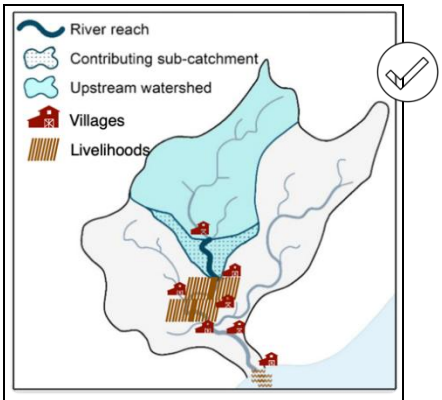
FAO/GCF Forest Landscape restoration (FLR) in Fiji – Investment models

As part of the FAO/GCF project, community landscape investment and management plans would be developed for priority watersheds and river basins selected using the Target Area Selection tool developed for the project. A set forestry-related investments would be implemented within each of these communities, which would be a mix of the following: (i) Upgrade and establishment of public and community nurseries; (ii) Sustainable Forest Management; (iii) Community mixed species forest restoration; (iv) Community supported high value conservation forests; (v) Natural regeneration and sustainable forest management of logged over forests; (vi) Restoration of degraded lands in former plantation areas; and (vii) Agroforestry investments.

This working paper provides details for each of these investments, including the description of the activities, the criteria for site identification, the species selection, the timeline of the activities, and the amount of workforce needed per 1ha of investment.

Common criteria for site identification



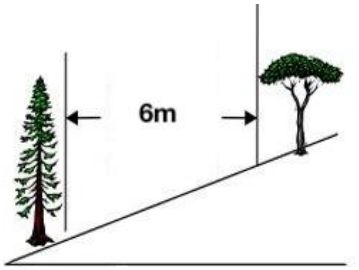
An upstream catchment that will support environmental services (slope stabilization, reduced runoff, water quality, etc.) to the communities involved and downstream. Priority will be given to sloping catchments providing multiple benefits to reefs, important assets, and community livelihoods.

Common techniques for tree planting

Nursery	Site	Planting	Care

When to plant: January to March, which are the summer months with most rainfall.

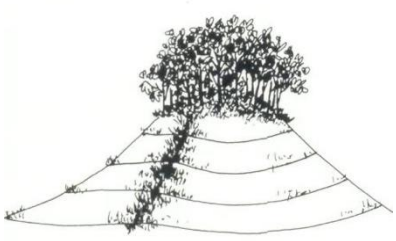
What tree density:
A lower-density plantation model, with a spacing of 6x6 meters, would be adopted to align with the current approach of the Ministry of Forestry. However, denser spacing (3x3m) is recommended for riparian reforestation.



This strategy is not only in line with established practices in Fiji but also offers the community flexibility in shaping the forest's future. A reference project by the Ministry of Forestry in Labasa in 2023 planted 23,000 trees on 67 ha of lands (or 343 trees per ha). Local consultation of forestry stakeholders revealed that tree density ranging from 280 to 350 is common practice in Fiji. In fact, by starting with a less dense layout, there is room for the community to introduce a variety of enhancements, such as the incorporation of additional native species, fruit trees, and shrubs, thereby tailoring the project to their evolving needs.

How to plant:
1. *Species selection and sourcing.*
Based on the identified sites, a set of species and where to source them would be identified to ensure better matching to the plantation areas. Across Fiji, community- and privately-owned nurseries already exist, and they can produce and average of 4,000 seedlings per year. Upgrade and establishment of new nurseries are planned to depend on the project needs.
(Please refer to the final page of this manual for the preliminary list of species.)

2. *Site preparation based on the spacing.* Activities include marking and digging where to plant the trees (mounds). For larger parcels or large-scale tree planting, additional techniques could be applied, such as line polling or marking of the direction to plant the trees along the contours; and line weeding or clearing of the weeds from the lines to allow for planting.



3. *Transport of seedlings.* Seedlings of adequate quality should be selected for planting. Special care must be provided to the seedlings during their transport depending on the distance between the nurseries and sites.

4. *Planting of the seedlings.* Good planting practices should be applied. In addition, labeling of the species should be added for record-keeping and monitoring.

5. *Maintenance.* Regular care, which consists mainly of hand weeding, should be conducted on the planting sites. In general, the timeline is every 3 months in the first year, 4 months in the second year, and 6 months in the third year. In addition, after the first year, survival assessment should be conducted to identify trees that need to be replanted.

7. *Monitoring.* Local communities and project staff would be involved in monitoring of the sites during the project implementation. Activities include mapping and georeferencing (GPS coordinates or boundary demarcation of the plots), tracking of the tree growths, etc.

Proposed timeline:

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Target area selection and development of landscape plans	X	X	X				
Nurseries development		X	X				
Site preparation, planting, and care			X	X	X	X	X
Monitoring			X	X	X	X	X

Common techniques for natural regeneration

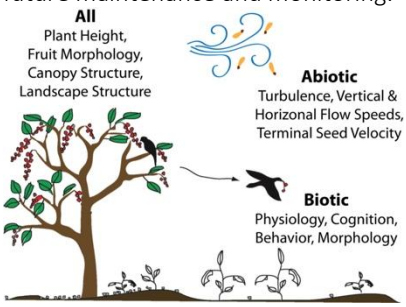
seed trees	promotion	care

When to start: January to March, which are the summer months with most rainfall.

How to:

1. *Identify seed trees*. This includes potential seed trees within or near the site. If necessary, introduce nearby native species by direct seeding or planting saplings.

2. *Promote seed trees.* Activities such as removal of invasive species – identified jointly with the department of Environment of the Prime Minister Office and IUCN and attraction of seed dispersers (for example, by creating a bird-friendly landscape with water and habitats) could be implemented to create favorable conditions for growth and seed dispersal. Seed trees should be marked with ribbon to facilitate future maintenance and monitoring.



3. *Maintenance.* Regular care, which consists mainly of weeding, should be conducted on the sites. In general, the timeline is every 3 months in the first year, 4 months in the second year, and 6 months in the third year.

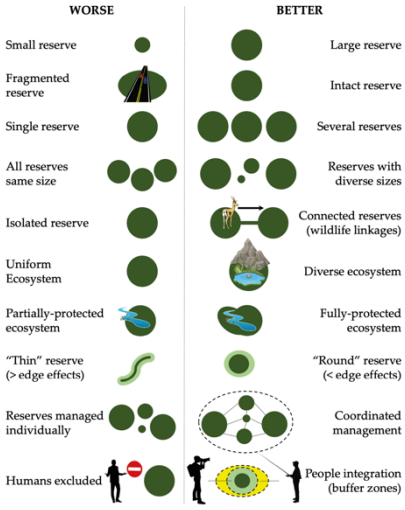
4. *Monitoring.* Local communities and project staff would be involved in monitoring of the sites during the project implementation. It consists mainly of mapping and georeferencing (GPS coordinates or boundary demarcation of the parcels) of the sites and tracking of the tree growths.

Proposed timeline:

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Target area selection and development of landscape plans	X	X	X				
Site identification, promotion of seed trees, and care		X	X	X	X	X	X
Monitoring		X	X	X	X	X	X

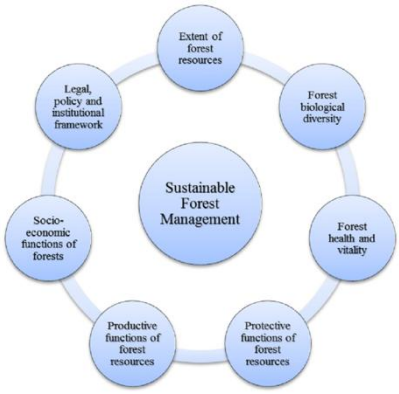
Common practices for forest conservation

The FAO/GCF project would support the establishment of high conservation value forests (HCVF). However, different management activities are available to the communities or government entities involved. These includes one or combination of the following: ecosystem restoration, wildlife protection, ecotourism, patrolling for infraction, research, etc. The figure below shows examples of best practices for a forest conservation activity with the aim to be inclusive, provide ecosystem services, and protect the biodiversity.



Common practices for sustainable forest management

The FAO/GCF project would also facilitate the establishment of Permanent Forest Estates (PFE), which is a cornerstone of Fiji's forestry management policy. PFE are established based on "forest functions", which would define the management options for the PFE, and stakeholder interest. Forest function categories include multiple use forests, protection forests, forest plantations, and mangroves.

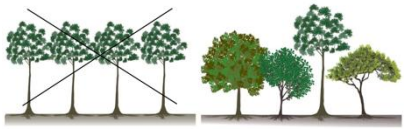


Specific details by investment

1. Community planting of mixed species

Description:
This activity consists of planting mixtures of tree species to establish plantations that provide multiple services to the communities in a high priority watershed. Mixed-species plantations have the potential to generate a variety of forest products, as well as a range of ecosystem services. They are often established using just two or three species[i,ii].

For the FLR project in Fiji, it is recommended to plant at least 3 native species and 1 fruit tree, with a 6m x 6m spacing.



The list of native and fruit trees suitable in Fiji are annexed to this document. Chosen species must be well-suited to the sites and known to provide non-timber value.

Target: 5,750 hectares

Specific site identification criteria:

✓	Non-forested.
✓	Not needed for agriculture or earmarked for any other development purposes.
✓	Community agreement and consent for planting of trees.

Requirements for 1 ha:

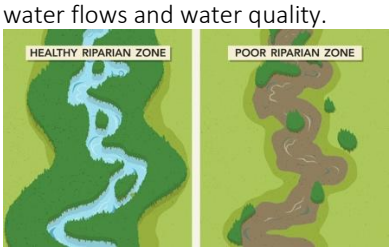
Resource requirements	Unit	Quantity
Nurseries development		
Establishment & maintenance	FJD (flat rate)	150
Mixed species plantation		
Seedlings	count	300
Site preparation	person-day	3
Planting	person-day	2
Care	person-day	9
Monitoring	person-day	5
Materials & Equipments	FJD (flat rate)	500

2. Community restoration of waterways and riparian zones

Description:

This activity consists of planting mixtures of tree species for the purpose of protecting waterways and riverbanks in a high priority watershed. This activity would work in synergy with the vetiver plantations promoted by the Ministry of Agriculture and Waterways. Vetiver could be added to the systems depending on the management plans and stakeholder interest.

For the FLR project in Fiji, it is recommended to plant at least 3 native species and 2 fruit trees, with a 3m x 3m spacing to allow interlocking for the roots. Denser systems will also help regulate the water flows and water quality.



The list of native and fruit trees suitable for riparian restoration are annexed to this document. Chosen species must be water tolerant species with strong root systems that can withstand flooding.

Target: 5,000 hectares

Specific site identification criteria:

✓	Highly degraded riverbanks, especially in agricultural areas (formal and informal settings).
✓	Community or Individual agreement and consent for planting of trees. Formal settings (agricultural leases) make decision independently, whereas Informal settings (by villages) make decisions as community

Buffer zone for riparian areas are 10 to 20 meters from the riverbanks. However, it is encouraged that the activity would promote agroforestry at the buffer zones within 500 meters.

Requirements for 1 ha:

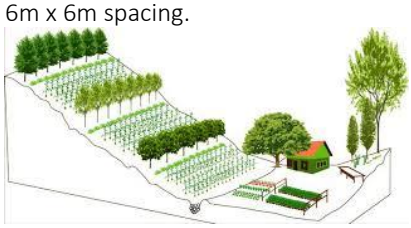
Resource requirements	Unit	Quantity
Nurseries development		
Establishment & maintenance	FJD (flat rate)	550
Restoration of riparian zones		
Seedlings	count	1,100
Site preparation	person-day	3
Planting	person-day	2
Care	person-day	9
Monitoring	person-day	5
Materials & Equipments	FJD (flat rate)	500

3. Agroforestry

Description:

This activity consists of an interplanting of trees in agricultural systems for sustainable livelihoods and environmental services. Agroforestry systems are multi-functional, and it is up to the farmers to decide on the management options[iii], such as production systems, woody perennials, sylvopasture, etc.

For the FLR project in Fiji, it is recommended to plant at least 3 native species and 1 fruit tree, with a 6m x 6m spacing.



The list of native and fruit trees suitable in Fiji are annexed to this document. Chosen species must be well-suited to the local conditions and can provide multiple benefits, such as food security, fodder, environmental services, nitrogen fixing, and economic returns.

Target: 7,000 hectares

Specific site identification criteria:

✓	Active agricultural areas.
✓	Community support for the agroforestry activities.
✓	Need and request from individual farmers.
✓	Sloping croplands (preferrable)

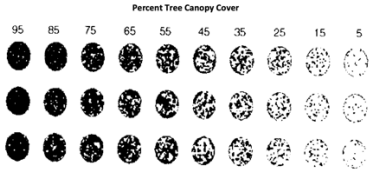
Requirements for 1 ha:

Resource requirements	Unit	Quantity
Nurseries development		
Establishment & maintenance	FJD (flat rate)	150
Agroforestry		
Seedlings	count	300
Site preparation	person-day	3
Planting	person-day	2
Care	person-day	9
Monitoring	person-day	5
Materials & Equipments	FJD (flat rate)	500

4. Natural regeneration of degraded forests

Description:

This activity consists of natural regeneration of native species in areas where forests have *partially* disappeared. It will be implemented by the benefitting communities.



The activity depend on the existence of seed trees and no nursery establishment is necessary. When identifying the seed trees, any native species with height greater than 40 cm found within the sites can be candidates. For areas with several candidates, the most dominant trees should be chosen.

The necessary activities to support the growth of the seed trees are explained in detail above.

Target: 5,000 hectares

Specific site identification criteria:

✓	Degraded forest areas where tree cover have been heavily reduced but still have canopy cover greater than 10%.
✓	Not needed for agriculture or earmarked

	for any other development purposes.
✓	Community agreement and consent for planting of trees.

Requirements for 1 ha:

Resource requirements	Unit	Quantity
Nurseries development		
Establishment & maintenance	n/a	n/a
Natural regeneration of degraded forests		
Seedlings	n/a	n/a
Site preparation	person-day	3
Planting	n/a	n/a
Care	person-day	9
Monitoring	person-day	5
Materials & Equipments	FJD (flat rate)	500

5. Natural regeneration of over logged primary forests

Description:
This activity should be similar to "**4. Natural regeneration of degraded forests**". However, it would be implemented by the private entities.

Target: 6,000 hectares

Specific site identification criteria:

✓	Degraded forest areas where tree cover have been heavily reduced but still have canopy cover greater than 10%.
✓	Not needed for agriculture or earmarked for any other development purposes.
✓	Consent from the private companies.

Requirements for 1 ha:

Resource requirements	Unit	Quantity
Nurseries development		
Establishment & maintenance	n/a	n/a
Natural regeneration of overlogged plantations		
Seedlings	n/a	n/a
Site preparation	person-day	3
Planting	n/a	n/a
Care	person-day	9
Monitoring	person-day	5
Materials & Equipments	FJD (flat rate)	500

6. Reforestation of over logged plantations

Description:
This activity should be similar to "**1. Community planting of mixed species**". However, it would be implemented by the private entities.

When choosing species, it is recommended to identify native dominant species that has been growing in the area before plantation and deforestation.

Target: 500 hectares

Specific site identification criteria:

✓	Deforested former plantation areas.
✓	Demonstrated urgent needs for more stable tree cover (next to waterways, downstream sedimentation, etc.).
✓	Needs and requests from the private entities.

Requirements for 1 ha:

Resource requirements	Unit	Quantity
Nurseries development		
Establishment & maintenance	FJD (flat rate)	150
Reforestation of over-logged plantations		
Seedlings	count	300
Site preparation	person-day	3
Planting	person-day	2
Care	person-day	9
Monitoring	person-day	5
Materials & Equipments	FJD (flat rate)	500

7. Restoration of left-aside degraded lands

Description:
This activity should be similar to "**1. Community planting of mixed species**". However, it would be implemented by the private entities.

When choosing species, it is recommended to identify native dominant species that has been growing in the area before plantation and deforestation.

In addition, because of probable poor soil quality, it is recommended to apply a 3m x 3m spacing to ensure higher survival rates. Thinning can be conducted later once the trees have grown.

Target: 4,312 hectares

Specific site identification criteria:

✓	Degraded former plantation areas.
✓	Demonstrated urgent needs for more stable tree cover (next to waterways, downstream sedimentation, etc.).
✓	Needs and requests from the private entities.

Requirements for 1 ha:

Resource requirements	Unit	Quantity
Nurseries development		
Establishment & maintenance	FJD (flat rate)	550
Reforestation of left-aside degraded lands		
Seedlings	count	1,100
Site preparation	person-day	3
Planting	person-day	2
Care	person-day	9
Monitoring	person-day	5
Materials & Equipments	FJD (flat rate)	500

8. Establishment of high conservation value forests

Description:
This activity consists of the identification and establishment of new protected areas based on the revised policies as part of the project. Once the protected areas are created the communities will contribute to its management and conservation.

There are 3 key activities that will support the protection status of the forests, namely: (i) Community awareness and training, (ii) Ecological monitoring by the community (Example manual[iv]), and (iii) Ongoing awareness and sensibilization

Target: 12,000 hectares

Specific site identification criteria:

✓	Forest areas with demonstrated conservation value or among the list identified in the Protected Area Committee (PAC).
✓	Available documentations on the rationale for establishing the protected areas.
✓	Draft management plans with community consultations.
✓	Establishment of compensation framework with community consultation.

Requirements for 1 ha:

Resource requirements	Unit	Quantity
Nurseries development		
Establishment & maintenance	n/a	n/a
Management of high conservation value forests		
Seedlings	n/a	n/a
Site preparation	n/a	n/a
Planting	n/a	n/a
Care	n/a	n/a
Monitoring	person-day	5
Materials & Equipments	n/a	n/a

9. Establishment of permanent forest estates

Description:

This activity consists of the identification and establishment of permanent forest estates based on National Forest Inventory and the revised policies as part of the project. Once the estates are recognized the stakeholders involved would decide on the management options.

As explained above, there are 04 forest function categories available: multiple use forests, protection forests, forest plantations, and mangroves. The project scenarios for activity 9 is the establishment of multiple use forests and plantation forests where sustainable timber harvesting can be expected.

Target: 10,000 hectares

Specific site identification criteria:

- Forest areas with identified forest functions in line with National Forest Inventory.
- Stakeholder requests.
- Draft management plans with stakeholder consultations.

List of Species Recommended for the FAO/GCF FLR in Fiji

Recommended Species list for each Activity models

NF	Nitrogen Fixing	**FO**	Fodder	**TM**	Timber	**HP**	Host Plant
EO	Essential Oil	**FR**	Fruit	**CB**	Carbon	**I**	Introduced
D	Medicinal	**BD**	Biodiversity	**CR**	n	**L**	Local

Recommended trees for agroforestry systems (Crops)

#	Common Name	Local Name	Scientific Name	I/L	Max ht	Habit	Value	Yrs to fruiting/ maturity	Suitable Soiltype	Spacing
1	Orange	Moli batiri	Citrus sinensis	I	8 m	Small tree	FR, HP	2 yrs	sandy loam	9m X 9m
2	Mandrin	Moli madirini	Citrus reticulate	I	8 m	Small tree	FR, HP	2 yrs	sandy loam	6m x 6m
3	Lemon	Moli lime	Citrus limon	I	8 m	Small tree	FR, HP	2 yrs	sandy loam	6m x 6m
4	Kumquat	Moli kamkot	*Citrus japonica*	I	8 m	Small tree	FR, HP	*2 Yrs*	sandy loam	6m x 6m
5	Guava	Quwawa	*Psidium guajava*	I	*3-10m*	Small tree	FR	*3 yrs*	Variety, sandy, loam, rocky	4m x 4m
6	Avocado Pear	Pea	Persia amiricana	I	5-10m	Small tree	FR	3 yrs	Rich, well drained, slight acidic	9m X 9m
7	Soursop	Seremaia	Anona muricata	I	3-10m	Small tree	FR	3 yrs	Deep and Rich Loam	5m x 5m
8	Breadfruit	Uto	Artocarpus alitis	I	26m	Large Tree	FR	7 yrs	Deep fertile, well drained	9m x 9m
9	Malay Rose Apple	Kavika	*Syzygium malacense*	L	*5-20m*	*Medium-Large*	FR	*4 yrs*	Rich and Free draining	9m x 9m
10	Noni	Kura	Morinda citrifolia	L	9m	Medium tree	FR, MD, HP	1 yr	Rocky soil	4m x 4m
11	Gliricidia	Bainicagi	Gliricidia sepium	I	3-10m	Large Shrup	NF, FO, HP	2 yrs	Wide range, degraded	4m x 4m
12	Calliandra	Kaliadra	Calliandra haematocephala	I	3-10m	Large shrub	NF, FO, HP	2 yrs	Wide range, degraded	4m x 4m
13	Candlenut	Sikeci	aleurites moluccanus	L	10-15m	Medium Tree	NF, EO, HP	2 yrs	Wide range, degraded	4m x 4m

Recommended trees for agroforestry systems (Livestock)

#	Common Name	Local Name	Scientific Name	I/L	Max ht	Habit	Value	Yrs to fruiting/ maturity	Suitable Soiltype	Spacing
1	Mango	Maqo	*Mangifera indica*	I	*10m*	*Med-Large Tree*	FR, CB	*3 yrs*	variety, alluvial, sandy, loam	9m x 9m
2	Tamarind	Tamarini	*Tamarindus indica*	I	*20m*	*Med-Large Tree*	FR, NF	*8 yrs*	moist, fertile, sandy	9m x 9m
3	Dragon Plum	Tarawau	*Dracontomelon vitiense*	L	*20m*	*Med-Large Tree*	FR, MD, TM	*5 yrs*	well drained, sandy, poor, rocky	9m x 9m
4	Golden Apple	Wi	Spondias dulsia	L	15m	Medium Tree	FR, MD	4 yrs	Light sandy, loamy, heavy clay	9m x 9m
5	Island lychee	Dawa	Pommetia pinnata	L	40m	Large tree	FR, MD, TM	3 yrs	well drained, fertile, loam, clay	9m x 9m
6	Tiger's claw	Drala	Erythrina variagata	L	25m	Med-large Tree	NF, MD	2 yrs	sandy loam, water logged	4m x 4m
7	Ylang-Ylang	Makosoi	Cananga odorata	L	25m	Med-large Tree	EO, MD	3 yrs	Fertile sandy loam, moist	10m x 10m
8	Beach Almond	Tavola	Terminalia cattapa	L	30m	Med-large Tree	FR, MD, CR	3 yrs	variety, coastal, well drained	10m x 10m
9	Cut-nut	Vutu	Barrintonia edulis	L	25m	Med-large Tree	FR, MD, CR	4 yrs	light sandy, med loam, Clay	9m x 4m
10	Tahitian chestnut	Ivi	Innocarpus fagifer	L	20 m	Med-large Tree	Fruit tree	8 yrs	Variety, water logged, degraded	10m x 10m
11	Gliricidia	Bainicagi	Gliricidia sepium	I	10m	Large Shrup	NF, FO, HP	2 yrs	Wide range, degraded	4m x 4m
12	Calliandra	Kaliadra	Calliandra haematocephala	I	10m	Large shrub	NF, FO, HP	2 years	Wide range, degraded	4m x 4m
13	Candlenut	Sikeci	aleurites moluccanus	L	115m	Medium Tree	NF, EO, HP	2 years	Wide range, degraded	4m x 4m

Recommended trees for Reforestation

#	Common Name	Local Name	Scientific Name	I/L	Max ht	Habit	Value	Yrs to fruiting/ maturity	Suitable Soiltype	Spacing
1		Dilo	*Calophyllum inophyllum*	L	30m	Large tree	EO, MD, TM	30	Variety, Coastal, sandy, well drained	9 m x 4m
2		Amunu	*Dacrycarpus imbricatus*	L	30m	medium -Large	BD, CB, TM	40	Fertile, moist, sandy soils	9m x 4m
3		Dakua Salusalu	*Decusssocarpus vitiensis*	L	35m	medium -Large	BD, CB, TM	60	Fertile, well drained, sloping	9m x 4m
4		Damanu	*Calophyllum vitiense*	L	40m	Large tree	BD, CB, TM	50	Fertile, well drained, sloping	9m x 4m
5		Kaudamu	*Myristica castaneifolia*	L	40m	Large tree	BD, CB, TM	50	Silty clay, gravely loam	9m x 4m
6	White Wood	Kauvula	Endospermum macrophyllum	L	40m	Large tree	BD, CB, TM	40	Fertile, well drained, sloping	9m x 4m
7		Kaunicina	*Canarium vitiense*	L	30m	medium -Large	BD, CB, TM	40	Fertile, well drained, sloping	9m x 4m
8		Koka	*Bischofia javanica*	L	30m	medium -Large	BD, CB, TM	30	Silty Clay, loam	9m x 4m
9		Kuasi	*Podocarpus neriifolius*	L	30m	medium -Large	BD, CB, TM	50	Fertile, well drained, sloping	9m x 4m
10		Marasa	*Storckiella vitiensis*	L	30m	medium -Large	BD, CB, TM	30	Fertile, well drained, sloping	9m x 4m
11		Qumu	*Acacia richii*	L	25m	Medium tree	NF, BD, CB, TM	40	poor degraded soils	9m x 4m
12		Sasawira	*Dysoxylum richii*	L	35m	Large tree	BD, CB, TM	30	Silty clay, gravely loam	9m x 4m
13		Dogo	*Bruigeria gymnorhiza*	L	25m	Medium tree	BD, CB, TM	50	Coastal, river delta, waterlogged	9m x 4m

Recommended trees for Aforestation

#	Common Name	Local Name	Scientific Name	I/L	Max ht	Habit	Value	Yrs to fruiting/ maturity	Suitable Soiltype	Spacing
1		Vaivai	*Albizia saman*	I	25m	Medium tree	EO, MD, TM	30	Light, medium and heavy soil	9 m x 4m
2		Vaturakaraka	*Barringtonia racemosa*	L	25m	Medium tree	BD, CB, TM	50	Silty c;ay ;oam	9m x 4m
3		Velau	*Gymnostoma vitiense*	L	30m	medium -Large	BD, CB, TM	40	Silty c;ay ;oam	9m x 4m
4		Vesi	*Intsia bijuga*	L	40m	Large tree	BD, CB, TM	100	Variety, Saline, coastal	9m x 4m
5		Wikau	*Spondias dulcis*	L	30m	medium -Large	BD, CB, TM	30	Deep well drained, loamy, clay	9m x 4m
6		Ashoka	*Saraca asoca*	I	30m	medium -Large	BD, CB, TM	20	Deep well drained, loamy, clay	9m x 4m
7		Mahogany	*Swietenia macrophylla*	I	40m	Large tree	BD, CB, TM	35	Deep fertile, moist, well drained	9m x 4m
8		Teak	*Melaleuca alternifolia*	I	30m	medium -Large	BD, CB, TM	25	Alluvial, moist	9m x 4m
9		Pine	Pinus caribaea	I	30m	medium -Large	BD, CB, TM	20	Variety, loam, sandy loam, poor	3m x 3 m
10		Sandalwood	*Santalum yasi*	I	20m	small - meduim	BD, CB, TM	20	Sanhy loam, clay, sandy gravel	4m x 4m
11		Eucalyptus		I	30m	medium -Large	BD, CB, TM	30	Deep well drained, loamy, clay	9m x 4m
12		Cadamba		I	25m	Medium tree	BD, CB, TM	20	Deep well drained, loamy, clay	9m x 4m
13		Sekoula	*Delonix regia*	I	20m	small - meduim	BD, CB, TM	20	Deep well drained, loamy, clay	9m x 4m

References

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