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Silvopastoral systems for climate change mitigation and adaptation

Key Messages

- Silvopastoral systems (SPS) are a type of agro-forestry in which livestock graze on the edges or understories of forests or tree plantations, or trees and shrubs are grown within or alongside pastures. This approach provides shelter and more diverse and nutritious fodder for the animals while allowing farmers to use resources more efficiently and generate more income from the land, combining livestock, timber and non-timber products.
- SPS have multiple environmental benefits, especially when used to restore degraded pastureland or forests. The combination of trees, shrubs, legumes and grasses can help improve the soil and increase carbon storage and water absorption. Silvopastoral systems have also been found to boost biodiversity and make landscapes more resilient to drought and landslides.
- SPS can take many forms and can be practiced at any scale: from clusters of trees and shrubs or “live fences” added to small pastures to provide shade and extra fodder, to large-scale, intensive SPS, which have been developed across Latin America, often backed by significant government investments and payment for environmental services (PES) schemes.
- Many Southeast Asian farmers have applied SPS techniques for generations, though governments may not always recognise them as such. For example, some Indigenous communities graze livestock on the edges of forests, and backyard farmers in the Philippines keep cattle under trees.
- Given the rapid growth of the livestock sector in ASEAN countries, and the economic, climate and ecological benefits of SPS, promoting implementation of SPS approaches at all scales could be a valuable mitigation and adaptation strategy for the region.
- Key challenges to address include building farmers’ knowledge of SPS through technical support, providing incentives for adoption and assisting with access to finance, especially as returns on planting trees can take years to be realised. There may also be cultural barriers– but it is also crucial to recognise and build on existing SPS approaches in the region.
- Understanding of the local context is crucial to social inclusion and gender equity in the promotion of SPS. In both the livestock and forestry sectors, women, for example, are often constrained by their limited access to extension services, credit, trainings and information. They also tend to lack decision-making power. Project implementers need to identify gaps and explicitly address them, so all members of the community can participate and benefit equally.

Livestock production is a key part of Southeast Asian food systems. It is also a significant and growing environmental concern, due both to the emissions associated with the animals and their feed, and to impacts on the land. From 1990 to 2018, direct emissions from livestock in the region, including manure, grew by 46%, to about 153 million tonnes of carbon dioxide equivalent (CO_2e).[1] Land has also been cleared for pasture and to grow feed at the expense of forests and other valuable ecosystems.

Southeast Asia is considered one of the world's major deforestation hotspots. By one estimate, between 2005 and 2015, the region lost 79.5 million hectares (ha) of forest, about 62% of it in Indonesia and 17% in Malaysia (Estoque et al. 2019).[2] Another study found that between 1990 and 2007, Indonesia, Malaysia and the Philippines lost over 25% of their forest cover (de Koninck and Rousseau 2012). Deforestation and forest degradation are also key sources of greenhouse gas (GHG) emissions in the region (Estoque et al. 2019; Pearson et al. 2017).

Today, forest cover in the ASEAN countries varies dramatically: from about 72% in Brunei Darussalam and Lao PDR in 2018, to 24% in the Philippines and 22% in Singapore.[3] Levels have risen slightly in Thailand and the Philippines in recent years but only Vietnam has significantly increased its forest cover in the past three decades. This highlights the importance of reversing current trends: By 2050, one study found, the region could lose another 5.2 million ha of forest – or in a sustainability scenario, regain 19.6 million ha (Estoque et al. 2019).

A great deal is at stake for ASEAN's agriculture sector as well. Climate change poses many threats to the region, including sea-level rise, with associated flood risks as well as saltwater intrusion; more extreme and variable precipitation; rising temperatures; and ecosystems degradation, all of which have implications for food security and farmer livelihoods (Hijioka et al. 2014).

Sustainable livestock practices, such as integrating livestock with crop production and forestry, can reduce environmental impacts, including GHG emissions, while increasing efficiency and profitability, improving food security and animal welfare, and building resilience to climate change (Jose and Dollinger 2019). This brief focuses on one such practice with particular promise for ASEAN countries: silvopastoral systems (SPS).

How does silvopasture work?

SPS integrates trees and forage with animal grazing as a distinct form of agroforestry.[4] Such arrangements often combine fodder plants, such as grasses and leguminous herbs, with trees and shrubs for animal nutrition and complementary uses (Balehegn 2017). SPS offer a "three dimensional feed source", with high-quality fodder and forage for the animals, but also fuel wood and timber, for instance (Yadav et al. 2019, pp.76–77). They can thus optimise land productivity while conserving plants, soils and nutrients. As climate change brings more extreme heat, SPS could also provide crucial shade and cooling for livestock.

A water buffalo grazes under trees in Phayao Province, Northern Thailand. Photo: Flickr/Heiko S

[1] Authors' calculations based on emissions data from FAOSTAT (enteric fermentation, manure management, manure applied to soils, and manure left on pasture): http://www.fao.org/faostat/en/#data/QL.
[2] All estimates are based on analysis of satellite imagery and can thus vary considerably. By another estimate, Southeast Asia's forest cover was 268.0 million ha in 1990, 250.6 million ha in 2000, and 236.3 million in 2010 (Stibig et al. 2014), which would indicate a slower, but persistent, loss of forests.
[3] See World Bank data for forest cover (% of land area) for the 10 countries (based on Food and Agriculture Organization data): https://data.worldbank.org/indicator/AG.LND.FRST.ZS?locations=VN-ID-KH-SG-TH-LA-MM-PH-MY-BN.
[4] Agroforestry is a collective name for land use systems and technologies that incorporate woody perennials – such as trees, shrubs, palms, bamboos, etc. – into the landscape together with agricultural crops and/or livestock (FAO 2015) . Agroforestry has multiple benefits, including carbon sequestration and soil protection, nature conservation, poverty reduction and food security, and environmental resilience (Hanisch et al. 2019).

Southeast Asian households have long kept small numbers of animals sustainably, but fast-growing demand for meat has led to intensification, with significant ecological impacts. Meat and poultry production in the region has nearly tripled since 2000, growing by 70% from 2010 to 2019 alone.[5] Larger-scale livestock production typically relies on large amounts of pasture and/or large monocultures for feed, and such systems can deplete natural resources and degrade the land.

By contrast, SPS allow the intensification of livestock within an area through natural interactions. They recognise that clear-cut boundaries between ecosystems "exist primarily for managerial convenience" (Jose and Dollinger 2019, p.2), and instead apply an understanding of hierarchical relationships within ecosystems to create mutually beneficial connections and make the most of nutrient cycling. Often SPS mirror practices embedded in traditional ecological knowledge – though they may not always be recognised as such (see Box 1).

There are several methods to implement SPS: from planting scattered trees (or clusters of trees) in pasturelands, to intensive SPS that combine high-density cultivation of fodder shrubs with improved grasses with tree or palm species, with many options in-between (FAO 2019; Pezo et al. 2018; Yadav et al. 2019). Animals can also graze amid native or secondary forests, or within timber plantations. Rows of trees and shrubs can be set up as windbreaks to protect animals, or serve as "live fences" or hedgerows. Clusters of trees or shrubs can serve as fodder banks, to be browsed directly, or cut for feed. There is also alley farming, in which rows of trees and shrubs are interspersed with alleys of grasses or legumes. Agrisilvopastoral systems integrate crop production with forestry and livestock.

Animals benefit from SPS in multiple ways (Yadav et al. 2019). Trees provide important shelter, protecting them from heat stress – a growing concern in hot climates, especially as temperatures continue to rise. They have more choice over what they eat, and feed and socialise better. Protection from heat and wind stress has been shown to enhance milk yield, live-weight gain, and reproductive performance (Pezo et al. 2018). The trees and shrubs provide more diverse and high-quality feed sources, and the grasses and legumes grown among them show higher contents of crude protein and minerals. The multiple layers of vegetation can greatly increase how many animals the land can support (Yadav et al. 2019).

The extra sources of feed can be especially valuable for areas prone to droughts (Jose and Dollinger 2019) and, more generally, during the dry season, when grasses dry up, but shrubs and tree leaves still provide good nutrition (Galang and Calub, 2020). SPS can thus make livestock systems more resilient to climate change. For example, in Ethiopia's drylands, SPS is seen as a way to maintain and increase livestock productivity under threats of water shortages and rainfall variability (Balehegn 2017). For farmers, SPS can also reduce dependence on external sources of animal feed and the costs associated with it.

Well-managed SPS can have multiple benefits for ecosystems and the climate. Grazing controls grass growth that might compete with trees and shrubs, and the manure distributes nutrients more broadly, enabling healthier forest growth and building resilience. Even greater benefits come from having a much greater concentration and diversity of plant life, including woody perennials (Pezo et al. 2018; Yadav et al. 2019). Silvopasture has been found to improve soil properties: from nutrient uptake and cycling, to nitrogen fixing, to soil carbon storage. SPS also conserve water, with less runoff or evapotranspiration. They attract more wildlife, further contributing to biodiversity. And they reduce GHG emissions not only by capturing more carbon in the soil, but also by reducing the need for chemical fertilisers and reducing methane emissions from ruminants.

Altogether, the Food and Agriculture Organization (FAO 2019) has found that SPS have the potential to contribute to achieving several Sustainable Development Goals, notably improved livelihoods (SDG 1), food security (SDG 2), increased economic benefits which contribute towards decent work and economic growth in rural areas (SDG 8), climate action (SDG 13), restoration of terrestrial ecosystems (SDG15) and opportunities for multi-sectoral partnerships in development (SDG17).

SPS in Southeast Asia

Silvopasture is already practiced in Southeast Asia – both as part of traditional livestock systems, and as introduced through agricultural development and sustainability projects in recent years. SPS has been far less studied in this region than in Latin America or even Africa, but the knowledge base is growing. This section provides snapshots from across the region, highlighting the potential to adopt SPS more widely and to learn from and scale up existing local practices.

In both upland and lowland areas in the Philippines, almost 94% of cattle – more than 2.3 million heads – are raised in backyard farms, typically tethered to trees and

[5] Authors' calculations based on emissions data from FAOSTAT (livestock primary production): http://www.fao.org/faostat/en/#data/QL.

fed a mix of cut-and-carried grasses, fodder tree leaves, crop residues, and other available plants: small-scale, resourceful silvopastoral systems (Galang and Calub, 2020). A study in San Isidro, a small community in Southern Luzon where raising cattle is a major livelihood, found the animals were sheltered under trees and grazed on pastures, supplemented by feedstuff from trees and perennial shrubs growing in the area. In the dry season, crop residues were used as feed as well, and fields were temporarily converted into additional grassland. The farmers thus made the most of available ecosystem services. However, a decline in communal land through land privatisation had reduced access to good forage trees, and farmers were relying more and more on commercial feed. Younger people are also less interested in cattle farming. These factors are testing the resilience of traditional SPS in San Isidro.

Another study, in the Libungan-Alamada Watershed in the Philippines, found a variety of traditional agroforestry practices that incorporated livestock, including silvopastoral grasslands, silvopastoral plantations, and riparian forests for silvopastoralism; small animals were also kept in home gardens and multi-story farms (Galang and Vaughter 2020). Farmers across generations had substantial knowledge of ecosystem services across the landscape, which younger farmers supplemented with formal schooling on climate change.

In Indonesia, farmers utilise *pekarangan* systems, a traditional, small-scale agroforestry method, defined as the "landscape between agriculture and forestry", that combines annual crops, perennial crops, trees and livestock (Christanty et al. 1986). These systems have been shown to improve biodiversity conservation, provide additional nutrition for households, and increase incomes, as farmers can sell excess goods (Choliq and Kaswanto 2017).

The potential for modern versions of SPS to improve the productivity and sustainability of farms and plantations in Southeast Asia is increasingly recognised as well.
For example, a recent study in Peninsular Malaysia found multiple benefits from grazing cattle in oil palm plantations (Tohiran et al. 2019). Undergrowth can obstruct the harvest of palm fruit and compete with oil palms for nutrients, so it is typically controlled using mechanical, biological and chemical methods. A review of data from 45 plantations found that those integrated with cattle managed to control the undergrowth enough to maintain good access to the palms for harvesting, while avoiding the need for herbicides that harm biodiversity and may disqualify the oil from sustainability certifications. Having cattle can also reduce production costs, increasing profit margins while providing additional food.

Other types of agroforestry could benefit from integrating livestock, too. One study of potential ways to improve teak production by smallholders in Lao PDR, for instance, noted that in Colombia and Brazil, silvopastoral systems with teak were used to obtain short-term economic benefits from beef production while awaiting the longer-term benefits of harvesting timber (Pachas et al. 2019). Teak (*Tectona grandis*), a tropical hardwood, is an important species for forest plantations throughout Southeast Asia. However, it requires particularly intensive management during the establishment of a plantation, management, and through to harvest, to maximise its yield and quality. While they are growing, the trees can provide shade and shelter for the livestock and help farmers diversify their incomes.

A Cambodian farmer with cattle. The trees provide shade during the hottest part of the day. Photo: Flickr/Andrea Hale

Box 1

Traditional agrisilvopastoral systems in Thailand and Lao PDR

In the Southeast Asian uplands, traditional agrosilvopastoral systems contribute to food security and livelihood opportunities. In northern Thailand and northern Lao PDR, forest-dependent communities grow rice alongside other crops, such as cassava or taro, while rearing cattle in the surrounding forests.

The Indigenous communities living in these areas have long relied on forests for their livelihoods and household provisions and have developed conservation techniques. However, they also use swidden, or shifting cultivation, methods, which has led their governments to call them "destroyers of the forest", disregarding the holistic nature of their practices.

Raising livestock is a key component of traditional swidden systems and have been integrated with the cultivation of upland crops, paddy fields, fallow areas, forest trees and non-timber forest products. This system serves cultural functions, improves soil fertility, mitigates risks through diversification, and helps communities build wealth. However, policy-makers' inability to recognise the role of traditional ecological knowledge in these systems and their many benefits, including high adaptability, raises concerns about their future viability. Negative perceptions of these strategies have also prevented policy-makers from drawing insights from them that could be more broadly beneficial.

Source: Summarised from Choocharoen et al. (2014)

Implementation considerations

Like SPS techniques themselves, the settings in which SPS are implemented vary widely, ranging from small-scale farms run by Indigenous communities, following traditional practices, to pilot projects designed to evaluate the benefits of SPS in different contexts, to large-scale operations. The methods used, resources required and, if needed, appropriate financing mechanisms will vary accordingly.

Policy-makers seeking to promote SPS as a climate-smart practice and/or for biodiversity and conservation should start by seeking to understand existing local and Indigenous practices that integrate forestry, agriculture and livestock, and building on communities' existing knowledge. This includes the cultivation of native species, pest and weed management, and local adaptive practices. Incorporating local knowledge can help avoid implementation challenges and yield reductions (Mbow et al. 2019).

SPS can also play a key role in habitat and landscape conservation without a trade-off with food production, as traditional conservation efforts typically set land aside entirely to protect it (Hanisch et al. 2019). By maintaining the forest to best suit the integrated crops and livestock, rotating livestock to avoid overgrazing, and pruning the canopy as needed, farmers can realise ecological benefits while producing food and forest products.

More biodiverse, wildlife-rich landscapes are also more attractive for tourism. And as noted above, silvopasture could help make some forms of plantation agriculture more profitable and sustainable.

The most ambitious, large-scale model for SPS, which emerged in Latin America decades ago, is known as "intensive SPS" (Sales-Baptista and Ferraz-de-Oliveira 2021). It combines high-density plantation of trees and fodder shrubs, improved grasses, and rotational grazing, aiming to maximise climate and ecological benefits. This approach was scaled up with support from research institutions, significant financial and technical support for farmers, and incentives such as payments for environmental services.

Even when implemented at smaller scales, however, SPS is more complex than pastoralism, forestry or crop production individually. The choice of trees and shrubs, for example, depends on their desired uses: to provide additional animal feed, to produce crops (e.g. fruit and nut trees), to provide timber or fuel, to demarcate property lines or contain the animals, to provide ample, deep shade on very hot days. The placement of trees and shrubs is important as well, especially if they are interspersed with crops: they need to cast shade in the right way (Pezo et al. 2018). Similarly, if animals are kept too close to crops, they may damage them (Musa et al. 2019).

In order to scale up SPS adoption to improve productivity, profitability, environmental benefits and animal welfare, it is crucial to understand the potential technical, financial and cultural obstacles in the implementation. In addition to technical constraints, limitations may include access to finance, capital investment, established practices/beliefs, and implementation capacity. Moreover, often producers are focused solely on agricultural crops, or else livestock, but not both, and they may lack the interest or knowledge to combine the two (Yadav et al. 2019).

As with other kinds of agroforestry, SPS also face the basic challenge of near-term vs. long-term payoffs, as trees and shrubs take time to grow to maturity, and in the meantime, farmers may be forgoing income from annual crops (see, e.g., Lan et al. 2016). Bankers may share that reluctance. Forestry projects often have trouble accessing finance, as the long payoff times are seen as a potential risk (Gromko 2015). From that perspective, SPS may actually improve financing options, as livestock and other crops can provide revenue in the near term. If they can quantify their climate and ecological benefits, these projects may also qualify for REDD+ and other international programmes (Salvini et al. 2016).

In order to overcome financial barriers, SPS implementation may require subsidies or access to targeted finance to overcome initial negative cash flow in the initial phases before stabilising and, ultimately, becoming profitable (Gromko 2015). Agricultural extension programmes have key roles to play in building technical capacity as well, to help farmers select species, manage their land, and control pests. For example, in Parana, Brazil, extension agents helped farmers prune trees and identify and treat pests, and they advised them on harvest and other critical forest management decisions.

Scaling up SPS may require multiple enabling mechanisms at once. A study in Costa Rica identified five ways to help promote the adoption of SPS innovations: (a) offering premium prices for certified products coming from sustainable livestock systems; (b) a well-organised, trusted, and affordable certification and traceability system to support such premium labelling; (c) access to payments for environmental services; (d) access to reforestation incentives programmes for all types of livestock farmers; and (e) "green credit" lines that provide favourable terms to farmers who adopt sustainable practices (Pezo et al. 2018).

In implementing or promoting SPS, however, it is important to avoid pitfalls or trade-offs. For example, converting too much land for pasture may result in food insecurity for people whose diets depend on wild meat. SPS can also be misused to make clearing forests for livestock more politically palatable, especially when livestock production is seen as important for poverty reduction (Jose and Dollinger 2019).

Complementary strategies to maximise benefits

A common benefit of SPS implementation is improved animal nutrition, which results from combining SPS with feed management. This can be done by growing better grasses and other forage plants, processing feed for better nutrient absorption, and the strategic use of supplements.[6] By providing cattle with high-quality forage, including more dry matter, digestible energy and protein, farmers can improve the efficiency of digestion, reduce the amount of grazing time and supplementary feed, and ultimately reduce GHG emissions.

Pasture management, through controlled nutrient management, fertilisation, and plant and crop integration, can also protect against erosion and help maintain good water quality. By utilising trees, shrubs and grasses, the varied root lengths in SPS minimise nutrient leaching and increase overall resource efficiency (Jose et al. 2019). Integrating rotational grazing practices can also limit soil compaction and minimise any negative impacts on the growth of trees.

Effective manure management is also crucial. Not only can manure be utilised as an organic fertiliser, but it can also be used as an energy source when farmers are able to capture the methane it releases. Manure stored in biodigesters for biogas emits less N_2O than manure directly applied to the landscape (Mushi et al. 2015). A biogas-coffee project in Bali by su-re.co, for example, promotes the use of biogas among coffee producers as a way to improve energy access and diversify livelihoods through new products from climate-smart agriculture (Budiman 2016). This method could also be utilised by SPS farmers.

SPS can also benefit from careful selection of livestock breeds to ensure a good fit with local conditions. Ideally, low-producing breeds are replaced with higher-yielding, improved breeds to reduce methane emissions while maintaining yields (Mushi et al. 2015). Where water is scarce, farmers may want to choose livestock breeds adapted to water scarcity. Although they might not be as high-yielding under normal conditions, they can survive when other breeds may not and are less prone to diseases (FAO 2012). Reducing the number of cattle in an SPS system, also known as destocking, may also be

[6] See Climate Change Connection guidance on pasture management: https://climatechangeconnection.org/solutions/agriculture-solutions/livestock-production/pasture-management/.

helpful, especially to prepare for the dry season or adapt to reduce forage availability. Farmers can then obtain the best possible prices and to reduce potential losses, in accordance with their own food security and nutrition strategies (FAO 2016). By removing less-productive animals, destocking can lower methane emissions as well.

Climate benefits of SPS

According to the Intergovernmental Panel on Climate Change, SPS have very high mitigation and adaptation potential to secure food systems (IPCC 2019). As noted earlier, SPS increase soil carbon storage – and they also increase overall biomass and above-ground carbon storage by adding multiple layers of vegetation in croplands, pastures and forests (see also Yadav et al. 2019). Tree roots are also able to reach deeper soil depths compared to grass monocultures.

Leguminous-based pasture systems offset the N_2O release from fertiliser use, and better-quality forage contributes to reduced methane emissions from rumen fermentation. Higher feed conversion reduces GHG emissions per unit of animal product, reducing emissions by 57% in milk production and 73% in meat production (FAO 2019). As noted earlier, SPS also use land more efficiently, producing more forage in a given area. Altogether, with SPS, GHG emissions per unit of animal product are reduced.

The value of SPS for adaptation is also evident. They increase productivity, conserve water, improve biodiversity and promote ecosystem health. In a changing climate, with rising temperatures overall and more extreme heat, shade trees and forested patches can provide vital shelter for animals (see Box 2). The sustainability and resilience of SPS increase, of course, if the chosen crops, livestock and trees are well suited to changing climate patterns, and crops are rotated as appropriate.

SPS combined with wildlife habitat support biodiversity conservation and ecosystem services and are particularly useful in reducing land degradation and deforestation, particularly where the risk of soil erosion is high (National Farmers Union 2017). As noted, shrubs and trees in SPS systems have been found to positively influence biodiversity by creating habitats for animals and plants; they also positively contribute to the physical, chemical and microbiological properties of the soil (see also Sokheang et al. 2019). Increased biodiversity can enhance production through the added environmental services as well, such as pollination, pest control and water regulation (FAO 2019).

Box 2

The Global Agenda for Sustainable Livestock

In order to guide the sustainable development of the global livestock sector, the Global Agenda for Sustainable Livestock was established in 2011 as a partnership mechanism for all stakeholders in the livestock sector. Going one step further, the Global Network on Silvopastoral Systems (GNSPS) more specifically promotes the scaling-up of SPS at the global level.

The GNSPS advocates for sustainable livestock production by integrating livestock with forestry as a way to reduce the impact of livestock on natural resources, increase the productive efficiency and profitability of the system, improve food security and animal welfare, and contribute to the mitigation and adaptation to climate change (FAO 2019). It works to scale up silvopastoral systems worldwide by generating, disseminating and exchanging knowledge; documenting public policies; and facilitating dialogue.

SPS and social equity

The evaluation of sustainable agriculture practices has typically focused on economic and environmental indicators, sometimes failing to give adequate attention to social indicators. For example, in addition to whether or not livelihoods are being improved in a given community, it is key to understand how environmental, economic and social benefits are spread across the community and whether women and men and people of different social and economic backgrounds, abilities and identities are benefitting equally.

At the regional level, ASEAN stresses the important role that women play in the livestock and forestry sectors, both formally and informally, contributing to smallholder livestock production, agroforestry, watershed management, tree improvement, forest protection and retailing products (see ATWGARD 2018). However, despite the fact that women make up a significant portion of the labour force, “their roles are not fully recognised or documented, and their wages and working conditions are usually inferior to those of men” (ATWGARD 2018, p.12). Women are rarely involved in planning or formulating forest-related policies. Hence, the issue of gender inequalities often puts women in a disadvantaged position, not only in their capability to participate in and contribute to, but also in the benefit from the broader context of natural resources management.

Moreover, as highlighted in Box 1, the implementation of sustainable land practices such as SPS often fails to consider Indigenous Peoples’ traditional ecological knowledge. At times, the resistance to incorporate such knowledge into environmental policies has “prevented or even prohibited small-scale farmers from managing forests through agroforestry systems” (Hanisch et al. 2019, p.2).

SPS implementation requires proper training, secure land tenure, access to resources and appropriate finance. Access to such resources may be difficult for poor and marginalised people, such as Indigenous communities, women and very small-scale farmers, especially if they are not included in decision-making. For example, in both the livestock and forestry sectors, women are often constrained by their limited access to extension services, credit, trainings and information. They also tend to lack decision-making power at the household, community or institutional level (ATWGARD 2018).

While men decide based on commercial considerations on what trees to plant, women are primary users of these trees in line with their roles in the households and the caring of children. Women prefer trees that can be used as fodders for domestic animals, fuelwood or as food. Thus, they also do not only want commercial trees to be planted but prefer vegetables and other annual crops (Mulyoutami et al. 2015). This means that involving women in these decisions will have important ramifications on the welfare of the household and its members (Mathez-Stiefel et al. 2016). Therefore, it is crucial to ensure that the policies, facilities, and other support for SPS implementation could encourage participation and benefit for women.

Social equity in SPS requires opportunities for meaningful participation in trainings and decision-making along with the resources needed to carry out those decisions. In the case of SPS, there needs to be equal control over productive resources such as land, livestock, water and forests as well as financial assets.

The power to make decisions is also important when it comes to time use and income (Akter et al. 2017). Additionally, integrating livestock into agroforestry systems requires upfront investment. Marginalised groups, and women in particular, often have less control over the assets needed as collateral or mortgages for loans and may not have the know-how or networks that would allow them to access to appropriate financing (Catacutan and Naz 2015).

Relevant ASEAN guidelines and frameworks

ASEAN has a number of frameworks relating to the implementation of SPS, particularly in relation to the extensive agroforestry and forestry guidance available for the region. The ASEAN Guidelines for Agroforestry Development (ASEAN 2018) note that agroforestry is essential for the achievement of the SDGs, as it has the potential to contribute to eradicating hunger, reducing poverty, supporting gender equity and social inclusion, providing affordable and cleaner energy, protecting life on land, reversing land degradation and combatting climate change. This extends to SPS, a form of agroforestry.

Guideline 9 highlights that understanding the local context is crucial to social inclusion and gender equity and key to the successful implementation of agroforestry policy interventions and implementation measures (ASEAN 2018). However, limited guidance exists specific to gender considerations in SPS.

Strategic Thrust 4 of the 2016–2025 Vision and Strategic Plan for ASEAN Cooperation in Food, Agriculture and Forestry, which focuses on increasing resilience to climate change, natural disasters and other shocks prioritises the need to expand agroforestry systems (AMAF 2015).

The Plan of Action (PoA) for the ASEAN Cooperation in Forest and Climate Change (2016–2020) does not specifically mention agriculture, agroforestry or the inclusion of livestock in forest landscapes, but it does consider the impacts of climate change on the forestry sector, and suggest an action plan for climate change mitigation and adaptation in the sector (ASOF 2017a).

The region’s Plan of Action for Forest Management promotes inter-sectoral cooperation between the forestry and agriculture sectors (ASOF 2017c). Finally, the Plan of Action on Social Forestry emphasises the importance of agroforestry in the region, including the Agroforestry Guidelines, a stocktaking of best practices and agroforestry trainings in its planned activities (ASOF 2017b). However, it does not mention the inclusion of livestock in forestry practices.

An agenda for action

SPS provide an environmentally and economically beneficial option for farmers to diversify their incomes, restore and protect ecosystems, reduce emissions, and build resilience to climate change. While SPS models vary, the core principles are closely aligned with many traditional practices in Southeast Asia. Still, the uptake of SPS in the region has been limited to date. Below we provide recommendations for policy-makers, funders, development partners and project implementers, as well as priorities for further research in the ASEAN countries.

Recommendations for policy-makers

- Given that SPS have the potential to sequester a significant amount of carbon dioxide, SPS should be part of national climate change strategies and plans, and farmers should be provided with support and incentives to implement them. Additionally, existing SPS practices should be recognised and included in local planning.
- Payments for ecosystem services (PES) should be offered at the national level to support the uptake of SPS methods, and farmers should be supported also in accessing finance through international programmes such as REDD+.
- ASEAN policy-makers should promote knowledge-sharing and mutual learning about SPS implementation across countries and promote SPS upscaling at the national level.
- ASEAN should work with international organisations to realise the objectives of the Global Agenda for Sustainable Livestock and the Global Network on Silvopastoral Systems.
- Agricultural extension programmes should receive funding and training to support SPS implementation, through specialised units, and be given a mandate to promote SPS.

Recommendations for development partners and project implementers

- Provide information, trainings and financial support to assist farmers in establishing SPS, given the increased labour and input needs as well as advanced knowledge to adequately harvest and sell all farm products. Farmers may also need access to supplies and machinery.
- Work with farmers to conduct a financial risk assessment and a detailed financing plan to ensure there is a thorough understanding of cash flows.
- Ensure that SPS projects do not exacerbate social inequalities but rather provide opportunities for meaningful participation and benefit sharing among different stakeholders.
- Provide opportunities for information exchange among farmers to share experiences of implementing SPS locally.
- Financing institutions should be encouraged to offer finance that supports the addition of livestock to forestry systems, as this can generate yearly revenue from the outset – and, conversely, should provide finance for livestock producers to shift to SPS systems. Insurance schemes are also needed to reduce financial risks and encourage the implementation of SPS.

Recommendations for further research

- Examples of SPS and agrisilvopastoral systems in Southeast Asia are underrepresented in the literature, with a majority of research coming from Latin America. More research focusing on regional examples, including the integration of traditional practices with modern SPS, could aid further implementation of SPS in the region. A related priority is the identification of particularly effective practices in common Southeast Asian settings, as much of the literature on SPS is based on research in very different landscapes.
- Conduct new and synthesise existing research on SPS implementation, particularly in ASEAN Member States and highlight best practices for policy-makers, finance institutions and sustainable business initiatives.
- Enhance understanding of the carbon sequestration potential of SPS and work with ASEAN Member States to integrate SPS into their climate change mitigation plans and strategies.
- Enhance the knowledge base of the gendered implications of SPS and how to ensure that all farmers have equal access to the resources and trainings, with a focus on specific challenges within Southeast Asia.

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All briefs are available at https://asean-crn.org/overview/publications/study-and-policy/.

The CSLU project builds on the successes of the Forestry and Climate Change Project (FOR-CC) under the Former ASEAN-German Program on Response to Climate Change (GAP-CC), which supported ASEAN in improving selected Framework conditions for sustainable agriculture and Forestry in AMS. CSLU aims to strengthen the coordination role of ASEAN in contributing to international and national climate policy processes for climate-smart land use in agriculture and forestry.

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