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# Evaluation of *Pinus eldarica* hazardous criterias in the Babol city (Mazandaran province, northern state of Iran)

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## ABSTRACT

Any defects in street trees may cause injuries to human, vehicles and buildings. This research was investigated in the Babol city, Mazandaran province, in the northern state of Iran.Used the perfect inventory methods and measured the diameter at breathe height (DBH), height and hazardous criteria (dead woods, cracks or seams, decay, wound or cankers, root problems, weak branch unions and skew from vertical line). In each hazardous criterion classes compered the Slenderness (h/d); height (m) and diameter at breathe height (cm). The means of different between Slenderness (h/d), height (m) and diameter at breathe height (cm) in the hazardous criteria classes were estimated by ANOVA test. Data analyzing was done by SPSS16 software. Results showed that the mean of DBH and h/d in the hazardous class (class one) was higher the other classes in the seven hazard criteria, but mean height of tree in the class 3 (non-hazard classes) was higher quantity. Results showed that the different between three classes of hazard in the seven hazard criteria was significant. Overall results showed that the hazardous class (class one) has a higher h/d quantity and more hazardous potential.

**Key words:** Slenderness (h/d), height, DBH, Babol city, hazardous criteria, northern state of Iran.

## INTRODUCTION

Street trees are one of the most important components of urban green spaces. Any defects in street trees may cause injuries to human, vehicles and building (Pourhashemi *et al*, 2012). Trees often fail during catastrophic windstorms such as hurricanes and tropical cyclones. The main cause of the failure is the extreme wind speed (430 m/s (67 mph), but other factors such as precipitation, soil strength, and tree characteristics (Kane, 2008) are impacted. There are also many reports of failures of forest trees following catastrophic storms (Putz and Sharitz, 1991; Valinger *et al*., 1993; Everham and Brokaw, 1996).) The researcher summarized the previous reports, noting that failures were more likely as tree size and wind speed increased (Duryea *et al*., 2007). The assessment of hazardous oriental plane (*Platanus orientalis* Linn.) trees in Valiasr street of Tehran, and used the eight types of tree defects include: dead woods, cracks or seams, weak branch unions, decay, wound or cankers, root problems, poor tree structure and contact with power transmission lines. Results showed that the dead woods and poor tree structure are the main tree defects (with values of 80 and 69 percent of all sample trees, respectively), while weak branch

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unions and decay have less importance. Regarding to combination of tree defects, 19 trees were classified as very dangerous and must be removed (Pourhashemi *et al*, 2012). The main aim of this study is an evaluation of slenderness (h/d); height and diameter at breathe height in the tree hazardous criteria in the *Pinus eldarica* Medw in Babol city, Mazandaran province, north of Iran.

## MATERIALS AND METHODS

### Site description

This research was investigated in the Babol city, Mazandaran province, in the northern state of Iran (Figure 1).

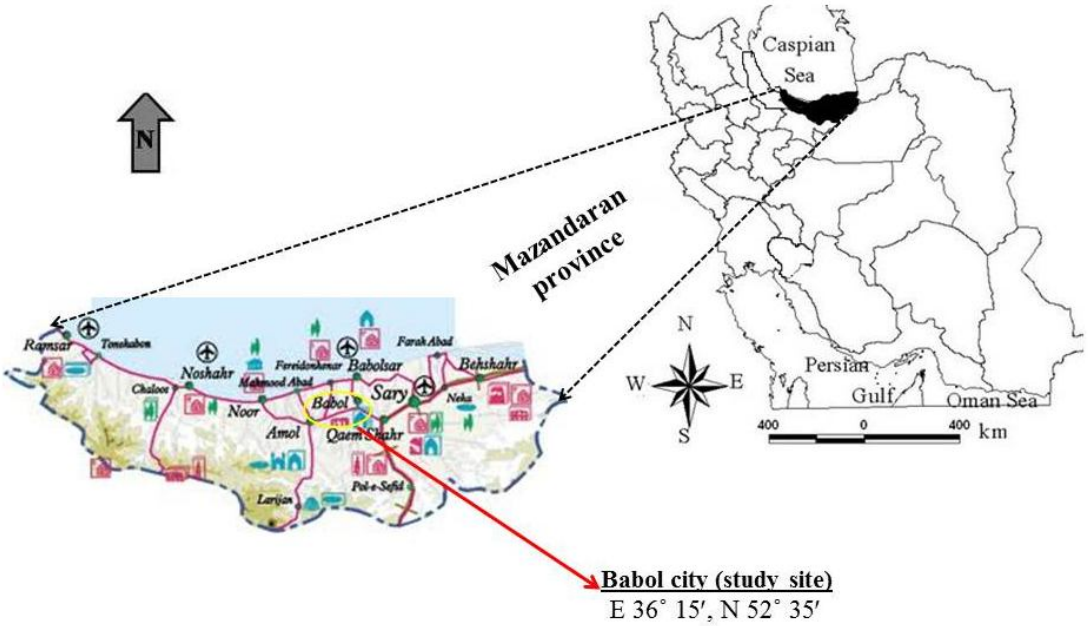


**Figure 1:** location of study area in the Mazandaran province and Iran.

Babol is located in the Caspian littoral and north-east of Tehran (in Mazandaran province). Bābol is the capital of Babol County, Mazandaran Province, Iran. It is the city in the north of Iran. At the 2011 census, its population was 195,733; in 41,837 families it is famous for its orange farms.

### Analysis

Used the perfect inventory methods and measured the diameter at breathe height (DBH), height and seven hazardous criteria (table 1). seven types of tree hazardous criteria were selected in this research include: dead woods, cracks or seams, decay, wound or cankers, root problems, weak branch unions and skew from vertical line.In each hazardous criterion classes compered the Slenderness (h/d); height (m) and diameter at breathe height (cm). The means of different between Slenderness (h/d), height (m) and diameter at breathe height (cm) in the hazardous criteria classes were estimated by ANOVA test. Data analyzing was done by SPSS16 software.

**Table 1:** the classes of seven hazardous criteria in this study

| hazardous criteria | code | dead woods | cracks or seams | decay | wound or cankers |
|---|---|---|---|---|---|
| Very dangerous | 1 | Completely crown dead | more two cracks in the stem | decay in the stem and root | cankers in the stem and root |
| Medium dangerous | 2 | Half of crown dead | one or two cracks in the stem | decay in the stem | medium cankers in the stem and root |
| Non-dangerous | 3 | Non- crown dead | non cracks in the stem | non-decay in stem | Non- cankers in the stem and root |
| hazardous criteria | | root problems | weak branch unions | skew from vertical line | |
| Very dangerous | 1 | Salient half of root | Weak crown | More 20 degree skew | |
| Medium dangerous | 2 | Salient of root | Medium crown density | 10 – 20 degree skew | |
| Non-dangerous | 3 | Non salient of root | Compact crown density | Less 10 degree skew | |

## RESULT AND DISCUSSION

The mean of quantity parameters of tree (Slenderness (h/d), height (m) and diameter at breathe height (cm)) was a most important in the tree stability (table 2). Table 2 showed that the mean of Slenderness (h/d), height and diameter at breathe height in the study area was 24, 13.5 (m) and 65 (cm), and this tree have stable conditions. Results of table 3 showed that the different between three classes (class1, 2 and 3) of hazard in the seven hazard criteria was significant (except the height of tree in the root problems). Results of figure 2 showed that the mean of DBH parameter in the three classes (health class) was higher in the seven tree hazard criteria, but class 1 in the seven tree hazard criteria was lower quantity. Results of figure 3 showed that the mean of tree height in the one classes (non- health class) was higher in the seven tree hazard criteria, but class 3 in the seven tree hazard criteria was lower quantity. Results of figure 4 showed that the mean of Slenderness (h/d) in the one classes (higher hazardous class) was higher in the seven tree hazard criteria, but class 3 in (non- hazardous class) the seven tree hazard criteria was lower quantity.

**Table 2:** mean of *Pinus eldarica* Medwcharacters in the Babol city

| Tree parameter | DBH | height | Slenderness (h/d), |
|---|---|---|---|
| Mean±sd | 65±18.5 | 13.5±3.3 | 24±5.7 |

**Table 3:** results of ANOVA test in the hazardous classes in the seven criteria (N=120 trees)

| hazardous criteria | df | DBH (cm) | | Height (m) | | Slenderness (h/d) | |
|---|---|---|---|---|---|---|---|
| | | F | Sig. | F | Sig. | F | Sig. |
| dead woods | 2 | 5.564 | 0.000** | 4.989 | 0.004** | 5.897 | 0.000** |
| cracks or seams | 2 | 7.341 | 0.000** | 5.081 | 0.000** | 6.009 | 0.000** |
| decay | 2 | 5.435 | 0.000** | 4.907 | 0.009** | 5.908 | 0.000** |
| wound or cankers | 2 | 6.091 | 0.000** | 6.705 | 0.000** | 8.439 | 0.000** |
| root problems | 2 | 4.098 | 0.005** | 2.981 | 0.099ns | 6.989 | 0.000** |
| weak branch unions | 2 | 5.087 | 0.000** | 4.781 | 0.003** | 5.897 | 0.000** |
| skew from vertical line | 2 | 3.453 | 0.012* | 3.992 | 0.022* | 4.104 | 0.004** |

** Different letters indicate significant differences in 5% level, ** Different letters indicate significant differences in 1% level.*

Results showed that the mean of height of *Pinus eldarica* Medw in the Banol city was suitable (average quantity) and this tree have a high DBH and mean of 13 meter height, this results indicated that this tree not high quantity of hazard (table 2). Results showed that the mean of DBH and h/d in the hazardous class (class 1) was higher the other classes in the seven hazard criteria (figure 1 and 3), but mean height of tree in the class 3 (non-hazard classes) was higher quantity (figure 2). Results showed that the different between three classes (class1, 2 and 3) of hazard in the seven hazard criteria was significant (table 3).

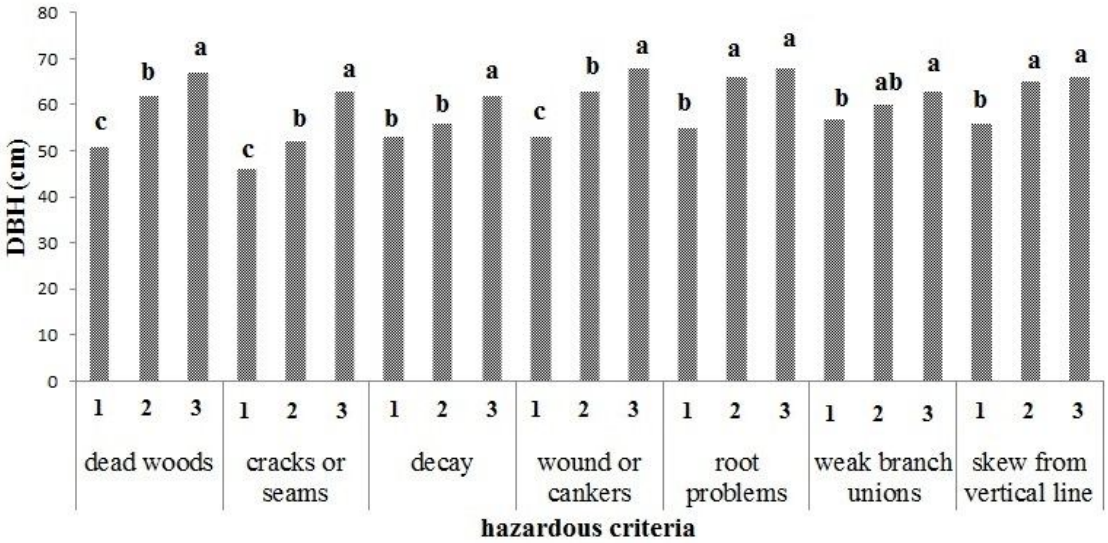


**Figure 2:** mean of DBH in the three classes of seven hazardous criteria

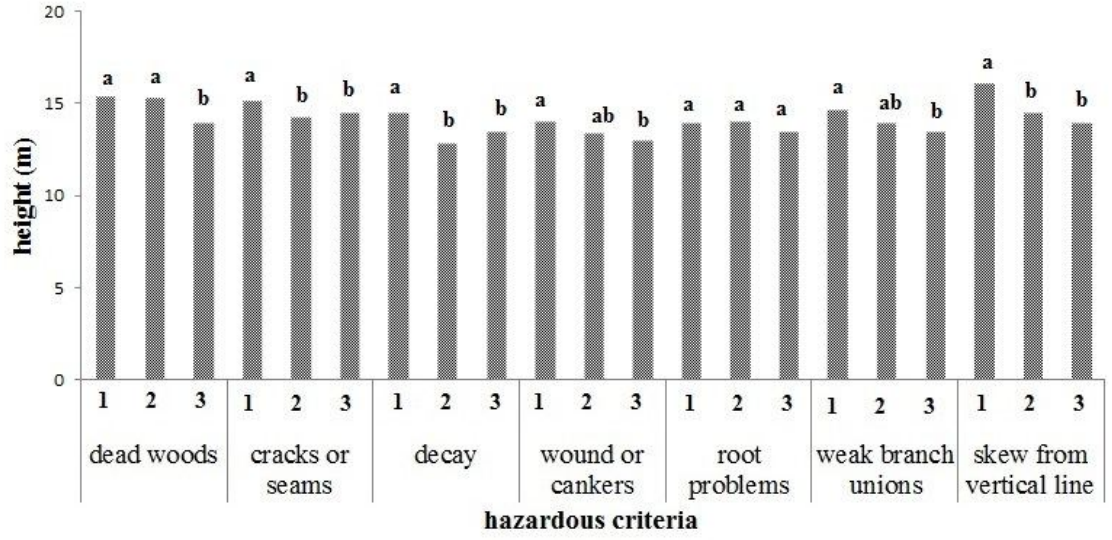


**Figure 3:** mean of height of tree in the three classes of seven hazardous criteria

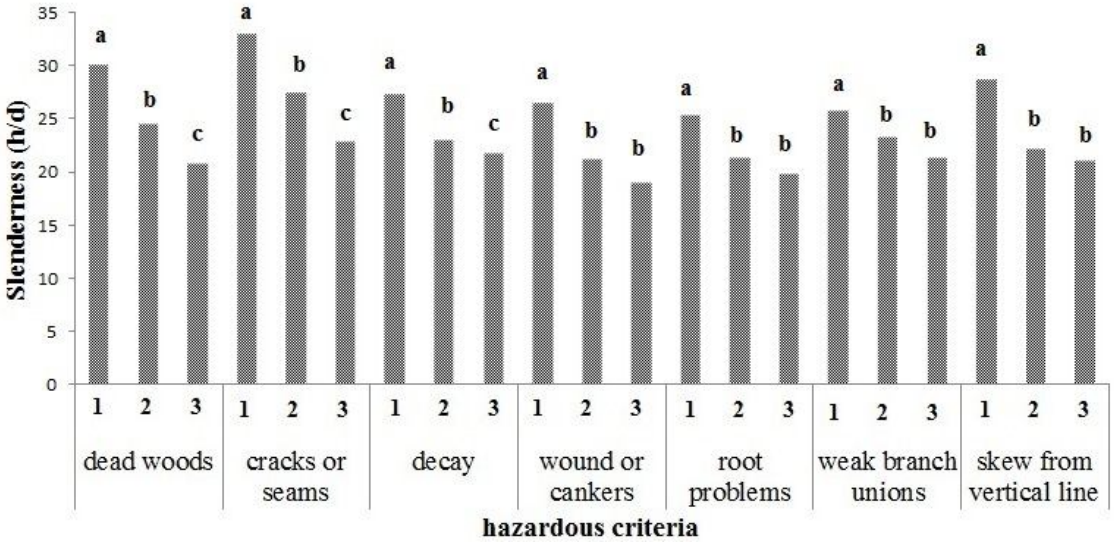


**Figure 4:** mean of Slenderness (h/d) in the three classes of seven hazardous criteria

Overall results showed that the hazardous class (class 1) has a higher h/d quantity and more hazardous potential. This study indicated that *the hazard tree of Pinus eldarica* Medw have a high potential of hazard and Pourhashemi *et al*, (2012) showed that the *Platanus orientalis* Linn in the Tehran have a (4 percent) very dangerous. Furthermore, trees in medium and high risk classes were classified based on their potential to move toward more dangerous classes. Totally, improvement practices such as pruning of dead branches of trees with medium and high risk and cutting of very dangerous trees are recommended.

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