ASIAN JOURNAL OF FORESTRY
Volume 8, Number 1, June 2024
Pages: 1-17

E-ISSN: 2580-2844
DOI: 10.13057/asianjfor/r080101

Review: The potential of agroforestry in South Asian countries towards achieving the climate goals

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Manuscript received: 18 July 2023. Revision accepted: 11 September 2023.

Abstract. *Raihan A. 2024. Review: The potential of agroforestry in South Asian countries towards achieving the climate goals. Asian J For 8: 1-17.* Throughout history, millions of South Asian smallholder farmers have relied on traditional agroforestry techniques. Since last two decades, agroforestry's potential as a carbon sink has been debated in international climate negotiations. Greenhouse Gases (GHGs) offsetting, livelihood provision, Sustainable Development Goals (SDGs) localization, and achievements towards biodiversity conservation are the areas in which agroforestry plays a pivotal role. This paper reviews the benefits of agroforestry practices to human well-being and assesses their contribution on adaptation and mitigation of climate change in South Asian countries. This research delves into the factors that can help or hinder the mainstream adoption of agroforestry systems, which could be used to achieve international goals for reducing consequences of global warming. The South Asian countries who have joined hands in the Nationally Determined Contributions (NDCs) to the United Nations Framework Convention on Climate Change (UNFCCC) recognize the value of agroforestry systems in mitigating global warming. A major enabling condition for ensuring the efficacy of employing agroforestry to achieve climate targets was established in 2016 with the adoption of the South Asian Association for Regional Cooperation (SAARC) resolution on agroforestry by all regional governments. One of the main obstacles to effectively monitoring plant and soil carbon stocks is the lack of standardized approaches to database building. Other challenges that should be properly addressed by nations in the region in order to enhance their capacities to accomplish national climate ambitions include water shortages, inadequate governance through interaction, property rights for farmers, legal protections complications, and inadequate financial assistance to small-scale farmers for agroforestry. Strong examples were provided from Nepal and India, encompassing sustainable local economies, carbon-free futures, and financial incentives, all of which point to the need to move from planning to implementation to improve readiness.

Keywords: Agroforestry, carbon neutrality, climate change, emission reduction, South Asia

INTRODUCTION

Human-caused climate change is currently recognized as a global climate emergency (Ripple et al. 2020; Raihan and Said 2022; Evans-Agnew et al. 2023; Raihan and Himu 2023; Raihan 2023a). Many places have been hit harder by climate change due to greater vulnerability to climatic risks and poor adaptability (IPCC 2022; Isfat and Raihan 2022; Caretta et al. 2023; Johnson et al. 2023; Raihan 2023b). Sustainable Development Goals (SDGs) including food security, biodiversity protection, ecosystem restoration are major worldwide challenges (Feliciano et al. 2018; Begum et al. 2020; Kok et al. 2023; Raihan 2023c). Natural disasters and climatic variability are increasing, making climate adaptation and mitigation more important (Raihan and Tuspekova 2023a; Ghosh et al. 2023; Usman et al. 2023). Adaptation activities to enhance methods for managing water and land are vital to climate risk resilience (Amer et al. 2023; Kyriakopoulos and Sebos 2023; Raihan and Tuspekova 2023b).

Countries like Sri Lanka, Pakistan, Bangladesh, India, the Maldives, Nepal, Afghanistan, and Pakistan make up South Asia. South Asia has many civilizations and ecosystems (Steger 2023; Voumik et al. 2023). South Asia's growing population, poverty, dependency on natural resources, and low adaptive capacity make it vulnerable to climate change (Raihan and Voumik 2022a; Ranasinghe et al. 2023). Approximately 25% of the world's population lives in South Asia (Maharjan et al. 2020; Sarkar et al. 2023). Rapid population growth and the geographical position of the countries (cyclone prone coastal areas of India, Bangladesh, Sri Lanka, and the Maldives) make the region a hotspot of climate crisis (Dutta et al. 2013). It is becoming harder to feed a growing population without jeopardizing agricultural land (Raihan and Tuspekova 2022a; Rabbi et al. 2023). Expanding and intensifying agriculture worsens biodiversity loss and deforestation (Mulinge 2023; Raihan 2023d). Food production must be environment friendly because of limited agricultural land per population (Beal et al. 2023; Raihan et al. 2023a). Multifunctional land use systems support productive landscapes, ecosystems, social, economic, and regulatory goals while meeting rising regional land and food demands and climatic dangers (Westholm and Ostwald 2020; Baldwin et al. 2023; Raihan et al. 2023b).

Adaptation is necessary since climate extremes are expected to strike developing nations the hardest (Yang et al. 2020; Stange et al. 2023). Farmers must adapt to changing climates and invest in productive, cost-effective farms to achieve the SDGs (Jat et al. 2020; Wang et al.

2023; Raihan 2023e). The Intergovernmental Panel on Climate Change (IPCC) has highlighted South Asia's ability to embrace alternatives for both adaptation and mitigation, with the potential for carbon-offset partnerships to advance pro-poor development. Farmers oversee techniques like agroforestry, natural regeneration, and adaptive agriculture (Raihan et al. 2018; Cialdella et al. 2023). When contemplating adaptation-mitigation synergy, income diversification from trees and forests shouldn't be the exclusive focus. Restoring ecosystems improves soil health, biodiversity, and fire safety (Raihan et al. 2019; Kirkland et al. 2023). Thus, restoring ecosystem through agroforestry is a good adaptation and mitigation approach. The Paris Agreement's Intended Nationally Determined Contributions (INDCs) are the primary pathway for the countries to set targets and report progress. Another NDC-achievable adaptation and mitigation approach is terrestrial vegetation carbon sequestration. Several studies found that agroforestry in critical landscapes can help developing nations meet NDC obligations (Rosenstock et al. 2019; Telwala 2023).

Trees Outside Forests (TOFs) boost biomass, carbon stocks, and improves the socio-economic conditions of people by providing livelihood and tangible ecosystem services. In recent decades, policymakers have included TOFs in national forest inventories due to their expanding importance (Raihan et al. 2021a; Reiner et al. 2023). Agroforestry improves lives by providing, regulating, and preserving ecosystem services (Kumar 2016; Santoro 2023). Trees on fertile land can absorb carbon and help adapt to and mitigate climate change (Raihan et al. 2022a; Critchley et al. 2023). IPCC (2022) reported that global temperatures are expected to rise 1.5˚C over pre-industrial levels between 2030 and 2052 due to the increasing rate of carbon emissions. On the other hand, trees absorb the atmospheric carbon dioxide and store it as biomass carbon. Thus, the role of trees to mitigate climate change is becoming more important (Raihan et al. 2021b). Adapting to climate change needs understanding regional agroforestry practices, developing pathways for future promotion to fulfill climatic promises, and ensuring widespread adoption (Dhakal and Rai 2020; Wakweya 2023). However, there is a research gap exploring the potential of agroforestry to achieve climate change adaptation and mitigation targets by the South Asian countries although agroforestry is being practiced vastly throughout the region. Thus, the present study reviewed Agroforestry Systems's (AFS) ability to support South Asian countries' mitigation targets and NDCs. The study also highlights significant concerns, existing policies, and places where agroforestry gaps need to be addressed in the region and explores the need to incorporate AFS into MRV (Monitoring, Reporting, and Verification). This review critically examines the extensive proof that AFS and its operations provide broad ecological function in South Asia, the crucial climate-related discourse involving agroforestry as a tool for climate change adaptation and mitigation; the essential features and limitations of agroforestry for climate change adaptation and mitigation. This effort of this review to aggregate and communicate AFS information and mainstream it in climate debates will benefit academics, politicians, and researchers. This study would be helpful for the policymakers for formulating effective policies in the areas of climate-smart agroforestry practices to reduce the negative impacts of global warming and climate change.

SOUTH ASIAN AGROFORESTRY PRACTICES

Agroforestry techniques are widely utilized and accepted in tropical developing South-East Asian, South Asian, Central American, and South American nations (Ramirez-Santos et al. 2023). This is due to the fact that agroforestry techniques are dynamic and sustainable means of food production and management (Wienhold and Goulao 2023). Despite the fact that the Agroforestry Systems's (AFS) are well-known, it is still difficult to locate real and reliable statistics on the true scope of the AFS in South Asia. The International Assessment of Agricultural Knowledge, Science, and Technology for Development (IAASTD) has prepared a list of countries all over the world, that have land areas with agroforestry use. This list contains locations where trees are cultivated for use in agricultural production. According to Zomer et al. (2022), agroforestry covers one billion hectares of land worldwide. The agroforestry environment around the world is broken down into its essential components and are summarized in Table 1.

The AFS of South Asia are well-known for their resistance to a extensive climate and environment variations, which is one of their most prominent traits (Eydivandi et al. 2021; Kos et al. 2023). Throughout the course of millennia, numerous smallholder farmers and marginalized communities have accumulated knowledge on strategies of climate adaptation and mitigation (Raihan and Tuspekova 2022b; Mardero et al. 2023). India, China, Indonesia, and Australia account for more than 60% of all of the AFS research carried out in the region, with a particular emphasis placed on agroforestry and agropastoral practices. Shin et al. (2020) offered an outline of the many research initiatives carried out on AFS in India between the years 1970 and 2018. A comprehensive description of various cases of traditional AFS from all over the world, including South Asia, was presented by Nair et al. (2017).

Table 1. An overview of agro-forestation around the world

Covering farmland with trees	Tree-covered farmland around the world (km^2)	Agricultural tree coverage
Less than 10%	10,120,000	46%
Less than 20%	5,960,000	27%
Less than 50%	1,670,000	7.5%

Source: Adapted from Nair et al. (2009) and Zomer et al. (2014)

Among many AFS practiced in the South Asian region, private home gardens are most frequently used (Chavan et al. 2023; Darge et al. 2023). Because of the tremendous benefits that come with working with such small portions of land, people in South Asia have faith in the traditional AFS (Melvani et al. 2022). Because of this, working with AFS becomes an appealing alternative. The application of time-honored techniques of agroforestry may be observed in Table 2, and this practice has been widely implemented across the entirety of South Asia. Growing fuelwood, fodder, and fruit trees on top of farming bunds is a common practice among locals in Nepal, India, Bhutan, Sri Lanka, Bangladesh, and the Maldives (Raihan and Tuspekova 2022c). These practices also contain significant opportunities for those living in poverty in rural areas of the region to earn a living. Farmers in Pakistan are hesitant to plant trees on their agricultural bunds out of concern for the potential negative effects this could have on their crops (Ahmad and Ekanayake 2023). Because of this, natural forests and other types of vegetation provide the vast majority of their requirements for fuelwood and fodder (Jaafar et al. 2020; Raihan 2023f).

According to Rosenstock et al. (2019), the genuine size of agroforestry in the South Asian region is now grossly undervalued as a result of difficulties in detecting low-density tree cover, which is typical of the tiny landholdings of rural farmers. This results in an underestimation of the true extent of agroforestry in the region. South Asia is said to have a lower percentage of land covered in trees in comparison to other regions of Asia, according to data on agroforestry cover collected from throughout the continent (Paradis 2021). Table 3 provides an outline of the geographic distribution of agroforestry systems across Asia.

According to the findings of a research project that was carried out by the Central Agroforestry Research Institute (CAFRI 2022) India, AFS cover a combined total of 13.75 million acres of land over the entirety of India. According to the Indian State Forest Report (ISFR 2019), As a fraction of the country's total landmass, AFS occupies 9 percent, which are classified as Trees Outside Forests (TOF) and span a total landmass of 294 thousand km^2 of the nation. AFS is able to fulfill more than 65% of the nation's wood requirements and 50% of the nation's firewood demand.

Oli et al. (2015) found that agroforests in Nepal had a greater variety of tree species when compared to wild forests in Nepal. A study of Chakraborty et al. (2015) raised awareness to the significance of agroforests in Bangladesh. Fuelwood for homes is sourced from agroforests in Bangladesh, which lowers the country's reliance on natural forests and the amount of money spent on purchasing wood.

Table 3. Location-specific agroforestry coverage across Asia

Area	Tree-covered farmland (million km^2)	Agricultural tree coverage
Total (Global)	10.12	46%
South Asia	0.38	21%
South-East Asia	1.34	82%
East Asia	0.41	23%
Northern and Central Asia	0.65	27%
Western Asia and North Africa	0.1	9%

Source: Adapted from Zomer et al. (2014)

Table 2. Adoption of conventional agroforestry techniques in South Asia

AFS		Area with agricultural and ecological change
Agri-silvicultural	Shifting cultivation, Taungya, Chena, Bewat, dippa, dhya, erka, kumara, jhum, peenda, podu, pothur, zabo, rep syrti	North-East India's tropical forests, Bangladesh, Sri Lanka
	Windbreaks and shelterbelts	Areas prone to high winds include the coasts, deserts, and mountains of India, Sri Lanka, Bangladesh, and the Maldives
	Agricultural method based on plantations	Primarily hot and muggy tropical regions (India, Sri Lanka, Bangladesh, Maldives)
	Boundary Planting and live hedges	In every country in the area
	Scattered trees on farms, parklands	Everywhere, but mainly the dry and semiarid lands
	Crop plantations in an industrial setting	Areas with dense plantings and bunds
	Protection of soil through wooded areas	In the valley and hills of the area, as well as its coastal sections
Silvi-pastoral	Horti- pastoral	In orchards, both hilly and flat, to prevent soil erosion
	Silvi-pastures	Subtropical and tropical regions with distinct bio-edaphic climaxes
	Tree on rangelands	In every country in the area
	Crop plantations with grazing lands	Climates that are predominantly humid or sub-humid and where plantation lands have less grazing pressure
	Grazing in the forests seasonally	Ecosystems in the mountains and the semi-desert
Agro-silvi-pastoral	Homestead plots	Sri Lanka, India, the Maldives, and Bangladesh are highlighted as key countries in the region.
Other AFS	Aqua forestry	The lowlands in all countries of the region
	Tree-based beekeeping	In all countries of the region

The National Research Centre for Agroforestry (Dev et al. 2019) has released estimations indicating that India's 25.4 million ha of agricultural forests have the ability to support 943 million person-days yearly. According to Dagar et al. (2014), an investment in agroforests that include species like silver oak (*Grevillea robusta*) and teak (*Tectona grandis*) offer both short term and long term ecological and social benefits. Eucalyptus (*Eucalyptus* spp.) and Poplar (*Populus* spp.) are two species that are frequently utilized for commercial planting in India and Pakistan due to the fact that they have a high growth rate and produce a significant amount of biomass. It has been shown that the best trees for industrial agroforestry plantations and shelterbelts are those that develop quickly, such as *Eucalyptus* spp., *Populus* spp., *T. grandis*, and *Casuarina equisetifolia* (Basu 2014; Shah et al. 2023). This is because of the economic benefits that fast-growing trees bring as well as the ecological benefits that they provide, in addition to their high growth rates. Farmers in this region choose agroforestry trees that have market value since these trees have a lower risk of failing as yearly crops (San et al. 2023). The great popularity of *Moringa oleifera* in India can be attributed to its market value and the various health benefits associated with every portion of the plant (Maryam and Manzoor 2023). In a similar vein, many harvests can be acquired from the same common fodder trees by harvesting them at different times of the year (Kumar 2016; Bödeker et al. 2023). This can be done by picking the leaves, flowers, or fruits.

According to Gupta et al. (2023), important examples of AFS may be found in Bangladesh, Sri Lanka, India, and the Maldives. Home gardens and other multipurpose agroforestry ecosystems foster food security and contribute to the conservation of rare and threatened species (Bacon et al. 2023). Land management strategies based on trees (plantations of spices in India, Sri Lanka, and Kerala) have shown promise in terms of assisting rural industrialisation and enabling communities a variety of options for their means of survival. This is because these tree-based land management programs are built on the premise that trees are good land managers (Raihan and Tuspekova 2022d). The most effective strategy for adapting to the consequences of climate change as well as for mitigating those effects is the use of integrated agri-silvi-horti farming practices (Dinesha et al. 2023). These approaches place an emphasis on resource conservation and support the conservation of traditional agrobiodiversity (Raihan and Tuspekova 2022e; Gupta et al. 2023).

The benefits of agroforestry for society

According to the study of Potschin-Young et al. (2018), people reap environmental, material, and psychological benefits as a result of ecosystem services that are offered by natural or semi-natural ecosystems. These ecosystem services may be found in both natural and semi-natural settings. Agroforests, which are defined as forests planted in agricultural or pastoral contexts, are said to give a variety of benefits to society, including economic, ecological, and climate change adaptation potential (Shin et al. 2020; Raihan and Tuspekova 2022f; Tschora and Cherubini 2020; Ntawuruhunga et al. 2023; Dissanayaka et al. 2023). One of the numerous ecosystem services supplied by agroforestry is climate adaptation, which is a vital component in combating global warming (Feliciano et al. 2018; Raihan and Tuspekova 2022g). Another one of the many ecosystem services offered is biodiversity conservation (Raihan and Tuspekova 2022h; Raihan et al. 2023c). According to Ali et al. (2022), AFS programs in South Asian countries have developed throughout the course of time to take advantage of and optimize a wide range of good effects for individuals. This development has occurred in an effort to maximize the number of benefits that people receive from participating in the programs. According to the study of Udawatta et al. (2019), the presence of multifunctional landscapes results in an increase in the benefits that pollinators receive, the support of traditional agrobiodiversity, and the conservation of less well-known species of wild animals. According to Oli et al. (2015), the upkeep of these AFS in such a way that they serve many functions in a sustainable manner safeguards a wide variety of ecological processes while also giving considerable advantages to the well-being of humans. It is vital to keep in mind that farmers do not make decisions regarding land usage based on a benefit cost ratio; rather, they do so based on the projected net revenue. According to Rahman et al. (2020), farmers in Bangladesh are more interested in cultivating horticulture agroforestry rather than agroforestry on croplands and homesteads.

According to Gupta et al. (2023), ecosystem services have the potential to be revived with the assistance of AFS if these systems are used to restore and rehabilitate ecosystems that have been destroyed. The availability of food, ownership assurances, upgraded farm-based earnings, managing biodiversity (both terrestrial in nature and soil), ecological sinks, hydrological processes, corridors for wildlife, reduced erosion of soil, higher levels of biodiversity conservation, better microclimate, boosted retention of nutrients (through root captivate and cycling), etc. are just a few of the many indicated advantages associated with AFS in this area (Rosenstock et al. 2019; Duffy et al. 2021; Park et al. 2022; Paudel and Shrestha 2022; Raihan et al. 2023d; Tan and Kuebbing 2023). According to Cedamon et al. (2019), the high biomass of fodder and meat as well as the output of non-timber forest products are all in favor of agroforestry interventions as a strategy to guarantee food security in Nepal. This is because these factors contribute to manufacturing of forest byproducts other than timber. The practice of agroforestry in Bhutan has led to enhanced nitrogen fixation and decreased soil erosion, as per the study of Nkonya et al. (2016) and Koirala et al. (2023). In Bangladesh, the use of the AFS farming approach resulted in significantly less soil erosion and nutrient loss as compared to agriculture practices such as jhum or slash and burn (Das et al. 2020).

There is a wealth of evidence to demonstrate that AFS helps to sustainable production by assisting in the conservation of natural resources, the recharging of aquifers, the providing of various products to auxiliary homes, and so on (Shin et al. 2020; Ruba and Talucder 2023). Within the framework of a paradigm for land use,

agroforests are said to assist "sustainable intensification" (Muschler 2016; Raihan and Tuspekova 2022i). In contrast to the conventional reliance on chemistry and climate studies, this approach uses other factors. Article 2 of the Paris Agreement includes provisions for sustainable growth and ending poverty go hand in hand, and its goal is to boost global efforts to prevent the repercussions of climatic change (Raihan and Voumik 2022b; Raihan et al. 2022b; Voumik et al. 2022; Sultana et al. 2023). It is impossible to overstate the importance of agroforestry, and if the global climate goals are to be achieved, it is necessary that regular agriculture practices at the national level incorporate agroforestry (Litschel et al. 2023; Ntawuruhunga et al. 2023). It is absolutely vital for us to take advantage of the potential that exists in the land use sectors in order for us to be successful in our efforts to reduce emissions (IPCC 2022; Raihan 2023g). If we are going to be successful in our efforts, we must take advantage of the potential that exists in these sectors. It will be feasible to embrace less fertile marginal croplands that have a low level of productivity across South Asia with the deployment of a wide range of AFS techniques. This will allow for greater agricultural diversity. Adaptive rainfed dryland agriculture (Kattumuri et al. 2017) can be improved in several ways (Castro et al. 2019), the most important of which are the restoration of the soil's health, the enhancement of the efficiency of irrigation, and the creation of carbon sinks (Raihan et al. 2022c; Han et al. 2023).

AGROFORESTRY SYSTEMS AND GLOBAL CLIMATE

According to the IPCC (2019), the United Nations Framework Convention on Climate Change (UNFCCC) and the other major multinational scientific and environmental groups have focussed on the significance of mainstreaming and putting into practice sustainable land management approaches such as Agroforestry Systems's (AFS) (Bongaarts 2019; Raihan et al. 2022d). The UNFCCC, the FAO, the World Bank and the CBD, have all praise on AFS. The important conventions and studies that have brought AFS to the attention of scholars and policymakers on a global basis are depicted in Figure 1. The Kyoto Protocol was the first international arrangement to acknowledge the importance of AFS in climate mitigation. Since that time, there has been a rising interest in AFS as a potential strategy for enhancing carbon sequestration (Zomer et al. 2016; Raihan et al. 2022e). This can be attributed to the fact that AFS can increase the period of time that carbon is stored. In spite of the fact that the Kyoto Protocol was used as the foundation for the Clean Development Mechanism (CDM), the incorporation of AFS into the CDM was slowed considerably by a inconsistency in methods used to calculate emissions sinks as well as attendant land right difficulties (Atangana et al. 2014). This was the case despite the fact that the Kyoto Protocol served as the framework for the CDM (Mele et al. 2021).

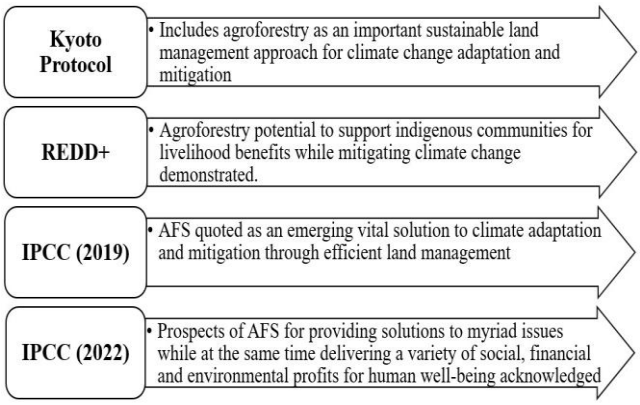

Figure 1. Significant commitments and reports addressing agroforestry systems

The Agriculture, Forestry and Other Land Use (AFOLU) sector, however, were thrust back into the public eye in 2007 by REDD+. Since that time, a number of nations put efforts to enhance each country's preparation by acknowledging the part that these AFOLU industries play in adaptation and mitigation of climate change (Fortuna et al. 2019; Raihan et al. 2022f). A few of the seventeen SDGs that AFS is known to contribute to include the following: SDG 15 (life on land), SDG 13 (climate action), SDG 12 (sustainable consumption and production), SDG 1 (no poverty), SDG 2 (zero hunger), SDG 3 (good health and well-being), SDG 8 (decent work and economic growth), SDG 5 (gender equality), and SDG 10 (reduced inequalities). By promoting technological, geographical, legal, and economic synergy in policy, AFS can assist both developing and underdeveloped countries in meeting their climate mitigation goals (especially 2.4; 13.2 and 15.3), restoring multifunctional landscapes, adapting to and mitigating climate change, meeting goals for tree planting in response to the Bonn challenge, the United Nations' Restoration Decade (2021-2030), and bolstering water and food availability (Waldron et al. 2017; Borah et al. 2018; Fagan et al. 2020; Raihan et al. 2022g).

Mitigation and adaptation for climate change through agroforestry

Due to a lack of accurate carbon stock information for agroforestry strategies in comparison to forestry and agriculture, our knowledge of carbon sinks in the region's varied AFS is still at a very fundamental and limited (Ali et al. 2022; Panwar et al. 2022; Raihan et al. 2022h). Among all land uses considered by the IPCC (2022), agroforestry has been found to have the most promising for the capture of carbon. Despite the fact that agriculture and forestry together are responsible for about 21% of total emissions (Raihan 2023h), In global carbon finance schemes and local carbon finances, AFS offers a large mitigation capacity that has not yet been empirically assessed (Zomer et al. 2016; Khatri-Chhetri et al. 2022; Raihan et al. 2022i; Kumara et al. 2023). Despite the fact that AFS has not been subjected to experimental evaluation in regional carbon accounts. The carbon reserves that can be discovered in

agroforestry systems are outlined in Table 4. On a global, national, and zonal basis, only a small portion of the carbon reserves in AFS have been investigated (Raihan and Tuspekova 2022j; Yasin et al. 2023). On the other hand, research and reporting in South Asia are typically carried out at the regional level (Raihan et al. 2022j). According to Yasin et al. (2019), the variation in carbon stocks of trees and Soil Organic Carbon (SOC) is not frequently addressed together in scientific research. When conducting research on agroforestry, one of the most difficult tasks is trying to determine how various kinds of systems can possibly serve as carbon sinks (Westholm et al. 2020; Raihan and Tuspekova 2022k; Nguyen et al. 2023; Rodrigues et al. 2023).

Because of their significance in easing and stimulating the movement of wildlife throughout the landscape and supporting biodiversity and agricultural activities, the trees that make up an agroforest are analogous to "keystone species" (Carbutt and Kirkman 2022; Raihan et al. 2023e). Agroforests are a type of forest that is managed for agricultural purposes (Yahya et a. 2023). According to Mbow et al. (2014), AFS serve an important function as wildlife corridors because they provide the necessary migration channels for species to adapt to changing climatic circumstances. This makes AFS an essential component of wildlife conservation (Ambele et al. 2023; Raihan 2023i). The importance of AFS can be seen from this perspective. It needs to make concentrated and coordinated efforts to maximize the good impacts while decreasing the unfavorable effects on the climate to get the most out of AFS for both mitigation and adaptation. This will allow to get the most bang for buck out of AFS. Mbow et al. (2014) presented a comprehensive study of the opportunities for adaptation and mitigation in relation to AFS. Because South Asia is predominantly an agricultural region (Raihan et al. 2023f), there is a large amount of untapped potential in the region for the mitigation and adaptation of the consequences of climate change via the utilization of agroforestry (Bernzen et al. 2023). This potential may be found throughout South Asia. According to Ahmad et al. (2020), based on a criteria of 55% or higher, 69% of South Asia's entire landmass is still suitable for agroforestry.

Table 4. Carbon stored in AFS as reported

Area	Carbon Stock (Mg C ha^{-1})
Global	6.3
Temperate	63
Humid	50
Sub-humid	21
Semi-arid	9
Sri Lanka	38.8
Pakistan	29.7
India	25.4
Bangladesh	23

Source: Adapted from Baul et al. (2021) and Lowe et al. (2022)

Agroforestry in NDCs

The "Intended Nationally Determined Contributions" (INDCs) were something that were also submitted by every country that signed the Paris Agreement. NDCs are the primary tool for lowering emissions in accordance with national priorities, capacities, and responsibilities (Quandt et al. 2023; Raihan et al. 2023g). These NDCs are reported to the UNFCCC. These vows are often referred to as the INDCs. According to Duguma et al. (2017), agroforestry has the potential to make a contribution to NDCs by providing support for initiatives related to both mitigation and adaptation of the influences of climate change. Agroforestry is specifically included in the Nationally Determined Contributions of about 40% of the countries that are not part of Annex I (Zhai et al. 2023). These are the developing nations that the UNFCCC has identified as being particularly susceptible to the damaging effects of climate change, such as being at risk from rising sea levels, desertification, and drought (Beillouin et al. 2023). Only 21 percent of Asia's governments have included AFS in their national development commitments (Rosenstock et al. 2019). This ratio is considerably lower when compared to the proportions of countries in Africa (71%), the Americas (34%), and Oceania (7%), respectively.

The countries of South Asian region have put into practice a large number of different adaptation strategies, ranging from ecological to agricultural in nature (Tiemann and Douxchamps 2023). Bangladesh, Nepal, Sri Lanka, and Bhutan have each taken steps to advance the ideas of "ecosystem-based adaptation" and "landscape-scale adaptation," respectively. Water resource management, agroforestry, agricultural management via rotation of crops, and natural management of vegetation are all examples of such practices (Dinesha et al. 2023). Because the composition of trees is the primary determinant of the total carbon flux, there is a greater need for comprehension of this topic during the implementation phase (Harmon et al. 2020). As the Table 5 indicates, even though several nations have not officially stated AFS in their NDCs, NDC of these countries used AFS as potential measure of climate change mitigation. It is absolutely necessary to broaden the scope of forestry activity while simultaneously reducing the amount of emissions produced by agriculture. In light of this, Bangladesh's 4.1 million hectares of Trees Outside Forests (TOF) (croplands, homesteads, and horticulture-based agroforestry) presents a vast array of business prospects. This constitutes 27 percent of the entire land area of the country (Sheikh et al. 2021).

The SAARC Regional Coordinated Program on Agroforestry (SARCOPA) was founded in 2016 by the SAARC group of states, which consists of Bangladesh, Afghanistan, Bhutan, the Maldives, India, Nepal, Sri Lanka, and Pakistan. Both the ICRAF and the SAC were instrumental in this goal's successful completion. The project will be completed in two distinct phases: the first phase will last for a period of six years and will concentrate on developing mechanism and methods of administration; the next stage will also last for a period of six years and will extend the scope of the AFS to include a larger group of individuals. Both phases will run for the same amount of

time. The initial stage in SARCOPA is to raise public awareness of the issue, as well as to create any relevant guidelines, policies, and databases of data already collected on AFS. Although India and Nepal's national agroforestry policies demonstrate their commitment to the development of AFS, Bhutan and Bangladesh's national agroforestry policies are just in the preliminary stages of development at this point. It is expected that India will have greatly reduced its overall emissions by the year 2050 with only a 30% expansion in the quantity of land covered by AFS (Nath et al. 2021). SARCOPA has provided support for diversified activities, consisting of the development of institutional and sole capacity, the locating, revamping, and dissemination of AFS that are successful, and others. Nepal's national government came up with a Local Adaptation Plan of Actions. In addition, the positive aspects of woods, conservation activities at the local level, and conventional AFS will be incorporated into the nearly 2200 community forest adaptation plans, in addition to the approximately 375 local adaptation plans that have been produced in the past (Darjee et al. 2021). When India implemented an agroforestry policy in 2014, it was a first for the region. The policy was praised as a simple technique to reap the benefits of a productive land-use system and to boost the economy (Bose 2015). The policy was welcomed as a straightforward method that might easily enjoy the benefits of an effective land-use system.

In order to provide necessary economic assistance and to contribute to the creation of human settlements that are more resistant to the effects of climate change, Sri Lanka has made a commitment to the conservation of natural resources and biodiversity, as well as to the enhancement of climate resilience (De Zoysa and Inoue 2016). Again, agroforestry isn't officially addressed, but it's thought to be included due to the vast number of backyard gardens in the country (which make up around 13% of the overall land area). Historically, the cultivation of these gardens has promoted climate adaptability and assisted in mitigating the effects of natural calamities such as drought and storms. The Green Pakistan Program, which is also known as the Plantation Tsunami, was started by the government of Pakistan in order to reach the Bonn Targets (Baig et al. 2021). This will be accomplished by planting one hundred million trees over the course of the next five years as a part of the Green Pakistan Program. However, this status might shift in the near or far future. The currently available data makes it clear that all of the South Asian countries are cooperating with one another to exchange information and resources in order to make it feasible for all of them to put AFS into practice and enjoy its benefits. This is because all of the South Asian countries want to ensure that it is possible for all of them to put AFS into practice and enjoy its benefits (Shin et al. 2020).

Table 5. South Asian NDCs and the involvement of agroforestry

Countries	NDC Obligation	Aspects of Agroforestry in the NDC
India	Reduce emissions by 33–35% from 2005 levels by 2030, with non-fossil fuel share growing by 40% and another 2.5–3 billion metric tons of carbon sequestered through increased tree cover by that year.	Although agroforestry is not specifically mentioned in India's INDC, among the eight goals listed under the NAPCC, it is widely believed to play a crucial part in the country's efforts to reduce carbon emissions.
Pakistan	Aiming to reduce emissions by 20% from 2030 projections with the help of international funding.	Among the many ways for dealing with climate change, agroforestry is one.
Bangladesh	Agriculture and forest sector development to reduce emissions. Commitment, without preconditions, to using existing resources to cut greenhouse gas emissions by 5% from the power, transportation, and industrial segments by 2030. Reducing GHG emissions from the electricity, transport, and industrial sectors by 15% by 2030, contingent on receiving adequate international help to do so.	The NDC's ecosystem-based adaptation makes no reference to agroforestry. However, the NDC incorporated replanting of mangroves, green belt Afforestation, and wetlands and coastline preservation through community action.
Nepal	Reduce reliance on fossil fuels and work toward reforesting at least 40% of the country by 2050.	Agroforestry and other forest restoration methods are included as means to meet NDC goals.
Sri Lanka	The energy sector's emissions should be cut by 20% by 2030; emissions from the forest, transportation, industry, and other sectors should be cut by 10%.	Agroforestry systems are prioritized along with urban forests, green pathways, green roofs, and parks in urban and semi-urban areas.
Bhutan	To maintain carbon neutrality, where emissions are balanced by forest carbon sequestration.	Mitigation strategies include the prospect of climate-smart agriculture, such as the growth of agroforestry, agri-silvi-pastoral frameworks in order to raise livestock, cultivate organically, or practice conservation agriculture.
Maldives	A target of a 26% decrease in emissions by 2030 relative to "business as usual".	No mention of agroforestry.
Afghanistan	Reducing emissions by 13.6% below the "business as usual" level by the year 2030.	Agroforestry is not mentioned.

Agroforestry under REDD+ and NAMAs

According to Ntawuruhunga et al. (2023), marginalized groups in underdeveloped and undeveloped nations that participate in agroforestry may be able to make a financial profit from the sale of carbon sinks. The AFS are able to make a contribution toward the conservation of natural woodlands by reducing the need for fuelwood and lumber among the countries of South Asia (Duffy et al. 2021). Since 2007, the UNFCCC is in charge of climate change discussions, and REDD+ has been an integral part of these talks ever since. According to Fortuna et al. (2019), significant progress has been achieved toward integrating the agriculture, forestry and other land use (AFOLU) sectors into national plans for mitigating the catastrophic consequences of global warming by the utilization of REDD+. These plans have been developed to lower GHG emissions from forest clearing and deterioration. According to Atangana et al. (2014), goals of the REDD+ initiative is to provide financial incentives to participating nations so that these nations will take actions to conserve and responsibly manage their forest resources. As part of the REDD+ program, eco-agricultural practices have been promoted because they help boost food production without having a bad impact on native biodiversity (Roberts 2019; Villa et al. 2020). This is because eco-agricultural methods have been shown to help increase food production without having a negative impact on native species (Aich et al. 2022).

AFS is one type of farming method that is considered to be environmentally friendly (Li et al. 2021; Shennan-Farpón et al. 2022). According to Rosenstock et al. (2019), AFS makes a major contribution to the UNFCCC's Koronivia Joint Work on Agriculture (KJWA), which focuses on increasing resilience, boosting carbon stores, soil quality, species richness, and soil fertility. This is accomplished by AFS through the promotion of sustainable livestock management, the delivery of a variety of nutritional advantages, and the diversification of livelihood options. On the other hand, the KJWA makes no reference to the AFS in any part of its text. Extensive research (Holmes et al. 2017; Owusu et al. 2021; Hastings et al. 2023) reveals that native and community-based organizations are warmly supporting AFS. REDD+ is based on the concept that there should be an increase forest's ability to sequester carbon, a decrease in the amount of pressure that is placed on forests, and progress toward more diverse methods of sustenance (Basnet and Karki 2020). These three things are all interconnected and should occur in tandem. When REDD+ projects in the region are examined, it becomes evident that the countries in South Asia have extremely varied implementation techniques. The REDD+ policies and programs that South Asian countries have established are summarized in Table 6.

CHALLENGES TO AGROFORESTRY'S POTENTIAL IN ACHIEVING GLOBAL CLIMATE GOALS

The technological capacity to monitor carbon stocks from agroforestry systems, including an update to the UNFCCC lags well behind national intentions, resulting in a significant gap between the two sets of goals (He et al. 2020; Low et al. 2022). Although it will take some time for capacity to emerge in terms of carbon stock warehouses in AFS, SARCOPA will be of significant aid in filling this deficit over the next few years. According to Feliciano et al. (2018), the current AFS database in the region suffers from a large absence of information on soil carbon reserves, and a dearth of data on carbon reserves before land use alteration. Monitoring, reporting, and verification (MRV) is a procedure that is important for accomplishing national goals connected to economic growth and climate adaption (Perosa et al. 2023). The development of a dependable MRV system for AFS in South Asia is a significant step in simplifying the process of gaining access to national and international sources of finance and other forms of support (Nunes et al. 2020; Raihan 2023j). Agroforestry and MRV systems have proved difficult to combine, despite the growing prominence of AFS and TOF in talks taking place all over the globe on the topic of global warming. This is in spite of the fact that the UNFCCC proposes that they need to be combined. It's probable that certain countries won't have any trouble employing the MRV methods developed by others, but some might have trouble doing so (Rosenstock et al. 2019; Raihan 2023k). Despite the fact that the inclusion of AFS in MRV is supported by Nepal's extremely low forest requirement, Bangladesh's forest definition does not include TOF (also known as AFS). The inclusion of AFS in MRV is given further weight by the fact that Nepal meets the very low forest requirement. One constraint is the dependence on local variables, which play a role in determining the amount of carbon stock. Other potential barriers that could stand in the way of achieving the benefits of AFS in the region include a lack of regular financial support, changes in the instructions supplied by the government, concerns over the limitations of data collecting and analysis, and so on (Raihan 2023l). All of these factors could make it more difficult to realize the potential benefits of AFS in the region. According to Duguma et al. (2017), one of the most significant structural barriers to the adoption of AFS is the inadequate amount of money that is allocated to the agroforestry business in comparison to intensive agriculture.

The majority of South Asian states have been unable to move forward due to the limits imposed on them by their institutions, which has resulted in stagnation (Kasuya and Reilly 2023). Some of the additional challenges that must be overcome in order to realize the beneficial effects that AFS will have on climate policies along with their implementation include having unreasonable expectations for agricultural output per hectare; lack of markets; lack of land rights; and lack of assistance in technology (Cechin et al. 2021; Lojka et al. 2021; Raihan 2023m). The presence

of a considerable number of smaller farms in the area acts as a key barrier to the disease's progression throughout the area. In addition, there are geographical issues that work against the general implementation of AFS, such as the number of animals, the proximity of the forest to the villages, and the susceptibility as well as illiteracy of the farmers. According to Baig et al. (2021), an additional key barrier to the transmission and implementation of AFS is the shortage of adequate water. The Forest Conservation Amendment Act of 1988 in India, which outlawed the harvesting of timber in state forests, gave a financial incentive to apply AFS. This act was passed in order to encourage the adoption of AFS. This served as a monetary incentive to submit an application to AFS.

The poor adoption of AFS despite its economic and environmental benefits is a result of legal and legislative hurdles, such as insecure land tenure, onerous transportation laws, tariffs on agriculture-based products, and the socioeconomic isolation of local farmers (Siankwilimba et al. 2023). A increasing desire in regional countries to satisfy market requirements is a significant criterion for acceptance, as is the implementation of rules that offer transparent data on ownership of land and trees in order to authorize NAMA and REDD+ benefaction (Wallbott and Florian-Rivero 2018). On the other hand, farmers in the region are not interested in planting trees because they do not hold the logging rights that are required for them to make a financial profit from the trees they grow. In addition, harvesting and moving the wood transported from agroforests to sell is not permitted until authorized by the forest department, which is another barrier that inhibits the adoption and marketing of AFS (Baig et al. 2021). This is one of the reasons why AFS has not been widely adopted.

According to farmers in Nepal, the inadequate controls placed on tree harvesting and marketing prevent them from taking advantage of the economic potential given by AFS (Cedamon et al. 2019). Farmers and agricultural professionals in Bangladesh are in agreement that in order to fully embrace AFS and reap the climatic, economic, and environmental benefits it delivers, regulation and standards are essential. Baig et al. (2021) cites a lack of competent forest workers, farmers' lack of access to technological assistance, an inadequate knowledge of tree varieties, low market access, and low wood price as some of the primary limiting restrictions facing Pakistan's wood business. Other major limitations include an inadequate understanding of tree species. Because South Asian countries are unable to engage in outreach initiatives linked to agroforestry, the potential of AFS to enhance land management and encourage its acquisition in order to focus on worldwide climate disputes has been severely limited (Rivera-Ferre et al. 2021; Karada et al. 2023; Yasin et al. 2023).

Table 6. Policies and plans for implementing REDD+ in South Asian nations

Countries	Status	Extent of REDD+
India	Implementation of REDD+ in light of major COP-16 resolutions, the Warsaw Framework for REDD+, the Paris Agreement, and the national legislative and policy agenda for forest conservation and enhancement.	Includes trees and other forest types (TOFs), which may also contain AFS. Coalition with the National Forest Policy is achieved through the efforts of REDD+ to increase forest and tree cover.
Nepal	The REDD+ strategy's first draft was completed in 2014, paving the way for additional consultations and the development of the strategy's second iteration.	The national forestry industry's dream of thriving woods and happy people is included in the REDD+ strategy statement produced in accordance with the fundamentals of the goals of sustainable development. The Forests Act (2019) recognized the necessity to operate agroforest crops or livestock firms in a way that is compatible with the conservation and development of the forest. The Forests Act (2019) also mentioned that agroforestry system may be pursued as prescribed in the land of forest area without changing the land use. Expanding the definition of REDD+ to include private forests, public forests, forest leases, and religiously protected forests all exist is likely at this point.
Pakistan	Initiated in 2010, REDD+ views forest ecosystems as a public asset, a source of numerous benefits necessary for development, and one that may help to mitigate global warming whereas simultaneously improving the resilience of local communities and their natural environments.	The National Forest Policy of 2015, the Climate Change Policy of 2012, and the Environment Policy of 2005–the cornerstones of the REDD+ strategy–all work together to enhance forest conservation.
Sri Lanka	National REDD+ Investment Framework and Action Plan developed with assistance from the UN-REDD Programme for the next five years (2018-2022). A high level of preparedness for REDD+, as defined by the Warsaw Framework, and including the technical basics of REDD+.	There were 13 different policies found to be effective in dealing with the causes of forest cover change. With the goal of "creating favorable circumstances to render present agroforestry systems economically feasible for adoption and implementation," policy measures that extend coverage to other wooded lands lend assistance to agroforestry models for combating forest degradation.

Policy issues

Because it is already familiar to small and medium size farms, AFS is a prospective easy pickings for meeting the NDCs as well as helping with climate change prevention and adaptation (Handa et al. 2020; Chavan et al. 2022). This is due to the fact that AFS is already familiar with farmers. As a direct result of this, elevating knowledge of AFS will not be sufficient to overcome the more fundamental problem of relying on it to combat climate change on a global scale. In order to accomplish the NDCs, it is absolutely necessary to provide a legislative policy framework that is acceptable and effective, as well as strategic execution, in order to back the expansion of AFS in the region. It is possible that a market-based infrastructure may be constructed with the assistance of such governmental backing (Raihan 2023n). This infrastructure would protect the rights and ownership of communities while simultaneously attracting incentives and investments. As a result of the many advantages it provides, AFS should be given a more prominent position in REDD+ and NAMAs (Getnet et al. 2023; Katayi et al. 2023; Kumar 2023). However, in order for agroforestry to attain its full potential, it is necessary to take into consideration the numerous obstacles that were mentioned in the portions that came before it and to solve them in an appropriate manner. Only then will the agroforestry industry be able to realize its entire potential. The following courses of action are suggested as potential remedies to the problem: (i) In order to increase the fund flow to AFS as well as increase knowledge and collaboration amongst key stakeholders, federal and the state's legislation should support techniques to detect, group, and record AFS. This should be done in order for national and state policies to promote approaches to identify, categorize, and report on AFS. In addition to this, the amount of funding that will be made available to AFS needs to be increased (Table 7). (ii) In order for agriculture and forestry practices to be able to share cutting-edge technology on a worldwide basis and to make better use of land resources, national policies that address agriculture and forestry practices need to take into account both effective mitigation and adaptation approaches (Table 7). (iii) It is essential to keep in mind that future implementation will be influenced by land-use decisions in addition to rising social, political, and economic powers even though monetary incentives and regulatory measures are presently being used (Raihan 2023o).

The legislative framework that is built to cope with climate risks should be comprehensive enough to stimulate income from AFS while also internalizing the harmful effects of climate change (Feliciano et al. 2018).

By implementing the Agroforestry Policy in India, the AFS hopes to contribute to the objective of expanding the region's forest cover from the current 23% to the target of 33% of the region (Nath et al. 2021). In contrast to the goal of the REDD+ strategy, which is to put an end to deforestation and slow down the rate at which lower-lying forests degrade, this objective will not be achieved. The Green India Mission is an extra effort that is aimed at aiding the American Friends Service Committee (AFS) in its expansion into rural parts of the country (Basu 2014). Both Nepal's Climate Change Strategies (2011) and NDCs (2016) acknowledge the significance of forests and trees, particularly AFS, in the process of encouraging climate adaptation and mitigation. As a result, the The next stage is to establish a national policy on agroforestry that should be taken and should be implemented as soon as possible. In Bhutan, the EU-TACS project was started in June of 2020. The funds necessary for the initiative are being provided by the European Union (EU). Additional work will need to be done below the larger aegis of SARCOPA for the Maldives, Pakistan, and Sri Lanka in order to establish agroforestry strategies that are applicable to these countries and their respective agricultural climates in which they are located. Other smaller nations, such as Bangladesh and Bhutan, are already working hard working hard to develop policies that are applicable to agroforestry.

Table 7. An overview of South Asian agroforestry policy and programs

Countries	Policies and Programs	Description
India	National Agroforestry Policy	Focuses on the positive effects of AFS on the environment, such as lessening GHG emissions, the stimulation of carbon stocks, the preservation of biodiversity, and the protection of soil and water.
	National REDD+ Policy	Consists of general principles for developing and implementing REDD+ programs in order to reap the rewards of the worldwide REDDprocess and generate economic benefits for the community at large to participate in forest ecosystem protection.
	Green India Mission	Among of the eight goals under the National Plan of Action on Climate Change is to target AFS in 10 Mha of agricultural land with irrigation and 18 Mha of soaked land.
Nepal	National Agroforestry Policy	Developed by the World Agroforestry Centre and the Climate Technology Centre and Network
Pakistan	Green Pakistan Program	Global tree-planting initiatives aim to fulfill the Bonn Commitment and slow climate change.
Bhutan	Analyzing AFS and its implementation	To aid in formulating an agroforestry plan and a nationwide agroforestry initiative.

Source: Adapted from Dev et al. (2019) and Baig et al. (2021)

CONCLUSION AND RECOMMENDATION

The ICRAF, the SAC, and all local administrators have thrown their support behind SARCOPA, making it a historic initiative in the field of acknowledging and mainstreaming the benefits of AFS, with an emphasis on national scale climate change. The UNFCCC urges governments to generate information from regional field surveys and complete detailed reporting in line with MRV in order to generate factors unique to each country for accurate stock estimations of biomass and SOC. MRV stands for "monitoring, reporting, and verification." A two-step procedure that begins with laser scanning and is followed by field surveys is the most efficient technique for evaluating TOF resources. This method consists of laser scanning as the first step and field surveys as the second. In this part of the world, there is a pressing need for further national studies of TOF models for estimating biomass, with those models tailored to account for AFS tree resources. The first thing that has to be done in order to properly implement a national REDD+ plan is to create standard operating procedures for evaluating carbon stocks. Since the 1980s, India is among few countries to routinely use satellites for surveying changes in forest cover. Both the National REDD+ program of India, which was adopted in 2018, and the National Agroforestry Policy of India, which was enacted in 2014, would be of assistance to the government in achieving its NDC goal through TOF. The AFS incentive programs that are already in existence have a requirement that additional funding be provided from sources that are located outside of the region. The next stage in bolstering foresters' and communities' ability may be to construct agroforestry projects for REDD+, as well as creating awareness on the integration of AFS for increased benefits. This would also be the next step in raising awareness. Because it would assist in increasing awareness of the potential benefits of incorporating AFS, this would be an essential step to take. When it comes to the construction of projects, having a cautious, community-based, and inclusive approach can assist to lessen the likelihood that disagreements will arise as a result of AFS. The first phase of the SARCOPA plan of action, which involves the establishment of model agroforestry farms, is currently in the process of being put into operation throughout the entirety of the SAARC area. This phase also includes the creation of model agroforestry farms. The number of people participating in the national and subnational levels in India, Nepal, Bangladesh, and Bhutan who are interested in these topics is growing. Future research on AFS in the region will require additional mechanical and process-oriented investigations, as well as models linking AFS and crop development with water in the soil, carbon, and biogeochemical processes.

The synthesis that has been presented in this paper provides strong evidence for the relevance and promise of AFS in protecting the human well-being of those in the globe who are most at risk, in addition to those who are marginalized and poor, while also assisting South Asian nations in fulfilling their nationally determined contributions and helping to mitigate climate change. In spite of the fact that AFS has already provided a large deal of benefits, these advantages have not been exploited to the extent of their full potential on either a regional or national level. A regional agreement at the country level is required in order to mainstream AFS, and this is beginning to take shape as countries work together to facilitate and provide aid to together under SARCOPA. The pursuit of commitments from governments to acknowledge the advantages of AFS within the context of national agroforestry policy is an important step toward achieving important goals for the future. The SAARC agreement on agroforestry is currently being implemented, and this process, which is being carried out in stages, has already begun. It is anticipated that its implementation will proceed during the course of the following years as planned. Hearing these commitments from regional states and the administrations of those nations gives one reason for optimism. The AFS is an easy win that requires caution; as a result, nations like Nepal and India have built proactive agroforestry strategies. The Maldives, Bangladesh, and Bhutan have all made concerted attempts in recent years to create national agroforestry programs. These efforts have been successful to varying degrees. Coastal Bangladesh, the Maldives and Sri Lanka, two island nations, as well as mountainous Bhutan, would all benefit from concerted efforts in this area to establish synergies for the aim of adapting and mitigating the consequences of climatic change. Because only Central Asia has a lower percentage of agricultural land that is covered with trees (11%), South Asia has the second-lowest percentage in all of Asia. To begin, the countries in the area need to coordinate their efforts in order to identify a goal that is both feasible and ambitious: to improve and restore their AFS by at least 50% over the course of the next five years. This improvement and restoration must take place over the period of the next five years. AFS practitioners in the region have accumulated years of experiences and a wealth of information that is peculiar to the area. Both of these components have the potential to be utilized in order to enhance the present conditions and take on NDCs. The momentum that is already there in the region with regard to AFS needs to be strengthened, and in order to do so, it is required to move behind consciousness and technological collaboration in order to reap the advantages, satisfy the demands that are placed on local livelihoods, and give further opportunities. Critical tools for boosting the agricultural output of forest-dependent, economically disadvantaged populations as well as smallholders through the use of improved inputs, cutting-edge innovations, and incentives to enhance the intensification of agriculture and diversification of income sources can contribute to success in reaching NDC goals and making progress on a number of SDGs. This improvement in agricultural productivity can be achieved through the use of improved inputs, cutting-edge innovations, and incentives to enhance the intensification of agriculture and livelihood diversification.

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