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Existing agroforestry system and component in District Reasi of J & K

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Abstract

The aim of this research was to examine the existing agroforestry system and its elements within traditional agroforestry setups across various altitudes in the Reasi district of Jammu and Kashmir, India. The study encompassed three distinct altitude ranges: high altitude (2000–2800 m), middle altitude (1200–2000 m), and lower altitude (354–1200 m). It comprehensively documented all agroforestry components across these altitudes, including crops, fruit-bearing trees, and regular trees. The respective proportions of trees, fruit trees, and crops were found to be 41.86%, 30.23%, and 27.90%. The research identified a total of 18 different forest tree species, 13 fruit tree species, and 12 crop species in the area. The prevalent agroforestry systems observed in the region encompassed agri-silviculture, agri-horticulture, and agri-horti-silviculture.

Keywords: Agroforestry, agro-climate, horticultural trees, multipurpose trees

Introduction

Agroforestry plays a crucial role in advancing the Indian economy by providing both tangible and intangible benefits. Farmers commonly adopt the practice of integrating crops, trees, and livestock to address the pressing issues of fuel and fodder shortages, among other essential goods (Bhatt 2002) [2]. Agroforestry is a comprehensive term encompassing land-use systems and technologies where perennial woody plants are deliberately incorporated into the same land parcels alongside agricultural crops and/or animals, arranged in various spatial or temporal configurations. Within agroforestry systems, there exist intricate ecological and economic interactions among the different components (Lundgren and Raintree, 1982) [6]. Farmers typically have limited options when selecting tree species for their fields, often relying on what is naturally available on their land (Bhatt *et al.* 2010) [3]. Saroj and Dadhwal (1997) [8] found that the choice of intercrops depends largely on the area's climatic conditions, resource availability, and the specific needs of the farmers.

In the Jammu region of Jammu and Kashmir (J&K), agroforestry is a permanent and integral aspect of the agricultural landscape. It fosters a symbiotic relationship with the farming community, serving as a source of supplemental food, fuel, fodder, fruits, and fibers, while also contributing to environmental balance. The Jammu division spans altitudes ranging from 300 meters to 4200 meters above mean sea level (MSL) and is divided into three agro-climatic zones: sub-tropical, intermediate, and temperate. The sub-tropical zone covers areas between 300 meters and 1200 meters above MSL, including the entire Jammu and Samba districts, as well as parts of Kathua, Udhampur, Reasi, and Rajouri Districts. This land is conducive to the cultivation of guava, litchi, ber, mango, citrus, and various other minor fruits. The intermediate zone, characterized by low hills, lies at altitudes ranging from 1200 meters to 2000 meters and experiences harsh, cold winters with snowfall in higher elevations. This investigation aims to gather information on the existing traditional agroforestry systems and their components at different altitudes in the Reasi District of J & K, India.

Materials and Methods

The research was carried out in the Reasi district of Jammu and Kashmir, which covers an area of 1719 square kilometers and is located between 33°09' N and 74°84' E. This district has been categorized into three primary agro-climatic zones based on factors such as topography, altitude, and temperature conditions: The Temperate zone (altitude of 2000–2800 meters), Intermediate zone (altitude of 1200–2000 meters), and Sub-tropical zone (altitude of 300–1200

meters). The study focused on agricultural fields predominantly occupied by trees. In this investigation, three out of the twelve developmental blocks within the district were chosen to represent the three different altitudes. Specifically, six villages—Salal, Arnas, Mala, Kanjali, Bhabbar, and Mahore—were selected for the study. These villages are distributed across four developmental blocks: Reasi, Arnas, Katra, and Mahore. To ensure a comprehensive analysis, two villages were selected from each agro-climatic zone to gather data (as indicated in Tables 1). Field surveys were conducted in the Salal, Arnas, Mala, Kanjali, Bhabbar, and Mahore blocks in February 2022. During the surveys, valuable information such as village names, altitudes, existing agroforestry systems, tree species, and cultivated crops was recorded. Within each village, ten sample plots measuring 10×10 square meters were randomly designated for an in-depth examination in the field of agroforestry.

Table 1: Surveyed blocks/villages

Blocks	Altitudes, M		
	300–1200	1200–2000	2000–2800
Katra	Kanjali	-	-
Reasi	Bhabbar	-	-
Arnas	-	Arnas, Chinkah	-
Mahore	-	-	Mala, Mahore

Results and Discussion

Based on the field survey conducted in Reasi district, it was noted that the prevailing agroforestry systems comprise the following: agri-silviculture (involving the cultivation of trees alongside agricultural crops), agri-horticulture systems (which entail the planting of edible fruit trees alongside agricultural crops), and agri-horti-silviculture systems (combining the cultivation of fruit trees and forest trees with agricultural crops) as outlined in Table 2.

According to the data presented in Table 2, the distribution of forest trees, fruit trees, and crops in the area was approximately 41.86%, 30.23%, and 27.90%, respectively. The study area documented a total of 12 different crops, 13 species of fruit trees, and 18 species of forest trees.

In the lower Himalayan altitudes (ranging from 300 to 1200

meters), commonly found forest tree species included Tunu (*Toona ciliata*), Babul (*Acacia nilotica*), Dhaman (*Grewia optiva*), Kalal (*Bauhinia variegata*), Beri (*Ziziphus mauritiana*), Siri tree (*Albizia lebbbeck*), Taali (*Dalbergia sissoo*), Bamboo (*Dendrocalamus strictus*), Dhrenk (*Melia azedarach*), Toot (*Morus Alba*), and Lasinia (*Leucaena leucocephala*). In the mid Himalayan altitudes (ranging from 1200 to 2000 meters), commonly found forest tree species included Fagori (*Ficus palmata*), White willow (*Salix Alba*), Himalayan alder (*Alnus nepalensis*), Honeyberry (*Celtis australis*), Siri tree (*Albizia lebbbeck*), Dhaman (*Grewia optiva*), Kalal (*Bauhinia variegata*), Beri (*Ziziphus mauritiana*), Black locust (*Robinia pseudoacacia*), and Toot (*Morus Alba*). At higher Himalayan altitudes (ranging from 2000 to 2800 meters), species like Himalayan alder (*Alnus nepalensis*), Banj oak (*Quercus leucotrichophora*), White willow (*Salix Alba*), Black locust (*Robinia pseudoacacia*), and Himalayan elm (*Ulmus wallichiana*) were commonly encountered.

Regarding fruit trees, species such as Pear (*Pyrus pyrifolia*), Lemon (*Citrus limon*), Pomegranate (*Punica granatum*), Peach (*Prunus persica*), Orange (*Citrus sinensis*), Mango (*Mangifera indica*), and Loquat (*Eriobotrya japonica*) were prevalent in the lower Himalayan altitudes (300-1200 meters). In the mid Himalayan altitudes (1200-2000 meters), Mango (*Mangifera indica*), Orange (*Citrus sinensis*), Pomegranate (*Punica granatum*), Peach (*Prunus persica*), Pear (*Pyrus pyrifolia*), Loquat (*Eriobotrya japonica*), and Lemon (*Citrus limon*) were commonly grown. At high Himalayan altitudes (2000-2800 meters), species such as Plum (*Prunus domestica*), walnut (*Juglans regia*), apricot (*Prunus armeniaca*), and apple (*Malus pumila*) were frequently cultivated.

In terms of crops, common crops cultivated by farmers across various altitudinal ranges included Wheat (*Triticum aestivum*), Maize (*Zea mays*), Paddy (*Oryza sativa*), Mustard (*Brassica nigra*), Chickpea (*Cicer arietinum*), Black gram (*Vigna mungo*), Oat (*Avena sativa*), Bajra (*Pennisetum glaucum*), and Potato (*Solanum tuberosum*).

Zone-Sub tropical (300–1200 m)

Agri-silviculture, Agri-horticulture, Agri-silvi-horticulture

Table 2: Agroforestry systems and its components in Reasi district

Forest trees	Horticulture trees	Crops
Babul (<i>Acacia nilotica</i>), Toot (<i>Morus alba</i>), Siris tree (<i>Albizia lebbbeck</i>), Dhaman (<i>Grewia optiva</i>), Kardyar (<i>Bauhinia variegata</i>), Beri (<i>Ziziphus mauritiana</i>), Taali (<i>Dalbergia sissoo</i>), Bamboo (<i>Dendrocalamus strictus</i>), Dhrenk (<i>Melia azedarach</i>), Tunu (<i>Toona ciliata</i>), Lasinia (<i>Leucaena leucocephala</i>)	Jamun (<i>Syzygium cumini</i>), Pomegranate (<i>Punica granatum</i>), Lemon (<i>Citrus limon</i>), Peach (<i>Prunus persica</i>), Guava (<i>Psidium guajava</i>), Mango (<i>Mangifera indica</i>), Loquat (<i>Eriobotrya japonica</i>), Aonla (<i>Emblica officinalis</i>)	Black gram (<i>Vigna mungo</i>), Chickpea (<i>Cicer arietinum</i>), Paddy (<i>Oryza sativa</i>), Mustard (<i>Brassica nigra</i>), Wheat (<i>Triticum aestivum</i>), Maize (<i>Zea mays</i>), Horse gram (<i>Macrotyloma uniflorum</i>), Oat (<i>Avena sativa</i>), Bajra (<i>Pennisetum glaucum</i>), Potato (<i>Solanum tuberosum</i>)

Zone-Intermediate (1200-2000 m)

Agri-silviculture, Agri-horticulture, Agri-silvi-horticulture

Forest trees	Horticulture trees	Crops
White willow (<i>Salix alba</i>), Khirk (<i>Celtis australis</i>), Siris tree (<i>Albizia lebbbeck</i>), Dhaman (<i>Grewia optiva</i>), Kalal (<i>Bauhinia variegata</i>), Beri (<i>Ziziphus mauritiana</i>), Toot (<i>Morus alba</i>), Fagori (<i>Ficus palmata</i>), Black locust (<i>Robinia pseudoacacia</i>), Himalayan alder (<i>Alnus nepalensis</i>)	Peach (<i>Prunus persica</i>), Pear (<i>Pyrus pyrifolia</i>), Orange (<i>Citrus sinensis</i>), Mango (<i>Mangifera indica</i>), Lemon (<i>Citrus limon</i>), Loquat (<i>Eriobotrya japonica</i>), Pomegranate (<i>Punica granatum</i>),	Oat (<i>Avena sativa</i>), Wheat (<i>Triticum aestivum</i>), Bajra (<i>Pennisetum glaucum</i>), Maize (<i>Zea mays</i>), Mustard (<i>Brassica nigra</i>), Black gram (<i>Vigna mungo</i>), Horse gram (<i>Macrotyloma uniflorum</i>), Potato (<i>Solanum tuberosum</i>), Yams (<i>Dioscorea spp.</i>)

Zone-Temperate (2000-2800 m)

Agri-silviculture, Agri-horticulture, Agri-silvi-horticulture

Forest trees	Horticulture trees	Crops
Himalayan elm (<i>Ulmus wallichiana</i>), White willow (<i>Salix alba</i>), Black locust (<i>Robinia pseudo-acacia</i>), Himalayan alder (<i>Alnus nepalensis</i>), Banj oak (<i>Quercus leucotrichophora</i>)	Apple (<i>Malus pumila</i>), Walnut (<i>Juglans regia</i>), Apricot (<i>Prunus armeniaca</i>), Plum (<i>Prunus domestica</i>)	Oat (<i>Avena sativa</i>), Wheat (<i>Triticum aestivum</i>), Maize (<i>Zea mays</i>), Mustard (<i>Brassica nigra</i>), Potato (<i>Solanum tuberosum</i>)

Bijalwan (2013) [4], Dadhwal (1989) [5], Semwal and Maikhuri (1996) [7] and Toky *et al.* (1989) [9] in their study observed similar pattern in results in western Himalayan region.

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Conclusion

The diversity, composition, and structure of species in the Reasi district are influenced by its topography and climate zones. Additionally, the orientation of the terrain in hilly areas also has a significant impact on the types of plants and their composition. Research has revealed that agroforestry systems in this region mainly consist of versatile tree species and horticultural tree varieties. This study compiles a comprehensive list of these multipurpose and horticulture tree species, including crops, found in farmers' agricultural fields, which are situated at varying altitudes. Documenting these multipurpose trees and agroforestry practices could be valuable for introducing them into other regions within the same Himalayan agro-climatic zones.

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