

Internet surveillance – new web search and response application is a valuable biosecurity tool

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Summary An urgent need to identify, contact and prohibit Internet sources from shipping invasive plants into biosensitive areas is addressed by development of software to spider, download, index, and track the sale of these plants. This Internet surveillance software will allow regulators to identify offending websites, contact the owners and track compliance. The software is completely customisable. The implications of Internet surveillance will be discussed as well as the prospects for international cooperation in identifying and stopping the online sale of noxious plants.

Keywords Internet surveillance, data mining, biosecurity, noxious weeds, invasive species, biodiversity, database.

INTRODUCTION

Invasive plants are estimated to infest 100 million acres in the United States and spread to an additional 3 million acres every year (US National Invasive Species Council 2001). In Western Australia's agricultural systems, weed control costs have been estimated at 20 percent of production costs. Invasive plants are considered to be a significant threat to natural ecosystems and no accurate figures are available on the substantial funds spent on the control of weeds nor on the time spent controlling them (Western Australia State Weed Plan Steering Group 2000).

These invasive plant species not only cause economic damage, but severely impact the lands and waters of sensitive non-native territories. The biodiversity of native ecosystems and stability of agricultural systems is under constant threat by the often-unintentional introduction of these non-native species. Rapidly expanding global trade and communication have directly contributed to the mixing of native and non-native species across biogeographical boundaries. Once established, some invasive species have the ability to displace or replace native plant and animal species, disrupt nutrient and fire cycles, and cause changes in the pattern of plant succession. Unfortunately, these non-native species are often identified after they have become established. The most cost effective method of eliminating invasive plants is prevention and early intervention. Therefore, there is an urgent need to identify routes of entry and mitigate

the importation of these plants before they impact the environment or harm agricultural systems.

A major, and often overlooked, pathway of unregulated importation of destructive, non-native species is global availability of plants and seeds on the Internet. Many seed and plant companies maintain large, searchable databases of their catalogues on the Internet. Many web sites allow the sale or trade of potentially destructive plants. These businesses and individuals have the ability to sell and ship potentially destructive seeds all over the world. Often, the owners of these web sites do not know of the potential danger of shipping what may be an otherwise harmless plant in their country or territory to areas where the plants are invasive.

The US cannot succeed in addressing its invasive species problems unless it takes a major role in international cooperation and invests strategies to raise the capacity of other nations to manage the movement of invasive species (US National Invasive Species Council 2001). In response to this urgent need, the NSF Centre for Integrated Pest Management (CIPM) along with the United States Department of Agriculture, Animal and Plant Health Inspection Service (USDA/APHIS) has developed an Internet surveillance tool that searches, tracks, and archives websites that sell or trade noxious weeds on the Internet.

MATERIALS AND METHODS

Software Software for the Internet Surveillance tool was written using ColdFusion markup language (CFML), and standard Internet protocols. At present, the software is housed on a Windows 2000 server running ColdFusion Server on the North Carolina State University campus. All data are stored using SQL Server 2000.

Security Several levels of security are utilised in accessing the surveillance tool online. Along with standard server security, users can log into the tool and, based on their specific login information, are tracked during the use of the application. Only information pertinent to their area of expertise, security clearance and allowed actions are accessible. A third layer of security is provided by the underlying database that

is stored on a separate computer, isolated from the Internet.

Identifying sources Internet sources of noxious plant sales are identified by the use of spidering software or intelligent robots that scan the Internet for specific keywords (i.e. plant common names, scientific names and synonyms). Other connector words (i.e. for sale, buy, order, credit card, etc.) help filter the information to only those sites that sell noxious plants or seeds. Several other techniques for filtering relevant information can be incorporated into the tool, including the use of natural language queries, excluding keywords, and excluding specific Internet domains (i.e. .gov, .mil, and .org.).

Relevant information about web sites identified as selling invasive plants are downloaded and indexed in the SQL Server database. The URL of the site, company name, keywords, IP, owner and date found are added to the database.

Tracking Regulators can view the most recent web sites that have been flagged as potentially selling noxious plants as soon as they log into the tool. The application allows the user to browse the sites, rate the application of the site, and make notes about the site.

Once a site has been marked as having high risk for selling noxious plants, the regulator can send an email or letter to the web site owner. Dynamically generated emails will be available in a series of standardised templates that can be modified by the regulator. The software tracks the emails that are sent out to web site owners and allows the regulator to categorise any responses received. The system can also be configured to copy additional regulatory agencies and individuals on each email.

Table 1. Web sites selling plants from the Western Australia noxious weeds list (Department of Agriculture – Western Australia 2002).

Noxious weed	Number of web sites selling this plant
Water lettuce (<i>Pistia stratiotes</i>)	5
Arrowhead (<i>Sagittaria montevidensis</i>)	2
Prickly acacia (<i>Acacia nilotica</i>)	6
Water hyacinth (<i>Eichhornia crassipes</i>)	4
Arum lily (<i>Zantedeschia aethiopica</i>)	4

Archives and statistics The Internet Surveillance tool archives all data that is stored in the database, unless otherwise deleted by the regulator. This historical information allows the user to access statistics on the regulator's success. Number of sites identified as positive, types and rating of sites, number of letters sent and the number of websites that comply are available to the regulator. Statistics on success rates can be tracked over time.

Customisation The application is completely customisable. New search words or connector words can be added at any time. Searches can be customised to users' needs. Users can be added and multiple levels of security can be assigned to each person.

RESULTS AND DISCUSSION

A quick search of the Internet for several plants listed as weeds in Western Australia (Department of Agriculture – Western Australia 2002) produced the following partial list of web site hits (Table 1).

Web sites are not the only potential marketing venues for noxious plants; many forums, online discussion groups and auction sites also provide an opportunity for plants to be shipped into biosensitive regions. One of the largest online auction sites in the United States, eBay (eBay US 2002), alerts sellers and buyers of the prohibited noxious weeds with the following statement:

'Some Federal, state and local laws prohibit the sale of certain types of plants or seeds that are considered 'exotic' or 'noxious' weeds. The United States Department of Agriculture prohibits the importation and interstate movement of Federal Noxious Weeds and Seeds. Besides reviewing the list of prohibited Federal Noxious Weeds and Seeds, buyers and sellers of plants or seeds should also review the following state-by-state list of Regulated Noxious Weeds, and consult with state and local authorities to determine whether the items they are considering buying or selling are legal in their state.'

This disclaimer does not occur on the Australian eBay site (eBay Australia 2002) as well as some of the other eBay country sites, leaving auctions open to the sale of prohibited plants and seeds. We plan to use the intelligent robot spiders to search through auction sites and discussion forums to alert regulators of the sale and shipment of noxious weeds. Thereby, regulators can alert auction site owners of the potential for illegal trade.

Most plant sellers may be unaware that they are selling potentially noxious plants. The tool can be used to find and contact the site owners to gently alert them

that they may be shipping plants illegally. Since the regulator can pick from several letter templates, the email or letter can be customised for the severity of the violations and offer suggestions that will bring the owner into compliance. It can also contain links to educational information about the dangers of invasive species. Further action can be taken if the owner does not add a disclaimer to the web site and continues shipping the noxious plant to prohibited areas. Since each letter is archived, the regulator can know, at any time, the history of communications between the regulator and the business or individual selling the noxious plant or seed. The regulator can then share this important information with other regulators or countries, and it can be used as evidence in a court of law.

The opportunity to partner with other countries can be built into the Surveillance tool. This would include adding the ability to send letters to cooperators or regulators of other governments. Reciprocal agreements between the Australian Quarantine and Inspection Service (AQIS) and US APHIS would allow the cooperation of these countries by notifying them when noxious weeds are being sold globally.

Most search tools on the market are targeted towards intellectual property search for businesses or for intelligence operations of governments and military organisations. No software currently on the market performs the type of data-mining services and tracking that the Internet surveillance tool created by the USDA/APHIS and the NSF CIPM can perform.

Most importantly, few software applications allow the level of customisation to the needs of the regulators using the program. We look forward to developing the tool to better suite the needs of regulators and government officials and, more importantly, allow the global cooperation of countries trying to keep noxious weeds from moving over their borders.

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REFERENCES

- Department of Agriculture – Western Australia (2002). Declared Plants List. http://www.agric.wa.gov.au/programs/app/dec_pl/declaredplants.htm.
- eBay US (2002). Community Standards: Policies and Guidelines: Prohibited Items Plants and Seeds. <http://pages.ebay.com/help/community/png-plantsandseeds.html>.
- eBay Australia (2002). <http://www.ebay.com.au/>.
- US National Invasive Species Council. (2001). Meeting the Invasive Species Challenge: National Invasive Species Management Plan, 80 pp.
- Western Australia State Weed Plan Steering Group (2000). A weed plan for Western Australia. <http://www.agric.wa.gov.au/programs/app/swp/b4409.pdf>.