

# What is the impact of invasive plants on land snail assemblages in the alluvial ecosystems?



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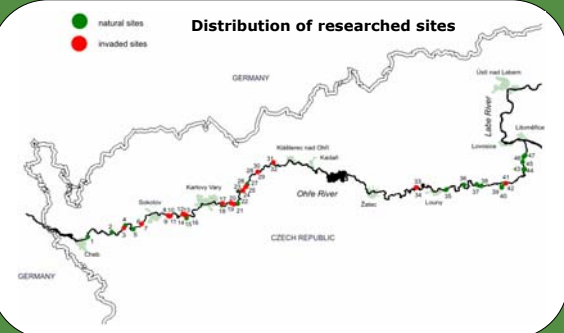
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## How do invasive plants *Fallopia sachalinensis*, *F. japonica*, *F. x bohemica* and *Impatiens glandulifera* affect land snail communities of the natural alluvial forests?

### MATERIAL AND METHODS

A total of 47 sites were researched on both river banks in an alluvium of the **Ohře River in the western part of the Czech Republic** from 2006 to 2008. Natural and plant-invaded alluvial forests were researched. The sites invaded by four invasive plants, with covering over 70 %, were researched – *Fallopia sachalinensis*, *Fallopia japonica*, *Fallopia x bohemica* and *Impatiens glandulifera*. There were recorded a phytocenological relevés on the plots size of 10x10 m<sup>2</sup> in the invaded and non-invaded alluvial forests. The relevés were used to ordination of vegetation in consequential analyses and to computation of Ellenberg's indicator values (light, temperature, continentality, moisture, soil reaction and nutrients). Composite litter samples were collected to reflect the relevé area on four plots 25x25 cm<sup>2</sup>. Samples of the leaf litter were dried up and sifted by the soft sieves, then washed away and extracted material with empty shells was sorted and determined to species level. With regard to presence of dendrophilous species and slugs, one person collected molluscs on the relevé plot for thirty minutes. The soil samples were analyzed for soil reaction and soil content of calcium and magnesium. The CANOCO 4.5 package was used for all ordination techniques and STATISTICA 7 was used for other analyses.



**Fallopia spp.** Houtt.  
The species of genus *Fallopia* are native to eastern Asia and belong among one hundred of the world's worst invaders.

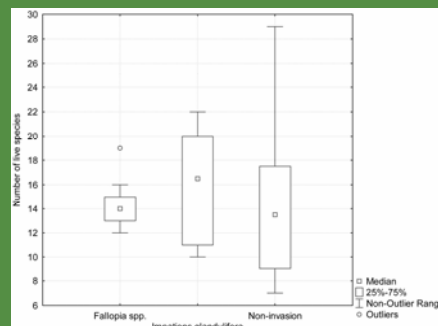


**Impatiens glandulifera** Royle  
The species is native to Himalaya (Asia). In 1896, firstly recorded in the Czech Republic.

### What is the impact of invasive plants *Fallopia* spp. and *Impatiens glandulifera* on abundance and species richness of land snail communities?

The abundance and land snail communities species richness of invaded and non-invaded alluvial forests were compared.

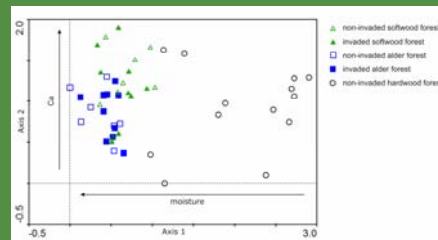
In total: 28 non-invaded sites, 9 *Fallopia* spp. invaded sites and 8 *Impatiens glandulifera* invaded sites were compared.



### What is the invasibility of three different types of alluvial forests?

In total: 47 sites from Ohře river floodplain were analyzed by CANOCO 4.5 in terms of measured environmental variables.

Detrended correspondence analysis (DCA) was used.

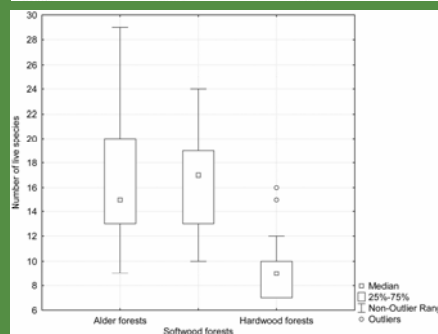


### How do particular types of natural alluvial forests differ in abundance and species richness of land snail communities?

The abundance and land snail communities species richness of three types of natural alluvial forests – alder forest, softwood forest and hardwood forest, were compared.

In total: 47 sites were analyzed.

Mann-Whitney U-Test was used for comparison of particular forest types in terms of number of live species and individuals.



### RESULTS

- *Fallopia* spp. relatively decreases the species richness and abundance of land snail communities.
- *Impatiens glandulifera* relatively supported the species richness and abundance of land snail communities.
- Certainly, the **natural non-invaded alluvial forests** have generally the highest species richness and abundance of land snail communities.

- The invasibility of alluvial forests is related to **moisture** of these habitats.
- The alder forests and softwood forests with high moisture and accompanying richness of nutrients have **high invasibility**.
- The hardwood forests are drier and poor in nutrients, especially in content of calcium, hence they are **non-invaded**.

- The alder and softwood forests **do not differ** in abundance and species richness of land snail communities.
- The alder forest differs from hardwood forest in **higher abundance** of snails ( $P < 0.05$ ) and **higher species richness** ( $P < 0.001$ ).
- The hardwood forest differs from softwood forest in **lower abundance** of snails ( $P < 0.001$ ) and **lower species richness** ( $P < 0.001$ ).

### CONCLUSIONS

- The influence of *Fallopia* invasive species relatively decreases abundance and species richness of land snail communities in the alluvial forests. In spite of the results from all invaded sites are not significant because of high variability of environmental variables (especially in habitats), the project is going on to increase the number of the researched invaded sites and thus to gain more accurate statistical output. The detrended correspondence analysis (DCA) of vegetation data showed a big significant impact of invasion covering ( $P < 0.01$ ) on species richness of the herb layer, on which the land snail community depends. Consequently, the *Fallopia* spp. have indirect impact on the malacoenoses.
- Invasive species of *Impatiens glandulifera* relatively increases abundance and species richness of land snail communities in the river floodplain forests. Some snail species e. g. *Succinea putris* prefer this plant in their food and occur affluently on such invaded sites.
- According to results of snail species DCA, the main environmental variables influencing the composition of land snail communities are elevation ( $P < 0.001$ ), vegetation ( $P < 0.001$ ), moisture ( $P < 0.001$ ), soil reaction ( $P < 0.001$ ) and invasion covering ( $P < 0.02$ ).
- There are high abundance and species richness of land snail communities in the alder and softwood forests by contrast with dry and nutrient poor hardwood forests.
- The invasibility of the alder and softwood forests is high in contrast to non-invaded hardwood forests.