





24 would provide quantitative references for plantation management practices and boreal forest  
25 growth prediction under future climate change. The data set is freely available for  
26 noncommercial scientific applications, and the DOI for the data is [https://doi.org/10.1594/](https://doi.org/10.1594/PANGAEA.880984)  
27 [PANGAEA.880984](https://doi.org/10.1594/PANGAEA.880984).

28

## 29 **1 Introduction**

30 Boreal forests, the second largest biome in the world, cover about one-third of the Earth's  
31 forest area (Keenan et al., 2015). Dahurian larch (*Larix gmelinii* Rupr.) is a dominant tree  
32 species in Chinese boreal forest, which is distributed primarily in northeast China. *Larix*  
33 *gmelinii* forest is also the predominant timber source in China, occupying 55% of Chinese  
34 boreal forest area and accounting for 75% of Chinese boreal forest volume (Xu, 1998; Zhou  
35 et al., 2002). *Larix gmelinii* forest is situated in the southernmost part of the global boreal  
36 forest biome (Shugart et al., 1992) and undergoing the greatest climatically induced changes.  
37 Thus understanding the growth characteristics of *Larix gmelinii* forest in China are of critical  
38 need for management and prediction under future climate change.

39 With increased greenhouse effective and climate warming in recent years, forest carbon  
40 sink is ~~is payed~~ more and more attention by the world. Forestation is the main measure to offset  
41 the greenhouse gas emission and increase carbon sink. China has the largest area of forest  
42 plantations in the world, approximately 79 million ha or one-fourth of world total (FAO,  
43 2015; Payn et al., 2015). *Larix gmelinii* is an important fast-growing and cold-tolerant tree  
44 species used in forestation in northeast China. *Larix gmelinii* is usually planted after fire or  
45 logging. The growth rates of *Larix gmelinii* plantations are important indexes in the  
46 assessment of forest recovery processes and carbon sequestration potentials, which could  
47 supply strategies for post-fire or post-harvest management. The data set can provide basis for  
48 evaluating and predicting the carbon sequestration and its potential of the forestation



49 activities.

50 Relating the easily measured variables (e.g. tree height, ~~diameter~~) to other structural and  
51 functional characteristics, is the most common and reliable method for estimating forest  
52 biomass, net primary production and biogeochemical budgets (Luo, 1996; Fang et al., 2001).  
53 For larch forests in northeast China, synthesis studies mainly focused on biomass and net  
54 primary production with a small quantity of samples, for example, N=28 (Luo, 1996), N=17  
55 (Wang et al., 2001a), N=18 (Wang et al., 2001b; Zhou et al., 2002), N=36 (Wang et al., 2005),  
56 N=83 (Wang et al., 2008). However, large numbers of growth measurements (e.g. tree height,  
57 ~~DBH~~, volume) have scarcely been studied systematically at the large scale. Therefore, a  
58 comprehensive growth data set (N=776) of Dahurian larch in northeast China was developed  
59 in this paper.

60

## 61 **2 Data and methods**

### 62 **2.1 Research origin descriptors**

63 **(1) Identity:** Growth data set of natural and planted Dahurian larch in northeast China,  
64 version 1.0

#### 65 **(2) Originators:**

66 Bingrui Jia, State Key Laboratory of Vegetation and Environmental Change, Institute of Botany,  
67 Chinese Academy of Sciences, Beijing 100093, China;

68 Guangsheng Zhou, Chinese Academy of Meteorological Sciences, Beijing 100081, China.

69 **(3) Period of Study:** From January 1965 to December 2015.

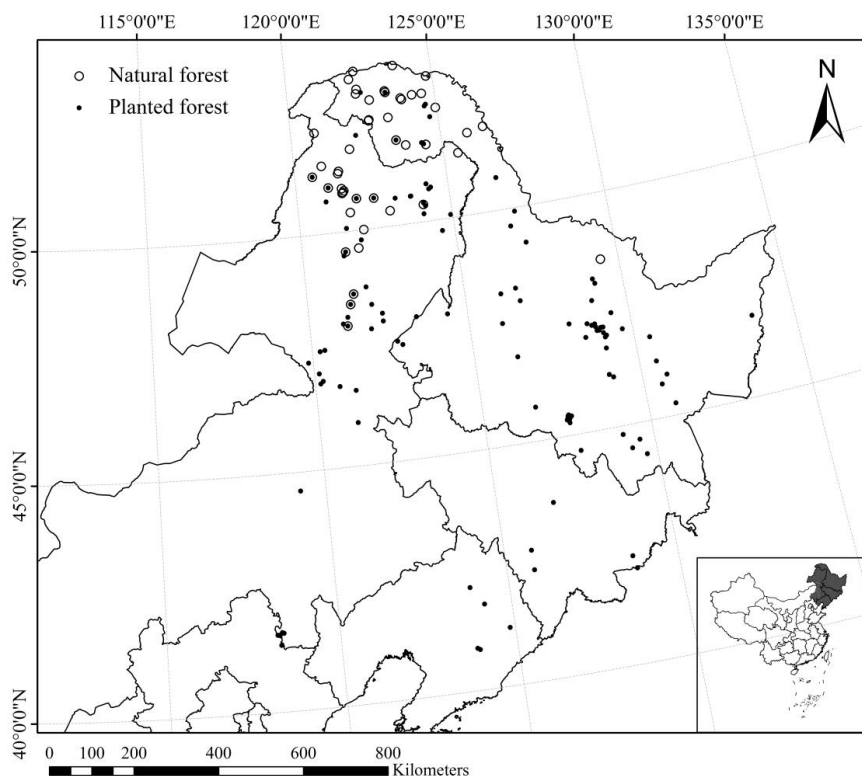
70 **(4) Objectives:** We conducted a complete literature and book review of published studies on  
71 tree height, ~~DBH~~, and/or volume in *Larix gmelinii* forests including natural and planted  
72 forests in order to develop a growth data set. The data set can be used to analyze growth



73 characteristics of *Larix gmelinii* forests and assess their potential productivity in future  
74 climate warming.

## 75 2.2 Site description

76 (1) **Site type:** Data were derived from 123 study sites in northeastern China. This region  
77 includes Heilongjiang, Liaoning, Jilin provinces and the eastern part of Inner Mongolia  
78 Autonomous Region (Fig. 1).



79

80 Figure 1. Study sites of *Larix gmelinii* across northeastern China, including Heilongjiang,  
81 Liaoning, Jilin provinces and the eastern part of Inner Mongolia Autonomous Region. Open  
82 circles represent natural forests and dots represent planted forests.

83 (2) **Habitat:** *Larix gmelinii* forest is naturally distributed in Great Xing'an Mountains of  
84 northeastern China. *Larix gmelinii* was usually planted in barren hills, post-fire or  
85 post-harvest area in northeast China.



86 **(3) Climate:** The climate in northeast China is controlled by the high latitude East Asia  
87 monsoon, changing from cool temperate to temperate zones from north to south, and from  
88 semi-arid to humid zones from west to east. Mean annual temperature (MAT) for these sites  
89 ranged from -6.1 to 7.0 °C, and mean annual precipitation (MAP) from 355 to 926 mm.

### 90 **2.3 Data sources**

91 Published studies (1965-2015) were collected from available online full-text databases,  
92 including China Knowledge Resource Integrated Database (<http://www.cnki.net/>), China  
93 Science and Technology Journal Database (<http://www.cqvip.com/>), Wanfang Data  
94 Knowledge Service Platform (<http://www.wanfangdata.com/>), ScienceDirect (<http://www.sciencedirect.com/>), ISI Web of Science (<http://isiknowledge.com/>) and Springer Link  
96 (<http://link.springer.com/>). The different combination of the terms “Dahurian larch (or *Larix  
97 gmelinii*)” with “height”, “diameter at breast height (or DBH)”, “tree volume” and “stand  
98 volume” were searched in full text. Meanwhile, we also looked up the related books (e.g. Ma,  
99 1992; Wang, 1992; Zhou, 1994; Yang, 2009). We attempted to compile a complete growth  
100 data set of natural and planted Dahurian larch in northeastern part of China (between 40.85 °  
101 N and 53.47 °N; between 118.20 °E and 133.70 °E).

### 102 **2.4 Data collection criteria**

103 A critical review of the literatures collected from the above-mentioned sources was  
104 conducted to obtain reliable growth data using the following criteria:

105 **(1) Scope:** The objective of this study was to provide the data for understanding growth  
106 characteristics of *Larix gmelinii* natural forests (pure *Larix gmelinii* or its proportion more  
107 than 50%) and monoculture plantations. Forest stands included in the data set were restricted  
108 to those not recently disturbed by logging, fire, or insect pests. Additionally, the following  
109 small numbers of special types were excluded: (i) *Larix gmelinii* afforestation in wetland (Li  
110 et al., 1985; Song & Li, 1990; Huang, 2011; Cui et al., 2013), pastureland (Duan, 2005), or



111 abandoned mine land (Yang et al., 2013); (ii) hybrid test between *Larix gmelinii* and other  
112 larch (Deng et al., 2010; Zhang et al., 2005); (iii) low-yield stands in hard environment, e.g.  
113 igneous rock forest (Wang et al., 1979), old man forest (Wang et al., 1991).

114 **(2) Study design and sampling:** ~~Tree height and~~ DBH were averaged from the measurement  
115 values of all trees in plots ~~or~~ with random/systematic sampling method. Tree regeneration  
116 layer, generally below 5 cm in DBH or 1.3 m in height, was neglected in sampled plots. Stem  
117 volume of individual tree was computed from felled-wood samples or local tree volume  
118 equations. Stand volume was usually calculated by multiplying mean individual volume with  
119 stand density. Besides the growth data (i.e. ~~height, DBH~~ and/or volume), the necessary  
120 information should be provided in the original sources, e.g., ~~study site, stand origin,~~ stand age,  
121 etc.

122 **(3) Quality control:** The data quality has been carefully reviewed by the authors. Data has  
123 undergone substantial checking, for example, cross-check for the relevant information from  
124 different sources, preliminary correlation analysis among growth variables.

125 Consequently, 776 records that met the above criteria were selected to develop a  
126 comprehensive growth data set of Dahurian larch in China. The data set includes growth  
127 characteristics of Dahurian larch (i.e. mean tree height (m), mean DBH (cm), mean tree  
128 volume ( $10^{-3} \text{ m}^3$ ) and/or stand volume ( $\text{m}^3/\text{ha}$ )). In addition, associate information was  
129 included, if available in original sources or ascertainable from other relevant literatures, i.e.,  
130 geographical location (province location and locality name of study site, latitude (°),  
131 longitude (°), altitude (m), aspect and slope (°), stand description (origin, stand age (years),  
132 stand density (trees/ha) and canopy density), climate (mean annual temperature (MAT, °C)  
133 and mean annual precipitation (MAP, mm)), and sample regime (observing year, plot size and  
134 number).

## 135 2.5 Data structural descriptors



136 Table 1 Variable information in the data set.

Column code	Definition	Unit	Number	Range
ID	Unique identification number of each record	N/A	776	1—776
Province	Province location of study site	N/A	776	N/A
Study site	Locality name of study site	N/A	123	N/A
Latitude	Latitude of study site	°	776	40.85—53.47
Longitude	Longitude of study site	°	776	118.20—133.70
Altitude	Altitude of study site	m	776	130—1260
Aspect	Slope direction of study site, including flat slope (FL), sunny slope (SU: South), half-sunny slope (HSU: West, Southwest, Southeast), shady slope (SH: North) and half-shady slope (HSH: East, Northwest, Northeast)	N/A	300	N/A
Slope	Slope degree of study site	°	357	0—60
Origin	Stand origin was classified into natural and planted forests	N/A	776	N/A
MAT	Mean annual temperature, from original study or other related reference	°C	776	-6.1—7.0
MAP	Mean annual precipitation, from original study or other related reference	mm	776	355—926
Age	Stand age, which is generally defined as age since germination in natural forest and since planting in planted forest. Stand age is usually obtained from historical records or tree rings.	years	776	1—280
Height	Mean tree height	m	670	0.24—29.40
DBH	Mean diameter at breast height, base diameter was only given in some young forests and marked with <sup>B</sup>	cm	664	0.70—34.89
V <sub>tree</sub>	Mean tree volume, the estimated tree volume data from the two-variable larch equation were marked with <sup>E</sup>	10 <sup>-3</sup> m <sup>3</sup> /tree	696	0.04—935.73
V <sub>stand</sub>	Stand volume, the estimated stand volume data from the estimated tree volume and stand density were marked with <sup>E</sup>	m <sup>3</sup> /ha	590	0.07—975.32
Density	Stand density/Canopy density, planting density was only given in some studies and marked with <sup>P</sup>	trees/ha %	656 150	213—13275 0.2—1.0
Area	Plot area	m <sup>2</sup>	397	50—10000
Plot	Plot numbers, i.e. replications	N/A	573	1—25
Year	Investigation year	N/A	533	1954—2014
Reference	Data sources, the sources used to supplement climate information lacking in the original publications were added asterisks.	N/A	226	1965—2015

137

138 **3 Data estimates and evaluation**139 **3.1 Geographical location**

140 Google Earth (Version: 7.1.8.3036) was used to estimate latitude, longitude, and/or altitude

141 when the geographic coordinates was unavailable in original sources.

142 **3.2 Tree and stand volume**

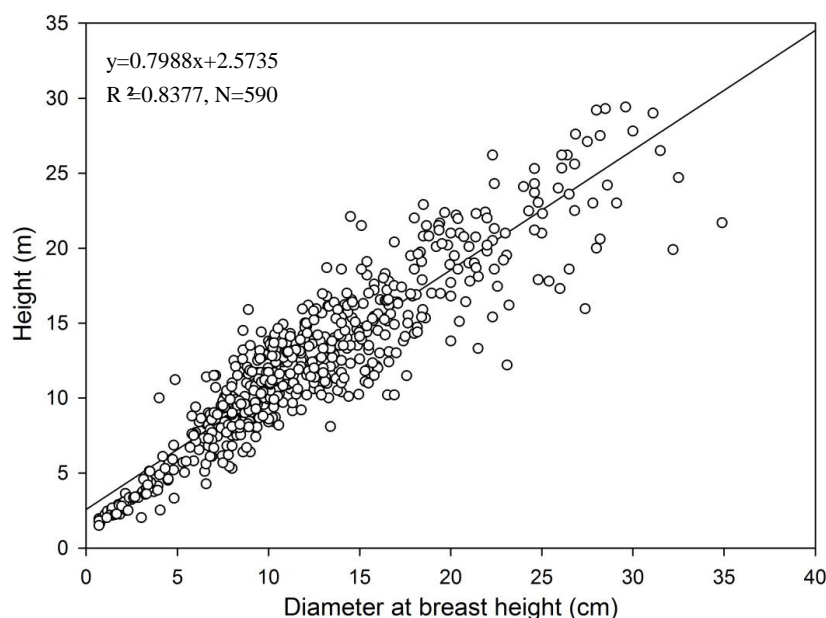
143 The missing tree and stand volumes were estimated with the available information (mean

144 DBH, mean tree height and stand density). Stem volume of individual tree was calculated



145 with the larch equation in northeast China ( $V_{\text{tree}} = 0.000050168241 \text{ DBH}^{1.7582894} \text{ H}^{1.1496653}$ ),  
146 the best method recommended by the [national](#) standard of China: Tree volume tables (LY  
147 208-77) ([Forestry Administration](#) of China, 1978; Liu, 2017). Meanwhile, available 590 pairs  
148 of mean tree height and mean DBH in the data set were used to establish the linear H-DBH  
149 correlation ( $r = 0.8377$ , see Fig. 2). To calculate tree volume from only one known variable  
150 of DBH, tree height was firstly calculated with the linear H-DBH equation in Fig. 2. The  
151 estimated stand volume was determined by multiplying the estimated tree volume with stand  
152 density.

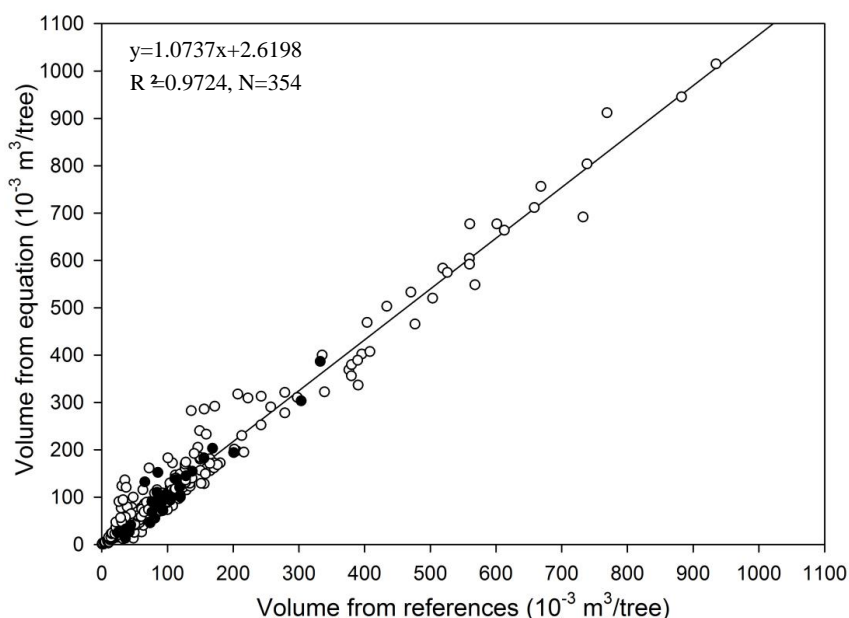
153 The accuracy of tree volume was assessed by comparing the extracted data from references  
154 with the calculated data from the above-mentioned two-variable tree volume equation (Fig. 3).  
155 The coefficient of determination ( $R^2$ ) was 0.9724 and the slope was 1.0737. Therefore, we  
156 were confident in applying the larch volume equation to interpolate tree and stand volume  
157 data in this study.



158

159 Figure 2. Relationship between mean tree height and diameter at breast height in the data set.





160

161 Figure 3. Comparison of available tree volume from references with simulated values from  
 162 the two-variable tree volume equation ( $V_{\text{tree}}=0.000050168241 \text{ DBH}^{1.7582894} \text{ H}^{1.1496653}$ ). Open  
 163 circles (N=317): tree height (H) and diameter at breast height (DBH) were available in the  
 164 references, solid circles (N=37): DBH was only available in the references and H was  
 165 estimated with the H-DBH correlation from Fig. 2.

166

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