

Contents lists available at ScienceDirect



Agriculture and Natural Resources

journal homepage: <http://www.journals.elsevier.com/agriculture-and-natural-resources/>



Original Article

Survey of flood-tolerant bamboos in 2011 flooding in Thailand

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ARTICLE INFO

Article history:

Received 21 September 2016

Accepted 9 March 2018

Available online xxx

Keywords:

Bamboo
Flood-tolerant
Thailand

ABSTRACT

This survey work was undertaken in 2013 but has never been published. Several places that suffered from the 2011 Thailand floods were surveyed during December 2012 to March 2013 to identify potential bamboo species that could tolerate flooding stress. In total, 23 survey points were investigated, mainly in those places where flooding persisted for relatively long periods. These also included another flood-prone area in the riparian forests along the Mun River, northeastern Thailand. Ten bamboo species were found in the study areas. Some bamboo species in the genus *Bambusa* were more flood-tolerant than those from other genera. The relatively well-known multi-purpose bamboo species, *B. beecheyana*, was the most flood-tolerant and it appeared that it could withstand being flooded for at least 5 mth.

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Introduction

Now, there is no doubt that climate change is human caused and that a severe result of climate change is flooding, which causes the death of both agricultural crops and forest plants and consequently can lead to food and wood shortages (The Intergovernmental Panel on Climate Change, IPCC, <http://www.ipcc.ch/>; Wheeler and von Braun, 2013). Even though terrestrial plants have aquatic origins, only about 1–2% of the extant angiosperms are aquatic (Cook, 1999; Colmer and Voesenek, 2009; Jackson et al., 2009; The Plant List, 2010). However, some land plants can tolerate flooding too and bamboos are among them (Franklin et al., 2010).

Due to their high species diversity, wide distribution and availability, rapid growth and easy handling, bamboo is centrally involved in human daily life, especially in Asia, America, and Africa, where they grow naturally, so that consequently, bamboo is recognized as one of the best multi-purpose plant species in the world (Kurz, 1876; Dransfield and Widjaja, 1995; Rashford, 1995; Wong, 1995; Sungkaew et al., 2011). Bamboo is also regarded as a potential crop for flood-prone areas and as a suitable material for flood countermeasures. However, to date, there are few studies on

this specific topic available (Franklin and Hogarth, 2008; Franklin et al., 2010; Banik, 2015). In Thailand, bamboo has been involved in the everyday life of Thai people from ancient time to the present (Sungkaew et al., 2011) and has been used in many applications including as food and construction material and in musical instruments, furniture and handicrafts (Wong, 1995; Sungkaew et al., 2011).

Following the widespread flooding in Thailand in 2011, bamboo was acknowledged as one of the most useful plants that both people and animals can use during such hard times; however, at that time, such knowledge was relatively vague (Forestry Research and Development Bureau, 2009; Sungkaew et al., 2011; Deecharoen, 2014). Despite the lack of data, this study focused on the flood-tolerant bamboo species which can survive in flood-prone areas and specifically their period of submergence and the depth of flooding.

Material and methods

Field surveys on potential bamboo species that can tolerate flooding were made during December 2012 to March 2013 in flood-prone areas, particularly in Phitsanulok, Chainat and Phra Nakhon Si Ayutthaya provinces. Bamboo species in riparian forests along the Mun River of northeastern Thailand were also investigated.

Primary data of flood-tolerant bamboo species were directly observed and documented in the study areas. Plant specimens were

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<https://doi.org/10.1016/j.anres.2018.03.001>

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collected for identification using classical herbarium techniques. At each survey point, information was collected about the utilization of each bamboo species, vernacular names and parts used by the indigenous people together with some secondary data from relevant publications.

Results and discussion

In total, 23 survey points, in four regions of Thailand, were observed (6 in the north, 5 in the northeast and 12 in central and eastern Thailand) as shown in Fig. 1. All the bamboo species found in this study were of mature size (Ohrnberger, 1999; Sungkaew et al., 2011).

Central region

In Ang Thong province one survey point was chosen in Ratchasathit municipality, Chai Yo district (47P: 654501.09 m E/1623078.57 m N). The flood levels were around 1–2 m high in 2011. This area was affected by flooding for 4 mth. *Bambusa beecheyana* Munro and *B. blumeana* Schult. f. were identified as flood-tolerant species.

In Phra Nakhon Si Ayutthaya (Ayutthaya) province, three survey points were selected in Kob Chao municipality, Bang Ban district (47P: 658883.87 m E/1587383.05 m N), Singhanat municipality, Lad Bua Luang district (47P: 651524.57 m E/1564930.17 m N) and Phai

Phra municipality, Bang Sai district (47P: 655221.68 m E/1572134.66 m N). The flood levels were around 1–2 m high during the 2011 Thailand floods. These areas were submerged for 2–4 mth. Two bamboo species (*B. beecheyana* and *B. blumeana*) were identified as flood-tolerant.

In Chainat province, three survey points were selected in Wung Man municipality, Wat Sing district (47P: 599745.84 m E/1679284.47 m N), Makhm Tao municipality, Wat Sing district (47P: 612526.46 m E/1685947.49 m N) and Khao Kaew municipality, Sapphaya district (47P: 639194.05 m E/1674702.18 m N). The flood levels were around 0.5–2 m high. These areas were submerged for 1 wk to 4 mth. Three flood-tolerant bamboo species were identified: *B. beecheyana*, *B. blumeana* and a tentative hybrid species *Dendrocalamus membranaceus* × *Thyrsostachys siamensis* (Dr. Somran Suddee, pers. comm.), known in Thai as ‘pai liang’.

In Nakhon Pathom province, two survey points were selected in Salaya municipality, Buddha Monthon district (47P: 642779.17 m E/1523362.88 m N) and Bang Phasi municipality, Bang Len district (47P: 633809.15 m E/1548028.85 m N). The flood levels were around 1–2 m high. These areas were affected by flooding for 1–2 mth. Six bamboo species were found alive in the areas surveyed: *B. bambos* (L.) Voss, *B. beecheyana*, *B. blumeana*, *B. vulgaris* Schrad., *B. longispiculata* Gamble and *Thyrsostachys siamensis* Gamble.

In Prachin Buri province, two survey points were selected in two villages (Wung Hang and Nong Ean) in Na Kham municipality,

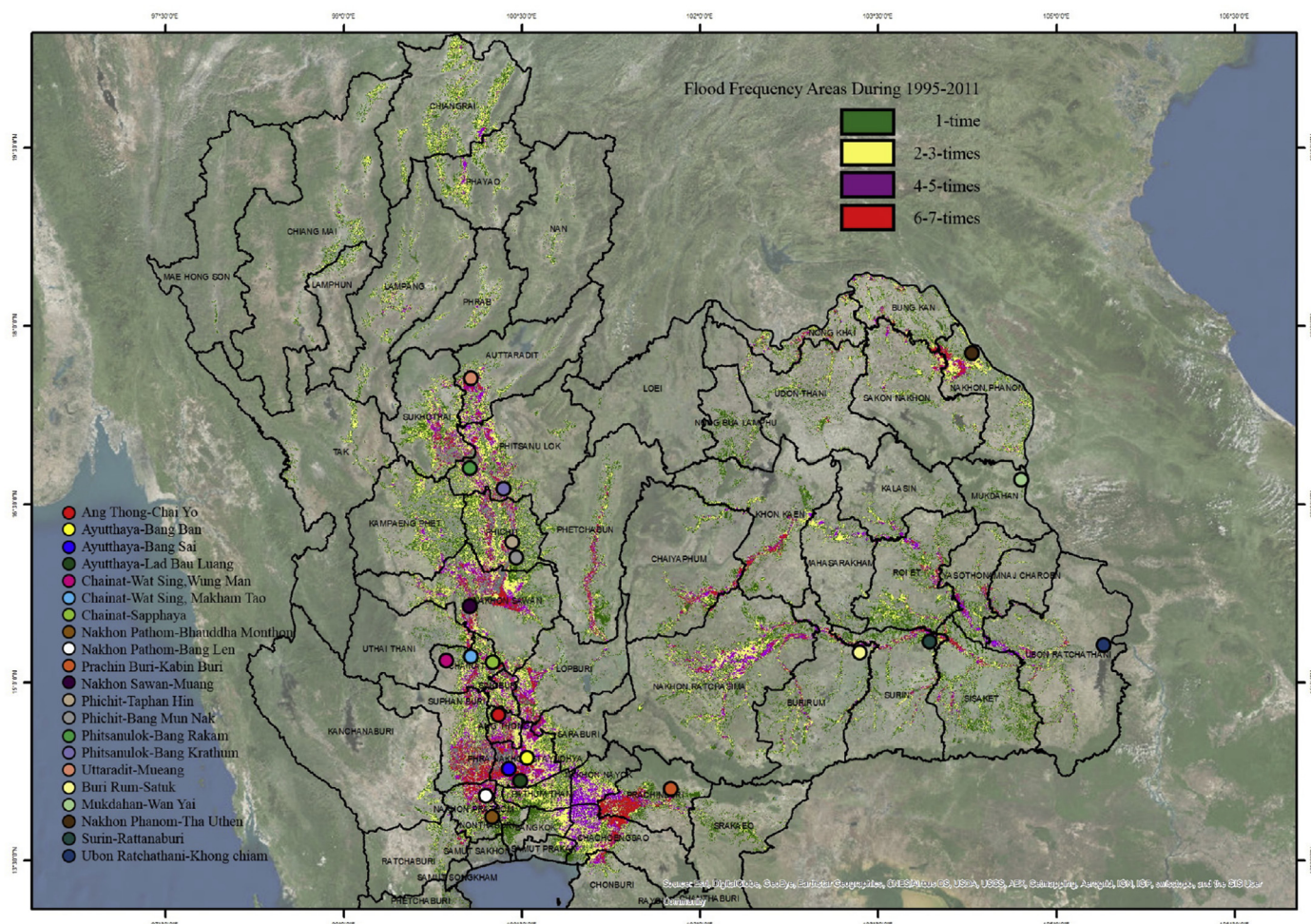


Fig. 1. Map of areas of repeated flooding in Thailand during 1995–2011 showing survey points (eastern region is omitted, adapted from <http://flood.gistda.or.th>).

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