Field Report to InfiniteEARTH:

Rimba Raya Carbon Assessment Survey
June 22 – July 4, 2009

by
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Table of Contents

1. Executive Summary 3
2. Introduction 3
3. Rimba Raya Project Background 4
4. Purpose and Objective of the Carbon Assessment 4
5. Methods
    5.1 Field Work Areas and Transect Locations 4
    5.2 Transect and Plot Layout 6
    5.3 Field Team Organization 6
    5.4 Field Team Workflow, Equipment and Survey Protocols 7
    5.5 Data Recording - Tally Sheets 8
    5.6 Training 9
    5.7 Field Work Schedule 9
    5.8 Transport, Logistics and Personnel 10
6. Results
    6.1 Description of Survey Transects 10
    6.2 Data Entry, Description and Summary 14
7. Next Steps
    7.1 Data Finalization – Latin Names of Tree Species 14
    7.2 Data Analysis 15
    7.3 Additional Field Work 15

Appendix A. Detailed Maps of the Survey Areas 16
Appendix B. Field Team Positions 28
Appendix C. Field Equipment Checklist 28
Appendix D. Accounting for Field Transport 29
Appendix E. Accounting for Field Logistics 30

1. Executive Summary

Forest Carbon consultants and Orangutan Foundation International (OFI) conducted a field survey June 22 – July 4, 2009 on behalf of InfiniteEARTH to support the Rimba Raya carbon assessment. Two 8-person field teams, including experienced forest surveyors, OFI staff and local residents familiar with Rimba Raya forests conducted the survey. A total of 12,750 meters of transect were marked and surveyed with peat depth measured in 131 locations and biomass data recorded across 28 plots representing 7 hectares of forest. 27 of 28 plots were located in logged peat swamp forest which is the predominate forest type in Rimba Raya.

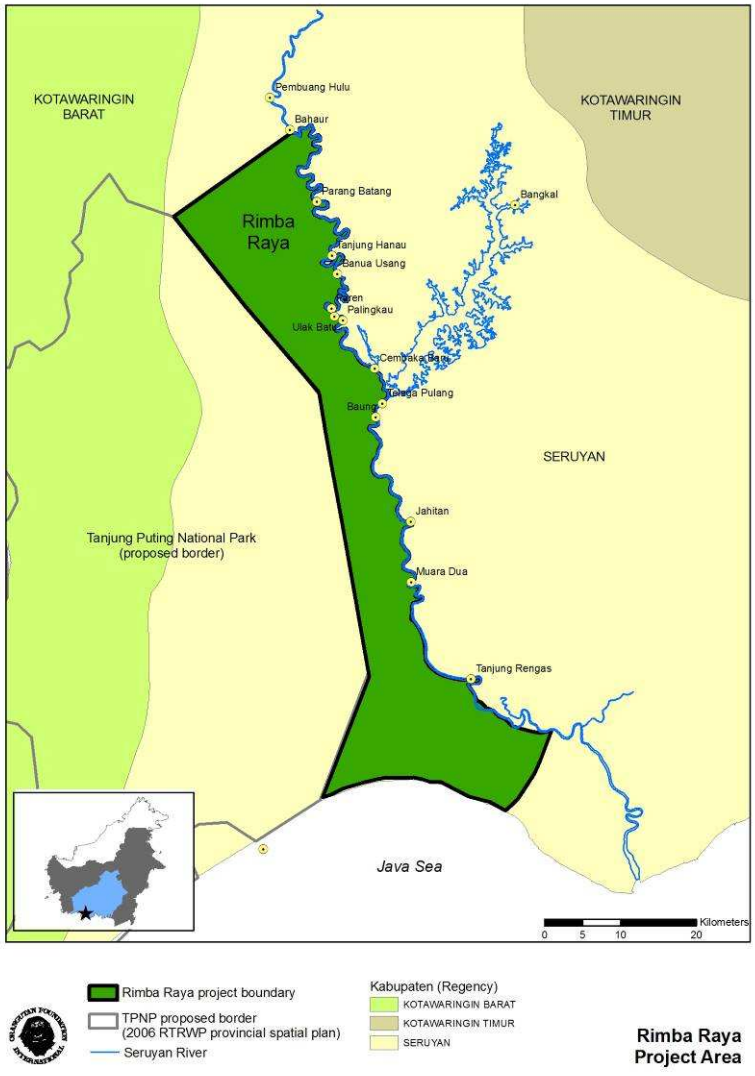
Preliminary results indicate that despite the history of selective-hand logging in the area, forest biomass is moderately high and relatively consistent across major forest blocks in Rimba Raya. Unexpectedly, peats were moderately deep across all survey transects. Most peat measurements exceeded the reach of the peat probe at 4 or 5 meters. Peats were 2-3 meters deep on the southernmost transect within 10 km of the Java Sea.

All survey data has been entered into an Excel workbook and provided to InfiniteEARTH, Forest Carbon and Orangutan Foundation International (OFI). These data provide the first detailed ground information on the condition and characteristics of forest and peat in Rimba Raya which will be used in carbon stock assessments and other ecological analyses conducted by project participants.

2. Introduction

Forest Carbon consultants and Orangutan Foundation International (OFI) conducted a field survey June 22 – July 4, 2009 on behalf of InfiniteEARTH, the major proponent of the Rimba Raya proposed Restoration Concession, Seruyan District, Central Kalimantan. The purpose of the survey was to collect detailed ground information for the Rimba Raya carbon stock assessment.

This report describes the survey design, field methods, equipment, teams, survey sites and data collected on the survey, including detailed maps of the field work areas. Also included in this report is an account of logistics, transport and personnel which can be used in planning future field expeditions in Rimba Raya.



Survey data from this field work has been entered into Excel spreadsheets from

hardcopy tally sheets in preparation for analysis. These data will be used for ground verification of biomass estimates from aerial photographs obtained during over-flights July 1 – 8. These data also provides the first detailed ground information on the condition and characteristics of forest and peat in Rimba Raya which will be used in carbon stock assessments and other ecological analyses conducted by project participants.

3. Rimba Raya Project Background

The Rimba Raya proposed Restoration Concession covers an expanse of 101,000 hectares of tropical peatlands adjacent to Tanjung Puting National Park in Central Kalimantan. Rimba Raya provides habitat for the orangutan and a diversity of other species and also helps protect Tanjung Puting by providing a forested buffer to the park. Rimba Raya peatlands also harbor an estimated 28 million tons of carbon in the forest canopy and in the peat. Protecting this rich carbon bank prevents the release of an estimated 105 million tons of carbon dioxide, the primary greenhouse gas contributing to global warming. This adds to the importance of managing Rimba Raya for conservation and sustainable resource use.

The Rimba Raya project, led by InfiniteEARTH, aims to protect forests and orangutans, extend and strengthen park conservation, mitigate climate change by protecting rich carbon stocks, and provide new economic and social opportunities to Seruyan villages on the project border. The Rimba Raya climate, community and biodiversity (CCB) project represents an innovative approach in the emerging field of Reductions in Emissions from Deforestation and Degradation (REDD).

4. Purpose and Objective of the Carbon Assessment

The objective of this field project is to estimate above and below-ground biomass in the Rimba Raya Restoration Concession in order to scientifically assess carbon stocks. By following specific protocols to meet international standards, the Rimba Raya project will be able to obtain VCS (Voluntary Carbon Standard) issued carbon credits. Commercial trading of these carbon credits will provide the basis for funding conservation and community development projects into the future.

5. Methods

5.1 Field Work Areas and Transect Locations

Field survey areas were distributed north to south and located to cover a broad geographic area representing forest types throughout Rimba Raya (Figure 1). Six transects were used to organize survey points, plots and subplots. Available land cover maps and satellite imagery of the area were reviewed in order to locate transects in forest across a variety of hydrologic conditions and levels of disturbance.

Field teams staged field work out of OFI monitoring posts and temporary camps near transects. Transects 1 and 2 were surveyed by combined teams at the start of the fieldwork. Following completion of these surveys, separate teams moved south to survey Transects 3 and 4 (Central Team) and Transects 5 and 6 (Southern Team).

From overnight camps, teams navigated to the transect start to cut and mark the centerline. On 4 of 6 transects, the transect center was used as the start point to provide an efficient means of accomplishing multi-day surveys from centrally-located camps or site access points. At these sites (T2, T3, T4, T6), transect layout proceeded in two parts: 1-1.25 km to the East and 1-1.25 km to the West. At the other sites (T1 and T5), forest conditions relative to site entry points required transect layout from the endpoints.

Maps of the field work areas and transect sites are included in Appendix A. Northern transects 1 and 2 were located in the vicinity of Baung River and OFI's Post Sitiung (Appendix A, Figures 2A-2D). Central transects 3 and 4 were located in the interior of Rimba Raya from Muara Dua village on the Seruyan River accessed by the Sigintung River and Tatah "J" Canal (Appendix A, Figures 3A-3D). Southern transects 5 and 6 were located in Rimba Raya in the vicinity of Tanjung Rengas village on the Seruyan, accessed by canals (Appendix A, Figures 4A-4D).

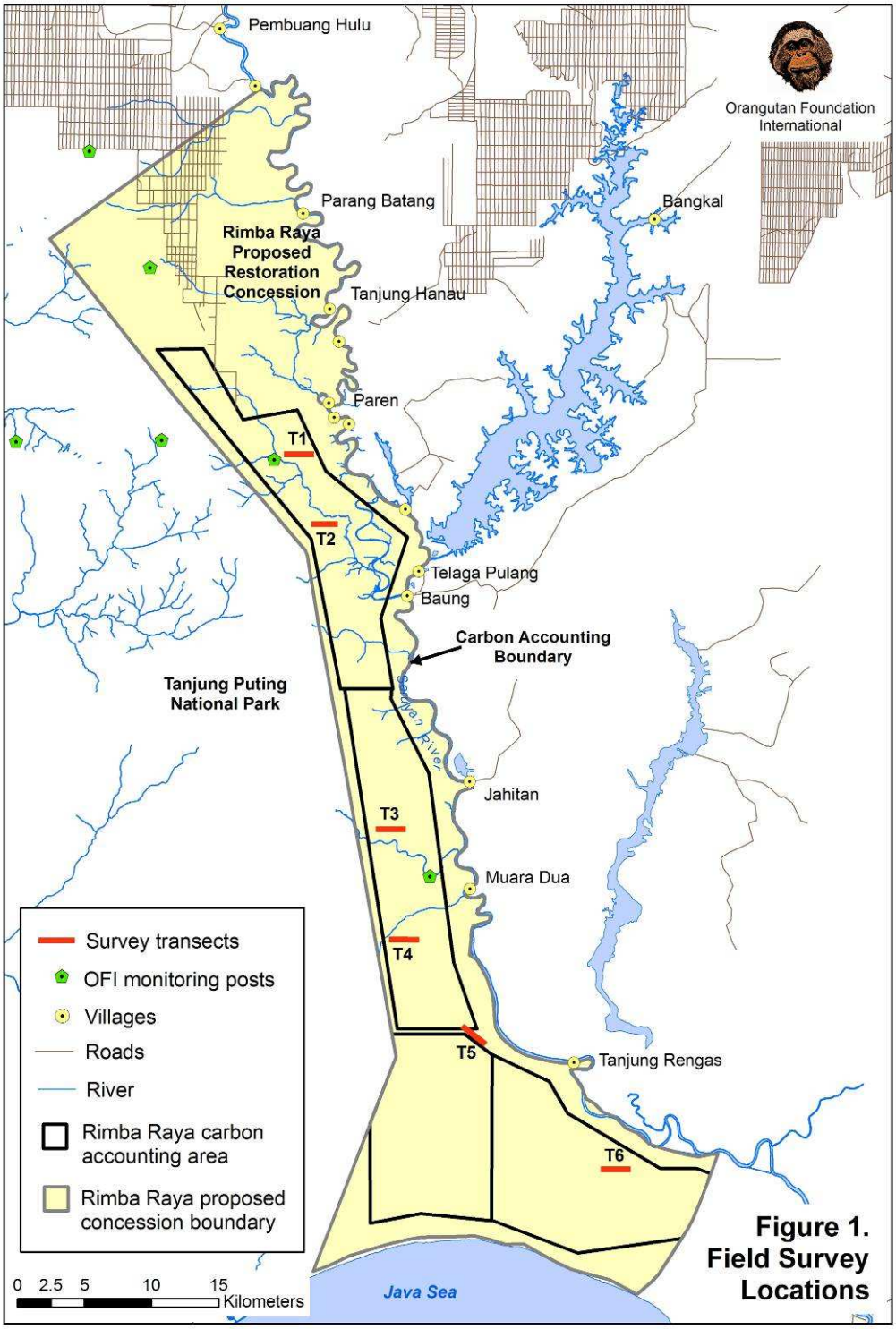


Figure 1. Field Survey Locations

5.2 Transect and Plot Layout

The survey was designed to orient all transects east-west to facilitate accuracy and consistency in layout. All transects follow this east-west orientation except Transect 5 which follows the orientation of the relatively narrow forest patch. Transects were 2.0 - 2.25 km in length oriented on a bearing of 90° - 270°. Transect 5 was oriented on a bearing of 310° - 130° to traverse the existing forest patch. Transect centerlines were marked every 10 meters with poles and flagging which provided orientation for survey plots.

Along the transect, tree counts for volume estimates were recorded every 50 meters and peat depth was measured every 100 meters. Biomass plots 250m x 10m (¼ hectare), were located at 250 meter intervals on the transect (Figure 5). Tree diameter, tree height and tree canopy measurements were recorded in biomass plots for large trees (> 20 cm dbh) across the entire plot and within two nested subplots (50 x 10m) for small trees (10-20 cm dbh) (Figure 6).

A total of 12.75 km of transect were surveyed including 131 sample locations for peat depth, 262 sample locations for tree volume and 28 biomass plots representing 7 hectares of detailed tree surveys.

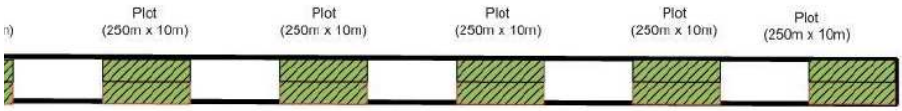


Figure 5. Schematic of transect plot layout

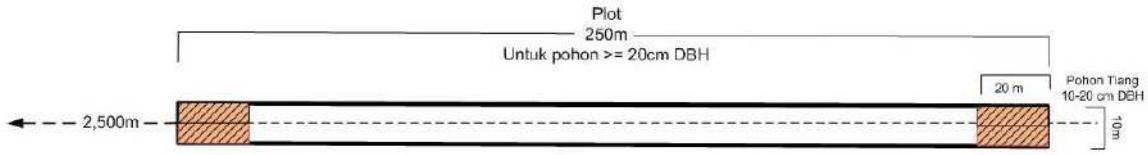


Figure 6. Schematic of plot layout. Note plot is divided into five 50x10m large tree subplots with two nested 20x10m small tree subplots (shown above) at each end

5.3 Field Team Organization

Each survey team of 8 people was divided into 3 subteams assigned to particular survey tasks. Subteam positions are listed below and the responsibilities of each position are briefly described in Appendix B.

Transect Subteam
- Compass person/distance measurer
- Trail cutter

Peat Subteam
- Note taker/tree volume measurer
- Peat measurer

Biomass Subteam
- Note taker/biomass team leader
- Tree canopy measurer (clinometer and laser)
- Tree identifier and diameter measurer (2 people)

5.4 Field Team Workflow, Equipment and Survey Protocols

The transect subteam led the survey by cutting and marking the first part of the transect (1-1.25 km) on a fixed bearing. The compass person directed the line cutter and marked the transect center line with a flagged pole every 10 meters. The transect team used a 10 meter cord to measure pole distances along the transect. After the survey was completed on this portion of the transect (typically 1 day), the transect subteam cut and marked the second half of the transect.

The peat subteam followed behind the transect subteam after a portion of the transect had been cut, recording data at 50 and 100 meter intervals on the transect centerline. The roles of note taker, peat measurer and tree counter were shared between two people on the peat subteams.

At 50 meter intervals, tree counts were recorded in point-centered variable plots using 10 and 20 BAF (Basal Area Factor) prisms. The prisms were calibrated to show which trees (given their size and distance from the survey point) should be included in the tree count, which provides an estimate of tree density. Live and dead trees were counted and recorded separately.

At 100 meter intervals, the peat measurer used a probe to measure peat depth. The peat probe consisted of 5, 1 meter threaded, attachable pipe units, one with a pointed probe end and one with a horizontal bar handle. The handled unit was attached and used to push the probe into the ground, then detached and replaced with a straight unit until the bottom of the peat was reached. Unexpectedly, peats in most areas were greater than 5 meters deep and therefore exceeded the reach of the peat tool used on this survey. In these cases depths were recorded as 5+ meters. On transects 5 and 6, one of the peat tool sections broke and the maximum depth that could be recorded was 4 meters.

The biomass subteam followed the peat subteam, working in nested subplots to manage workflow across 250 x 10 meter (1/4 hectare) plots. The transect centerline and 10 meter marks were used to define subplot boundaries within which tree measurements were recorded on separate subplot tally sheets. A laser range finder was used to determine exact distances from transect centerline for borderline trees. The note taker played a key role in managing data collection, keeping track of subplot boundaries and directing biomass subteam members to specific trees for measurement.

Within each subplot, two tree identifiers searched for trees meeting the diameter requirements, identified the species using the local name and measured diameter at breast height (DBH). At the same time, the note taker directed the canopy measurer to selected trees (2 per subplot) to measure crown dimension, canopy class and tree height. Crown dimension was measured at the broadest radius and the radius perpendicular to the first measurement (Figure X) using a laser range finder to record distance from canopy edge to the tree stem. Canopy class was visually estimated following (author) where class 5 was assigned to an understory tree receiving no direct sunlight and class 1 was assigned to a canopy emergent receiving full sunlight (Figure 7). The sketches below were printed on the tally sheets to aid tree crown data collection. Tree height measures (observer distance and angle to the tree) were also recorded for the selected crown measure trees. Distance was measured using the laser range finder and angles to tree base and tree crown apex were made using a clinometer. An equipment list is included in Appendix C.

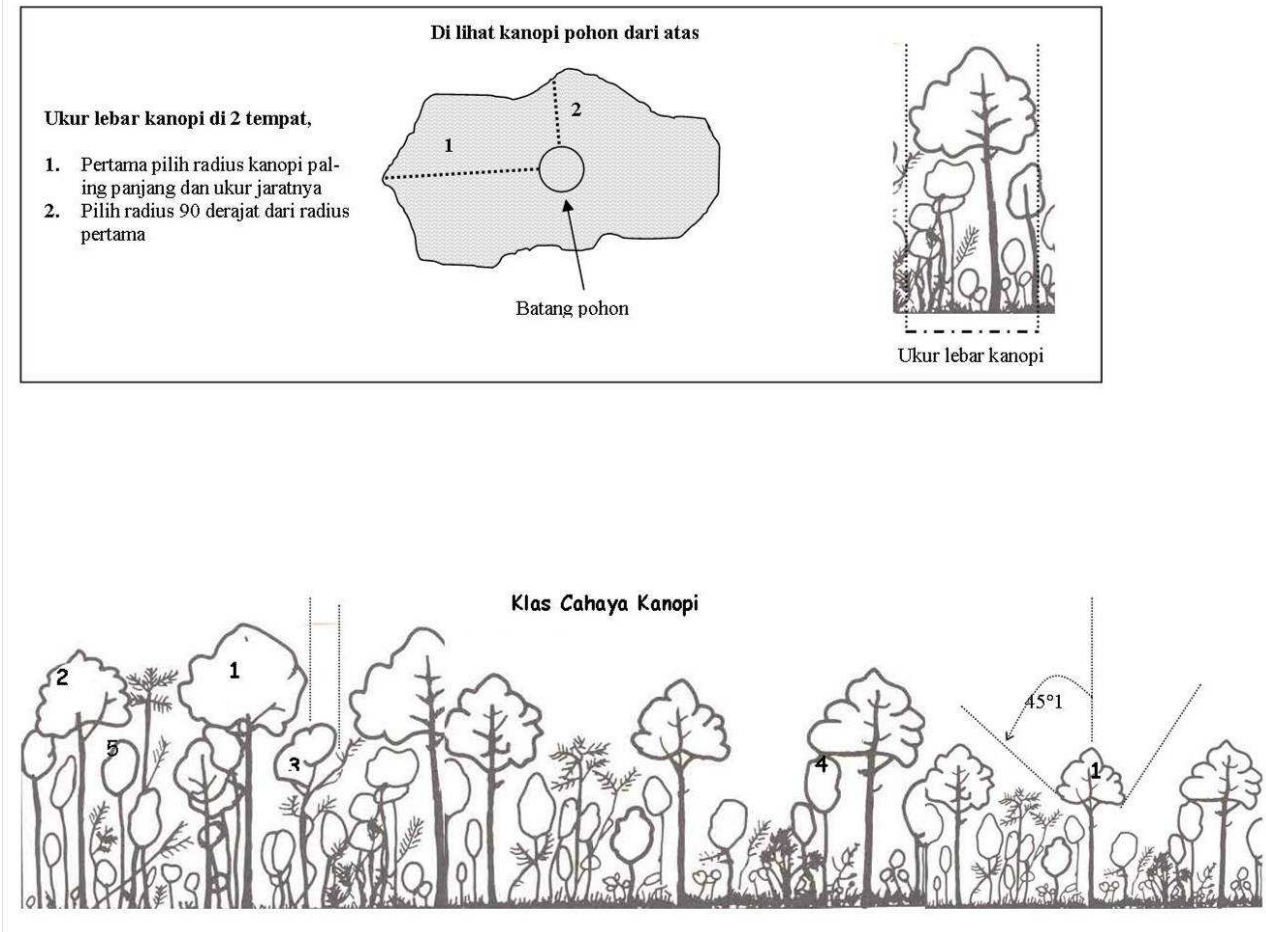


Figure 7. Crown canopy measurement diagrams

5.5 Data Recording - Tally Sheets

Survey data were recorded on hardcopy tally sheets carried on clipboards. One peat tally sheet was used per survey session to record peat depths and tree counts at 50 and 100 meter intervals. Transect numbers were read from flagging and used to indicate position along the transect. Transect numbers progressed from 0 to 2250 on a 90° bearing for T1 and a 310° bearing for T5. Transects with a center start point (T2, T3, T4, T6) had two sections numbered 0 to 1000 and 0 to 1250 on opposite bearings (90° and 270°). Direction of travel along the transect ("derajat" or bearing) was recorded at the top of the tally sheet to indicate which section of the transect was being recorded. A total of 2-3 peat tally sheets were used for each transect.

Multiple tally sheets were used to record biomass plot data, with one sheet for each subplot. Each plot started with a small tree subplot (20x10m), proceeded by five large tree subplots (50x10m) and ending with a second small tree subplot (20x10m). Plot and subplot numbers progressed west to east on each transect regardless of start point and were recorded on tally sheets. Thus on T1,2,3,4,6, the westernmost end of transect starts plot1 with subplots numbered 1(small trees), 1,2,3,4,5 (large trees), 2 (small trees) west to east. On T5, plots were numbered 1-5 in the direction of travel (310°). A total of 28 (4 plots) or 35 (5 plots) tally sheets were recorded for each transect.

5.6 Training

Training began with a presentation of the field work plan, objectives and survey protocols, following team member introductions at Post Sitiung. A demonstration of the survey equipment and hands-on training was conducted the next day which provided an opportunity for team members to expand and improve their skills in field ecology survey techniques prior to collecting data. Most team members were already experienced in laying out transects with a compass and measuring trees with a diameter tape. Other survey equipment, such as the clinometer and peat probe were less familiar to team members and the laser range finder and prism were new to survey team participants.

Training and practice at the post also provided an opportunity for team coordinators to evaluate personnel skills which helped assign roles on subteams. Training and refinement of methods continued as the first transect was surveyed by combined teams.

5.7 Field Work Schedule

The field work was completed as scheduled in 13 days, June 22 – July 4 (Table 1).

Table 1. Field Work Schedule Overview

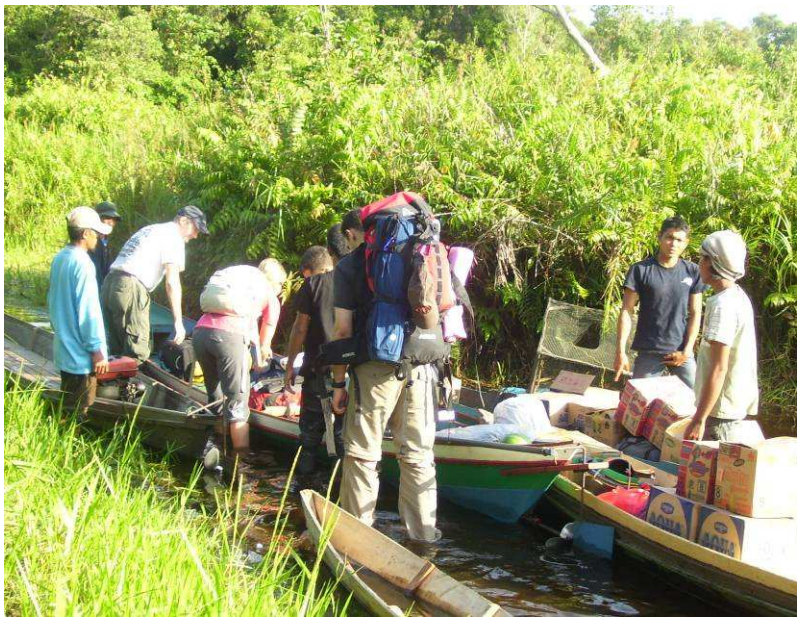
21	22	23	24	25	26	27
Final Field Planning	Travel to Field and Begin Training	Training Survey T1	Training Survey T1	Survey T1, Survey T2	Survey T1, Survey T2	Two Teams Travel
28	29	30	1	2	3	4
Survey T3, Set up T6	Survey T3, Survey T6	Survey T4, Survey T6	Travel to PBun, Set up T5	Survey T5	Survey T5	Travels to Pbun

Team members traveled from various locations in Pangkalan Bun, OFI monitoring posts and Seruyan villages to meet at Post Sitiung Monday June 22 and begin training. The combined team of 18 people spent 2 days conducting training surveys on Transect 1, then separated into two teams to complete Transects 1 and 2. Saturday June 27 both teams travelled south. The central team moved to Post Sigintung to overnight and the southern team headed south toward Tanjung Rengas enter the logging canal and camp overnight.

Both teams established new transects and conducted surveys over the next 6 days (Sunday June 28 – Friday July 3). Distance, field conditions and site access, contributed to longer transect establishment times in the south. The central team completed surveys on T3 and T4 by July 1 and the southern team completed surveys on T5 and T6 by July 3. Teams traveled separately back to posts and towns after surveys were completed.

5.8 Transport and Logistics

Transport and logistics were planned based on schedules used by OFI's field post operations. Transport included overland travel (SUV) to carry people, gear and supplies between Pangkalan Bun and eastern transfer points on the Baung and Seruyan Rivers. Otherwise, all transport in the field was by boat. Speed boats are available for rent on the Seruyan River and significantly reduce travel time to field sites, but have become too costly (10 times the price of other boat transport) due to inflated local fuel prices. Therefore kelotoks (motorized wooden boats) provided the primary means of river transport.



On the Baung River and canals, only small kelotoks or "ces" could be used to navigate narrow channels and low water levels characteristic of the June-November dry season months. Ces can be rented from residents in most Seruyan villages. For this field effort, three field assistants from Muara Dua village brought ces with them. OFI provided a larger ces which effectively provided transport on the Baung but was too large to navigate narrow canals and rivers to the south. Regularly scheduled longboat taxis provided transport back to Pembuang Hulu from Seruyan villages at the end of the field work. A schedule and budget for transport is included in Appendix D.

Most food and all gear and supplies were carried into the field from Pangakalan Bun. These included basic supplies (e.g. rice, noodles, canned corned beef, sardines, dried fish, cooking pots, and tarps) typically used by OFI field staff and organized by OFI field team managers. A 3-day supply of perishable fruit and vegetables were also brought in as well as packaged dry snacks for field lunches. Staple foods were resupplied in Seruyan villages.

Fuel and boat repair supplies including roders were carried in for use on the Baung River before supply shops on the Seruyan could be reached. During low water season, boat roders often hit submerged logs, breaking the shear pins and sometimes damaging or losing the roder. During the 6 days on the Baung River, roders on 4 ces were repaired or replaced every day. A list and budget for logistics are included in Appendix E.

6. Results

6.1 Description of the Survey Transects

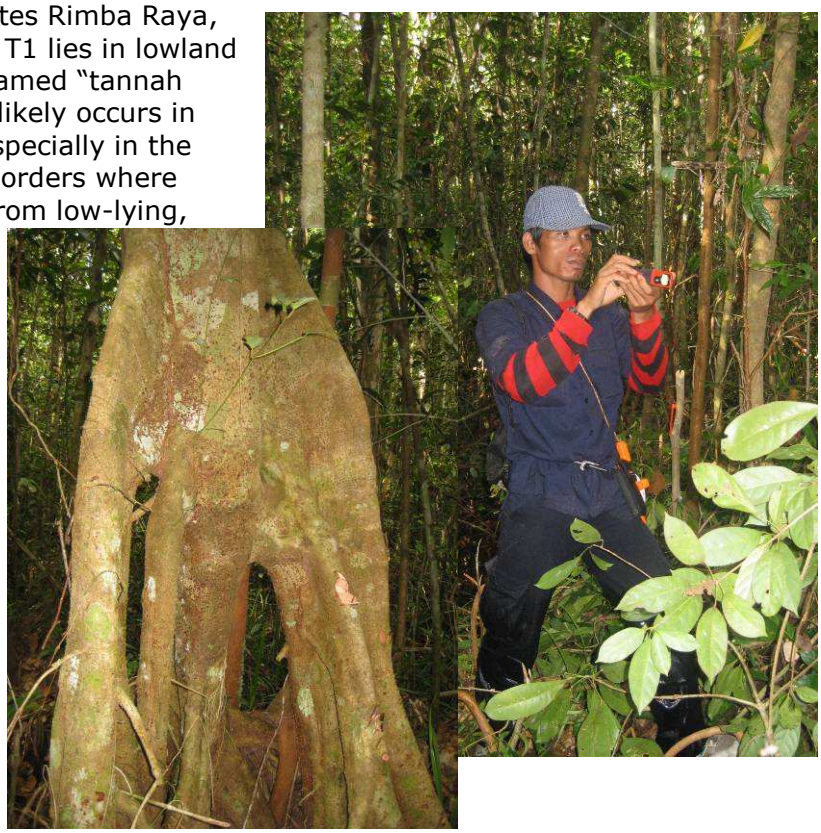
Rimba Raya forests are primarily peat swamp that has been selectively hand-logged with moderate intensity in the last two decades. More than half of the area has already been deforested, primarily by uncontrolled burning from deliberately set fires. Surveys indicate that Rimba Raya swamp forests are comprised of a common suite of infrequently occurring species. More than 100 species are represented by the ~1050 large trees measured, with only 20 species occurring with a frequency of more than 2%

(Table 2). Two of these, lanan (sp name) and ramin (sp name) have been particular targets of logging and were certainly more abundant in these forests prior to logging.

Table 2. Frequency of Tree Species on Survey Transects

Species (Local Name)	Number of Occurrences on Survey (of 1056 Large Trees Measured)
ketiau	92
lamanaduk	68
asam asam	40
medang	40
bentan	39
idat	34
lanan	33
bekunyit	32
banitan	31
kumpang	30
ramin	30
pempaning	29
jangkang	28
jelutung	27
penemplaan	27
bekepas	26
terantang	24
ubar	24
papung	23
puak	21

Transect 1, located close to Post Sitiung on the Baung River, is primarily comprised of swamp forest, which predominates Rimba Raya, however the first 500 meters of T1 lies in lowland forest. Lowland forest (locally named "tannah tinggi" or "high ground forest") likely occurs in small patches in Rimba Raya, especially in the north and possibly on western borders where there is a slight elevation gain from low-lying, seasonally inundated, swamp forest. This is the only patch of lowland forest encountered on the survey. The remainder of the 2250 meter transect was comprised of swamp forest (locally named "rawa") with tall (>1 meter) hummocks and buttressed tree stems characteristic of ombrogenous (rainfed) peat swamps in the region. Peat was not encountered until 500 meters into T1 where lowland forest transitioned to peat swamp forest. Peat depths on the transect ranged from 3.2 to 4.3 meters.



Logging canals, probably more than 10 years old, traverse the T1 area, which was likely heavily logged given the substantial size of the canals and scarcity of large trees. However, deep swamps extending 1-2 kilometers into the interior from the Baung River make access to the area difficult which has probably deterred further exploitation of sparsely-distributed, smaller-stemmed and less-valuable wood. Presence of the relatively intact lowland forest patch, gibbon calls and hornbill sightings in the area and abundant orangutan nests indicate this area has high ecological value.

Transect 2 was located adjacent to riverine forests and seasonal lakes bordering the Baung River south of transect 1. Seasonal lakes are a common feature in the region, characterized by shrubby hummocks rising out of waist-deep, sedge-filled swamps where flooded forests once stood. Riverine forests are comprised of the same suite of species as swamp forests but are often characterized by one or two dominant species, larger trees, more abundant fruit and presence of figs, all of which can be attributed to river flooding which brings nutrient-rich mineral soils into adjacent peatlands.

Transect 2 was less-deeply hummocked than transect 1, viney, with more canopy openings, deep leaf litter, standing dead trees and many decomposing treefalls. Peat measurements on this transect were all >5 meters, where the peat tool did not reach the bottom of the peats. Presence of more ramin and lanan and absence of a large logging canal network indicate the T2 area may have been less-heavily logged than T1. The cause of the high volume of dead trees, treefalls and canopy gaps remains unknown, but deep flooding and slow decomposition rates may provide a partial explanation. Nearby seasonal lakes and the open area at the west end of the transect indicate that fire has also played a role in land cover change in the area. Despite a likely history of human-caused forest change, presence of large vertebrates (e.g. sunbear signs, orangutan nests) and frugivores (e.g. hornbills and gibbons) indicate the forest in the T2 vicinity remains ecologically valuable.

Transect 3 is located more than 20km south of Transects 1 and 2 in swamp forests formerly targeted for intensive selective logging. The area covered by T3 and T4 transects still comprise one of the largest forest blocks in Rimba Raya. Transect 3 lies <1 km from the Sigintung River, approximately 5 kilometers NW of Post Sigintung. The western end of T3 is adjacent to a logging canal used to access the area and move large logs out to the river. Total basal area of T3 plots was somewhat lower than most other transect plots, which may be attributable to the logging history of the

area. OFI staff still considered the area to be "good forest" and presence of orangutan nests confirm that the forest still retains key habitat features which relate to canopy structure and tree biomass. All peat measures on Transect 3 were over 5 meters deep.

Transect 4 lies in swamp forest approximately 9 kilometers south of T3 on the Tatah "J" ex-logging canal. This canal operated for more than 15 years as the main transport route for hardwood coming out of Tanjung Puting National Park and the Rimba Raya area east to the Seruyan. This canal was closed by OFI in 2005 and there has been no recent logging activity in the area. Despite high levels of logging in the area, forest in the Tatah "J" area remains relatively intact. T4 forest had higher biomass than transect 3 based on total basal area per plot (large trees more abundant), as well as a greater abundance of orangutan nests. Like T3, deep peats were found on T4 with all peat measures greater than 5 meters.

Transect 5 is located at the southernmost end of the T3/T4 forest block where 2006 fires significantly reduced the size of the remaining forest patch in this area. Field reconnaissance indicate that deforested shrublands comprise landcover 5-8 kilometers to the west and south of this area. Remnant forests in the T5 area are characterized by standing dead and fire-blackened trees and shrubby re-growth at the edges, with a low-canopied, viney interior. Where the forest canopy was closed, approximately 500 meters from the forest edge, tree diameters were similar to those measured on other transects and some large-stemmed trees remain in the interior. The largest tree measured in the study, a 120cm lanan, was recorded at this site. Forests in this area are difficult to access and may be perceived as poor quality by local residents, and therefore remain unexplored for remaining large, valuable hardwoods such as lanan. Peats measured at this site all exceeded the tool depth which was 4 meters.

Transect 6 is located at the southern end of Rimba Raya where a relatively intact ~60km2 forest patch remains between the Seruyan River to the north and the Java Sea to the south, bordered by broad, open areas east and west. The northern edge of forest lies past seasonal lake and abandoned agricultural lands where grasslands were being burned at the time of the survey. On the northern interior of the forest patch, the survey team encountered several hand-logging sites, which included cut stems and remnant timber from large, recently cut trees including lanan and banitan kuning. Further into the interior, the forest was somewhat more open and less dense, with numerous treefalls

and canopy gaps and no evidence of recent logging. The transect was placed in a relatively homogenous patch of this forest.

T6 was hummocked and viney, with large treefalls and canopy openings but also many large trees and relatively abundant figs. Total basal area measured at T6 was greater than any other site. Peats at this site were shallower and more variable ranging from 1.7 to 4 meters deep. Most peats here measured 2-3 meters. Presence of hornbills and gibbons in and near the site confirm that the area remains high quality habitat with sufficiently high tree biomass/fruit abundance, but relative isolation of this forest patch from forest blocks 8-10 kilometers to the west and north, may account for the sparse distribution of orangutan nests.

6.2 Data Entry, Description and Summary

Survey data was entered from 209 hardcopy tally sheets recorded by day, transect, plot and subplot. An Excel workbook was set up to store data records. Three separate worksheets were used to store: 1) peat and tree volume counts, 2) biomass subplot data for small trees and 3) biomass subplot data for large trees. The data validation tool in Excel was used to constrain data entry and provide one data accuracy check. Data for each tally sheet was entered and reviewed one sheet at a time as a second accuracy check. All data was entered by Leslie who participated in the survey and is familiar with survey data and local tree names. Questions on tree names and other data entries were reviewed with biomass team leaders Pak Tumin and Pak Idul who recorded all biomass plots data on hardcopy data sheets.

A total of 12,750 meters of transect were marked and surveyed with biomass data recorded in 28 plots and 196 subplots representing 7 hectares of forest. Total data records for this survey include: 131 peat measures, 262 tree volume counts, 444 small tree diameter measurements, 1051 large tree diameter measurements and 392 tree crown measurements.

All hardcopy datasheets were photocopied with one set of originals and one photocopy stored at the OFI office and one hardcopy sent to Scott. Digital copies of the excel data were sent to project participants at Forest Carbon, OFI and InfiniteEARTH.

7. Next Steps

7.1 Data Finalization – Latin Names of Tree Species

Digital data is considered "Draft Final", that is the data transfer from hardcopy and quality checks are considered complete and ready to use in statistical analysis. These data will be augmented by adding Latin names to tree species identified in this survey. Several lists of local tree names and Latin names are currently in use by OFI and other

NGOs in the area, which will provide a starting point for translating tree names used in this survey to the correct Latin name. This work will be carried out by Leslie in the coming months as part of her PhD studies in the Rimba Raya area. Latin names of tree species will be used in the carbon assessment and other analyses that follow.

7.2 Data Analysis

Forest Carbon will take the lead in data analysis for the carbon assessment which will include relating biomass measures (including total basal area measures and tree volume estimates) on the ground to aerial imagery from recent over-flights of the transect survey areas. Survey data will also be used to develop allometric relationships of tree crown measurements to tree stem diameter which can be used to predict tree biomass from tree crown measurements obtained from aerial imagery in Rimba Raya swamp forests.

Data from this survey will also support other ecological analysis which Forest Carbon consultants and OFI researchers plan to conduct in the coming months, including research and analysis of the relationship between peat, forest and orangutan habitat quality in Rimba Raya.

7.3 Additional Field Work

In order to support ecological research, OFI will carry out additional surveys in Rimba Raya to augment data collected in this survey. Leslie will take the lead in these surveys which will include extending transects 1 and 2, adding two new transects 7 and 8 in the large forest block currently unsurveyed (Figure 8), and conducting orangutan nest surveys where forests support substantially high orangutan population densities (Transects 1,2,3,4 and new transects 7,8). Results of this field work will be shared with project participants to augment the carbon assessment and ecological database for Rimba Raya.

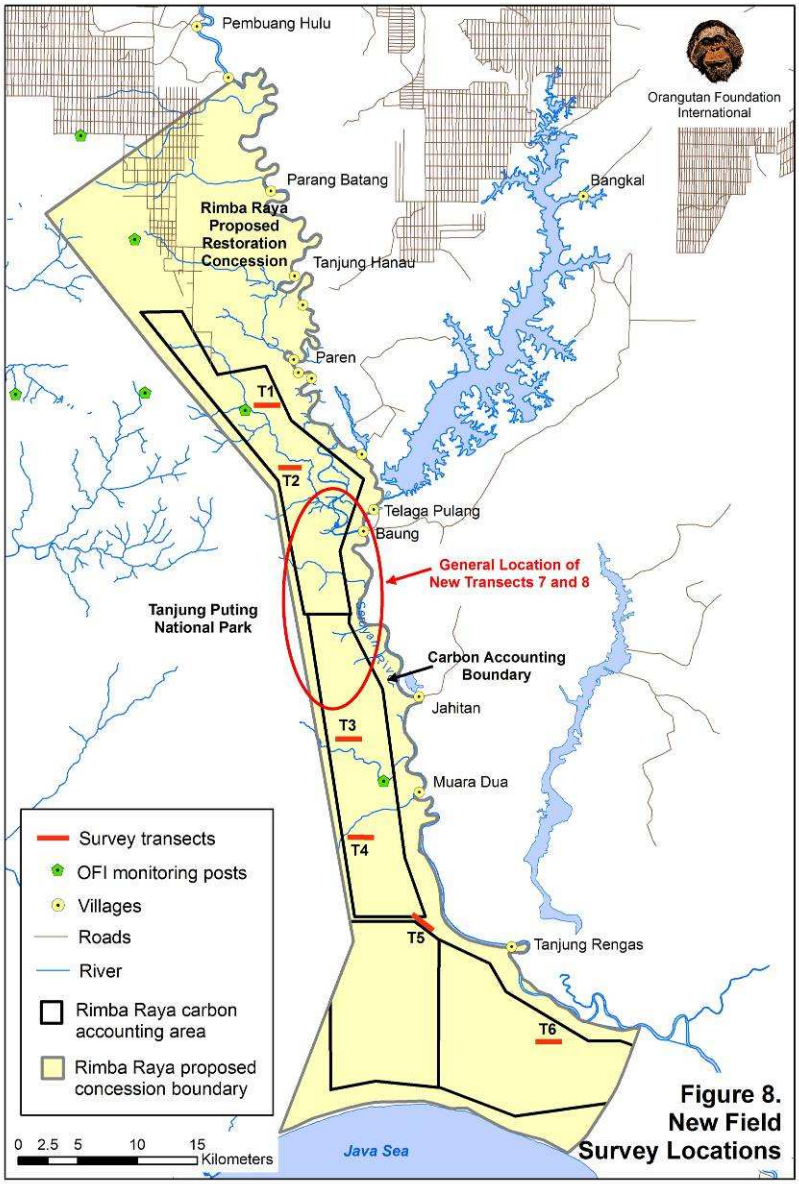


Figure 8. New Field Survey Locations

Appendix A. Detailed Maps of the Survey Areas

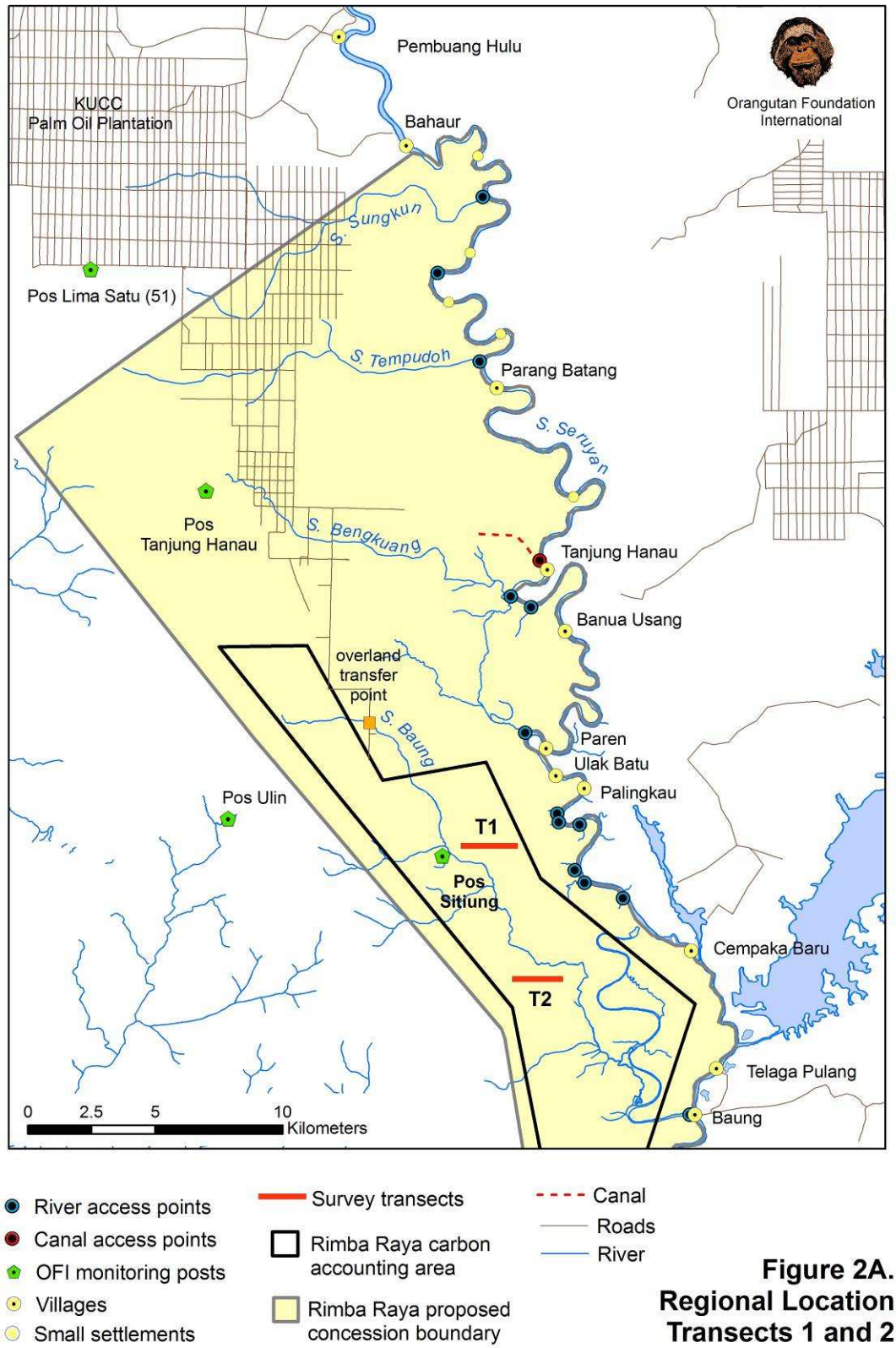


Figure 2A.
Regional Location
Transects 1 and 2

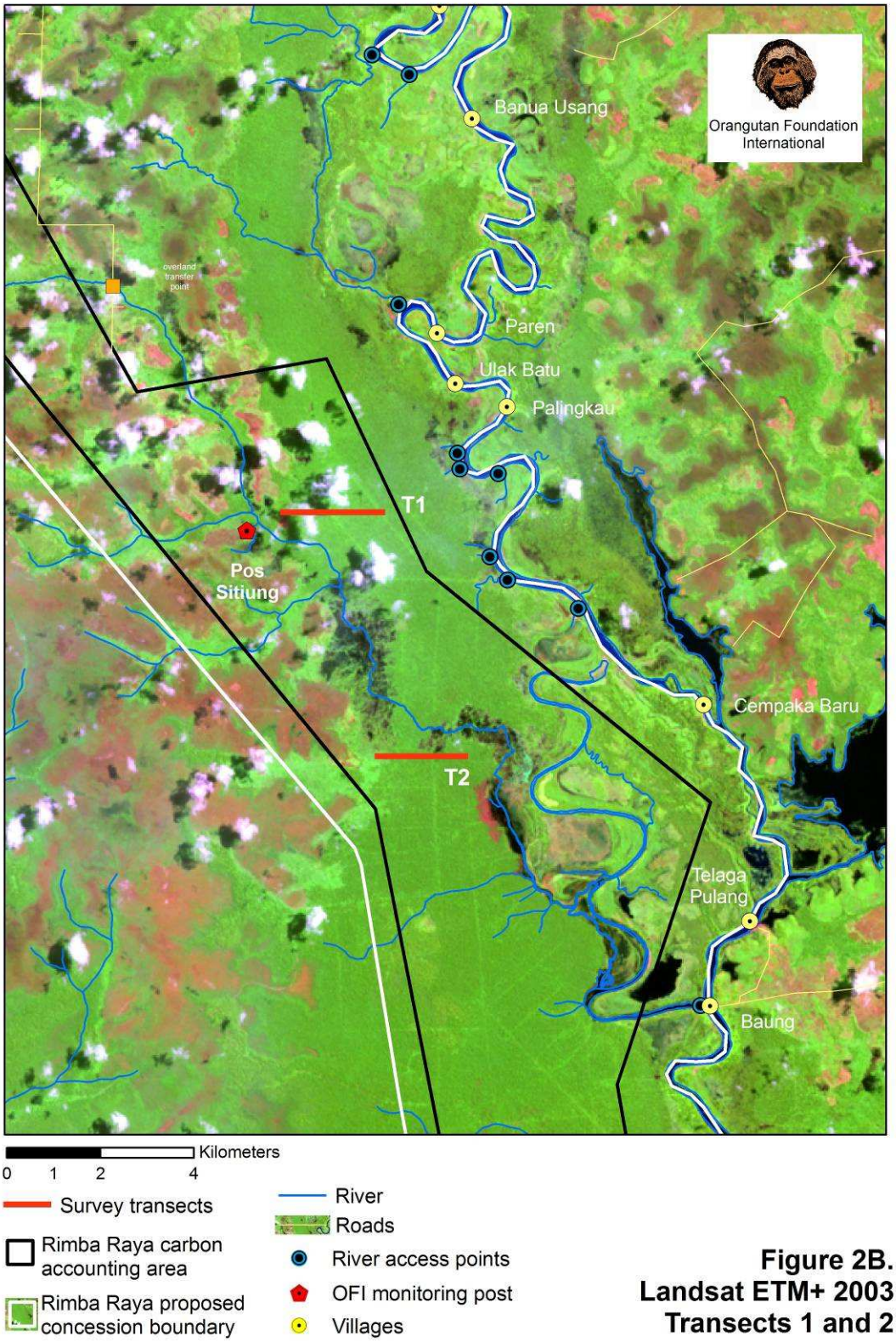
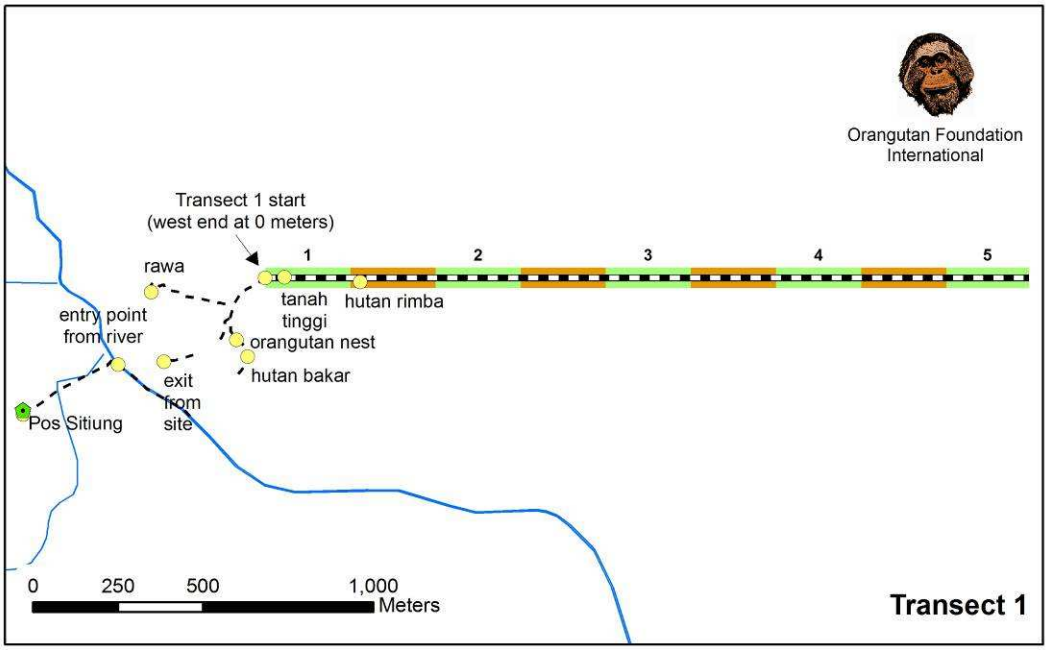
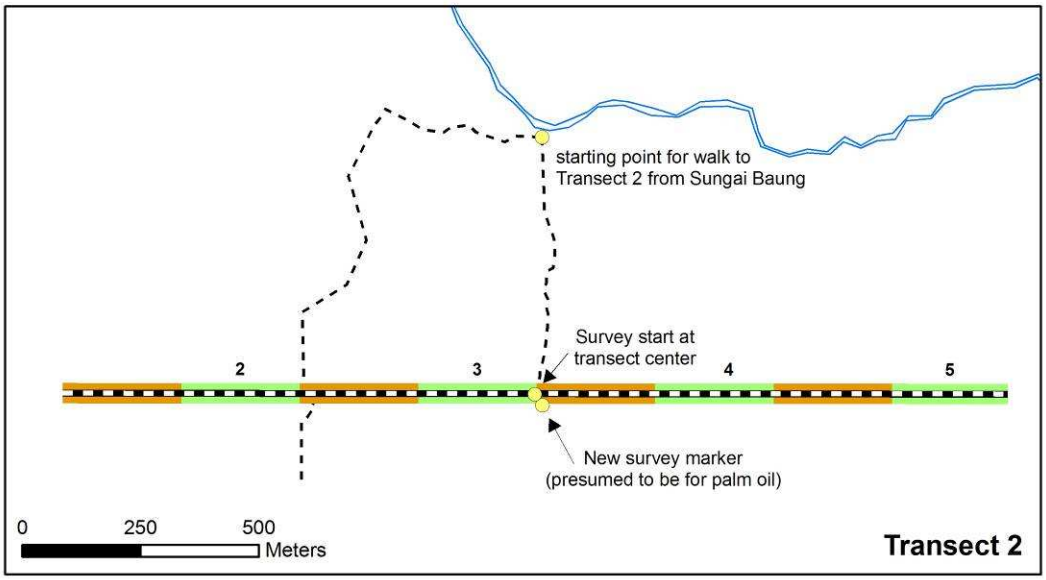


Figure 2B.
Landsat ETM+ 2003
Transects 1 and 2

Figure 2C.
Landsat ETM+ 2008
Transects 1 and 2





site locations (edited from GPS data)

track walked/cut by survey team

transect marked and surveyed

OFI monitoring post

river

Survey Type

peat, tree volume, biomass plot

peat, tree volume

Figure 2D.
Survey Sites
Transects 1 and 2

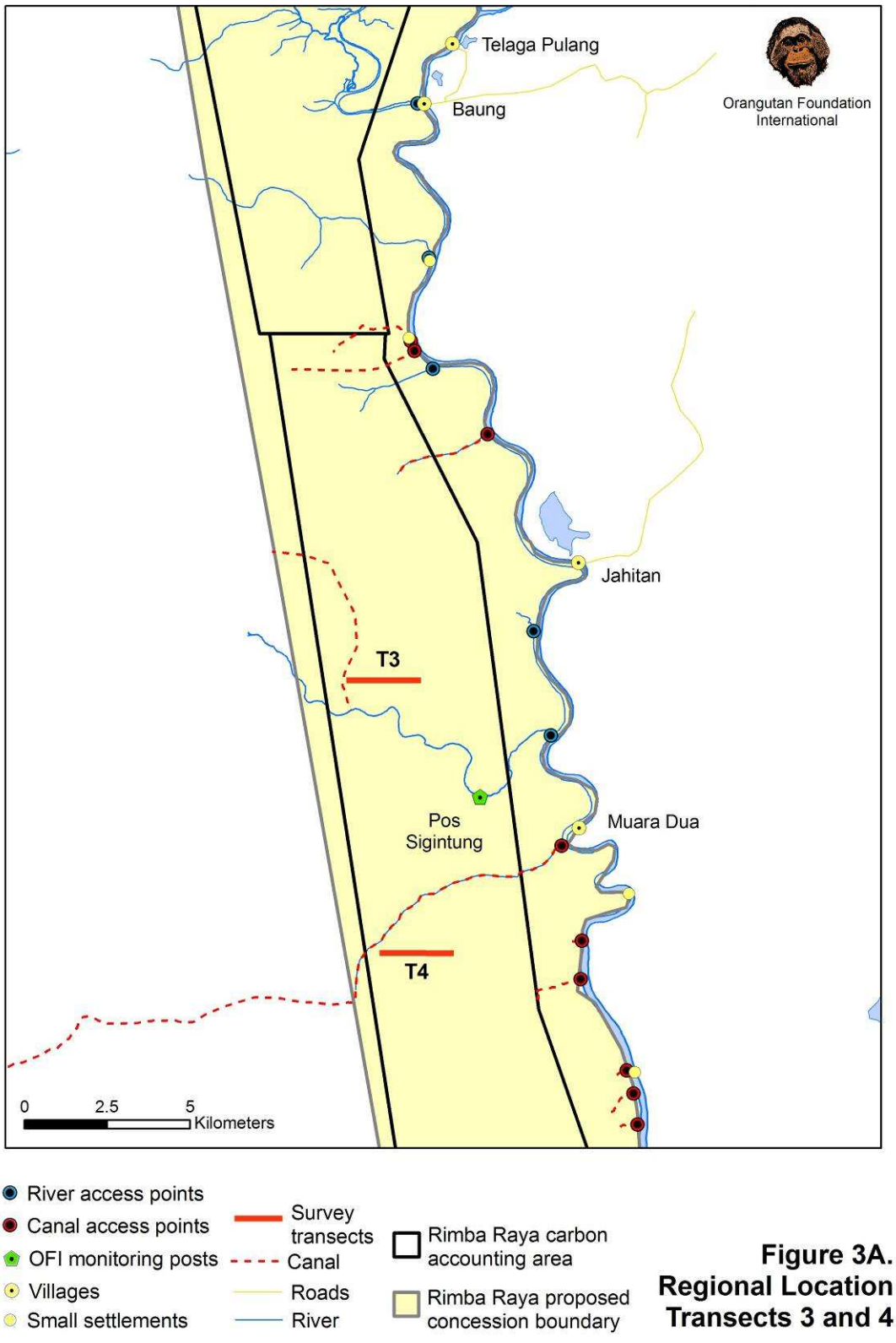


Figure 3A. Regional Location Transects 3 and 4

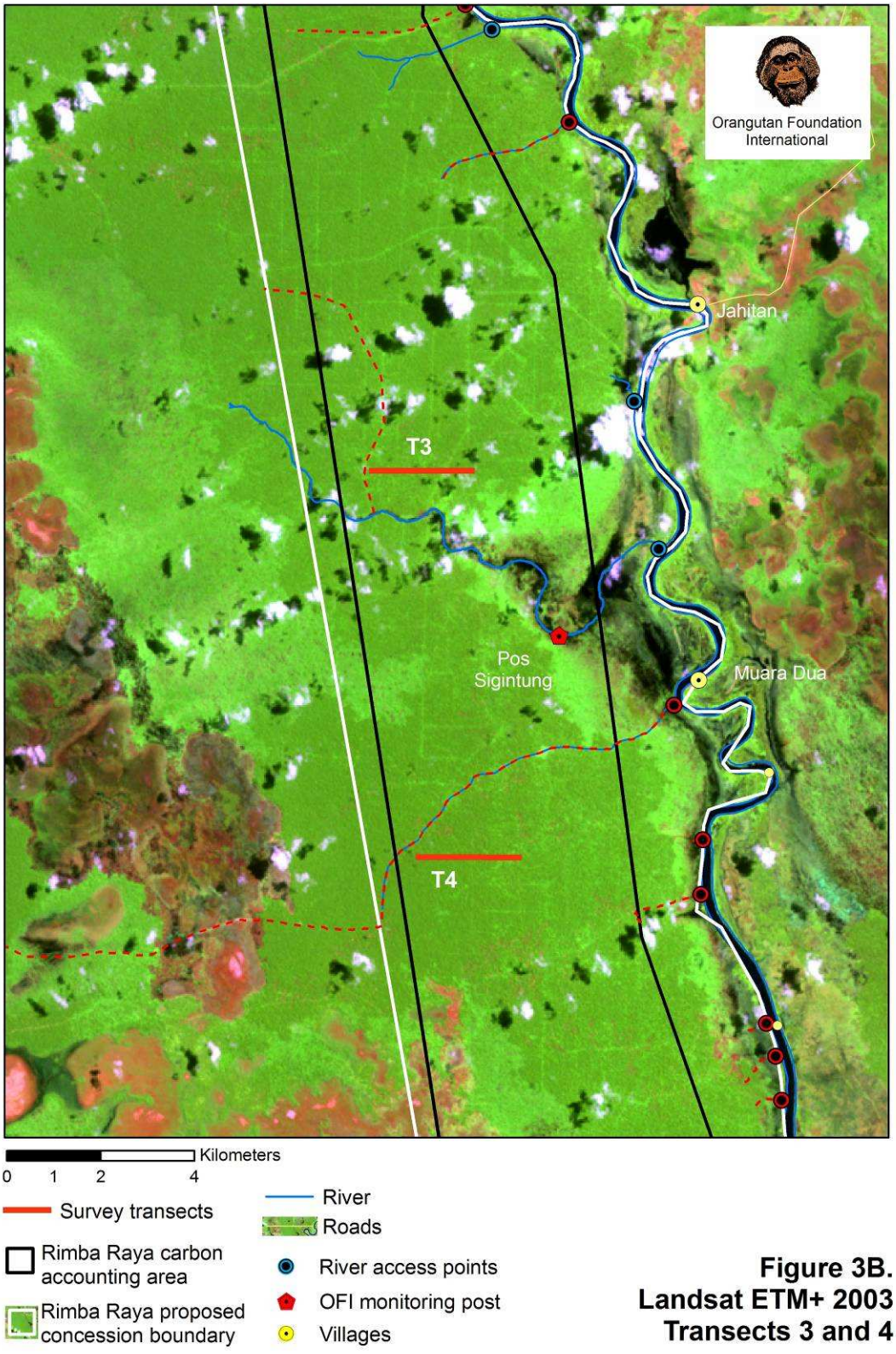


Figure 3B. Landsat ETM+ 2003 Transects 3 and 4

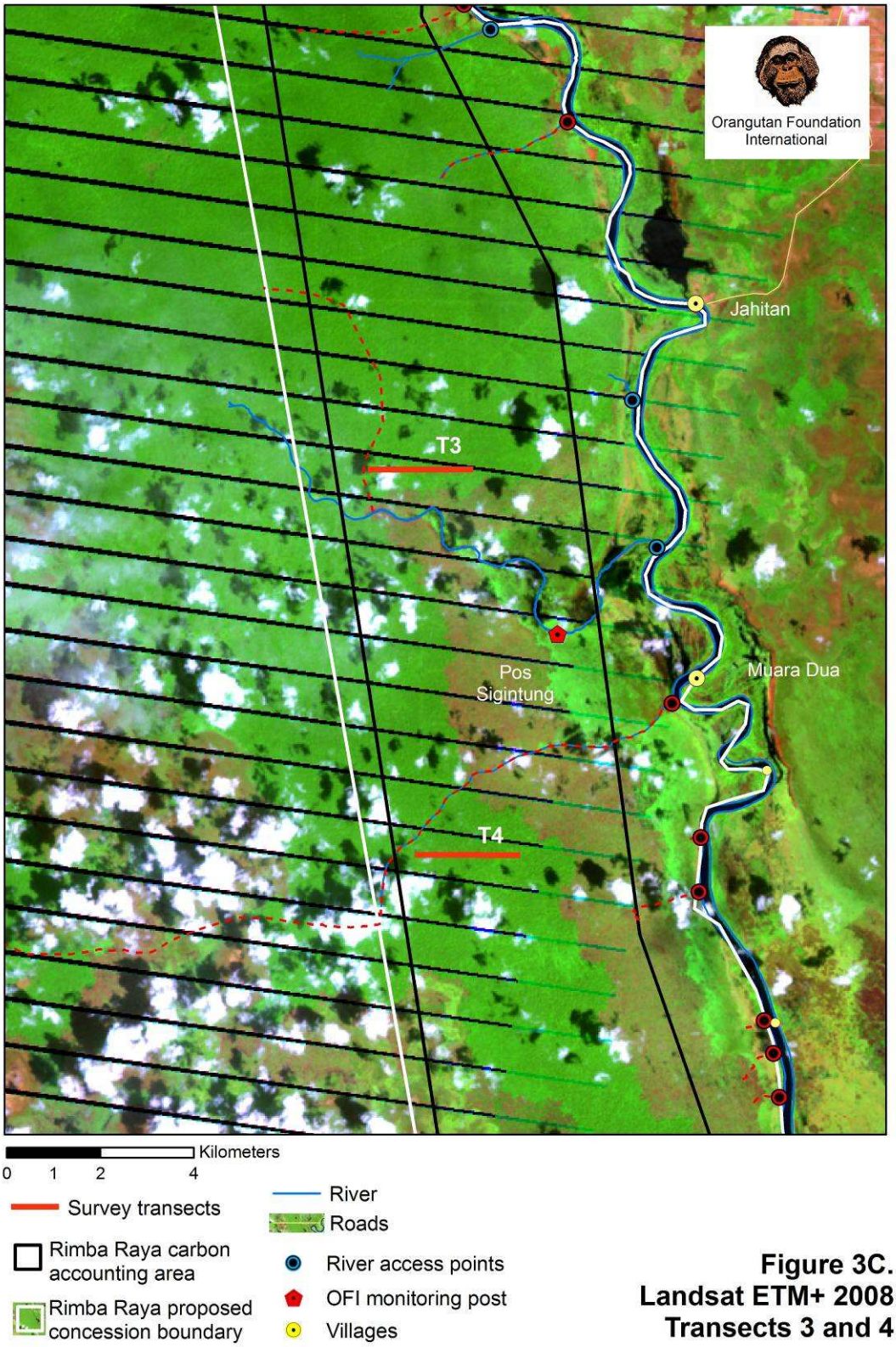
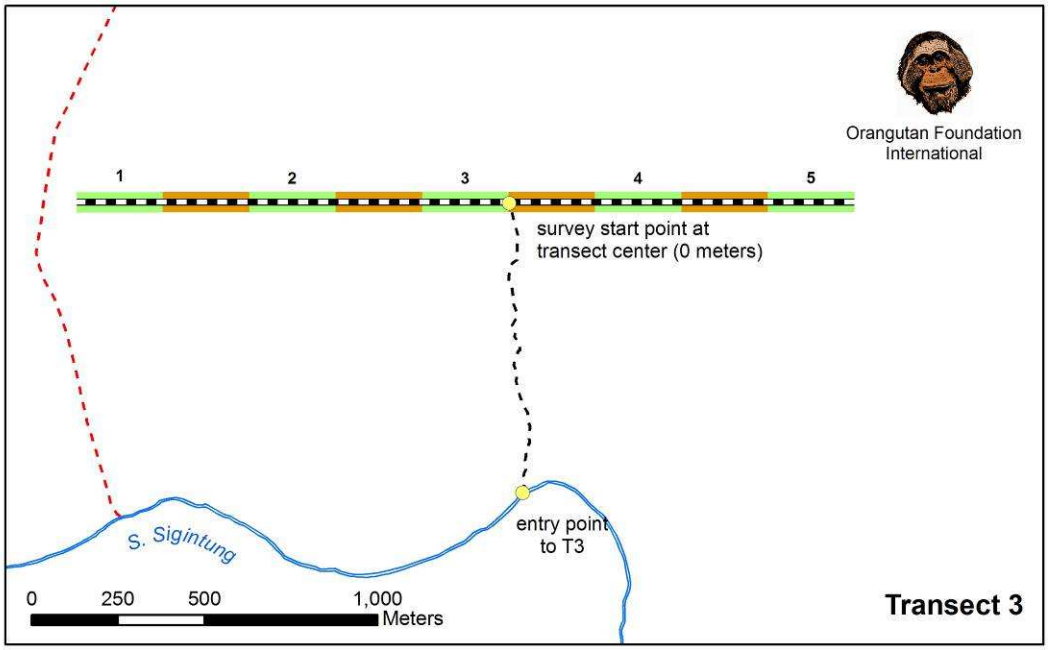
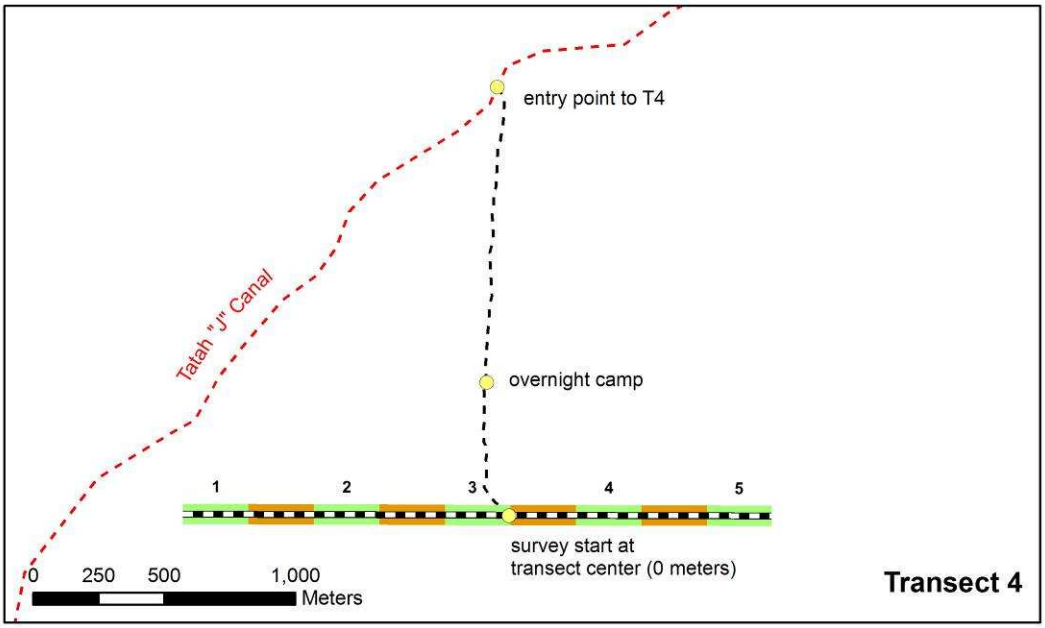


Figure 3C.
Landsat ETM+ 2008
Transects 3 and 4





Survey Type

peat, tree volume, biomass plot

peat, tree volume

site locations (edited from GPS data)

track walked/cut by survey team

transect marked and surveyed

river

canal

Figure 3D.
Survey Sites
Transects 3 and 4

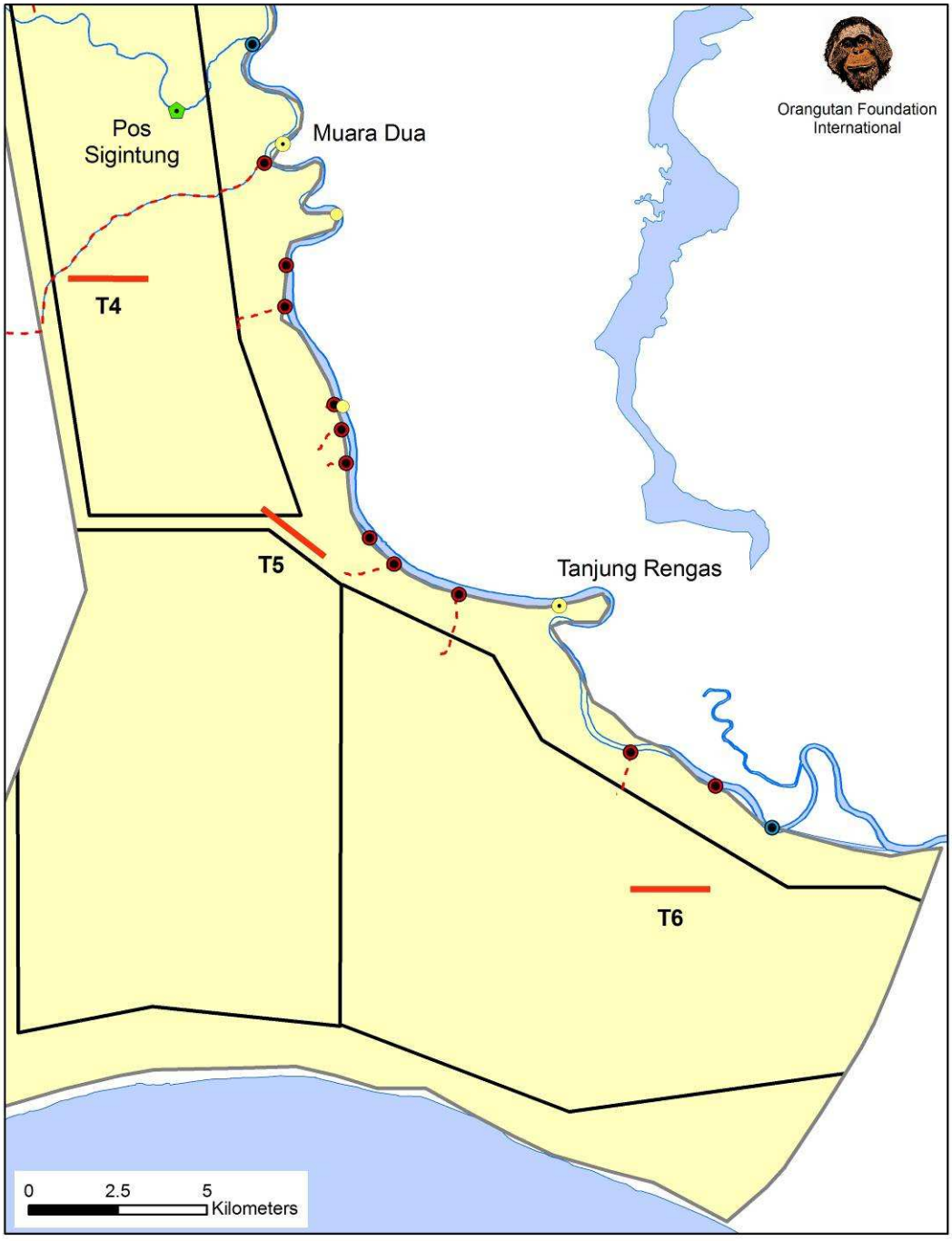


Figure 4A. Regional Location Transects 5 and 6

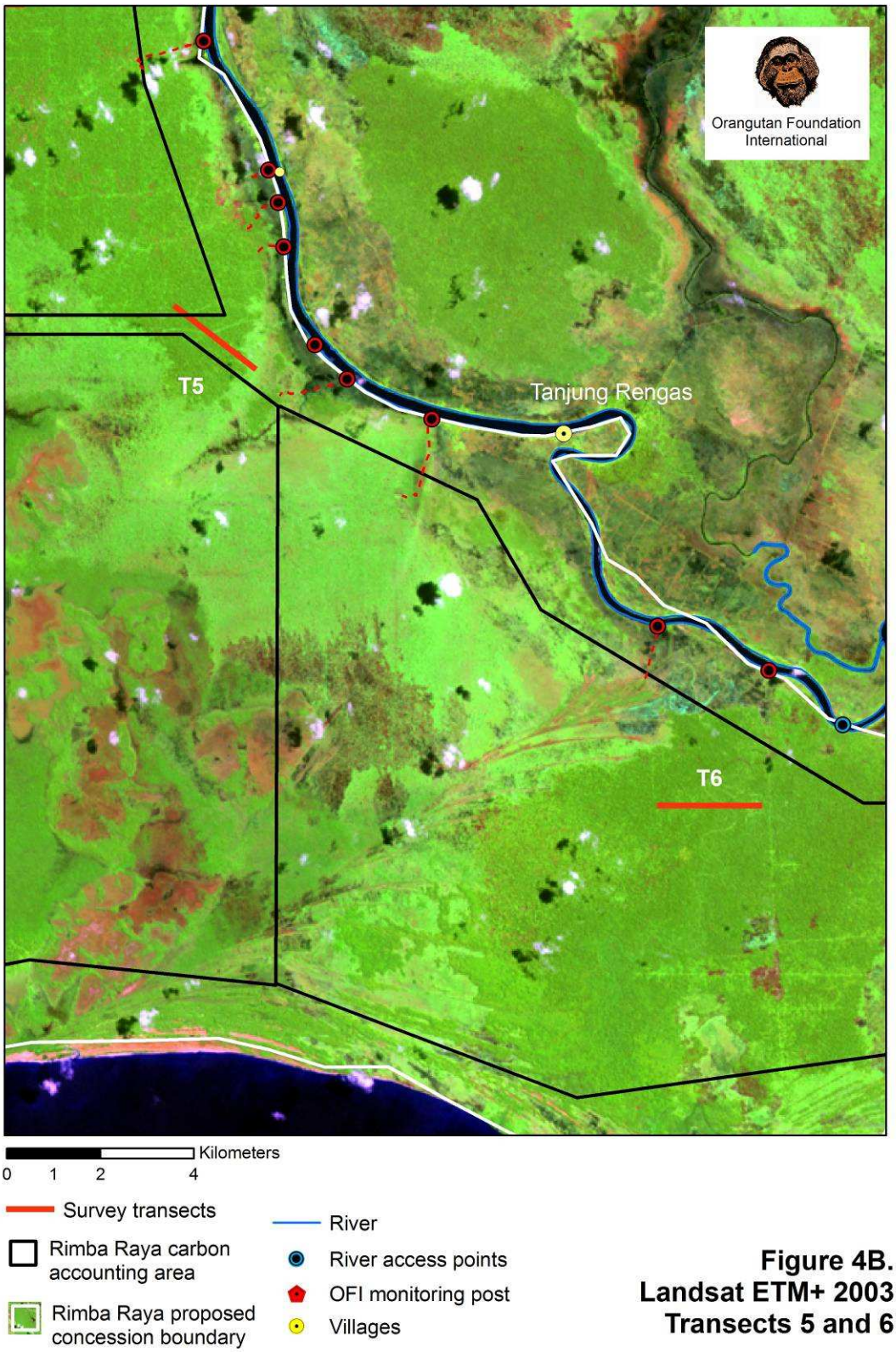


Figure 4B.
Landsat ETM+ 2003
Transects 5 and 6

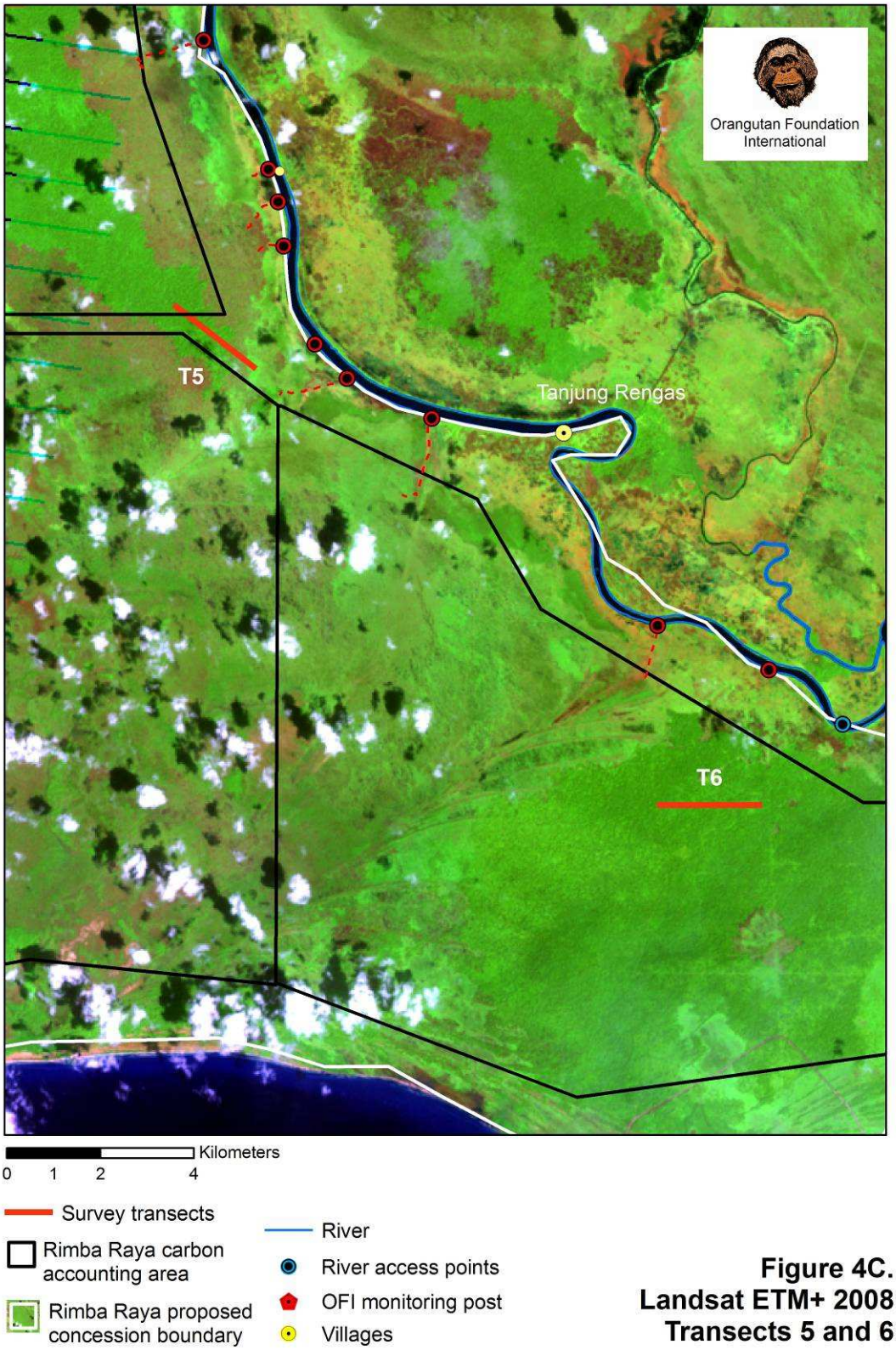


Figure 4C.
Landsat ETM+ 2008
Transects 5 and 6

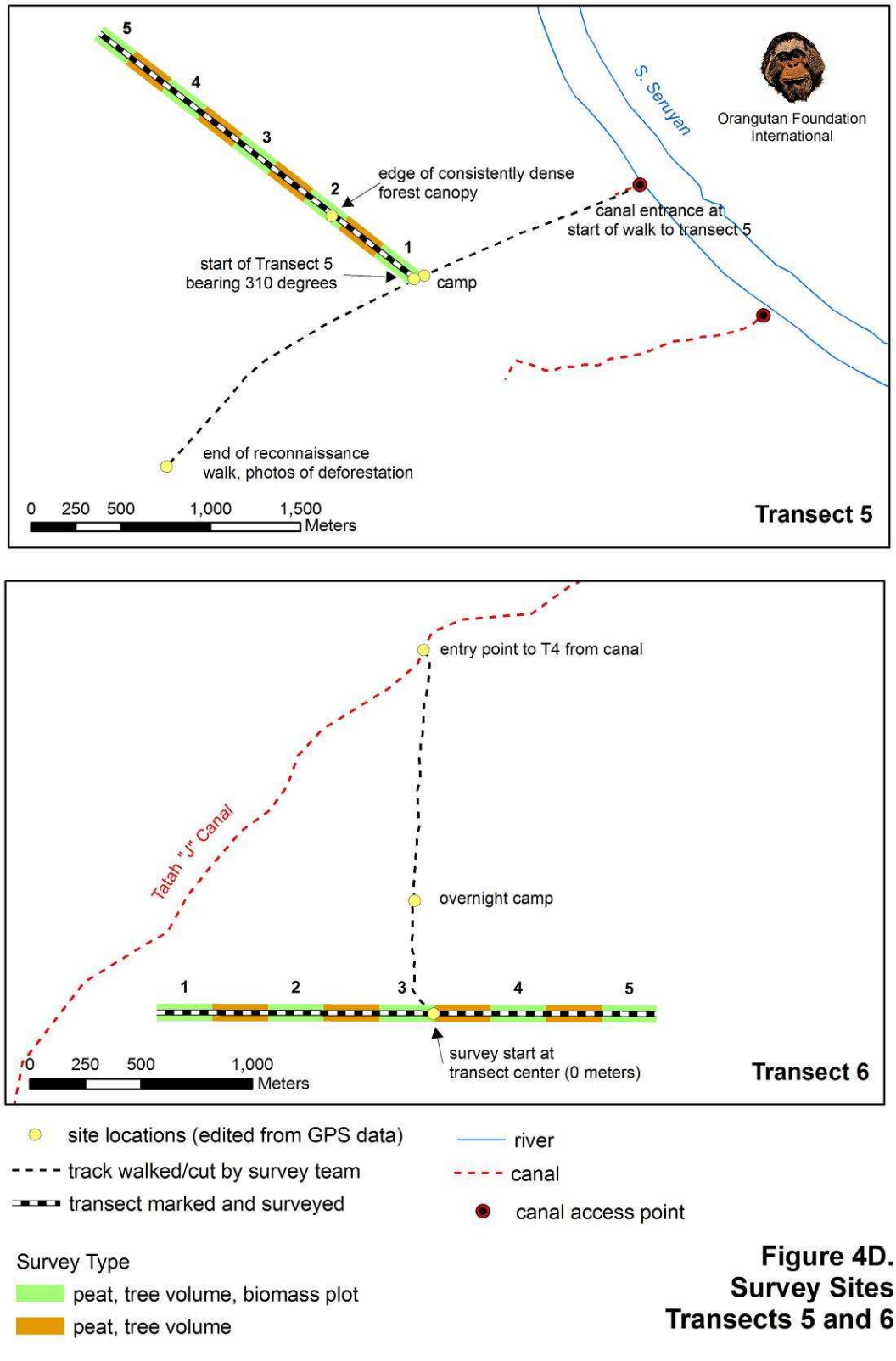


Figure 4D.
Survey Sites
Transects 5 and 6

Map A1. Transects 1 and 2 North - Post Sitiung
Map A2. Transects 3,4 and 5 Central - Post Sigintung
Map A3. Transects 6,7 and 8 South - Tanjung Rengas

Appendix B. Field Team Positions

Position Name	Sub-team Name	No. of people	Responsibilities
Note taker/Biomass team leader	Biomass	1	Records information on tally sheet, double checks the distance written on the flagging. Selects trees for canopy measurements, directs biomass team members to measure trees and manages workflow.
Tree canopy measurer (clinometer and laser)	Biomass	1	Takes distance of borderline trees using laser, measures canopy diameters and heights for subsample, measures tree heights using clinometer.
Tree identifier and diameter measurer	Biomass	2	Needs to be knowledgeable on tree species identifications. Measures DBH using D-tape. Needs to know how to read D-tape.
Note taker/Tree Volume measurer	Peat	1	Records depth of peat, takes basal area using prism, records visual condition of forest.
Peat Measurer	Peat	1	Uses peat probe to measure peat depth.
Trail cutter	Transect	1	Cuts the transect path according to directions from the compass man. Holds the 10m line to maintain the distance. Plants a pole (stake) every 10m.
Compass man/ Distance measurer	Transect	1	Controls the direction of the transect running either 90 or 270 degree. Writes the distance on flagging and attaches flagging to stake (pole). Stands at the last stake to control and maintain 10m distance for the trail cutter. Alternates positions with the trail cutter to relieve him.
TOTAL PEOPLE		8	

Appendix C. Field Equipment Checklist (2 Teams)

Tool Name	No. of units	Subteam
GPS Garmin 60cs	2	Biomass
Laser distance measurer	2	Biomass
Suunto compass	2	Biomass
Suunto clinometer (%)	4	Biomass
Diameter tapes	4	Biomass
Clip board	2	Biomass
Clip board	2	Peat depth/BA
Prism for basal area	2	Peat depth/BA
Peat Probe	2	Peat depth/BA
Pre-stretched 10m line	2	Transect measurer
Suunto compass	2	Transect measurer
Flagging tape	10 rolls	Transect measurer
Markers (spido2)	6	Transect measurer
25m Tape	2	Transect measurer

Appendix D. Accounting for Field Transport

Date	Location	Team	Transportation				Cost	Total	Paid by
			Car	Ces/Klotok	Speed Boat	Long Boat (Seruyan Water Taxi)	/ day (Rp)		
22/06/2009	P Bun-Setiung	A+B	2				750,000	1,500,000	
	Muara Dua-Setiung (warga desa)	A+B		3			workers arrived in their own klotoks		
23/06/2009	Setiung - Transek 01	A+B		3+1			*	*	
24/06/2009	Setiung - Transek 01	A+B		3+1			*	*	
25/06/2009	Setiung - Transek 02	A+B		3+1			*	*	
26/06/2009	Setiung - Transek 02	A+B		3+1			*	*	
	Setiung-P Bun (Scott and Sean)	A+B	1				600,000	600,000	
27/06/2009	Setiung-Telaga Pulang	A+B		3+1			*	*	
TOTAL								**2,100,000**	**Scott**
27/06/2009	Telaga Pulang - Pos Sigintung	A		3+1			*	*	
28/06/2009	Pos Sigintung - Transek 03 - Pos Sigintung	A		3+1			*	*	
29/06/2009	Pos Sigintung - Transek 03 - Pos Sigintung	A		3+1			*	*	
30/06/2009	Pos Sigintung - Transek 03 - Pos Sigintung	A		3+1			*	*	
1/7/2009	Pos Sigintung - Transek 04	A		4			*	*	
2/7/2009	Transek 04	A		4			*	*	
2/7/2009	Transek 04 - Muara Dua	A		4			*	*	
3/7/2009	Muara Dua- Pembuang Hulu	A				1 (5 orang)	300,000	300,000	
3/7/2009	Pembuang Hulu - Pangkalan Bun	A	1				600,000	600,000	
3/7/2009	ces rental (3 x 10 days) + (1 x 4 days)	A		4			3,900,000	3,900,000	
TOTAL								**4,800,000**	**Gabe**
27/06/2009	Telaga Pulang - muara tatah Transek 06	B			2		900,000	1,800,000	
28/06/2009	walk to Transek 06 - klotok for gear transport	B		1			60,000	60,000	
29/06/2009	Transek 06	B							
30/06/2009	Transek 06-Tanjung Rangas	B		1			100,000	100,000	
1/7/2009	Tanjung Rangas - Transek 05	B		1			70,000	70,000	
2/7/2009	Transek 05	B							
3/7/2009	Transek 05 - Muara Dua	B		1			200,000	200,000	
4/7/2009	Muara Dua- Pembuang Hulu	B				1 (5 orang)	350,000	350,000	
4/7/2009	Pembuang Hulu - Pangkalan Bun	B	1				600,000	600,000	
TOTAL								**3,180,000**	**Leslie**
GRAND TOTAL								**10,080,000**	

NOTES

* 1 OFI klotok + 3 rented klotoks were used for 10 days of surveys by combined team and Team A. Team A rented an additional (small) klotok for the last 4 days of survey. Total cost of this rental 3,900.000Rp is shown 3/7/2009.

speed boats were quoted at 2,000,000 each for return to Pembuang Hulu so teams used longboat taxi

Appendix E. Accounting for Logistics (12 days, 18 people)

Pre-trip Equipment and Fuel

Item	Amount		Rp	Paid By
Terpal 6x8 m	1	Rp	430,000	Tumin
Meteran 50 m	2 @ 45,000Rp	Rp	90,000	Tumin
Sarung tangan	1 Lsn	Rp	30,000	Tumin
Survey Supplies (folders, pens, etc)		Rp	52,000	Tumin
Survey Supplies (clipboards, folders etc)		Rp	107,000	Leslie
Bensin	40 Liters @ 5000 Rp	Rp	200,000	Tumin
Roda	4 @ 10,000 Rp	Rp	40,000	Tumin
cooking equipment		Rp	240,000	Tumin
cooking equipment		Rp	615,000	Tumin
Total		**Rp**	**1,804,000**	

Pre-Trip Logistic (Food, Water, Mosquito Coils, First Aid etc)

Item	Amount		Rp	Paid By
Food	1 week supply	Rp	681,000	Tumin
Food	1 week supply	Rp	156,000	Tumin
Food	1 week supply	Rp	1,889,000	Tumin
Sayur	3 day supply	Rp	250,000	Tumin
Air Mineral (Aqua)	6 dus	Rp	222,000	Tumin
First Aid		Rp	86,000	Tumin
Total		**Rp**	**3,284,000**	

In Field Equipment and Fuel

Item	Amount		Rp	Paid By
peat tool repair and transport		Rp	500,000	Scott
bensin		Rp	250,000	Gabe
bensin	20 liters @ 6000	Rp	120,000	Gabe
bensin	20 liters@ 5250	Rp	105,000	Leslie
minyak tanah	5 liters @ 4000		20,000	Leslie
roda	10 pc @ 10,000		100,000	Leslie
minyak tanah	10 liters @ 5000		50,000	Leslie
roda	10 pc @ 9,000		90,000	Leslie
survey supplies (pens, book)			31,000	Leslie
Total			**1,266,000**	

In Field Logistic (Food, Water, Mosquito Coils, First Aid etc)

Item	Amount	Rp	Paid By
food, water		417,000	Leslie
food, water, first aid		433,000	Leslie
field gear (gloves etc) and first aid		77,000	Leslie
overnight, meals, photocopies		250,000	Leslie
overnight, meals		100,000	Leslie
makan siang longboat		161,000	Leslie
food		201,000	Gabe
Total		**1,639,000**	

GRAND TOTAL	**Rp**	**7,993,000**