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Shrubs in Agroforestry: Small Plants with Big Potential

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Shrubs in Agroforestry: Small Plants with Big Potential

When we think about agroforestry, trees usually take centre stage. We imagine coconut and arecanut in home gardens, shade trees over coffee plantations, or trees planted along agricultural boundaries. Yet, beneath and between these larger plants is another group of woody vegetation that often receives much less attention—**shrubs**. Shrubs occupy an important position between trees and herbaceous plants. Generally smaller than trees, often densely branched and capable of repeated regeneration, they can be incorporated into farms, home gardens, pastures, field boundaries, bunds and degraded landscapes. They can provide **fodder, fuelwood, fruits, biomass and traditional-use resources**, while also contributing to soil protection, moisture conservation and biodiversity. The importance of shrubs becomes clearer when agroforestry is viewed as a **multilayered production system** rather than simply trees growing with crops. Different plants occupy different levels, use resources differently and provide different products and ecological services. Shrubs form one of these important intermediate layers.

What Makes Shrubs Special?

Shrubs are woody perennial plants that are generally smaller than trees and often have several stems branching from near the base. Many useful agroforestry shrubs are approximately 1–5 metres tall and are fast-growing and relatively easy to manage. One of their most useful characteristics is **coppicing ability**. After cutting, many shrubs can regenerate from the base and produce new shoots. This allows farmers to harvest biomass repeatedly without completely removing the plant. Shrubs can also grow in places where large trees may not be appropriate. They can be established along boundaries, on bunds, around livestock areas, beneath suitable tree canopies or in degraded sites. Their relatively small size allows them to fit into spaces that might otherwise remain underutilised. This makes shrubs particularly suitable for **small and diversified farms**, where every part of the land may have a productive or protective function.

Shrubs as a Hidden Layer of Agroforestry

A mature agroforestry system can contain several layers of vegetation. Tall trees form the upper canopy, medium-sized trees occupy the middle layer, shrubs and smaller woody plants fill lower levels, and crops, herbs and vegetables occupy the ground. This arrangement allows sunlight to be intercepted at different heights and helps farmers obtain several products from the same area. Shrubs also contribute to microclimate regulation by providing shade, reducing wind speed and helping conserve soil moisture. Their roots can stabilize soil, while their leaves and branches contribute organic matter when they fall or are pruned. Shrub

vegetation can also provide habitat for pollinators and other beneficial organisms. The value of a shrub therefore cannot be judged only by the product harvested from it. Its contribution may also come through the **services it provides while growing**.

Shrubs for Different Needs

The great strength of shrubs in agroforestry is their diversity. Different species can be selected according to the needs of the farmer and the characteristics of the site.

Nitrogen-fixing shrubs

Species such as *Gliricidia sepium* and *Sesbania* spp. are useful in agroforestry because of their association with biological nitrogen fixation. Their foliage can also contribute organic matter and, when managed appropriately, be used as green manure.

Fodder shrubs

Calliandra calothyrsus, *Leucaena leucocephala* and *Sesbania sesban* are examples of useful fodder shrubs. They can supplement livestock feed and reduce pressure on natural grazing lands.

Fruit-producing shrubs

Carissa carandas and *Berberis* spp. are examples of fruit-producing shrubs that can provide edible products and potentially contribute to household income.

Medicinal and household species

Moringa oleifera and *Aloe vera* are widely valued for their food, household and traditional medicinal uses. Several other shrubs have important ethnobotanical associations.

Protective and fencing species

Suitable shrubs and small woody plants can be planted along field boundaries as live fences, providing both protection and additional biomass. The important point is that **one shrub need not perform only one function**. A suitable species can contribute to several needs simultaneously.

Shrubs for Livestock and Fodder Security

Livestock are closely integrated with agriculture in many rural landscapes. One of the major challenges for livestock owners is maintaining fodder availability throughout the year. Fodder shrubs offer an opportunity to produce additional leafy biomass directly on farms. *Calliandra calothyrsus* and *Leucaena leucocephala*, for example, can be incorporated into suitable fodder and silvopastoral systems. Shrubs can be planted along boundaries or in designated fodder areas, depending on farm size and management practices. Their repeated regeneration can make them useful for regular harvesting. This approach also illustrates the broader philosophy of agroforestry: **the same land can support crops, trees and livestock rather than being dedicated to only one form of production**.

Fuelwood and Biomass from Shrubs

In many rural communities, woody biomass continues to be an important household resource. Shrubs can contribute to fuelwood production because several species grow rapidly and regenerate after cutting. Traditional agroforestry systems across India have utilized numerous shrub species for fuelwood and fodder. Examples include species of *Berberis*, *Rubus*, *Rosa*, *Spiraea*, *Ziziphus* and *Lonicera*. The ability to harvest shrubs periodically can make them a renewable source of biomass when managed properly. However, repeated harvesting must be balanced with regeneration. If biomass is removed faster than the shrub can recover, productivity will decline. Therefore, coppicing is useful only when accompanied by appropriate harvesting practices**.**

Traditional Home Gardens: Shrubs in a Living Mosaic

One of the most familiar forms of agroforestry in the tropics is the **home garden**. A traditional home garden is rarely a random collection of plants. It is often a multilayered system in which plants of different heights occupy different spaces. Tall coconut and jackfruit trees may form the upper canopy. Mango, cashew and other medium-sized trees occupy the middle layer. Smaller trees and shrubs such as **moringa, papaya and citrus** occur below, while vegetables, agricultural crops and ornamental plants occupy the ground layer. Such

systems allow farmers to produce several commodities from a small area. The home garden therefore represents an important principle of agroforestry:

Diversity can be productive.

Instead of relying on a single crop, households can obtain fruits, vegetables, spices, medicinal resources, fodder and other products from different plants growing together.

Uttara Kannada: A Regional Example

The traditional agricultural landscapes of **Uttara Kannada** provide an excellent example of this type of diversity. In the coastal taluks of **Ankola, Kumta and Bhatkal**, agroforestry systems contain several vegetation layers. Coconut and jackfruit form the upper layer of many home gardens, while cashew, soapberry and mango occur in the middle layer. Smaller plants including papaya, moringa and citrus occupy intermediate positions, with vegetables and agricultural crops forming the lower layer.

The region also contains silvopastoral systems, bund plantations, live fences and boundary plantations. *Gliricidia*, *Leucaena* and *Agave* are among the useful woody plants associated with these systems. Such landscapes demonstrate how farmers can combine **production and protection** within the same land-use system.

The traditional systems of Uttara Kannada are particularly interesting because they have developed within a landscape where agriculture, forests, plantations, streams and settlements occur close to one another. The diversity of plants maintained around farms reflects both environmental conditions and generations of local knowledge.

Shrub Diversity and Traditional Knowledge

Traditional agroforestry systems across India contain a remarkable variety of shrubs and small woody plants. In the Western Ghats of Karnataka, including Uttara Kannada, species such as *Theobroma cacao*, *Hibiscus tiliaceus*, *Murraya koenigii*, *Coffea arabica*, *Vitex negundo*, *Punica granatum* and *Jatropha curcas* have been documented in traditional agroforestry systems. This diversity reflects the fact that farmers often select plants for several purposes rather than focusing exclusively on the principal crop.

A shrub may provide a fruit during one season, fodder during another, fuelwood when required or material for a fence. Its value may therefore be spread across the year. This makes plant diversity a form of **resource security** for farming households.

Coorg: Coffee Growing Under a Living Canopy

Another remarkable agroforestry landscape of Karnataka is **Kodagu, popularly known as Coorg**. Kodagu is famous for coffee, but its traditional coffee farms are much more than simple coffee plantations. Coffee is commonly cultivated beneath shade trees, creating a complex multispecies agroforestry system.

Research from Kodagu has documented substantial tree diversity in coffee agroforests and has shown that management intensity can strongly influence vegetation diversity. A study of coffee agroforests recorded 95 tree species and found that greater intensification was associated with reduced tree diversity. This makes Kodagu an important example of how agricultural landscapes can retain some characteristics of natural ecosystems. The coffee crop occupies the principal production layer, while the shade canopy above it creates a different environment from that of an open plantation.

The Lesson from Coorg: Diversity Matters

Research in Kodagu has also demonstrated that vegetation diversity can have practical agricultural consequences. A study of coffee agroforests found that greater shade-tree diversity was associated with higher coffee production and bean quality, while simplified systems experienced greater coffee berry borer incidence. Another study comparing native-shade coffee agroforestry with systems dominated by *Grevillea robusta* found higher tree diversity and carbon storage in native coffee agroforestry systems.

The lesson is not that every farm must contain exactly the same species. Nor does it mean that economically valuable species such as silver oak have no place in Kodagu. Rather, it

shows that **the degree of vegetation diversity and the type of species maintained can influence the ecological character of an agroforestry system**. For shrubs, the same principle applies. Maintaining an appropriate lower vegetation layer can add structural diversity, but shrubs must be selected and managed so that they do not compete excessively with coffee.

Shrubs as Living Fences

Farm boundaries are often treated as unproductive spaces, but they can be transformed into useful parts of the farm through **live fencing**. Shrubs and other woody plants can be planted along boundaries to mark fields, restrict livestock movement and provide additional biomass. They may also contribute to habitat creation and wind protection.

In coastal Uttara Kannada, *Gliricidia* and *Agave* have been recorded in live-fence systems. A well-managed live fence therefore performs several functions at once:

Boundary protection + biomass production + habitat + farm utility.

This is a simple but effective example of multifunctional agroforestry.

Shrubs in Soil and Water Management

The root systems of shrubs can contribute to soil stabilization, particularly on vulnerable slopes. Their roots help bind soil, while stems and foliage can slow the movement of rainwater across the land. Leaf litter also provides a protective layer on the soil surface. This is especially relevant in high-rainfall regions where intense rainfall can increase runoff and erosion. Species such as *Cajanus cajan* can contribute to soil and water management through their deep root systems and effects on soil structure. Shrubs can therefore be valuable components of **vegetative approaches to soil conservation**, particularly when combined with appropriate land-management practices.

Shrubs in Ecological Restoration

The role of shrubs extends beyond agricultural production. Some shrubs are capable of establishing in disturbed environments and can help initiate vegetation recovery. Their roots stabilize soil, their litter contributes organic matter and their presence can create more favourable microsites for other plants. Species such as *Coriaria nepalensis* and *Elaeagnus* spp. have been associated with the nursing and establishment of other valuable species in landslide-prone areas.

Shrubs can therefore act as **early-stage vegetation in ecological restoration**, although species selection must always consider local ecological conditions. This role is particularly relevant in landscapes affected by erosion, landslides and other forms of disturbance.

Shrubs and Biodiversity

Agricultural landscapes can support more biodiversity when they contain different vegetation layers. Shrubs provide additional structure between the ground and tree canopy. Their flowers, fruits and foliage can provide resources for insects, birds and other organisms. Their branches can also offer shelter and refuge.

In agroforestry, this structural complexity can be particularly valuable where farms occur close to natural forests. Shrubs do not replace natural forests, which remain essential for biodiversity conservation. Instead, shrub-rich agroforestry systems can provide **additional habitat within agricultural landscapes** and help create a more gradual transition between cultivated and natural areas.

Shrubs and Carbon

Carbon storage is another important consideration in modern agroforestry. Large trees are major carbon stores because of their size and longevity, but shrubs also contribute through their stems, branches, roots and litter. When shrubs form part of a diverse agroforestry system, their biomass becomes one component of the overall carbon pool. Their contribution may be smaller than that of mature trees on an individual-plant basis, but collectively they can add to the carbon stored in vegetation and soil.

Research from Western Ghats coffee agroforestry systems demonstrates that vegetation composition and management influence carbon storage.Thus, shrubs should be viewed as **one component of a broader carbon-storing landscape**, rather than as an independent solution to climate change.

Ethnobotanical Importance

Shrubs have long been associated with traditional knowledge concerning food, household uses and healthcare. Species including *Jasminum nervosum*, *Lantana camara*, *Lepionurus sylvestris*, *Millettia pachycarpa* and *Ricinus communis* have documented ethnobotanical uses. Such knowledge is an important part of cultural heritage and can also guide future research.

However, traditional medicinal use should not automatically be interpreted as scientifically proven treatment. Scientific studies are necessary to establish safety, effective dosage and therapeutic value. Conserving shrub diversity can therefore help conserve not only plant resources but also the **traditional knowledge associated with them**.

Choosing the Right Shrub

Not every shrub is suitable for every agroforestry system. Before introducing a species, farmers need to consider its growth rate, root system, canopy density, water requirement, coppicing ability and compatibility with existing crops. A rapidly growing shrub may produce large amounts of biomass but may also compete strongly with crops. A dense shrub may provide excellent shade but become unsuitable where sunlight is required. An introduced species may perform well economically but require careful ecological assessment. Therefore, species selection should be based on the principle of **"the right shrub in the right place."**Local climate, soil, rainfall, landform and farming objectives should all be considered.

Challenges and the Need for Good Management

Shrubs provide many benefits, but they are not automatically beneficial simply because they are shrubs. If planted too densely, they can compete with crops for light, water and nutrients. Some may become difficult to control or spread beyond their intended area. Poor harvesting practices can also reduce their regenerative capacity.

Management is therefore essential. Regular pruning, appropriate spacing, controlled harvesting and careful species selection can help farmers obtain the desired benefits while limiting competition.The objective should not be to maximise the number of shrubs, but to maximise their useful contribution to the agroforestry system**.**

The Future of Shrubs in Karnataka's Agroforestry

Karnataka contains remarkably diverse agroforestry traditions, from the home gardens of Uttara Kannada to the coffee landscapes of Kodagu and many other tree-based farming systems across the state.These systems provide an important foundation for developing climate-resilient agriculture. Shrubs can be incorporated according to local requirements as fodder plants, fuelwood sources, live fences, fruit-producing plants, soil-protection vegetation and components of multilayered farms. Future agroforestry development should combine **traditional knowledge with scientific understanding**. Local farmers already possess extensive knowledge of which plants grow well together, when they should be harvested and what products they provide. Scientific research can complement this knowledge by evaluating productivity, nutrient cycling, biodiversity, carbon storage and long-term sustainability. Rather than replacing traditional systems with simplified plantations, there is considerable value in understanding what makes these diverse systems successful and adapting those principles to present-day needs.

Conclusion

Shrubs may be small compared with trees, but their role in agroforestry is remarkably diverse. They can provide **fodder, fuelwood, fruits, biomass and traditional-use resources**, while contributing to soil protection, nutrient cycling, habitat creation and the structural diversity of agricultural landscapes.

The traditional agroforestry systems of **Uttara Kannada** demonstrate how different plant layers can be combined within home gardens, silvopasture, live fences and boundary plantations. The coffee landscapes of **Kodagu (Coorg)** provide another important example of agriculture existing beneath a diverse woody canopy. Together, these landscapes demonstrate a fundamental principle of agroforestry: **sustainability comes from relationships between different components, not from any single plant species.** Trees may form the canopy, crops may provide the main harvest, livestock may provide additional income, and shrubs can fill the spaces between these components while performing their own productive and ecological functions. As Karnataka's agricultural landscapes face increasing pressure from climate variability, land degradation and biodiversity loss, the importance of maintaining diverse agroforestry systems is likely to grow. The future of agroforestry is therefore not simply about planting more trees. It is about creating **well-designed, diverse and multifunctional landscapes** in which every layer has a purpose. And sometimes, one of the most important layers is the one growing closest to the ground. **Small plants, big functions—and a much bigger role in the future of sustainable agroforestry.**