“Seed Trees Method”

System of Silviculture for Harvesting and Managing Mangrove Forest in Indonesia

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Outline

1. Introduction;
2. General philosophy of Seed trees method;
3. Practices of seed trees method at Bintuni bay;
4. Statue of mangrove logged over area, mainly seed trees, and natural regeneration of seedling and sapling;
5. Closing remarks

1. Introduction

Mangrove Forest Resources

Functions:
- **Ecology and Ecosystem;**
- **Conservation;**
- **Buffer zone;**
- **Nesting for marine organism;**
- **etc**

Local community development for better life and bright future

Utilizations:
- **Daily income;**
- **Construction material;**
- **Food and nutrients;**
- **So on**

Professional and commercialized utilization
(Harvesting mangrove forest)

The terms "Harvesting" implies the cutting of some products that can be used to supply the needs of people*, Wackermen (1949)*




2. GENERAL PHILOSOPHY OF SEED TREES METHOD

Silvicultural operation

Wackermen (1949): Cutting operation in young unmerchantable stands or trees that does not yield usable timber products of merchantable value in excess of the cost of cutting are not harvesting operation or *non commercialized silvicultural operation*

Cutting operation for producing valuable and merchantable products is *commercialized silvicultural operation*

Mangrove forest resources

Seed trees method

(Sistim pohon induk)

3.1. Mangrove silvicultural system *(Seed trees method*

(SK Dirjen Kehutanan No. 60/Kpts/DJ/I/1978)

General philosophy of the Seed trees methods are explained as follow:

- Cutting cycle is for 30 years;
- There are seed trees population of 40 per ha, with healthy, having Φ 20 cm up, representative (good and ideal) shape/crown,commercial species, and well distributed an over areas;
- Trees with Φ 10 cm up prior for cutting;
- Green belt zones are 50 m from coastal area and 10 m from river side;
- Timber cruising intensity is 5%;
- Maximum area for log stacking is 1% of total working area;
- Thinning is conducted after 15-25 years after cutting.
- Mangrove forest has seedling population minimum of
- 2500 per hectare, and distributed across areas.

3. PRACTICES OF SEED TREES METHOD AT BINTUNI BAY

BUMWI`s Seed Trees method

A. PLANNING **Scale (1 : 100.000)**

1. Mapping cutting unit area	Et-3
2. Forest inventory	Et-2
3. Labeling and numbering the seed trees	Et-1
4. Marking coastal and river buffer zone, protected areas	Et-1
5. Forest Engineering	Et-1

B CUTTING **Et**

C. RE-FORESTATIONAND REHABILITATION

1. Logged over area inventory	Et+2
2. Nursering	Et+3
3. Enrichment planting	Et+4
4. Rehabilitation	
4.1. Rehabilitation I	Et+3
4.2. Rehabilitation II	Et+4
4.3. Rehabilitation III	Et+5
Prunning	Et+5- 20

Marking cutting block

3.1. Timber cruising

- systematic strip sampling *(5 % of Sampling Intensity)*
- 2 m x 2 m for Seedling *(sampling plot unit/SPU)*
- 5 m x 5 m for sapling *(SPU)*
- 10 m x 1000 m for trees *(Continuous strip sampling)*

- ✓ Seedling is less than 5 m high,
- ✓ Sapling more than 5 m high with diameter (Φ) of less than 10 cm at DBH,
- ✓ Trees are more than 5 m high with Φ 10 cm up

Forest engineering

Protected area

- 50 m from river side;
- 200 m from coastal side

Labeling and seed trees

Selection:
- 40 trees/ha;
- Distance : 17 m, or crown radius of 8.5 m;
- Healthy and balance crown
- Commercial species,
- Diameter 20 cm up;

3.2. Haversting

Cutting down the trees

Bucking

Debarking

debarker

Log stacking

Skiddir

Skidding track contruction

3.3. Transporting to the industry

Loading

Transport

Unloading

Processing

3.4. Reforestation and Rehabilitation

Nursering

4. STATUE OF MANGROVE FOREST LOGGED OVER AREA

4.1. State of seed trees at logged over area (LOA)

State of seed trees at LOA after 2 year cutting (Et+2) has been investigated by Ukru (2003). Cutting unit area (CUA) for 2001 is 19. 5 CUA were selected, or 15% intensity.

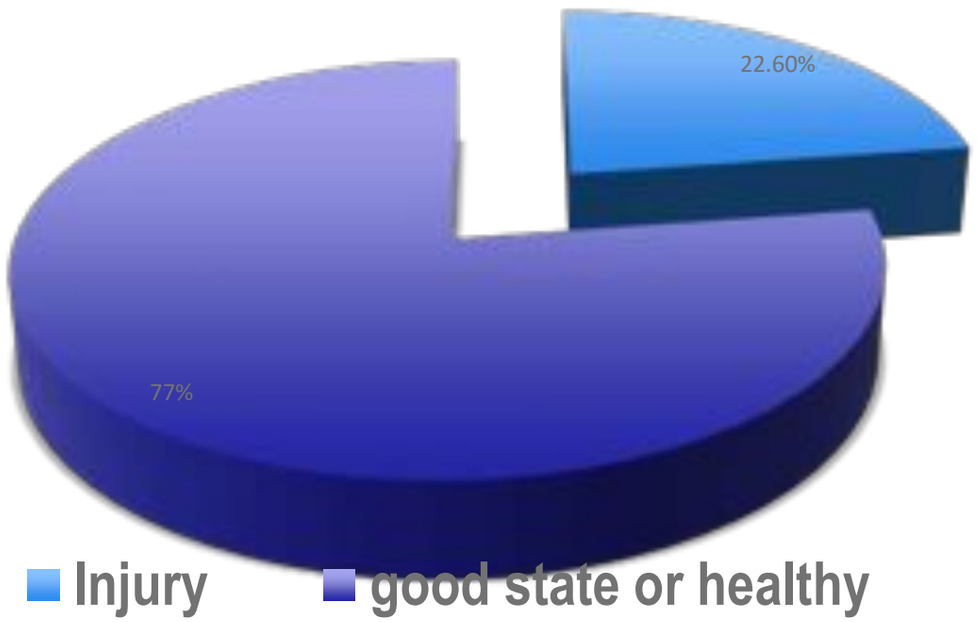
It was summarised that:

- - an average number/population of seed **trees are 99 per ha;**
- - there were two CUA with more than 100 per ha, **168 and 112 per ha**;
- - four commercial species of mangrove were recorded, namely *Rhizophora apiculata, Bruguiera gymnorrhiza, B. parviflora*, and *Ceriop tagal;*

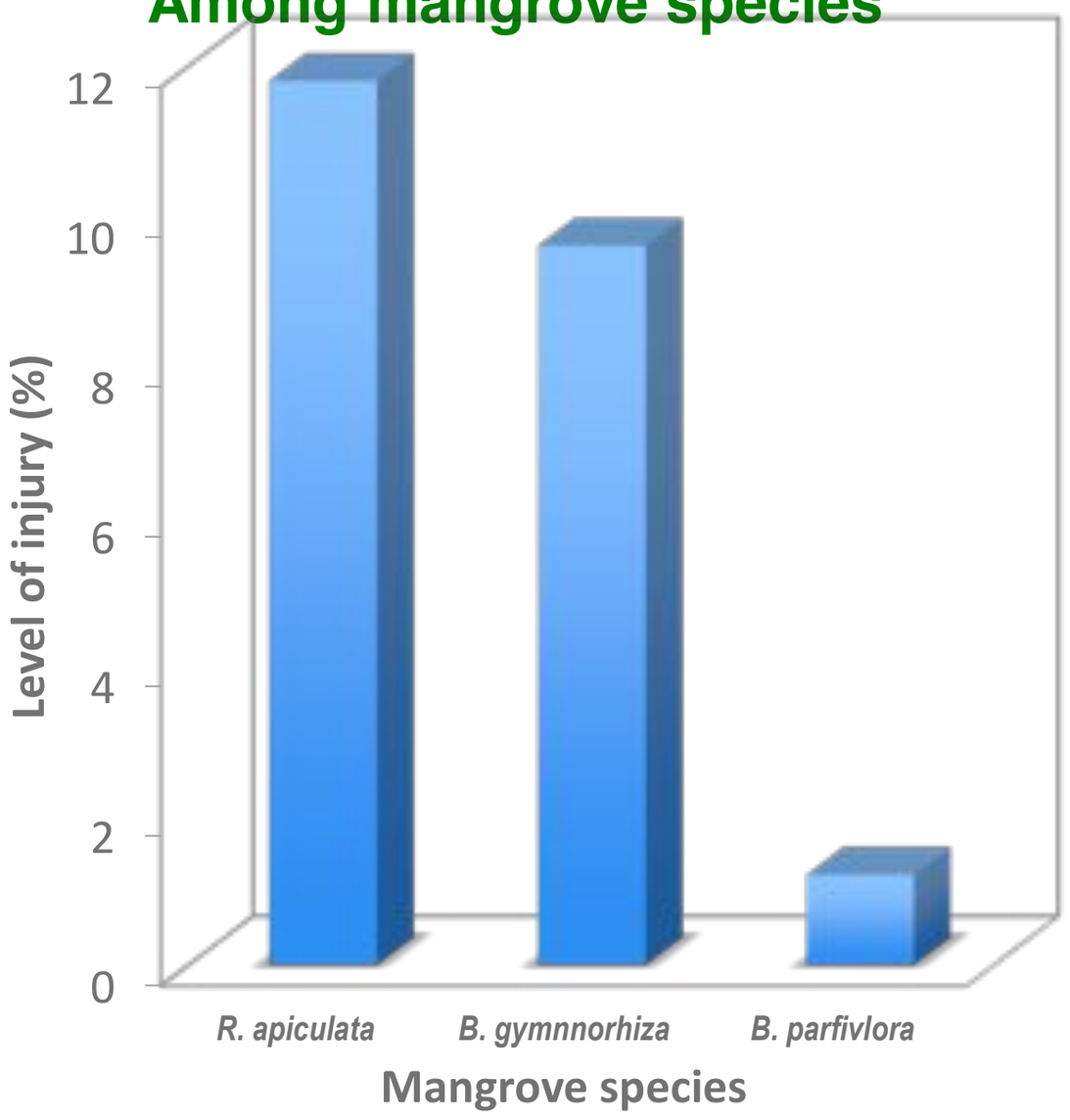
The number or population of seed trees are exceed, or double to that of recommended of 40 per ha

Health state of seed trees

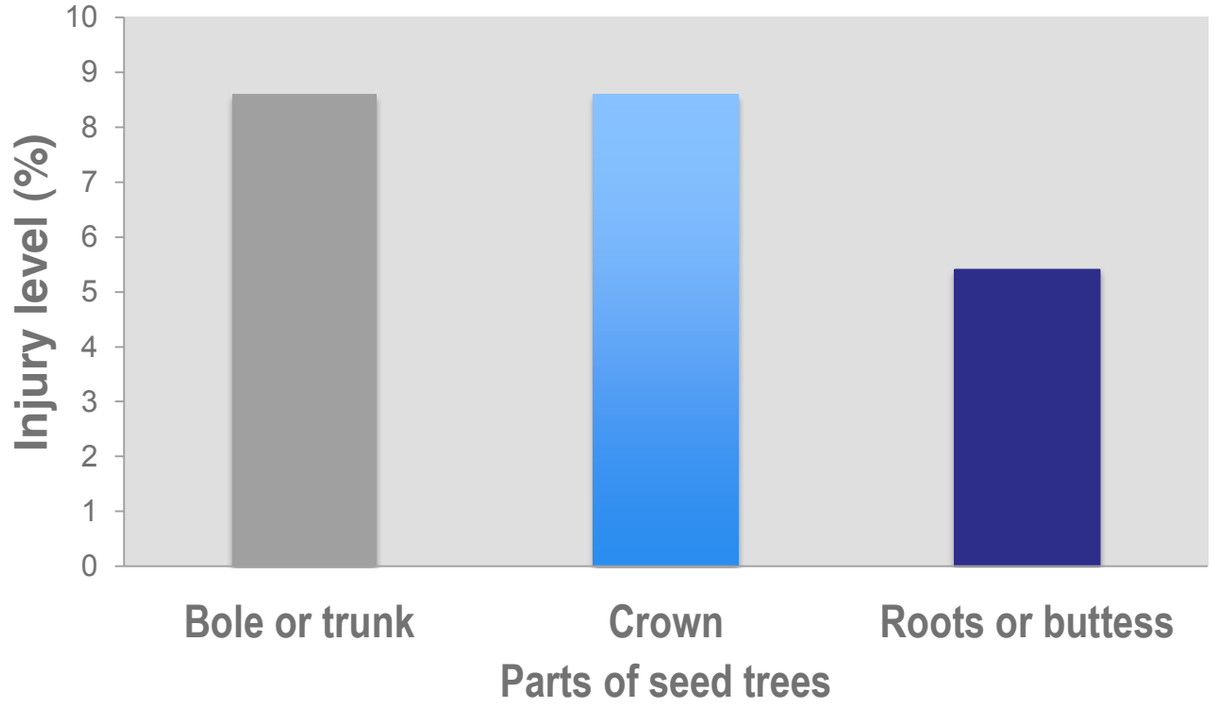
Majority is good state or healthy



Among mangrove species



Part of seed trees

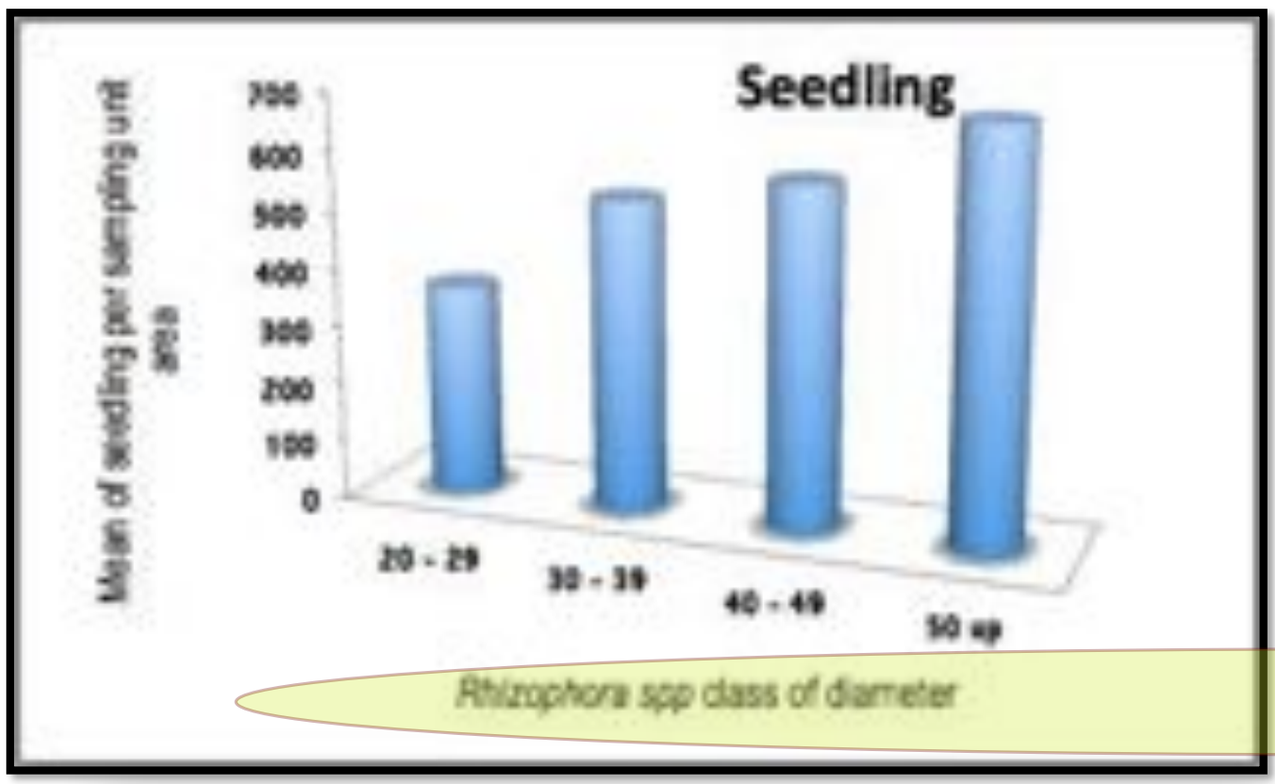


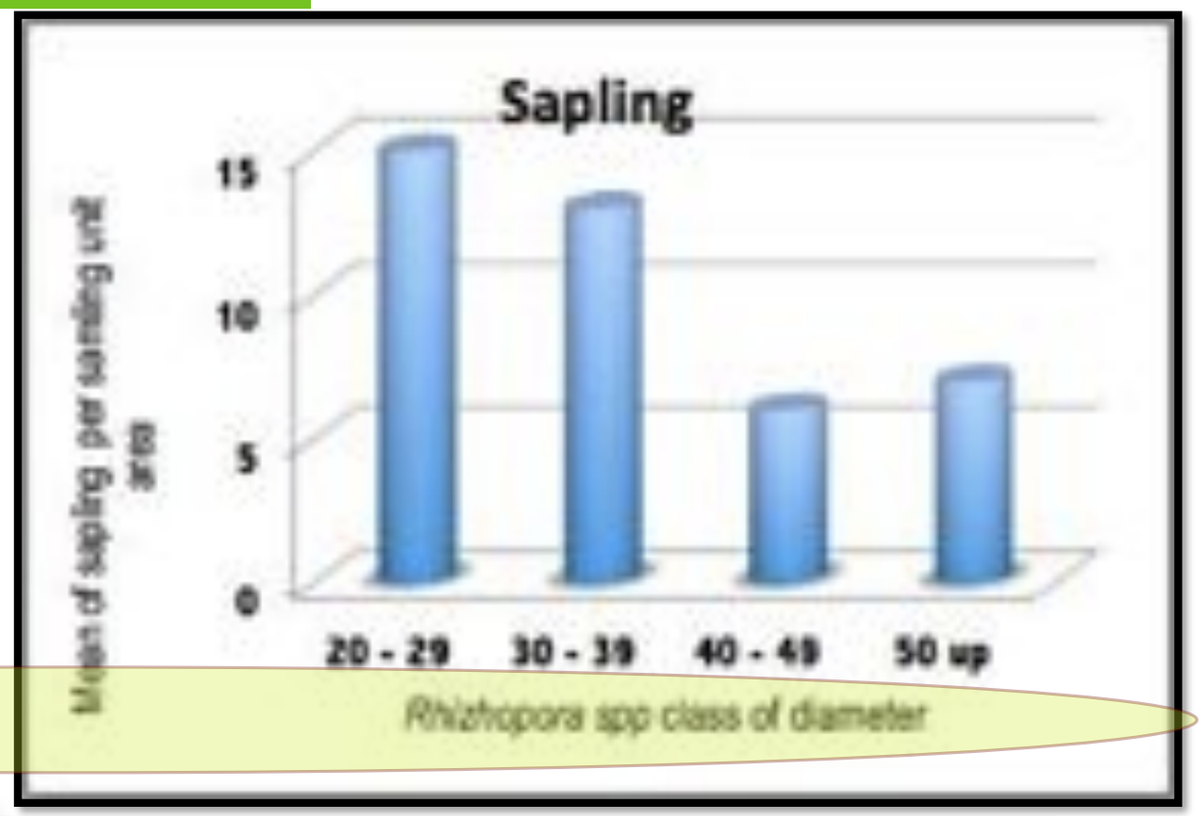
4.2 Natural regeneration under seed trees after 2 year cutting

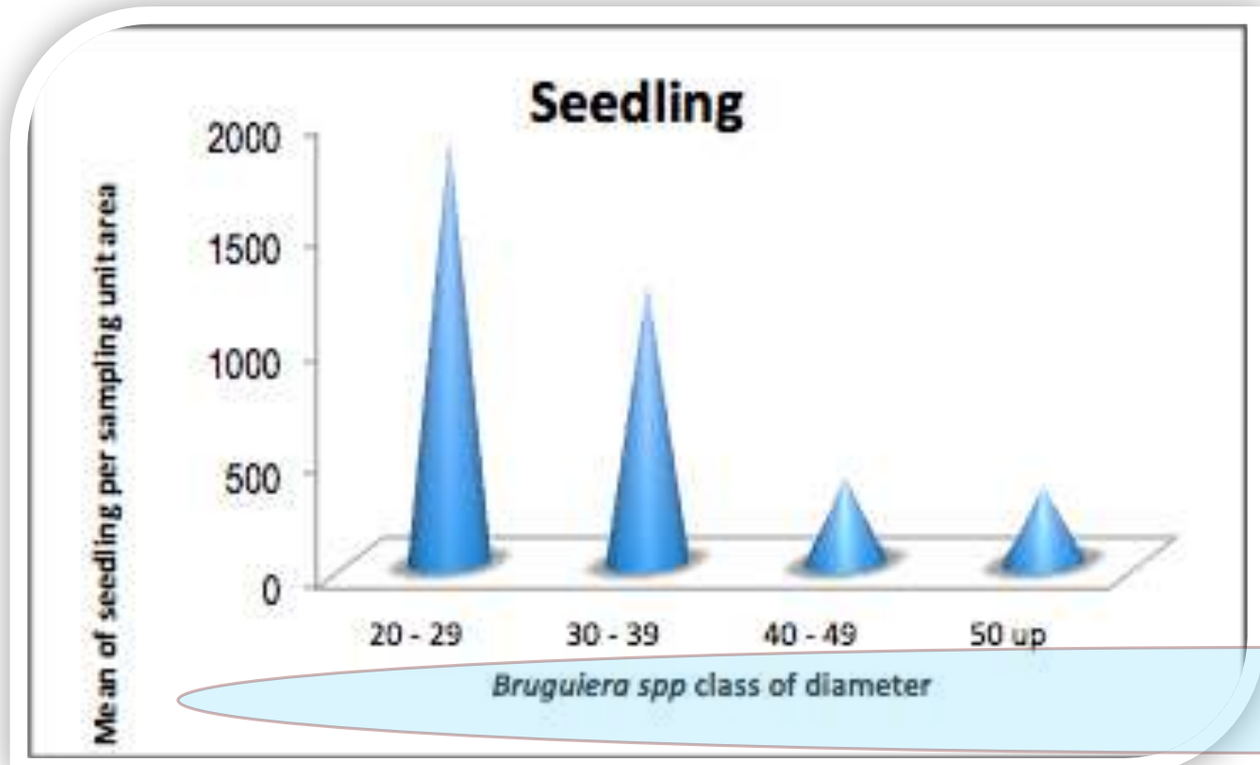
Population natural regeneration, seedling and sapling, under seed trees and number the seed trees 2 years after cutting (Et+2) have been reported by Elnatan (1997). Sampling unit areas are 3 m x 3 m for seedling, and 4 m x 4 m for sapling, respectively. The results are summarized as follows:

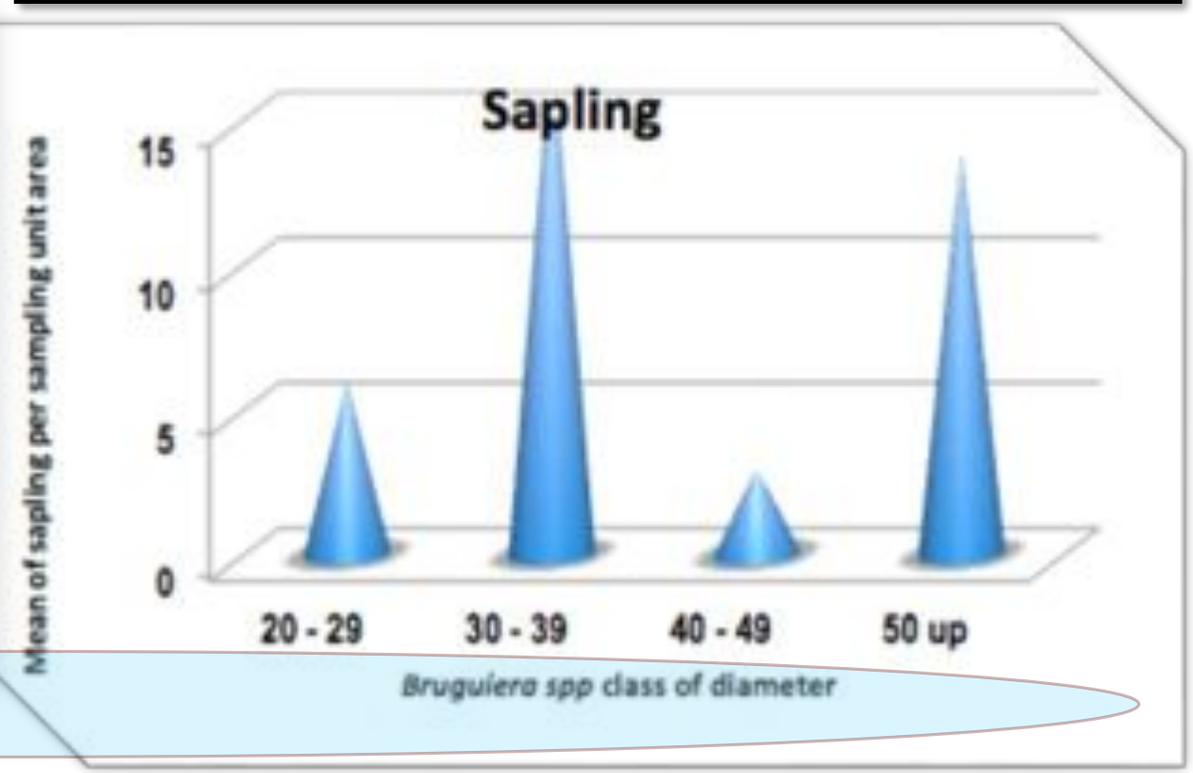
Mangrove Species	Class of Diameter (cm)	Seed trees number (n)	Clear bole (m)	Mean of High	Mean of crown diameter (m)	Seedling (n)	Sapling (n)	Total Nat. Reg. (7+8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Rhizophora spp	20-29	15	9.02	10.67	3.55	359	15	374
	30-39	15	12.6	12.73	4.50	529	13	542
	40-49	15	10.73	14.33	6.41	577	6	583
	50 up	15	11.6	12.6	5.95	691	7	698
Total		60	43.95	50.33	20.41	2156	41	2197
Mean			**10.99**	**12.58**	**5.10**	**539**	**10.25**	**549.25**
Bruguiera spp	20-29	15	8.73	10.6	3.63	1856	6	1862
	30-39	15	9.17	13.33	4.45	1218	18	1236
	40-49	15	6.93	10.73	4.37	372	3	375
	50 up	15	9.8	11.63	4.7	331	14	345
Total		60	34.63	46.29	17.15	3777	41	3818
Mean			**8.66**	**11.57**	**4.29**	**944.3**	**10.25**	**954.5**

Rhizophora spp vs Bruguiera spp









4.3. Natural regeneration

Natural regeneration at different sites on logged over area have been reported by Beto (2003). The results are summarized as follows:

Logged over areas of mangrove forest sites	Number of natural regeneration (n/ha)		
	Seedling	Sapling	Total
Stacking log	895,83	70,84	966,67
Working camp	4166,67	900,00	5066,67
Skidding track	3058,33	606,93	3665,26
Unreachable tidal wave	359,38	26,04	385,42

Less natural regeneration, probably, due to:

1. Soil compaction, bark deposit, etc (stacking log);

2. Unreachable seeds distribution (less tidal wave occured, soil condition, etc)

4.4. Number of natural regeneration required by seed trees method

Seed trees method required a minimum seedling of 2500 per ha ***(see section 3.1 point h).***

Various results indicated that population seedling are

- ET +7 = 26000 per ha, *Pribadi (1998);*

- Et + 2= 8480 per has, *Beto (2003);*

- Et + 2= 3133 per ha, *Djulsafri (1997)*

Therefore, the Seed trees could produce good enough quantity of seedling, and they provide higher quantity than recommended

4.5. Reduce impact logging

1. NO heavy equipment of logging trucks, jack loader, bulldozer, etc, are used for mangrove extraction at the forest sites;
2. Mangrove forest extraction results less damages to the environmental and remained standing forest

4.5 Forest operation at non mangrove forests

4.6. BUMWI`s achievement on practices of sustainable forest management and chain of custody

5. CLOSING REMARKS

- The seed trees method has been using to manage and harvest mangrove forest resources in Bintuni bay, since 1988;
- Seed trees method could offer an extra numbers of the seed tress at logged over areas, and eliminate the damage or injury of the seed tress;
- This silvicultural system of mangrove has proved to provide good enough quantity of seedling, produced by the seed trees, for the next cutting rotation;