

IV. Scientific Aspects of Early Warning

Early Detection, Reporting, Identification, Vouchering, Notification, and Information Management

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I. INTRODUCTION.

The first and foremost strategy for dealing with new and emerging invasive plants is early detection and reporting of incipient infestations. To do this, we will need to develop a framework for delivering reliable and timely reports of new invasions (at various geographic scales) to appropriate officials for rapid assessment. The specific charge of Working Group One was to conceptualize and outline a coordinated local/state/national interagency framework that will:

- Encourage early detection of new plant species throughout the United States,
- Provide a mechanism for prompt reporting, identification, vouchering, and official notification of appropriate officials when new a state and/or national plant record is confirmed by a recognized specialist,
- Provide a coordinated local, state, national, and international framework that will enhance interagency cooperation in detecting and responding to new plant invasions in a timely manner,
- Trigger a rapid assessment of a confirmed new species by designated specialists in cooperation with appropriate local, state, and national agencies/organizations..

In general, the proposed system should address invasive plants in all landscapes (e.g. agriculture, wild lands, natural areas, research plots, urban and suburban landscapes, etc.), utilizing existing infrastructures where possible. The success of the system depends on the support and assistance of all groups that are likely to observe new invasive plants, including all related trade and professional organizations, field scientists and herbaria staff. In addition, to be effective, information must flow into and from the system through multiple channels and at multiple levels. All reports must be encouraged, evaluated, and acknowledged by a designated state level network coordinator. All new county, state, and national records should be maintained in a web based, distributive information management system that is readily accessible by the public. In short, the ability

of officials to mount a timely response to a new invader depends entirely on knowing that it exists. [Top](#)

II. GROUP DISCUSSION AND CONCLUSIONS.

State Early Detection Coordinator. The first step in establishing a State Early Detection System for Invasive Plants will be for the State Invasive Species Council to designate a **State Early Detection Coordinator**. The Coordinator (a botanist or weed specialist from a college, university, or other public agency) will take a primary lead in developing the State Early Detection Network. The Coordinator will also work with the National Early Warning Coordinator and other State Early Detection Coordinators to arrange for state and regional herbaria to act as repositories for voucher specimens (*ideally, the State Early Detection Coordinator would be affiliated with at a cooperating herbarium*). The state detection coordinator must have or develop the credentials to interact with the scientific and professional communities as well as be a "people person". There may be some instances where this person may be outside the state and function with a multiple state overview (i.e., New England as a region). Likewise, in some instances a local level (below the state) may be in place or work well. These local infrastructures must report to the state coordinator. State detection coordinators must encourage interagency cooperation and participation by acting as a nexus for information. The state coordinator must have the ability to accept data from large groups such as schools, scouts etc. as well as recognize their participation and contributions and to provide feedback.

State Early Detection Network. Within each state, the proposed system should utilize existing survey networks whenever possible (heritage programs, county extension agents, native plant societies, weeds science societies, rangers, herbaria etc.), but could improve their effectiveness for early detection through training, reference material, and etc. One important group that is sometimes overlooked in favor of 'trained professionals' is the private landowner. Since many land owners live on their land, they are often the first ones to notice a new invader on their property. Therefore, landowners need to be encouraged to report new infestations or unknowns through the state detection network. Property owners are much more likely to become willing participants and system advocates if their concerns about private property right, owner notification, and access permission are taken into account. Another idea for improving early detection is to develop a volunteer cadre of certified parataxonomists within each state to assist the State Detection Coordinator in developing and operating the Network. This will significantly increase the likelihood that new species will be detected and will further encourage public participation in the process.

Cooperating Regional Herbaria. Within each region of the country, one or more cooperating regional should work with their colleagues at the state level to develop state early detection networks in every state of the region. Participating regional herbaria must act as a liaison with the academic community, Flora of

North America, trained professionals and parataxonomists. They must also offer training and assist in identification and verification as well as serve as a conduit for information into national and international data bases.

Target Species. The proposed National Early Detection System should focus primarily on detection of new county, state, and national records of vascular and non-vascular plants in the United States. The documented flora of the country will serve as a baseline of information for determining whether a reported species is a new record or is a rare native plant.

Priority Areas for Survey and Early Detection. All modes of spread, including human, biotic, and abiotic pathways, are important in the short and long distance movement of plants. However, since invasive plants typically have very high reproductive capacities, plant collectors should focus on sites where invasive plants are most likely to become established and then further spread. Some of these sites include disturbed and waste areas, botanical gardens, valuable areas with high biological diversity, and vulnerable areas (fragile ecosystems etc.). Areas of disturbance are particularly important as seed propagation nurseries and often serve as reservoirs for further long distance spread by human activities.

Survey and Detection Methods. In conducting their early detection programs, State Early Detection Coordinators will use both *systematic* (planned survey of target species or priority sites) and *opportunistic surveys* (botanists on vacation, trappers, fisherpeople, game wardens, etc.) depending on the costs, benefits, availability of trained personnel and particular situations. Often, the latter may trigger the former. Systematic ground based surveys include **detection surveys** (surveys of potential high risk sites), **delimiting surveys** (surveys to determine the extent of an infestation), and **appraisal surveys** (post-treatment surveys to determine the effectiveness of control efforts). Survey methods that have proven effective in past weed eradication programs include **traditional walking surveys** of a designated area, and **riding surveys** on four-wheeled ATVs, on horseback, or on truck or tractor mounted survey platforms. **Canine survey** (survey with trained dogs) is another type of survey that holds promise in this area. **Remote sensing** through aerial or satellite imagery is an important new technology that will ultimately permit land managers to pinpoint new infestations that have not been previously detected through ground survey and operations.

Collection Methods & Protocols. The main objective of the Early Detection System is to collect plant species that are new to a county, state, or the nation. In doing so, collectors should use standard plant collection and preparation methods. Voucher specimens should be collected for positive identification and as a permanent record. If the population is large, the collector should take enough plant materials for regional repositories, state herbaria, specialists, and network exchange. If just a few individuals, don't collect until identification is certain. This will help avoid accidentally collecting rare species). Observational reports are extremely important but require follow-up.

Submitting an Initial Field Occurrence Observation - (Level I – Field Reporting). Once a suspected new plant has been observed and collected in the field, the population should be reported to proper authorities to ensure that all confirmed county, state, and national records are properly addressed. *New species that go unreported cannot be addressed.* The first step in the reporting process is to submit a voucher specimen from the observed population to the designated State Botanist for identification and processing. A primary goal of the National Early Warning System is to create a strong link between plant collectors and agencies that are in a position to address confirmed problems.

Because we expect observations by a wide variety of persons from professional botanists to backyard gardeners, the system must have minimal but flexible reporting requirements. However, a standard **Field Reporting Form** should be developed to ensure that appropriate information is gathered at the time of collection including:

- Name of Taxon (if known)
- Place of Observation, Including Latitude and Longitude, if Possible
- Date of Observation/Collection
- Observer's name, Address, Phone Number, Affiliation, Position, and Experience
- Appropriate Voucher Specimen
- Photograph of the Growing Plant, if Possible

Ultimately, standard protocols for plant collection and vouchering must be developed and made available both in hard and soft copies. Such information could be posted on the National Early Warning Website by the National Early Warning Coordinator.

Processing an Occurrence Observation Report (Level II - Verification & Determination of Significance). To be effective, the National Early Detection Network must maintain high visibility and have clear reporting directions and continual feedback mechanisms. Reports can and will enter the system at any point from any source, but must be routed through a designated state level early detection coordinator for processing by a cooperating herbarium.

Once a cooperating herbarium has received a suspected new plant specimen, the staff should follow a standard procedure for handling new species until it is determined to be insignificant (not a county, state, or national record). This is especially important in handling regulated species, parasitic plants, and other taxa with small seeds that pose a significant risk in being further spread.

Upon receipt, the specimen should be identified (utilizing distant taxonomic support if necessary), its significance should be determined (county, state, or national record?), permanent voucher specimens should be prepared and distributed to appropriate repositories, proper authorities should be notified in

coordination with the State Invasive Species Council, and the collector should receive prompt feedback. If requested, steps should be taken to ensure that the collector receives academic credit for the new record. Acknowledging the plant collector in all subsequent official reports should take care of this need. A program newsletter (electronic and hard copy might solve this and serve lots of other needs/functions. Finally, confirmed new county, state, and national records should be entered into a distributive, web based information management system for invasive species, as a new addition to the baseline information on the flora of North America.

Taxonomic Support. Since a primary objective of this national system is to detect new populations of introduced plants, it will be important to enroll the support of botanists throughout the country, and to establish a network of participating herbaria. In this regard, it will be important to become associated with the Flora of North America project which in turn maintains list of taxonomic specialists. The National Early Warning Coordinator should develop and maintain a list of knowledgeable regional/state floristic botanists who may be network participants

To be effective, the early warning system will require broad participation from the taxonomic community to: support existing herbaria, produce current, affordable manuals and weed identification guides, conduct research on invasive species biology and systematics, train parataxonomists, maintain nomenclatural and distributional standards, maintain a controlled vocabulary, exchange specimens of highly invasive species so each regional network herbarium will have identification material available, support mentoring by training students as future invasive species biologists and weed scientists (herbaria could offer student stipends as incentives for involvement), and to support science based invasive species symposia, courses, colloquia, etc.

Taxonomists could support the Early Warning System in other ways as well. Other possibilities include creation of an "Ask a Taxonomist" website, a toll free number for questions about new plants, a web based photo gallery of important invasive plants, as well as production and dissemination of electronic keys, polyclaves, fact sheets, etc.

Information Sources for Identifying Potential Invaders. There are many sources to help identify new and emerging invasive species. Some of these include regulated noxious weeds (county, state, federal), horticultural and seed trade catalogs and databases, websites that sell plants, The Germplasm Information Network (GRIN) (USDA Agricultural Research Service), American Association of Botanical Gardens and Arboreta (AABGA), aquarium trade databases and catalogs, land management agency publications, and international partners (e.g., New Zealand and Australia; web based Global Early Warning System maintained by the Invasive Species Specialist Group of the World Conservation Union).

Broad Information Sharing about New Invasive Plants. To engage appropriate stakeholders, information on confirmed new invaders must flow to and from various (*and numerous!*) repositories. Some of these repositories include:

DATABASES:

- Aquatic Nonindigenous Species Database, (USGS; Gainesville, FL)
- Biodiversity Conservation Information System (BCIS)
- Biota of North America Program (BONAP; UNC-Chapel Hill)
- Botanical Gardens & Arboreta Database (BGBase)
- Germplasm Information Network (GRIN; USDA Agricultural Research Service)
- INVADERS Plant Database (University of Montana)
- International Taxonomic Information System (ITIS)
- PLANTS Database (USDA, NRCS)
- Southwest Exotics Mapping Program, (SWEMP; USGS)
- Taxonomic Resource Expertise Directory (TRED)

DISTRIBUTIVE INFORMATION MANAGEMENT SYSTEMS:

- North American Biodiversity Information Network (NABIN; U-CA, Davis)
- Inter-American Biodiversity Information Network (IABIN; U-CA, Davis)

GROUPS, ASSOCIATIONS, AND SOCIETIES

- American Biodiversity Information Association (ABIA)
- Global Invasive Species Programme, (GISP)
- Hawaiian Ecosystems at Risk Program (HEAR)
- The Nature Conservancy (TNC)
- Plant Conservation Alliance (National Park Service)
- American Nursery and Landscape Association (ANLA)
- Scientific Societies
 - Weed Science Society of America
 - North American Weed Management Association
 - Ecological Society of America
 - American Botanical Society

PUBLIC AGENCIES

- County Weed Programs
- State Agencies; State Heritage Programs; State Biological and Natural History Surveys
- Federal Agencies

WWW Listserves:

- Aliens-Listserve (Invasive Species Specialist Group, World Conservation Union)
- EnviroWeeds Listserve (Australia)

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III. RECOMMENDATIONS FOR ACTION.

**** Hire a National Early Warning Coordinator ... soon.** Developing an effective National Early Warning and Rapid Response System for Invasive Plants will require a fulltime, energetic coordinator to bring together the various groups needed to make this concept a reality.

**** Designate a State Early Detection Coordinator in each participating state.**

**** Develop standards for early detection and protocols for reporting.**

**** Establish a pilot Early Detection Program in a few key states.**

**** Establish a network of cooperating regional herbaria to assist in development of state early detection networks and to serve a conduit for information into regional and national databases..**

**** Establish a distributed web-based information network for invasive plants.** It is critical to establish a 'one stop shopping' gateway for access to all of the websites that contain information about invasive plants.

**** Promote early detection and reporting.** Public understanding of the need for prevention through early detection and rapid response is critical.

**** Develop methods for quality assurance and quality control for all aspects of the system and the data entered into it.**

**** The system should use existing infrastructures at all levels where possible (e.g., county agents, heritage network, native plant societies, weeds science societies, rangers, herbaria).**

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