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## An Overview of Tree Species Used for Agroforestry Practices in Nepal

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### ABSTRACT

Tree species are the main component of the agro-forestry system because they provide farmers with direct benefits and play a vital role in mitigating climate change, stabilizing slopes, and ecological balance. The list of tree species used in different agro-forestry practices shows 110 tree species belonging to 42 families. Tree species belonging to the family Moraceae are widely used in agro-forestry practices, followed by Liguminosae, Rosaceae, Rubiaceae, and so on. There are approximately 44 species of trees suitable for single use, such as forage, fruit, fuelwood, and timber production. Similarly, tree species with two functions are better than tree species with only one function. Approximately 40 trees have two functions: food and fuelwood, fruit and fuelwood, and wood and fuelwood. Among the 110 species used in agro-forestry practices in Nepal, 21 species have more than two functions and are the most suitable species for agro-forestry practices. The use of tree species in different agro-forestry practices shows that the number of trees used in Silvo-pastoral systems is the highest (30%), followed by Horto-agri-silviculture (23%). Approximately 21% of tree species are used in more than two agro-forestry systems. The minimum number of tree species used for Agri-silvi-pastoral and home gardens is 3% and 4% respectively.

### INTRODUCTION

Agro-forestry is a type of land use in which trees supply both products and services to the environment (Forestry et al., 2013). When trees grown on different farmlands in the same area are aggregated in agro-forestry systems, it might result in a better-wooded situation, hence improving environmental protection (Otegbeye, 2002). According to Kang (1993), trees have social and economic values in addition to direct agricultural benefits. From a social, economic, and ecological standpoint, the value of tree components derived by farmers from agro-forestry was assessed (Anderson and Sinclair, 1993). Agro-forestry's social and economic benefits can be measured in terms of production, stability, and long-term viability.

Rural Nepali farmers' livelihoods, and thus food security, are largely dependent on their ability to access tree resources, whether from their own land or from community forests. (Cedamon et al., 2018). Nepali farmers have a long history of planting trees on their land (Nuepane et al. 2002) and these traditional agro-forestry systems have been well described by Amatya and Newman (1993) among others. Typical Nepali agro-forestry relies largely on fodder trees for livestock and the manure and forest litter produced, which are used as bedding materials to maintain soil fertility (Garforth et al. 1999; Palikhe and Fujimoto 2010). Agro-forestry trees are the primary source of fodder (Amatya 1990; Pandey et al. 2009), accounting for up to 70% of dry matter intake for much of the year (Degen et al. 2010). Farmers grow maize, wheat, millet, and vegetable crops on their terraced, tree-bounded farms. These agro-forestry systems supply subsistence products as well as environmental services like soil stabilization and improvement (Pandit and Thapa 2004; Pandit et al. 2014; Nuepane and Thapa

2001; Gilmour and Nurse 1991; Malla 2000; Regmi and Garforth 2010; Nuepane et al. 2002; Pandit and Thapa 2004; Nuepane and Thapa 2001) and conservation of biological diversity (Acharya 2006).

Modern agro-forestry integrates technological knowledge along with multipurpose tree species to provide maximum benefits to farmers. However, in Nepal, traditional agro-forestry practices are the most common. Rather than planting seedlings of multipurpose tree species, farmers protect seedlings and saplings of naturally regenerated species. Tree species are primarily employed for the production of fodder, fuelwood, fruit, and timber. Farmers are still unaware of the multiple roles that tree species perform in the agro-forestry system. The main aim of this study is to compile a list of tree species, their applicability, and their use in various agro-forestry systems, as well as to offer policymakers with pertinent advice for encouraging the planting of these species. On the other hand, it directly assists farmers in the adoption of agro-forestry practices along with multipurpose tree species, as well as reaping the benefits of maximizing the value of a limited piece of land.

The objective of this report is to provide an overview of the tree species employed in Nepal's agro-forestry systems.

### METHODOLOGY

Secondary sources are employed to acquire information on tree species used in Nepalese agro-forestry practices. Published articles, relevant books, and online databases are all included in this source. About 15 agro-forestry related articles from 1984 to 2021AD retrieved from Research Gate, and the tree species referenced by various authors were compiled in an excel spreadsheet. The tree

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species are then classified according to their family, uses, and classification system. Excel was used to display the results in charts, tables, and a pie chart.

## RESULT AND DISCUSSION

### Tree species and their family

In Nepal, around 110 tree species from 42 different families are used in agro-forestry practices. The Moraceae family has the most tree species (16), followed by the Leguminosae family (8), Rosaceae and Rutaceae (6), and Anacardiaceae and Malvaceae (5) tree species in each

family, respectively. Each of the three tree families, Lauraceae, Euphorbiaceae, and Fagaceae, has four tree species. Similarly, the Sapindaceae, Verbenaceae, Meliaceae, Myrtaceae, and Combretaceae families each include three tree species, whereas the Rubiaceae, Caesalpiniaceae, Sapotaceae, Annonaceae, Lythraceae, Theaceae, Arecaceae, Apocynaceae, and Lamiaceae families each contain two tree species.

There are 19 different families within family others in the following chart, each with one tree species utilized for agro-forestry.

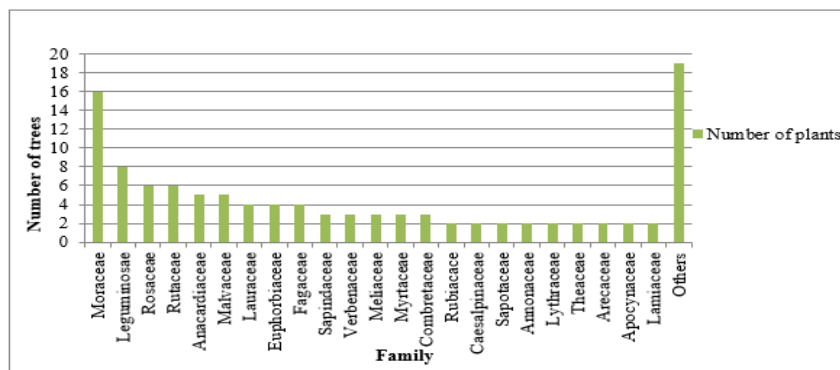


Figure 1: Family wise number of agro-forestry tree species

### Tree species having single use

Out of the 110 tree species cultivated in agro-forestry in Nepal, 44 species are particularly good for single

function. These 44 tree species are further divided into groups based on their intended usage. Only 22 species are used for fodder, 12 species for fruit, 6 species for fuel wood, and 4 species are used for timber.

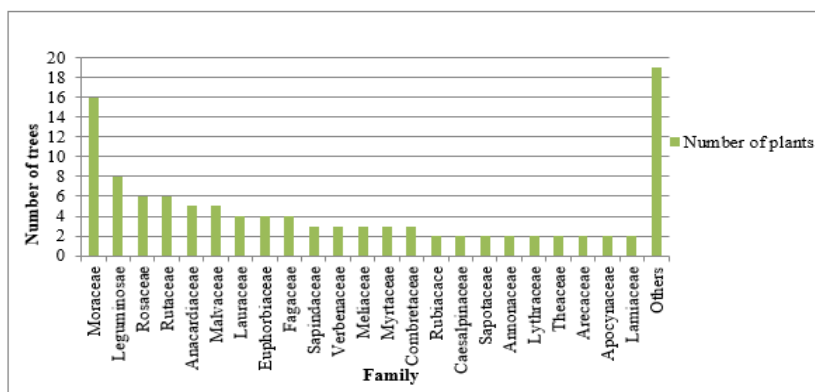


Figure 2: Agro-forestry tree species having single use

### Status of species having multiple (2) functions

18 species of trees are used for fodder and fuelwood, 13 species are used for fruit and fuelwood, and 9 species are

used for timber and fuelwood products, out of the total species used for agro-forestry practices in Nepal.

### Multipurpose agro-forestry tree species

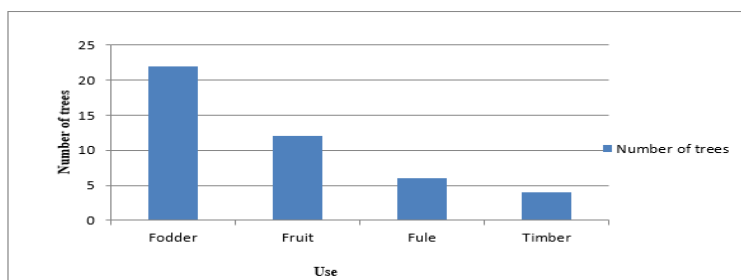


Figure 3: Agro-forestry tree species having two uses

Trees species having multiple applications are best for agro-forestry practices as they provide maximum benefits within same piece of land comparing the species having

single application. 21 tree species which are best for agro-forestry practices in Nepal are listed in following table1.

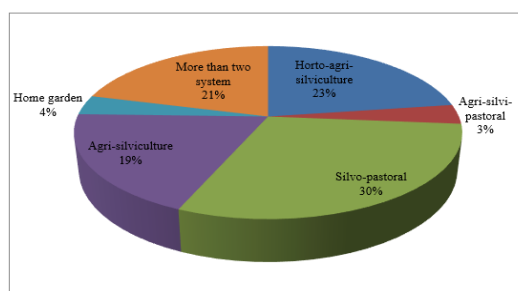
**Table 1:** Agro-forestry tree species having multiple uses

S.N	Local Name	Scientific Name	Family	Use
1	Badahar	Artocarpus lakoocha	Moraceae	Fodder, timber, Fruit, firewood
2	Dabdabe	Garuga pinnata	Burseraceae	Fodder, fuel (timber)
3	Bakaino	Melia azedarach	Meliaceae	Fodder, Timber, fruit
4	Sal	Shorea robusta	Dipterocarpaceae	Fodder, Timber, Firewood
5	Sisoo	Dalbergia sisoo	Liguminosae	Fodder, Timber, firewood
6	Aanp	Mangifera indica	Anacardiaceae	Fruit, Fuel, Timber
7	kadam	Anthocephalus chinensis	Rubiaceae	Timber, fuel, fodder
8	Gamari	Gmelina arborea	Verbenaceae	Timber, fuel, fodder
9	Seto siris	Albizia procera	Liguminosae	Timber, fuel, fodder
10	Karma	Adina cordifolia	Rubiaceae	Fodder, fuel, timber
11	Amala	Phyllanthus emblica	Euphorbiaceae	Fuel, fruit, Medicine
12	Harro	Terminalia chebula	Combretaceae	Fuel, fruit, Medicine
13	Baroo	Terminalia bellerica	Combretaceae	Fuel, fruit, Medicine
14	Uttis	Alnus nepalensis	Betulaceae	Timber, Fuelwood, Fodder
15	Musure Katus	castanopsis tribuloides	Fagaceae	Fuelwood, Fodder, Fruit
16	Chilaune	Schima wallichii	Theaceae	Timber, Fuelwood, Fodder
17	Paiyu	prunus cerasoides	Rosaceae	Timber, Fuelwood, Fodder
18	Mel	Pyrus pashia	Rosaceae	Fuel, timber, live fence
19	Vakkimilo	Rhus javanica	Anacardiaceae	Fodder, fuel, Medicine, Fruit
20	Khari	Celtis australis	Cannabaceae	Fodder, fuel, timber
21	Chiuri	Bassia butyracea	Sapotaceae	Fodder, fruit, fuel

#### Tree species and appropriate agro forestry system

Different tree species are the component of different agro-forestry systems. The choice of tree species depends upon objectives of farmers but in conventional agro-forestry practices, most of the farmers having lack of knowledge about species

identification to suit specific practices. In this review, maximum numbers of tree species (30%) are used for silvo-pastoral system followed by the horto-agri-silviculture system i.e. 23% and Agri-silviculture i.e.19%. Similarly, 4% and 3% tree species are used for Home garden and Agri-silvi-pastoral system.



**Figure 4:** Agro-forestry tree species having two uses

#### Tree species for agro-forestry practices

There are about 110 tree species of 42 families are used for agro-forestry practices in Nepal.

**Table 2:** Tree species used for agro-forestry practices, their family, uses, appropriate agro-forestry system and altitudinal range

SN	Local Name	Scientific Name	Family	Uses	Systems	Altitude(m)
1	Badahar	Artocarpus lakoocha	Moraceae	Fodder, timber, Fruit, firewood	Horti-agri-silvicultur, Agri-silviculture, Silvo-pastoral, Home garden	1300

2	Dabdabe	Garuga pinnata	Burseraceae	Fodder, fuel (timber)	Silvo-pastoral	1300
3	Ipil-Ipil	Leucaena leucocephala	Leguminosae	Fodder, Fuel,	Agri-silvi-pastoral, Silvo-pastoral	1500
4	Kabro	Ficus lacor	Moraceae	Fodder	Home garden	500
5	Khnyau	Ficus semicordata	Moraceae	Fodder, Fuel,	Agri-silviculture, Home garden, Silvo-pastoral	200-1700
6	Kimbu	Morus alba	Moraceae	Fodder, Fruit,	Horti-agri-silvicultural	2400
7	Koiralo	Bauhinia variegata	Caesalpiniaceae	Fodder, Fuel,	Home garden	1900
8	Kutmero	Litsea monopetala	Lauraceae	Fodder, Fuel,	Agri-silviculture, Agri-silvi pastoral	1500
9	Tanki	Bauhinia purpurea	Caesalpiniaceae	Fodder, Fuel,	Home garden	1600
10	Bakaino	Melia azedarach	Meliaceae	Fodder, Timber, fruit	Home garden, Agri-silviculture, Silvo-pastoral	700-1300
11	Sal	Shorea robusta	Dipterocarpaceae	Fodder, Timber, Firewood	Agri-silvi-pastoral	1000
12	Sisoo	Dalbergia sisoo	Liguminosae	Fodder, Timber, firewood	Horti-agri-silvicultural, Agri-silviculture	1500
13	Amba	Psidium guajava	Myrtaceae	Fruit	Horti-agri-silvicultural	500
14	Aanp	Mangifera indica	Anacardiaceae	Fruit, Fuel, Timber	Horti-agri-silvicultural	1200
15	Anar	Punica granatum	Punicaceae	Fruit, Fuel	Horti-agri-silvicultural	700-2300
16	Aaru	Prunus persica	Rosaceae	Fruit, Fuel	Horti-agri-silvicultural	1500-2680
17	Kagati	Citrus aurantifolia	Rutaceae	Fruit, Fuel	Horti-agri-silvicultural	800-1400
18	Litchi	Litchi chinensis	Sapindaceae	Fruit, Fuel	Horti-agri-silvicultural	800
19	Mewa	Carica papaya	Caricaceae	Fruit, Fuel	Horti-agri-silvicultural	1000
20	Naspati	Pyrus serotina	Rosaceae	Fruit, Fuel	Horti-agri-silvicultural	1800-2800
21	Nibuwa	Citrus limon	Rutaceae	Fruit, Fuel	Horti-agri-silvicultural	800-1400
22	Rukh katahar	Atrocarpus heterophyllus	Moraceae	Fruit, Fuel	Horti-agri-silvicultural	160-1528
23	Sapeta	Eucalyptus camaludensis	Myrtaceae	Timber	Horti-agri-silvicultural, Agri-silviculture	1500
24	Teak	Tectona grandis	Verbenaceae	Timber	Agri-silviculture, Silvo-pastoral	700
25	kadam	Anthocephalus chinensis	Rubiaceae	Timber, fuel, fodder	Silvo-pastoral	1000
26	Gamari	Gmelina arborea	Verbenaceae	Timber, fuel, fodder	Silvo-pastoral	1200
27	Kapok	Ceiba pentandra	Malvaceae	Timber, fuel,	Silvo-pastoral	1000
28	Seto siris	Albizia procera	Liguminosae	Timber, fuel, fodder	Silvo-pastoral, Agri-silviculture	1500
29	Neem	Azadirachta indica	Meliaceae	Timber, fuel	Silvo-pastoral	900



30	Ginderi	Premna integrifolia	Verbenaceae	Fodder, fuel	Silvo-pastoral	600-3500
31	Khaksi	Streblus asper	Moraceae	Fodder	Silvo-pastoral	500
32	Karma	Adina cordifolia	Rubiaceae	Fodder, fuel, timber	Silvo-pastoral	800
33	Jamun	Syzygium cumini	Myrtaceae	Timber , fuel	Silvo-pastoral	1600
34	Mahuwa	Madhuca indica	Sapotaceae	Timber , fuel	Silvo-pastoral	1200
35	Khyar	Acacia catechu	Liguminosae	Timber, fodder, fuel	Silvo-pastoral	1400
36	Gazuma	Guazuma ulmifolia	Malvaceae	Fodder, fuelwood	Silvo-pastoral	400-1200
37	Simal	Bombax ceiba	Malvaceae	Timber ,fodder	Agri-silviculture	1500
38	Amala	Phyllanthus emblica	Euphorbiaceae	Fuel, fruit, Medicine	Agri-silvi-pastoral	150-1400
39	Harro	Terminalia chebula	Combretaceae	Fuel, fruit, Medicine	Agri-silvi-pastoral	1100
40	Baroo	Terminalia bellerica	Combretaceae	Fuel,fruit, Medicine	Agri-silvi-pastoral	1100
41	Bhogate	Citrus grandis	Rutaceae	Fruit, fuel	Horti-agri-silvicultural	1340
42	Sitafal	Annona reticulata	Annonaceae	Fruit, fuel	Horti-agri-silvicultural	1500
43	Sarifa	Annona squamosa	Annonaceae	Fruit, fuel	Horti-agri-silvicultural	1500
44	Sajana	Moringa oleifera	Moringaceae	Fruit	Horti-agri-silvicultural	600
45	Bel	Aegle marmelos	Rutaceae	Fruit	Horti-agri-silvicultural	150-1400
46	Suntola	Citrus reticulata	Rutaceae	Fruit	Home garden	900-1200
47	Mausami	Citrus sinensis	Rutaceae	Fruit	Horti-agri-silvicultural	900
48	Aanar	Punica granatum	Lythraceae	Fruit	Horti-agri-silvicultural	700-2300
49	Aaruba-khada	Prunus domestica	Rosaceae	Fruit	Horti-agri-silvicultural	1000-2000
50	Syau	Malus pumila	Rosaceae	Fruit	Horti-agri-silvicultural	1500-2700
51	Imili	Tamarindus indica	Liguminosae	Fruit	Horti-agri-silvicultural	1500
52	Bayer	Ziziphus mauritiana	Rhemnaceae	Fruit	Horti-agri-silvicultural	1200
53	Uttis	Alnus nepalensis	Betulaceae	Timber, Fuelwood, Fodder	Agri-silviculture	500-2700
54	Musure Katus	Castanopsis tribuloides	Fagaceae	Fuelwood, Fodder, Fruit	Home garden, Agri-silviculture, Silvo-pastoral	450-2300
55	Bar	Ficus bengalensis	Moraceae	Fodder	Home garden, Agri-silviculture	600
56	Pakhuri	Ficus glaberrima	Moraceae	Fodder	Home garden, Agri-silviculture	750-1134
57	Dudhilo	Ficus nimoralis	Moraceae	Fodder	Home garden, Agri-silviculture	900-2200
58	Pipal	Ficus religiosa	Moraceae	Fodder	Home garden, Agri-silviculture	1520

59	Kapas	Gossypium herbaceum	Malvaceae	Fodder	Home garden, Agri-silviculture	1500
60	Botdhyaro	lagerstroemia parviflora	Lythraceae	Fodder	Silvo-pastoral	1200
61	Kaulo	Machilus odoratissima	Lauraceae	Fodder	Agri-silviculture, Silvo-pastoral	1000-2000
62	Salla	Pinus roxburghii	Pinaceae	Timber, Fuelwood	Silvo-pastoral	400-2000
63	Kharsu	Quercus semicarpifolia	Fagaceae	Fodder	Silvo-pastoral	1700-3800
64	Rittha	Sapindus mukorossi	Sapindaceae	Fodder	Silvo-pastoral	1000
65	Chilaune	Schima wallichii	Theaceae	Timber, Fuelwood, Fodder	Home garden, Silvo-pastoral	900-2000
66	Bedula	Ficus subincisa	Moraceae	Fodder	Agri-silviculture	300-1800
67	Paiyu	Prunus cerasoides	Rosaceae	Timber, Fuelwood, Fodder,	Agri-silviculture	1200-2400
68	Lapsi	Choerospondias axillaris	Anacardiaceae	Fruit	Horti-agri-silvicultural	850-1900
69	Vimsenpati	Buddleia asiatica	Scrophulariaceae	Fuelwood, Fodder	Agri-silviculture	350-2000
70	Timilo	Ficus auriculata	Moraceae	Fuelwood, Fodder	Agri-silviculture	250-1700
71	Thotne\ Khasreto	Ficus hispida	Moraceae	Fuelwood, Fodder	Agri-silviculture	450-1100
72	Asna	Terminalia tomentosa	Combretaceae	Fuelwood, Timber	Agri-silviculture	1400
73	Sindur	Bixa orellana	Bixaceae	Fodder, Fuelwood	Agri-silviculture	2000
74	Rato Tanki	Bauhinia longifolia	Fagaceae	Fodder, firewood	Horti-agri-silvicultural	1000
75	supari	Areca catechu	Arecaceae	Fruit	Horti-agri-silvicultural	1000
76	Chuletro	Brassiopsis hainla	Arecaceae	Fodder	Agri-silviculture	800-1800
77	Chhatiwan	Alstonia scholaris	Apocynaceae	Timber	Silvo-pastoral	1000
78	Bhalayo	Semecarpus anacardium	Anacardiaceae	Fuel	Silvo-pastoral	1000
79	Sindure	Mallotus philippinesis	Euphorbiaceae	Fodder	Silvo-pastoral	1500
80	Gedilo	Ficus clavata	Moraceae	Fodder	Agri-silviculture	750-1134
81	Vimal	Grewia optiva	Malvaceae	Fodder, fuel	Agri-silviculture	1800-2000
82	Bilauni	Maesa chisia	Primulaceae	Fodder, fuel	Silvo-pastoral	2130
83	Mel	Pyrus pashia	Rosaceae	Fuel, timber, live fence	Silvo-pastoral	1158-2000
84	Vakkimilo	Rhus javanica	Anacardiaceae	Fodder, fuel, Medicine, Fruit	Silvo-pastoral	500
85	Kathe kaulo	Machilus gamblei	Lauraceae	Fodder, fuel	Silvo-pastoral, Agri-silviculture	700-2400
86	Guren	Callicarpa arborea	Lamiaceae	Fodder, fuel	Silvo-pastoral	1300-1700

87	Tejpat	Cinnamomum tamala	Lauraceae	Spice, fuel	Silvo-pastoral	450-2200
88	Gayo	Bridelia retusa	Euphorbiaceae	Fuel, fodder	Silvo-pastoral	1000-1400
89	Lakuri	Fraxinus floribunda	Oleaceae	Fuel, timber	Silvo-pastoral	1500-2700
90	Kabirei	Nerium odoratum	Apocynaceae	Fuel, sacrificial value	Silvo-pastoral	1900
91	Khari	Celtis australis	Cannabaceae	Fodder, fuel, timber	Agri-silviculture	500-2500
92	Mandar	Erythrina variegata	Fagaceae	Fodder, fuel	Agri-silviculture	1500
93	Chiuri	Bassia butyracea	Sapotaceae	Fodder, fruit, fuel	Agri-silviculture, Horto-agri-silviculture	1000-2500
94	Kafal	Myrica esculenta	Myricaceae	Fruit, fuel	Silvo-pastoral	900-1500
95	Maleto	Macaranga pustulata	Euphorbiaceae	Fuel	Agri-silviculture	900-1800
96	Anyaar	Lyonia ovalifolia	Ericaceae	Fodder	Silvo-pastoral	1500-2200
97	Githhi	Boehmeria rugulosa	Urticaceae	Fodder	Agri-silviculture	1000-2000
98	Jhingaane	Eurya acuminata	Theaceae	Fuel	Silvo-pastoral	1500-2400
99	Bhasure	Leucoscepterum canum	Lamiaceae	Fuel, Fruit	Agri-silviculture, Horto-agri-silviculture	1000-2800
100	Cassod	Cassia siamea	Leguminosae	Fuel	Silvo-pastoral	1400
101	Champ	Michelia champaca	Magnoliaceae	Timber	Agri-silviculture	600-1500
102	Gogan	Saurauia napaulensis	Actinidiaceae	Fodder	Agri-silviculture	750-2100
103	Ban timila	Ficus sarmentosa	Moraceae	Fodder	Agri-silviculture	1400-2500
104	Sandan	Desmodium oojenense	Liguminosae	Fodder	Agri-silviculture	600-1220
105	Dumri	Ficus racemosa	Moraceae	Fodder	Agri-silviculture	300
106	Piyari	Bachanania latifolia	Anacardiaceae	Timber, Firewood	Silvo-pastoral	150-2000
107	Kusum	Schleichera oleosa	Sapindaceae	Timber, Firewood	Silvo-pastoral	900
108	Rato siris	Albizia julibrissin	Liguminosae	Fodder	Agri-silviculture, Silvo-pastoral	1500
109	Akhataruwa	Trichilia connaroides	Meliaceae	Fuel	Agri-silviculture, Silvo-pastoral	1000
110	Asare	Viburnum cordifolium	Adoxaceae	Fuel	Agri-silviculture, Silvo-pastoral	2700-3000

Sources: [(Kerkhoff, 2003), (Dhakal et al., 2012), (Magar et al., 2020), (Tamang et al., 2020), (Pandit et al., 2014), (Fonzen & Oberholzer, 1984), (Paudel et al., 2019), (Luang, 2006)(R. Sharma et al., 2007), (Cedamon et al., 2018), (Khadka et al., 2021), (S. Sharma, 2021), (Brook et al., 2012), (Chander 2015.Pdf, n.d.)]

## CONCLUSION

Agro-forestry relies heavily on trees since they bring various benefits to farmers. The tree species chosen in an agro-forestry system significantly impact the ultimate product. Farmers gain many benefits from planting multipurpose trees with agricultural crops, such as fuelwood, lumber, fruit, fodder, and so on. In addition

to direct benefits, these trees provide various indirect benefits. Agro-forestry practices use 110 tree species from 42 distinct families, however only 21 species provide more than two benefits and are the best for agro-forestry operations.

Trees have their own altitude ranges in which to grow. Farmers can use any of these species for various goods depending on the altitudinal content of the site.



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