 21st Century climate change in Africa, suggests that at continental scales changing temperature, rainfall and land use patterns will have a small negative impact on the carbon stored in woody vegetation across the entirety of Sub-Saharan Africa (Ross et al., 2021). However, at regional scales, distinct regional drying in Southern and West Africa will tend to reduce woody biomass, while projected increases in rainfall in parts of East Africa will tend to increasing vegetation biomass in that region. The analysis of Ross et al. (2021) also indicates that the interactions between climate and land use will impact different dryland regions in different ways, depending on the changing rainfall patterns, projected changes in human populations, land use and use of fire. Thus a picture emerges of differential risks and opportunities for carbon sources and sinks across global drylands.

2.3 Changing Soil Carbon

In regions experiencing increasing drought and heat extremes, soil organic carbon can be reduced through reduced inputs from vegetation primary production and increased exposure of soils to wind and water erosion (Okin et al., 2018). Increasing frequency of other extremes, such as intense rainfall events, can lead to surface sealing preventing moisture infiltration, reduced plant growth and ultimately a reduction in soil carbon stocks (Fu et al., 2021). In common with vegetation, climate impacts on soil carbon stocks can also be indirect, with conversion to cropland driven by population growth and climate change induced migration leading to losses of up to 60% of SOC stocks in dryland soils (IUCN 2019). The differences in above-ground woody biomass across gradients in tree and shrub cover are not necessarily associated with similar changes in SOMc carbon or root biomass, because grasslands can also store significant amounts of below-ground carbon in both SOMc and root biomass pools (Jackson et al., 2002; Schutz et al., 2009; Dass et al., 2018).

2.4 Climate Feedbacks

While drylands are sensitive to climate change, their large spatial extent means they may also have key roles to play in global climate regulation, with the potential to either exacerbate or mitigate global warming. Climate feedbacks *via* albedo, surface roughness and boundary layer interactions (controlling surface temperature, atmospheric stability, cloud formation and rainfall) were once thought of as a key mechanism linking vegetation degradation in arid regions to future rainfall (Otterman, 1974; Charney et al., 1975). More recent observations and climate model simulations, however, indicate that global sea surface temperatures generally provide the stronger forcing for regional drought than do local or regional-scale land surface-atmosphere interactions (Giannini et al., 2003; Neelin et al., 2003; Held et al., 2005; Lu and Delworth, 2005). On the other hand, the vast spatial extent of the drylands may mean that the cumulative effects of, for example, reduced evapotranspiration could impact regional scale rainfall (as inferred from model experiments in Zemp et al., 2017). Indeed, evidence has already been found for drying climates in higher latitudes in both Asia and North America which can threaten carbon stocks stored in organic soils associated with boreal forests and permafrost (Prăvălie et al., 2019). Furthermore, increases in dust emissions from the drylands, and industrial aerosol emissions from remote urban centers, can deflect incoming radiation impacting cloud formation and precipitation (Booth et al., 2012; Choobari et al., 2014).

3 MANAGEMENT OPPORTUNITIES FOR DRYLANDS IN A CARBON NEUTRAL FUTURE

3.1 International Agreements

The ability to limit global warming below 2 °C, the target set by the Paris Climate Agreement, is predicated on significant greenhouse gas (GHG) emission reductions in the land use sector (Wollenberg et al., 2016). While land use accounts for nearly 25% of net annual anthropogenic GHG emissions (Roe et al., 2019), it also offers opportunities to mitigate climate change. Estimates suggest that globally land use interventions could generate up to 30% of the emission reductions and carbon sequestration needed to meet the Paris Agreements (Griscom et al., 2017). Given the huge area of the drylands, efforts to preserve and enhance carbon in dryland vegetation and soils will be a critical part of this effort. This is recognised by the UN's Convention to Combat Degradation (UNCCD), which has set forth an aim to achieve Land Degradation Neutrality by 2030. To date 127 countries have signed up to work towards LDN, including many countries in drylands where vegetation degradation, and associated loss of soil and biomass carbon, is an ongoing risk.

Various international agreements as part of the UN Decade on Ecosystem Restoration, including the Rio Conventions, the Bonn Challenge and related regional initiatives, provide a total global range of commitments from 765 million to 1 billion hectares restored, or undergoing restoration, by 2030 (Sewell et al., 2020). The commitments cover a wide range of land use types including forest (42%) and agricultural lands, including cropland and grassland (37%; Sewell et al., 2020). Almost half of all restoration commitments are in Sub-Saharan Africa. To narrow this geographic imbalance, there may be scope to

expand dryland restoration and carbon management programs in underrepresented regions, including North America, Russia and Central Asia, West and Central Europe, the Middle East and Northern Africa (Sewell et al., 2020).

3.2 Land Use

The human populations inhabiting drylands have devised land use and management strategies which are resilient and adaptable. Future adaptations to climate change in drylands need to build on this history, engaging with local communities to ensure policies are informed by local practices, strategies and governance structures. In addition, management practices directed towards the preservation or enhancement of carbon stocks in the drylands must, first and foremost, be compatible with the livelihoods, sustainability and autonomy of local populations, while also addressing wildlife and conservation priorities (Reid et al., 2016). Adaptation to climate change in drylands will likely demand further diversification, meaning markets will also need to adapt to accommodate the production of drought and heat resistant crops (ICARDA/CCAFS, 2012).

3.3 Afforestation and Reforestation for Carbon Sequestration

Arguments have been made for carbon mitigation in drylands based on afforestation or reforestation of existing, and often ancient, grasslands and savannas (Bastin et al., 2019). Whether this should be considered either feasible or desirable is the topic of some considerable debate (Veldman et al., 2015; Bastin et al., 2019; Bond et al., 2019; Lewis et al., 2019; Veldman et al., 2019; Aynekulu et al., 2021). Bastin et al., 2019, modelled the potential climate change mitigation impacts of increasing global forest cover, including increasing tree cover in the drylands. However, a global assessment of this type tends to overlook issues specific to local dryland systems, and the logistical, ecological and social-ecological difficulties that so often cause large-scale reforestation programs to fail (Coleman et al., 2021; Del Campo et al., 2021). At local scales, where social-ecological conditions permit, small scale afforestation programs can be managed to contribute to carbon storage, while also meeting community needs for timber, fruit, nuts and fuelwood (Sendzimir et al., 2011; Hanan, 2018). Community-driven and locally appropriate programs have been successful, but the potential mismatch of top-down programs with local socioeconomic and cultural priorities, and impacts on ecosystem function and biodiversity, need careful consideration (Herrmann and Tappan, 2013; Bond et al., 2019).

3.4 Livestock Management

Managing livestock for carbon sequestration in drylands will depend upon an increased understanding of the interacting impacts of changing climate and grazing practices. Studies have suggested that seasonal rainfall patterns (modal, bi-modal, shorter and longer rainy seasons, etc.) are as important as total annual precipitation in determining how grazing and precipitation interact to effect soil carbon stocks. For example, von Wehrden et al., 2012 reviewed more than 50 studies and found that in higher rainfall areas with low inter-annual

variability, there was a high incidence of degradation caused by grazing. This is consistent with the Ellis and Swift (1988) model, suggesting that high variability in rainfall buffers drylands against degradation due to long-term limits on livestock populations. Another review by Derner and Schuman (2007) suggested a threshold of 600 mm mean annual precipitation above which grazing tends to reduce soil carbon in rangelands. In drylands with rainfall below this threshold, however, inter-annual variability in rainfall has a larger impact on soil carbon stocks than grazing pressure. As climates change, the impact of grazing on plant community composition and palatability will also influence pastoral sustainability, diversity, structure and function of the drylands (Koerner et al., 2018).

3.5 Fire

Fire is used as a management practice in many drylands. It can increase nutrients in the soil, leading to a flush of new growth for grazing animals. However, frequent fires release biomass carbon and other greenhouse gases to the atmosphere (Scholes and Andreae, 2000) and tend to reduce long-term tree cover and tree biomass (Hanan and Lehmann, 2011). However, the short-term impacts of fire on above ground vegetation in ecosystems adapted to fire has relatively little impact on annual carbon balance, since the primary fuels are short-lived herbaceous plants where carbon uptake during the growing season inevitably turns-over rapidly either through fire, or herbivory or decomposition (Bond and Keely, 2005). For example, Hanan et al. (2008) showed that in savannas exposed to frequent fire, individual fires may remove tree seedlings, and thus prevent increase in tree cover, but they have relatively little impact on carbon stocks in larger, already established and fire resistant trees. The impacts of fire on carbon held in the soil can be equally complex. Fire can increase input of black carbon to the soil, but can also increase soil respiration causing a net loss (Scholes and Andreae, 2000). Frequency and timing of burning are a major determinant of carbon changes in soil. Burning during the dry season has been shown to result in higher losses of SOC, whereas cooler wet season fires may have no effect on SOC (Fynn et al., 2003). In addition, the loss of ground cover during fires can be associated with increased soil erosion (and loss of SOC) in subsequent rainfall events (Everson et al., 1989; Okin et al., 2018). Thus fire management provides opportunities for preservation and enhancement of carbon in soils and vegetation, but top-down proscriptive approaches should be avoided in favour of locally-adapted programs that recognize the local constraints on carbon dynamics and local social and ecological priorities.

4 CONCLUSION AND RECOMMENDATION

Drylands are a critical part of the earth system in terms of total area, socioeconomic and ecological importance (**Figure 1**). While somewhat overlooked in discussions of global carbon dynamics, their large spatial extent means they are in fact highly significant for global terrestrial carbon storage in both vegetation and soils (**Figure 2**; **Table 1**). As ecosystems that are, by definition, limited

by water availability, the drylands are vulnerable to long-term increases in temperature. Climate change impacts are, however, particularly dependent on future trends in rainfall that climate model scenarios indicate will include both drying and wetting trends at regional scales (**Figure 4**). Regional rainfall trends will initiate trends in dryland productivity, vegetation structure and soil carbon storage (**Figure 3**). By virtue of their existing large carbon stocks, coupled with management opportunities to protect and restore carbon, drylands can also play a significant role in climate regulation. In particular, drylands have the potential to either exacerbate or mitigate global warming based on local and regional changes in soil organic matter and biomass in woody vegetation structure, particularly *via* management of fire and grazing, and community-based local afforestation and agroforestry initiatives. However, while management of fire and herbivory can contribute to increased carbon sequestration, results are highly dependent on locally unique ecosystem responses and climate, soil, plant interactions. Globally, drylands are home to more than 2 billion people, meaning that future climate changes and top-down management decisions will impact about a quarter of the world's population. However, many dryland communities have developed land management systems which are well adapted to historical and current social, ecological and climatological conditions. As the climate changes in the coming decades, top-down prescriptive measures designed to increase carbon storage should be avoided in favour of locally-adapted approaches that balance carbon management priorities with local livelihoods, ecosystem function, biodiversity and cultural, social and economic priorities.

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