



Background

- Lots of recent interest in human health impacts of invasion by exotic species



Gardener Has Painful Encounter With Wild Parsnip

July 27, 2016 5:24 PM By Bill Hudson
Filed Under: Annandale, Bill Hudson, Wild Parsnip

ANNANDALE, Minn. (WCCO) — We have all heard the warnings to stay away from poison ivy, and we know the dangers if we do not.

But there is a lesser-known plant in Minnesota that is potentially more **painful** and difficult to treat.

It is called wild parsnip, and it is growing along roadside ditches and open fields in many parts of the state.

'My legs were on fire:' Vermonter Warns of Poison Parsnip Burns

The invasive weed is now in flower, and its sap can cause pain if it comes in contact with your skin
by Jack Thurston

Iowa woman suffers painful effects of poisonous weed

Updated 9:39 AM CDT, Jun 29, 2016

What's going on here? This is a burn you don't want to feel

FRANK SCHATZ
Sunbury, July 31, 2016

JANESVILLE—A plant that causes misery to humans has extended its range in many wild places across southern Wisconsin, notably in roadside ditches. It's called wild parsnip.

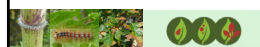
In Janesville, the plants were rare in parts of the greenbelt—near homes and as near our elementary school—before the city moved some of them down.

Wild parsnip, an invasive plant that can cause painful burns, is now full bloom along Highway 52 in Janesville.

Proliferating wild parsnips should be avoided

Background

- Lots of recent interest in human health impacts of invasion by exotic species
- Important and often overlooked impact of invasion



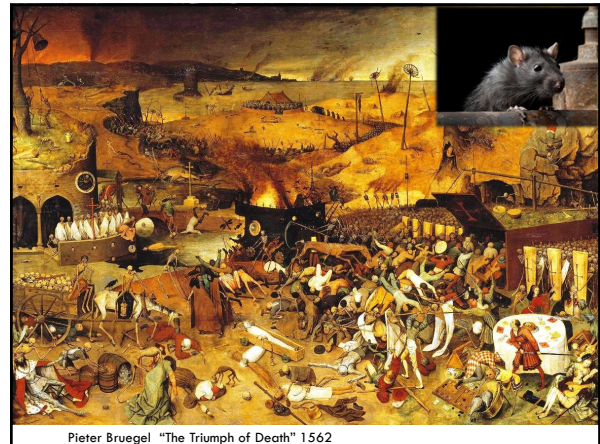
Definition of an Invasive Species

1. Non-native (or alien) to the ecosystem under consideration and
2. Whose introduction causes or is likely to cause economic or environmental harm **or harm to human health.**



Background

- Lots of recent interest in human health impacts of invasion by exotic species
- Important and often overlooked impact of invasion
- Long history of human health impacts from the spread of exotic species



Pieter Bruegel "The Triumph of Death" 1562

Outline

- General principles
- Carrots
 - Wild Parsnip
 - Poison Hemlock
 - Giant Hogweed
- Tree of Heaven
- Tick Borne Diseases and Invasive Plants



Invasive plants as catalysts for the spread of human parasites

Richard N. Mack, Melissa C. Smith

School of Biological Sciences, Washington State University, Pullman, WA 99164 USA

Corresponding author: Richard N. Mack (rmack@wsu.edu)

Academic editor: Ingrid Kuhn | Received: 20 February 2011 | Accepted: 27 June 2011 | Published: 11 August 2011

Citation: Mack RN, Smith MC (2011) Invasive plants as catalysts for the spread of human parasites. NeoBiota 9: 13–29. doi: 10.3897/neoBiota.9.1156

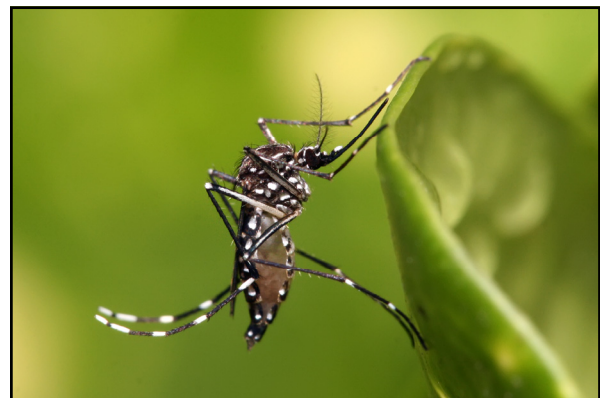
Abstract

To a degree not widely recognized, some naturalized and invasive plants increase the risks to human health by enhancing the proliferation of vectors of virulent human parasites. These potential risks are restricted by neither ecosystem nor geography. The dense, floating mats of the tropical South American invasive macrophyte *Eichhornia crassipes* (water hyacinth) creates habitat for larvae of the dipteran vectors of *Plasmodium* spp., the causative agents of malaria, and other parasites. In Africa, the South American shrub *Lantana camara* (lantana) provides suitable habitat in otherwise treeless areas for dipteran vectors (*Glossina* spp.) of protozoans (*Trypanosoma* spp.) that cause trypanosomiasis. In the eastern United States, proliferation of the invasive *Berberis thunbergii* provides questing sites for the blacklegged ticks that carry the spirochete *Borrelia burgdorferi*, the causative agent of Lyme disease. Unanticipated health consequences will likely continue to emerge from new plant introductions. Hantaviruses are rodent-borne parasites that cause lethal hemorrhagic fevers in humans. Populations of rodent Hantavirus vectors in South America increase rapidly in response to fruit availability among masting, native bamboos. In the United States the omnivorous deer mouse *Peromyscus maniculatus* also carries Hantavirus (Sin Nombre Virus). The on-going escape of Asian frost-tolerant bamboos from cultivation raises the possibility of their becoming invaders – several have already become naturalized – and in turn providing a temporary food source for populations of infected native rodents. Proposed introductions of floating aquatic vascular species, species

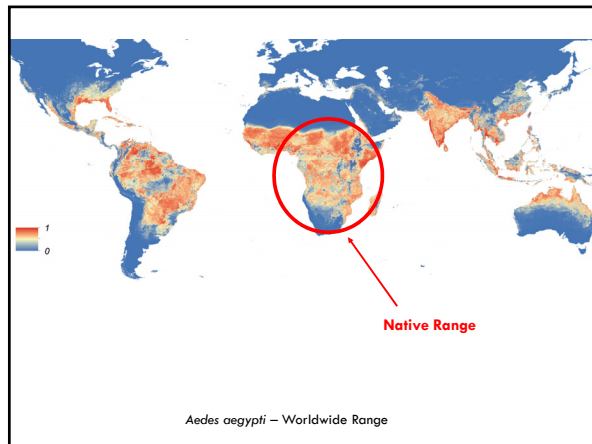
Three Methods of Impact

- As a pathogen, toxin, poison or otherwise directly harmful
- As a vector/host for a native or exotic pathogen
- By provoking changes in ecosystems that favor outbreak of native or exotic pathogens or increased risk of exposure to hazards

(adapted from Neil and Arim 2011)



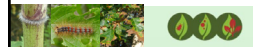
Zika virus vector - *Aedes aegypti*



Feral pigs – Disease vectors

- ☐ Leptospirosis
- ☐ Brucellosis
- ☐ E. coli
- ☐ Salmonellosis
- ☐ Toxoplasmosis
- ☐ Rabies
- ☐ Swine Influenza viruses
- ☐ Trichinosis
- ☐ Giardiasis
- ☐ Cryptosporidiosis

(Mississippi State University Extension)



By ALFONSO SERRANO AP October 26, 2006, 7:44 PM

Blame Wild Pigs For Tainted Spinach?



Spinach fields at the Natural Selection Foods LLC plant are shown Monday, Sept. 18, 2006, in Salinas, Calif. Spinach grown in the California Salinas Valley and packaged and distributed by two companies including, Natural Selection Foods LLC, has been traced to the recent E. coli outbreak that has killed one person and sickened more than 100 others in 21 states. / AP

Comment / f Share / Tweet / Stumble / @ Email

Africanized 'killer' bees attack Ramona man

By: 10/26/06 7:29 PM
POSTED: 10:27 PM, May 26, 2006
UPDATED: 10:40 PM, May 26, 2006



VIDEO BY KUTV

RAMONA, Calif. - A Ramona man was attacked Saturday by a swarm of angry Africanized bees.

Man gets Caught in Milfoil in Columbia River and Drowns

KENNEWICK, Wash. - "Columbia Basin Dive Rescue did locate a body approximately 10:20 this morning," said Kennewick Police Corporal Chris Walters.

After an overnight and morning search spanning more than 10 hours in the Columbia River, Columbia Basin Dive Rescue recovered the body of an unidentified 22-year-old man. Kennewick police say they received a report of a drowning around 10 o'clock last night.

"The Columbia River has a lot of obstacles," says Columbia Basin Dive Rescue PIO Scott Pattison. Large rocks, concrete, rebar, milfoil, lots of things to get entangled in."

Authorities say peer pressure from friends caused the man to swim out to a bridge pillar underneath the Blue Bridge, 150 feet from shore. As he headed back, his legs got caught in milfoil, an equivalent to quicksand.

"Your legs get entangled in it and you panic and it starts to pull you down and gets a better hold of ya and you just continue to go down," says Pattison. There's really not a lot you can do about it. If you panic and aren't able to get your legs out."

According to officials, milfoil is impossible to see at night. It's even difficult during the day. Standing on the boat dock, you hardly notice it. But a closer look allows you to see a forest of milfoil. Boaters like Gary Hammond have had experiences with it. He says it can wreak havoc on boats.

"It can block the water intake causing the engine to overheat," according to Hammond.




SKYCAM FOOTAGE
[aerial imagery]

Gorse (*Ulex europaeus*) increasing fire risk



Exotic Carrots

- Apiaceae family
- Eight exotic species established in Illinois (12 other species reported to occasionally escape)



Queen Anne's Lace



Exotic Carrots

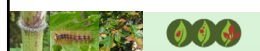
- Phytophotodermatitis
 - Wild Parsnip (*Pastinaca sativa*)
 - Giant Hogweed (*Heracleum mantegazzianum*)
- Phytotoxic poisons
 - Poison hemlock



Wild Parsnip

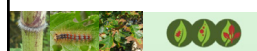
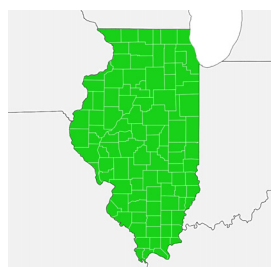
Pastinaca sativa

- Biennial forb
- Native to Eurasia
- Introduced as a food source



Wild Parsnip

in Illinois



Wild Parsnip

Identification

- 3-5 feet tall (Biennial forb)
- First year – Rosette
- Leaves are alternate, compound and branched with jagged teeth. Leaflets are yellowish-green and coarsely-toothed
- Flowers - Pale yellow flat umbels
- Grooved, hairless stems



Wild Parsnip

Ecology

- Biennial
 - Rosette and flowering stages
 - Dies back in winter months
- Prefers open areas, such as roadsides, old fields, prairies, ditches, etc.



Wild Parsnip – Human Health Risk

- Phytophotodermatitis
 - Sap in contact with skin in presence of sunlight
- Chemical burns “Like a very bad sunburn”



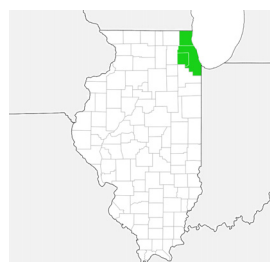
Giant Hogweed

Heracleum mantegazzianum

- Biennial (or short-lived perennial) forb
- **Federal Noxious Weed, Illinois Exotic Weed**
- Native to Eurasia
- Introduced as an ornamental



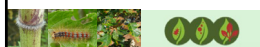
Hogweed in Illinois



Hogweed

Identification

- Tall forb (8-15 feet when flowering)
- Huge, compound, dissected leaves (up to five feet wide)
- Stem hollow and blotched with purple
- Large “umbel” flower head (looks like Queen Anne’s lace flower)





Hogweed Identification

- Thick stem
- Blotched with purple
- Hollow



Hogweed Identification

- Huge (up to 2 ½ feet wide) flower heads



Hogweed Ecology

- Biennial or short-lived perennial
 - Rosette and flowering stages
 - Dies back in winter months
- Prefers moist soil and partial shade but can grow in a variety of conditions
 - Riverbanks, streamsides, old fields, railroad ROWs, open woods, other disturbed areas
- Many infestations result from previous plantings



Hogweed – Human Health Risk

- Phytophotodermatitis
 - Sap in contact with skin in presence of sunlight
- Skin rashes, chemical burns, blindness (if the sap gets in your eye)



Mitigating Phytophotodermatitis

- Wear gloves, long sleeved shirts, long pants, closed toed shoes, and eye protection anytime when working with these plants
- Thoroughly clean clothes and equipment after working in invaded area
- Consider 'hands-off' approaches such as broadcast applications of herbicides
- No mechanical control, don't expose sap
- For Giant Hogweed, report to state (through any of the First Detector Contacts)



Poison Hemlock

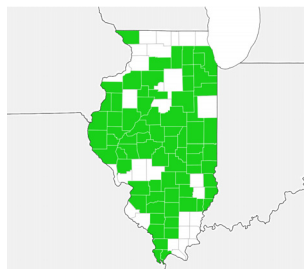
Conium maculatum

- Biennial forb
- **Illinois Exotic Weed**
- Native to Europe
- Introduced as an ornamental



Poison Hemlock

in Illinois



Poison Hemlock

Identification

- Tall forb (5-12 feet when flowering)
- Leaves finely dissected and 'fern-like'
- Stem blotched with purple
- Many, white or cream-colored small "umbel" flower heads



Poison Hemlock

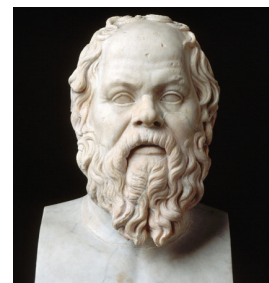
Ecology

- Biennial
 - Rosette and flowering stages
 - Second-year plants die back in winter months (Rosettes stay green)
- Prefers open, disturbed sites
 - Ditchbanks, roadsides, old fields, railroad ROWs, other disturbed areas



Poison Hemlock – Human Health Risk

- ❑ Acutely poisonous – all plant parts
 - Contains four different poisonous alkaloids
 - Coniine – Primary toxin
- ❑ Ingesting less than a tenth of a gram of coniine can be fatal
 - Consumption is the primary method of poisoning, it can also result from inhalation or skin contact



399 B.C. - Socrates drank a liquid infused with hemlock to carry out his death sentence (Socrates had been convicted of impiety toward the gods and corruption of the youth).

Mitigating Poison Hemlock

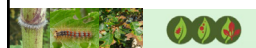
- ❑ Don't eat it!
- ❑ Wear gloves, wash and clean clothes thoroughly after working in invaded area
- ❑ Don't pile and burn it, treat and remove it before prescribed fire if possible
- ❑ Avoid handling it as much as possible



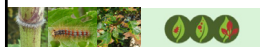
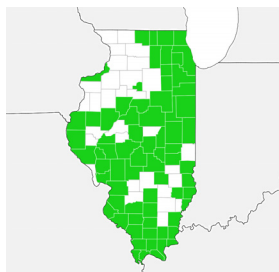
Tree of Heaven

Ailanthus altissima

- ❑ Tall, clonal, deciduous tree
- ❑ Native to Asia
- ❑ Introduced as an ornamental
- ❑ Exposure to sap has potential to cause dermatitis and myocarditis



Tree of Heaven in Illinois



Tree of Heaven identification

- ❑ Tall, deciduous tree
- ❑ Alternate, long, pinnately compound leaves
 - Each leaflet with glandular notch(es) at base
- ❑ Smooth, tight, light gray bark
 - Light diamond-shaped pattern on larger stems
- ❑ Clusters of yellowish small flowers
 - Single-seeded, winged fruit
- ❑ Spongy, brown pith
- ❑ Entire plant has strong, unpleasant odor





Tree of Heaven

Ecology

- ❑ Clonal growth – can form large, interconnected patches
- ❑ Thought to be allelopathic
- ❑ Shade intolerant
- ❑ Found usually in open sites, forest edges, open woods, barrens, old fields, and other open, disturbed areas



Tree of Heaven – Human Health Risk

- ❑ Contact dermatitis – some records of rashes, sometimes severe, forming after contact with sap
- ❑ Myocarditis – Intestinal pain, chest and arm pressure, shortness of breath
 - A group of workers, all clearing Tree of Heaven, all came down with symptoms similar to heart-attacks after contact with sap
 - Avoid contact with skin, wear long sleeves and gloves when working with Tree of Heaven
 - Avoid prolonged exposure

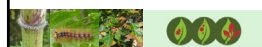


Understanding the relationship between invasive plants and tick borne diseases



Tick-borne diseases in Illinois

- ❑ **Alpha gal allergy** (lone star tick)
- ❑ **Anaplasmosis** (black legged tick)
- ❑ **Babesiosis** (black legged tick)
- ❑ **Ehrlichiosis** (lone star tick)
- ❑ **Lyme disease** (black legged tick)
- ❑ **Rocky mountain spotted fever** (dog tick)
- ❑ **Southern tick-associated rash illness (STARI)** (lone star tick)
- ❑ **Tularemia** (dog tick, lone star tick)



Common disease-vectoring ticks in Illinois



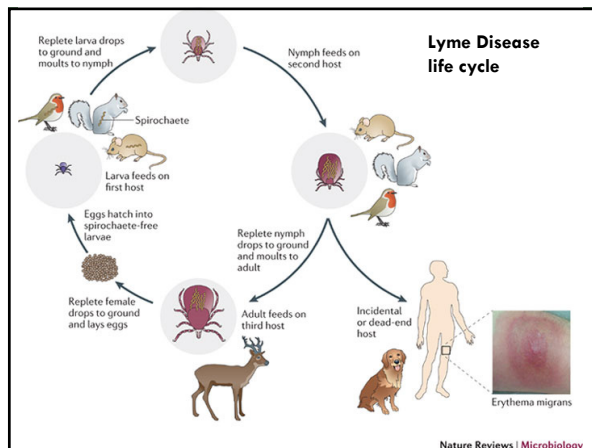
Black legged tick
Ixodes scapularis



Lone star tick
Amblyomma americanum



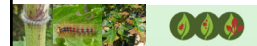
Dog tick
Dermacentor variabilis



Questing black-legged ticks - <http://lymegradient.blogspot.com/>

Disease Incidence Factors

- Tick population
 - Food source, habitat, survivorship
- % of population infected
 - Amount of and proximity to infected hosts
- Access for transmission to humans
 - # of infected ticks in proximity to humans, tick activity



Tick Population



- Higher humidity (to prevent desiccation and allow for increased activity)
- Closed canopy
- Well developed shrub layer
- Access to small mammals and birds (primary food sources for first blood meal)
- Access to larger mammals (i.e. deer) for adult stage feeding
 - Humans and dogs are typically dead-end hosts (no completion of life cycle through to egg laying)



Tick Population

Invasive shrubs ↑ shrub density compared to native shrubs
 ↑ shrub density = ↑ humidity and ↑ host populations =
 ↑ tick population



"Adult ticks may be concentrated in barberry infestations in early spring during barberry leaf-out, when limited forest overstory canopy allows for increased sunlight penetration, creating less than favorable conditions for tick survival by lowering soil moisture and relative humidity." (Williams and Ward 2009) –

"These surveys indicated a nearly five-fold greater density of deer in honeysuckle invaded areas relative to uninvaded areas" (Allan et. al 2010)

Shrub Density

- Invasive shrub stem density was twice that of native shrub stem density (Elias et al 2006)
- An 18-fold increase in overall density of plants in honeysuckle-invaded areas relative to uninvaded areas (Allan et al 2010)



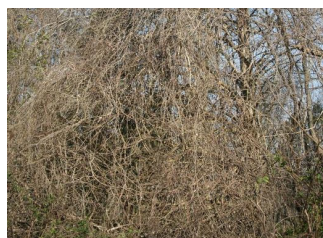
Bush honeysuckle invasion in southern Illinois

Exotic Shrubs/Vines and Tick Populations

- Exotic shrubs - twice as many adults ticks and nearly twice as many nymphs (Elias et al 2006)
- Bush honeysuckle - Higher abundances of both nymph and adult life stage ticks in eastern Missouri (Allan et. al 2010)
- Tick preferences - Bush honeysuckle, Japanese barberry, and Oriental bittersweet (Schulze et al. 1998)



Exotic Shrubs/Vines and Tick Populations



5456817

% of Population Infected

- Three-stage life cycle (larva, nymph adult) with one blood meal per stage
 - Spirochete that causes Lyme is not typically passed from adult to egg so each new generation must acquire infection (i.e. feed on a infected host)
- Exotic shrubs are good habitat for small rodents and birds (sources of first blood meal and reservoirs for spirochete that causes Lyme Disease)



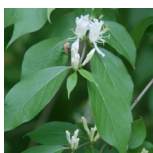
% of Population Infected

- A significant reduction in ticks infected with the Lyme disease spirochete in areas where barberry was either controlled or absent (Williams and Ward 2009 and Williams and Ward 2010)
 - 131-200 infected ticks/acre in areas with heavy barberry infestations
 - 44-55 infected ticks/acre in areas where barberry has been controlled
 - 3-36 infected ticks/acre in areas with no or minimal barberry



% of Population Infected

- In eastern Missouri - the density of lone star tick nymphs infected with the pathogen that causes Ehrlichiosis was ~10-fold higher in the honeysuckle-invaded plots compared with the native vegetation plots (Allan et. al 2010)



TickEncounter Resource Center

Amblyomma americanum (Lone Star ticks)



Control works!

- In invasive plant control studies, the % of tick population infected did not change, but the overall number of infected ticks (and all ticks) was drastically reduced
 - Control of Japanese barberry reduced the number of infected ticks by nearly 60% (Williams and Ward 2010)
 - Control of bush honeysuckle reduced the number of infected nymphs nearly four-fold (Allan et. al 2006)



Japanese Stiltgrass – Muddying the waters

- Invasion by stiltgrass seems to reduce tick populations by negatively altering habitat
 - 13% increase in temperature and 19% decrease in humidity
- 173% increase in mortality for dog ticks
- 70% increase in mortality for lone star ticks



Summary

- Invasive species have been impacting human health for a long time
- Invasive plants in Illinois, particularly exotic carrots and tree-of-Heaven pose serious risks to humans
- Avoidance of sap, use of proper protective gear and careful control of these invaders are the best mitigating practices to use



Summary

- Invasive plants drastically increase tick populations and amount of ticks infected
 - Due to habitat alteration and increased access to hosts
- Not all invasives are created equal (stiltgrass seems to limit tick populations)
- Control of invasive plants (particularly shrubs) can have big impact on human health in a region by reducing potential for transmission of tick-borne diseases

