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The costs of invasion control measures subtropical *Ailanthus altissima* in Hesse.

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Abstract

Global commerce moves plants from their natural places to others where many of them become invasive. The subtropical tree *Ailanthus altissima* is invasive in temperate zones because global change makes the latter warmer. Such proliferation causes root-induced damages to the foundations of buildings, water channels, railroads and pavements; also the pollen of *A. altissima* is allergenic to people. We interviewed to top-officers of parks, the railway company and health ministry in the state of Hesse (Germany) to assess how much the different strategies to control *A. altissima* for the whole state cost. Uncontrolled damages totalized 5Mi €/y. The most expensive control strategy combines fire and steam, costing 295718 €/ha; the cheapest one was poisoning 6400€/ha. None of the control techniques reduces plant reproduction so we suggest to pruning *A. altissima* in June and July, when it starts flowering in order to reduce populations to save money for further years.

Key words: alien plants, control methods, economic impact, management.

1. Introduction

Transportation for commercial proposes made many plants like *A. altissima* (Mill. Swingle Simaroubaceae) to leave their natural habitats, colonize others and proliferate more than native plants. Human colonization and commerce increased the scale and impact of such invasions. Introduced species often have no natural enemies in their new environments so they spread quickly (Vitousek et al. 1996, Mooney & Hobbs 2000, Defra 2003). As a consequence, invasive plants reduce the populations and even extinct other native plants and animals (e.g. by means of competition or toxicity), and affect the functions of ecosystems and habitats (Munyaradzi & Mohamed-Katerere 2003, Pyšek et al. 2004).

Ailanthus altissima (known as Tree of Heaven) is a pioneer tree, native to eastern China (Hu 1979, Hoshovsky 1988, Kramer 1995, Kowarik & Säumel 2007), introduced in Europe in 1751. Currently, *A. altissima* is present in more than 30 countries, being invasive in disturbed, urban areas of Europe –including Germany. After the Second World War, *A. altissima* was used in Germany for public gardens and then spread across Europe (Kowarik 1983, Kowarik & Böcker 1984, Hoshovsky 1988, Knapp & Canaham 2000). Now it damages buildings foundations, streets, sidewalks, water channels and railways so private and government agencies invest millions of Euros to control this species. This study assessed: (a) what control techniques are used against *A. altissima* proliferation in the State of Hessen, Germany, and (b) how much these controls cost in addition to the costs of medical treatment for allergies.

2. Material and Method

During the winters of 2005 and 2007, we interviewed 10 top-directors of parks, three top-managers of the German Railway Company (Deutsche Bahn –DB) and two top-officers of the health authorities. They were asked for the prices of management, equipments, salaries and costs for the control of *Ailanthus altissima* in the whole state of Hesse. Printed information supplied by DB (www.db.de/sustainability-report) and on the costs of anti-allergic treatment was consulted too.

3. Results and Discussion

Uncontrolled spread of *A.altissima* species costs up to 5 Mi €/y in Hesse. About 18% of investments in monitoring by the DB are devoted only to such species. In 2007 about 61% of the 64,000 Km of track were treated with an herbicide specifically developed for this use. The “killing by heating” method combined to steam control costs was the most expensive practice (295718€/ha) whereas poisoning was the cheapest (6400€/ha). Allergies caused by the pollen of *A.altissima* costed 1.5 Mi € /year.

Results shown here are consistent to studies showing economic damages by invasive species ranging from 8 Mi- to 16 Bi €/y (U.S. Congr. Off. Technol. Assess. 1993, Pimentel et al. 2000, Pimentel 2002, World Bank 2002, UFZ 2002, Cock 2003, Andreu & Vilá 2007). *A. altissima* may also alter the species composition of plants and animals (e.g. pollinators). As well, it may

alter ecosystem functions like nitrogen and carbon cycling; all these have been demonstrated for other invasive trees in Europe (Williamson 1996, Wilcove et al. 1998, Parker et al. 1999, Sala et al. 2000, Stein et al. 2000, Marchante et al., 2001). In spite of the well known damages and costs to control *A. altissima*, we found that none of the very expensive control strategies practiced in Hessen avoids *A. altissima* populations to recover. In concrete, new seeds and seedlings are always produced and remain able to colonize new areas. Besides throwing small plants to avoid them to become adults, we propose managers to prune *A. altissima* adult individuals in June and July –when they start to flower. Combined, both practices avoid adults to produce offspring, reduce rapidly the size of the populations, save money for the following years, and are applicable to all places invaded by *A. altissima*.

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