Special Features

Ulu Segama Malua Forest Reserve
Photo by Dr. Arthur Chung

Some notes on *Agathis* in Sabah

When the word 'Agathis' is mentioned in Sabah, it is usually in reference to its buff-coloured timber, turning almost golden when varnished. However, due to their naturally limited occurrence, *Agathis* timber is a very scarce commodity these days. Not many Sabahans can relate to the tree itself because they are generally found along ridges at elevations above 500 *m* in remote areas not readily accessible to the public. Perhaps the easiest place to see Agathis is at the Rafflesia Visitor Centre near Tambunan, where they are one of the more common canopy trees behind the visitor centre.

Taxonomy

Agathis is a broad-leaf conifer belonging to the family Araucariaceae, represented by two genera (*Araucaria* and *Agathis*). Araucariaceae is represented in Borneo only by the genus Agathis. It is a relatively small genus, consisting of 21 species worldwide, and confined to the Malesian region and the Southern Hemisphere (e.g. New Caledonia, Australia, and New Zealand) where they are generally known as kauri. The giant kauri pine of New Zealand (*A. australis*) is probably the best known *Agathis* species due to its large size and long history as a timber tree.

Although there is still uncertainty in their identifications, current taxonomic knowledge identifies five species of Agathis that are found naturally in Sabah – *A. Borneensis*, *A. Endertii*, *A. Kinabaluensis*, *A. lenticula*, and *A. orbicula*. The distribution and taxonomy of the five species in Sabah remains unclear due to the lack of careful and systematic study. The largest amongst these *Agathis* spp. is *A.borneensis*, commonly reaching diameters of over 120 *cm* and attaining heights of up to 60 *m*. The adult tree itself is typically tall, perfectly straight, with a cylindrical bole lacking buttresses. The common vernacular name (Dusun) for *Agathis* in Sabah is *Mengilan*, whereas in Peninsular Malaysia it is known as *Damar Minyak*.

Ecology

In Sabah, *Agathis* spp. are generally confined to relatively sandy soils of the Crocker and Maliau soil associations. They are typically found on the upper slopes, along ridges, and plateaus from elevations 600 *m* to about 2000 *m asl*. Therefore, *Agathis* is considered an upland to lower montane element. However, in Brunei and parts of Indonesian Borneo, *A. borneensis* is known to occur in nearly pure stands in the sandy margins of some peat swamps and lowland kerangas forests where the standing volume of *Agathis* can reach 400 m^3ha^{-1}. No such low-altitude stands are found in Sabah. Field observations in Sabah find both *A. borneensis* and *A. kinabaluensis* occurring over the same sites, thus suggesting overlapping distribution.

Large trees of *A. borneensis* are common along the ridge tops of the Nurod Urod Forest Reserve.

Noteworthy natural populations of *Agathis* are still found in the Maliau Basin Conservation area, the Kinabalu, Tawau Hills, and Crocker Range State Parks, the Ulu Padas and Nurod Urod Forest Reserves, as well as the recently created Mengilan Forest Reserve (FR). The Mengilan FR was gazetted in 2011 mainly to preserve the *Agathis*-rich stands in the area.

22-year old *Agathis kinabaluensis* planted in a row at the Rafflesia Information Centre, Tambunan

(L-R) Young male cones of *Agathis Borneensis;* the distinctive bark character of *Agathis* makes it easily identifiable in the field; and fresh-flowing *Agathis* resin exudate burns readily.

Timber & Wood properties

The principal source of Agathis timber in Sabah is likely to be *A. Borneensis* and *A. kinabaluensis*, owing to their commonness and relatively more widespread distribution. The wood of *A. borneensis* is soft, and classified as 'light,' with a wood density ranging 450-550 kg m^{-3} at 15 % moisture content. *Agathis* wood is not durable when exposed to the weather or in contact with the ground. The timber is very susceptible to attack by dry-wood termites, and is readily attacked by subterranean termites. It must be processed and dried quickly as it is susceptible to blue stain. The timber peels well and makes excellent plywood. When *Agathis* timber was still abundantly available, it was popular as decorative panels for walls and ceilings, and also commonly used in furniture making.

Other uses

Before the large-scale exploitation of *Agathis* for its timber, *Agathis* was tapped commercially by rural natives for its resin, also generally known as 'copal'. The difference between copal from *Agathis* and dipterocarp resins is that copal is readily soluble in alchohol, while the latter is not.Copal is used to in the industrial manufacturing of wood varnish and paint, and incense to a lesser extent. The increasing use of synthetic resins later led to the decline in demand for copal. Due to improper tapping techniques, the practice of resin-tapping in the past was destructive, and usually leads to tree death. The trade of copal from Sabah has longed ceased, with the last documented copal export of about 390 *kg* (valued at $4,500) reported in the Annual Report 1966 of the Sabah Forestry Department. The export of dipterocarp resins (damar) from Sabah were much greater than copal, but in subsequent years, export statistics lump copal and damar together, so the proportion of each produce could not be determined. Today, the largest producer of copal is Indonesia (namely Java) and the Philippines, where *Agathis* was planted specifically for copal production. Although it continues as a small scale industry to provide livelihoods for certain communities, its trade is not as significant as in the past.

Today *Agathis* is planted in Sabah as an ornamental, more commonly in arboreta or botanical gardens, as a subject of peculiar botanical interest, being one of few conifers that occur naturally in the tropics, and bears cones like the more common and widespread conifers found in temperate regions. *Agathis* can grow in the open under relatively poor soil conditions.

Agathis is usually the dominant species in the highland kerangas forest of the Ulu Padas Forest Reserve.

Prospects

Agathis is not cultivated commercially in Sabah for any purpose, and is not likely to figure as an important timber species in the future, largely owing to its relatively slow growth when compared to other popular plantation species. The use of modern chemosystematic techniques should be explored in resolving taxonomic issues for Agathis.

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Bornean Sun Bear Conservation Centre Progress in 2012

Project background

The BSBCC was established as a not for profit organization in Sabah in 2008. It is a joint project between sun bear researcher Wong Siew Te, Land Empowerment Animals People (LEAP), the Sabah Wildlife Department (SWD) and the Sabah Forestry Department (SFD).

The project consists of a two-stage effort to provide for the care, rehabilitation and release of orphaned and captive sun bears, as well as much needed education and awareness for the species.

The BSBCC facility is located directly adjacent to the world-renowned Sepilok Orang Utan Rehabilitation Centre (SOURC) in Sandakan, Sabah, on the site of an old bear house and a former rhino enclosure provided by SWD, along with several hectares of adjacent forest provided to the project by the SFD. The Centre includes large forest enclosures in existing primary forest in order to provide a natural environment better suited to the needs and welfare of the bears and facilitate the rehabilitation, training and return of individuals to the wild. Sun bear mothers spend the first 2-3 years of their cub's life teaching survival skills. The Centre will aim to reach these skills to orphaned/ex-captive bears before they are reintroduced into the wild. The Centre also aims to provide critical outreach, information and education materials to promote knowledge and awareness of this little known species locally, regionally and internationally and serve as a base for continued sun bear research in Sabah.

The Centre will have capacity for 43 bears, accommodated in two new bear houses and eight large fenced forested enclosures. Constructed of the first bear house, with a capacity of 20 bears, was completed in early 2010, and the bears previously kept in cramped quarters in the old bear house were successfully moved into the state-of-the-art new facilities. These bears were able to go out into the adjoining forest enclosures and experience their natural habitat again, some after spending many years in small cages. Since then more bears have been brought to the Centre, bringing the total at the end of 2012 to 28.

Funding was received in 2011 from the Malaysian Federal Ministry of Tourism, through SWD, for the construction of an observation platform to view the bears in the forest enclosures and access trails to the platform from the old bear house, an access boardwalk from the main car park at Sepilok, and upgrading of the existing roads and drains. The construction began in August 2011 and was completed in May 2012.

Although the BSBCC is not yet opened to the public, with the completion of the boardwalk and observation platform, occasional visitors can have the chance to observe sun bears in their natural habitat of the attached forest enclosure.

Operations

BSBCC Board of Directors

Cynthia Ong and Wong Siew Te remained as BSBCC Directors during 2012. The Directorship of Mr. Fred Kugan, Deputy Director of SFD, was confirmed in September 2012 while that of Mr. Augustine Tuuga, Deputy Director of SWD, was still in progress.

Meetings with Partners

Throughout the year three meetings were held between partners LEAP, SFD and SWD, on 21st March, 10th July and 16th November 2012.

Staffing

During 2012, 8 new staff joined the BSBCC team bringing the total number to 11.

Visitors enjoying the view of a sun bear in its natural forest habitat from the newly constructed observation platform. (Photo courtesy of Cede Prudente)

(L-R) Animal keeper David and a volunteer feeding the bears in the enclosure; animal keepers and volunteers putting together tyres into a "tyreball" as enrichment for the bears; and general worker maintaining the tidiness of the Centre.

Standing from left to right: Dawn Tukalan, David bin Tahir, Tee Thye Lim, Wong Siew Te, Ng Wai Pak, Chiew Lin May & Gloria Ganang. **Sitting from left to right**: Beyri Demsy, Azzry bin Dusain, Tommy Johnny & Julian Benignus.

The addition of new staff at BSBCC greatly helped in the daily operations of the Centre, including in management, maintenance of facilities, bear husbandry and welfare work and educational activities.

Staff Development Activities

A 3-day Animal Enrichment Workshop was held on 22nd June 2012 by BSBCC's Project Manager, Ng Wai Pak. The workshop was attended by BSBCC staff and volunteers and focused on safety and the importance of enrichment for captive animals to meet their daily needs.

From 26th to 30th November 2012, Wong and Thye Lim took part in a training workshop on Surveillance and Prevention of Emerging Infectious Diseases from Wildlifeorganized by SWD with EcoHealth Alliance, at Lok Kawi Wildlife Park in Kota Kinabalu.

Enrichment workshop attended by BSBCC staff and volunteers.

Sun Bears

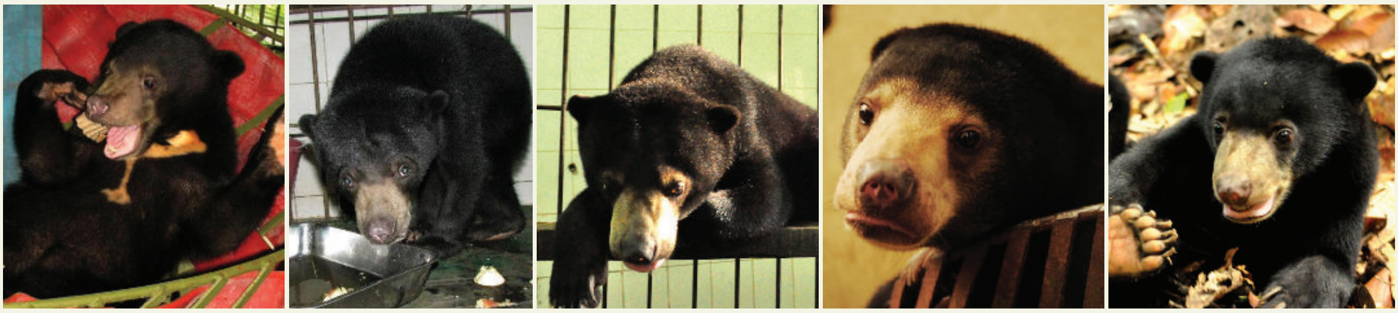
Bear Arrivals in 2012

2012 commenced with 23 bears at the Centre, increasing to 28 bears by end of the year. All the bears which arrived in 2012 were females, four of them sub adults aged between 1 - 2 years old and one bear cub aged 5 months. All except one were surrendered to SWD by members of the public before being brought to BSBCC.

Health Checks

Annual health checks were conducted on all resident bears at BSBCC in 2012 by SWD Wildlife Rescue Unit veterinarian Dr. Diana Ramirez or veterinarian Dr. Nigel Hicks of Sepilok Orang Utan Appeal UK. Health checks were also conducted on newly arrived bears.

Dr. Diana and Wong conducting a health check on Bongkud at BSBCC.



(L-R): Debbie, Coco, Ah Bui, Bongkud and Damai - new bears which arrived at BSBCC in 2012.

Bear Training & Introduction to Forest Enclosures

The BSBCC staff conducted electric fence training on all the bears that were released to the forest enclosures. By the end of 2012, a total of 8 adult females were being released daily into the enclosures, as well as 3 adult males. The bears started to perform natural activities in their forest habitat, and were often seen climbing, resting, foraging and making nest in their enclosures.

During 2012, electric fence training was also conducted for sub adult bears Natalie, Runggus, Ah Lun and Julaini, in preparation for them to be released in the forest enclosures. Newly arrived sun bear cub, Damai, was brought out to the adjacent forest daily by BSBCC staff, as soon as she had completed her quarantine period.

(L-R) Keningau, climbing a tree in the forest enclosure; Lawa, enjoying her nest on a tree; and Damai breaking open a termite mound.

Enrichment

Bears were also equipped with different types of enrichment in their indoor cages. Enrichment items provided were donated or made by groups visiting the Centre or custom made by BSBCC staff and volunteers.

(L-R) Ah Lun digging treats from a toy ball; Runggus hanging from a fire hose hammock; and Natalie balancing on a tyre ball.

Sun Bear Reintroduction Activities

A team comprising staff from BSBCC and SWD Wildlife Rescue Unit (WRU) visited Tabin Wildlife Reserve in south east Sabah from 10th -12th December 2012 to check whether the area is a possible future release site for rehabilitated sun bears. Five camera traps were set up in different parts of the Reserve to start gathering information on the resident sun bear population and other wildlife.

Wong and WRU staff setting up a camera trap in Tabin Wildlife Reserve.

Volunteers

Bear Action Teams (BATs) Volunteer Groups

The BATs programme continued to run successfully throughout 2012 with a total of 8 groups (119 individuals) participating from Camps International and Raleigh International.

Camps International volunteers partially completed a composting area next to the new bear house.

The Raleigh International volunteers built climbing structures for bears, to be placed in the second bear house forest enclosure as enrichment.

(L-R) Camps International volunteers building the foundation for the composting area; Raleigh International volunteers with the completed bear climbing structure; and Raleigh International volunteers and the foundation of the bear climbing structure.

Individual Volunteers

Individual volunteers continued to play an important role at BSBCC, assisting with enrichment, feeding and cleaning, maintenance and education. They are also important ambassadors especially in promoting awareness of sun bears in their respective countries. A total of 28 individual volunteers from 11 countries worked at BSBCC in 2012, out of a grand total of 85 individual volunteers who have contributed to the Centre since its establishment.

(L-R) Volunteer Margaret helping in maintaining the cleanliness of the new bear house area; Miriam assisting in the food preparation for the bears; and Ronan helping out in maintaining the roof for the compost bin area.

Infrastructure Development

Observation Platform Access Road Upgrading & Access Boardwalk

In addition to the Centre's old bear house and new bear house, an observation platform is essential for BSBCC to achieve its aims in promoting awareness to the public about sun bears. In 2011, the Malaysian Federal Ministry of Tourism, through SWD, provided funding for the construction of an observation platform, access trails to the platform from the old bear house, upgrading of the existing roads and drains, and an access boardwalk from the main car park at SOURC. This construction was completed in August 2012.

(L-R) Front view of the observation platform; concrete road to the new bear house; access boardwalk connecting the main Sepilok car park with BSBCC; and ground path leading towards the future BSBCC visitor centre.

The handing over ceremony of the newly completed structures to BSBCC and SWD on 14th July 2012. From left: Mdm Sylvia Alsisto (Officer in Charge of SOURC), Mdm Jum Rafia (Deputy Director of SWD) and Wong Siew Te (Founder & CEO of BSBCC).

Financial Summary

Funding

In 2012, BSBCC received a major grant of RM2.1 million from Yayasan Sime Darby (YSD) for the period of March 2012 to February 2013, to be used for construction of the second bear house and renovation of the old bear house to create a visitor reception area, office and new bear holding area, as well as operation expenses and reintroduction of sun bears to the forest. A proposal for funding of RM1.4 million for construction of remaining components including the second bear house forest enclosure and professional fees was submitted to the Malaysian Federal Ministry of Tourism in August 2012, however confirmation regarding this funding had not been received by the end of 2012.

Two vehicles purchased with Yayasan Sime Darby funding.

Due to unforeseen delays in the construction of the visitor centre, BSBCC was not able to open to the public in 2012 and generate revenue to support the operation costs.

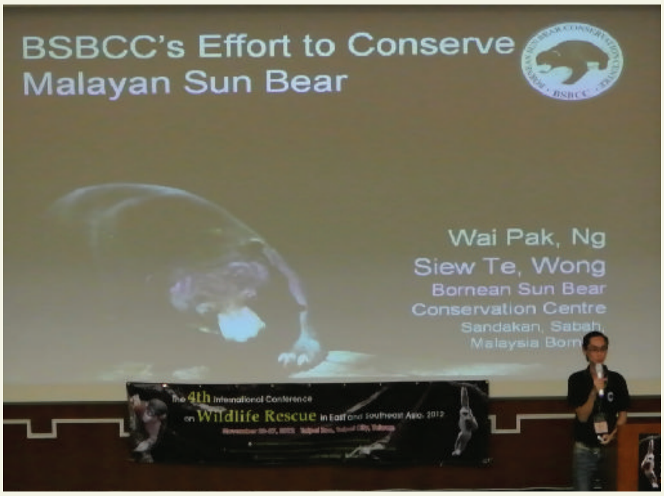
Fundraising

Various fundraising events throughout the year included Rockin' 4 the Environment - Sun Bear Rock held in Kuala Lumpur and Sun Bear Serenade held in Kota Kinabalu, as well as several corporate initiatives and donations and through Facebook.

Public Awareness & Education

Public awareness activities continued to be carried out during 2012, through blogs, facebook and the BSBCC website which was launched at the end of the year. Two film groups filmed at BSBCC during 2012 and BSBCC featured in at least three TV programmes, while several newspaper articles on sun bears were published. Wong Siew Te took part in three live radio interviews and gave a TedxKL presentation on BSBCC and Wai Pak presented at an international conference in Taiwan on Wildlife Rescue in East and Southeast Asia.

Educational programmes were carried out at BSBCC throughout the year, with a total of 596 school and university students from both local and international institutions visiting BSBCC in 2012. BSBCC was also one of the venues for the EE Race for local teachers.



Wai Pak during his presentation at the conference in Taiwan.

Universiti Malaysia Sabah (UMS) students talk session with Wai Pak.

Notable Visitors

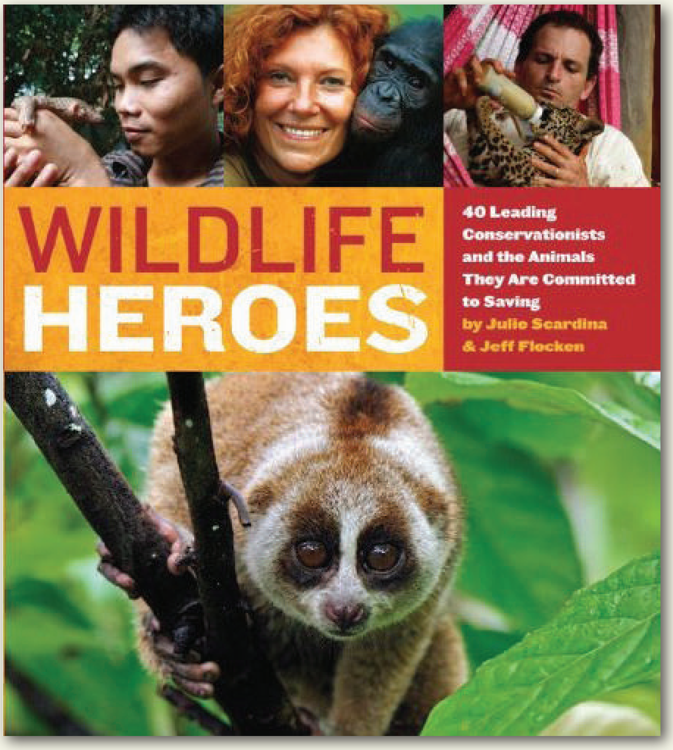
Federal Minister of Tourism, Dato Sri Dr. Ng Yen Yen visited BSBCC on 12th June 2012, accompanied by the Chairman of Sabah Tourism Board Tengku Adlin. She also visited the completed observation platform and access boardwalk and walkway built using funds from the Minister of Tourism.

Wong explaining about BSBCC operations to Dato Sri Dr. Ng Yen Yen and Tengku Adlin.

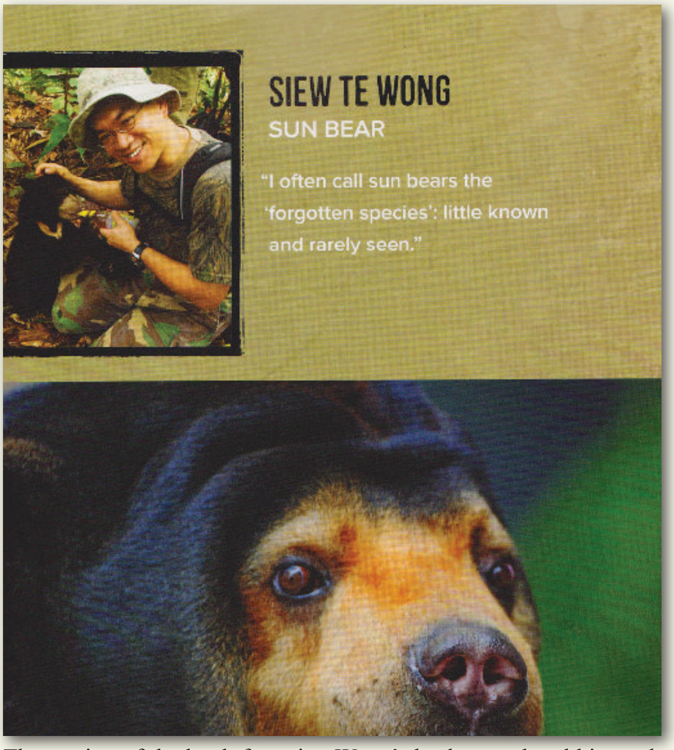
The British High Commissioner to Malaysia, HE Simon Featherstone visited BSBCC on14th August and the Australian Minister for Foreign Affairs, Senator the Hon. Bob Carr paid a visit to the sun bears on 5th November 2012.

Staff Achievements

Wong was selected as one of the 40 Wildlife Heroes across the world and was featured in the book "Wildlife Heroes: 40 Leading Conservationists and the Animals They Are Committed to Saving" published in 2012.



Cover of the book "Wildlife Heroes: 40 Leading Conservationists and the Animals They Are Committed to Saving".



The section of the book featuring Wong's background and his work to conserve sun bears.

Borneo Rhino Sanctuary Programme – 2012 Report

Last chance to prevent the extinction of the rhino in Borneo

The Sumatran rhino (*Dicerorhinus sumatrensis*) remains on the brink of extinction. No evidence of the continued existence of the species in Kulamba, Kalabakan, Kuamut and even in Tabin Wildlife Reserve (TWR) emerged during year 2012. This is the first year since 1980 for which no wild rhino signs were found in TWR, leaving Danum Valley as probably the last location of fertile wild rhinos in Malaysia. The only remaining possible means to prevent the species extinction is to focus on the single objective of producing more baby rhinos, with the programme in Sabah as part of a coordinated global effort. Rhinos in the wild will not breed as long as they are wandering as isolated individuals in remote and marginal habitats, just awaiting death from poaching, snare traps, accident or old age. The priorities have to include bringing fertile female and male rhinos together under close management, salvaging and storing genetic materials from infertile rhinos, and development of advanced reproductive techniques.

The euphoria generated in December 2011 with the capture of the female rhino Puntung (so-named because her front left foot has been lost in a poacher's snare) from Tabin Wildlife Reserve became more subdued in February 2012. A visiting specialist veterinary team from Leibniz Institute for Zoo and Wildlife Research (IZW; Berlin) found that Puntung has endometrial cyst growth in her uterus and Fallopian tubes, which would have significant implications on her ability to be fertilized or implant an embryo. However, she produces follicles, indicating that she is fertile. At the same visit, Tam was anaesthetized and a fresh semen sample obtained and preserved in liquid nitrogen for potential future artificial insemination. Further visits were made by the IZW team in March (when the cysts were partially removed by flushing with antibiotics and buffer solution) and again in June, by ultrasound-guided laser treatment.

Examination of snare trap ropes, set by poachers in forest near to plantation to obtain wild cattle (March 2012 at Kretam), but posing a risk also to the last remaining wild rhinos wherever they exist near to plantations.

Discussions were held on the possibility of developing a prosthetic foot for Puntung but, as she has lived with this condition since infancy and her musculature is therefore abnormal, the professional consensus conclusion was that the best method to relieve stress on her damaged leg is to have her out in her forest paddock as much as possible, and to minimise her time on concrete.

Based on data from zoos and other facilities since 1990s, it is known that healthy, fertile female Sumatran rhinos are receptive to mating only for a period of 1-2 days, at intervals varying between roughly 21-27 days. Dangerous fighting may occur between male and female rhinos if put together at times of "non-receptivity". Males seem to detect when a female is receptive by hormones in her urine, and subtle behavioural cues. In the wild, female rhino can simply run away from males when they are not receptive. The methods developed during 2012 at Tabin for humans to determine receptivity

IZW veterinary team leader Dr Thomas Hildebrandt examines video ultrasound imagery of Puntung's reproductive tract (24 February, Tabin Wildlife Reserve), and she is found to have severe endometrial cyst growth.

The BORA and IZW teams with Sabah Wildlife Department easing Tam onto a mattress after anaesthetisation and prior to electro-ejaculation to obtain fresh sperm (25 February 2012).

First breeding attempt for Puntung and Tam, in a temporary breeding pen at Tabin, 18 August 2012 (credit : Stephen Hogg, Wildtrack Photography)

dates were a mix of frequent monitoring blood serum levels of the hormone progesterone, ultrasound scanning of the size of follicles, and keepers' observations of behaviour. Based on monitoring of Puntung's progesterone since January 2012, and the successful reduction of her endometrial cyst growth in June, 17 August was determined to be the most likely date for the first mating attempt. Six attempts to put Puntung and Tam together in the breeding yard were done (17-19 August). Tam showed increasing aggression over those days, and no copulation occurred. Puntung's drop in progesterone in September occurred sooner than anticipated, and the likely best date was missed for a second mating attempt. Specialist examination in November revealed that Puntung's endometrial cyst growth had worsened. Puntung's endometriosis seems to be linked to an irregular and unpredictable cycling. Only one further mating attempt was made, in December, but Puntung rejected Tam's advances, and appeared very fearful of him.

The post-fertile old female rhino Gelogob remained at Tabin through 2012, pending renovation of her enclosure in Lok Kawi Wildlife Park.

Infrastructure completed during 2012 at Tabin Wildlife Reserve included the rhino breeding yard, a new interim paddock ready for any new rhino captured, a forest night stall for Puntung, replacement of swing doors with sliding doors, gazebos for visitors, and renovation and extensions to the paddocks, field manager's house, staff quarters and garage. Work commenced on a "food garden" near to the interim rhino facilities, whereby fast-growing woody plant genera preferred as food by rhinos can be maintained by coppicing.

Pending construction of permanent rhino facilities at Tabin, no further suitable sites exist for building of temporary holding facilities, due to topographical constraints, along with unsuitable road conditions and unreliable water supply. Over the period 2009-12, about RM700,000 has been spent, mainly by Sime Darby Foundation, on building and improving the temporary facilities. It is not considered appropriate or viable to continue using donor funds beyond year 2012 for more temporary facilities.

Surveys were conducted through 2012 at least twice monthly in various parts of Tabin Wildlife Reserve, primarily where rhinos were present between 1980s-2006, but no signs of rhinos were found. Commencing July, cameras were placed in the central and northern parts of Tabin, in a grid pattern supervised by IZW, at specific sites chosen where rhinos had been detected in the past and along large mammal trails in the forest. The cameras represent 3,205 "trap days" (total number of sites where cameras were operational multiplied by number of days operational). Images of all species of larger mammals present in Tabin were obtained, except images of rhino.

Reports from two independent sources in mid 2012 of the presence of rhino in the Kuamut region, led to a preliminary survey in June jointly by Sabah Wildlife Department, Borneo Rhino Alliance and Sabah Forestry Department. By November, no proof was found of rhinos, and notice of a reward for information was posted in Kuamut village and logging camps.

Following the report of sighting of two rhinos on the fringes of Kulamba Wildlife Reserve in December 2011, a decision was made to build a trap. As most of the region is swamp forest, unsuitable for building and monitoring a trap for such a large mammal, the best location on dry land was selected, in a zone between Kulamba and alienated land under forest cover. The trap was designed for the possibility of two rhinos traveling together. Working with advice from the Malay Tapir Conservation Project (which has successfully captured several tapirs in Peninsular Malaysia) various practical problems were solved to ensure that the mechanism would work perfectly 100% of the time. The trap was operational by mid June. By end of 2012, despite regular monitoring the Kulamba forests on the ground, no further signs of rhinos were found.

Puntung enters her wallow. Daily wallowing not only helps in thermo-regulation for Sumatran rhinos during the hot daylight hours, but also exposure to soft clay represents a treatment for her debilitating foot injury, the clay-rich mud being possibly also bactericidal.

Rhino trap designed for the possibility of two rhinos traveling together : a small paddock with hardwood fence and door at each end, built on a rhino trail. When a large animal enters the trap, it will push a central arrangement of barely-visible, fine plastic-coated wires, that pull a steel plate downwards and simultaneously releases ironwood pegs, cables and both doors within 1 second.

A preliminary proposal was developed towards end of 2012 to capture rhinos from Danum Valley and to retain them nearby. By this means, the dual issues of removing rhinos from the chronic threat of so-called "gaharu collectors" (more likely rhino poachers) in the Danum region, and providing additional facilities for any rhinos captured, could be combined. Agreement was reached on this proposal at the departmental and NGO levels, and a specific 3 hectare site for the facility was identified in Ulu Segama Forest Reserve, close to Danum Valley, in December by the key agencies.

Collaboration was pursued with external institutions, in particular Indonesia, which has the last three remaining small wild breeding populations of Sumatran rhinos. A meeting of the Sumatran Rhino Global Management and Propagation Board (GMPB), an ad hoc group of governmental authorities, global experts, keepers and donors met in the Ministry of Forestry HQ in Jakarta, Indonesia, on 15 March, chaired by Director of Sabah Wildlife Department. A letter of intent was crafted and signed during the meeting, which formalised an intent of collaboration between the key institutions. Signatories included Director-General, Forest Protection and Nature Conservation, Indonesia; Director, Biodiversity Conservation Indonesia; Director, Sabah Wildlife Department; Executive Director, Indonesian Rhino Foundation; Executive Director, International Rhino Foundation; Director, Center for Conservation and Research of Endangered Wildlife, Cincinnati Zoo & Botanic Garden; Chairman, Borneo Rhino Alliance; Chief Executive Officer, Sime Darby Foundation; Coordinator, WWF-International Asian Rhino and Elephant Action Strategy programme; Chairman, IUCN Asian Rhino Specialist Group; Vice-chair, Asian Rhino Project. A male rhino was successfully born to Ratu and Andalas on 23 June in the Sumatran rhino Sanctuary in Way Kambas National Park Sumatra. This provided a significant boost to confidence that the programme in Sabah can yield results if the right combination of rhinos, professionally-designed facilities and expertise are all in place. At the four-yearly IUCN World Conservation Congress, held in South Korea, 6-15 September, Sabah successfully argued for the following clause to be included in the Congress's statement on rhinoceros : "for the Sumatran rhinoceros, close management of rhinos in fenced, managed conditions will be necessary in order to explore all possible techniques that may boost birth rate above natural death rate, including super-ovulation, artificial insemination, in vitro fertilization and other advanced reproductive techniques."

An unusual chance to see the inside of a Sumatran rhino's mouth.

(L-R) Drs. Widodo Ramono, executive director, Indonesian Rhino Foundation; H. Zulkifli Hasan, Minister of Forestry Indonesia; Tun Musa Hitam, chairman, and Hjh. Yatela Zainal Abidin, chief executive officer, Sime Darby Foundation (5 November 2012).

Sime Darby Foundation and WWF-Germany continued to be the major financial supporters of the Borneo Rhino Sanctuary programme in Sabah. Sime Darby Foundation has provided consistent "hands on" support for the programme. The Foundation's Chairman Tun Musa Hitam met with the Minister of Forestry Indonesia in November, noting that "the Minister agreed that both parties could and should work together to breed the rhinos in managed sanctuaries .. we can learn from their experiences and collaborate .. we should work on all areas of cooperation and consideration should also include exchange of rhinos".

Cable Logging In North Borneo

(Part II. Diesel Engined Yarders of the Post-War Era)

As stated in the first sequel to this article published in the 2011 edition of this report[1] cable logging using steam yarders was abandoned in 1935 and more than twenty years were to elapse before the technique was re-introduced in the mid 1950s. The intervening years had seen the Japanese Occupation, the collapse of the British North Borneo (Charter) Company and the re-emergence of the State as a British Colony in 1946. Following the resumption of the British Borneo Timbers monopoly over timber rights in June 1952 new forest concessions had been introduced and the forest industry was expanding rapidly.

The first crawler tractors were introduced in 1951 and their use in conjunction with rail and road transportation systems was rapidly adopted by all major logging companies.[2] Initially all tractors were operated with towed logging arches and their use persisted until the late 1950s

Logging arches were designed to reduce the frictional resistance of the drag by raising the butts of the logs. This they did quite effectively but with serious limitation to the manoeuvrability of the tractor. Moreover, logging arches were found to be unstable in the steeper and broken terrain which was encountered as operations moved inland away from the coast and their use was soon discarded. Although it was found that tractors could be operated successfully in the steeper country, some managers, particularly those with North American experience, were advocating the re-introduction of cable logging and by the late 1950s all three expatriate concessionaires had brought in yarders.

Elliott Bay Mill Company, the Seattle based owners of Kennedy Bay Timber Company Ltd, had been operating yarders in their Basilan Lumber operation in the Southern Philippines since 1946, and this was probably the first company in North Borneo to start cable logging again --- but the Bombay Burmah Corporation at Kalabakan was not far behind.

Kennedy Bay shipped their first yarders in from Basilan in 1953 although they were not immediately deployed. The yarders at Basilan were a mixture of Skagit and Washington Iron Works units; some of which may have been pre-war steam yarders converted to diesel power. The details of those shipped to Kennedy Bay are not available but Bombay Burmah purchased a Washington Iron Works 157 yarder in 1958 and both companies operated Hyster Triple Drums mounted on Caterpillar D8 tractors in the late 1950s. British Borneo Timbers also operated at least one yarder, thought to be from Washington Iron Works, at their Darvel Bay operations in the early 1960s.

At the same time the three expatriate concessionaires were also using North American heel-boom loaders to yard and load peripheral roadside logs. These heel-boom loaders, predominantly manufactured by Skagit Corporation and Washington Iron Works, were fitted with double drum winch decks (and a straw line) with a main line capacity of about 600 ft of 1-1⅛ wire rope and 1200 ft of haulback line. Although some of these machines were heavy enough to load logs

Fig.1 : Caterpillar D8 with Hyster Logging Arch, North Borneo Timbers, Kretam 1951. (Photo: George Brown, author's collection.)

Fig.2: Washington Iron Works TL-15 with guy-lines rigged for yarding: British Borneo Timbers, Kalumpang, 1958. (Photo Keith Wookey; Robin Wookey collection).

Fig. 3: Roadside yarder deck; Bombay Burmah Trading Corporation, Kalabakan, 1958. (Photo Keith Robinson; courtesy Mrs Judith Robinson). The yarder and spar tree are on the hill just out of the picture to the right and the logs have been conveniently decked.

without being guyed back, securing the two guy lines against the direction of lead created a stable yarding platform. When yarding, the haulback line ran through a 360º rotating sheave at the top of the yarding tower while the main line remained running over the wide loading boom sheave. Almost invariably rigged for High-lead[3] these machines compensated for their relative lack of deflection by their ability to slew the boom in order to guide logs past an obstruction. Heel-boom loaders could effectively yard logs for a width of 4-500 ft on either side of a road both in an uphill and downhill direction. Nevertheless their use (known as "*cherry-picking*" by North American loggers), essentially took out the easy roadside logs which detracted from the efficiency of the primary yarding systems employed.

With the exception of the tractor mounted Hyster Triple drums (there were three units in Kalabakan operated by Bombay Burmah Trading and probably a similar number with Kennedy Bay Timbers) the rest of the yarders were sled mounts.

The diesel yarders of the 1970s were fundamentally similar to the pre-war steam driven units in as much as they consisted of two main drums; a main line drum and a haulback drum, and in addition, a straw line drum. Basically there were two dominant manufactures; Skagit Corporation and Washington Iron Works. (Fig. 4.[4])

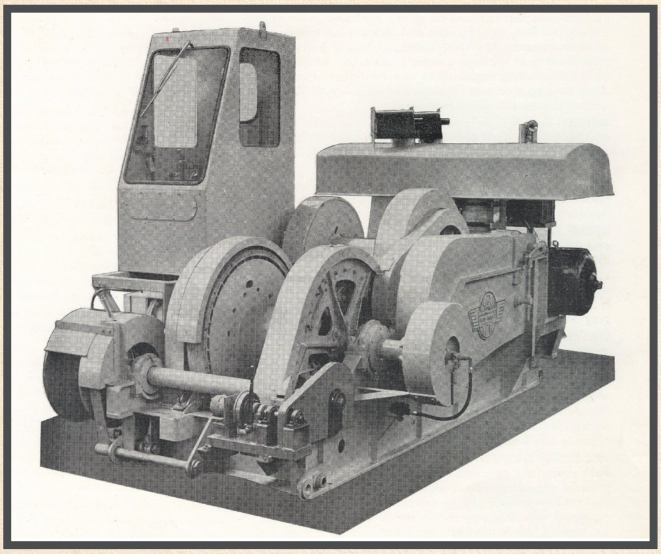
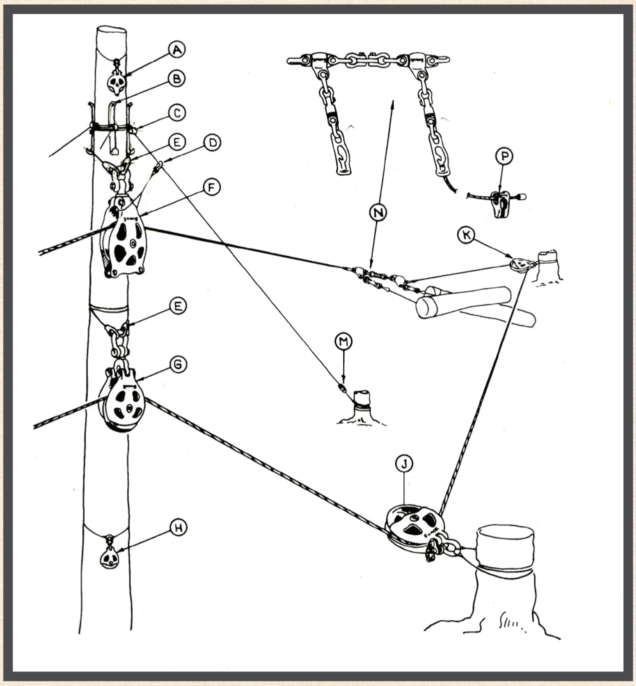


Fig.4: Washington Iron Works 207 Yarder c.1970. (manufacturer's catalogue) c.f. the WIW 1920 steam yarder in Part I of this article.[4]

The Washington yarder depicted in Fig.4. was generally powered by a diesel engine of about 300HP (make and model to owners spec.) driving through a Twin-Disc torque converter and a planetary two-speed Torque-Master gear box. Main drum capacity was 1650ft of 1⅜ and the haulback held 3400ft of ⅞ wire rope. The transmission combination provided a wide variation of line speeds ranging from a main line speed of 102 FPM in low range with a line pull of 25 tons to 970 FPM (10 mph) with a full drum. (The stall pull on the torque converter with an empty drum could exceed 100 tons, well in excess of the rigging capacity, but a good operator knew just how much power he could safely apply.) The drums were engaged through air operated friction valves and braked by foot lever operated band brakes with the option of air controls.

These yarders were mounted on sledges constructed in exactly the same manner as they were at Bettotan in the 1920s.[5] Although by the 1970s chain saws, powered augers and heavy lifting equipment were available the construction of a new yarder sledge required considerable skill and the final result was an impressive piece of craftsmanship. A yarder mounted on its sledge with full fuel tank, drums loaded with wire rope and attendant rigging weighed 60-70 tons. In North Borneo Timbers Tawau Operations, whenever yarders required transporting for a significant distance, they were transported by one of the Pacific logging trucks.(Fig.5.)

In order to provide deflection the tractor mounted Hyster triple drums and the sled mounted yarders had to be rigged in conjunction with a spar tree. Usually a suitable roadside tree was topped or, if a suitably placed tree was not available, a long log could be erected. Although the tractor mounted Hyster yarder had the advantage of mobility the drum capacity was only 800ft compared to over 1600ft on the average sled mount. As some 300 ft of the mainline is used in the lead from the



(Left) Fig. 6: High- Lead Rigging Arrangement. (After Young) (Key A. Riggers Block, B. Tree Irons, C. Guy Line Sleeve, D. Safety Strap Shackle, E. Strap Sockets, F. High Lead block, G. Head Trip Block, H. Straw Line Block, J.& K. Haul-Back Corner Blocks, N. Butt Rigging, M. Guy Line Hook. P. Choker Hooks.)

Fig.5: Washington 227 yarder carried by a Pacific P16 logging truck getting a helping hand from a Clark 668 log skidder, North Borneo Timbers, Brumas c. 1980. (Photo Ross Ibbotson) Note wear on front of runners.

yarder to the tree block and down to the base of the spar the effective yarding radius of the Hyster was only 500ft which would allow it to harvest a maximum area of 18 acres which could be expected to yield about 25,000 H. cu ft (900m^3). This compares to the effective yarding radius of a big sled-mounted yarder of 1200ft which could access over 100 acres expected to yield 150,000 H.cu ft.(5400 m^3). Both yarders involved similar rigging times so the Hyster was considerably less productive and as a result, eventually discarded.[6]

The hardware requirement for cable logging has changed little in the last 100 years. It is extensive and it was also

Fig.7: Map to scale of 1:10,000 of part of North Borneo Timbers workings c.1978. (Author's working plan) Yarder settings are shown by circles with tractor feed indicated by arrows.

initially expensive. The rigging package depicted in Fig.6. would have cost at least USD10,000 in the 1970s. In addition to being technically demanding, cable logging needed the services of a blacksmith's shop capable of babbiting ferrules and splicing wire ropes, and was never adopted by the local logging companies.

The efficient deployment of yarders on their own or integrated with tractor skidding requires considerable forward planning. A road system laid out for yarders is located on the higher ground so that most of the logs are yarded uphill whereas tractors and skidders operate more efficiently yarding downhill. Yarding downhill with cable systems reduces the deflection and as a result causes more hang ups on stumps or residual timber. In addition when yarding downhill in steep country logs have to be held tight by continuous application of the haulback brake to prevent overrun.

In the author's operations with North Borneo Timbers yarders were closely integrated with tractors and wheeled skidders. Utilising detailed topographic maps prepared by the company survey department to a scale of 1: 5000 with a contour interval of 20ft it was possible to prepare a detailed Harvesting Plan in which the roads and spar tree settings were accurately located for optimum deflection.

Roads were constructed at least 6 months and preferably 12 months in advance of harvesting with all spar trees selected and marked for retention prior to construction. Yarder and tractor landings were also pre-prepared. When extraction was scheduled it commenced from the inner settings at the end of the spur roads working out towards the main road so that road surfaces over which trucks were passing were not damaged by log landings or the passage of tractors or yarders. When yarders were moved in initially they were loaded on trucks to the inner settings. (Fig.5.) Subsequent short movements were accomplished using a tractor as an anchor.

A tractor (even one of the bigger road tractors) is not heavy enough to move a sled-mount yarder using the tractor winch.

Movements along a road were effected using the tractor as an anchor with the bulldozer blade facing the yarder. The yarder moving block is then attached to the tractor belly hook[7] by a heavy strap which passes over the top of the blade. The yarder main line is run out through the moving block and shackled back to the yarder to form a double purchase. The tractor reverses along the road taking out the main line for a convenient distance and then places the blade down to form an anchor which is made more effective by the action of the strap forcing the blade in as the yarder takes in the mainline. Using this technique a yarder could be moved to the next roadside setting in an hour or two whereas it might take a day or more to move using stump anchors, each of which would have to be rigged using the straw line and rigging blocks and were never conveniently located for a good pull along the road.

Fig.8: Washington 227 sled-mount yarder, North Borneo Timbers c. 1978. (Photo Ross Ibbotson). The yarder is located about 100ft from the base of the spar tree with the main line running up to the block at an angle of 45º.

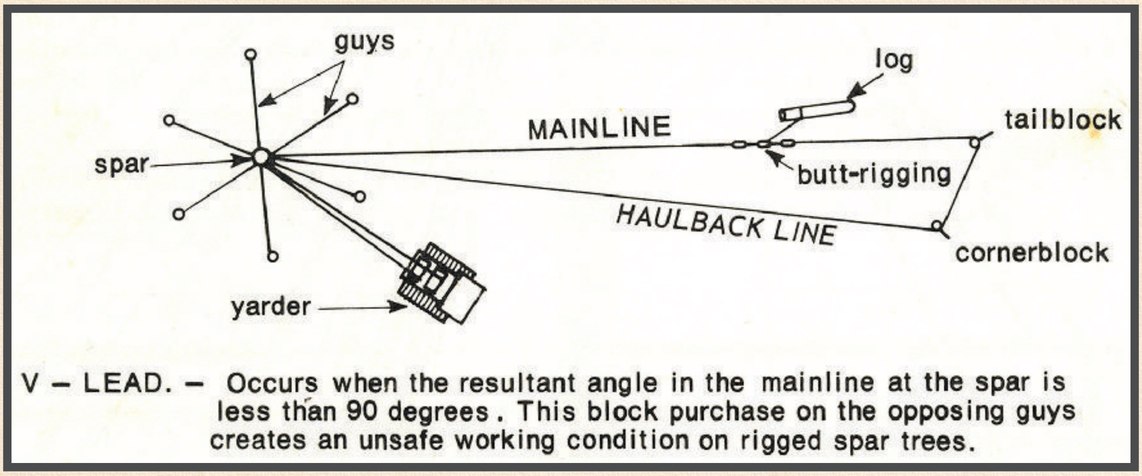


Fig.9: Unsafe Diamond Lead.

The yarder decked logs at the opposite side of the spar and could yard logs safely from this position until the angle described by the mainline to the corner block approached 900 (a position known as *square lead*). Any decrease of this angle to a V or *diamond lead* puts too much force on the rigging and is dangerous.

This means that, although the blocks would have to be repositioned from time to time, the yarder could access a segment of about 180º without needing to be moved. With average stands, some 500 logs (2500 m^3) could be produced from this position – enough for a month's work – before the yarder needed to be repositioned.

With the advantage of flat landings prepared by tractors a good yarder operator could deck logs neatly ready for loading. (Fig.10.)

Fig.10: Log deck and close up of Butt-Rigging for High Lead Operation, c. 1978. (Photographer unknown; author's camera) The choker setter is tightening a loose shackle pin on the mainline swivel. The standard Young butt-rigging consisting of two or three mainline swivels and together with drop swivels, chokers etc. as shown here, weighed half a ton. In addition to providing the strength to withstand continuous heavy loads safely this ensured that it dropped to the ground and did not hang up in tree canopies on the outhaul.

North Borneo Timbers integrated yarders with tractors as previously mentioned, using various rigging combinations to swing logs to roadside from remote tractor landings. This reduced the road construction requirement or the need to negotiate extreme adverse tractor hauls.

In the settings shown in Fig.7., where the spar trees are located in elevated positions above a steep river valley providing a large difference in elevation and plenty of deflection, a gravity or scooter carriage could be employed. In this system the main line, which could be extended by adding in another section, is anchored to a stump on the far side of the valley high enough up to provide adequate deflection and carries the carriage. The haulback line is used as the in-haul. On the out-haul the main

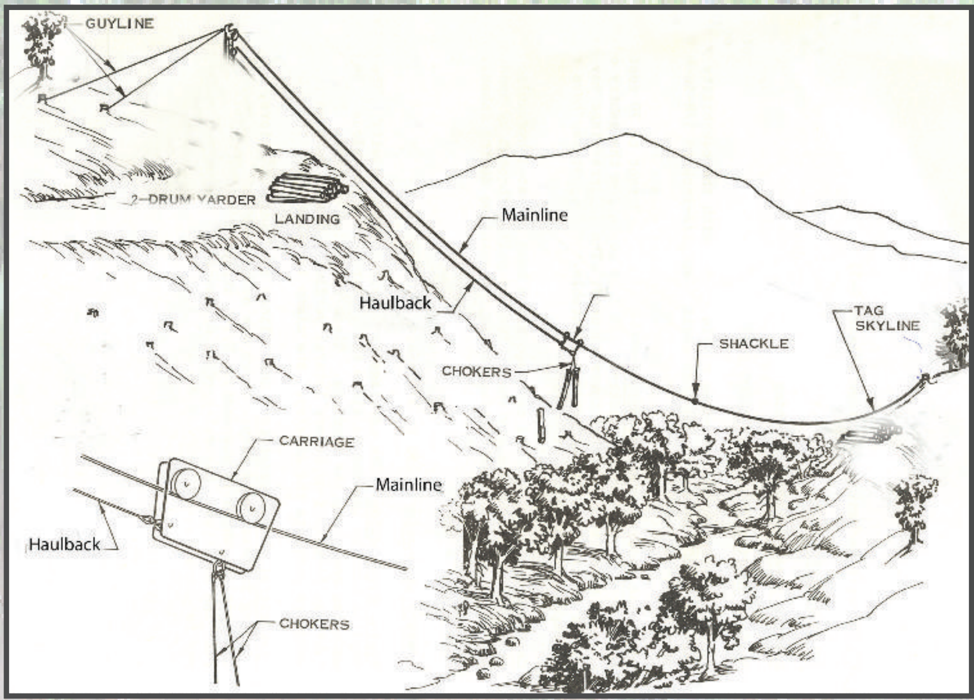


Fig.11: Scooter Yarding System.

line is tightened to lift the carriage high, the haul back brake is released, and the carriage races back at very high speed (close to 30mph) until it begins to lose inertia at the opposite slope. At a signal from the riggers[8] the stationary carriage is dropped over the log deck and the chokers are set for the in-haul. On the in-haul the main line is tensioned sufficiently for the turn to clear the terrain (but still maintaining adequate deflection) and the haulback drum winds in the turn. Even on the uphill haul, with the logs fully suspended high line speeds can be achieved and this was an efficient system and very simple to rig. It could swing more than 100 logs a day; often exceeding the capacity of the team of 5 or 6 tractors working on the opposite bank.

The scooter carriage has wide sheaves to allow it to pass over the shackles used to secure the main line extensions and was heavily constructed to resist shock loads and provide sufficient inertia to unspool the haulback and carry it up the back slope over the log deck. The carriage shown in Fig.12. was fabricated by North Borneo Timbers and weighed almost 2 tons.

Fig.13. Scooter turn approaching landing, North Borneo Timbers c.1978. (Photo Ross Ibbotson) The perspective shown in this view is deceptive; the remote landing was at least 2000 ft from, and 600 ft below, the roadside. (Inset) **Fig. 12:** Close up of NBT Scooter Carriage (Photo Ross Ibbotson).

Fig. 14: Decking Scooter turn; North Borneo Timbers c. 1978. (Photo Ross Ibbotson) The logs are being cleared and prepared for loading by a Washington TL-6 grapple loader. With the high output of a scooter set up the landings could easily become congested and needed a loader in attendance.

In situations where there was not a significant difference in elevation between the head spar and the remote landings it was possible to rig a tight skyline as described in Part I of this article. The most commonly used was the North Bend System.[9] Tight skylines require considerable rigging and are more suited to double swings with yarders because they require the topping or erection of a remote tail tree and attendant rigging. In Kennedy Bay Timbers, which was predominantly a cable operation, they were employed regularly to save on road construction (*see* Fig.15.). In North Borneo Timbers the author tried sky lines once or twice but found them expensive and relatively unproductive.

North Borneo Timbers also effectively used wheeled skidders to swing logs produced by yarders. The usual combination was with the yarder located on the top of a steep ridge or hill remote from the road, and from where it could access a full circle. A single skid trail facilitated a downhill skid of the logs decked by the yarder to roadside. The yarder was able to operate relatively unaffected by weather, in terrain too steep for efficient tractor operation and probably produce about 1000 logs from the setting over a period of two months or so. The skidder could out-produce the yarder and was deployed elsewhere for a day or two while the yarder deck built up (*see* Fig.16).

In all cable yarding operations there is the element of unproductive time required to move the yarder to a new set up and top and rig trees although once rigged they are less affected by rain or adverse slopes. In order to minimise set-up times in North Borneo Timbers' yarding operations a rigging truck was deployed. The rigging truck was an old Leyland Hippo logging truck chassis on which a small Skagit BU-20

Fig. 15: North Bend Skyline; Kennedy Bay Timber Company, Silam Operations, 1960s. (Photo Sabah Information Department)

Fig. 16: Aerial view of yarder operating on remote setting; North Borneo Timbers c.1980 (Photo Ross Ibbotson) The yarder is decking a big log while the skidder can just be seen leaving the deck to the left.

Fig. 17: Madill track-mounted mobile tower, Sabah Timbers, Tinkayu. (Photo R.M. Macpherson collection)

yarder had been mounted. Using this truck and winch set, the high-climber was able to top and pre-rig the next spar tree, complete with tensioned guylines, main and haulback blocks installed and strawline threaded. With this accomplished, the main yarder could move out (leaving the guylines and blocks in the completed setting for the rigging truck to dismantle later) and set up in the new setting in one day instead of about five. This resulted in a considerable increase in productivity.

With all combinations of yarders, wheeled skidders and tractors in North Borneo Timbers the objective was to maintain productivity in difficult and inaccessible areas and to save on road construction. The productivity of individual machines or operators was not the issue; what was important was the overall production of the entire team which had to meet or exceed the production target of 10m3 per machine per hour worked, based on a minimum of 200 hours per machine per month. Hours were based on machine service meter recorders. This system worked well with hourly paid employees but it does not lend itself to the contract system where operators are paid on volume produced to roadside. In this situation each individual jealously guards his production tally, considering that he is more skilful or works harder than his neighbour and stubbornly resists any suggestion that he could be better off working as part of a team. This was the main reason for the failure of wheeled skidders to gain acceptance in Sabah operations. Similarly, although cable yarding was efficient in steep terrain, it involved crews of 8 or 10 highly skilled men working as a team, considerable planning and support facilities and was much more difficult to implement.

In the 1960s the North American loggers, mindful of high crew costs, began the development of mobile steel spars mounted on tracks or wheeled undercarriage to minimise moving and set-up times. One of the first companies to enter this field was S. Madill in a plant at Nanaimo on Vancouver Island. Subsequently, Washington and Skagit and a number of other manufacturers began production. These machines were equipped with a double telescopic, self-erecting steel tower100–110ft in length, with 8 guy-line drums. The 4-speed double-drum yarder deck could include a third skyline drum. The whole set-up was mounted either on a tank chassis or on a custom-made 4-axle undercarriage. The latter units were equipped with engines of about 500 h. p. and weighed about 100 tons. They were extremely expensive machines; costing the equivalent of several tractors, and the author concluded that they were not justifiable for North Borneo Timbers' operations.[10]

Sabah Timbers did, however, purchase a Madill mobile spar in the early 1970s which they operated in their Kalumpang operations until these closed in about 1983. Details of the model number and date of purchase are not available, but it appears to be a Madill 09 based on a Sherman tank undercarriage. (see Fig.17).

Many observers in the past have suggested that cable logging was more detrimental to the environment than conventional tractor yarding. I believe this is mainly the result of relying on observations made from the roadside and basing conclusions on the obvious severity of damage round the spar tree. In fairness visitors were not encouraged, or even allowed, to venture inside yarder settings. When anyone enters the setting they must be accompanied by one of the crew with the knowledge of yarder signals in order to safely cross cable roads. The first impression one gains when within a setting is the absolute silence. There is no engine or chainsaw noise and the yarder engine itself cannot be heard --- only the yarder air horn activated by the riggers in the block can be heard clearly ---- telling the initiated what line is about to move and in which direction. When a log is choked and the mainline is given the go-ahead the log glides on its way in an eerie silence with minimum impact on soil or vegetation. One of the riggers will follow the log, and if a hang up is encountered, will signal to apply the haul back brake to lift the butt up or stop the line and reposition the choker to pass round the obstruction. It is only when the log is approaching the spar tree and the road side that damage through the repeated passage of logs appears at its worse.

It should also be noted that the area in the immediate vicinity of the spar tree is usually affected by the spoil slopes left by road and landing construction. Moreover, when corrected for slope, the area is less significant than it may first appear. For example a radius of 200ft from the spar tree (based on a full circle) would have an area of about 3 acres which is about 3% of the total area yarded by a 1200 ft setting. On the other hand the environmental impact in the peripheral areas is much less than that of conventional tractor logging and overall recovery is rapid.

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[1] Ibbotson (2012), ***Cable Logging in North Borneo*** (Part 1, Steam Logging) Sabah Forestry Department; Annual Report for 2011, PP 348-355.

[2] For those interested in a comprehensive account of the introduction of tractors and the post-war mechanization of North Borneo logging operations see '***The History of Logging in North Borneo***', Ross Ibbotson (2013) ISBN 978-983-3987-50-4 Opus Publications.

[3] For the High-lead rigging diagram see Ibbotson (2012) loc. cit. p350, Fig.6

[4] Ibbotson (2012) *loc. cit*. p350, Fig.3

[5] See Part I. SFD Annual Report for 2011 *loc. cit*.

[6] After deducting for the lead from the yarder to the tree block and down again the balance line will access a circle from the base of the spar tree and the harvestable area can be calculated using πr2 where r= available line length. As a result the accessible area increases very rapidly with drum capacity.

[7] Belly Hook: heavy duty hook attached to the engine protection plates under the tractor normally used in recovery operations

[8] By this time the "whistle punk" signal man described in Part I, who had operated an electrical cable system to relay the yarder signals, had finally been made redundant and signals were transmitted using a "Talkie-Tooter". A light weight radio controlled device carried on the belts of the riggers, which transmitted the traditional signals (un-changed since the days of steam) direct to the relay activating the yarder air horn. It could also be used as a walkie-talkie radio if the need arose to communicate with the yarder landing.

[9] SFD Annual Report for 2011 p354 Fig. 10.

[10] The author thought seriously about acquiring a unit for NBT, but decided that in view of the fact that: a) Sabah wage costs for yarder crews were a fraction of those in North America, b) by employing a rigging truck set-up times could be further reduced, and c) second-hand drum sets for sled mount yarders were available in North America at very reasonable prices, this was not justifiable.

This article was contributed by Ross Ibbotson author of "The History of Logging in North Borneo" Opus Publications 2013
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