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Title

The Agroforestry Practices in SAARC Countries: A Critical Review

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Abstract

Agroforestry, a land use practice that integrates tree and agriculture crops in a given space and time, is a prominent land-use practices in South Asia region. In addition to trees and agriculture component, agroforestry accommodates livestock and non-timber forest products and therefore enhances people's livelihood at the local level. It has also been claimed that agroforestry practices minimise the effect of climate change, conserve soil and water, sequester atmospheric carbon and provides various ecosystem services. But as concrete evidences are rather scarce.

In order to examine the benefits and service functions of agroforestry (production, protection, regulatory and other ecosystem services), a critical review of existing agroforestry related policy and provision from the region was carried out. The review suggests that almost all SAARC countries practice agroforestry as one of the options for immediate use of forestry products while generating additional household income. However, the evidences of intangible agroforestry functions such as regulatory, protection and other ecosystem services aren't duly acknowledged. There are now legal provisions for taking up agroforestry practices.

The review suggests that small land holdings (< 0.5 hectares) among the farmers is one of the most hindering factor in developing large scale agroforestry practices in the region. Scale of products obtained from agroforestry practices are not large and are not adequate enough to make desired income. Yet the future of agroforestry in most SAARC countries is bright because of increasing awareness towards agroforestry and its multiple uses including trend of utilizing the tree species for small scale enterprises, and for industrial and commercial use.

Keywords: Agroforestry, ecosystem services, SAARC countries, sustainable development goals.

Introduction, scope and main objectives

Introduction

Eminent scientists of the world, engaged in agroforestry, (King, 1979; Vergara, 1981; Raintree, 1990; Huxley, 1983; Nair, 1989) have defined agroforestry in various forms. The World Agroforestry Centre (WAC) then International Centre for Research on Agroforestry (ICRAF) has defined Agroforestry system as “a land use system that integrates trees with agricultural crops and / or animals, simultaneously or sequentially, to get higher productivity, more economic returns, and better social and ecological benefits on a sustained yield basis, than are obtainable from monoculture on the same unit of land, especially under conditions of low levels of technological inputs and on marginal sites” (ICRAF, 1982). This definitions of agroforestry have gradually been refined in terms of the services it provides and combination pattern of both agriculture and forestry products. Declaration of 1st World Congress of Agroforestry held on Orlando, Florida, USA during 27 June to 02 July, 2004 mentions “Agroforestry as a science without borders, can tackle problems of biodiversity, rural poverty, deforestation, land degradation, genetic erosion, soil fertility decline, climate change, environment, food and nutritional security”.

In a nutshell, agroforestry can be seen as a land use option where agriculture and forestry crops are combined together to provide multiple products (food, timber, fodder, fuel wood, leaf litter, medicine) in a given space and time. Recorded history of planting trees goes back to as old as *Padma Purana* (Article 19 b) a Hindu epic. It says “**those people who plant trees near road side s/he would feel happy in heaven as much the number of years as the tree has fruits and leaves on it**” (Amatya et al 2018). Empirical evidences show that agroforestry is a land use system which increases social, economic, and ecological benefits on a sustainable basis. It has both biological and socio-economic advantages. Some of them are:

Biological

- Increased space utilization
- Increased productivity
- Potential reduction in soil erosion

Socio-economic

- Increased income opportunities
- Potential for improved human nutrients
- Crop diversity and reduced risk
- Reduced establishment costs

- Reduced risk of complete crop failure
- Physical support for herbaceous climbers
- Positive use of shade
- Reduces pressure on forest and promotes livestock development.
- Minimize effect of climate change and help sequestering atmospheric Carbon.

Scope and objectives

The objective of this review is to look at agroforestry practices being adopted in SAARC countries and to identify the factors that encourages individuals to take up agroforestry practices as one of the livelihood and land use options.

Methodology/approach

This review is based on literature, review reports, seminar papers, consultancy reports, and other documents both published and unpublished especially on SAARC countries. It was very difficult to find reports devoted on agroforestry of Afghanistan and Maldives. Hence, some of the review findings are extracted from consultancy reports and other unpublished papers.

Results

Agroforestry in SAARC countries

The South Asian Association for Regional Cooperation (SAARC) was established on 8 December 1985. SAARC comprises of eight Member States: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. The Secretariat of the Association was set up in Kathmandu on 17 January 1987. One of the major objectives of the Association is to promote the welfare of the peoples of South Asia and to improve their quality of life; to accelerate economic growth among others. SAARC countries occupy 3% of the world's area, 21% of the world population (Asia Pacific Forestry Sector Outlook, 2012. RAPA publication 2012/10, Bangkok). SAARC countries are one of the least-forested sub regions in the Asia-Pacific region (Table 1) with a per capita forest area of about 0.05 hectares.

source

Table 1: SAARC Countries with its forest capital

SN	Country	Total geographical area (km ²)	% of forest area
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1	Bangladesh	147, 570	17.5 *
2	Afghanistan	652, 864	1.3
3	Bhutan	38,394	81.5
4	India	3,287,263	24.1
5	Maldives	1192 small coral islands that stretches over 90,000 Km2 **	3.3***
6	Nepal	147,181	44.7****
7	Pakistan	881,913	1.9
8	Sri-Lanka	65,610	29.9

Source: Asian Development Bank, 2016; * Ahmed (2018), ** Gurung et al (2015) ***World Bank, 2015; **** DFRS (2015).

Agroforestry is one of the important practice that provides food, timber and other products in this region. The objectives of practicing agroforestry in all the SAARC countries are more or less the same i.e. meeting household fuel wood requirement, fodder for livestock, grazing, conserving soil and water utilizing traditional agroforestry knowledge and technologies, learnt from their forefathers. They all practice Agri-silviculture system of agroforestry followed by Silvo-pstoral and home gardens. However, depending on the countries, some of the practices is very diverse and tends to be complex. Table 2 below gives a glimpse of agroforestry practices of this region.

Table 2: Agroforestry practices in SAARC countries

Country	Agroforestry practices
Afghanistan	<p>Information on agroforestry and practices, in Afghanistan is very scare. Although Forest Assessment Reports published by FAO in 2010 and 2020 gives some glimpse of forests and forestry it does not provide agroforestry practices Iza-MN (2003). Groninger (2012) has reported that Afghanistan is trying to develop its forest resources so as to alleviate poverty.</p> <p>Although the practice is not much followed by general farmers' some of them are inter planting Alfalfa with water melon and sun flower. Farmers are looking at some other possibilities of intercropping trees with Hing (<i>Ferula assa-foetida</i>) especially in those villages where it grows naturally. Small farmers are following agri-silviculture, alley cropping and multi-storey home garden techniques). Various kinds of agriculture crops (maize, cassava, egg plants and cabbage) and horticulture crops (papayas, coconuts, oranges, cloves) were grown in between tree species. Planting Alfalfa (<i>Medicago sativa</i>),</p>

	<p>a perennial flowering plant, is a common agroforestry forage crop in many districts of Afghanistan. Farmers plant this species underneath of tree species (<i>Populus</i>, <i>Zizuba</i>, <i>Mulberry</i>, <i>Acacia</i> and <i>Russian Willow</i>). They harvest this species three to four times a year. It has been estimated that the yield varies between 8 to 15 tons per hectare in Rustaq district (Amatya, 2013).</p>
Bhutan	<p>Some of the important agroforestry system being practiced in Bhutan are: Agri-silvicultural systems, Silvi-horticultural systems, Agro-silvopastoral systems. Collection of Non Timber Forest Products from wild and shifting cultivation are also common in Bhutan (Gurung <i>et al</i> 2015). Integration of crop production, grazing animals and forest areas into a mutually supportive system is the main features of agroforestry being practiced in Bhutan.</p>
Bangladesh	<p>In Bangladesh, both farm and forest based agroforestry systems are being practiced. Scope of agroforestry in Bangladesh is most effective and use from the point of view of sustainability (Ahmed, 2018). A case study conducted by Islam <i>et al</i> (2013) shows that Traditional agroforestry practice in Jessore district of Bangladesh has helped increase the food production and income through providing new job opportunities.</p> <p>However, there are various challenges in agroforestry development. One of them is inadequate policy support followed by insufficient participation by the concerned farmers. It is mainly because farmers feel the insecurity of tenure once the trees are introduced on their farmland.</p>
India	<p>In India, about 25 million ha area in the country (8.2 % of the total reported geographical area), is reported under agroforestry in both irrigated and rainfed agriculture which also includes trees outside forests and scattered trees on and off the agricultural fields. On the basis of nature of components, a total of 20 agroforestry systems are prevailing in different agro-ecological regions.</p> <p>Agroforestry in India is more developed in comparisons to other SAARC countries. Both farm and forest based agroforestry systems are being practiced. But the intensity and use differs along with the agro-ecological zones of the country. Silvo-pastoral practices are being practiced within village grazing grounds and in forests but differ in practice.</p>
Maldives	<p>The Republic of Maldives is an archipelago of 1192 small coral islands that stretches over 90,000 Km² in the Indian Ocean (Gurung <i>et al</i> 2015).</p> <p>Coconut forests are among the few resources that the people of Maldives dependence on for its basic needs. Coconut and oil is as a major food source and other household utensils and furniture. There are three forms of agroforestry in Maldives. Coconut intercropping with as cassava and vegetables followed by coconut based coastal agroforestry system with mangrove trees and coconut based home garden which accommodates a variety of</p>

	crops with multiple use perennial food crops, fruits, vegetables, roots, tubers, medicinal plants). Trees and shrubs such as <i>Gliricidia</i> , <i>Sesbania</i> , <i>Erythrina variegata</i> and Coconut are used in live fences, home gardens system and as wind breaks.
Nepal	The agroforestry systems practiced by Nepalese farmers vary according to the physiographic zones. The main determining biophysical factors are altitude and aspect. Within a given physiographic zone, local variations are significant. Nepal's subsistence hill farmers have traditionally practiced many types of agroforestry. Hill farming systems are, in fact, based on strategies to manage forest, pasture, and arable lands simultaneously, and in an integrated fashion, to obtain essential items of food, shelter and clothing. In Nepal, the number of practices have increased since scientific postulation of agroforestry began from 14 in 1995 to 35 in 2018 Amatya <i>et al</i> (2018).
Pakistan	In Pakistan, both farm and forest based agroforestry are being practiced. The objectives of employing agroforestry are to maximize the positive interaction of the resources to harvest a higher and sustained productivity and improving the livelihood. People prefer to plant Poplar, Eucalyptus, Acacia, Sissoo on their farmlands. Presently, farmers are interested in planting mulberry for silk production and basket making, Tamarix aphylla as shelterbelts, and block plantations of Ipil-Ipil for fodder and fuel.
Sri-Lanka	In Sri-Lanka, agroforestry is one of the main sources of timber and food for the country. Tree planting on homestead supplies wood and other forest products for fulfilling household demand. Jackfruit (<i>Artocarpus integra</i>) constitutes as an important component of most Sri-Lankan home gardens. Tea (<i>Camellia sinensis</i>) based agroforestry, Rubber (<i>Hevea brasiliensis</i>) based agroforestry and Coconut based agro-forestry are some of the important practices in Sri-Lanka. Sri-Lankan home gardens are considered to be most complex and diverse in the world.

Agroforestry in all SAARC countries, are being adopted by individual farmer based on their experience and transfer of knowledge gained from their forefathers. Besides the direct benefits, agroforestry is playing important role in reducing vulnerability, increasing resilience of farming systems and buffering households against climate related risk but reports on these aspects are lacking.

In order to document the evolution of agroforestry system in SAARC countries, SAARC Agriculture Centre (SAC) and SAARC Forestry Centre (SFC) has developed a SAARC Regional consultation document. The document is very comprehensive and provides a lot of details related with agroforestry systems and practices in SAARC countries.

Agroforestry related policies, Acts and regulations

Almost all SAARC countries have their own forestry policies, Acts and Regulations in place. Forest law in Afghanistan seem to have enforced in 2008. The law tries to balance between conservation of forest resources and maximization of their productivity. The other important features of the law are to introduction of community based forest management (Belinda, 2008)

India is the first country among SAARC region to have agroforestry policy in 2014. Government of India, through this policy, is trying to integrate existing policies of agriculture, forestry, water and environment so as to maximize the land use (Singh, *et al* 2016).

Similarly, Government of Nepal recently adopted a National Agroforestry Policy, 19. One of the objectives of this policy is to enhance livelihood of people through generating employment and other income generating activities. This policy has provisioned of obtaining loan keeping trees as collateral. This is a paradigm shift in promoting agroforestry in private land.

Agroforestry models

No agroforestry modalities have been tested so far in SAARC countries except in India. In India, recently a book on successful agroforestry models for different agro-ecological region have been published (Handa, *et al* 2019). The book presents a comprehensive account of 40 successfully tested agroforestry systems for 20 different agro-ecological regions in India.

Some of the agroforestry technology developed in different agro-climatic zones in India are

- Poplar based Agroforestry system
- Alder - large cardamom based agri-silviculture
- *Prosopis cineraria* based agroforestry for hot arid region of Gujarat and Rajasthan
- Amala based agroforestry system for semi-arid region
- Multipurpose Tree based black pepper production system in Kerala and
- Teak based agroforestry system

Actually, any model should perform three important criteria. They must be simple, easy to replicate and follow and should meet the desired objectives and or goal. Agroforestry is no exception. All agroforestry models, that have to be developed in SAARC countries in future, must satisfy all these criteria.

Sustaining agroforestry practices in SAARC countries

It has been reported by Amatya (2019) that agroforestry practices would further scale up if the selection of tree species vis-a-vis their silvicultural characteristics and local suitability is known and practiced accordingly. Some of the problems that farmers are facing to adapt agroforestry as a viable land use option in SAARC countries are:

- Subsistence farming system,
- Inadequate improved technology,
- Lack of technology,
- Shortage of labor mainly because of youth migration,
- Inadequate and unstructured market system,
- Lack of knowledge on tree species, which are the important of component of agroforestry practices,
- Lack of study, research and information dissemination,
- Unavailability of seeds, seedlings, and other technical inputs, and
- Unforeseen problems of pest and diseases. To cite but example, disease that occurred in Sissoo trees in Nepal has discouraged in planting Sissoo in agroforestry practices.

Role of Local and International Non-Governmental Organizations

Dr. Chun K Lai, the then Coordinator of Asia Pacific Agroforestry Network (APAN) has the idea that Networks are about people and institutions. The role of Asia Pacific Agroforestry Network (APAN) funded by Food and Agriculture Organization of the United Nations was instrumental in sharing, providing training and making exchange visit within and outside the country in agroforestry. It has generated a huge amount of information on this field (FAO, 1989).

Discussion

Agroforestry is one of the viable land use options in almost all SAARC countries. Most SAARC countries have their own Policy, Act and Regulations that governs forestry and related subject matters, but only India and Nepal has brought out agroforestry policy so far. Besides conducive policy, act and regulations, it is necessary to identify technological factors that may enhance agroforestry development. Agroforestry should focus on supporting community based natural resource

management, developing and disseminating improved nursery strategies, promoting watershed management schemes that integrate forestry, range management, and agronomic production.

Proper choice of shrubs and herbs of economic value for commercial and general purposes, such as, medicine, essential oil, fiber, floss, and food could be encouraging for agroforestry practitioners. Capacity building should focus on skill development, market and its linkages and optimal use of available resources, optimal use of spacing, livelihood development and their enhancement.

Agriculture, including forestry and fisheries has been projected as a pathway towards development and food security built in increasing productivity and incomes, enhancing resilience of livelihoods and ecosystems and reducing and removing greenhouse gas emissions from the atmosphere but there is no quantitative evidence on it.

Research exclusively in agroforestry is very scanty in SAARC countries, except in India. In case of Nepal, Department of Forest Research and Survey (DFRS) and National Agriculture Research Council (NARC) has mandate for Agroforestry research but institutions responsible for research and development in agroforestry is not clear. Additionally, agroforestry embraces various other discipline apart from agriculture and forestry and is a complex task to perform.

Conclusions/ wider implications of findings

Agroforestry is old practice in all SAARC countries. People have been practicing planting trees on their farmland along with agriculture crops underneath and in and around tree crops. They were realizing the benefits of tree and agriculture crops subsequently since time immemorial. It is only in recent years the concept of agroforestry based on scientific principle has been adopted.

In all SAARC countries, agri-silviculture system i.e. intercropping tree with agriculture crops is one of the most favourable practice. This could be because the system provides immediate use of tree and agriculture crops for immediate household use. The other important agroforestry systems and practices of this region are agro-pastoral system and home gardens. The agroforestry systems and practices, however, differs among the SAARC countries based on the geographical locations, economic conditions and educational status of the populations.

Almost all SAARC countries have conducive legal regulations in place for enhancing agroforestry systems and practices but farmers are in many cases are reluctant in planting tree species on their farmland. They are, in many cases, afraid of tedious and time regulatory systems prevailing for harvesting trees grown on their farmland.

There is a big scope of developing and enhancing agroforestry systems and practices in all SAARC countries. But most of literature are available only in language that are not conducive to local farmers. The role of National and International NGOs are very important in developing and enhancing agroforestry in this region. While carrying out agroforestry experiments, care must be given if we are accommodating the feelings and thoughts of agroforestry practitioners and enhance their crop productivity if they follow a certain technique which can be replicated and adopted easily.

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References

1. Amatya SM. 2019. User Friendly Forestry Research: Nepalese case study. Paper presented at the XXV IUFRO Congress 2019, Curitiba, Brazil. 29 September- 05 October 2109.
2. Ahmed Z. 2018. Agroforestry in Bangladesh. Department of Economics and Banking.
3. Amatya SM. 2013. Reforestation and fuel production within LIPT-III project. A consultancy report submitted to Terre des hommes, Livelihood Improvement Program (LIPT III), Rustaq, Afghanistan.
4. Amatya SM, Cedamon E, Nuberg I. 2018. Agroforestry systems and practices in Nepal. -Revised Edition, Agriculture and Forestry University:, Rampur, Nepal, 108 pp.
5. Amatya SM, Ian N, Edwin C. 2020. What sustains Nepalese agroforestry practices? *Indian Journal of Ecology*, 47(2): 540-2.
6. Amatya SM, Nuberg I, Cedamon E and Pandit BH. 2015. Removing Barriers to the Commercialization of Agroforestry Trees in Nepal. In Proceedings of International IUFRO

- Symposium on Small-scale and Community Forestry and the Changing Nature of Forest Landscapes, 11-15 October 2015, Queensland, Sunshine Coast, Australia.
7. Belinda B. 2008. Paper presented in USAID Forestry Partners Workshop, Kabul, 19 February 2008 USAID
 8. FAO. 2010. Country Report Afghanistan. Global Resources Assessment 2010. FAO, Forestry Department Food and Agriculture Organization of the United Nations, Rome.
 9. FAO. 2020. Global Forest Resources Assessment 2020 – Key findings. Rome. <https://doi.org/10.4060/ca8753en>
 10. FAO. 1989. Asia Pacific Agroforestry Network. Asia and the Pacific Region. Project Findings and Recommendations. FAO, 1989.
 11. Groninger JW. 2012. Reforestation Strategies Amid Social Instability: Lessons from Afghanistan. *Environment Management*, 49: 833-45.
 12. Gurung TR and Tempel KJ. 2015. Technological advancement in agroforestry systems: Strategy for climate smart agricultural technologies in SAARC Region.
 13. Handa AK. 2019. Successful agroforestry models for different agro-ecological regions in India. New Delhi, India: World Agroforestry South Asia Regional Programme.
 14. Islam MM and Sadath MN. 2013. Contributions of Agroforestry Practice Towards Reducing Poverty at Keshabpur Upazila of Jessore District. *Journal of Environmental Science and Natural Resources*, 5(2): 267-74.
 15. King KFS. 1979. Agroforestry and the utilization of fragile ecosystems. *Forest Ecology and Management*, 2: 161-8.
 16. Huxley PA. 1983. Comments on agroforestry classification with special references to plants. In: Huxley PA (ed.), *Plant Research and Agroforestry*, ICRAF, Nairobi, Kenya, 161-71 pp.
 17. Lundgreen BO and Raintree JB. 1982. Sustained agroforestry. In: Nestel B (ed.) *Agricultural research for development: potentials and challenges in Asia*. ISNAR, The Hague, 37-49 pp.
 18. Nair PK. 1979. *Tropical Agroforestry Systems and Practices*. International Council for Research in Agroforestry, Nairobi, Kenya.
 19. Nair PKR. 1989. *Agroforestry Systems in the Tropics*. Kluwer Academic Publishers.
 20. Nair PKR. 1987. Agroforestry systems inventory. *Agroforestry Systems*, 5: 301–17.
 21. Singh VP, RB Sinha, Nayak D. 2016. *The national agroforestry policy of India: experimental learning in development and delivery phase*. In: ICRAF Working Paper.
 22. Vergara NT. 1981. *Integral agroforestry: a potential strategy for stabilizing shifting cultivation and sustaining productivity of the natural environment*. Working paper. Environment and

Policy Institute, East-West Center, Honolulu, Hawaii, USA.
www.worldagroforestry.org/publicatio/economic-aspects-soil-fertility-management-and-agroforestry-practices.