























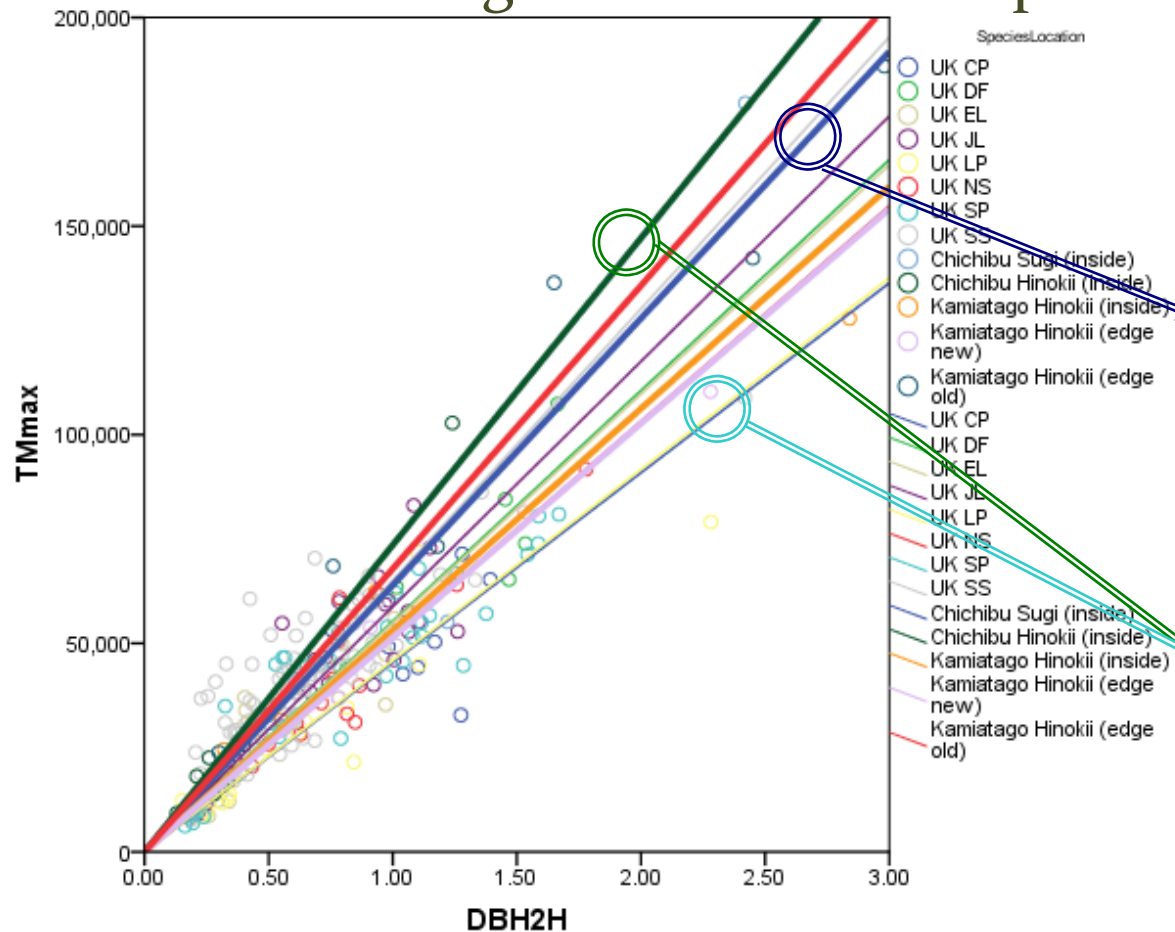






## 4. Results

- Linear regression models depending on species



**General Linear Model (GLM)**  
was used to compare models between species.

**Eg.1: SS vs. sugi**

1 model  $Sig. = 0$

2 models  $Sig. = 0.09$

- Models of SS and sugi are preferable to be one model at 0.05 level.
- Thus, vulnerabilities against overturning are not statistically different.

**Eg.2: CP vs. hinoki (Chichibu)**

1 model  $Sig. = 0$

2 models  $Sig. = 0.001$

- It is hard to statistically show that these models are different or not.
- More data would be necessary.

Figure 2: Linear relationship between applied turning moment and DBH2H of overturned sugi, hinoki, and tree species with more than 80 cm of root-soil plate depth in soil type A (mineral soil) in British tree-pulling database.

# 4. Results

## 3. Breakage: Demonstrated rupture vs. Real rupture

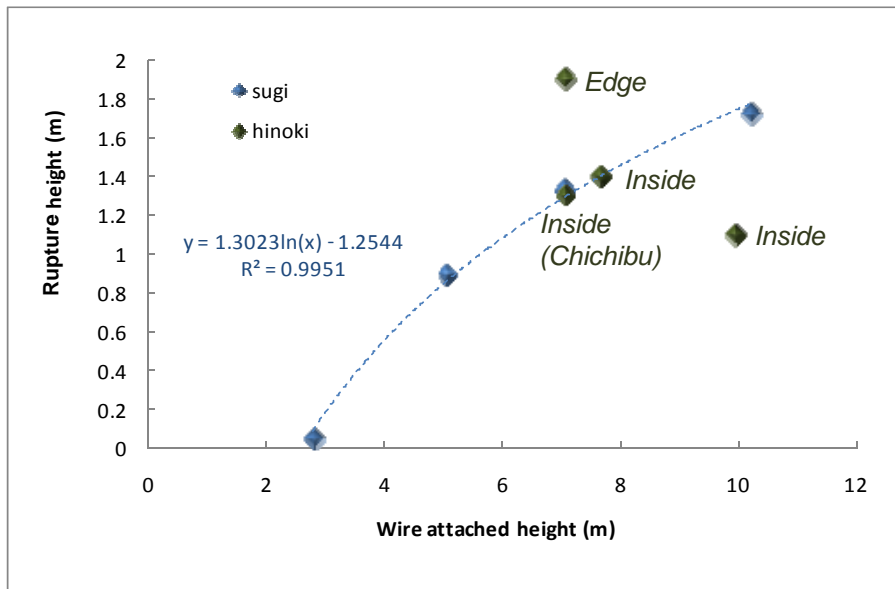


Figure 3: Ruptured sugi and hinoki in the tree-pulling experiments in Chichibu & Kamiatago

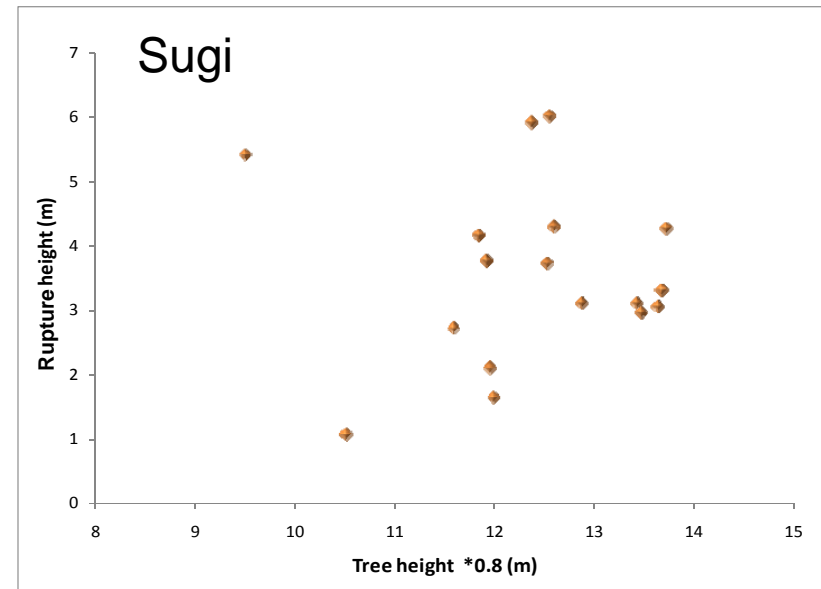


Figure 4: Relationship between rupture height and tree height\*0.8 caused by a typhoon in Kyusyu Island in 1991 (Data was provided by Dr. Chiba at FFPRI.)



# 5. Questions

To improve procedures of tree-pulling experiments,

1. **Overturning:** Although main factors, such as root-soil plate depth and soil type, are similar, various types of stability ( $\text{dbh}^2\text{h}$  against the turning moment) were found.

➡ Are other supportive data required?

- E.g. Measuring water content and stiffness in the soil

2. **Breakage:** Ruptured trees can be used to calculate MOR based on the hypothesis of uniform stress on the stem (Morgan and Cannell, 1994).

➡ Can this assumption used for any tree species and conditions?

- E.g. Trees with very strong stem and root system (eg. hinoki) or on very steep terrain



# Conference Information

## International conference on Multipurpose Forest Management

-Strategies for sustainability in a climate change era-

(IUFRO Division 4)

20-25 Sep. 2009, Niigata, Japan

Main sections are:

- ✓ Forest functions and zoning forest management unit
- ✓ Silvicultural systems and management planning
- ✓ Disaster damage reduction
- ✓ Carbon sequestration
- ✓ Mathematical modelling
- ✓ Application of remote sensing and geographic information
- ✓ Large-scale forest inventory

Further information is available at

<http://www.keiri.fr.a.u-tokyo.ac.jp/multiFM/ov.html>