
THE
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Meeting Summary
Second Meeting: Non-native Species Task Group
State of the Nation's Ecosystems Project
June 18 and 19, 2003
The Heinz Center

The second meeting of the Non-native Species Task Group was held on June 18 and 19, 2003 at The Heinz Center. Attendees are listed in Attachment A.

The meeting had four major elements. The first morning was primarily taken up with the definition of the task group universe. The issues were whether the report should include all non-natives or only invasive species, and identifying definitions for those terms. The second issue addressed was indicators for farmlands and urban/suburban areas. The group discussed refinements to these indicators and the parts of the systems to which they applied. The third discussion area was the refinement of the overall invasion pattern indicator, and the fourth issue discussed was the further identification and refinement of potential invasion impact indicators. The Task Group's report outline was also briefly discussed.

There was one additional item that was discussed in several parts of the meeting. In considering the various types of indicators (i.e., pattern, impact), the Task Group also identified a hierarchy of preference among these various types of indicators. The hierarchy is as follows:

- Reporting *numbers of species* is acceptable if no other information is available.
- Reporting *invasion pattern* (as this indicator has been described by the Task Group) is desirable if this information is available. Within the invasion pattern indicator, the group agreed that assessment based on one or more taxonomic groups was acceptable, but that a full assessment, based on all four taxonomic groups (plants, vertebrates, pests/pathogens, and other invertebrates) is the most preferred.
- Reporting *invasion impacts* is the most preferred, but also the least likely to be possible, given current data availability.

Thus, the group would like to communicate that, *some* information is better than *no* information, but that monitoring programs should be actively working to move down the hierarchy, from reporting of simple species counts to consideration of the actual degree of invasion by non-natives, to (eventually) reporting on impacts.

Definition of Task Group Universe

The Task Group began the meeting by addressing the question of whether reporting should focus on all non-native species, only invasive species, and how to define those two terms.

The group agreed that there are two dimensions of introduced species that the report addresses. The larger dimension is “non-native species” which was described as the superset, and the smaller dimension is invasive species. Additionally, the group agreed that an additional subset is necessary for those species that have a strong potential to become invasive, termed “watch list species”.

- Non-native species were defined as self-sustaining populations of species that are non-native to a particular ecosystem (i.e., to geographically referenced localities) and therefore could originate from within or from outside of the US if found to be expanding beyond their historical range. (For plants, non-native self-sustaining populations are termed “naturalized.”)
- Invasive species are a subset of non-native species that are having negative ecosystem impacts. Taxa can move from non-native to invasive if impacts are demonstrated over time.
- Watch list species are present in an ecosystem with self-sustaining populations and have a high potential to become invasive. For example, the species in question is currently invasive in ecosystems outside of the US or is very similar to a taxon that is already invasive elsewhere. Management agencies may also have “watch lists” of species that are not yet present in their particular area, but are present and problematic elsewhere. Both groups are likely to be the focus of particular management concern and action because they represent opportunities to prevent invasions from occurring.

Key discussion points

- The group agreed that native species acting invasively (e.g., white tailed deer) within their native ecosystem would be acknowledged as important, but would not comprise a primary indicator in the report.
- When considering whether or not a species has undergone a range extension, the group recognized that the judgment would necessarily be made on a case-by-case basis because the distinction where a range begins and ends over space and time is fuzzy. Invasions occur when a species breaks out of its historical range either from anthropogenic movement or an external circumstance such as climate change or other disturbance that allows the species to overcome a biogeographic barrier.
- It is also important to recognize that species populations are always expanding and contracting naturally – populations oscillate and during any given period population boundaries will vary. Periodic residence is part of the natural range flux. These oscillations are not what should be measured for range expansion.
- The group agreed that the invasive subset would be the focus of the impacts indicator.

- Watch list species can move between categories, especially from watch list to invasive. Watch list species can also include those that are causing problems outside of the U.S. or that are very similar to a species having negative impacts elsewhere.

Invasion Pattern Indicators for Farmlands and Urban/Suburban Areas

Farmlands

In the 2002 Report, the farmland indicator focused on the non-cropland section of farmland (woodlots, small wetlands, small grass lands prairies hedge rows), but the majority of the June 2003 non-native working group felt that the indicator should focus on crop pests because the other natural and semi-natural ecosystem types (forests, grasslands, etc.) would cover the non-cropland portions of farmlands. A minority portion of the working group expressed a dissenting view, reasoning that the non-croplands imbedded in the farm landscape are fragmented with a large edge to area ratios, and are therefore subject to heavier invasion pressure and more vulnerable to invasion. The group agreed that the majority position would be sent out for comment.

- The group agreed that the most useful pattern indicator for farmlands would measure the abundance of a non-native that exceeded a predetermined economic threshold (modeled after those that are used in agriculture) and also looked at the total number of non-native species in the ecosystem. The indicator was defined as the number of events in which non-native species are present at levels above the economic threshold. However, the definition of “event” must be clarified.
- The impact indicator would measure the increase in negative impact on crop yield and marketability of the product. This would translate to a dollar value.
- The group proposed that there be no independent pattern indicator for non-cropland areas; this would be subsumed under other indicators for each ecosystem type. [This idea has been sent out for review and feedback]
- For non-cropland areas, the farmland impact indicator would measure the negative impact on ecosystem services from the land. At a bare minimum, this indicator would include the number of invasive species and their abundance.

Key Discussion Points

- Including measurements of the number of non-native species and their abundance gets at the fact that one or two species can have a disproportionate impact on the ecosystem.
- A weakness of using an “economic threshold indicator” is that these numbers will vary based on changes in the economy.
- Integrated pest management (IPM) argues against using an economic impact indicator because it does not take into account prevention efforts and does not consider changes in costs that occur in year one of the introduction versus year five.

- Aquaculture is the source of non-natives that may propagate into other systems; this differs from the situation with other agriculture, and may require that aquaculture be treated / reported differently.

Urban/Suburban Ecosystems

The discussion of urban/suburban ecosystems addressed the following issues and questions:

- The group agreed that the universe for urban/suburban ecosystems is the same as the overall non-native species universe – species must be capable of maintaining self-sustaining populations (i.e., those that require cultivation will not be reported).
- The group also agreed that those species that cause ecological damage or that damage infrastructure would also be included, even if they have a human health dimension (e.g., West Nile virus). However, those species whose sole impact is human health (e.g. HIV/AIDS) would not be included.
- The group agreed that the basic pattern indicator developed for other biomes applies to all of the natural and semi-natural areas of the urban/suburban ecosystem (reserves, parks and private property).
- The group agreed that the impact indicators include dollar values:
 - Energy/nutrients needed to maintain
 - Human health impacts
 - Damage to plant/animal/property values

It was suggested that the units be per capita “events” (events/per capita, events/year, events/area). For example, the number of cases of West Nile virus or the number of houses invaded by Formosan termites in New Orleans.

- Key discussion points:
- The group discussed but did not resolve whether the costs associated with protection and control should be included in impact indicators.
- The group discussed but did not resolve whether or how “quality of life” indicators (shade lost, species replacement, personal loss) should be included in the impact indicator.
- There are two levels of invasive species in urban areas: organisms that no one wants such as rats and red imported fire ants and those other organisms that some people consider invasive and others consider desirable.

Invasion Pattern Indicators

During the first meeting non-native Task Group meeting in April 2003, the group put forth a candidate invasion pattern measure comprised of three taxonomic groups, with potential application to all four natural/semi-natural ecosystems (coasts and oceans, freshwater, forests, and grasslands and shrub lands). This indicator would report the degree of invasion within an ecosystem by reporting the percent of the system that has a high degree of invasion, a moderate degree of invasion, and a low degree of invasion (see

below for a brief outline and the Meeting Summary: Non-native Species Task Group April 16, 17 for a complete discussion).

Invasion pattern measure: adding a taxonomic group

Concern was expressed that the method of assessing invasion pattern invertebrates was really only applicable to parasites and pathogens, not other invertebrate species. The group therefore decided to include separate categories for parasites and pathogens and other invertebrates. How the invertebrate category would be measured has not been defined.

Invasion pattern measure thresholds

The invasion pattern measure is intended to describe the degree to which various areas are occupied or invaded by non-native species. This indicator would report the degree of invasion within an ecosystem or biome by reporting the percent of geographic units (such as estuaries, watersheds, or EMAP hexagons) within each major biome that have a high degree of invasion, a moderate degree of invasion, and a low degree of invasion.

Defining “Degree of Invasion”: An overall “degree of invasion” rank would be determined first by assessing the degree of invasion for each of four major taxonomic groups, as described below.

- *Vertebrates*: The percent of total vertebrate biomass that is composed of non-native species (this would be ranked from 0 to 100%).
- *Plants*: The percent of ground that is covered by non-native vascular plants (this could have values from 0 to multiples of 100%).
- *Invertebrates*: An as-yet-undefined metric describing invertebrates that are not included within the parasite / pathogen group.
- *Parasites / Pathogens*: The percent of available host plants that are infested with non-native parasites and pathogens. This would be calculated based on the percent of a host species that is infested times the percent that that host species occupies of the total ecosystem area, summed over all possible hosts. Using this approach, this part of the indicator could have values from 0 to multiples of 100%.

A key component of the indicator is the ability to characterize the degrees of invasion for a taxonomic group (e.g., vertebrates) in an area (e.g., watershed or estuary) as high, medium or low, so that assessments from different taxonomic groups can be compared and combined into an overall “degree of invasion” rank (rules for combining are described below). Thus, we need to “bin” the continuous numerical values derived from the taxonomic-group assessments described above into “high”, “medium”, or “low.”

The group tentatively identified the following as a breakdown of degree of invasion applicable to all taxonomic groups and all biomes.

Low: 0-10%

Medium: 10-50%

High: 50% or greater

The group recognized the need for validation of the breakpoints identified and has sought feedback by sending out a description of this proposed indicator to key people with knowledge and data on these systems.

Feedback is being sought as to whether this set of categorical definitions is reasonable for each combination of major biome and major taxonomic group. In other words does it make sense to characterize non-native vertebrates in forests, non-native plants in coastal systems, and non-native pathogens in farmland systems, etc. in this fashion?

Members of the Task Group volunteered to explore the reasonability of this tentative set of breakpoints for particular taxa and ecosystems and to explore the need for further refinement and tailoring the indicator structure to each biome. The following table lists those who agreed to take on specific tasks (with the exception of Pam Fuller and Sarah Reichard, who were not present. Someone on the group that is working on the same taxa / biome set will contact these individuals to gain their participation. Gaby Chavarria will contact the Wildlife Management Institute, WMI, and the American Bird Conservancy).

	Vertebrates	Plants	Inverts	Pathogens / parasites
Forests	Gaby C WMI ?	Faith C / Jerry B	Jerry B	Jerry B
Grass/Shrub	Gaby C WMI ?	Dick M / Peter	Dave T	Chris D / Gaby C
Coastal	Greg R	Greg R	Greg R	Greg R
Fresh	Dave T / Pam F	Dave T / Pam F	Dave T / Pam F / Richard O	Dave T / Pam F
Urban / Suburban	Chris / Gaby American Bird Conservancy?	Faith C / Sarah R / Nelroy J	Richard O	Jerry B
Farmland		Richard O	Richard O	Richard O

The group agreed that the first and most important step was to identify whether the breakpoints were reasonable, based on an assessment of real data. Members were asked to obtain both the professional judgment about reasonableness of the breakpoints and some basic information about the data on which those judgments were based (i.e., (program / person, citation for source, geographic locations, number of sites/plots, general collection methods, dates).

Deadlines: By August Meeting (if possible), By September 15 (absolute drop dead).

A further step will be to assess the availability of data to report on the pattern indicator, including both large-scale national databases and the best “next-tier” non-national databases.

Combining Taxonomic Ranks into Regional Ranks

One of the things we agreed we needed to do at the end of the meeting was revisit the protocol for defining a place as having low, medium, and high degree of invasion. We expanded the number of taxonomic groups to be assessed from three to four, and no one had a clear thought on how this would change our previous approach.

The old version, which was based on three taxonomic groups (plants, animals, pathogens/pests), was as follows:

- 1) If any taxonomic group is rated as "high" in their assessment, the whole area is ranked HIGH
- 2) If two taxonomic groups are rated "medium", the whole area is ranked HIGH
- 3) If one group is "medium" and the rest are "low", the area is MEDIUM
- 4) If all groups are "low", the area is LOW

In order to expand this to four taxonomic groups, Robin is proposing the following generalized rule, which the Task Group should evaluate to determine whether it is too conservative (see below):

- 1) If ANY group is rated high, the area is rated HIGH
- 2) If any TWO GROUPS are rated medium, the area is HIGH (but, see below)
- 3) If one group is medium, the area is MEDIUM (but, see below)
- 4) If all groups are rated low, the area is LOW

This essentially generalizes the rule we stated originally. However, it is clear that this approach is quite conservative, in that it defines most places with anything but low degree of invasion as a HIGH degree of invasion. For example, if two out of four taxonomic groups have a medium level of invasion (that's half the groups, not 2/3 as it was the first time we set this up), the area gets rated HIGH.

Table 1: Permutation and outcomes with proposed rule applied

OVERALL RATING	# of taxonomic groups with LOW rating	# of taxonomic groups with MEDIUM rating	# of taxonomic groups with HIGH rating
LOW	4	0	0
MEDIUM	3	1	0
HIGH	3	0	1
MEDIUM	2	2	0
HIGH	2	1	1
HIGH	2	0	2

HIGH	1	3	0
HIGH	1	2	1
HIGH	1	1	2
HIGH	1	0	3
HIGH	0	4	0
HIGH	0	0	4
HIGH	0	3	1
HIGH	0	2	2
HIGH	0	1	3
HIGH	0	0	4

*The non-native group must evaluate whether or not this is too conservative a measure.

Invasion Impact Indicators

The Task Group drafted tentative language for an invasion impacts indicator definition, as follows:

Number of instances in which self-sustaining non-native species have caused [negative impacts] [significant changes] to the species composition and function of native species in an ecosystem. To be considered, impacts should be of sufficient magnitude to be considered ecologically significant. Impacts may also be inferred on the basis of strong evidence concerning their abundance, occupation of native species habitat, competition with, predation upon, or parasitism/pathogenicity of native species, modification of the physical environment, or other similar alterations or interactions.

“Instances” were defined as “the occurrence within a geographic unit of a [a self sustaining population of a] species that is defined as having negative impact”. Geographic units could include counties, watersheds, ecoregions, EMAP grid sections, etc.

Invasive Species Indicators Report

Discussion of the invasive species indicators report occurred at the tail end of the meeting. Chris Dionigi agreed to create a diagram describing the universe of species covered in the report and Ann Bartuska and Gary Matlock agreed to write the context section of the report. Other assignments will be made at future meetings. An annotated outline is include as Attachment B.

Attachment A

**Attendance at June 18-19, 2003 Meeting
Non-native Species Task Group**

Ann Bartuska (<i>Chair</i>) Executive Director, Invasive Species Initiative The Nature Conservancy	Peter M. Rice Division of Biological Sciences University of Montana
Jerome Beatty Deputy Director, Forest Health Protection USDA Forest Service	Greg Ruiz Smithsonian Environmental Research Center
Faith Campbell American Lands Alliance	Dave Thomas Director, Illinois Natural History Survey
Gabriela Chavarria Policy Director, Wildlife Conservation National Wildlife Federation	Robin O'Malley, Senior Fellow and Program Director The Heinz Center
Chris Dionigi, Ph.D. Assistant Director for Domestic Policy, Science, and Cooperation National Invasive Species Council Liaison to the National Invasive Species Council and the Invasive Species Advisory Council)	Laura Meyerson AAAS Fellow US EPA NCEA
Nelroy E. Jackson Monsanto (<i>Retired</i>)	Not in attendance
Terri Killeffer Botanical Research Associate NatureServe	Pam Fuller USGS/BRD Nonindigenous Aquatic Species Program Center for Aquatic Resource Studies
Richard N. Mack School of Biological Sciences Washington State University	Tom Stohlgren Biological Resources Division, USGS Natural Resources Ecology Lab
Gary Matlock, Ph.D. Director, National Centers for Coastal Ocean Sciences (NCCOS) National Ocean Service (NOAA)	Sarah Reichard Assistant Professor College of Forest Resources, Center for Urban Horticulture Washington State University
Richard Orr USDA Animal Plant and Health Inspection Service Risk Analysis Systems	Kent Cavendar-Bares, Fellow and Research Associate The Heinz Center

Outline for Invasive Species Indicators Report

Background – Summary of first report and identification of needs

Scope covered by this report (CHRIS –DIAGRAM)

- Definition notes from 6/18
- Limiting to non-native invasive species
- Acknowledge importance of native species acting invasively but state that this will not be a part of the report

Context (ANN, GARY)

- Why did every ecosystem type identify invasive species as an issue? Use 2002 report language
- Many land and resource management accomplishments are being compromised and the ability to accomplish management goals is being hindered by non-native invasive species; some uses of ecosystems by humans also being affected (but not true for some fishery management such as striped bass restoration);
- Recognition of benefits of invaders (may have negative impacts as well)
- Unpredictability of invasions
- Global context

Approach to Issue

- Theoretical basis for indicators - Population biology vs. ecosystem function
- Staged approach / order of preference:
 1. Number
 2. Aspect dominance
 3. Impact focus

Discussion by ecosystem types

- Coasts and Oceans
- Freshwater
- Forests
- Grasslands and shrub lands
- Farmlands
- Urban/suburban

Monitoring systems

- What already exists?
- Can we measure proposed indicators?