Impatiens glandulifera 简体中文 正體中文

System: Terrestrial

Kingdom	Phylum	Class	Order	Family
Plantae	Magnoliophyta	Magnoliopsida	Geraniales	Balsaminaceae

Common name policeman's helmet (English), ornamental jewelweed (English), Himalayan balsam (English), Niecierpek himalajski (English, Poland), Niecierpek gruczolowaty (English, Poland), verev lemmalts (English, Estonia), Indisches Springkraut (German, Germany), puku sprigane (English, Latvia), balsamie de l'himmalaya (French), bitine sprige (English, Lithuania), Washington orchid (English), jättebalsamin (English, Sweden), jättipalsami (English, Finland), kjempespringfrø (English, Norway), Kæmpe-Balsamin (English, Denmark), Drüsiges Springkraut (German), Indian balsam (English), risalísa (English, Iceland)

Synonym *Impatiens roylei* , Walpers.
Impatiens glanduligera , Lindley

Similar species

Summary *Impatiens glandulifera*, or Himalayan balsam, is a problematic invasive which has spread throughout Europe, parts of North America and New Zealand following introductions as an ornamental. It is an annual herb which thrives in riparian zones and disturbed areas. Its high reproductive rate, early germintation, propensity for establishing thick stands, rich nectar production, hardiness, and habitat tolerance and plasticity have allowed it to spread rapidly, dominate landscapes, and compete with and displace native plant species. Eradication has proven very difficult once established and preventative measures are recommended.

view this species on IUCN Red List

Species Description
Impatiens glandulifera is an erect, annual herb which stands from 1-5 m tall. Its leaves are glabrous, simple, oblong, ovate to elliptical, and arranged oppositely. Leaves are 5-18 cm inches long, 2.5-7 cm wide, and sharply serrated. Stems are reddish coloured, multi-branched, erect, hollow, and hairless with large swollen nodes. Roots to a depth of 10-15 cm. Its inflorescences are racemes of 2-14 flowers 2.5-4 cm long, which range in colour from white, pink, red, and purple. Flowers are irregular, bearing 5 petals and zygomorphic, with the lowest sepal forming a sac that ends in a straight spur. Seed capsules are 1.5-3.5 cm long, up to 3.5 cm wide, and contain 4-16 seeds (ANHP, 2004; Helmisaari, 2006; Beerling & Perrins, 1993; Willis & Hulme 2004).

Notes
Impatiens glandulifera has been found to be an important source of nectar for bumble-bees and to their conservation, especially in the changing seasons and among agricultural lands (Stary & Tkalcu, 1998).

Lifecycle Stages
An annual species, *Impatiens glandulifera* germinates in February to March. A period of chilling at 4º C for over 45 days is necessary to break seed dormacy. Germination is epigeal and occurs relatively early giving seedlings an advantage over other plants as long as they are not exposed to frost. After 12 days the first lateral roots emerge and by 18 days these roots, the radicle, and hypocotyl greatly elongate. Within four weeks the testa is lost and the cotyledons become photosynthetically active. The first true foliage emerges as a whorl of 4 leaves, with subsequent whorls of 3. Seed sets occur about 13 weeks after flowering (Beerling & Perrins, 1993; NWCB, 2007)

Uses
Impatiens glandulifera is a popular ornamental internationally. Many of its introductions to new locations have resulted from its unintentional establishment after \"escaping\" confined habitats (Beerling & Perrins, 1993).

Habitat Description
Impatiens glandulifera requires moist and relatively nutrient rich habitats and does particularly well in frequently disturbed areas. Tolerant of a wide range of soil textures and structures *I. glandulifera* occurs in fine and course alluvium, maritime shingle, free-draining mineral soils, peats, and colliery spoil. It most commonly occurs in riparian zones, but may also be found in open areas of forests, forest edges, riverine and fen scrub, roadsides, and man-made structures. *I. glandulifera* is tolerant to a pH range of about 4.5-7.7, elevations 1800-3200 m, and relatively low sunlight. *I. glandulifera* was found to require a growing season of 2195 day-degrees in Europe. Distributions may also be constrained by its high moisture requirement and frost sensitivity. Late spring and early autumn frosts are known to kill seedlings and adults respectively outside its native range (DAISIE, 2009; Beerling & Perrins, 1993; Beerling, 1993; Hedja & Psyek, 2006).

Reproduction
Impatiens glandulifera is a summer-annual, therophyte with no vegetative reproduction. Seed production varies with plant density. From germination flowering takes about 13 weeks and continues for another 12 weeks. Seed capsules mature producing up to 10 seeds and burst, expelling the seeds 3-5 m. Individual plants may produce more than 2,500 seeds in a vegetative period with taller plants producing more seeds and pods. *I. glandulifera* competes on river banks through synchronous germination of a large seed bank providing sufficient biomass to suppress neighbouring species. This synchronous reproductive strategy is thought to rely on habitats with seasonally predictable disturbances such as flooding (Beerling & Perrins, 1993; Burkhart & Nentwig, 2008; Sheppard *et al*, 2005; Willis & Hulme, 2004).

General Impacts
Impatiens glandulifera is known to compete with and displace native plant species as in the case of European native *Impatiens noli-tangere*, reduce native plant diversity, and negatively impact habitat for wildlife. Its hardiness, high reproductive rate, rapid growth, early germination, and propensity to establish thick, dense stands all make *I. glandulifera* a very formidable competitor. Hulme & Bremner (2006) reported that the introduction of Himalayan balsam resulted in more than a 25% reductions in species richness and diversity. However, studies in some locations claim effects of *I. glandulifera* on native biodiverstiy are mild, and that it predominately displaces non-native weeds. *I. glandulifera* promotes erosion in watercourses and can alter water flow. Its modest root system and characteristic dying back in the fall renders river banks more susceptible to erosion in the fall and winter, which damages river banks and increases flooding. *I. glandulifera* can also compete with and exclude native plants from pollination. It produces nectar sugar at a significantly higher rate (0.47 ± 0.12 mg per flower per hour) than many of its native neighbours in introduced habitats. In central Europe, its main invasive range, no plant produces more than 0.3 mg per flower per hour. Being a more appealing source of nectar to pollinators including bumblebees, honeybees, moths, and wasps, *I. glanulifera* has been demonstrated to cause pollinators to neglect native plants, reducing instances of their pollination and their resultant reproductive success. Finally because of their high holocellulose content, *I. glandulifera* stems persist throughout the winter and suppress competing seedlings the following spring (ANHP, 2004; NNSS, undated; DAISIE, 2006; Burkhart & Nentwig, 2008; Chitka & Schurkens, 2001; Lopezaraiza-Mikel *et al*, 2007; Perrins *et al*, 1993; Hulme & Bremner, 2006).

Management Info
Impatiens glandulifera is a highly invasive plant and should not be introduced to new locations. Care should be taken to prevent ornamental and contained plants from establishing in the wild. Studies indicate once widely established, eradication is extremely difficult. Maintenance of a dense grass sward along river banks may prevent the germination of *I. glandulifera* seedlings (Centre for Ecology and Hydrology, 2004; Wadsworth *et al*, 2000).
Please follow this link for more details on the management and control of *Impatiens glandulifera*.

Pathway
Many introductions of *Impatiens glandulifera* are the result of their use as decorative plants (Beerling & Perrins, 1993), and as a nectar source for commercial bees and planted by beekeepers (Helmisaari, 2006).Transportation of topsoil bearing overwintering seeds a common means of dispersal of *Impatiens glandulifera* (Beerling & Perrins, 1993).

Principal source: Delivering Alien Invasive Species Inventories for Europe (DAISIE), 2009. Species Factsheet: *Impatiens glandulifera*
USDA-ARS 2004. Taxon: *Impatiens glandulifera* Royle. National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland.
Alaska Natural Heritage Program (ANHP), 2004. Non-Native Plant Species of Alaska Ornamental jewelweed *Impatiens glandulifera* Royle Environment and Natural Resources Institute University of Alaska Anchorage

Compiler: National Biological Information Infrastructure (NBII) & IUCN/SSC Invasive Species Specialist Group (ISSG)

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ALIEN RANGE

[1] AUSTRIA **[1]** BELGIUM

[1] BULGARIA
[1] CROATIA
[1] DENMARK
[1] FINLAND
[1] GERMANY
[1] IRELAND
[1] ITALY
[1] LIECHTENSTEIN
[1] LUXEMBOURG
[1] NETHERLANDS
[1] NORWAY
[1] ROMANIA
[1] SERBIA
[1] SPAIN
[1] SWITZERLAND
[6] UNITED KINGDOM
[8] CANADA
[1] CZECH REPUBLIC
[1] ESTONIA
[1] FRANCE
[1] HUNGARY
[1] ISLE OF MAN
[1] LATVIA
[1] LITHUANIA
[1] MONTENEGRO
[1] NEW ZEALAND
[1] POLAND
[1] RUSSIAN FEDERATION
[1] SLOVAKIA
[1] SWEDEN
[1] UKRAINE
[12] UNITED STATES

BIBLIOGRAPHY

86 references found for **Impatiens glandulifera**

Managment information
Alien Plants in Ireland, 2007. *Impatiens glandulifera*
Summary: The database of alien plants in Ireland contains detailed information on 715 alien plant taxa currently occurring in (semi-) natural habitats in Ireland (both the Republic and Northern-Ireland). This database was developed in 2006 at the School of Natural Sciences, Trinity College Dublin, as part of the BioChange project, funded by the Environmental Protection Agency (EPA), Ireland.
Available from: http://www.biochange.ie/alienplants/index.php [Accessed April 26 2007]
This page available from: http://www.biochange.ie/alienplants/result_species.php?species=564&lang=latin&p=i [Accessed 26 April 2007]
Beerling, D. J; Woodward, F. I., 1994. Climate change and the British scene. Journal of Ecology. 82(2). 1994. 391-397.
Burkhart, Karin and Wolfgang Nentwig, 2008. Control of *Impatiens glandulifera* (Balsaminaceae) by Antagonists in its Invaded Range. Invasive Plant Science and Management Volume 1, Issue 4 (October-December 2008) pp. 352–358
Summary: Abstract: Field and garden experiments were performed to investigate if pathogens, generalist herbivores, or a specialist herbivore (the tortricid moth *Pristerognatha fuligana*) have the potential to control the invasive Himalayan balsam. Impacts of generalist herbivores and pathogenic fungi were excluded by using thiacloprid and trifloxystrobin. Results show no effect of any antagonist in the field experiment, though we found a modest impact of the combined influence of generalist herbivores and pathogenic fungi in the garden experiment, i.e., under suboptimal growing conditions. Limited information from the native area (the Himalayas) suggests a strong impact of specialist herbivores, thus confirming the enemy release hypothesis. We predict that impact studies of native specialized herbivores will clearly indicate antagonists from the native area with a strong impact on Himalayan balsam in its invaded area.
Available from: http://wssa.allenpress.com/perlserv/?request=get-pdf&doi=10.1614%2FIPSM-08-090.1 [Accessed 20 January 2009]
CABI, 2009. Project The biological control of Himalayan balsam (*Impatiens glandulifera*) in the UK. Phase 2.
Summary: Available from: http://www.cabi.org/ProjectsDetail.asp?ProjectID=354 [Accessed 20 January 2009]
Climate Change and Freshwater, 2009. Wetlands in Temperate Ecoregions, Species affected by Climate Change: *Impatiens glandulifera*
Summary: Available from:
http://www.climate-and-freshwater.info/wetlands-temperate-ecoregions/climate-change-species/detail.php?id=20 [Accessed 20 January 2009]
Collingham, Y. C., Wadsworth, R. A., Huntley, B., Hulme, P. E. 2000. Predicting the Spatial Distribution of Non – Indigenous Riparian Weeds: Issues of Spatial Scale and Extent. The Journal of Applied Ecology 37 supplement 1, NERC/SERAD Special Issue. Large Scale Processes in Ecology and Hydrology:13 – 27
Conservation Evidence.com., The effect of removal of Himalayan balsam *Impatiens glandulifera* on plant species diversity of invaded riparian vegetation in the central Czech Republic
Summary: Available from: http://www.conservationevidence.com/ViewEntry.asp?ID=444 [Accessed 20 January 2009]
Dawson, F. Hugh; Holland, David., 1999. The distribution in bankside habitats of three alien invasive plants in the U.K. in relation to the development of control strategies. Hydrobiologia.(415). Nov. 15, 1999. 193-201.
Summary: Abstract: The national distribution of *Fallopia japonica* (Japanese Knotweed), *Heracleum mantegazzianum* (Giant Hogweed) and *Impatiens glandulifera* (Himalayan Balsam) in bankside habitats is given for 1994-96 in the U.K. and contrasted with the occurrence of large stands of other nuisance plants. The typical habitats of these plants were derived by analysis of flow, channel and bank substrates from River Habitat Surveys and shows their invasion potential across the U.K. Study of the dispersal mechanisms and control techniques shows: (a) the consequences of accidental introductions to river banks from locations away from the river, (b) their further dispersal by the downstream drift of seed or fragments with their subsequent invasion, and (c) the key areas in the development of appropriate control programmes. The concentration of effort to immediate action and to small areas, especially upstream, is recommended, in preference to widespread but incomplete control.
Delivering Alien Invasive Species Inventories for Europe (DAISIE), 2009. Species Factsheet: *Impatiens glandulifera*.
Summary: Available from: http://www.europe-aliens.org/speciesFactsheet.do?speciesId=17367 [Accessed 20 January 2009]
Essl, F.; Hauser, E., 2003. Distribution, habitat preference and management concept of selected invasive neophytes in the national park Thayatal and the adjacent area (Austria). Linzer Biologische Beitraege. 35(1). 30 Juni, 2003. 75-101.

European and Mediterranean Plant Protection Organization (EPPO), undated. Data sheet on Invasive Plants: *Impatiens glandulifera*
Summary: Includes a summary of Invasiveness.
Available from:
http://www.eppo.org/QUARANTINE/Pest_Risk_Analysis/PRAdocs_plants/draftds/05-11831%20DS%20Impatiens%20glandulifiera.doc
[Accessed 20 January 2009]
Hejda, Martin., 2006. Species Factsheet: *Impatiens glandulifera*. Delivering Alien Invasive Species Inventories for Europe (DAISIE)
Summary: Available from: http://www.europe-aliens.org/pdf/Impatiens_glandulifera.pdf [Accessed 20 January 2009]
Helmisaari, H. 2006. NOBANIS – Invasive Alien Species Fact Sheet – *Impatiens glandulifera*. – From: Online Database of the North European and Baltic Network on Invasive Alien Species – NOBANIS www.nobanis.org, Date of access x/x/200x.
Summary: Available from: http://www.nobanis.org/files/factsheets/Impatiens_glandulifera.pdf [Accessed 20 January 2009]
Hulme P.E & Bremner E.T., 2006. Assessing the impact of *Impatiens glandulifera* on riparian habitats: partitioning diversity components following species removal. Journal of Applied Ecology, 43, 43-50
Hulme, Philip E., 2006. Beyond control: wider implications for the management of biological invasions. Journal of Applied Ecology. 43(5). OCT 2006. 835-847.
Summary: Abstract: 1. Government departments, environmental managers and conservationists are all facing escalating pressure to address and resolve a diversity of invasive alien species (IAS) problems. Yet much research to date is primarily concerned with quantifying the scale of the problem rather than delivering robust solutions and has not adequately addressed all stages of the invasion process, and only a few studies embrace the ecosystem approach.2. Three successive steps, prevention, eradication and control, form the cornerstones of recommended best practices aimed at managing IAS. The goal of such actions is the restoration of ecosystems to preserve or re-establish native biodiversity and functions.3. Prevention is widely promoted as being a more environmentally desirable strategy than actions undertaken after IAS establishment, yet is hindered by the difficulty in separating invasive from non-invasive alien species. Furthermore, the high number of candidate IAS, the investment required in taxonomic support and inspection capacity, and the expense of individual risk assessments may act against the net benefits of prevention. More rewarding avenues may be found by pursuing neural networks to predict the potential composition of pest assemblages in different regions and/or model introduction pathways to identify likely invasion hubs.4. Rapid response should be consequent on early detection but, when IAS are rare, detection rates are compromised by low occurrence and limited power to discern significant changes in abundance. Power could be increased by developing composite indicators that track trends in a suite of IAS with similar life histories, shared pathways and/or habitat preferences.5. The assessment of management options will benefit from an ecosystem perspective that considers the manipulation of native competitors, consumers and mutualists, and reviews existing management practices as well as mitigates other environmental pressures. The ease with which an IAS can be targeted should not only address the direct management effects on population dynamics but also indirect effects on community diversity and structure. Where the goal is to safeguard native biodiversity, such activities should take into account the need to re-establish native species and/or restore ecosystem function in the previously affected area.6. Synthesis and applications. A comprehensive approach to IAS management should include consideration of the: (i) expected impacts; (ii) technical options available; (iii) ease with which the species can be targeted; (iv) risks associated with management; (v) likelihood of success; and (vi) extent of public concern and stakeholder interest. For each of these issues, in addition to targeting an individual species, the management of biological invasions must also incorporate an appreciation of other environmental pressures, the importance of landscape structure, and the role of existing management activities and restoration efforts.
Kelly, J., Maguire, C.M. and Cosgrove, P.J., 2008. Best Practice Management Guidelines Himalayan balsam *Impatiens glandulifera*. Prepared for NIEA and NPWS as part of Invasive Species Ireland.
Summary: The aim of this plan is to provide best practice management guidance on the control of Himalayan balsam (*Impatiens glandulifera*) on the island of Ireland.
Available from: http://www.invasivespeciesireland.com/files/public/BPM%20Guidance/Himalayan%20Balsam%20BPM.pdf [Accessed 20 January 2009]
Kollmann, Johannes; Banuelos, Maria Jose; Nielsen, Steen Lykke., 2007. Effects of virus infection on growth of the invasive alien *Impatiens glandulifera*. Preslia (Prague). 79(1). MAR 2007. 33-44.
Summary: Abstract: The absence of fungal or viral diseases of some invasive alien plants partially explains their success. However, for several species this issue has not been studied and no account of such infections are recorded for *Impatiens glandulifera*, a problematic weed in moist and half-open habitats of central and western Europe. We record for the first time viral infections in plants from different European regions grown in a common garden experiment. The infection was systemic and could be transferred to two species of *Chenopodium* and five species of *Nicotiana*, and resulted in the development of local necrotic spots within a week. The symptoms resembled Tobacco Rattle Virus, but this was not confirmed by an ELISA-test. In *I. glandulifera* the virus led to reduced above-ground biomass. Relative stem biomass and basal diameter were also lower in diseased plants, but there was no significant differences in plant height and number of main branches. Also virus infection did not affect the following reproductive traits: time to flowering, pollen viability, fruit abortion, seed/ovule ratio, seed number per fruit and individual seed mass. This virus was not transmitted *via* seed. The potential effects of such viral infections on the population dynamics and biological control of this alien plant are discussed.
Kurtto, Arto., 1996. *Impatiens glandulifera* (Balsaminaceae) as an ornamental and escape in Finland, with notes on the other Nordic countries. Acta Universitatis Upsaliensis Symbolae Botanicae Upsalienses. 31(3). 1996. 221-228.
Summary: Abstract: *Impatiens glandulifera*, a native of the Himalayas, is in Europe a popular ornamental and nowadays also a common and often completely naturalised garden escape, especially along rivers and brooks. In Norden the process of true naturalization began probably in the 1920s-1940s. Autochory, various forms of anthropochory (including deliberate transport of seeds and seedlings), hydrochory and combinations of these are the main means of dispersal. The success and even invasive nature of the species are based on many factors, of which the most important are: (1) climatic hardiness (originally a plant of high mountains), (2) wide phenotypic flexibility connected with a fairly wide ecological spectrum, (3) synchronous and early germination of a large number of seeds to achieve habitat dominance by a light-blocking canopy (shade tolerance, massive cotyledons and rapid elongation of shoots are essential in this), (4) abundant seed set ensured by showy and late flowers producing much nectar rich in sugars, and by self-compatibility, (5) lack of diseases and scarcity of parasites and feeders.

Larsson, Charlotta; Martinsson, Karin., 1998. *Impatiens glandulifera* in Sweden - An invasive species or a harmless garden escape? Svensk Botanisk Tidskrift. 92(6). 1998. 329-345.
Summary: Abstract: The Himalayan Balsam *Impatiens glandulifera*, first introduced to Sweden in 1842, has been available in Swedish trade since the last decades of the 19th century. It became a garden escape during the 1920s and was naturalised in southern Sweden in the 1940s. It has spread into natural habitats, especially moist localities such as banks of streams and rivers. It is mainly found in the southwest, with occasional localities in the east and north. During the last decades its expansion has been promoted by decreased grazing. The invasiveness of *I. glandulifera* in seminatural and natural habitats was studied in totally 7.8 km of riverbanks along Viskan in Vastergotland, SW Sweden. Established populations were mainly found in glades. Extensive populations were found in ungrazed grassland but not in pastures. Vascular plant species found within the stands were almost all perennials known as strong competitors, e. g. *Rubus idaeus*, *Urtica dioica* and *Elytrigia repens*, although they were quite low in numbers. *I. glandulifera* was sometimes found together with the indigenous *I. noli-tangere*. *I. glandulifera* affects the surrounding vegetation by its competiveness.
Noxious Weed Control Board (NWCB), 2007. Written Findings of the State Noxious Weed Control Board-Class B- B-designate Weed-Policeman s helmet (*Impatiens glandulifera*) Royal.
Summary: Available from: http://www.nwcb.wa.gov/weed_info/written_findings/impatiens_glandulifera.html [Accessed 20 January 2009]
Perrins J. M, Fitter A, Williamson M., 1993. Population Biology and Rates of Invasion of Three Introduced *Impatiens* Species in the British Isles. Journal of Biogeography 20:33 &#65533; 44
Protopopova, Vera V.; Shevera, Myroslav V.; Mosyakin, Sergei L., 2006. Deliberate and unintentional introduction of invasive weeds: A case study of the alien flora of Ukraine. Euphytica. 148(1-2). MAR 2006. 17-33.
Summary: Abstract: Based on the analysis of invasions of alien plants in Ukraine, the impact of non-native plant species upon the native flora and adverse consequences of their spread are assessed. A case study gives examples of the role of alien plants in fragmentation of populations of native species; contamination of genetic resources of rare and endangered native species, formation of new ecotypes and hybridization with native taxa, disruption of the structure of natural plant communities as a result of introduction of alien species and formation of specific plant communities with domination of aliens. Arguments are provided against uncontrolled casual introductions and subsequent escape from cultivation as a result of ill-judged deliberate introduction of plants for ornamental, agricultural, technical, forestry, and other uses without any preliminary assessment of their invasion potential in the region concerned. Invasions of alien plants promote dramatic changes in the taxonomic, geographical, and ecological patterns of local floras, disruptions in the phytosociological spectrum, spectra of biomorphs, deterioration of zonal peculiarities of the flora, and finally lead to the decline of the vegetation productivity. A list of highly invasive plant species threatening forest, steppe, and submediterranean zones of East Europe is provided.
Provan, Jim; Love, Heather M.; Maggs, Christine A., 2007. Development of microsatellites for the invasive riparian plant *Impatiens glandulifera* (Himalayan balsam) using intersimple sequence repeat cloning. Molecular Ecology Notes. 7(3). MAY 2007. 451-453.
Summary: Abstract: *Impatiens glandulifera* (Himalayan balsam) is an invasive riparian plant species that can outcompete native perennials. Population genetic data on dispersal may aid in the management of invasive species, so we have developed microsatellite markers for this significant invader using an intersimple sequence repeat (ISSR)-based cloning method. Eight polymorphic markers displayed between two and five alleles, with overall levels of observed and expected heterozygosities ranging from 0.0500 to 0.7500 and from 0.1449 to 0.7692, respectively.
Pysek, Petr ; Prach, Karen., 1995. Invasion dynamics of *Impatiens glandulifera*: A century of spreading reconstructed. Biological Conservation. 74(1). 1995. 41-48.
Summary: Abstract: The invasion of *Impatiens glandulifera* in the territory of the Czech Republic, Central Europe, was reconstructed on the basis of floristic records. The first spontaneous occurrences were reported from the end of the 19th century. The exponential phase of invasion started in the 1930s and the highest increase in the cumulative number of localities reported occurred in the 1960s. Since its introduction, *I. glandulifera* has spread into 47.4% of available mapping squares. The species is closely confined to riparian habitats. At present it occupies 56% of the length of larger river systems. It is predicted that it will occur in all larger rivers in the Czech Republic by c. 2025, assuming that the rate of invasion remains constant. The rates of invasion in the Czech Republic, British Isles, Bavaria (Germany), and Slovakia are compared. In all the countries considered, the greatest increase occurred in recent decades, and was related to the date of escape from cultivation. Although the situation in the Czech Republic is at present not critical, the ability of *I. glandulifera* to outcompete native flora, and its predicted expansion along water courses, indicates that it could become a more serious threat to nature conservation in the future.
Sheppard, A.W; R. H Shaw & R Sforza., 2005. Top 20 environmental weeds for classical biological control in Europe: a review of opportunities, regulations and other barriers to adoption. Weed Research Volume 46 Issue 2, Pages 93 - 117
Summary: Abstract: Classical biological control remains the only tool available for permanent ecological and economic management of invasive alien species that flourish through absence of their co-evolved natural enemies. As such, this approach is recognized as a key tool for alien species management by the Convention on Biological Diversity (CBD), the European and Mediterranean Plant Protection Organization (EPPO) and the European Strategy on Invasive Alien Species (ESIAS). Successful classical biological control programmes abound around the world, despite disproportionate attention being given to occasional and predictable non-target impacts. Despite more than 130 case histories in Europe against insect pests, no exotic classical biological control agent has been released in the EU against an alien invasive weed. This dearth has occurred in the face of increasing numbers of exotic invasive plants being imported and taking over National Parks, forests and amenity areas in this region, as well as a global increase in the use of classical biological control around the world. This paper reviews potential European weed targets for classical biological control from ecological and socioeconomic perspectives using the criteria of historical biological control success, taxonomic isolation from European native flora, likely availability of biological control agents, invasiveness outside Europe and value to primary industry and horticulture (potential for conflicts of interest). We also review why classical biological control of European exotic plants remains untested, considering problems of funding and public perception. Finally, we consider the regulatory framework that surrounds such biological control activities within constituent countries of the EU to suggest how this approach may be adopted in the future for managing invasive exotic weeds in Europe.

T�orok, K; Z. Botta-Dukat, I. Dancza, I. N�emeth, J. Kiss, B. Mih�aly & D. Magyar., 2003. Invasion gateways and corridors in the Carpathian Basin: biological invasions in Hungary. Biological Invasions 5: 349�356, 2003.
Summary: Abstract: Biological invasions in Hungary are causing severe problems as a result of recent introductions and rapid land use changes. Poorly managed agricultural and rural, disturbed areas, and aquatic ecosystems are the most prone to plant invasions. Dry grasslands and semi-natural forests are less prone to invasions. A few plant species have led to human health (allergenic) problems. Some insect species have caused economic problems to crop production. A number of monitoring networks and control measures are in place for selected plants and insects.
Usher M B., 1986. Invasibility and Wildlife Conservation Invasive Species on Nature Reserves. Philosophical Transactions of the Royal Society of London B Biological Sciences. 314(1167). 1986. 695-710.
Summary: Abstract: Nature reserves are often considered to be assemblages of species in natural or semi-natural communities. However, in many parts of the world they also contain exotic species that interact with the native flora and fauna. An International Working Group has been endeavouring to understand the management of invasive species in natural landscapes. Data for four invasive species within the British Isles are analysed. The case studies investigated include Indian balsam (*Impatiens glandulifera*), rhododendron (*Rhododendron ponticum*), mink (*Mustela vison*) and coypu (*Myocastor coypus*). The rates of spread have been variable, usually increasing after an establishment phase. The discussions concentrate on assessing the impact of invasive species, on deciding whether control measures are feasible and/or desirable, on deciding whether or not nature reserves are less prone to invasion than other habitats, and on assessing wildlife conservation values when invasive species are present.
Varnham, K. 2006. Non-native species in UK Overseas Territories: a review. JNCC Report 372. Peterborough: United Kingdom.
Summary: This database compiles information on alien species from British Overseas Territories.
Available from: http://www.jncc.gov.uk/page-3660 [Accessed 10 November 2009]
Wadsworth, R. A., Collingham, Y. C., Willis, S. G., Huntley, B., Hulme, P. E. 2000. Simulating the Spread and Management of Alien Riparian Weeds: Are They Out of Control? The Journal of Applied Ecology 37 supplement 1, NERC/SERAD Special Issue. Large Scale Processes in Ecology and Hydrology:28 - 38
Summary: Abstract: 1. This paper examines the circumstances under which control programmes may reduce the range of two widespread invasive weeds of riparian habitats: *Impatiens glandulifera* (Himalayan balsam) and *Heracleum mantegazzianum* (giant hogweed). 2. The spread of both species was modelled using MIGRATE, a spatially explicit model that incorporates realistic demographic parameters and multiple dispersal mechanisms. Simulations of a range of control scenarios were run within a geographical information system (GIS) using authentic landscapes based on topographic, hydrological and land cover maps of County Durham, UK. Results were interpreted at both a catchment and a regional scale. 3. Six representative strategies were explored that prioritized control as follows: at random, in relation to human population density, or by the size, age (new and old) or spatial distribution of weed populations. These strategies were assessed at different intensities of management (area treated per year) and for varying efficiencies (proportion of plants destroyed) as well as the timeliness (how long since the species became established) of implementations. 4. Strategies that prioritized control based on weed population and spatial characteristics were most effective, with plant population size and spatial distribution being the key parameters. The reduction in geographical range within a catchment or region following control was always greater for *H. mantegazzianum* than *I. glandulifera* due to its slower rate of spread. 5. Successful control of both species at a regional scale is only possible for strategies based on species distribution data, undertaken at relatively high intensities and efficiencies. The importance of understanding the spatial structure of the population and potential habitat available, as well as being able to monitor the progress of the eradication programme, is highlighted. Tentative conclusions are offered as to the feasibility of eradicating these species at a regional scale.
Weber, Ewald., 2000. Switzerland and the invasive plant species issue. Botanica Helvetica. 110(1). Juni, 2000. 11-24.
Summary: Abstract: The increasing number of naturalized non-native plant species with a negative ecological impact on the communities where they grow (invasive species) is viewed as a major component of global change and is an important topic of current ecological research. In most regions of the world, the number of alien species is increasing as a result of trade, tourism, and disturbance, thus increasing the likelihood of plant invasions. Several international organizations have incorporated the invasive plant species issue in their main activities and have formulated guidelines for the management and eradication of invasive species. Switzerland as a central European country does not have as many invasive species as for example countries of other continents; however, some species are regarded as being invasive and are of special concern due to the highly fragmented and intensively used landscape. With the exceptions of the Alps, wildlife and areas of high conservation value are restricted to usually small areas, surrounded by heavily disturbed habitats or urban areas. In such places, invasive plant species may pose additional threats to the native diversity. Species of high concern are for example the north American *Robinia pseudoacacia*, *Solidago altissima*, *S. gigantea*, and the Asian species *Impatiens glandulifera* and *Reynoutria japonica*. In this article, the invasive species issue is highlighted with regard to the Swiss flora, and the needs for actions are discussed.
Willis, S. G.; Hulme, P. E., 2002. Does temperature limit the invasion of *Impatiens glandulifera* and *Heracleum mantegazzianum* in the UK? Functional Ecology, Volume 16, Number 4, August 2002 , pp. 530-539(10)
Summary: Abstract: 1. *Impatiens glandulifera* Royle and *Heracleum mantegazzianum* Sommier et Levier are widespread, non-indigenous plant species in the UK. A variety of correlational analyses suggest that their spatial extent is limited by climate, although no experimental studies have tested this hypothesis. This paper reports the first detailed experimental examination of the impact of climate on the performance of the two species.
2. Seeds of each species were sown, in each of 2 years, in replicated plots along an elevational gradient (10-600 m a.s.l.) in north-east England. Both species germinated readily at all elevations, even in areas well above their current limits within the study area. The plants were, however, smaller at higher altitudes. *I. glandulifera* also produced fewer seeds with increasing elevation.
3. Plant performance was assessed in relation to actual and interpolated climate data along the elevational transect. For *H. mantegazzianum*, the timing of germination was correlated most strongly with the pre-emergence heat sum; for *I. glandulifera* this relationship was significant in one year only. Maximum height of both species was correlated with increasing post-emergence heat sum, as was pod production by *I. glandulifera*. The biomass of second-year *H. mantegazzianum* plants varied non-linearly with post-emergence heat sum. For both species, overwinter survival of seeds was not related to winter temperature or frost days. Overwinter survival of first-year *H. mantegazzianum* plants declined with increasing frost incidence.
4. The results suggest that, of the two species, only *I. glandulifera* is currently most limited by temperature, although this is not the only factor determining the distribution of the species.

General information

Akiyama, Shinobu., 1999. New records of *Impatiens* (Balsaminaceae) in Hokkaido, Japan. Bulletin of the National Science Museum Series B (Botany). 25(4). Dec., 1999. 143-149.
Summary: Abstract: *Impatiens glandulifera* and *I. balfourii* were recently found naturalized in Hokkaido. They are both Himalayan species and are known to be widely naturalized in Europe and N. America.
Alaska Natural Heritage Program (ANHP). 2004. Non-Native Plant Species of Alaska Ornamental jewelweed *Impatiens glandulifera* Royle Environment and Natural Resources Institute University of Alaska Anchorage
Summary: Available from: http://akweeds.uaa.alaska.edu/pdfs/species_bios_pdfs/Species_bios_IMGL.pdf [Accessed 20 January 2009]
Assyov, Boris; Vassilev, Rossen., 2004. New chorological data and remarks on the distribution of some vascular plants in Bulgaria. Phytologia Balcanica. 10(2-3). 2004. 191-199.
Summary: Abstract: The paper presents contemporary chorological information and critical remarks on the distribution of 34 native and adventive Bulgarian vascular plants.
Beerling, David J., 1993. The Impact of Temperature on the Northern Distribution Limits of the Introduced Species *Fallopia japonica* and *Impatiens glandulifera* in North-West Europe (pp. 45-53). Journal of Biogeography Vol. 20, No. 1, Jan., 1993
Beerling, David J.; Dawah, Hassan A., 1993. Abundance and diversity of invertebrates associated with *Fallopia japonica* (Houtt. Ronse Decraene) and *Impatiens glandulifera* (Royle): Two alien plant species in the British Isles. Entomologist. 112(2). 1993. 127-139.
Summary: Abstract: The invertebrates associated with the foliage and leaf litter of two introduced plant species *Fallopia japonica* (Houtt.) Ronse Decraene. and *Impatiens glandulifera* Royle.) were sampled from a riparian site in South Wales during May, July and September, 1988. The density of animals collected from the foliage varied between 0.6 g-1 plant biomass (wet weight) in May to lt 0.01 g-1 plant biomass in July and September. *I. glandulifera* had a significantly (P lt 0.05) greater density of animals and a significantly (P lt 0.05) higher taxon richness (measured in terms of family) in the May foliage samples compared with *F. japonica*. The number of animals caught in the leaf litter samples was similar for both alien plants. However, the litter samples from beneath the cropped *I. glandulifera* plants had a consistently higher diversity than those of *F. japonica*. Seasonal changes in the taxonomic composition of the animals caught on the foliage and in the leaf litter are also described. The results are discussed with reference to the conservation implications for invertebrate diversity on areas of land where both species are established and invasive.
Beerling, DJ (1993) The impact of temperature on the northern distribution limits of the introduced species Fallopia japonica and Impatiens glandulifera in north-west Europe. Journal of Biogeography Vol. 20, no. 1, pp. 45-53.
Beerling D.J, Perrins J.M., 1993. *Impatiens glandulifera* Royle (*Impatiens roylei* Walp.). The Journal of Ecology 81:367 • 382
Bianchini, Francesco., 1994. Veronese Flora: Part VIII. Spermatophytes. Bollettino del Museo Civico di Storia Naturale di Verona. 18(0). 1991 (1994). 235-338.
Summary: Abstract: The eighth contribution to the knowledge of the flora in the Verona region concludes the presentation of the Geraniales order with a description of the family Euphorbiaceae; this is followed by a presentation of ten other orders systematically included between Rutales and Myrtales. Two recently discovered species are new to Veronese flora: *Impatiens glandulifera* and *Impatiens balfourii* of the family Balsaminaceae.
Borsic, Igor; Milenko Milovic; Iva Dujmovic; Sandro Bogdanovic; Petra Cigic; Ivana Resetnik; Toni Nikolic; & Bozena Mitic., 2008. Preliminary Checklist of Invasive Allien Plant Species (IAS) in Croatia. National Croatia, Volume 17 No 2 pp 55-71, Zagreb June 2008
Summary: Abstract: In this paper a preliminary check-list of invasive alien plant species (IAS) in Croatia is presented. It has been created on the basis of the literature and of field observations. The list consists of 64 taxa, with family, life-form and geographic origin assigned to each IAS. Analyses according to family affiliation, life-form and origin were made. Out of 27 families the majority (24 families) belong to the dicotyledons. The most numerous family is Asteraceae, and genera with the highest number of IAS are Conyza, Erigeron and Impatiens. Life-form analysis showed the predominance of therophytes but also presence of hemicryptophytes, phanaerophytes and geophytes. In the origin analysis, IAS from the Americas predominated, followed by those from Asia and Africa.
Bradford, Mark A.; Schumacher, Henry B.; Catovsky, Sebastian; Eggers, Till; Newington, John E; Tordoff, George M., 2007. Impacts of invasive plant species on riparian plant assemblages: interactions with elevated atmospheric carbon dioxide and nitrogen deposition. Oecologia (Berlin). 152(4). JUL 2007. 791-803.
Brandes, Dietmar; Oppermann, Friedrich Wilhelm., 1994. The riparian flora of the upper part of the river Weser (Germany). Braunschweiger Naturkundliche Schriften. 4(3). 1994. 575-607.
Bundesamt fuer Naturschutz, Neoflora-Handbuch: Impatiens glandulifera Royle (Balsaminaceae), Drüsiges Springkraut (German)
Burda, R. I.; Ryabokon, A. O., 1994. Naturalization of adventive species *Impatiens glandulifera* Royle (Balsaminaceae) in Kharkov. Ukrayins kyi Botanichnyi Zhurnal. 51(6). 1994. 140-145.
Summary: Abstract: The found of the adventive south-eastern-asian species *Impatiens glandulifera* Royle out of the culture of thickets in Charckov has been reported for the first time. The distribution of this usual weed of gardens, parks and flowerbeds in the Right Bank Ukraine is connected with ruderalized groupings of littoral-aquatic vegetation at the Uda, Lopan, Nemishi (the Severscky Donets - Don system). Most probably, the species appeared in the mentioned habitats from the culture and each year producing seeds, forming thickets, distributed along the uncared banks of rivers in the city. Under the conditions of the semiarid moistening the mentioned habitats have become ways of its advancement as hygrophyte to new territories. measurements of Charckov s individuals population witness that it is completely within the range of species variability, shown for the Himalayas populations, though some gigantism is typical of given to make up for a deficiency in the available information.
Centre for Ecology and Hydrology (CEH)., 2004. Information Sheet 3: Himalayan Balsam. National Environment Research Council (NERC) Centre for Aquatic Plant Management
Summary: Available from: http://www.nerc-wallingford.ac.uk/research/capm/pdf%20files/3%20himalayan%20balsam.pdf [Accessed 20 January 2009]
Chittka, L., Schurkens, S. 2001. Succesful Invasion of a Floral Market • An Exotic Plant Has Moved in on Europe•s River Banks by Bribing Pollinators. Nature 411:653 - 653

Cigic, Petra; Toni Nikolic, Mizko Plazibat, Vladimir Hrsak & Sven D. Jelaska., 2003. The Distribution of the Genus *Impatiens* L. (Balsaminaceae) in Nedvednica Nature Park, Croatia. National Croatia., Volume 12, No 1, pp 19-29 Zagreb March 31 2003.
Summary: Abstract: The flora research in Medvednica Nature Park has shown the presence of four species of the genus *Impatiens:*Impatiens balfourii Hooker f., *I. glandulifera* Royle, *I. noli-tangere* L. and *I. parviflora* DC. The species *I. noli-tangere* is the most widespread in the Park, while the other three species are registered for the first time. Distribution mapping was done by using the basic units of the Central European grid for floristic mapping (MTB).
Clements, David R; Feenstra, Kathleen R.; Jones, Karen; Staniforth, Richard., 2008. The biology of invasive alien plants in Canada. 9. *Impatiens glandulifera* Royle. Canadian Journal of Plant Science. 88(2). MAR 2008. 403-417.
Summary: Abstract: *Impatiens glandulifera* Royle (Himalayan balsam) is an invasive alien annual up to 3 in in height with showy flowers that are generally pink or purplish. Native to the Himalayan region, *I. glanditlifera* was first recorded in Canada in 1901 in Ottawa, and is now found in eight Canadian provinces: British Columbia, Manitoba, Ontario, Quebec, Nova Scotia, New Brunswick, Prince Edward Island and Newfoundland. *Impatiens glandulifera* is typically found in riparian habitats and may spread rapidly because its seeds are readily transported via waterways. Up to 2500 seeds are produced per plant and dispersed explosively Lip to 5 in from the parent plant. This can result in dense monotypic stands which prevent establishment of native plants and make stream banks vulnerable to erosion when the shallow-rooted plants die back. *Impatiens glandulifera* is susceptible to glyphosate but because herbicide use in riparian areas is not advised, other control methods such as hand weeding, mowing or flaming have been used. Methods for eradication are most successful when upstream populations are controlled first, lest the plants spread downstream. Removal of *I. glandulifera* should be managed synchronously with non-native control measures and ideally be accompanied by planting native species to ensure the restoration of native species composition. The prognosis for curbing its spread in Canada seems poor as it has quite rapidly become established along waterways in many regions, following a pattern seen over the past two centuries in Europe.
Dassonville, Nicolas; Vanderhoeven, Sonia; Vanparys, Valerie; Hayez, Mathieu; Gruber, Wolf; Meerts, Pierre., 2008. Impacts of alien invasive plants on soil nutrients are correlated with initial site conditions in NW Europe. Oecologia (Berlin). 157(1). AUG 2008. 131-140
Summary: Abstract: Alien invasive plants are capable of modifying ecosystem function. However, it is difficult to make generalisations because impacts often appear to be species- and site-specific. In this study, we examined the impacts of seven highly invasive plant species in NW Europe (*Fallopia japonica*, *Heracleum mantegazzianum*, *Impatiens glandulifera*, *Prunus serotina*, *Rosa rugosa*, *Senecio inaequidens*, *Solidago gigantea*) on nutrient pools in the topsoil and the standing biomass. We tested if the impacts follow predictable patterns, across species and sites or, alternatively, if they are entirely idiosyncratic. To that end, we compared invaded and adjacent uninvaded plots in a total of 36 sites with widely divergent soil chemistry and vegetation composition. For all species, invaded plots had increased aboveground biomass and nutrient stocks in standing biomass compared to uninvaded vegetation. This suggests that enhanced nutrient uptake may be a key trait of highly invasive plant species. The magnitude and direction of the impact on topsoil chemical properties were strongly site-specific. A striking finding is that the direction of change in soil properties followed a predictable pattern. Thus, strong positive impacts (higher topsoil nutrient concentrations in invaded plots compared to uninvaded ones) were most often found in sites with initially low nutrient concentrations in the topsoil, while negative impacts were generally found under the opposite conditions. This pattern was significant for potassium, magnesium, phosphorus, manganese and nitrogen. The particular site-specific pattern in the impacts that we observed provides the first evidence that alien invasive species may contribute to a homogenisation of soil conditions in invaded landscapes.
Fabiszewski, Jerzy; Brej, Teresa., 2008. Ecological significance of some kenophytes in Lower Silesian national parks. Acta Societatis Botanicorum Poloniae. 77(2). 2008. 167-174.
Flora of Northern Ireland: Impatiens glandulifera
Gigon A. & Weber E. 2005. (Geobot. Institut, ETH-Zentrum Zurich) in collaboration with the working group Invasive Neophytes of the Swiss Commission for Wild Plant Conservation CPS/SKEW and the Swiss Floristic Network CRSF/ZDSF.
Summary: Summary available
Available from: http://www.cps-skew.ch/english/inva_summary.pdf [Accessed 20 January 2009]
Global Compendium of Weeds (GCW), 2007. *Impatiens glandulifera* (Balsaminaceae)
Summary: Available from: http://www.hear.org/gcw/species/impatiens_glandulifera/ [Accessed 20 January 2009]
Hejda, Martin & Petr Pysek., 2006. What is the impact of *Impatiens glandulifera* on species diversity of invaded riparian vegetation? Biological Conservation Volume 132, Issue 2, October 2006, Pages 143-152
Summary: Abstract: Effect of invasion by *Impatiens glandulifera* (Balsaminaceae) on the community characteristics and species composition of invaded riparian communities was studied at six rivers in the Czech Republic. Two approaches were used: space for time substitution approach, i.e., comparing invaded and uninvaded sites under the same habitat conditions, and removal of the invader from experimental plots. Differences in the number of species, Shannon diversity index H and evennes J were compared between invaded and uninvaded plots. Uninvaded plots of the comparative study harboured by 0.23 more species per 16 m(2), and had higher value of H and J, calculated with species covers as importance values; however only the difference in J was marginally significant ($p = 0.04$). Other effects were not significant, indicating that once *I. glandulifera* is removed, communities recover without any consequences for species diversity. Multivariate analysis did not reveal any effect of invasion on the species composition in terms of species presence but their cover hierarchies changed after the invasion, as *I. glandulifera* became dominant at the expense of tall native nitrophilous dominants. It is concluded that *I. glandulifera* exerts negligible effect on the characteristics of invaded riparian communities, hence it does not represent threat to the plant diversity of invaded areas. This makes it very different from other Central European invasive aliens of a similar performance.
Available from: http://www.ibot.cas.cz/personal/pysek/pdf/Hejda,%20Pysek-Impatiens%20impact_BiolConserv2006.pdf [Accessed 20 January 2009]
ITIS (Integrated Taxonomic Information System), 2009. Online Database *Impatiens glandulifera* Royle
Summary: An online database that provides taxonomic information, common names, synonyms and geographical jurisdiction of a species. In addition links are provided to retrieve biological records and collection information from the Global Biodiversity Information Facility (GBIF) Data Portal and bioscience articles from BioOne journals.
Available from: http://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=29187 [Accessed 20 January 2009]

Kollmann, Johannes; Banuelos, Maria Jose., 2004. Latitudinal trends in growth and phenology of the invasive alien plant *Impatiens glandulifera* (Balsaminaceae). Diversity & Distributions. 10(5-6). September 2004. 377-385.
Summary: Abstract: Geographical differentiation of populations can be interpreted as a result of adaptive processes in response to environmental gradients and biotic interactions. Such adaptations are particularly interesting in invasive alien species which have been present in an area for a relatively short time. There are few observations of latitudinal trends in alien plants, and no account exists for *Impatiens glandulifera*, a problematic annual weed in most countries of central and north-western Europe. Here we describe variation in growth and phenology in 26 populations of this species from nine European regions in a common garden in Denmark. Above-ground biomass (an estimate of fecundity), height and basal diameter were lower in the northern populations which were first to produce flowers. Some differences were also observed in biomass allocation to leaves, flowers and fruits, albeit without a latitudinal pattern. The latitudinal trends in growth and survival disappeared in a field experiment, probably due to suboptimal site conditions. Most variation in plant traits was explained by differences among regions with some minor effects of populations within regions. Besides latitude, no other geographical, climatic or population trait correlated with the observed differences in growth and phenology. Differences in latitude may mainly represent variation in length of the growing season. The causes and potential consequences of such latitudinal trends for population dynamics and dispersal of alien plants are discussed.
Koval, L. V., 2006. New floristic records of alien species of vascular plants in the Desna Plateau area (Sumy Region, Ukraine). Ukrayins kyi Botanichnyi Zhurnal. 62(2). 2005. 243-247.
Summary: Abstract: Data are presented on new localities and distribution of alien species *Impatiens glandulifera* Royle, *Echinocystis lobata* (Michx.) Torr. & A. Gray, *Heracleum mantegazzianum* Sommier et Levier, *Ambrosia artemisiifolia* L. and naturalization of some ornamental species (*Rosa rugosa*, *Sorbaria sorbifolia*, etc.) in the Desna Plateau area of Sumy Region, Ukraine.
Lenzin, Heiner; Erismann, Claudia; Kissling, Marion; Gilgen, Anna K.; Nagel, Peter., 2004. Abundance and ecology of selected neophytes in the city of Basel (Switzerland). Tuexenia.(24). 2004. 359-371.
Summary: Abstract: The abundance and distribution of 23 exotic plant species were studied in the city of Basel, Switzerland. The selected species consisted of *Ailanthus altissima*, *Buddleja davidii*, *Bunias orientalis*, *Conyza canadensis*, *Corydalis lutea*, *Cymbalaria muralis*, *Erigeron annuus* Oat., *Geranium pyrenaicum*, *Geranium robertianum* subsp. *purpureum*, *Heracleum mantegazzianum*, *Impatiens glandulifera*, *I. parviflora*, *Mahonia aquifolium*, *Matricaria discoidea*, *Prunus laurocerasus*, *Reynoutria japonica*, *Rhus typhina*, *Robinia pseudoacacia*, *Solidago canadensis*, *S. gigantea*, *Syringa vulgaris*, *Veronica filiformis* and *V persica*. In 61 squares of a 500 x 500 m grid the five largest stands with spontaneous and subspontaneous occurrences were recorded. At each site, abundance, site type and substrate were scored. Common widespread species with high abundance were *Conyza canadensis*, *Erigeron annuus* s.lat., *Mahonia aquifolium* and *Solidago canadensis*, while *Bunias orientalis*, *Heracleum mantegazzianum*, *Reynoutria japonica* and *Rhus typhina* occurred at rather few sites and with low abundance. The specific site types and substrates are described and discussed for each species.
Lenzin, Heiner; Kohl, Jessica; Muehlethaler, Roland; Odiet, Muriel; Baumann, Nathalie; Nagel, Peter., 2001. Distribution, abundance, and location of selected botanical neophytes in the city of Basel, Switzerland. Bauhinia. 15 2001. 39-56.
Summary: Abstract: The abundance and distribution of twelve neophytes were studied in the city of Basel, Switzerland. The selected species are *Ailanthus altissima*, *Buddleja davidii*, *Conyza canadensis*, *Erigeron annuus* s.l., *Heracleum mantegazzianum*, *Impatiens glondulifera*, *Impatiens parviflora*, *Matricaria discoidea*, *Reynoutria japonica*, *Robinia pseudoacacia*, *Solidago canadensis*, and *Solidago gigantea*. All sites with spontaneous and subspontaneous occurrences were recorded and assigned to 124 grid squares of 500 m X 500 m. At each site, abundance and selected habitat factors were scored. Common species of wide distribution and high abundance were *Conyza canadensis* and *Solidago canadensis*, while *Heracleum mantegazzianum*, *Impatiens glandulifera* and *Reynoutria japonica* occurred at rather few sites and low abundance. The specific quality of the urban habitat of each species and its particular distribution type were analyzed for each species. The aim of this study was to provide basic information on the spatial and temporal biomonitoring of neophytes in Basel and will be continued.
Lopezaraiza-Mikel, Martha E.; Hayes, Richard B.; Whalley, Martin R.; Memmott, Jane. 2007. The impact of an alien plant on a native plant-pollinator network: an experimental approach. Ecology Letters. 10(7). JUL 2007. 539-550.
Summary: Abstract: Studies of pairwise interactions have shown that an alien plant can affect the pollination of a native plant, this effect being mediated by shared pollinators. Here we use a manipulative field experiment, to investigate the impact of the alien plant *Impatiens glandulifera* on an entire community of coflowering native plants. Visitation and pollen transport networks were constructed to compare replicated *I. glandulifera* invaded and *I. glandulifera* removal plots. Invaded plots had significantly higher visitor species richness, visitor abundance and flower visitation. However, the pollen transport networks were dominated by alien pollen grains in the invaded plots and consequently higher visitation may not translate in facilitation for pollination. The more generalized insects were more likely to visit the alien plant, and Hymenoptera and Hemiptera were more likely to visit the alien than Coleoptera. Our data indicate that generalized native pollinators can provide a pathway of integration for alien plants into native visitation systems.
MacQuarrie, Kate; Schaefer, Heidi., 2001. New plant records for Prince Edward Island. Canadian Field-Naturalist. 115(3). July-September, 2001. 446-450.
Summary: Abstract: The first records of *Apios americana* (Groundnut), *Polystichum braunii* (Braun s Holly Fern), *Hieracium piloselloides* (King Devil) and *Impatiens glandulifera* (Glandular Touch-me-not) from Prince Edward Island are reported. Large numbers of *A. americana* were found in two populations on the Lennox Island Mi Kmaq reserve, Malpeque Bay, Prince County while *P. braunii* was restricted to a few individuals along the bank of the Mill River, Bloomfield, Prince County. *H. piloselloides* was first identified in retired farmland at Greenwich, Kings County, and *I. glandulifera* was found along the Barbara Weit River at New Annan, Prince County.
Mannon, Theodore., 1991. Indian impatiens (*Impatiens glandulifera*): Is it now naturalized here? Bulletin de la Societe des Naturalistes Luxembourgeois. 0(92). 1991. 17-22.
Summary: Abstract: The distribution of *Impatiens glandulifera* is examined in the Grand Duchy of Luxembourg based on the results of personal investigation and public survey. Its origins as well as the ecological factors of distribution are researched. The status of *I. glandulifera* as a naturalized species is discussed.
Maskell, L. C.; Firbank, L. G.; Thompson, K.; Bullock, J. M.; Smart, S. M..2006. Interactions between non-native plant species and the floristic composition of common habitats. Journal of Ecology. 94(6). NOV 2006. 1052-1060.

Milberg, Per., 1998. Aggressive invasive species. Svensk Botanisk Tidskrift. 92(6). 1998. 313-321.
Summary: Abstract: The characteristics of aggressive invaders , and the possibilities to prevent them from being introduced, are discussed. Five species of vascular plants are currently considered to be aggressive invaders in Sweden: *Fallopia japonica*, *Rosa rugosa*, *Impatiens glandulifera*, *Heracleum mantegazzianum* and *Elodea canadensis*.
Ministry of Agriculture and Lands, British Columbia: Himalayan Balsam (*Impatiens glandulifera*)
New Zealand Plant Conservation Network, 2005. *Impatiens glandulifera* Royle
Summary: Available from: http://www.nzpcn.org.nz/exotic_plant_life_and_weeds/detail.asp?WeedID=1721 [Accessed 20 January 2009]
Nilsson, Thomas; Berg, Lars M., 1999. Introduced organisms in the terrestrial environment in Sweden. Fauna och Flora (Stockholm). 94(2). July, 1999. 63-74.
Non Native Species Secretariat (NNSS)., 2005. Factsheets: Himalayan Balsam (*Impatiens glandulifera*) GB NNSS
Summary: Available from: http://www.nonnativespecies.org/01_Fact_File/05_Fact_Sheets/Himalayan_Balsam.cfm?tvk=NBNSYS0000003189 [Accessed 20 January 2009]
Nummi, Petri., 2000. Alien Species In Finland. Case studies by Arto Kurtto, Jyrki Tomminen, Erkki Lepp&#xfffd;koski and Petri Nummi Ministry of the Environment 2000
Summary: Available from: http://www.ymparisto.fi/download.asp?contentid=34577 [Accessed 20 January 2009]
Pandza, Marija; Franjic, Josip; Trinajstic, Ivo; Skvorc, Zeljko; Stancic, Zvjezdana., 2001. The most recent state of affairs in the distribution of some neophytes in Croatia. Natura Croatica. 10(4). December 31, 2001. 259-275.
Summary: Abstract: During research into neophyte distribution in Croatia, a total of 332 new localities for 21 neophyte species has been discovered. The most numerous are new localities of *Bidens subalternans* (52), followed by *Impatiens glandulifera* (49), *Aster squamatus* (43), *Impatiens balfourii* (29), *Datura inoxia* (25), *Euphorbia prostrata* (11), *Galinsoga parviflora* (17), *Amaranthus albus* (14), *Galinsoga quadriradiata* (15), *Diplotaxis erucoides* (11), *Xanthium strumarium* ssp. *italicum* (9), *Phytolacca americana* (12), *Artemisia verlotiorum* (7), *Chamomilla suaveolens* (7), *Xanthium spinosum* (7), *Eleusine indica* (6), *Euphorbia maculata* (7), *Ambrosia artemisiifolia* (5), *Paspalum paspalodes* (3), *Euphorbia nutans* (2) and *Paspalum dilatatum* (1). The majority of the species investigated occur in all localities in a great number, only a few of them occurring individually.
Peltre, M. C.; Muller, S.; Ollivier, M.; Dutartre, A.; Barbe, J.; Haury, J.; Tremolieres, M., 2002. Aquatic plant proliferations in France: Biological and ecological features of the main species and favourable environments. I. Synthesis of a bibliographic survey. Bulletin Francais de la Peche et de la Pisciculture.(365-366). 2002. 237-258.
Summary: Abstract: Management of water-bodies affected by prolific growths of plants pose several problems related to assessment of created imbalances. The intensity of these phenomena should be considered on both spatial and temporal scales, as well as the impact of negative effects on practical uses of the water-bodies by man. An examination of invading growths recorded on the French hydrographic system has been carried out. As a result, an inventory of the most relevant plants was produced, called risk species , belonging to different macrophyte groups like macro-algae, native hydrophyte phanerogams as *Ranunculus* sp., *Potamogeton* sp., *Myriophyllum* sp., *Ceratophyllum* sp., *Lemna* sp., and introduced phanerogams like *Elodea* sp., *Lagarosiphon* sp., *Ludwigia* sp., *Myriophyllum aquaticum*. Some helophyte plants, Cyanobacteria and two riparian introduced species (*Fallopia japonica* and *Impatiens glandulifera*), have also been considered. Biological strategies determine their proliferation potential by developing high growth and substantial propagation abilities, through some special morphological and physiological features and means of reproduction. Environment types and factors favour this capacity. These favourable environments are connected with environmental conditions such as high irradiation, mostly linked to shallow depth and water warming, stable or low hydrological conditions, high mineralization and trophic level. The occurrence of dense vegetation is usually the combination of these two aspects, with the influence of mostly several favourable factors. Some situations of minimal and maximal risks can be defined. This knowledge should improve understanding of these events and provide more information for management and control practices.
Petzold, Antje; Nuss, M.; Reike, H.-P., 2004. Investigations on the population size of *Euplagia quadripunctaria* (PoDA, 1761) in the Muglitz valley in the eastern Erzgebirge (Lep., Arctiidae). Entomologische Nachrichten und Berichte. 48(2). 2004. 73-79.
Py&#xfffd;ek, P., Prach, K. 1993. Plant Invasions and the Role of Riparian Habitats: A Comparison of Four Species Allien to Central Europe. Journal of Biogeography 20:413 &#xfffd; 420
Slavik, Bohumil., 1996. The genus *Impatiens* in the Czech Republic. Preslia (Prague). 67(3-4). 1995 (1996). 193-211.
Summary: Abstract: A survey of the distribution of Impatiens species in the Czech Republic is given, including maps showing the present state of knowledge. The history of naturalization of introduced species *I. parviflora* DC. and *I. glandulifera* Royle is described and documented by distribution maps. *I. scabrida* DC. from the Himalayas is reported as a new adventive species for the Czech Republic. Cultivated species, escaping only occasionally, are briefly mentioned. A key to *Impatiens* species occurring at the territory of the Czech Republic is provided. For *I. parviflora* DC. complete list of localities from the first report in 1870 up to 1940 is given.
Stary, P.; Laska, P., 1999. Adaptation of native syrphid flies to new exotic plant (*Impatiens* spp.) - aphid - ant associations in Central Europe (Dipt., Syrphidae; Hom., Aphididae; Hym., Formicidae). Anzeiger fuer Schaedlingskunde. 72(3). June, 1999. 72-75.
Summary: Abstract: *Impatiens parviflora* and *I. glandulifera*, two invasive touch-me-not species of exotic origin were found to be associated with two aphid groups in Central Europe: a) Exotic species subsequently following their invasive plant hosts (*Impatientinum asiaticum* NEVSKY), b) native species secondarily adapted to the new exotic hosts (*Aphis fabae cirsiiacanthoidis* SCOP.). The species number (listed) of associated syrphid flies in the newly developed guilds was rather high, consisting of broadly oligophagous species. The plant phenology and adaptation of the aphids have resulted in associations which apparently represent seasonally significant sources of prey, their importance apparently increasing with the decreasing season. Ant-attendance was determined in both aphid species, and no adverse interference with the preying syrphid larvae was observed. In spite of an overall classification of the target plants as expansive weeds, they are classified positively as contributing to the enhancement of syrphid fly populations in the biocorridors in the cultivated landscape.

Stary, P.; Tkalcu, B., 1998. Bumble-bees (Hym., Bombidae) associated with the expansive touch-me-not, *Impatiens glandulifera* in wetland biocorridors. Anzeiger fuer Schaedlingskunde Pflanzenschutz Umweltschutz. 71(5). July, 1998. 85-87.
Summary: Abstract: Nine bumble-bee (*Bombus*)-species (listed) were determined to visit flowers Of an exotic invasive species, *Impatiens glandulifera* Royle in the wetland biocorridors in the Czech Republic. None of the species was found specific to the target plant and the dominant part of the guild represented common eurytopic species. *I. glandulifera* was classified as an important source of nectar and pollen, and the significance of this source increased with the decreasing season as the bloom period lasted much longer than that of most of the native plant species. Despite its invasive effects on the native plant communities in wetlands, *I. glandulifera* contributed to the conservation of common bumblebee species, as well as to an over-all positive role of wetlands in the cultivated landscape.
Tabak, Nava M. and Eric von Wettberg., 2008. Native and Introduced Jewelweeds of the Northeast. 2008 Northeastern Naturalist 15(2):159–176
Summary: Abstract: There are at least eight species of *Impatiens* (Jewelweeds) in the northeast, including native and non-native species, species of temperate and subtropical origins, and wild and planted species. The two native jewelweeds, *I. capensis* and *I. pallida*, are common in the region, and *I. capensis* has been introduced in Europe. *Impatiens glandulifera* is a non-native species that is locally well established and has the potential to become invasive in the region. The introduced *I. balfourii* and *I. parviflora* infrequently naturalize in the Northeast. Three *Impatiens* species of tropical origins, *I. balsamina*, *I. walleriana*, and *I. hawkeri*, may be able to establish in the Northeast with continued horticultural pressure. We review the descriptions and known distributions of these species, the direct experimental comparisons of their biological traits, and the histories of their introductions and horticultural uses. Such information is beneficial for assessing the invasive potential of these species in the northeast and abroad, and may help to set priorities for control efforts and regulation of horticultural uses.
Tamis, W.L.M., M. van't Zelfde, R. van der Meijden & H.A. Udo de Haes, 2005. Changes in vascular plant biodiversity in the Netherlands explained by their climatic and other environmental characteristics. Climatic Change 72 (1-2): 37-56.
Summary: Abstract: *Impatiens glandulifera* (Himalayan balsam) is an invasive riparian plant species that can outcompete native perennials. Population genetic data on dispersal may aid in the management of invasive species, so we have developed microsatellite markers for this significant invader using an intersimple sequence repeat (ISSR)-based cloning method. Eight polymorphic markers displayed between two and five alleles, with overall levels of observed and expected heterozygosities ranging from 0.0500 to 0.7500 and from 0.1449 to 0.7692, respectively.
Titze, A., 2000. The efficiency of insect pollination of the neophyte *Impatiens glandulifera* (Balsaminaceae). Nordic Journal of Botany. 20(1). 2000. 33-42.
Summary: Abstract: To comprehend the reproductional success of Impatiens glandulifera in Central Europe, the pollination system was analyzed under field conditions. *Impatiens glandulifera* attracts a lot of visitors because of its abundant amount of nectar with its high sugar content. The range of visitors, their composition and their changes during the blooming time and their pollen loading capacity were investigated as well as plant and flower morphology, the nectar production, the quantity and viability of pollen, the stigmatic pollen load, the pollen/ovule ratio and the seed production of the neophyte. The visitors, which in Central Europe almost exclusively utilize the nectar, are passively covered with pollen because of the morphology and the mobile suspension of the flowers. Consequently the next landing results in a pollination of *I. glandulifera* during the female blooming phase. Although the germination rate of the pollen deposited on the stigma is very low, a 100% seed set is readily obtained during the initial visit to a flower in female stage.
Toney, J. Christopher; Rice, Peter M.; Forecella, Frank., 1998.. Exotic plant records in the northwest United States 1950-1996: An ecological assessment. Northwest Science. 72(3). Aug., 1998. 198-213.
USDA, ARS, 2004. Taxon: *Impatiens glandulifera* Royle. National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland.
Summary: Available from: http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?19826 [Accessed 20 January 2009]
USDA, NRCS. 2009. *Impatiens glandulifera* Royle ornamental jewelweed. The PLANTS Database. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.
Summary: Available from: http://plants.usda.gov/java/profile?symbol=IMGL [Accessed 20 January 2009]
Vladimirov, Vladimir., 2001. New chorological data on four alien species in the Bulgarian flora. Phytologia Balcanica. 7(1). 2001. 33-37.
Summary: Abstract: The article reports new chorological data on 4 vascular plant species representing the adventive flora in Bulgaria: *Impatiens glandulifera* ROYLE, *Nicandra physalodes* (L.) GAERTNER, *Oxalis fontana* BUNGE, *Phytolacca americana* L. UTM-maps of the distribution of these taxa in Bulgaria are given summarizing the available information from the Bulgarian herbaria and literature.
Wilhalm, Thomas; Zemmer, Franziska; Beck, Reinhold; Stockner, Walter; Tratter, Wilhelm., 2004. Vascular plants new to the flora of South Tyrol (3). Results of floristic mapping, mainly from the period 2002-2004. Gredleriana. 4 2004. 381-412.
Willis, S. G.; Hulme, P. E., 2004. Environmental severity and variation in the reproductive traits of *Impatiens glandulifera*. Functional Ecology. 18(6). December 2004. 887-898.
Summary: Abstract: 1. Seed mass is widely regarded as a key plant trait, yet is notoriously variable within an individual species. This study reports the first field experiments to disentangle the relative importance of four major correlates of seed mass variation: resource limitation; plant height; seed number; and seasonality. 2. Variation in reproductive traits in *Impatiens glandulifera* Royle was partitioned among six populations established across an elevation gradient, among plants at each elevation and within individual plants. 3. Seed mass was the least variable trait both at the individual and population levels, while the number of pods per plant varied most. Seed mass variation was greatest among individual plants (42%) and was least among populations (28%). 4. Taller plants produced proportionally more seed pods and more seeds per pod. Seed mass was not related to the number of pods per plant, or the number of seeds per pod. Thus with increasing resources, *I. glandulifera* allocated resources to produce more seeds rather than larger seeds. 5. Seed mass was negatively correlated with the heat sum over the period of seed maturation, explaining increased seed mass at higher elevations and increasing seed mass over time at most elevations. This may indicate that environmental condition pre- and post-fertilization determines the relationship between seed mass and elevation, thereby limiting the potential for evolutionary selection for seed-size optima. 6. The study warns against correlative studies of seed mass variation that select arbitrary populations or ignore the temporal dynamics in seed mass, as these may generate spurious correlations among life-history traits. 7. The success of *I. glandulifera* as an invasive species may reflect the extended period of seed release, considerable seed mass variation and large seed size under conditions of environmental severity. These traits will facilitate the exploitation of spatially and temporally heterogeneous natural environments commonly found in riparian ecosystems.

Zarubin, A. M.; Ivanova, M. M.; Lyakhova, I. G.; Baritskaya, V. A.; Ivel skaya, V. I. 1993. Floristic finds in the Lake Baikal region. Botanicheskii Zhurnal (St. Petersburg). 78(8). 1993. 93-101.
Summary: Abstract: Nine new records for Central Siberia, Russia, were reported: *Atriplex nitens*, *Impatiens glandulifera*, *Coronilla varia*, *Lotus corniculatus*, *Galium mollugo*, *Campanula sibirica*, *Galinsoga ciliata*, *Onopordum acanthium*, and *Senecio viscosus*. New localities are also reported for 27 species that are little-known in certain areas of the Lake Baikal region.