Prevention and Pathways Update

The following brief outlines ongoing and potential future work related to prevention and pathways for the movement of invasive species that could be undertaken by the joint Aquatic Nuisance Species Task Force (ANSTF)/National Invasive Species Council (NISC) prevention working group in conjunction with other interested groups and efforts. Section 1 outlines a conceptual framework for prevention and pathways that seeks to integrate past, present and potentially future work in a more cohesive structure. Section 2 reviews updates to diagrams that identify potential pathways across a number of sectors.

1. Framework for work on pathways

Pathways are the variety of ways that invasive species are introduced or spread intentionally or unintentionally through some form of human mediation into a new environment. Their identification and management is increasingly a focus for attention at a number of geographic levels. For example, from the global perspective, international trade and transport have long played a role in moving goods and individuals, along with invasive hitchhikers, around the planet. At the national level, countries are increasingly looking at ways to improve border controls and sanitary and phytosanitary requirements to keep invasive species from entering. And at the site level, managers are struggling with how to deal with the fact that they may be on the receiving end of pathways over which they have limited control.

In the fall of 2012, the ANSTF adopted a recommendation calling for the joint-ANSTF/NISC prevention working group to "provide guidance for pathway management plans and a list of pathways to be considered for plan development." This recommendation builds on the working group's efforts to develop materials on pathway ranking, prioritization and risk analysis in 2005 and 2007.[1] Taken together these efforts combine to provide the methodological building blocks for prevention by identifying, assessing and restricting the successful introduction and establishment of invasive species associated with particular pathways. Recognizing ongoing work in a number of these areas, the following interconnected areas could be integrated using a stepwise approach:

1) Identification of pathways: Understanding the potential range of pathways establishes the context for identifying those that may be relevant to a particular geography, sector or project. Building on the previous publications by the ANSTF/NISC prevention working group, draft pathway diagrams in the areas of trade and living organisms, transportation, and infrastructure and resource management have been updated and are now available for comment (see Section 2).
2) Risk assessment[2]
    a. *Species*: fundamental to understanding the risk posed by a particular pathway is some knowledge of the species that it may move and the potential risk that they present. On the plant side, USDA APHIS has revised its pest risk assessment procedures in a manner

[1] These publications are available at http://invasivespecies.gov/global/prevention/prevention_index.html.
[2] Note: historically there were two task groups under the ANSTF/NISC prevention working group focused on risk analysis and screening, which developed some materials that might provide input into future work in this area.

that is being mirrored by a number of states. FWS is developing a screening tool, initially focused on aquatic organisms, and other methods are being tested by a number of academic and non-governmental entities. This work could be reviewed, collated and summarized.

b. *Individual pathway*: To prioritize management decisions around pathways, decision-makers need to understand the risks associated with relevant pathways. While not part of the ANSTF charge from 2012, a range of tools and initiatives currently exist including those by USDA APHIS, USACE, USGS, SERC and the ANSTF/NISC working group in 2007. Collation and review of recent developments in individual pathway risk assessment models and examples could be a future project.

c. *Multiple pathways*: After identification of relevant pathways and their individual risk, an understanding of the relative risks across pathways is necessary to inform management measures and resource allocation. Currently, there are only a limited number of examples and research efforts in this area partially due to data constraints, uncertainties and the paucity of tools to effectively compare risk using different parameters for different pathways. Collation and support for the development of comparative pathway risk assessment models and examples could be a future area of work.

3) Management plan guidance: Once a priority pathway has been identified, a plan needs to be put in place to detail the measures necessary to mitigate risks and to identify responsible actors, resources and implementation steps. Per the 2012 ANSTF request, development of guidance on preparation of pathway management plans is ongoing.

Recognizing the diversity of geographies both in terms of coverage and jurisdiction (e.g., state, region, nation) and socioeconomics and biogeography (e.g., ANS regions), these tools could be used by ANS regional panels, government agencies and others to assess risks and set priorities. Those priorities could then serve as a basis for future work on specific pathways.

2. Pathway diagrams

Attached are revised draft diagrams for pathways associated with trade and living industry, transportation, and infrastructure and resource management, as well as for crosscutting sectors and natural spread.[3] These categories have been modified from the original categories included in the 2005 and 2007 ANSTF/NISC reports which include diagrams for living industry, transportation and miscellaneous pathways. The current set of diagrams builds on these efforts and includes additional input from experts and more recent examples. It should be noted that there is no assessment of the magnitude or prioritization of the level of risk they present as that may differ according to the geography/site of concern.

The aim is to provide the final product in both a hard copy/static version as well as in a more interactive, on-line version that allows the user to view explanatory notes and, in the future, to access available guidance on the management of that particular pathway. The interactive on-line version recognizes the continuing evolution of the scientific and management knowledge about pathways and thereby would

[3] A draft, on-line version can be viewed at https://mm.tt/133945172?t=Oqm90jhKwF.

maintain the flexibility to evolve accordingly. The current iteration uses "mind-mapping" as a representational tool, which will require further evaluation of its flexibility, accessibility and potential for integration into other web-based media.

The diagrams were constructed in view of the functional role of the pathway in question (e.g., as an organism in trade or as a particular type of vehicle). While such an approach may facilitate the initial identification of a pathway according to category, it does not necessarily help identify related pathways within a sector or sphere of activity. For example, pathways related to recreational fishing, including boats and trailers, fishing gear, and bait are located in different portions of the existing diagrams, yet they are all closely related to a particular type of activity. For this reason, the pathway overview now includes a separate section using the concept of crosscutting areas to identify related pathways within a sector. A few indicative examples are included and further input is welcome on additional content for those examples or other areas that should be included.

In revising the pathway diagrams a few questions or issues require further consideration:

1. Definitions: the 2005 and 2007 pathway diagrams did not include definitions for each pathway. These could be developed to further the explanatory power of the diagrams and be included as an annex to the static version or as a descriptive element of the interactive version. However, reaching agreement on definitions may in itself be a difficult undertaking.
2. Examples: the interactive version includes indicative examples for a number of pathways for clarification purposes. Should this be done uniformly for all listed pathways?
3. Management guidance: compilations of pathway guidance are currently limited and existing guidance is often spread across websites and informational resources maintained by a range of governmental and nongovernmental entities. Future versions of the interactive diagrams could include links to websites and materials outlining available guidance.
4. Cross-cutting areas: as previously noted, input would be useful on the value of including cross-cutting areas as well as specific suggestions on what to include.

Comments

For interested individuals, comments would be most welcome by **30 June 2014** on the following items:

- The broader framework outlined at the start of this document that includes pathway diagrams, risk assessment (for individual and multiple pathways) and management plan guidance.
- The four issues related to the diagrams outlined in Section 2; and
- The attached diagrams on trade and living industry, transportation, and infrastructure and resource management pathways, as well as on cross-cutting sectors (or alternatively the draft, on-line versions of those same diagrams).

Please submit to:

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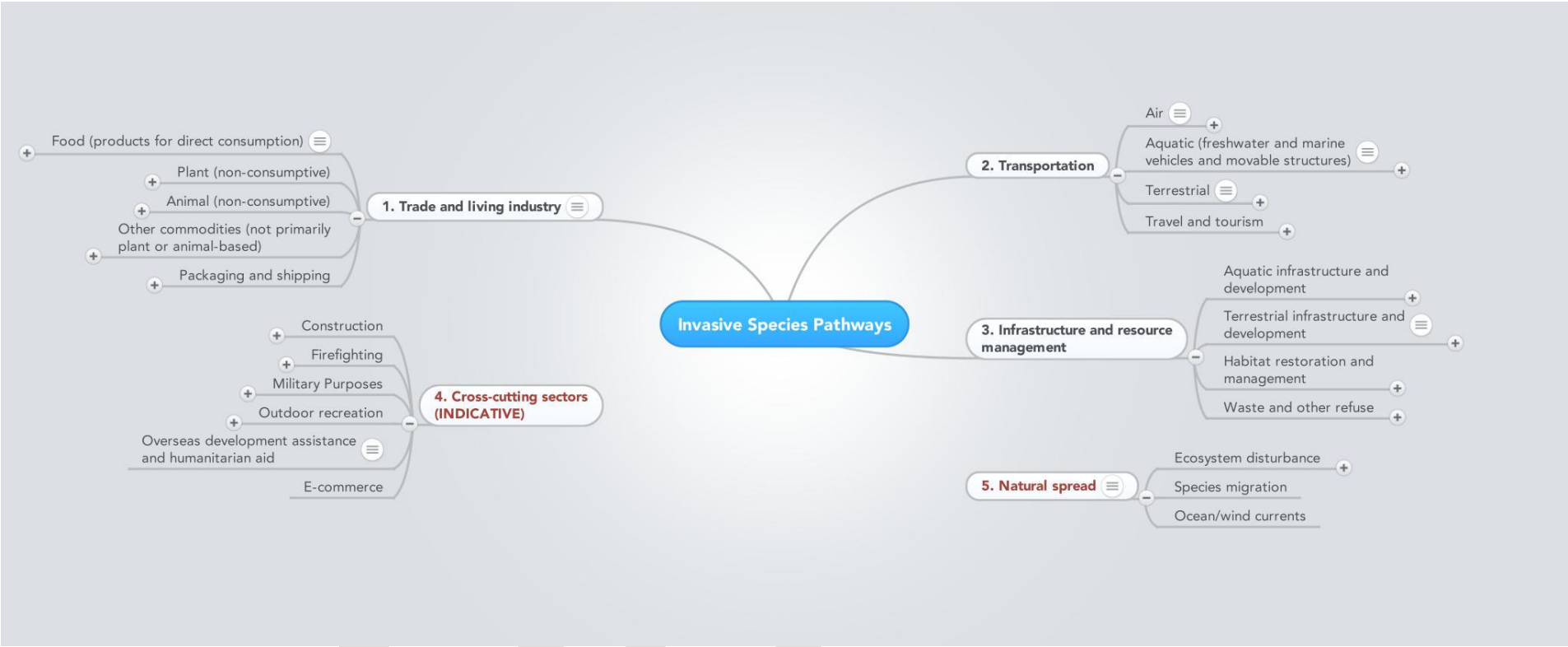
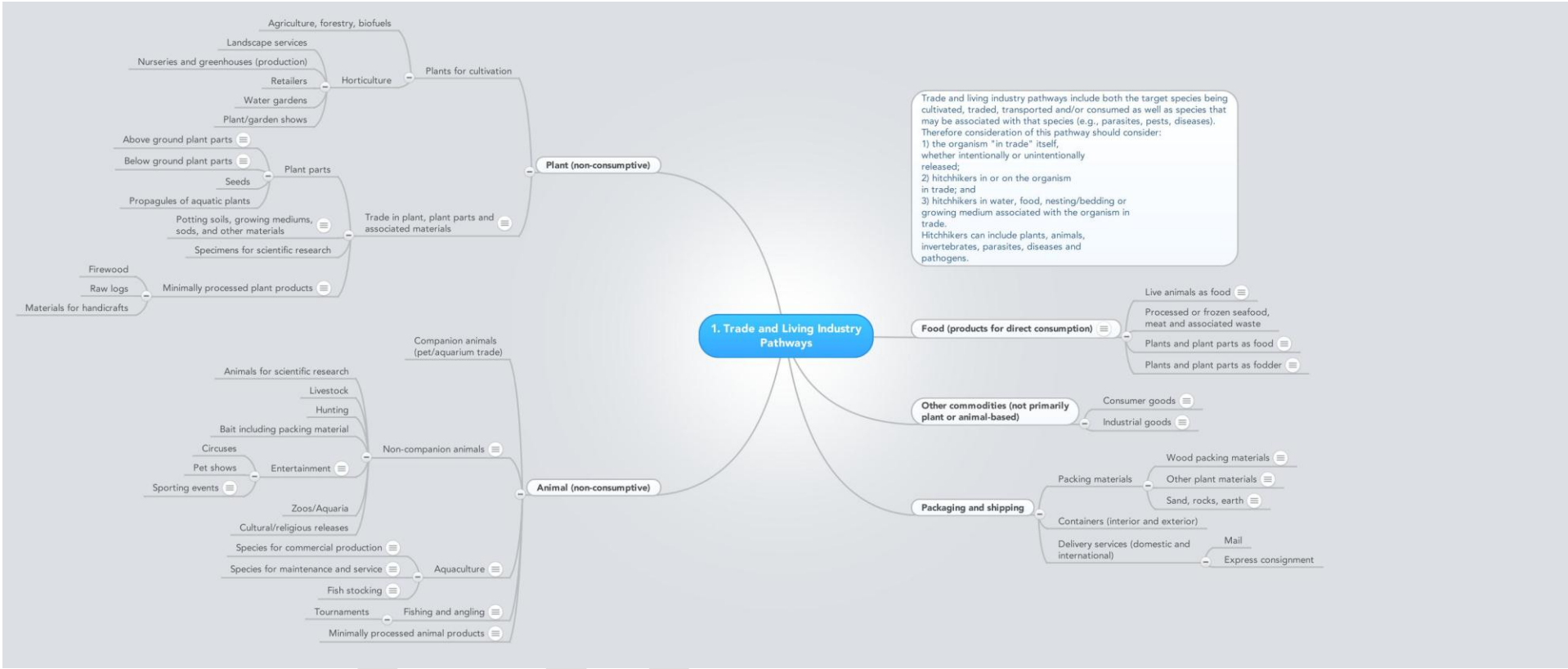
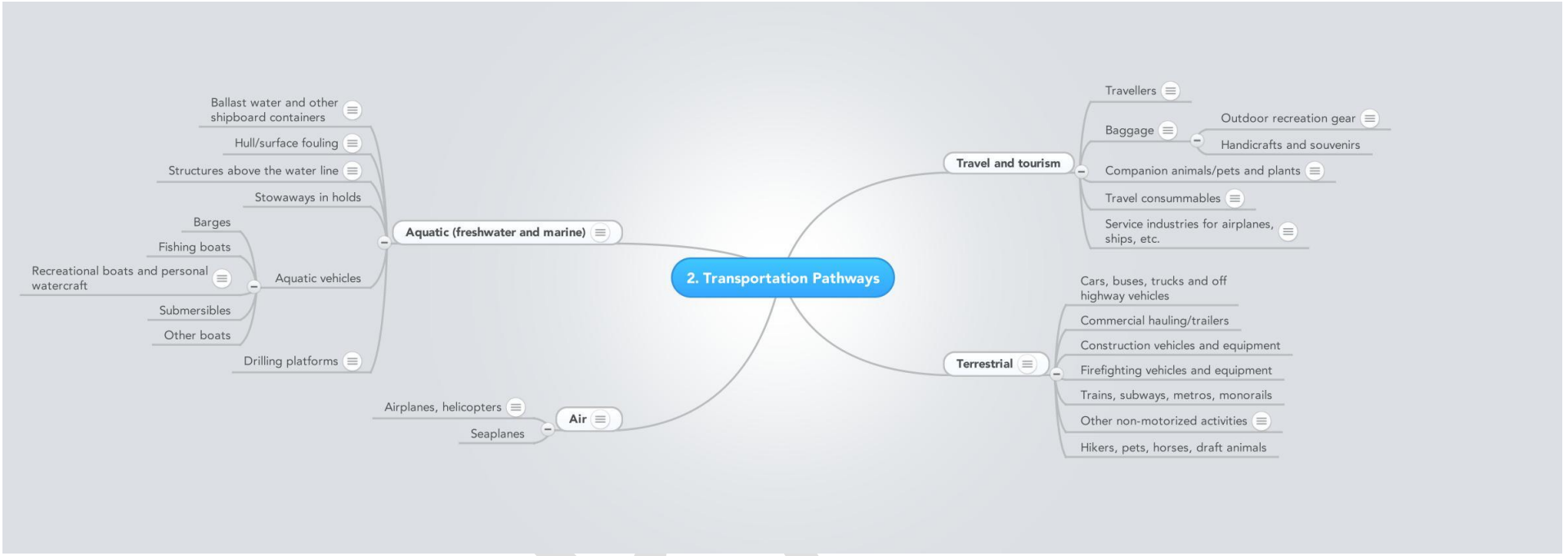
Invasive Species Pathways – Overview



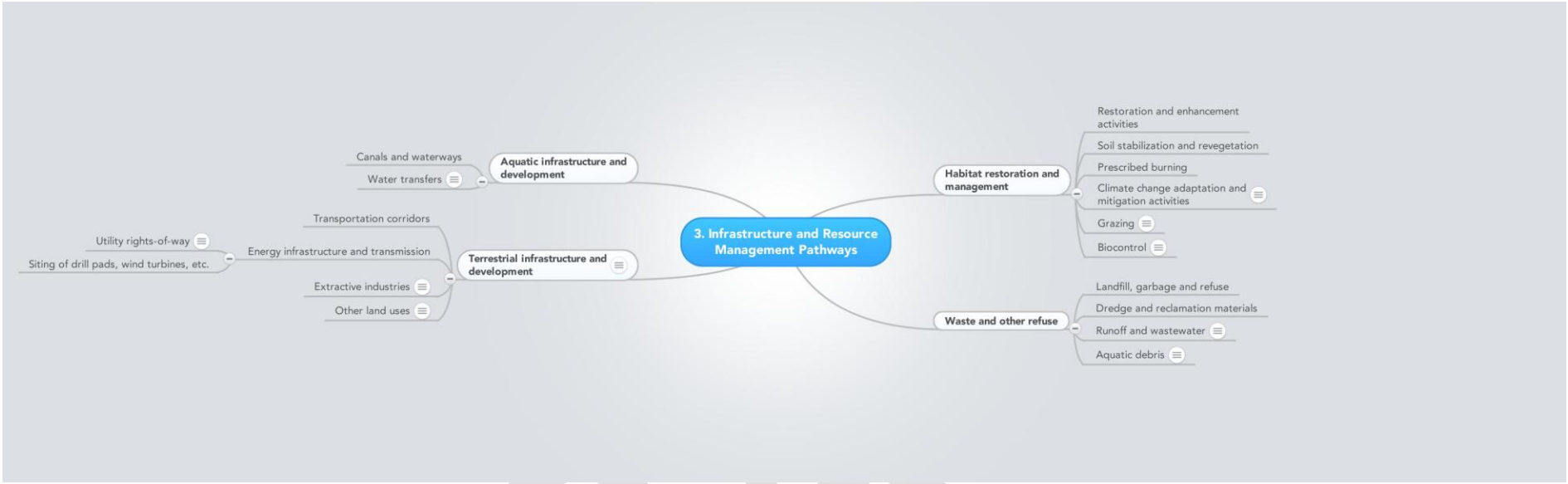
1. Trade and Living Industry Pathways



2. Transportation Pathways



3. Infrastructure and Resource Management Pathways



4. Crosscutting Sectors and Natural Spread