

## Background

All plots are located within Ujung Tanjung (UTNE) and Kandista (KNDE) Estates. These estates were initially selected because they are fairly flat and of similar elevation. Within the two estates, six provisional replicate locations were selected, based on GIS data, to be within flat areas of between 10-30m height above sea level, to not be adjacent to habitation, and to be of a similar age (planting date 1987-1993). Replanting will not occur on any of the sites until 2018, allowing sufficient time for data collection.

Candidate plots were then inspected to ensure they did not contain atypical features (such as buildings etc.) not shown on the map, and to ensure that each had a ditch at their periphery to allow aquatic work (Figure 1 – finalised location of plots).

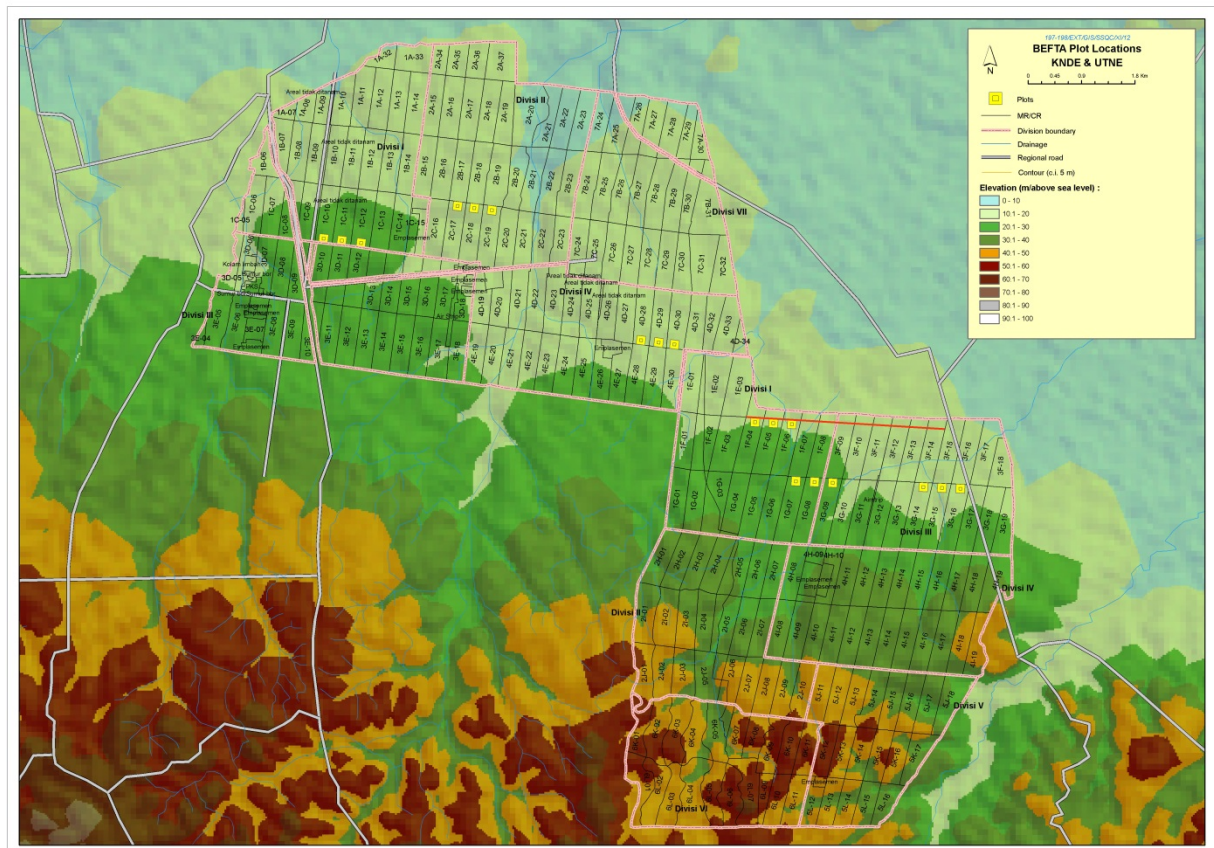


Figure 2. Locations of the plots within Ujung Tanjung and Kandista Estates.

## Methods

At each of the six replicate locations, we established three 150m x 150m (2.25 ha) area plots, with smaller 50m x 50m (0.25 ha) area plots inside. Each plot is located immediately adjacent to the road and in adjacent harvesting blocks to the other two plots in the replicate (Figure 2).

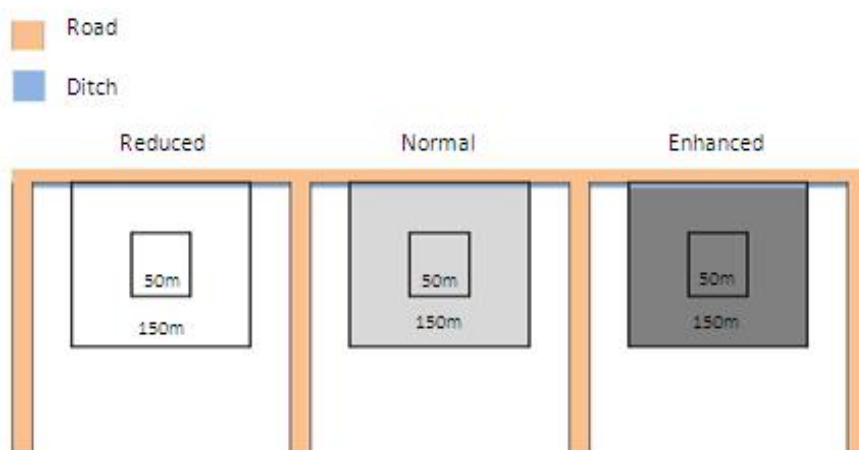


Figure 2. One replicate, consisting of the three plots located in adjacent sampling blocks.

One of three possible treatments was assigned at random to each of the three plots within each replicate:

1. **Normal complexity:** this represents standard industry practice and will include an intermediate level of herbicide spraying and epiphyte removal
2. **Reduced complexity:** this represents highly destructive management and will include the removal of all understory and epiphyte trunk vegetation using herbicides
3. **Enhanced complexity:** this represents reduced-input management/conservation treatment and will include minimal herbicide input and understory cutting. Understory growth will therefore be maximized as far as possible, including woody regrowth, while still allowing access to the palms for harvest.

These treatments will not be implemented until February 2014, allowing over a year to collect before-treatment data. For an overview of each plots characteristics (Table 1).

Table 1. General characteristics, treatment and location details of the 18 treatment plots.

BEFTA code	Treatment	Estate	Block number	Date Planted	Replanting date	Height (m a.s.l.)	Site description
1A	enhanced	Kandista	1F-04	1992	2019	10-20	South of road
1B	reduced	Kandista	1F-05	1992	2019	10-20	South of road
1C	normal	Kandista	1F-06	1992	2019	10-20	South of road
2A	enhanced	Kandista	1G-07	1992	2020	20-30	South of road
2B	normal	Kandista	1G-08	1992	2021	20-30	South of road
2C	reduced	Kandista	3G-09	1992	2020	20-30	South of road
3A	reduced	Kandista	3G-14	1993	2022	10-20	North of road
3B	normal	Kandista	3G-15	1993	2022	10-20	North of road
3C	enhanced	Kandista	3G-16	1993	2022	10-20	North of road
4A	reduced	Unjung Tanjung	1C-10	1987/1989	2018	20-30	North of road
4B	enhanced	Unjung Tanjung	1C-11	1987/1989	2018	20-30	North of road
4C	normal	Unjung Tanjung	1C-12	1987/1989	2018	20-30	North of road
5A	enhanced	Unjung Tanjung	2C-17	1987/1989	2018	10-20	South of road
5B	normal	Unjung Tanjung	2C-18	1987/1989	2018	10-20	South of road
5C	reduced	Unjung Tanjung	2C-19	1987/1989	2018	10-20	South of road
6A	enhanced	Unjung Tanjung	4D-28	1992/1993	2020	10-20	North of road
6B	reduced	Unjung Tanjung	4D-29	1992/1993	2020	10-20	North of road
6C	normal	Unjung Tanjung	4D-30	1992/1993	2020	10-20	North of road

## Setting up the plots

GPS units (Garmin GPSmap 62s) were used to locate the corners of both the inner and outer plots, which were marked with large plastic poles. The GPS points for these locations are in the file “final BEFTA points.”

At the same times as plots were set up in November 2012, a number of environmental factors were measured to assess the homogeneity of replicates. These were:

- Slope - taken from the centre of each plot to 25 metres out N,E,S and W using a clinometer
- Understory vegetation cover – estimated from five locations (centre of the plot and each corner of the 50 m survey area) as % cover of Ferns, grass, other vegetation, % cover bare ground, % cover dead oil palm fronds, and % cover Empty Fruit Bunches (EFB), within a 10 by 10m area
- Canopy openness – using a tube with 1cm divisions, from five locations (as above)
- The distribution and size of termite mounds – GPS location recorded and the length, width and height of each mound measured (later converted to volume) within each 50 m survey area.
- The presence of streams and their GPS location was also recorded and anything unusual about the areas noted.

Treatments across the replicates were found to be homogenous (Table 2) and did not differ significantly in any of the parameters recorded (Canopy openness: chi-squared = 0.6423, df = 2, p-value = 0.7253; Slope chi-squared = 0.4634, df = 2, p-value = 0.7932; Number of termite nests chi-squared = 0.1288, df = 2, p-value = 0.9376; Volume of termite nests chi-squared = 0.2664, df = 2, p-value = 0.8753; Bare ground cover chi-squared = 4.3452, df = 2, p-value = 0.1139; Dead frond cover chi-squared = 0.3803, df = 2, p-value = 0.8268; EFB cover chi-squared = 1.0639, df = 2, p-value = 0.5875; Vegetation cover chi-squared = 3.1596, df = 2, p-value = 0.206; Table 2 for summary of mean plot characteristics).

Table 2. Summary of characteristics recorded for each replicate plot.

BEFTA code	Stream present	No. of termite mounds	Termite Soil volume (m <sup>3</sup> )	Mean slope (degrees)	Mean canopy openness	% cover dead fronds	% cover E.F.B.	% cover bare ground	% cover ferns	% cover grass	% cover other vegetation	% cover deadwood	% cover stream
1A	1	14	152	1.9	3.2	18	0	36	36	0	9	2	1
1B	0	14	256	0.1	0.4	9	0	38	46	0	7	0	0
1C	1	1	3	0.1	4.6	11	0	26.6	41	5	14	2	0
2A	0	7	94	0.8	1.4	18	0	50	32	0	0	0	0
2B	0	13	334	1.5	0.2	15	0	27	46	0	12	0	0
2C	1	5	54	2.0	3.6	17	0	46	33	0	6	0	0
3A	0	7	168	1.0	3.2	7	0	44	42	0	7	0	0
3B	0	8	205	1.0	0.6	17	0	29	48	0	6	0	0
3C	0	8	113	0.3	1.2	18	0	47	30	0	5	0	0
4A	0	5	136	0.4	4.8	2	8	23	27	0	40	0	0
4B	0	10	181	0.5	2.6	2	6	26	33	4	30	0	0
4C	0	2	57	0.1	2.2	8	9	16	36	0	31	0	0
5A	0	5	90	0.5	2.4	3	0	42	33	0	22	0	0
5B	1	10	152	1.1	2.0	5	13	17	52	0	13	0	0
5C	0	8	87	1.6	4.8	12	0	12	39	0	37	0	0
6A	0	4	128	0.3	2.6	7	0	44	40	0	9	0	0
6B	0	5	99	0.8	0.8	9	0	39	33	0	18	1	0
6C	0	8	163	1.5	9.2	10	0	40	27	0	23	0	0

**Palm location and yield**

All trees in the middle 50m plot were marked with individual numbers. The Diameter Breast Height (DBH) of each marked tree (at 1.2m using modified calipers) and the tree height (to Frond number 33) was also recorded at the time of marking. Where trees were dead, additional trees immediately adjacent to the 50m plots were chosen and marked. The number and total weight of bunches produced by each tree has been recorded since January 2013.

**Status**

All of the initial plot location and recording has now been completed. Data on yield will be collected continuously and data on tree DBH and height once a year throughout the project.