

Frequency of Hemlock Woolly Adelgid Information Provided in the Media: Impacts, Ecology, and Citizen Outreach

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ABSTRACT

An analysis of 165 media articles about the hemlock woolly adelgid (HWA), an invasive insect killing native hemlocks in eastern North America, was undertaken to determine possible influences of the public's desire and ability to help with invasive species prevention and control. All of the articles mention at least one of the following: HWA impacts to ecosystems (55.2%), hemlock characteristics (47%), and the value of hemlocks (38.8%). Articles that mention HWA impacts and hemlock value also mention associated topics such as subsequent impacts from hemlock loss to shade and temperature control of forests and streams, trout and recreational fishing, and the importance of hemlocks as a foundation species. 22.4% of articles provide advice or contact information for citizens to report HWA infestations or get involved in outreach programs, or to help educate readers about how to prevent further HWA spread and introductions. Informing citizens about HWA invasions can be useful to detect early infestations, range, and spread, and to coordinate control. This allows transparency as well as education and community participation in management, reducing negative impacts.

INTRODUCTION

Public support can assist efforts to detect and control invasive species, helping to slow or prevent their introduction and giving researchers and managers greater access to resources and assistance (Crall *et al.* 2010). Media articles often make scientific information accessible. If the public is made aware of negative impacts of invasive species, they may be more likely to assist control efforts, take preventative measures, engage in outreach programs, and report infestations. We used the hemlock woolly adelgid (Hemiptera: *Adelges tsugae* or HWA) as a case study to identify trends associated with invasive species management presented in the media. HWA is an invasive insect devastating hemlocks in eastern North America, causing significant ecological and recreational damage (Siderhurst *et al.* 2010, Ellison *et al*. 2005).

METHODS

We used Google search engine with the term "hemlock woolly adelgid" to find relevant news articles and then used Google Chrome Web Scraper Extension (http://webscraper.io/) to retrieve the web address, heading, source, publication date, and a short description for each of 674 articles through August 15th, 2017. By using the "News" tab, articles not considered news articles were excluded. Articles were reviewed and irrelevant articles were eliminated, leaving 165 articles to be reviewed. Data collected (Table 1 and Fig. 1) were processed through an R code that returned the frequency and correlation between topics. Publication type, date, and location were also considered. This information was then analyzed to seek patterns and quantify the amount and detail of information provided.

LITERATURE CITED

Vander Zanden, M. Jake, *et al.* "A pound of prevention, plus a pound of cure: early detection and eradication of invasive species in the Laurentian Great Lakes." *Journal of Great Lakes Research* 36.1 (2010): 199-205.

Crall, Alycia W., *et al.* "Improving and integrating data on invasive species collected by citizen scientists." *Biological Invasions* 12.10 (2010): 3419-3428.

Ellison, A. M., *et al.* (2005), Loss of foundation species: consequences for the structure and dynamics of forested ecosystems. *Frontiers in Ecology and the Environment*, 3: 479–486.

Mehta, Shefali V., *et al.* "Optimal detection and control strategies for invasive species management." *Ecological Economics* 61.2-3 (2007): 237-245.

Siderhurst, L. A., *et al.* 2010. Changes in light levels and stream temperatures with loss of eastern hemlock (*Tsuga canadensis*) at a southern Appalachian stream: implications for brook trout. *Forest Ecology and Management* 260:1677–1688.

Image Citations

Childs, Robert. "A mass of hemlock woolly adelgid egg masses lined up along the base of the needles. This is the most noticeable stage for this pest." University of Massachusetts at Amherst. 2011.

RESULTS

	Value of Hemlocks		Impact of HWA on Ecosystems	
Information mentioned	**# Articles**	**% Articles**	**# Articles**	**% Articles**
Shade and/or temperature control of streams and forests	31	48.40%	24	26.80%
Recreational fishing industry and/or Trout	20	31.30%	18	19.80%
Wildlife habitat and/or shelter	19	29.70%	12	13.20%
Bird communities and/or neotropical, migratory birds	15	23.40%	13	14.30%
Foundation or keystone species	13	20.30%	17	18.70%
Recreational, aesthetic, cultural, and/or spiritual value	12	18.80%	5	5.50%
Deer shelter and/or food source	8	12.50%	4	4.40%
Prevent erosion and/or maintain riparian zones	7	10.90%	9	9.90%
Overall forest health	7	10.90%	5	5.50%
Soil and/or water acidity	5	7.80%	1	1.10%
Water quality	4	6.30%	5	5.50%
Nutrient cycling, water flow, and/or ecosystem processes	3	4.70%	10	11.00%
Snowmelt and/or snowfall	3	4.70%	2	2.20%
Stream and/or forest communities	3	4.70%	5	5.50%
No native species equivalent to replace hemlock	2	3.10%	2	2.20%
*Park quality and/or visitor safety	--	--	6	6.60%
*Effect of Climate change on HWA life cycle	--	--	2	2.20%
*Value to classes and/or research	--	--	2	2.20%
*Eastern Hellbender	--	--	1	1.10%
*Study 1 topics and fire ecology	--	--	1	1.10%

Table 1: Topics and frequencies within articles that mention value of hemlocks and impacts of HWA on ecosystems and the percentages in which they are mentioned.

*additional information mentioned in articles related to "impact of HWA on ecosystems (via hemlock decline)", but not mentioned in articles related to "value of hemlock".

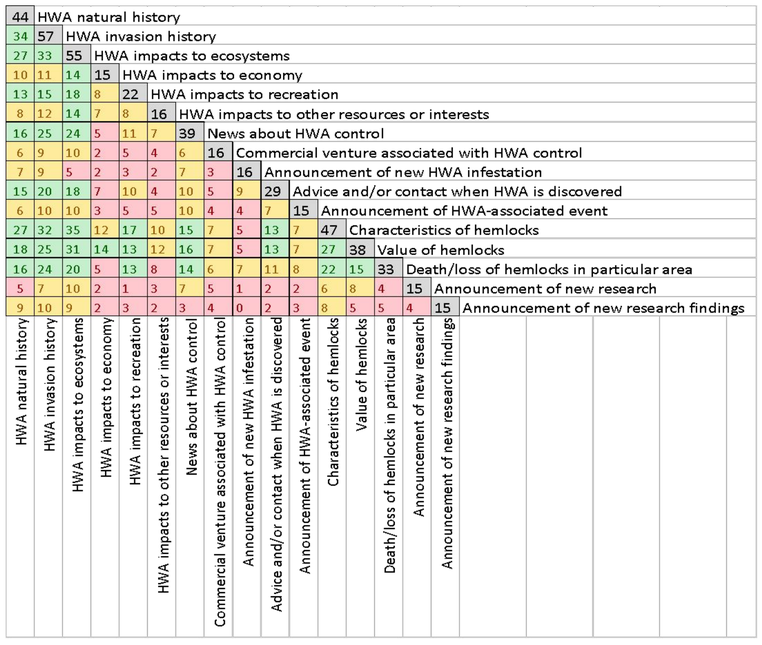


Figure 1: Numbers within the table are percentages that represent individual topics (gray squares) and corresponding topics (colored squares), indicating the frequency of information included in articles, individually and in association with other topics.

Data

- 22.4% (37 articles) of articles provide **CONTACT INFORMATION OR ADVICE** about **HWA identification, prevention, or control**.
- 29 of those articles provide contact information to **REPORT HWA INFESTATION** or for **INVOLVEMENT** in outreach programs.
- The most frequently mentioned topics are: **characteristics of hemlocks, HWA impacts to ecosystems, HWA natural history, HWA invasion history, death/loss of hemlocks in particular area, and value of hemlocks**.
- Topics mentioned the least are: **new research findings, new HWA infestations, new research, HWA associated event, commercial venture associated with HWA control, HWA impacts to other resources or interests, HWA impacts to recreation, and HWA impacts to the economy**.
- 38.8% (64 articles) of articles mention the **value of hemlocks**.
- 55.2% (91 articles) of articles mention the **impact of HWA on ecosystems**.

DISCUSSION

The best way to control invasive species is to simply prevent introductions in the first place. HWA and many other invasive species are commonly spread unwittingly by individuals (Vander Zanden *et al*. 2010). Media can inform the general public to prevent introductions (Vander Zanden *et al*. 2010), e.g., preventing firewood movement can help prevent HWA spread. Efforts by managers and researchers likely could benefit from greater efforts to provide contact information and preventative measures through the media. Early detection is likely to reduce the costs of control efforts, increase the likelihood eradication efforts will be successful, and mitigate negative impacts (Mehta *et al*. 2007). In order for citizens to report HWA infestations, they must know how to identify HWA and know where to report infestations.

The majority of articles included an inadequate amount of information about HWA. Information that may help sway public support and aid in control and detection efforts. e.g., HWA impacts to other resources or interests, HWA impacts to recreation, and HWA impacts to the economy, was generally excluded. This may be due to the lack of accessible information. Articles that included the most information were produced from university extension services in states where HWA infestations have occurred most recently. Contact information and advice were limited and mostly restricted to a few states.

Future research might consider why some topics important to understand HWA were included over others, accessibility of information related to research, and lastly, how the presentation of information might be improved. If scientists would like to involve the general public, researchers and managers might increase communication with media. By providing detailed information about impacts, media can appeal to the general public's interests and therefore promote willingness to participate in the prevention and management of HWA and other invasive species.