

**PROSIDING**

**The Eighth Conference of the Pacific Rim Termite Research Group**

**28 February -1 March 2011,  
Tawana Hotel, Bangkok, Thailand**



**Thailand  
2011**

**Minutes of the 8<sup>th</sup> Conference of the Pacific-Rim Termite Research Group**  
28 February - 1 March 2011, Tawana Hotel, Bangkok, Thailand

List of TRG 8 participants

	Name	Affiliation	Member (S or O)
1	Kunio TSUNODA	Research Institute for Sustainable Humanosphere, Kyoto University	O
2	Naotaka MARU	Research Institute for Sustainable Humanosphere, Kyoto University	O
3	Thuy Hien NGUYEN	Institute for Termite Control and Works Protection, Vietnam	O
4	Quoc Huy NGUYEN		O
5	Thu Huyen TRAN		O
6	Tan Vuong NGUYEN		O
7	Indah SULISTIOWATI	Faculty of Civil Engineering and Planning, Trisakti University	O
8	Chow-Yang LEE	Universiti Sains Malaysia	O
9	Foong Kuan FOO		O
10	Jian HU		O
11	Ching Chen LEE		O
12	Ikhsan GUSWENRIVO		O
13	G Veera SINGHAM		O
14	Kook Boon NEOH		O
15	Brian FORSCHLER	University of Georgia	O
16	Yusuf Sudo HADI	Bogor Agricultural University	O
17	Arinana		O
18	Dede HERMAWAN		O
19	Shuichi DOI	Tsukuba University	O
20	Niken SUBEKTI	Semarang State University	O
21	Gina BACHTIAR	State University of Jakarta	O
22	Nurwati HADJIB	Forest Products Research and Development Center	O
23	Maya ISMAYATI	Research & Development Unit for Biomaterial, Indonesian Institute of Sciences (LIPI)	O
24	Farah DIBA	Tanjungpura University	O
25	Ignasia SULASTININGSIH	Maria Forest Products Research and Development Center	O

26	Farkhanda Manzoor DUGGAL	Lahore college for women University	O
27	Syed Kamal NASIR	Division Manager, Professional Solutions Division FMC United Pvt Ltd	S
28	Jim CREFFIELD	Onwood Entomology Pty Ltd	O
29	Jeff LLOYD	Nisus Corporation, USA	
30	Abu Hassan AHMAD	Universiti Sains Malaysia	O
31	Aiman Hanis JASMI		O
32	Heng Chia HWA	Managing Director Agro Technic Pte Ltd	S
33	Heng YIWEI	General Manager Agro Technic Pte Ltd	S
34	Andrew CHAN	Managing Director Alliance Pest Management Pte Ltd	S
35	Francis LOH	General Manager Elite Pest Management Pte Ltd	S
36	William TAN	Operations Director Killem Pest Pte Ltd	S
37	Peter FERNANDIS	Director Business Development PestBusters Pte Ltd	S
38	David LEE	Managing Director The Pestman Pte Ltd	S
39	Azlie Bin MOHAMED	Operation Manager The Pestman Pte Ltd	S
40	Mohamad Nasser Bin SUHAIMI	Assistant Operation Manager The Pestman Pte Ltd	S
41	Leong Chee KWONG (Liang Zhi GUANG)	Sales Executive The Pestman Pte Ltd	S
42	Vernard LEWIS	University of California, Berkeley	O
43	Ronniel MANALO	Collegae of Forestry and Natural Resources, University of Philippines Los Banos	O
44	Kim Hon FONG	Foggers Marketing SDN. BHD.	S
45	Khalid Muhamad SALLEH		S
46	Shing-Kwong, Eric CHENG	City University of Hong Kong	O
47	Yoshihiro MINAMITE	Dianihon Jochugiku Co., Ltd.	S
48	Say-Piau LIM	Sumitomo Chemical Enviro-Agro Asia Pacific Sdn. Bhd.	S
49	Carlos GARCIA	Forest Products Research and Development Institute, Philippines	O
50	Sanoto UTOMO	PT. Johnny Jaya Makmur	S
51	Setijowati Tjiptati EKOWATI		S
52	Partho DHANG	Independent Consultant	S
53	Kaliman DESYANTI	Muhammadiyah University	O
54	Massijaya Muh. YUSRAM	Bogor Agricultural University	O

55	Lusita WANDANI	Lambung Mangkurat University	O
56	Elis Nina HERLIYANA	Bogor Agricultural University	O
57	Ilyas ZULYUSRI	Faculty of Mathematics and Science of State of Padang University	O
58	Istie Sekartining RAHAYU	Bogor Agricultural University	O
59	Charunee VONGKALUANG	Royal Forest Department	O
60	Khwanchai CHAREONKRUNG		O
61	Krisna CHAIKUAD		O
62	Sujit CHUTIBHAPAKORN		O
63	Sukun TANTICHAROENKIAT	Sherwood Chemicals PCL	S
64	Fa SAEBE		S
65	Vorasith KAHASATHIEN		S
66	Jason NASH	Bayer Thai Company Ltd	S
67	Piya PISAINORADEJ		S
68	Yoshio KATSUDA (Bayer?)		S
69	Ken STERN	Ensysyex (Thailand)	S
70	Sulaeman YUSUF	Research & Development Unit for Biomaterial, Indonesian Institute of Sciences (LIPI)	O
71	Van Hanh TRINH	Institute for Termite Control and Works Protection	O
72	Peerasak CHANTARAPRATEEP	Chulalongkorn University	O
73	Numchai LERTWUTTIKRAI	Chieng Thai Trading LTD., Partnership	S
74	Saowaluck PORNKULWAT	FMC Chemical (Thailand) LTD.	S
75	Somsak SAMANWONG	Dow Agrosience (Thailand) LTD.	S
76	Chayapol PRATHOOMRAT		S
77	Theodore EVANS	CSIRO	O
78	Beak Yong CHOI	BASF	N-S
79	Weerawan AMORNSAK	Kasetsart University	O
80	Isareerat SRIVORARAT	Bistec (Thailand) Limited	S
81	Nancy LEE	Chung Hsi Chemical Plant Ltd.	S
82	Trithot KHUEKAEW NA LUMPOON	TPMA	S
83	Airy Bin ABDULLAH		S

84	Aimy Bin ABDULLAH		S
85	Mold Mubeen Yee Bin ADNAN		S
86	Claude Mark DANKER		S
87	Azmi Bin LOKMAT		S
88	Mustafa Kamal Bin Hussein KAMAL		S
89	Muhamad Kamal Bin Hussein KAMAL		S
90	Yunus Bin AHMAD		S
91	Lee Keng FOOK		S
92	Mohamad Bin Abdul RASIT		S
93	Mohamad Zaini Bin Abd. RASHID		S
94	Shamugananthan SUBRAMANIAM	A/L	S
95	Mohd Fahmi AWALLUDIN	Universiti Sains Malaysia	O
96	Steph CHUA	Bentz Jaz	S
97	Rahmatullah P.M.D HUSSAIN	Dr. Rahmatullah Holdigs Sdn Bhd	NS
98	Ahmad Zikri A. SHABARY		NS
99	Curt RISCHAR	PMO (Vietnam)	N-S
100	Suchart LEELAYOUTHYOTIN	King Service Center CO.,LTD.	S
101	Sutee LEELAYOUTHYOTIN	King Service Center CO.,LTD.	S
102	Niran JOJANG	Pestech CO.,LTD.	S
103	Suthin MAIRATTANAKUL	Unipest CO.,LTD.	S
104	Chaiwat CHANTARAPITAK	Union of Unicor Group CO.,LTD.	S
105	Thanakorn ROJRUNGRUANG	C.S. Group CO.,LTD.	S
106	SUMALEE CHALUAYCHAROENWONG	Tempo-Thai CO.,LTD.	S
107	Wichian CHOOMUANG	Amiko (Thailand) CO.,LTD.	S
108	Chaichana KHANTISITDHI	Daimond Planet (Thailand) CO.,LTD.	S
109	Hassapichai SUJAWIPAN	Bangkok Pest Management CO.,LTD	S
110	Pracha ANGGANANONT	Winwave Suppy Limited Partnership	S
111	Wipakorn KITWATANACHAI	Mabel Group CO.. LTD.	S
112	Wutthikai MATHISARIYAPORN	M Factors CO.,LTD.	S

113	Sinhawee KLINPONKULKIT	Chemfleet CO.,LTD.	S
114	Norachote PUAGPIPAT	Pae Tradig CO.,LTD.	S
115	Andre KELLER	Advance Service (Thailand) CO.,LTD.	S
116	Nattaphong NATTAPHORNPHOT		S
118	Somchai PRECHATHAVEEKID	Food and Drug Administration	Guest
119	Sunantha PANTUWAN		Guest
120	Steve BROADBENT	Ensystex Thailand	S
121	Siri PONG	Sumitomo Thai	S
122	Suriyan VANITKITKOURPOL	Kincho Thai	S
123	Hirokazu KATO	Kincho Thai	S
124	Tharakorn SUTTHISIN	Kincho Thai	S
125	Sakorn TANGSUWAN	Intergrade Trading Thai	S
<b>Accompanying persons</b>			
126	Akiyo TSUNODA		A
127	Lisa KALA		A
128	Epifania F. GARCIA		A
129	Marsiah YUSRAM		A

Note: O = ordinary member, Non-O = non-ordinary member, S = sponsor member, N-S = non-sponsor member (local company), A = accompany person

### 28 Feb 2011 (First Day)

1.1 Registration began at 08.20 am.

1.2 The opening session (the first plenary session) started at 09.05 am with opening remarks from Dr. Kunio Tsunoda (KT), the President of the Pacific-Rim Termite Research Group (PRTRG). KT started by welcoming everyone to Bangkok, Thailand, and proceeded with the approval of agenda. Mr Jim Creffield was honored with an honorary life-long membership of the PRTRG for his dedication and services to the group. This year, there were a total of 3 recipients for the TRG Travel Fund, namely:

Ms Foong-Kuan FOO (Universiti Sains Malaysia, Penang, Malaysia).

Ms Maya Ismayati (Indonesian Institute of Science, Indonesia).

Mr Ronniel Manalo (University of the Philippines, Los Banos, Philippines).

1.3 Number of participants per country (129 participants [including 4 accompanying persons] from 12 countries)

Australia (3)

China [including Hongkong] (2)

Indonesia (20)

Japan (6)

Malaysia (27)

Pakistan (2)  
 Philippines (4)  
 Singapore (12)  
 Taiwan (1)  
 Thailand (42)  
 USA (4)  
 Vietnam (6)

1.4 A total of 38 papers (including 1 keynote paper) were presented at the conference. Dr Jeff Lloyd presented the keynote paper.

### The Eighth Conference of the Pacific Rim Termite Research Group Conference Program

1<sup>st</sup> day Monday 28 February 2011

08:30 – 09:00 Registration

09:00 – 09:20 Opening session Opening remarks

#### Plenary session (1)

(1) Approval of the agenda

(2) Reports from EC

(3) Other relevant issues

09:20 – 10:26 **Session (1)-Oral presentations** Chairperson: Kunio Tsunoda

- Jeff Lloyd and Kristen van den Meiracker (keynote): Termite Control - with Experience from the U.S.A. (30 min)
- Kunio Tsunoda: Methods to Determine the Minimum Number of Termites Required to Cause Visible Damage to Susceptible Plastic Films (12 min)
- Vernard Lewis, Shawn Leighton, Robin Tabuchi and Michael Haverty: Diurnal and Seasonal Patterns in Feeding Activity for the Western Drywood Termite, *Incisitermes minor*, for Naturally Infested Logs (12 min)
- Robert Hickman and Brian Forschler: Efficacy of Detection and Spot Treatment for the Drywood Termite *Incisitermes snyderi* (Kalotermitidae) in Naturally Infested Lumber Using Three RTU Products (12 min)

10:26– 10:45 Tea/Coffee break

10:45 – 12:11 **Session (2)-Oral presentations** Chairperson: Vernard Lewis

- Yoshio Katsuda and Yoshihiro Minamite: Development of Silafluofen and Its Practical Uses in Japan (10 min)
- Charunee Vongkaluang and Yoshio Katsuda: Development of Silafluofen-Based Termiticides in Thailand (10 min)
- Istie Sekartining Rahayu, Arinana and Imam Wahyudi: The Effect of Ammonia Fumigation on Subterranean Termites Mortality Percentage (12 min)
- Maya Ismayati, Khoirul Himmi Setiawan, Didi Tarmadi, Deni Zulfiana, Sulaeman Yusuf and Budi Santoso: The Efficacy of Organo-Complex Based Wood Preservatives Formula against Drywood Termite *Cryptotermes cynocephalus* Light (12 min)
- Farkhanda Manzoor, Saadiya A. Malik, Narjis Naz and Ayisha Liaquat: Laboratory Evaluation of Insecticide Treated Soil against *Coptotermes heimi* (Wasmann) (Isoptera: Rhinotermitidae) (12 min)
- Trinh Van Hanh, Tran Thu Huyen, Nguyen Quoc Huy and Nguyen Thi My: Research on Utilization Metavina 80LS to Treat *Odontotermes hainanensis* (Isoptera: Macrotermitinae) Damaging Dikes (12 min)
- Desyanti, Yumarni and Zulmardi: Pathogenicity of the Entomopathogenic Fungus *Myrothecium roridum* Tode Ex Steudel, *Beauveria bassiana* (Bals.) Vuill. and *Metarhizium* sp. from Natural in West Sumatera Indonesia against *Coptotermes gestroi* Wasmann (Blattodea: Rhinotermitidae) (10 min)
- Desyanti, Zulyusri and Melvi Zuhra: Pathogenicity of Entomopathogenic Fungi *Metarhizium anisopliae* (METSCH) SOROKIN and *Metarhizium brunneum* (PETCH) against Drywood Termites (*Cryptotermes* sp.) (Isoptera: Kalotermitidae) (8 min)

12:11–13:10 Lunch

13:15–20:30 Excursion: Visit to the Ancient City in Samut Prakhan and dinner

2<sup>nd</sup> day Tuesday 1 March 2011

09:00–10:36 Session (3)-Oral presentations

Chairpersons: Abu Hassan Ahmad (4) & Chow-Yang Lee (4)

- Partho Dhang: Elimination of Colonies of the Mound Building Termite *Macrotermes gilvus* ((Hagen)) Using Chlorfluazuron Based Termite Bait in Philippines (12 min)
- Kek-Boon Neoh, Atiqah Jalaludin and Chow-Yang Lee: Evidence of Colony Elimination of a Higher Termite, *Globitermes sulphureus* (Blattodea: Termitidae) by Bistrifluron Bait (12 min)
- Naotaka Maru, Kunio Tsunoda and Tsuyoshi Yoshimura: Laboratory Evaluation of Five Commercial Sports Drinks as Attractants and Arrestants for Subterranean Termites (12 min)
- Ching-Chen Lee and Chow-Yang Lee: Population Size and Caste Composition of a Fungus-Growing Termite, *Macrotermes gilvus* (Blattodea: Termitidae) (12 min)
- Ikhsan Guswenrivo, Hideyuki Nagao and Chow-Yang Lee: Analysis of Cellulose and Nitrogen Content of Nest Materials of a Higher Termite *Globitermes sulphureus* (Haviland) (12 min)
- Indah Sulistyawati, Surjono Surjokusumo, Yusuf Sudo Hadi and Niken Subekti: Similarity of Building Ventilation and Termite Mounds Architecture (12 min)
- Niken Subekti and Dodi Nandika: Soil Physical Properties of Subterranean Termite Mounds of *Macrotermes gilvus* Hagen (Blattodea: Termitidae) in Natural Forest, West Java, Indonesia (12 min)
- Trinh Van Hanh, Nguyen Tan Vuong, Ngo Truong Son and Nguyen Thuy Hien: Structure of *Odontotermes hainanensis* Light 1924 (Isoptera, Macrotermitinae) Nests in the Red River Dyke System in Vietnam (12 min)

10:36–11:00 Tea/Coffee break

11:00–12:20 Session (4)-Oral presentations Chairperson: Jim Creffield

- Aiman Hanis J. and Abu Hassan A: An Evaluation of Termite Attack Incidence on Araucaria Plantation Forest in Teluk Bahang, Penang (12 min)
- Gina Bachtiar and James Rilatura: Termite as Silent Pest of Buildings and Things Inside (12 min)
- Kwan-Cheung Cho and Shing-Kwong Cheng: The Preservation of Heritage Buildings through the Weakening of Termite Attack (10 min)
- Nurwati Hadjib and Mohammad Muslich: The Resistance of Some Indonesian Lesser Used Species against Termites (12 min)
- L. Wardani and Y.S.Hadi: Durability of Natural and Cultured Ironwood (*Eusideroxylon zwageri* T Et B) on Subterranean Termite (*Coptotermes curvignathus* Holmgren) (12 min)
- Arinana, Kunio Tsunoda, Elis Nina Herliyana and Yusuf Sudo Hadi: Resistance of Woods against Subterranean Termites by Laboratory Tests Using Indonesian and Japanese Standards (12 min)
- Arinana, Yudi Rismayadi and Elis Nina Herliyanai: Inventory of Low Grade Wood in East Java, Indonesia (10min)

12:20–13:40 Lunch

13:40–14:52 Session (5)-Oral presentations Chairperson: Sulaeman Yusuf

- I.M. Sulastiningsih and Jasnir: The Resistance of Laminated Bamboo Boards to the Subterranean Termite (*Coptotermes curvignathus* Holmgreen) (12 min)
- Y.S. Hadi, E. Fajriani, D. Hermawan, M.Y. Massijaya and N. Hadjib: Resistance of Particleboard Made from Fast Growing Species to Subterranean Termite Attack (12 min)



- D. Hermawan, Y.S. Hadi, A. Erizal, M.Y. Massijaya and N. Hadjib: Resistance of Mangrove Medium Density Fiberboard to Subterranean Termite (12 min)
  - Firda Aulya Syamani, Muh. Yusram Massijaya, Bambang Subiyanto: Termite Resistance Properties of Sisal Board (12 min)
  - Garcia, C.M., M.Y. Giron, M.R. San Pablo, D.A. Eusebio and E.D. Villena: Resistance of Wood Wool Cement Board to the Attack of Philippine Termites (12 min)
  - Ronniel D. Manalo and Carlos M. Garcia: Termite Resistance of Thermally-Modified *Dendrocalamus asper* (Schultes f.) Backer ex Heyne (12 min)
- 14:52-15:20            Tea/Coffee break

- 15:20 – 16:20            **Session (6)-Oral presentations**    Chairperson: Brian Forschler
- G. Veera Singham, Ahmad Sofiman Othman and Chow Yang-Lee: Preliminary Detection of SSR Markers in Mound Building Termite, *Macrotermes gilvus* (Hagen) (Termitidae: Macrotermitinae) (12 min)
  - Jian Hu, Kok-Boon Neoh and Chow-Yang Lee: Cuticular Permeability of Two Sympatric Species of *Macrotermes* (Blattodea: Termitidae) (12 min)
  - Wen-Hui Zeng, Rui-Xian Liu, Zhi-Qiang Li, Bing-Rong Liu, Qiu-Jian Li, Weiliang Xiao, Lai-Qun Chen, Jun-Hong Zhong: Comparison of Termite Lignocellulases Activity and Enzyme Distribution Patterns across Different Termite Genus (12 min)
  - Foong Kuan-Foo, G Veera Singham, Ahmad Sofiman Othman and Chow Yang-Lee: Survey of Natural Parasitism of *Macrotermes gilvus* (Termitidae: Macrotermitinae) by *Misotermes mindensis* (Diptera: Phoridae) in Malaysia (12 min)
  - Farah Diba: Antitermite and Antifungal Properties of the Soldier Defense Secretions of *Coptotermes curvignathus* Holmgren (Blattodea: Rhinotermitidae) (12 min)
  - Theo Evans

- 16:30 – 16:40            **Plenary session (2)**  
                                   (1) Future venues  
                                   (2) Proposals and requests from participants and EC, any other business matters  
                                   Closing remarks

18:00– 20:30            Banquet

#### 1.4 Chairpersons of oral presentation sessions

- Session (1): Kunio Tsunoda (KT)
- Session (2): Vernard Lewis (VL)
- Session (3): Abu Hassan Ahmad (AHA) and Chow-Yang Lee (CYL)
- Session (4): Jim Creffield (JC).
- Session (5): Sulaeman Yusuf (SY).
- Session (6): Brian Forschler (BF)

1.5 Session (1) started at 09.20 am and was followed by session (2) after tea/coffee break.

1.6 The excursion started at 01.30 pm after lunch to visit the Ancient City in Samut Prakhon province.

## 2 1 March 2011 (Second Day)

2.1 Sessions (3) and (4) were held in the morning.

2.2 Sessions (5) and (6) and were held in the afternoon.

2.3 After oral sessions were over, the second plenary session was held. Steph Chua (ST) announced the 8<sup>th</sup> TRG sponsors and each of them were presented with a memento of appreciation by the local organizing chairperson Dr Charunee Vongkaluang. They were:

Bayer Thai Company Ltd.  
Chieng Thai Trading Company Ltd  
Dainihon Jochugiku Company Ltd  
Dow AgroSciences  
Ensystem Company Ltd  
FMC Thailand Company Ltd  
Sherwood Thailand.

In addition, a momento was also presented to Dr Jeff Lloyd, the vice-president of the International Research Group on Wood Protection for delivering his keynote address at the conference. SC subsequently announced that the next conference venue (TRG 9 in 2012) would be in Hanoi, Vietnam, and 2013 in Malaysia, and 2014 in China.

2.4 Banquet was held at the conference venue, Tawana Hotel.

## Inventory of Low Grade Wood in East Java, Indonesia

by  
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### Abstract

Excessive exploitation of natural forests in the past and the high demand for high quality wood resulting it supplied fewer, so they were expensive and less affordable by most people. Society would increasingly consider the types of low-quality wood with a more economical price and adequate strength and durability. The purposes of this study were to know the kinds of low-grade timber that was used in East Java and the basic properties of low-grade wood especially strong and durable of timber class. Inventory the types of low-grade woods was done in district Lumajang and Malang, East Java. The surveys were conducted on timber sales centers randomly and represent the two locations. The data were analyzed in the form of the test results of wood density, bending strength, and firmness press and durability of wood in order to obtain strong and durable timber class. Based on survey results to the field and literature study in 45 low-grade timber species in East Java include wood density between 0.21 to 1.02, durability wood is a class II-V, and strength grade range is class I-V. Results of surveys indicate that there are 8 types of low-grade wood favorite of East Java. There is Mahogany, Acacia, Pine, Agathis, Mindi, Gmelina, Sengon, and Coconut. Besides, the types of bamboo that grows in East Java is also good potential to be utilized.

**Key words:** durability, density, strength grade, East Java.

### Introduction

Areas of forest in Indonesia, approximately 144 million hectares were covered with no less than 4000 kinds of wood. But only a small fraction that was well known in the market were wood-dipterocarp species such as Meranti, Keruing and other wood types (Teak, Agathis, Bangkirai and Merbau). Excessive exploitation of natural forests in the past and the high demand for high quality wood resulting it supplied fewer, so they were expensive and less affordable by most people.

The present and the future of society would increasingly consider the types of wood with a more economical price and adequate strength and durability. This could be realized with the use of timber species with enhanced low-grade quality, meaning the kinds of low-grade wood as a variable to get a relatively cheap price of timber combined with the technology improving the quality of wood as a variable to get the value of the strength and durability of wood better.

In East Java was expected quite a lot of the kinds of low-grade wood which utilized potential through the implementation of management systems and wood technology. Low-grade wood in question was the kind of mix that were previously little known or of a kind already known but in small amounts like Borneo and type of fast-growing timber species produced by industrial timber plantations or forest people.

The use of low-grade wood as building materials still need to be studied in depth mainly deals with the nature of the strength and durability of wood so it can be done sorting timber for proper use. Also an important factor in the use of low-grade wood is to consider about service life given the wooden buildings can suffer damage or deterioration of quality due to attack wood destroying organisms such as termites, beetles, and fungus.

Low-grade wood from timber species certainly have a diverse range of strength and durability of wood and for different. These conditions will be difficult for users to do even more information on sorting wood basic properties of the wood is still very limited. Based on that idea, we needed research and development of low-grade wood for building materials.

The purpose of this study are to know the kinds of low-grade timber that is used in East Java and to know the basic properties of low-grade wood especially strong and durable timber class.

## Materials and methods

### *Field survey*

Activity field survey aims to inventory the types of low grade wood in the area of East Java (Lumajang and Malang) and laboratory test sampling. The survey was conducted on timber sales centers randomly selected and represent the two locations.

### *Laboratory testing*

Laboratory testing aims to determine the durability of low-grade wood. Mechanical testing of each variable is as follows:

#### *Wood density*

Wood density obtained by weighing and measuring the volume of test sample. To find the volume of test sample used gravimetric method by dipping the test sample that has been coated with paraffin to the water, where the amount of water displaced is the volume of wood itself. Once the measured volume, test sample in an oven with a temperature of  $103 \pm 2^{\circ}\text{C}$  until constant weight.

#### *Bending and compressive strength*

Bending strength testing using a defect-free wood samples measured  $(5 \times 5 \times 76) \text{ cm}^3$  (methods of testing small clear specimens of timber) ASTM D 143-52. Meanwhile, compressive strength testing parallel to grain of maximum stress ( $\text{kg}/\text{cm}^2$ ) is determined by using a test sample  $(5 \times 5 \times 5) \text{ cm}^3$ . Tests carried out with firmness wood using wood strength testing sorting UTM. The test results are used as a measure of wood strength.

#### *Durability*

Durability of wood determined by testing the durability of wood against subterranean termites *C. curvignathus* tested in laboratory using a sample size of  $(2 \times 1.5 \times 1.5) \text{ cm}^3$  based on Somnuwat (1996). Reducing the volume of wood from termite attack after three weeks of feeding is used as a measure of durability of wood.

## Results and discussion

### *Diversity of types of wood*

The results of a survey on the timber trade center in East Java (Lumajang and Malang) showed that low-grade timber species that are relatively heavily traded in East Java about 45 (forty five) species with the endemic area in Bojonegoro, Bondowoso, Blitar, Bangil, Besuki, Banyuwangi,

Jember, Kediri, Lumajang, Madiun, Magetan, Malang, Mojokerto, Ngawi, Nganjuk, Pasuruan, Panarukan, Ponorogo, Probolinggo, Sumenep, and Surabaya. Low-grade timber species and their distribution in East Java presented in Table 1.

Table 1 Kinds of low-grade woods and their distribution in East Java

No	Name of wood	Scientific Names	Distribution Area
1	Afrika	<i>Maeopsis eminii</i>	Kosmopolitan
2	Akasia	<i>Acacia mangium</i> Willd.	Kosmopolitan
3	Bambu	<i>Bamboosa</i> sp.	Kosmopolitan
4	Bayur	<i>Pterospermum javanicum</i> Jungh.	Bjn, Bnd, Bsk, Jbr, Kdr, Njk
5	Benuang laki	<i>Duabanga moluccana</i> Bl.	Jbr, Lmj, Ml, Prb
6	Bintangur	<i>Calophyllum soulattri</i> Burm.	Srb, Snp
7	Bungur	<i>Lagerstroemia calyculata</i> Kurz.	Kosmopolitan
8	Cemara	<i>Casuarina equisetifolia</i> L.	Kdr, Lmj, Mdn, Pas
9	Cempaga	<i>Dysoxylum densiflorum</i> Miq.	Bnd, Bwi, Jbr, Pnk, Snp
10	Cengal	<i>Hopea sangal</i> Korth.	Blt, Bwi, Lmj, Ml
11	Dahu	<i>Dracontomelon mangiferum</i> Bl.	Jbr, Kdr, Bjn, Pnk
12	Damar	<i>Agathis alba</i> Foxw.	Kosmopolitan
13	Durian	<i>Durio zibethinus</i> Murr.	Bjn
14	Gelam	<i>Melaleuca leucadendron</i> L.	Png
15	Gmelina	<i>Gmelina arborea</i>	Kosmopolitan
16	Jabon	<i>Artocarpus cadamba</i> Miq.	Bjn, Bsk, Jbr, Srb
17	Kapuk hutan	<i>Ceiba petandra</i> Gaertn.	Kosmopolitan
18	Kelapa	<i>Cocos nucifera</i> L.	Kosmopolitan
19	Kemiri	<i>Aleurites moluccana</i> Wild.	Bjn, Bsk, Jbr, Kdr, Pnk, Srb
20	Kenanga	<i>Cananga odorata</i> Hook.	Bjn, Pnk, Srb
21	Kenari	<i>Canarium vulgare</i> Leenh.	P. Kangean & P. Paleat
22	Keruing	<i>Dipterocarpus</i> sp.	Bnd, Jbr, Lmj, Ml
23	Kesambi	<i>Schleichera oleosa</i> Merr.	Bjn, Kdr, Ngw, Njk, Pnk, Srb
24	Ketapang	<i>Terminalia catappa</i> L.	Pnk
25	Mahang	<i>Macaranga tanaria</i> Muell.	Bjn, Bnd, Jbr
26	Mahoni	<i>Swietenia mahogani</i> Jacq.	Kosmopolitan
27	Medang	<i>Cinnamomum parthenoxylon</i> Meissn.	Bnd, Bsk, Bwi, Jbr, Png
28	Melur	<i>Dacrydium elatum</i> Wall.	Kosmopolitan
29	Menjalin	<i>Xanthophyllum excelsum</i> Miq.	Bjn, Jbr, Kdr
30	Merambung	<i>Vernonia arborea</i> Ham.	Bnd, Bwi
31	Mindi	<i>Melia azedarach</i> L.	Kosmopolitan
32	Nyatoh	<i>Ternstroemia elongata</i> Kds.	Bwi
33	Nyirih	<i>Xylocarpus moluccensis</i> Roem.	Pnk
34	Pasang	<i>Lithocarpus elegans</i> Bl.	Bnd, Bnl, Bwi, Jbr, Mgt, Mjk,
35	Perepat laut	<i>Sonneratia alba</i> J.E.Sm.	Bwi, Pnk
36	Pinus	<i>Pinus merkusii</i> Jungh.	Kosmopolitan
37	Pulai	<i>Alstonia scholaris</i> R.Br.	Bjn, Bnd, Bsk, Jbr, Kdr
38	Puspa	<i>Schima wallhicii</i> Korth.	Mgt
39	Putat	<i>Barringtonia asiatica</i> Kurz.	Ml
40	Rasamala	<i>Altingia excelsa</i> Noronha	Mgt
41	Sampang	<i>Evodia aromatica</i> Bl.	Bnd
42	Sengon	<i>Paraserianthes falcataria</i> Fosberg.	Kosmopolitan
43	Simpur	<i>Dillenia ovata</i> Wall.	Kosmopolitan
44	Suren	<i>Toona sureni</i> Merr.	Bjn, Bnd, Jbr, Kdr, Pnk, Prb
45	Trembesi	<i>Samanea saman</i> Merr.	Kosmopolitan

Agathis, Mahogany, Pine, and Sengon are four types of low-grade wood most widely distributed in East Java other than teak wood which is a durable high-class. This is possible because the four species are cultivated in bulk timber on government-owned production forests, private, and people. Besides the four types of low-grade timber potential above, there Gmelina, Mindi, Coconut and Bamboo which are relatively high abundance in East Java.

Lumajang and Malang is known as a center of timber trade in East Java had sufficient supply of timber from forests in Lumajang and Malang itself or from another area of forest. Area of production forests and community forests in both locations were significant contribution in supplying the amount of wood in East Java. Especially in a community forest in the two locations was 13% of the total forest in East Java. Forest Service data from East Java in 2000 mentioned that the forest is the largest in Malang in East Java which was 266,624 hectares. Overall, the data area of production forests and community forests in Malang, Lumajang, and East Java.

Inventories are low-grade wood potential to meet the needs of society in general adequate and public interest in using low grade wood is relatively high potential. This is based on facts on the ground that the time required from arrival until the timber sold just one month in each center for trade.

#### **Low grade wood nature East Java**

There are nine species of woods from 45 species of woods were interested to be discussed base on their demand in the market, namely Mahogany, Acacia, Pine, Agathis, Mindi, Gmelina, Sengon, Coconut, and Bamboo. Table 2 showed the stratification of wood quality based on the wood density, durability and strength grade of nine of low-grade woods species from East Java.

Table 2 Natural characteristic of nine low-grade wood in East Java

No	Wood Names	Wood Density	Wood Durability	Strength Grade
1	Mahogany	0,64	III	II-III
2	Acasia	0,61	III	II-III
3	Pine	0,59	IV	III
4	Mindi	0,53	IV-V	II-III
5	Agathis	0,48	IV	III
6	Gmelina	0,33	IV	IV
7	Sengon	0,33	IV-V	IV-V
8	Coconut	-	-	-
9	Bamboo	-	-	-

Of the nine species, the mahogany has a durable and powerful class, much better than the eight other species. While Sengon is a type of wood that has a durable and strong class lowest among low-grade timber potential. Yet there are opportunities to improve the quality durability and strength of the wood so that the potential of wood for use as building materials more widely will be even greater.

#### **Conclusions**

Based on survey results to the field and literature study in 45 low-grade timber species in East Java include wood density between 0.21 to 1.02, durability wood is a class II-V, and strength grade range is class I-V. Results of surveys indicate that there are 8 types of low-grade wood favorite of East Java. There is Mahogany, Acacia, Pine, Agathis, Mindi, Gmelina, Sengon, and Coconut. Besides, the types of bamboo that grows in East Java is also good potential to be utilized.

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