



PAPER TITLE: Adopting Agroforestry to Improve Soil Health in the Pacific

Vinesh Prasad
Agroforestry Technician
Secretariat of the Pacific Community
Email: vineshfiji@gmail.com

Abstract

Agroforestry is a collective name for land-use systems and technologies where woody perennials are deliberately integrated with crops and/or animals on the same land management unit. Developing a farm with that model to achieve a fully sustainable farming venture in terms of soil nutrition and consistent supply for own consumption and sales is challenging. However, past experiments (**Fijian agroforestry at Namosi and Matainasau** – study by Inoke Ratukalou in central Vitilevu) have clearly shown that agroforestry does add value when compared to conventional agriculture farming systems.

In addition, investigation in other parts of the world has revealed that agroforestry contributes immensely to improving soil health. With these benefits in mind, the Secretariat of the Pacific Community (SPC) has undertaken work to ascertain how to best apply agroforestry in the Pacific context.

Agroforestry practices are being advocated as a way to enable communities to adapt well to the impact of climate change and continue to enjoy the goods and services derived from their available land and natural forests.

Not only do agroforestry systems provide a great opportunity for sequestering carbon and hence help mitigate climate change, they also enhance the adaptive capacity of agricultural systems in tropical and subtropical regions. Mixing crops with trees not only provides food but also improves soil, and therefore is seen as the way forward for small economies in the Pacific.

SPC has established agroforestry demonstration sites in several member countries to try out techniques on both flat land and sloping land. These sites combine 'climate ready' crops, tree species and livestock. This paper gives details of the work in progress and some of the lessons learnt. The lessons learnt, especially those relating to improving soil fertility, will be applied in replicating similar systems in the other parts of the Pacific.

[END]



Introduction

The century-old practice of agroforestry farming is now being given prominence worldwide due to its myriad benefits. For Pacific Island countries and territories (PICTs), adopting such systems is likely to provide many benefits, including more resilience in the face of a changing climate and growing population, as well as improved food security and preservation of culture/tradition.

Nair (1992) provides the following definition of agroforestry:

‘Agroforestry is a collective name for land-use systems and technologies where woody perennials are deliberately integrated with crops and/or animals on the same land management unit. The integration can be either in spatial mixture or temporal sequence.’

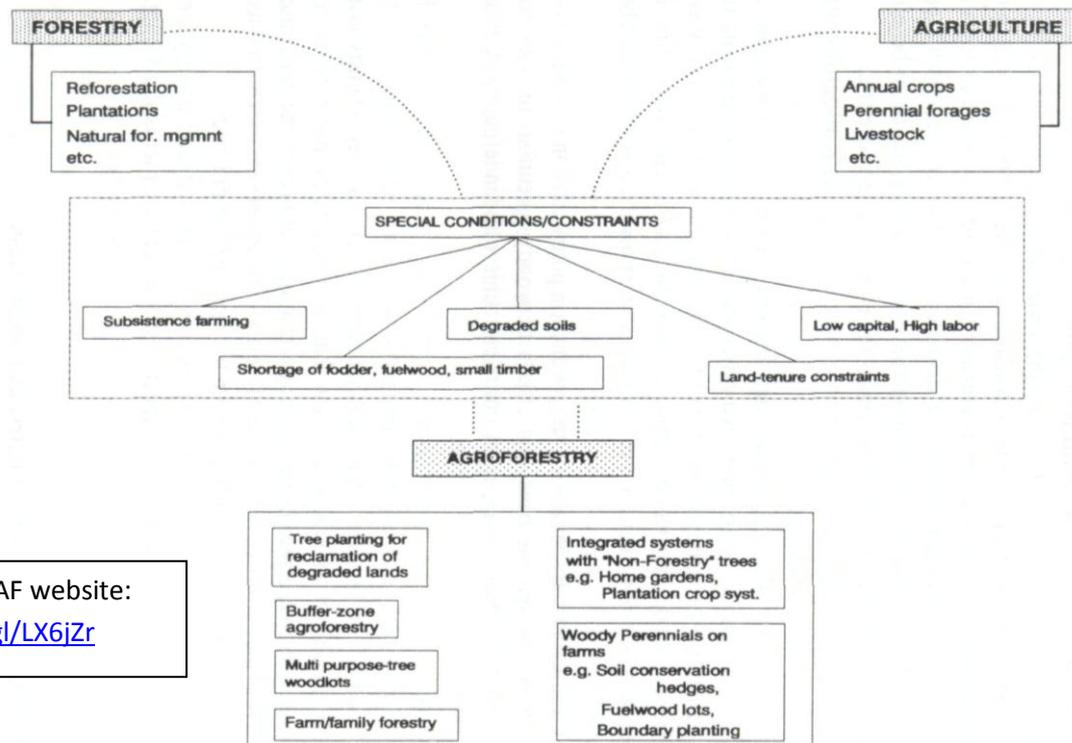
The shift from mixed farming towards more specific production ‘monoculture’ has been the major cause of the changing dietary pattern of Pacific Islanders and is linked to more reliance on imported goods and loss of biodiversity and other associated factors such as deterioration of soil health.

Generally, overuse of chemicals to maintain production in a mono-cropping system affects soil health negatively, and over a period of time it diminishes the productivity of the soil.

Unfortunately, there has not been much scientific investigation into the level of loss. However, recent World Agroforestry Centre (ICRAF) research has made advances in land health surveillance based on principles adapted from public health surveillance that centre on closely monitoring changes in the health of a population and applying statistical methods to develop evidence-base policy recommendations.

SPC through its Land Resources Division has been actively promoting agroforestry in the Pacific region, and to that effect it is conducting demonstration farms and capacity building training. One such activity was recently conducted in Tonga (further information is available at: <http://goo.gl/jwa4AE>).

Figure 1: The concept of agroforestry



Source: ICRAF website:
<http://goo.gl/LX6jZr>

Agroforestry farming systems – which basically consist of growing trees and agricultural crops on same piece of land based on land suitability and need – are not foreign to the Pacific. Such integration not only provides for the needs of the farmer but also improves the overall health of the farm.

A strictly scientific definition of agroforestry should stress two characteristics common to all forms of agroforestry and separate them from the other forms of land use, namely:

- The deliberate combination of woody perennials on the same unit of land as agricultural crops and/or animals, with the mixture being either spatial or temporal (sequence);
- Significant interaction (positive and/or negative) between the woody and non-woody components of the system, either ecological and/or economical.

Figure 1 illustrates the interaction between agriculture and forestry sector and covers mixed land-use practices. These practices have been developed mainly in reaction to the special needs and conditions of tropical developing countries that have not been adequately addressed by progress in conventional agriculture or forestry.

The interaction is used to depict various farming system ranging from simple forms of shifting cultivation to complex hedgerow intercropping systems; systems including



varying densities of tree stands ranging from widely-scattered *Faidherbia (Acacia) albida* trees in Sahelian millet fields, to the high-density multi-storied home gardens of the humid tropics; and systems in which trees play a predominantly service role (e.g., windbreaks) to those in which they provide the main commercial product (e.g., intercropping with plantation crops).

However, it needs to be reemphasized that one concept is common to all these diverse agroforestry systems: and that is purposeful growing or deliberate growing of trees with crops and/or animals in interacting combinations for multiple products or benefits from the same management unit. This is the spirit of agroforestry.

When promoting agroforestry one should then stress the potential of it to achieve certain aims, not only by making theoretical and qualitative remarks about the benefits of trees, but also, and more importantly, by providing quantitative information (Lundgren, 1982).

Role of SPC in Agroforestry

The Secretariat of the Pacific Community (SPC) has developed a strategic plan 2013–2017 for its Land Resources Division (<http://goo.gl/UVDqio>). One of the objectives in this plan relates to sustainable management of land, agricultural and forestry resources. The objective became the basis for renewed and vigorous promotion of agroforestry farming as it linked with climate change, food security, biodiversity conservation, income security, soil health improvement and maximising income from given unit land area.

Some of the country-specific activities related to agroforestry are described below.

Fiji

- Setting up demonstration agroforestry farm on flat and sloping land with community and individual farmers.
- Conducting training on nursery management including design, hygiene and production.
- Conducting training on vegetative propagation.
- Raising awareness on value chain relating to commodities with special focus on post-harvest handling and value adding.

Tonga

- Financial and technical support to Hango Agricultural College to establish agroforestry demonstration site and build an agroforestry module into their syllabus.
- Promoting sandalwood (*Santalum Spp.*) in an agroforestry model for Tonga.
- Training for MAFFF extension and research staff on agroforestry including nursery management, propagation, post-harvest, compost making and value chain.
- Establishment of a demonstration farm in collaboration with MAFFF and Petani women's group on island of Eua.



Vanuatu

- Training of research, extension, forestry and agricultural officers on agroforestry including nursery management, propagation, post-harvest, compost making and value chain.
- Financial support for establishment of demonstration farm with Department of Forestry.
- Assistance with promotion and awareness of agroforestry activities.

Papua New Guinea

- Support for Forestry Department in establishing demonstration site (technical expertise).

Tuvalu

- Establishment of demonstration site on Funafuti and on some outer islands to focus on food security.
- Staff and farmer training on agroforestry, including nursery management, propagation, post-harvest, compost making and value chain.

SPC envisages undertaking similar activities with its other member countries through partnership and is vigorously seeking assistance from donor agencies in this regard.

Issues and challenges faced

Throughout Pacific, the major issues and challenges that are impacting on farming in general, and more specifically on agroforestry, are:

1. Land tenure – The majority of land in the Pacific is open to community use, hence ownership is always an issue and this discourages individuals from undertaking long-term investments.
2. Lack of extension (awareness and education) – Transfer of appropriate knowledge and technology is always limited due to lack of human and financial resources and low emphasis on awareness and communication.
3. Value chain study and market access – Sharing information across the value chain and understanding the role of every player is hardly possible as one player is always suspicious of other, hence there is always an issue of mistrust.
4. Access and benefit sharing – Sharing of the benefits of genetic materials tends to exist on paper only; traditional owners of resources are reluctant to share some of the best genetic materials they have. However, SPC is now working with its member countries on material transfer agreements to facilitate and address this issue.



5. Supply and exchange of improved planting materials – SPC, through its Sustainable Resource Management Team, is facilitating the sharing of high-quality genetic materials throughout the region.
6. Policies, laws and regulations – SPC, with partners such as the Food and Agriculture Organization of the United Nations (FAO), have been working with member countries to improve policies. Efforts are now being made to encourage the line ministries (forestry and agriculture) to include policies and financial components in their work programmes so that agroforestry farming promotion can become more robust. Vanuatu has also developed a policy on agroforestry and Fiji is completing an agroforestry policy guide.
7. Another major constraint to adoption of agroforestry is that most people see it as a long-term investment rather than the sources of a quick economic return; however they fail to realise the payoffs, apart from monetary return, that can be derived from such a farming system

Lessons learnt

It is to have farmers involved in planning and implementation to ensure ownership of the activities undertaken; this enables participation and ownership of the action they undertake. This is one of the keys for project sustainability in the Pacific.

Capacity building of farmers to enable some of them to conduct training for others, identification of 'champions', and use of champions to encourage fellow farmers has worked very well on agroforestry model farms. Farmers adopt new technology more quickly through peer learning.

Demonstration plots are practical and simple tools enabling effective training for rural communities. Adoption of technology is greater when it is seen. Activities that generate income and diversification are more attractive to farmers in the Pacific and are likely to be adopted faster.

Discussion

Despite agroforestry being the traditional way of farming in all Pacific Island Countries and Territories, there has been a shift to mono-cropping and exclusion of trees from farming systems.

While this has brought in much needed foreign exchange and made possible some kinds of development, the damage it has done in the long term outweighs any advantages.

Every paper and journal article written on PICTs talks about biodiversity, food security, nutrition, health, and economic development, and these issues are high on



the agenda of numerous global campaigns, initiatives, task forces and research projects.

But in reality, they all have one thing in common: they are all concerned with the products we gain from agricultural cultivation, the business we create out of it, and the way we consume these products.

There is an urgent need to reengineer the campaigns and awareness to include trees in farming systems for a myriad of reasons.

Agroforestry can supplement soil moisture and retain it for use by plants in during dry period. If those trees are also nitrogen-fixing trees and shrubs, it can substantially increase nitrogen inputs to agroforestry systems.

In addition, trees within an agroforestry system can probably increase nutrient availability via its root system that can retrieve nutrients from lower soil horizons and weathering rock (referred to as 'mining' minerals and trace elements). The decomposition of tree litter and pruning can substantially contribute to maintenance of soil fertility as well. Such addition of high-quality tree pruning (i.e. high in nitrogen but those that decays rapidly) leads to huge increases in crop yields.

Agroforestry can provide a more diverse farm economy and stimulate the whole rural economy, leading to more stable farms and communities. Economic risks are reduced when systems produce multiple products. In other words, the risks are spread over a multiple crop hence the chance of losing out is greatly reduced.

Similarly, agroforestry also benefits livestock on farms as trees may provide fodder (during periods when other sources of feed are short in supply especially during dry period) and it also provide cooling shade for animals in tropical regions.

Weed management can also be done using trees with farming systems (when interpolated with crops) and may benefit if fertilisers are applied to crops (Preston 1998).

There needs to be further investigation to identify indigenous nitrogen fixing Fijian species that can be part of agroforestry models to enrich soil and provide fodder and fuel wood. The author is undertaking this investigation as his masters degree thesis.

Conclusion

For smaller island states in the Pacific, an integrated farming approach (IFA) is the best possible way forward to help ensure food and income security, provide resilience in the face of climate change and conserve biodiversity. Pacific countries



have their own varieties and tastes that should be marketed as it is and not modified as this is unique in itself.

We should not be copying larger economies with bigger land masses, as it will be difficult to compete with them in international markets. Growing what Pacific communities grow best and helping farmers understand and close the gaps in value chains should be the focus of efforts in this area. SPC is working with its members to help them realise their uniqueness in agriculture and become self-sufficient through promotion of agroforestry farming or IFA.

Agroforestry can improve soil health, in contrast to the use of chemical fertilisers that are harmful to nature. Trees should be considered vital components for any farming system.

Works Cited

Choudhury, P. a. (n.d.). *Role of Agroforestry in Soil Health Management*. Umiam – 793 103, Meghalaya: ICAR Research Complex for NEH Region.

Lundgren, B. (1982). *The use of agroforestry to improve the productivity of converted tropical land*. Nairobi: ICRAF.

Nair, P. K. (1992). *An Introduction to Agroforestry*. Dordrecht: Kluwer Academic Publishers.

Preston, T. R. (1998). The role of multipurpose trees in intergrated farming system for wet tropics. *Legume trees and other fodder trees as source of protein*, 193 - 208.

Young, A. (2nd edition.). *Agroforestry for Soil Management*. CAB International.