EUROPEAN AND MEDITERRANEAN PLANT PROTECTION ORGANIZATION
ORGANISATION EUROPEENNE ET MEDITERRANEENNE
POUR LA PROTECTION DES PLANTES

07-13604
WPPR, point 8.3

Report of a Pest Risk Analysis

This summary presents the main features of a pest risk analysis which has been conducted on the pest, according to EPPO Decision support scheme for quarantine pests.

Pest: *Polygonum perfoliatum* L. (POLPF)
PRA area: EPPO Member Countries
Assessor: PRA prepared by the EPPO Secretariat (February 2005) and reviewed by the *ad hoc* Panel on Invasive Alien Species (May 2007).
Date: 2007-05-21

STAGE 1: INITIATION

Reason for doing PRA: The plant is recorded as very invasive in the USA. The *ad hoc* Panel on invasive alien species recommended to study this species as it has a restricted distribution in the EPPO region.

Taxonomic position of pest: Plant- Polygonaceae

STAGE 2: PEST RISK ASSESSMENT

Probability of introduction

Entry

Geographical distribution:

EPPO Region: Russia (Siberia, native), Turkey (alien, status unknown).

Asia (native):
Temperate: Russian Federation (Far East), China (Anhui, Fujian, possibly eastern Gansu, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Inner Mongolia, southern Shaanxi, Shandong, Sichuan, Tibet (unconfirmed), Yunnan, Zhejiang), eastern Inner Mongolia, Chayu of southern Tibet, Japan, Republic of Korea, Taiwan.
Tropical: Bangladesh, Bhutan, India, Indonesia, Nepal, Thailand, Vietnam, Malaysia, Myanamar (Burma), Philippines, Manchuria, New Guinea.

America (alien): USA (Connecticut, Delaware, Maryland, New Jersey, New York, North-Carolina, Ohio, Oregon, Pennsylvania, Rhode Island, Virginia, Washington DC, West Virginia, Wisconsin).

Note: the plant has been eradicated from New Zealand. There is also a single record for Canada (British Columbia), but no additional records since 1954.
In Turkey, the plant is present on the northern face of the Kaçkar range of mountains in North Eastern Turkey (Güner, 1984).

Major host plants or habitats:	In its alien range, *P. perfoliatum* invades a wide range of habitats, mainly open and disturbed ones: edges of pastures, edges of woods, early successional forest, abandoned fields, roadsides, railroad, nurseries, wood-piles, clearings and ditches. It is also found in freshwater habitats such as stream banks and moist thickets.
Which pathway(s) is the pest likely to be introduced on:	The main pathways are: - plants for planting with growing media (e.g. *Rhododendron* stock, forestry trees). - soil/growing media as a commodity: import of soil is usually prohibited in EPPO Member Countries and this pathway is not studied further. - *P. perfoliatum* is suspected to have been introduced with *Meliosma* seeds imported from China (Kumar and DiTommaso, 2005) or with *Ilex* (holly) seeds from Japan (Lehtonen, 1994). These statements are nevertheless only suppositions which cannot be confirmed and are not considered further in this analysis. - The first record of *P. perfoliatum* in North America is from Portland, Oregon (1890) where it was believed to arrive by ship ballasts (Stahl, 2002). This pathway is not considered further as no Plant Health regulation applies.

Establishment

Plants or habitats at risk in the PRA area:	Cultivated ecosystems: edges of pastures, edges of woods, early successional forest, abandoned fields, roadsides, railroad, nurseries, wood-piles, clearings and ditches. Uncultivated ecosystems: freshwater habitats such as stream banks and moist thickets. These habitats are widely distributed.
Climatic similarity of present distribution with PRA area (or parts thereof):	See Climex analysis in Appendix. The countries of Europe most likely at risk are: Albania, Austria, Belarus, Belgium, Bosnia and Herzegovina, Croatia, France, Georgia, Germany, Italy, Montenegro, Poland, Portugal, Romania, Russia, Slovenia, Serbia, Spain, Switzerland, The Netherlands, Turkey, Ukraine. Mediterranean countries (Morocco, Tunisia, Algeria, Israel, Lebanon, Jordan) are moderately likely to be at risk.
Aspects of the pest's biology that would favour establishment:	*P. perfoliatum* is a very tender annual, overwintering as a seed. Until frost (late October to early November in regions of North eastern United States), the plant can grow up to 6 m long (15 cm per day), bearing about 50-100 seeds (Stahl, 2002). The plant reproduces only sexually and is primarily a self-pollinating plant. The self-compatibility of this species contributes to its successful dispersal because single plants once established in a new habitat can produce new populations without the need for cross-pollination from neighbouring conspecies (Okay, 1997). The species forms a long-term seed bank (Van Clef and Stiles, 2001). The ability of the plant seeds to germinate at relatively cold temperatures provides it a competitive advantage over other

annual and perennial weeds that germinate at higher soil temperatures in the soil (Kumar and DiTommaso, 2005).
The seeds are spread over long distances by water, birds and mammals.

Small populations may become established as one single introduction of *P. perfoliatum* in the late 1930's to a nursery site in York County (Pennsylvania) did produce a successful population of this plant.

Moreover, the pest is adaptable as it can live in a wide range of habitats, and both in temperate and tropical climates. It has a wide native range of distribution.

Characteristics (other than climatic) of the PRA area that would favour establishment:

P. perfoliatum generally grows in areas with an abundance of leaf litter on the soil surface (Okay, 1999), but has also been found in extremely wet environments with poor soil structure.

It is considered unlikely that existing species in the PRA area will prevent the establishment of the plant.

Absence of practices in tree plantations would favour the establishment of the pest.

Which part of the PRA area is the endangered area:

The endangered countries are: Albania, Austria, Belarus, Belgium, Bosnia and Herzegovina, Croatia, France, Georgia, Germany, Italy, Montenegro, Poland, Portugal, Romania, Russia, Slovenia, Serbia, Spain, Switzerland, Turkey, Ukraine.
Mediterranean countries (Morocco, Tunisia, Algeria, Israel, Lebanon, Jordan) are moderately likely to be at risk.

POTENTIAL ECONOMIC CONSEQUENCES

How much economic impact does the pest have in its present distribution:

Because it can smother tree seedlings, this weed has a negative effect on forest regeneration and commercial forest areas (Christmas tree farms). It has the potential to be a problem to nursery and horticulture crops that are not regularly tilled as a cultivation practice. This weed is not common in container nurseries and may only become a concern in nurseries under very low management systems (one or less operation of maintenance per year), such as Christmas tree farms (R Bates, pers. com., 2007).

P. perfoliatum weed is a threat to ecosystems as it has the ability to outgrow other species (Oliver, 1996). It is known to grow rapidly, scrambling over shrubs and other vegetation, blocking the foliage of covered plants from available light and reducing their ability to photosynthesize, which stresses and weakens them, the shade killing grasses and wildflowers.

Dense thickets of the sharp-spined plants can provide an unpleasant experience for people (Binion, 2005) and can restrict the movement of wildlife in natural areas (Okay, 1997).

Describe damage to potential hosts in PRA area:	The same economic, environmental and social impacts may be observed in the EPPO region. Existing management practices (continuous tillage and herbicide use) for other pests may limit the negative effects of the plant.
How much economic impact would the pest have in the PRA area:	Climatic and growing conditions in most EPPO countries are believed to be no limiting factors for *Polygonum perfoliatum*. Therefore, it is estimated that damage levels can be comparable to the damage levels in the USA. The plant may be a threat in tree plantations and nurseries of the countries at risk, as it has in North America. The main impacts would be on environment, especially on freshwater ecosystems.

CONCLUSIONS OF PEST RISK ASSESSMENT

Summarize the major factors that influence the acceptability of the risk from this pest:	*P. perfoliatum* is capable of causing significant damage to freshwater ecosystems and to commercial forests areas and forests regeneration. Therefore, the potential risk of *P. perfoliatum* should not be accepted.
Estimate the probability of entry:	The probability of unintentional introduction of seeds with plants for planting with growing media from countries where *P. polygonum* occurs is moderately high. Nevertheless, the plant already occurs in Turkey and maybe in other places where it has not been recorded. **Probability of entry is moderately high.**
Estimate the probability of establishment:	Once entered, the plant has a high probability to establish and to spread. **Probability of establishment is high.**
Estimate the potential economic impact:	The plant may be a threat in tree plantations and possibly in nurseries of the countries at risk. The main impacts would be on environment, especially on freshwater ecosystems. **Potential of economic damage is considered medium to high.**
Degree of uncertainty	Uncertainty: • It would be very helpful to know by which pathway the plant arrived in Turkey and what is the situation there. • Information on the eradication in Auckland may give helpful information on the ease to control the pest at an early stage. • The climatic prediction has not been run for Mediterranean countries.
OVERALL CONCLUSIONS	**The risk is unacceptable and management measures should be considered.**

STAGE 3: PEST RISK MANAGEMENT

IDENTIFICATION OF THE PATHWAYS

Pathways studied in the pest risk management	Plants for planting with growing media from countries where *P. polygonum* occurs
Other pathways identified but	Soil/growing media (closed pathway)

not studied

IDENTIFICATION OF POSSIBLE MEASURES

Pathway 1: Plants for planting with growing media from countries
Possible measures for pathways where *P. polygonum* occurs:

Measures related to consignments:
Plants free from growing media.

Measures related to the prevention of contamination of a crop:
Plants grown in containers with sterilized growing medium

Measures related to the crop or place of production
Pest-free place of production,
Or pest-free area.

Measures with a lower level of protection:
Monitoring and surveillance in the importing country and emergency plan to eradicate the outbreaks.

EVALUATION OF THE MEASURES IDENTIFIED IN RELATION TO THE RISKS PRESENTED BY THE PATHWAYS

Degree of uncertainty low

CONCLUSION:

Recommendation for possible measures (type presentation):

Unintentional introduction of seeds with plants for planting with growing media from countries where *P. polygonum* occurs	PC and, if appropriate, RC • Pest-free place of production, Or • pest-free area Or • plants grown in containers with sterilized growing medium Or • plants free from growing media A lower level of protection can be achieved with: Monitoring and surveillance in the importing country and emergency plan to eradicate the outbreaks.

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***Polygonum perfoliatum* (Polygonaceae) climatic prediction with CLIMEX**

The example below describes the preliminary approach used for the mile a minute weed (*Polygonum perfoliatum*). Further work can still be undertaken, e.g. using sensitivity analysis, to provide greater confidence in the reliability of the results.

1. Preliminary work and hypothesis

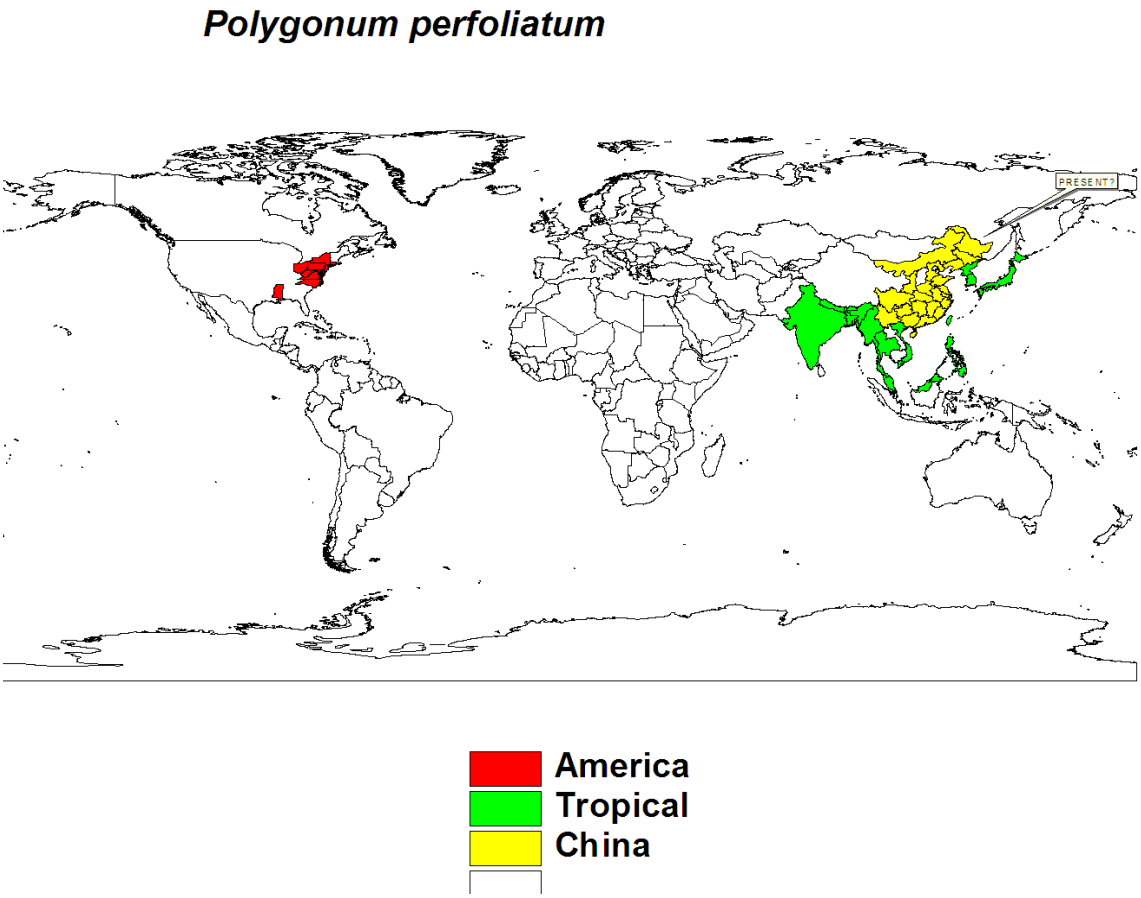

Fig 1: **Geographical distribution** of the plant in the world, differentiating native and alien range. The map has been made with Arcview.

According to this map and to information gathered in the bibliography on the **biology** of the plant, the following **hypotheses** on limitation factors and potential stresses can be made:

- The plant is considered to be temperate and to be able to colonize subtropical climates. The temperate template will be used for the Compare location analysis.

- The plant is an annual, with a maximum height of 6 m and reproduces successfully until it senesces after the first frost in late October to early November (in regions of eastern North America). Germination occurs in early to mid-March the following year and continues throughout April. The seeds lie dormant in the soil and can survive very harsh winters. This implies that only the climate between April and November is important for the plant. While conducting a Match climate analysis, this needs to be taken into account. Cold winters are not a limiting factor and winter conditions should be excluded (though vernalisation requirements may need to be taken into account). While conducting a Compare location analysis, the cold stress would be reduced.

- The plant can be found below 2300 m in moist areas in its native range, confirming that the plant does not seem to be limited by cold summers as temperatures at such elevations are low.

- *Polygonum perfoliatum* grows in wet habitats. It is therefore not limited by wet stress. While conducting a Compare location analysis, wet stress can therefore be reduced. Although the plant can survive in areas with relatively low soil moisture, it demonstrates a preference for high soil moisture. Soil moisture is necessary and may therefore need to be increased.

- It is stated that a temperature of 10°C or below must be sustained for an eight-week period to stimulate germination. Heat stress may therefore need to be increased.

- from the Asian distribution, cold winters and hot and wet summers do not seem to be limiting factors. For the Compare location analysis, dry stress is therefore considered as the main limiting factor.

2. Match index

We have few details of locations where *P. perfoliatum* is very abundant in Asia and North-Eastern USA (Fig. 1) to use the CLIMEX Match Index to identify European locations that would be most suitable for this species. Pittsburgh (USA) and Taipei (Taiwan) were chosen to represent locations where the species is known to be abundant and a Composite Match Index for all variables between April and October at 10 minutes latitude/longitude resolution for Europe was calculated and mapped in each case (Figs. 2 & 3).

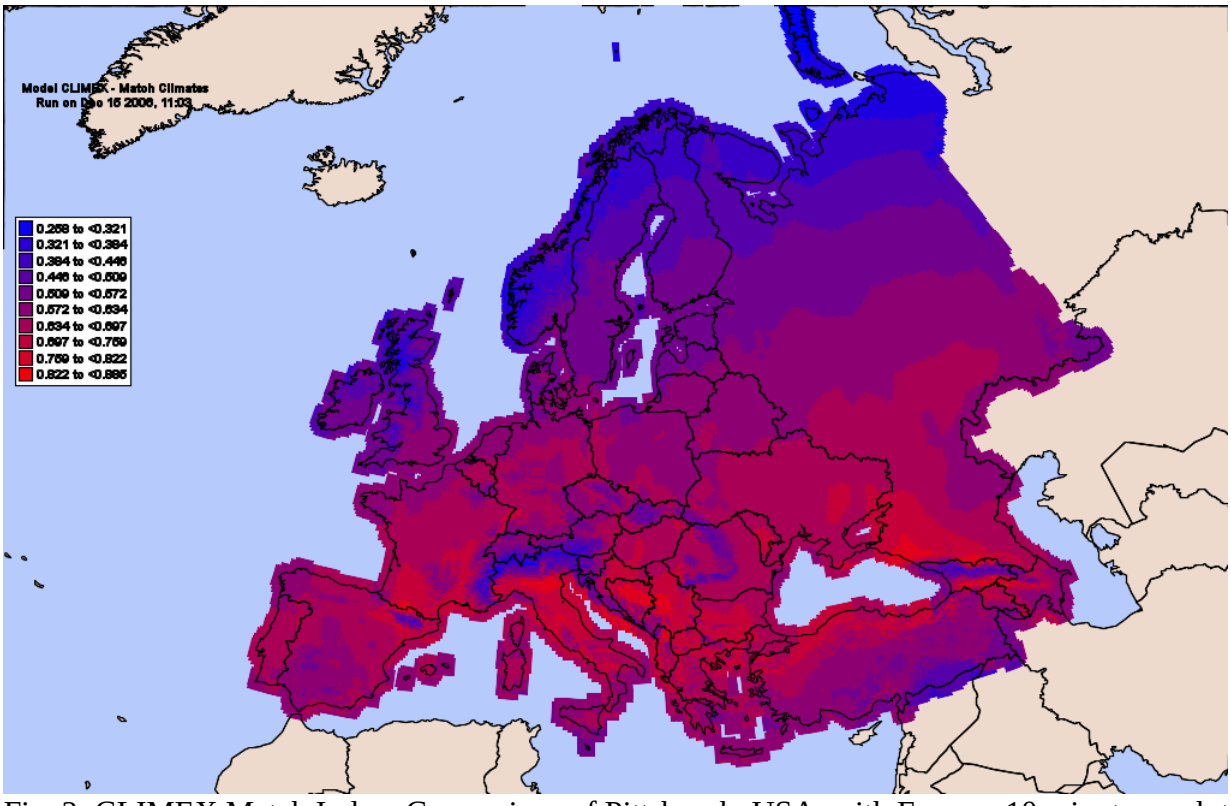

Fig. 2: CLIMEX Match Index: Comparison of Pittsburgh, USA, with Europe, 10 minute resolution

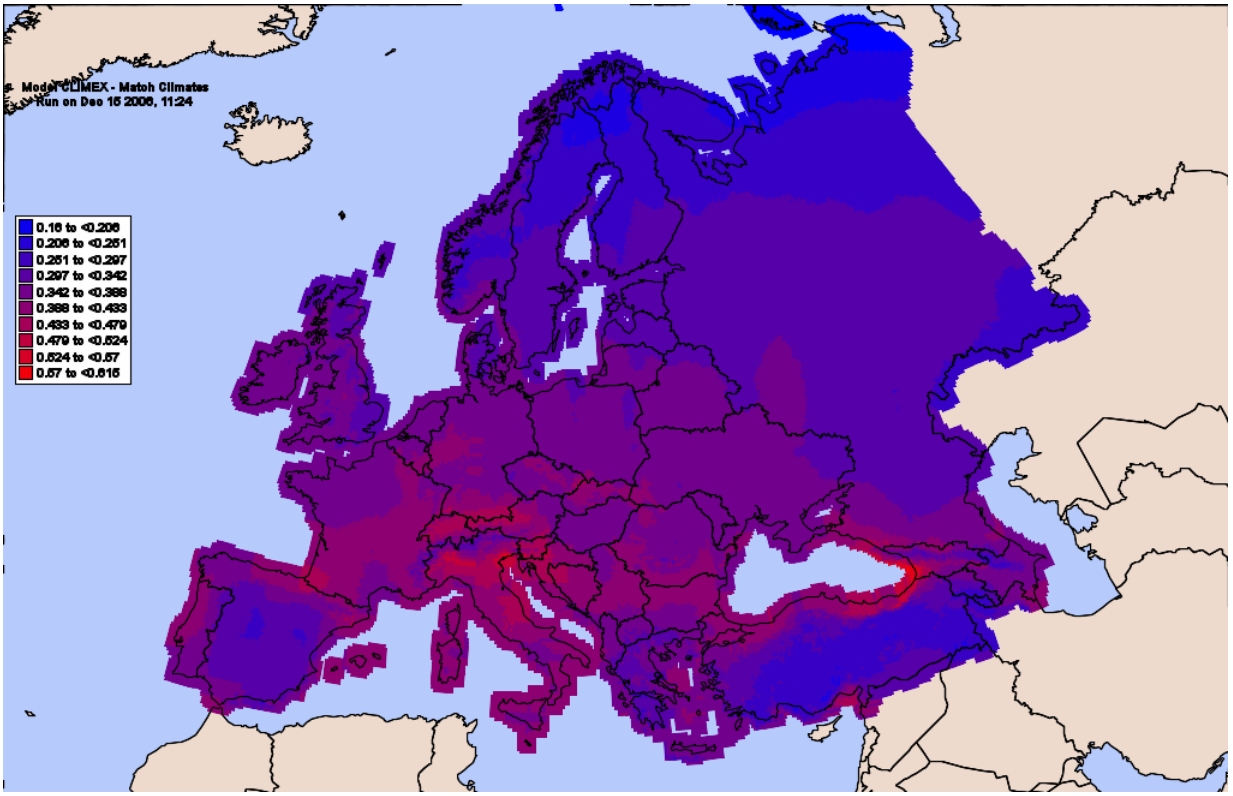

Fig. 3: CLIMEX Match Index: Comparison of Taipei, Taiwan, with Europe, 10 minute resolution

3. Compare Locations

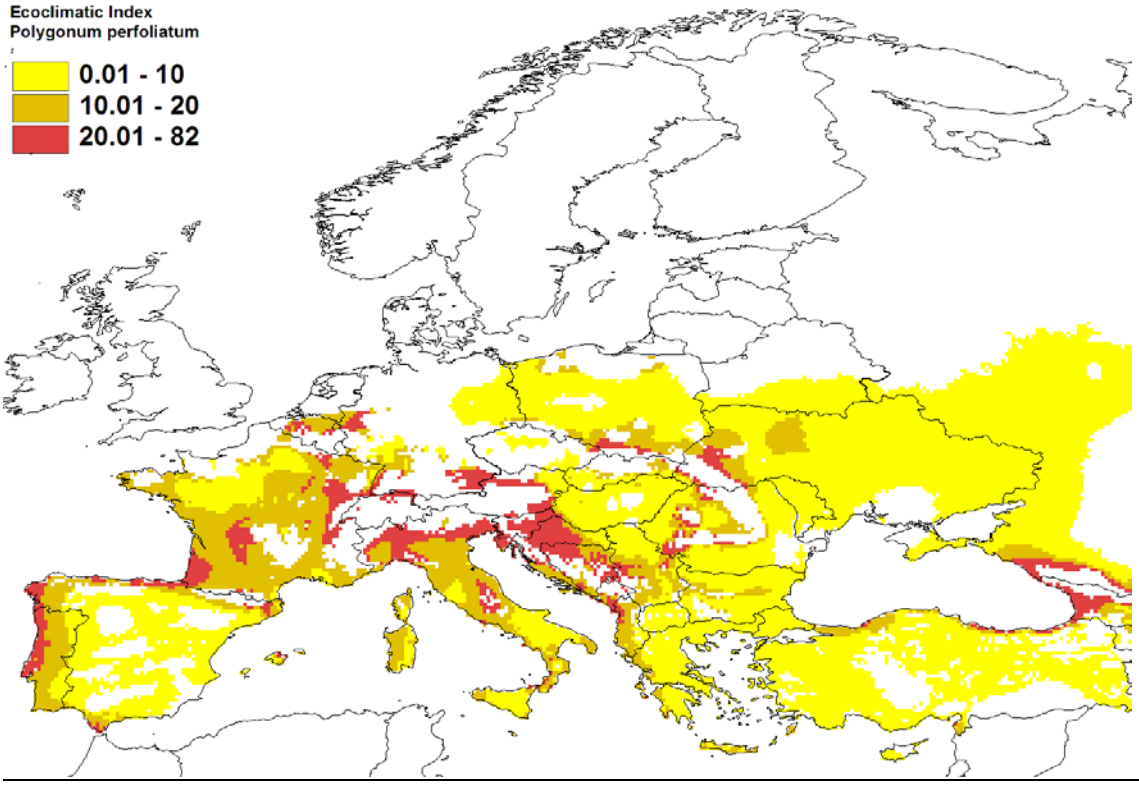

Fig. 3: *Polygonum perfoliatum* Ecoclimatic Indices for Europe, Imported to ArcGIS (Temperate Template, no cold stress, no wet stress, soil moisture minimum to 0.35, maximum temperature 36ºC, DV1=12°C).

Conclusion

If the use of both the Match Index and Compare Locations components of CLIMEX for *P. perfoliatum* are compared with Figures 3 and 13, the countries of Europe at risk are estimated to be: Albania, Austria, Belarus, Belgium, Bosnia and Herzegovina, Croatia, France, Georgia, Germany, Italy, Montenegro, Poland, Portugal, Romania, Russia, Slovenia, Serbia, Spain, Switzerland, Turkey, Ukraine.
The current distribution in Turkey (Rize, Ardeşen, on the Black Sea) perfectly coincides with the prediction.

The comparison of these figures also shows that the northern Adriatic and the area along the Atlantic coast border between France and Spain are most similar to Taipei and have the highest ecoclimatic indices. This is reassuring but further work should be undertaken to compare other locations using the Match Index CLIMEX module and determine the sensitivity of the parameters selected in the Compare Locations CLIMEX module. For example, a greater area of Europe has a similar April-October climate to Pittsburgh (Fig. 2) than to Taipei but the interpretation of these two maps needs a greater understanding of the plant in both locations. For both modules, much greater progress would be made if the current distribution of the plant could be determined in greater detail, in particular to identify locations where *P. perfoliatum* is most abundant (climatic conditions are most suitable), and to determine the minimum threshold for development and the number of degree days needed to complete its life cycle.

Further work could consist in comparing this climatic prediction map with habitats maps (e.g. CORINE landcover) so habitats at risk could be identified.