

**Annotated Bibliography on the
Ecology and Management of Invasive Species:**

English ivy (*Hedera helix*)

**Prepared by Judith Cullington & Associates, Victoria, BC
for the Garry Oak Ecosystems Recovery Team
and the Nature Conservancy of Canada**

Funding supplied by the Habitat Stewardship Program of the Government of Canada

March 2002

Badre-Bouchra; Nobelis-Photis; Tremolieres-Michele {a}, 1998.

Title: Quantitative study and modelling of the litter decomposition in a European alluvial forest: Is there an influence of overstorey tree species on the decomposition of ivy litter (*Hedera helix* L.)?

Source: *Acta-Oecologica*. Nov.-Dec., 1998; 19 (6) 491-500.

Language: English

Abstract: The influence on the decomposition rate of ivy litter (*Hedera helix* L.) of three ligneous overstorey species (oak, *Quercus robur* L., white poplar, *Populus alba* and ash, *Fraxinus excelsior* L.) that support ivy was studied in an alluvial hardwood forest. The ivy provides an abundant litter at the end of spring. The decomposition of ivy litter and the nutrient release rate were analyzed over four months during the growing season of the canopy trees, the hypothesis being that throughfall could slow down the mass loss rate of ivy depending on the support species. Mathematical models for mass loss and nutrient (P, N, K and Mg) release rates were developed. Mass loss rate and the release rate of magnesium, nitrogen and phosphorus show significant differences depending on species whereas no influence of species was observed on the release rate of potassium. The results illustrate the significant effect of oak compared to ash and poplar in slowing down mass loss rate and nitrogen, phosphorus and magnesium release rates. The mass loss rate over time under the three species followed the proposed exponential model, whereas the release rates of phosphorus and magnesium did not follow this model. This model is fitted to the data in two cases out of three for potassium. Magnesium and potassium are released more rapidly when nitrogen accumulates and the phosphorus content does not change significantly. No species X date interaction was observed, except in the case of magnesium. The species effect is interpreted as an effect of composition of throughfalls and presence or absence of inhibitory substances such as phenolic compounds.

Barnea-Anat {a}; Jeffrey B. Harborne, and C. Pannell, 1993.

Title: What parts of fleshy fruits contain secondary compounds toxic to birds and why?

Source: Biochemical-Systematics-and-Ecology. 1993; 21 (4) 421-429.

Language: English

Abstract: Saponins, flavonoids and cyanogenic glycosides were surveyed in pulps and seeds of wild, bird-dispersed fleshy fruits of hawthorn (*Crataegus monogyna*), ivy (*Hedera helix*), holly (*Ilex aquifolium*), a yew (*Taxus baccata*). Interactions between three of the four species (hawthorn, holly, and yew) and their avian seed dispersers were studied in the field. The results indicate that when different bird species foraged on the same fruit they spend similar periods of time on the tree and eat a similar number of fruits at each feeding bout. Frugivorous birds stayed on all plant species for short periods of time (1.3-5.3 min) and consumed only a few fruits in each feeding bout (4.3-6.5 min). There is a differential occurrence of secondary compounds in fruit part: in most cases allelochemicals were found in pulps but not seeds. These findings confirm the hypothesis that mild toxicity in the pulp can prevent consumption of too many fruits in one foraging bout and regulate seed retention time. This, combined with the short visits ensures better seed dispersal, as only few seeds will be deposited in one site at one time. Yew presents a special case, since cyanogenic glycosides were identified only in seed-coats, while both the fleshy aril and seed content are free of this toxin. A possible ecological explanation is suggested for this finding. The concentrations of some compounds may change during fruit ripening.

Brawley-J {A}; Mathes-M-C, 1990.

Title: The Influence Of Sodium Chloride On The Growth Of English Ivy *Hedera-Helix* Cuttings And Callus Tissue.

Source: Environmental-and-Experimental-Botany. 1990; 30 (1): 43-50.

Publication Year: 1990

Language: ENGLISH

Abstract: Experiments were designed to investigate the relative NaCl tolerance of five varieties of English ivy (*Hedera helix*); buttercup, sweetheart, golddust, glacier and goldheart. Cuttings from these plants were first grown in agar media with selected levels of added NaCl. Buttercup was the most resistant and sweetheart the most sensitive to all levels of NaCl. These differences in NaCl tolerance were further explored using a callus culture system. Actively growing sweetheart and buttercup callus tissue were placed on basal tissue culture media containing 2,4-D and selected levels of NaCl, Na₂SO₄ and KCl. Results from these experiments suggest that Cl has specific ion effects and is more toxic than Na⁺. The growth of sweetheart tissue that had been previously .gamma.-irradiated was compared with control tissue on a basal medium containing 5 g/l NaCl. .gamma.-Irradiation of sweetheart tissue prior to culture increased growth in the presence of 5 g/l NaCl over non-irradiated tissues.

Collier, Richard, 2001.

A Problem of English Ivy in Capital Regional District Parks. Unpublished paper prepared for CRD Parks.

Derr, Jeffrey F., 1993.

Title: English ivy (*Hedera helix*) response to postemergence herbicides.

Source: *Journal-of-Environmental-Horticulture*. 1993; 11 (2) 45-48.

Language: English

Abstract: One application of Roundup at 2.2 or 4.5 kg ai/ha (2.0 or 4.0 lb/A) with or without surfactant, Weedar 64 (2,4-D amine) at 1.1 kg ae/ha (1.0 lb/A), Banvel at 0.6 kg ae/ha (0.5 lb/A), or Garlon 3A at 0.6 kg ae/ha (0.5 lb/A) reduced new shoot growth of English ivy 10 weeks after treatment by 46 to 80%. Roundup at 4.5 kg/ha plus non-ionic surfactant was the only single application treatment that reduced older shoot growth of English ivy (41% reduction) 19 weeks after treatment. English ivy outgrew injury from all other single application treatments. Two applications of Weedar 64 completely controlled English ivy. Two applications of Roundup at 4.5 kg/ha (4.0 lb/A), with or without surfactant, eliminated new shoot growth 11 weeks after treatment, and reduced total shoot weight by approximately 60% 15 weeks after treatment. English ivy shoot weight decreased when the rate of Roundup was increased from 2.2. to 4.5 kg/ha (74 versus 92% reduction) 7 weeks after treatment, but adding a non-ionic surfactant did not further reduce shoot weight. Two applications of Banvel or Garlon (52 and 67% reduction, respectively, 7 weeks after treatment) were less effective than two applications of Roundup at 4.5 kg/ba (4.0 lb/A) in reducing English ivy shoot growth.

Geneve-R-L {A}, 1991

Title: Patterns Of Adventitious Root Formation In English Ivy.

Source: *Journal-of-Plant-Growth-Regulation*. 1991; 10 (4): 215-220.

Publication Year: 1991

Language: ENGLISH

Abstract: Adventitious root formation by debladed petiole cuttings of English ivy (*Hedera helix* L.) proceeds via a direct rooting pattern for the easy-to-root juvenile phase, while the difficult-to-root mature phase roots through an indirect rooting pattern. Juvenile petiole cuttings treated with .alpha.-naphthaleneacetic acid (NAA, 100 .mu.M) plus the polyamine biosynthesis inhibitor, difluoromethylarginine (DFMA, 1 mM), formed an increased number of roots per cutting initiated by the indirect rooting pattern. The increased root formation and change in rooting pattern were reversed by the addition of putrescine (1 mM). Delaying auxin application to petiole cuttings for 15 days also induced juvenile petioles to root by the indirect pattern. This could be reversed by rewounding the base of the cutting prior to auxin application after day 15. The data support the use of the terms "competent root-forming cells" and "induced competent root-forming cells" to describe the target cells for the initial events of root

formation for the direct and indirect rooting patterns, respectively.

Geneve, R. L., M. Mokhtari, and W.P. Hackett, 1991

Title: Adventitious root initiation in reciprocally grafted leaf cuttings from the juvenile and mature phase of *Hedera helix* L.

Language: English

Subjects: English ivy, Roots/Development, Aerial roots

Feature Article.

Source: *Journal of Experimental Botany*.

ISSN: 0022-0957.

Volume/Issue: 42.

Pages: 65-9.

Date: Ja '91.

Record Type: article.

Physical Description: bibl il.

Gonzalez, Hernandez M.P., Pando F. Javier Silva, 1996.

Title: Grazing effects of ungulates in a Galician oak forest (northwest Spain).

Source: *Forest-Ecology-and-Management*. 1996; 88 (1-2) 65-70.

Language: English

Abstract: The effect of roe and red deer on an oak forest in Galicia studying the vegetation (floristic composition, nutritive value and biomass) in an established enclosure and outside is described. A decrease in number and biomass of the species was generally observed outside after 3 years due to the pressure of grazing, although species like *Erica arborea* nearly doubled its biomass outside in three years, confirming the sometimes favouring effect of grazing. However, other desirable plants for these ungulates, like *Rubus* sp., *Agrostis capillaris*, *Vaccinium myrtillus* and *Hedera helix* decreased in biomass. The seasonal pattern in productivity and floristic composition is shown, as well as the decrease in nutritive value (protein and in vitro digestibility) by an ageing of vegetation due to the effect of grazing. A decrease in the number of species has also been observed after 3 years with posterior stability in floristic composition.

Harmer-Ralph {a}; Peterken-George; Kerr-Gary; Poulton-Paul, 2001.

Title: Vegetation changes during 100 years of development of two secondary woodlands on abandoned arable land.

Source: *Biological-Conservation*. [print] October, 2001; 101 (3): 291-304.

Publication Year: 2001

Language: English

Abstract: Broadbalk and Geescroft Wildernesses were abandoned as arable fields in the 1880s and allowed to develop with little further direct human intervention. Both have now developed into mature mixed deciduous woodland, variants of National Vegetation Classification type W8, *Fraxinus excelsior* - *Acer campestre* - *Mercurialis*

perennis woodland. In addition, a portion of Broadbalk Wilderness has been maintained as grassland by removing woody colonists and, latterly, by grazing. The succession from arable to woodland has been recorded at irregular intervals for more than 100 years. Despite its limitations, this is the longest record of the floristic development of secondary woodland on farmland in the UK. Woody species colonised Broadbalk within 10 years, but at Geescroft they were not recorded until 30 years after abandonment. At present, both sites have good overstorey canopies with well developed understories which provide densely shaded conditions. There are currently 17 species of shrubs and trees at each site. The transition from a flora of mainly light-demanding species to shade tolerant species took place within 20-40 years of abandonment. The development of the shade flora within the woods has been characterised by: (1) a high turnover of species; (2) a failure to colonise by some shade-bearing species in the vicinity; and (3) inability of some colonists to spread beyond the wood margins. This appeared to be associated with: (1) dense shade from the closed woodland canopy; (2) competition from established ground flora dominants, particularly *Hedera helix*; (3) lack of suitable moist soils and open space habitats within the woods; and (4) pronounced acidification of soils in one wood. Some implications for new farm woodland creation are discussed.

Larocque, K.L, 1999.

Blurred Boundaries and the Spread of English Ivy (*Hedera helix L.*): Case studies from Greater Victoria, British Columbia." M.Sunshine Coast. Thesis, University of Victoria, BC.

Lemieux-Nicole {a}; Maynard-Brian-K {a}; Johnson-William-A {a}, 2000.

Title: A regional survey of deer damage throughout Northeast nurseries and orchards.

Source: Journal-of-Environmental-Horticulture. [print] March, 2000; 18 (1): 1-4.

Publication Year: 2000

Language: English

Abstract: In order to quantify the regional perspective on deer damage, a survey was sent to growers throughout nine Northeast states (ME, NH, VT, MA, CT, RI, NY, NJ, and PA). The objective of the survey was to assess the extent of damage, economic impact, plants damaged, control methods used, and efficacy of control methods. After excluding those surveys that were returned as undeliverable mail (n = 103), a total of 341 (30%) responded. Of the respondents, 65% reported that deer damage was a problem at their nursery. Forty-seven (14%) respondents reported dollar sign 10,000 or more in plant losses during 1996. The majority of the damage was due to browsing by deer (59%), while rubbing (33%) and trampling (8%) were less common. Plants damaged included yews (*Taxus spp.*), arborvitae (*Thuja spp.*), and fir (*Abies spp.*), various shade trees, hosta (*Hosta spp.*) and English ivy (*Hedera helix*). Most respondents (66%) with a deer damage problem utilized one or more methods of control. Repellents (66%) and fencing (56%) were the most common methods used to

minimize damage. Forty percent of respondents using fencing reported fencing to be 'very' or 'somewhat' effective.

Masuda-T {A}; Sato-T, 1990

Title: Effect Of Soil Volume And Watering Conditions On The Growth Of Hedera-Helix.

Source: Kagawa-Daigaku-Nogakubu-Gakujutsu-Hokoku. 1990; 42 (2): 185-191.

Publication Year: 1990

Language: JAPANESE

Abstract: An experiment was carried out to clarify the influence of soil water conditions on the growth of Hedera helix. Eight experimental plots were set up in combination with three factors, soil volume (9 liter of 3 liter), watering conditions (every day or every five days: the amount of water at each watering was 5 mm calculated in terms of rainfall) and perlite (included or not included). The results analyzed using the 'quantification scale type I' were as follows: Soil Volume and watering conditions had a great influence on top dry weight of the plants (partial correlation coefficient (r) of the former was 0.75 and that of the latter was 0.80), but perlite had almost no influence (r=0.02). Soil Volume (r=0.60) and watering conditions (r=0.76) had a great influence on root dry weight as same as on top dry weight, and still more, perlite had a fairly good influence on root dry weight (r=0.53).

Mende, Astrid, J. Mosch and W. Zeller-, 1994.

Title: On the induced resistance of plant extracts to fire blight (*Erwinia amylovora*).

Source: Zeitschrift-fuer-Pflanzenkrankheiten-und-Pflanzenschutz. 1994; 101 (2) 141-147.

Language: German; Non-English

Abstract: Induced resistance is the attainment of disease resistance in plants by non-genetic methods. To obtain induced resistance to fireblight (*Erwinia amylovora*), four plant extracts from *Alchemilla vulgaris*, *Hedera helix*, *Reynoutria sachalinensis* and *Viscum album* were applied on separated leaves of two susceptible hostplants (*Cydonia oblonga*, *Cotoneaster watereri*) under controlled conditions in climatic chambers. Between application of the extracts and inoculation with the pathogen, a time period of 48 h was necessary for protection to occur. During a time period of 7 days, all four plant extracts showed an effect of induced resistance, resulting in a marked reduction in the bacterial development and inhibition of disease symptoms.

Morisawa, T, 1999.

Weed Notes: *hedera helix* L. The Nature Conservancy.

Nielsen-Bjarne {a}, 2001

Title: Identification of dynamic growth of *Hedera helix* as response to variation in daily light levels.

Source: Journal-of-Horticultural-Science-and-Biotechnology. [print] July, 2001; 76 (4): 402-407.

Publication Year: 2001

Language: English

Abstract: The dynamic responses in shoot growth of three pot plants of *Hedera helix* L. 'Mein Herz' in relation to changes in photosynthetic photon flux density (PPFD) is identified. In the experiment a two-level strategy of PPFD to the plants was used. The current level of PPFD on any day was either high or low, and was determined using a pseudo random binary signal (PRBS) both to avoid any correlations between the PPFD and other variables, and to ensure that the dynamic characteristics of the plant growth were present in the data. For each of the three pot plants a discrete dynamic model of growth responses to PPFD was estimated, and an agreement between the parameters of the three models was observed. The results show that not only is the current PPFD level of the current day related to the daily increase in fresh weight, but growth is also a function of the PPFD level of the previous days. With respect to the previous days the effects of PPFD can be described as an exponential decay where from one day to the previous day the effect of PPFD is reduced to 67%, 66% and 80% respectively for the three pot plants in the experiment.

Pettersson, Maj-Lis, 1995.

Title: Horticultural pests and diseases in Sweden 1994.

Source: Vaxtskyddsnotiser-. 1995; 59 (3) 86-91.

Language: Swedish; Non-English

Abstract: This is a survey of the more noticeable pests and diseases that occurred in Sweden 1994. Rainy weather in the spring from the middle of May to the end of June was favorable for downy mildew, *Peronospora destructor* and white rot, *Sclerotium cepivorum* on onion, leaf spot and shot hole, *Stigmata carpophila* and blossom wilt, *Monilia laxa* on *Prunus* spp. The summer became extremely warm and dry with heavy attacks of red spider mite, thrips, aphids and mildew on glasshouse crops. The western flower thrips *Frankliniella occidentalis* caused serious damage to *Saintpaulia ionantha* and many other species of potted plants. Even this year, as in 1993, the most conspicuous insect attacks were caused by the birdcherry ermine moth, *Yponomeuta evonymella*. We experienced very severe outbreaks of downy mildew, *Pseudoperonospora cubensis*, on field-grown cucumber, dutch elm disease, *Ceratocystis ulmi*, white rust on chrysanthemum, *Puccinia horiana*, and pear rust, *Gymnosporangium fuscum*. New pests and diseases discovered in Sweden 1994 include tomato gall mite, *Aculops lycopersici*, raspberry root rot, *Phytophthora fragariae* var. *rubi* and powdery mildew, *Oidium* sp. on *Hedera helix* as a pot plant, and a bacterial disease on carrot.

Saenz, G.S.; S.T. Koike, 1998.

Title: First report of powdery mildew caused by *Oidium araliacearum* on ivy on California.

Source: Plant-Disease. Jan., 1998; 82 (1) 127.
Language: English

Thinggaard, K., B. Koppe, 1997.

Title: First report of *Phytophthora cinnamomi* root rot, stem, and leaf blight on ivy.
Source: Plant-Disease. 1997; 81 (8) 960.
Language: English

Thomas-L-K-Jr {a}, 1998.

Title: Topographic alterations, forest structure, and invasion by English ivy (*Hedera helix* L.) in the Rock Creek floodplain, Washington, D.C.
Source: Natural-Areas-Journal. April, 1998; 18 (2) 164-168.
Publication Year: 1998
Language: English

Abstract: Topographic alteration may encourage invasion of the exotic species English ivy (*Hedera helix* L.) in floodplain forest. To test that hypothesis, I designated 16 sampling stations on the floodplain of Rock Creek Park in Washington, D.C. Eight of the stations were on the spoil ridge that resulted from construction of a sewer line in 1927 (median height = 22 cm). In 1983 the ground layer of half of each station on the spoil ridge and on the "flat" near the ridge were dominated by English ivy; other stations were ivy-free. By 1989 English ivy had invaded four of the ivy-free stations. This increase in ivy abundance was not statistically significant on the "flat" but was significant (χ^2 , $p < 0.1$) on the ridge. There was no significant difference (χ^2 , $P > 0.1$) between ivy rooting depth on the sewer ridge and on the flat, indicating that good soil conditions were present in both places. Basal area of the trees dominating the sites differed: the "flat" had 69 m²ha⁻¹ while the spoil ridge had 59 m² ha⁻¹. The results support the hypothesis that a slight alteration of topography influences patterns of invasion by English ivy.

Van-Ruremonde-R-H-A-C {A}; Kalkhoven-J-T-R, 1991

Title: Effects Of Woodlot Isolation On The Dispersion Of Plants With Fleshy Fruits.
Source: Journal-of-Vegetation-Science. 1991; 2 (3): 377-384.
Publication Year: 1991
Language: ENGLISH

Abstract: By relating species presence, number and density to the perimeter and isolation of small (0.1-2.75 ha) homogenous woodlots (n = 43), indications were obtained that some fleshy-fruited species are negatively affected by woodlot isolation. The number of fruit-bearing herbaceous perennial species increased with woodlot area, probably because of the increasing heterogeneity of the herb layer. The density of individuals of the investigated species were negatively correlated to woodlot area. There were also some indications that the presence/absence of species was related to the length of the forest edge (e.g. *Hedera helix*). Because woodlot areas and shape index

were strongly correlated, the effects of increased forest area and forest edge were had to separate. The probability of occurrence of *Lonicera periclymenum* and the density of *Ilex aquifolium* decreased with an increasing degree of isolation of present forest islands. The chance of occurrence of *L. periclymenum* decreased also with the degree of isolation in the past, measured from topographical maps of about 60 yr. ago. The total area of broad-leaved forest within a radius of 500 m, as well as the distance to the nearest connecting landscape element, seem to be good indicators of woodlot isolation.

Useful Websites

www.nps.gov/government/plants/alien/fact/hehel.htm

PCA Alien Plant Working Group. (Swearingen and Diedrich)

www.noivyleague.com

Information on ivy and removal of area in Portland OR.

www.hort.agri.umn.edu/h5015/00papers/okerman.htm

Research paper by Anne Okerman, 2000.

Other sources:

CRD Parks, 1998. "Ivy removal at Elk/Beaver Lake Regional Park." prepared by Tracy Fleming.

- ◆ Brief description of purpose and methodology for two-year ivy removal project at Elk/Beaver Lake.

Hartshorne Tree Service Ltd. "Ivy, Ivy All Over." Brochure prepared by arborist Dorothy Hartshorne, Sidney BC.

- ◆ Brief description of characteristics of ivy, life history, impacts and management.

Saanich Parks and Recreation, 1997. English Ivy. Information Brochure.

- ◆ General information on life history and need to control.

Dawn Loewen, 1996. Invader Plants of Greater Victoria.

- ◆ Brochure put out by Victoria Horticultural Society on concerns re invasive plants.