

[ Description in English ]

แผนที่ความเหมาะสมของดินสำหรับปลูกไม้สัก  
ในจังหวัดอุดรธานีและจังหวัดหนองบัวลำภู

Soil suitability map for teak plantation  
in Udon Thani and Nong Bua Lam Phu Provinces

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2012

It means B.E.2555 on Buddhist  
calendar, and also 2012.

RFD-JIRCAS Joint Research Project

โครงการความร่วมมือด้านการวิจัยระหว่างกรมป่าไม้และ JIRCAS

RFD-JIRCAS Joint Research Project



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Published by RFD-JIRCAS Joint Research Project, March, 2012

Printed by Funny Publishing Ltd., Part., Bangkok, Thailand

จัดทำโดย โครงการความร่วมมือด้านการวิจัยระหว่างกรมป่าไม้และ JIRCAS, มีนาคม ๒๕๕๕

พิมพ์ที่ ห้างหุ้นส่วนจำกัด ฟันนี่ พับบลิชซิง กรุงเทพมหานคร

Published by RFD-JIRCAS Joint Research Project, March, 2012

Printed by Funny Publishing Ltd., Part., Bangkok, Thailand

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**แผนที่ความเหมาะสมของดินสำหรับปลูกไม้สัก  
ในจังหวัดอุดรธานีและจังหวัดหนองบัวลำภู  
(Soil suitability map for teak plantation  
in Udon Thani and Nong Bua Lam Phu Provinces)**

**ที่มา (Introduction)**

The environmental factors that are critical to the success of forest plantations are the topographical and climatic. The trees planted are appropriate for environment, they will growth well and survival in response to the objectives. On the other hand, If area is not appropriate for the tree, they have lower survival or slow development and growth. Environmental factor should be considered in site selection and planting is the soil, landform and climate. The promotion of teak plantation in the northeastern of Thailand, the climate factors such as annually rainfall, raining days and temperatures are not different very much. The main environmental factors affecting to growth and survival of the forest are soil and physical characteristics of the surface such as the height of mean the sea level, slope and soil type, etc.

Royal Forest Department in collaboration with Japan International Research Center for Agricultural Science (JIRCAS) conducted the joint research project “Development of Combined Management Techniques for Agriculture and Forestry to Support Farmers Who Are Engaged in Planting Beneficial Indigenous Tree Species” under research plan “Development Techniques for Nurturing Beneficial Indigenous Tree Species and Integrated management of Agriculture and Forestry in Northeast Thailand”. One of the results is the maps showing the soil suitability for teak plantations in the Northeast of Thailand. We hoped that this map will benefit to farmers and investors teak plantation in the selection of suitable site for teak plantation.

In the natural growth, teak grows in areas with different geological models. The growth will be good or not depending on the physical properties of soil such as depth, structure, soil porosity, water drainage, and the ability to retain moisture, etc. Teak prefer soils with neutral soil reaction or slightly alkaline. Normally, teak grows and develops well in soils with pH values from 6.5 to 7.5. Teak should avoid be planted in the area with water locking, shallow and compaction soil. The growth of teak will be halted in the lateritic soil, although some areas were not compact. Teak is a tree that grows well in soils with calcium (calcicolous species). Teak requires more calcium to the development and growth than other species. The young teak has a lot of fibrous root in the top soil during the rainy season. They will die in the dry season and the new roots will be developed in deeper soil layers, which have adequate ventilation (White, 1991) in the early stages of growth tap

root developed within the deep soil and act as a significant portion of water uptake. Teak has a long but not very thick tap root. Soil moisture content affects to the amount and distribution of the root which absorb the moisture. Development of roots will be halt in the sediment and clay soil and the development of tap root can is very low (Kadambi, 1972). Teak can grow in different ecological conditions which the annual rainfall is between 700 to 2000 mm.

This study was conducted in Udon Thani and Nong Bua Lam Phu Provinces, Northeast of Thailand. They are the pilot study area. Udon Thani located on the Korat plateau, Northeast of Thailand closed to Khon Kean Province (in the south) and Nong Khai Province (in the north). The area is 7,331,437.5 rai, mean annual rainfall was 1,520 mm. Nong Bua Lam Phu Province located on the west side of Udon Thani province (it was part of Udon Thani in the former time). The area is 2,411,875 rai, mean annual rainfall 1,016 - 1,844 mm (average during 2538-2545)

### **วิธีการ (Methodology)**

1) The 1:50,000 soil map in Udon Thani and Nong Bua Lam Phu Provinces of LDD were apply to classify suitable soil for cash crops. The soil properties such as subsoil texture, drainage, soil depth, soil pH and natural soil fertility. This step classified into 3 classes namely well suited, moderately suited and not suited. The ground check was not conducted in this step.

2) Revised map to soil suitability for teak plantation in Udon Thani and Nong Bua Lam Phu Provinces

3) Collected the teak plantation sites position data from Royal Forest Department (RFD).

4) The soil suitability maps were overlaid with teak plantation sites for selecting observation plantations. (ground check)

5) Ground check by sampling teak plantation in various sites in Udon Thani and Nong Bua Lam Phu Provinces. Soil samples were collected and analyzed the properties. Landform, soil properties and teak growth were described as well.

6) Used the data to improve and reclassify soil suitability classes

7) Re-mapping soil suitability map in Udon Thani and Nong Bua Lam Phu Provinces

8) Accuracy was investigated by comparing the revised soil suitability class by the field observation with the teak growth class (site index) of teak plantation in Northeast of Thailand

9) Making the soil suitability map for teak plantation in Udon Thani and Nong Bua Lam Phu provinces.

## ความหมายของสัญลักษณ์ในแผนที่ (Symbol on the map)

### 1. Soil suitability class

From the study, the soil suitability class should be re-classify to 5 classes as follows:

- 1) Soil very well suited
- 2) Soil well suited
- 3) Soil moderately suited
- 4) Soil poorly suited
- 5) Soil unsuited

Soil suitability class 1 is the best suitable for teak plantation or the soil has no limitation for teak plantation. In this study the slightly acid soil was classified in this class.

Soil suitability class 2 is the soil which is suitable for teak plantation with some limitations such as lack of nutrients.

Soil suitability class 3, 4 is the soil which properties can be improved by soil management such as fertilizing, combined with legume species for improving soil richness.

Soil suitability class 5 is the unsuitable soil for teak plantation. Teak plantation is not recommended in this area.

### 2. Limitation of soil

Limitations of soil according to the definition of LDD (1990) are :

- a : Slightly acid
- d : Poor drainage, too wet soil
- f : Flooding
- g : Gravel or shallow soil
- n : Nutrient in soil (lack of or too much nutrient) or soil pH too high or too low
- s : Unsuitable soil texture such as sandy or low natural nutrient

### 3. Relation between soil suitability class and teak growth class

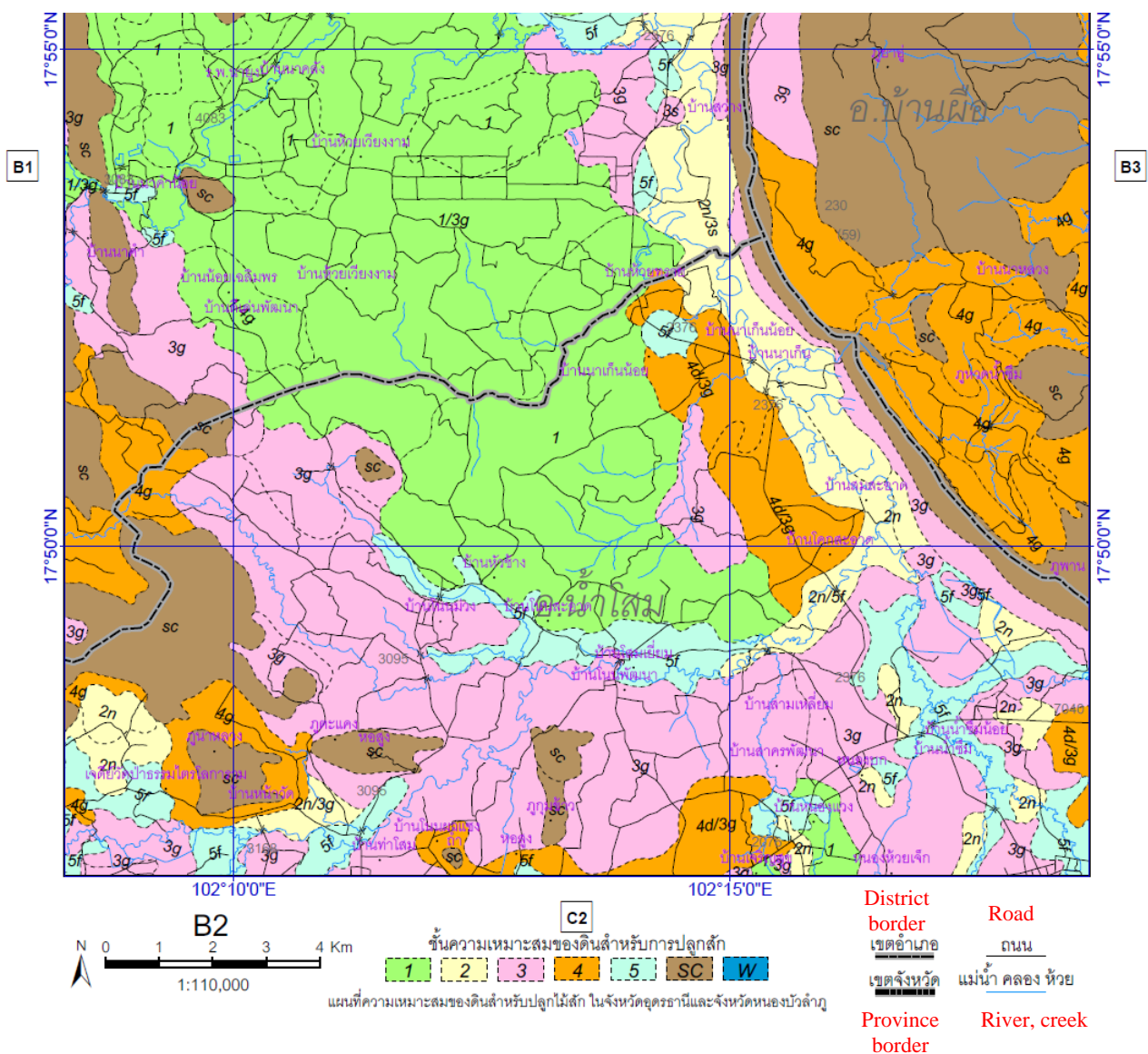
According to ground survey, teak growth can be classified to 5 classes using the site index followed by Yield Table of teak plantation in Northeast of Thailand which produced by Joint Research Project between RFD and JIRCAS (2010). Teak growth class 1 means teak growth is very good, 2 is good, 3 is medium, 4 is poor and 5 is very poor. The relationship between soil suitability class and teak growth class as follows;

Soil suitability class	Teak growth class
------------------------	-------------------

1	1~2
2n	2~3
3d	3~4
3g	3~4
3s	3~4
4d	4~5
4g	4~5
5f	5

For example, soil suitability class 1 means that the capacity of teak growth can be reach to class 1 or 2 of teak growth class. However actual teak growth in lower soil suitability class could be upgraded by other factors such as management especially in the young stage. The best management can make the best teak growth. We would like to improve this soil suitability map with consideration for such factor influences.

### การใช้แผนที่ (How to use maps)



Taking your area in Nong Bua Lam Phu Province as an example, the following shows how to use soil suitability map;

1) An area is near Nong Hui Jek which is shown as soil suitability class “1”. Or the green area means very well suited soil for teak plantation without any limitation. Teak can be grown very well. The growth also depends on the management. If your teak plantation is not good managed, teak growth could be only class 2.

2) An area is in Ban Charoensuk, the soil suitability is “2n” or in the light yellow area. It means that soil suitability class is 2 with the limitation in nutrient and soil pH is too acid or too alkaline. If soil is improved by fertilizing, soil suitability can be reach to class 1

3) An area is in Ban Sakhon Pattana, the soil suitability is “3g” or in the pink area. It means that soil suitability class is 3 or medium suitability with the limitation in soil mixed with gravel or shallow soil.

4) Area of the soil suitability “3g” or in the pink area means that soil suitability class 3 or moderated suitability with the limitation in soil mixed with gravel or shallow soil.

5) Area of the soil suitability “4d/3g” or in the orange area means that soil suitability class is combination between 4d which poorly suited soil with the limitation in water drainage, too wet soil for teak and another class is 3g or medium suitability with the limitation in soil mix with gravel or shallow soil. The 4d is more dominant than 3g

6) Area of soil suitability “5f” or in the blue area means that this soil is unsuited for teak because of flooding. Teak should not planted in this area

7) Area of brown or Slope Complex (SC) is slope more than 35 percent. It is reserved for soil and water conservation.

8) Dark blue area(W) shows the water area such as water reservoir.

**คำแนะนำในการเลือกพื้นที่ที่มีสภาพดินเหมาะสมสำหรับการปลูกไม้สัก (Instruction on how to select site with suitable soil for teak plantation)**

Teak is the tree species that must be planted in appropriate locations. Therefore, for effectively successful or economic returns worth for the investment, we should plant in an area with soil suitability classes 1-2. In classes 3-4, it may need appropriated management to improve soil conditions. Depending on the cost of the investment, such as 4d, with limitations in the water, it will be increased the investments if we dig trenches to drain the excessive. In the case of 3g, which has



limited the availability of gravel mixed in the soil, improving the soil may be difficult or require a large investment which may not be worth. However, we should avoid planting teak in areas with suitable soil in class 5.

### **ชุดดินที่เหมาะสมสำหรับการปลูกสร้างสวนป่าไม้สัก ในจังหวัดอุดรธานีและหนองบัวลำภู (Soil suitability for teak plantation in Udon Thani and Nong Bua Lam Phu Provinces)**

Soil series which are representatives of suitable soil for teak plantation in Udon Thani and Nong Bua Lam Phu Provinces are;

1 : Soil very well suited ; Loei (Lo), Wang Hi (Wi), Chieng Mai (Cm), Tha Muang (Tm), Sri Kei (Si)

2n : Soil well suited with limitation in soil pH (slightly acid) ; Korat (Kt), Sa Tuk (Suk), Wa Rin (Wn), Yasothon (Yt), Pak Chong (Pc) and Chock Chai (Ci)

3s : Soil moderately suited with limited in soil texture such as sandy soil or low nutrient. This soil series are Chum Pong (Cpg), Chakrarat (Ckr), Ban Pai (Bpi), Mahasarakham (Msk) and Num Phong (Ng)

3g : Soil moderately suited with limitation in gravel and shallow soil. This soil series are Chang Khan (Ch), Pon Pisai (Pp), Sakhon Nakhon (Sk), Poon Ngam (Png), Lad Ya (Ly), Tha Yang (Ty) and Mae Rim (Mr)

4d : Soil poorly suited with limitation in drainage or too wet soil for teak. This soil series are Ubon (Ub) and Pen (Pn)

5f : Soil unsuited ; Burirum (Br), Pi Mai (Pm), Ratchaburi (Rb), Chom Sang (Cs), Nakhon Phanom (Nn), Roi Ed (Re), Renoo (Rn), Kula Rong Hi (Ki) and Udon (Ud)

From the soil suitability map for teak in Udon Thani and Nong Bua Lam Phu Provinces can be summarized as follow:

#### Udon Thani Province

As for Udon Thani Province, the results showed very well suited areas 21,009 ha (1.9 %) in the northwest part of Province as Na Yung and Nam Som Districts. Well suited areas were 132,005 ha (12.1 %) mainly in Kudchab, Nong Wua So, Nong Saeng and Wang Sam Mo Districts. Moderate suited areas were 462,086 ha (42.3 %). Poorly suited areas were 130,443 ha (12.0 %) and unsuited areas were 257,626 ha (23.6 %)

#### Nong Bua Lam Phu Province

As for Nong Bua Lam Phu Province, the results showed very well suited areas 7,816 ha (1.9 %) in the northwest part of the Province as Suwan Khuha District. Well suited areas were 77,316 ha (19.1 %) mainly in Na Klang, Si Bun Ruang and Mueang Districts. Moderately suited areas were 66,392 ha (16.4 %). Poorly suited areas were 85,754 ha (21.2 %), and unsuited areas were 118,046 ha (29.1 %)

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## คำนิยม (Acknowledgement)

We appreciate teak plantation owners in Udon Thani and Nong Bua Lam Phu Provinces for giving us opportunity to collect data of teak growth and soil samples. We thank colleagues from LDD for help and support on collecting soil sample and analyzing. Also we thank officers of Forest Management Bureau No. 6 (Udon Thani) for good cooperation and support on many things during the study.

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**ภาคผนวก**  
**ภาพถ่ายอย่างดินตามชั้นความเหมาะสมของดิน**  
**(Appendix)**  
**(Soil sample photographs of soil suitability classes)**

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[Followings are captions of photographs]

ชั้นความเหมาะสมของดิน (Soil Suitability Class : SSC) = 1

อำเภอสุวรรณคูหา จังหวัดหนองบัวลำภู วันที่ 26 สิงหาคม 2554

Soil suitability class(Soil Suitability Class : SSC) = 1

Photo: Suwan Khuha District, Nong Bua Lam Phu Province, Aug. 26, 2010

ชั้นความเหมาะสมของดิน (Soil Suitability Class : SSC) = 1

อำเภอน้ำโสม จังหวัดอุดรธานี วันที่ 26 สิงหาคม 2554

Soil suitability class(Soil Suitability Class : SSC) = 1

Photo: Nam Som District, Udon Thani Province, Aug. 26, 2009

ชั้นความเหมาะสมของดิน (Soil Suitability Class : SSC) = 2n

อำเภอเมือง จังหวัดหนองบัวลำภู วันที่ 25 สิงหาคม 2554

Soil suitability class(Soil Suitability Class : SSC) = 2n

Photo: Mueang District, Nong Bua Lam Phu Province, Aug. 25, 2010

ชั้นความเหมาะสมของดิน (Soil Suitability Class : SSC) = 2n

อำเภอบ้านผือ จังหวัดอุดรธานี วันที่ 23 กรกฎาคม 2554

Soil suitability class(Soil Suitability Class : SSC) = 2n

Photo: Ban Phue District, Udon Thani Province, July 23, 2010

ชั้นความเหมาะสมของดิน (Soil Suitability Class : SSC) = 2g

อำเภอสุวรรณคูหา จังหวัดหนองบัวลำภู วันที่ 26 สิงหาคม 2554

Soil suitability class(Soil Suitability Class : SSC) = 2g

Photo: Suwan Khuha District, Nong Bua Lam Phu Province, Aug. 26, 2010

ชั้นความเหมาะสมของดิน (Soil Suitability Class : SSC) = 3g

อำเภอน้ำโสม จังหวัดอุดรธานี วันที่ 21 กรกฎาคม 2554

Soil suitability class(Soil Suitability Class : SSC) = 3g

Photo: Nam Som District,Udon Thani Province, July 21, 2010

ชั้นความเหมาะสมของดิน (Soil Suitability Class : SSC) = 3g

อำเภอเพ็ญ จังหวัดอุดรธานี วันที่ 27 สิงหาคม 2554

Soil suitability class(Soil Suitability Class : SSC) = 3g

Photo: Phen District, Udon Thani Province, Aug. 27, 2009

ชั้นความเหมาะสมของดิน (Soil Suitability Class : SSC) = 3s

อำเภอวังสามหมอ จังหวัดอุดรธานี วันที่ 10 กุมภาพันธ์ 2554

Soil suitability class(Soil Suitability Class : SSC) = 3s

Photo: Wang Sam Mo District, Udon Thani Province, Feb. 10, 2010

ชั้นความเหมาะสมของดิน (Soil Suitability Class : SSC) = 3s

กิ่งอำเภอกู่แก้ว จังหวัดอุดรธานี วันที่ 11 กุมภาพันธ์ 2554

Soil suitability class(Soil Suitability Class : SSC) = 3s

Photo: Ku Kao District, Udon Thani Province, Feb. 11, 2010

ชั้นความเหมาะสมของดิน (Soil Suitability Class : SSC) = 4d

อำเภอนากลาง จังหวัดหนองบัวลำภู วันที่ 27 สิงหาคม 2554

Soil suitability class(Soil Suitability Class : SSC) = 4d

Photo: Na Klang District, Nong Bua Lam Phu Province, Aug. 27, 2010

ชั้นความเหมาะสมของดิน (Soil Suitability Class : SSC) = 4g

อำเภอสุวรรณคูหา จังหวัดหนองบัวลำภู วันที่ 26 สิงหาคม 2554

Soil suitability class(Soil Suitability Class : SSC) = 4g

Photo: Suwan Khuha District, Nong Bua Lam Phu Province, Aug. 26, 2010

ชั้นความเหมาะสมของดิน (Soil Suitability Class : SSC) = 4g

อำเภอนากลาง จังหวัดหนองบัวลำภู วันที่ 27 สิงหาคม 2554

Soil suitability class(Soil Suitability Class : SSC) = 4g

Photo: Na Klang District, Nong Bua Lam Phu Province, Aug. 27, 2010

ชั้นความเหมาะสมของดิน (Soil Suitability Class : SSC) = 5f

อำเภอเมือง จังหวัดหนองบัวลำภู วันที่ 24 สิงหาคม 2554

Soil suitability class(Soil Suitability Class : SSC) = 5f

Photo: Mueang District, Nong Bua Lam Phu Province, Aug. 24, 2010