



CLIMATE CHANGE & INVASIVE SPECIES

Northwest Regional
Practitioner Survey
Results

June 2021

Cover Photos: Upper left - North Coast-Cascades Network Invasive Plant Management Team and Olympic National Park staff in the backcountry at Olympic National Park's Elwha River. Middle - zebra mussels. Bottom - scotch broom. All photos are public domain.

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Background

The Northwest Regional Invasive Species and Climate Change (NW RISCC) Network is a community of practice dedicated to helping practitioners address the nexus of climate change and invasive species, including plants, animals, and pathogens. The objective of the Network is to help managers and planners within federal, tribal, state, and local agencies and conservation organizations (hereafter referred to as “organizations”) integrate climate change science and adaptation with invasive species prevention, early detection, control, monitoring, and research activities (hereafter referred to collectively as “invasive species management” activities).

NW RISCC Advisory Team



This report shares the results of an online survey, adapted from others released by the Northeast and Pacific Islands RISCC Networks (see Beaury et al. 2020¹), to gather feedback from regional practitioners²—primarily those with interest and/or experience in invasive species management and climate change adaptation—on:

- The degree to which they are considering the nexus of climate change and invasive species;
- Emerging practices and policies that may address the dual goals of reducing climate-related vulnerabilities and invasive species management efforts; and
- Needs, opportunities, and limitations faced by practitioners in the region.

The survey was distributed via regional listservs and through contacts of Advisory Team members. Responses were collected through SurveyMonkey between October 2020 and January 2021 with 304 participants from across the Northwest region (e.g., Washington, Oregon, Idaho, Montana, British Columbia).

Key Takeaways

Respondent Demographics

- The majority of participants:
 - Represent **federal** (28%), **state/provincial** (26%), or **local** (24%) government agencies
 - Work in **project/program management** (35%) or **on-the-ground operations** (30%) (e.g., land stewards, field technicians)
 - Have **10 or more years of experience** in their current profession (57%)
 - Represent organizations focused on **species and habitat conservation and restoration** (38%) and **general natural resources management** (26%)
 - Operate in **Washington** (54%), **Oregon** (41%), and **Idaho** (16%)
- The most common management priorities across all respondents are **biodiversity** (66%), **rare species and habitats** (58%), **habitat connectivity** (56%), and **freshwater resources** (56%).

Managing Invasive Species in a Changing Climate

- On average, respondents currently spend **more time addressing existing invasive species** than new invasive species.

¹ Beaury EM, Fusco EJ, Jackson MR, Laginhas BB, Morelli TL, Allen JM, Pasquarella VJ, Bradley BA. 2020. Incorporating climate change into invasive species management: insights from managers. *Biological Invasions* 22:233–252. <https://doi.org/10.1007/s10530-019-02087-6>

² The survey was open to all interested participants, including scientists, conservation practitioners, field crew personnel, fire managers, agency leads, agricultural specialists, and more.

- The majority of respondents indicate that they/their organizations are **very or somewhat concerned** about the effects of climate change on invasive species management.
- Only three percent (3%) of respondents indicate that they are **not knowledgeable** about the impacts of climate change on invasive species.
- Seventy-three percent (73%) of respondents indicate that their organizations integrate climate change into invasive species management at least **some of the time**.
- Forty-nine percent (49%) believe they are currently **holding ground** against invasive species.
- The highest priorities for climate-informed invasive species management include **native community resilience** (62%) and **environmental degradation** (60%).
- Invasive species of concern that were most frequently mentioned as challenges both **currently and within the next 10–20 years** include: zebra mussels, reed canary grass, knotweeds, and scotch broom.

Limitations

- Limitations that consistently affect practitioners' ability to successfully manage invasive species and integrate climate change into management activities include **staff capacity, funding, and other management priorities**. Factors that become more of a challenge with climate change include **technical expertise** and **the availability of and/or access to information, models, and data**.

Decision-Making Needs: Knowledge, Products, and Services

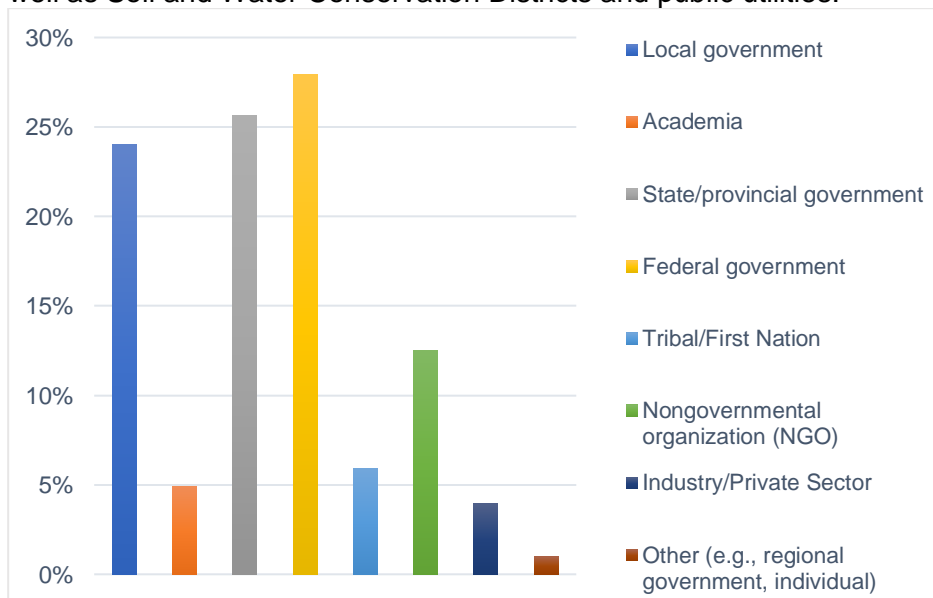
- Most participants rely on **best practices and lessons learned** (91%) and **knowledge from peers** (91%) to make decisions. Fewer rely on **land cover or use data** (44%) and **models** (38%).
- Respondents indicated a desire for climate projections at a **medium- to long-timeframe** (i.e. 10+ years) and at a **watershed** scale.
- The majority of respondents indicated a strong desire for the following products and activities from the NW RISCC Network: **case studies** (59%), **targeted guidance on integrated climate change and invasive species management** (59%), **workshops/webinars** (54%), and **peer-to-peer knowledge exchange** (53%).

Respondents: Background and Demographics

Respondents were asked to identify their professional affiliation, position type, years of experience, and the state(s) and sector(s) in which they work.

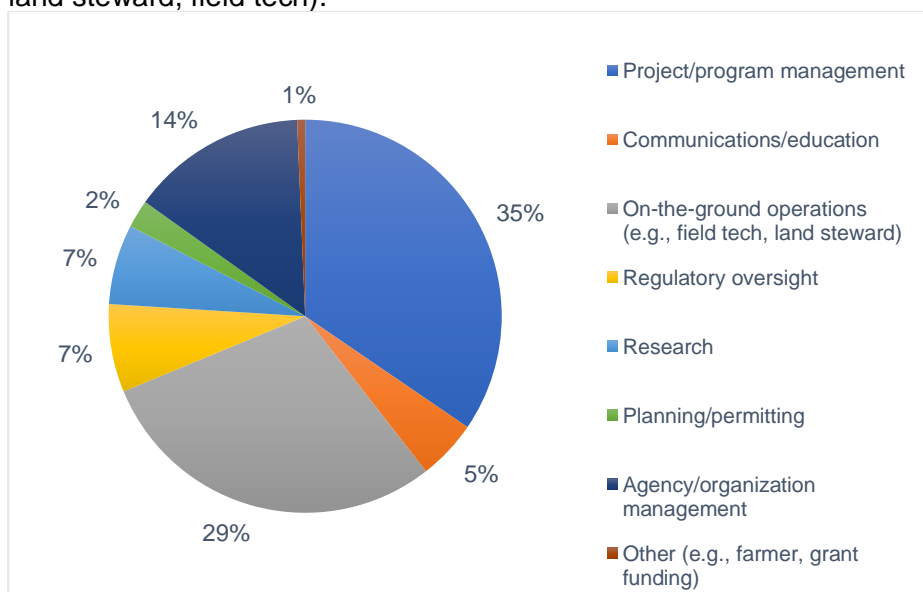
Organization type (n=304)

The largest number of survey participants represented federal (28%), state or provincial (26%), or local (24%) government agencies. Local government entities included city and county government agencies as well as Soil and Water Conservation Districts and public utilities.



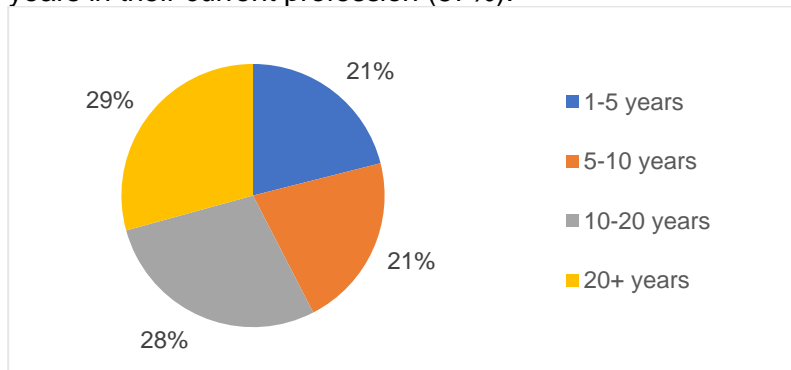
Primary role (n=304)

Respondents identified across a range of position roles, including project and program management (35%), on-the-ground operations (30%), agency and organization management (14%), regulatory oversight (7%), research (7%), communications and education (5%), and planning and permitting (2%). Those working for government entities—federal, Tribal/First Nation, state/provincial, city and county—covered the majority of role types, while nongovernmental organizations (NGOs) and private sector groups primarily included respondents in management (organizational or project/program) or on-the-ground operational roles (e.g., land steward, field tech).



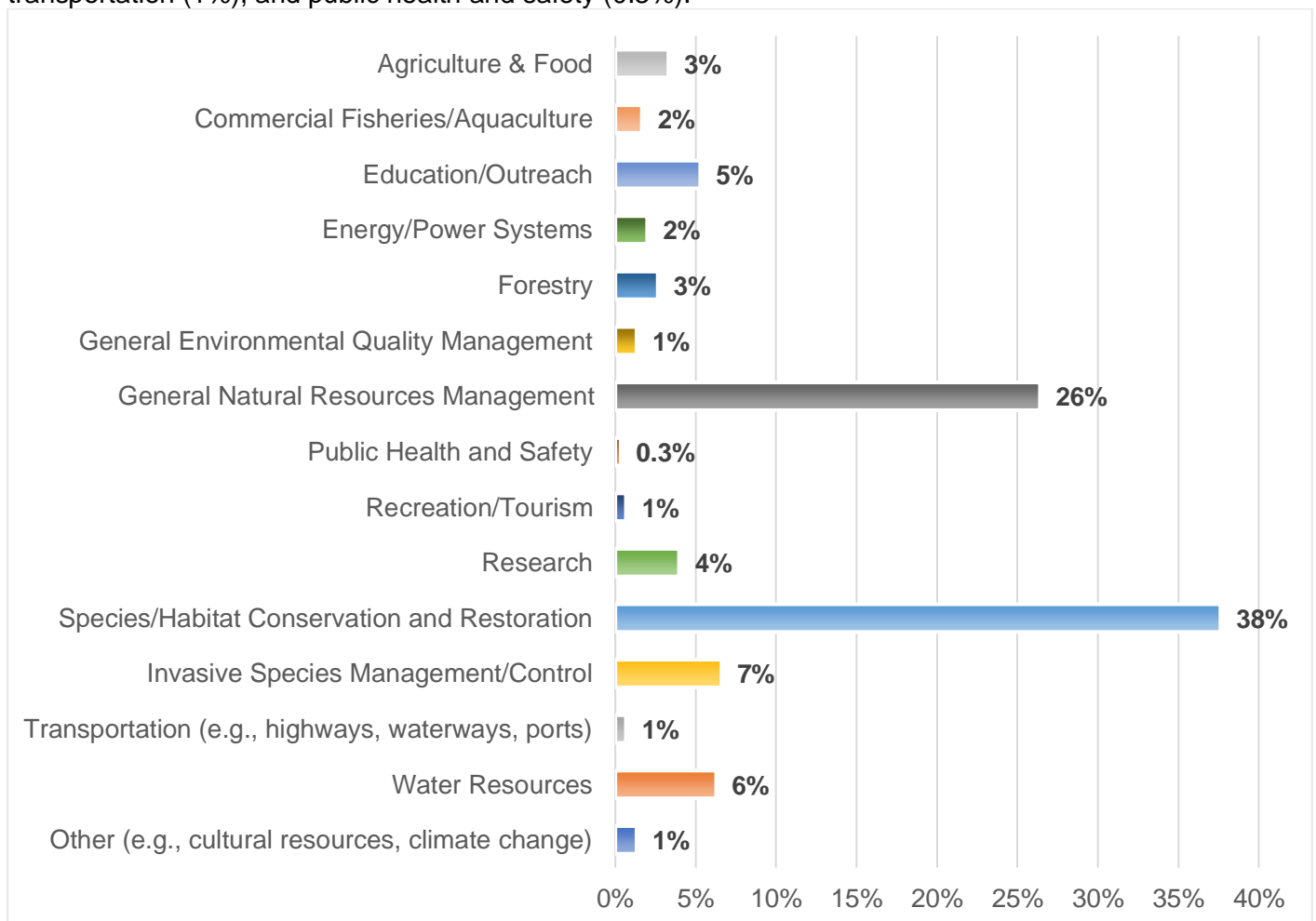
Years in current profession (n=304)

Respondents are distributed across years of experience, with the majority representing 10–20 or more years in their current profession (57%).



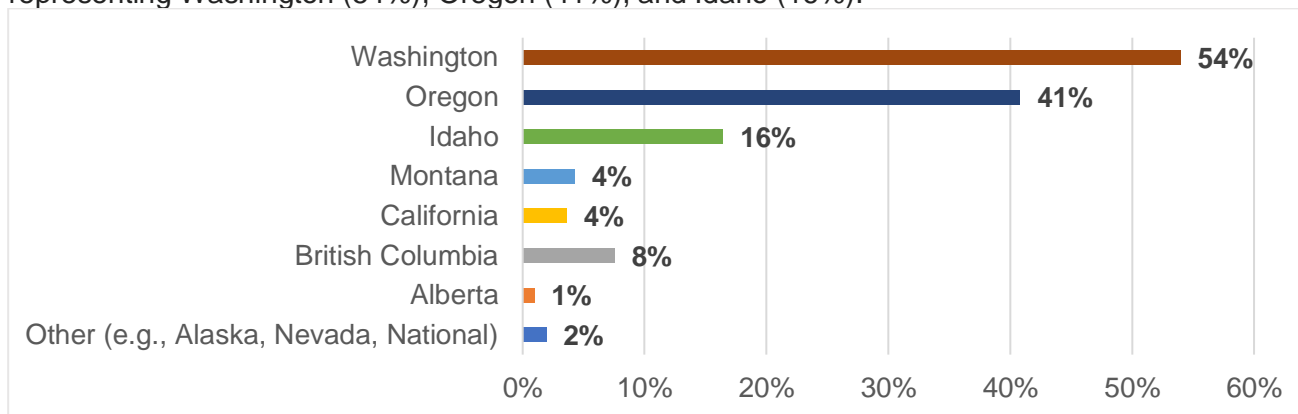
Primary sector (n=304)

Respondents primarily represented entities focusing on species and habitat conservation and restoration (38%) and general natural resources management (26%). About 7% of respondents indicated that they exclusively work on invasive species management and control. The lowest participation included those representing agriculture (3%), forestry (3%), fisheries (2%), energy (2%), recreation/tourism (1%), transportation (1%), and public health and safety (0.3%).



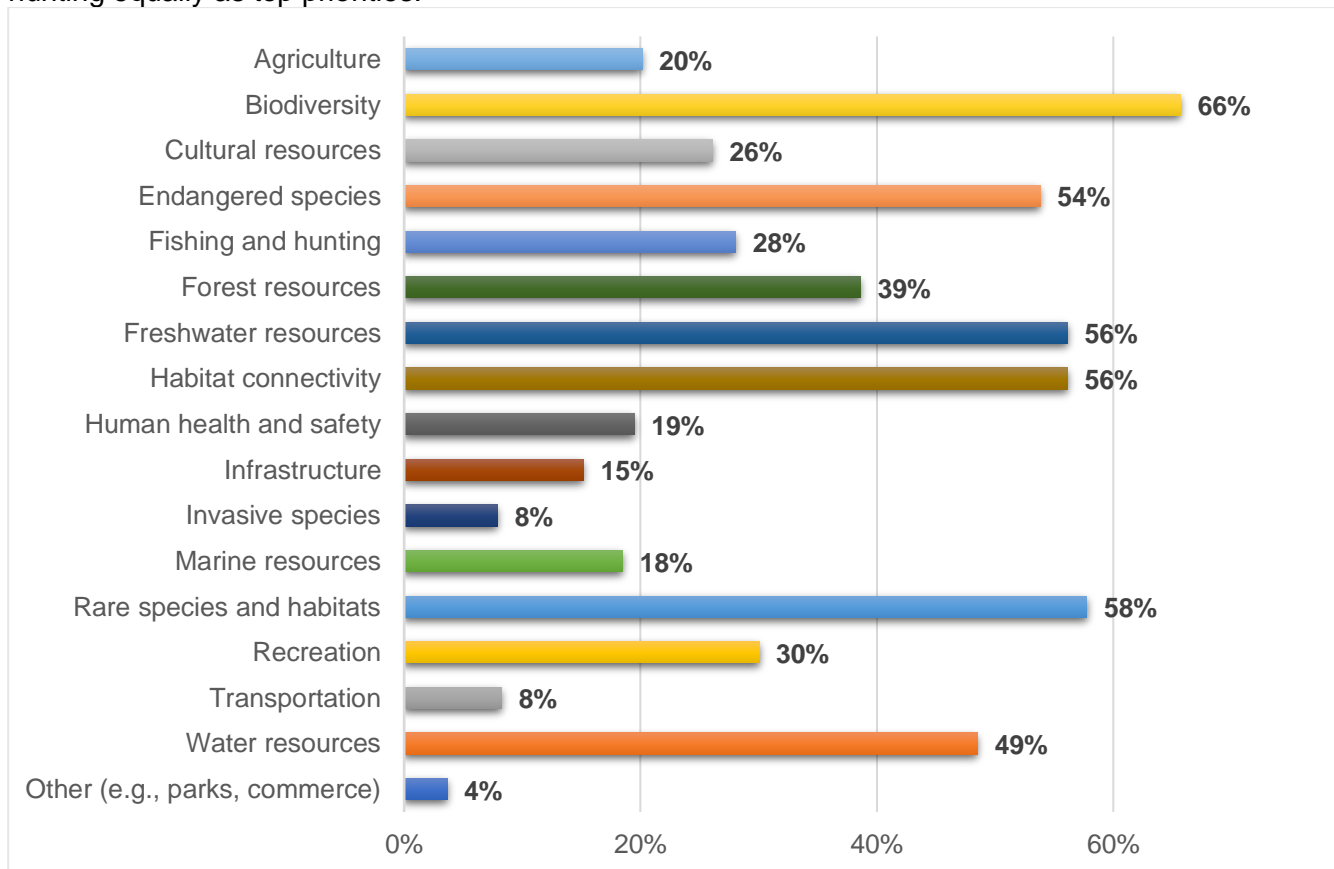
State(s)/Province(s) (n=304)

Respondents were also asked to indicate the state(s) or province(s) in which they work, with the majority representing Washington (54%), Oregon (41%), and Idaho (16%).



Management priorities (n=304)

The most common priorities across all respondents included biodiversity (66%), rare species and habitats (58%), habitat connectivity (56%), freshwater resources (56%), and endangered species (54%). Less frequently noted priorities included agriculture (20%), human health and safety (19%), marine resources (18%), infrastructure (15%), and transportation (8%), likely a reflection of lower survey participation from these sectors. Biodiversity was the top noted priority among local and state/provincial government and NGO respondents, while federal participants ranked rare and endangered species as their highest priorities. Tribal and First Nation respondents prioritized cultural resources, freshwater resources, and fishing and hunting equally as top priorities.

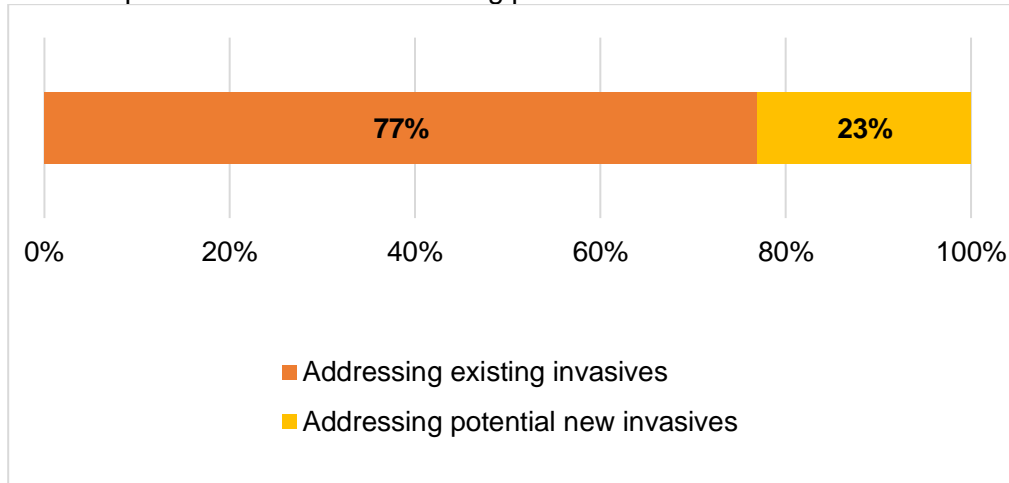


Managing Invasive Species in a Changing Climate

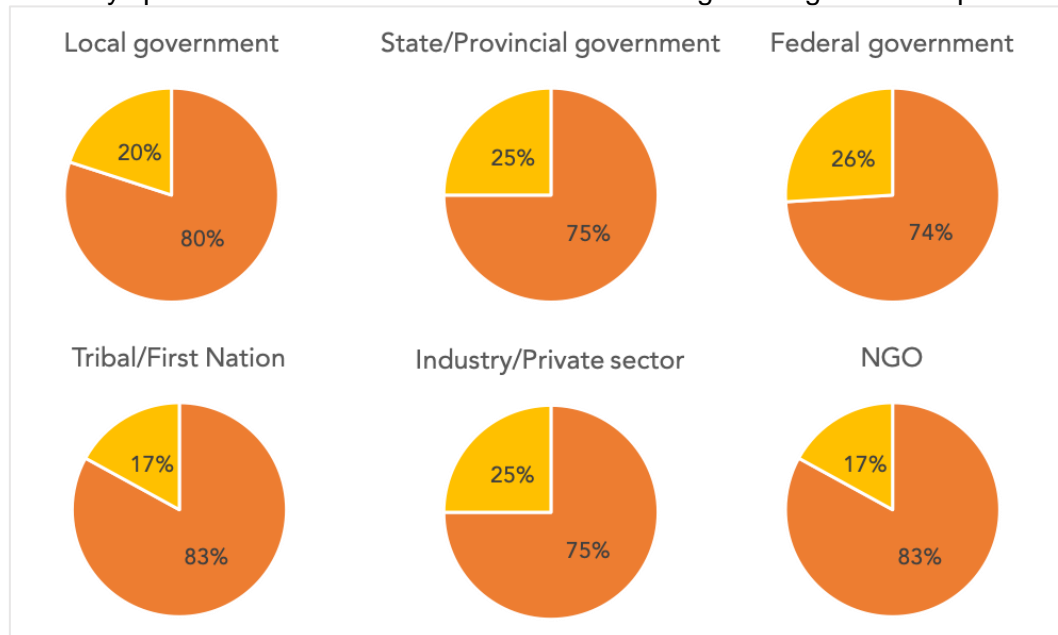
Participants were asked for input on current management challenges as well as perceived future concerns, particularly the effects of climate change on the ability of managers to successfully respond to invasive species.

Time spent addressing current versus potential new invasive species (n=296)

On average, respondents currently spend most of the time addressing existing invasive species (77%) and about a quarter of the time addressing potential new invasions.

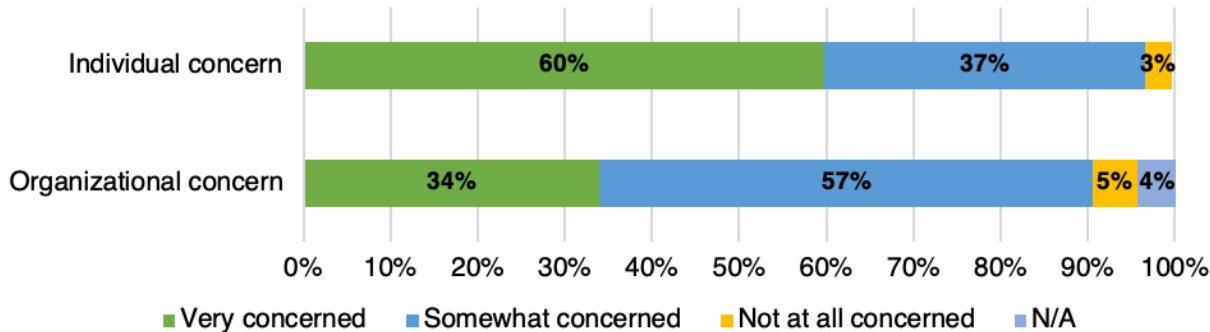


Only local government (80%), Tribal/First Nation (83%), and NGO (83%) respondents indicated that they currently spend more than 77% of the time addressing existing invasive species issues.

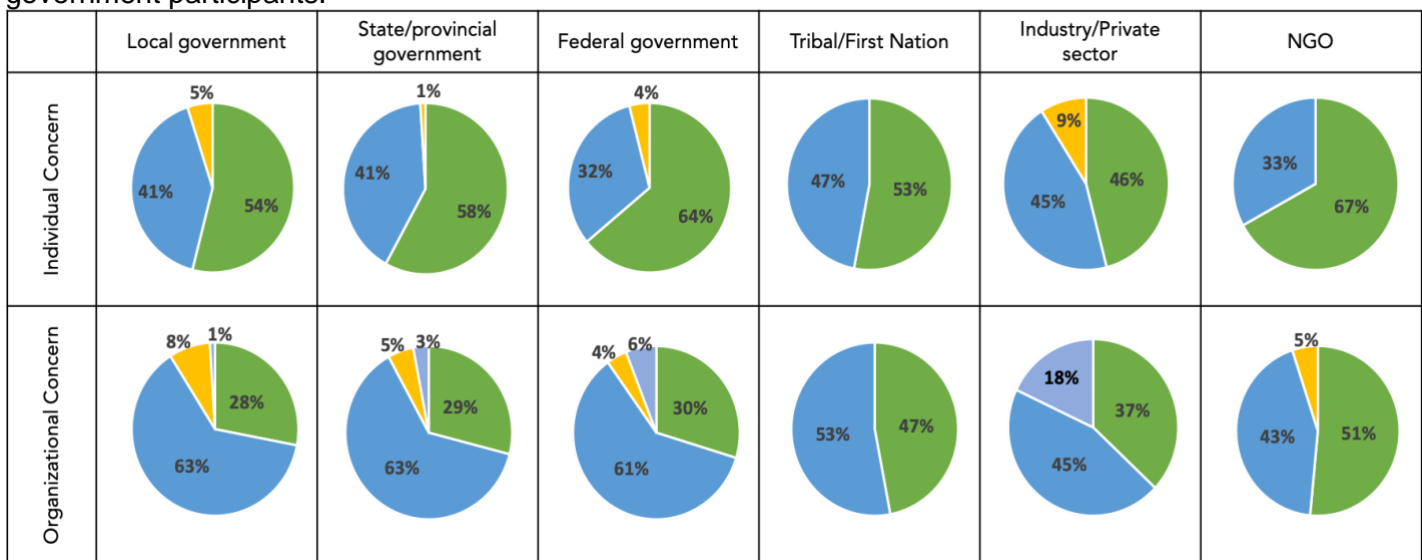


Level of concern about the effects of climate change on invasive species management (n=303)

Sixty percent (60%) of respondents indicated that they are “very concerned” about the effects of climate change on invasive species management. In contrast, only 34% of respondents believed that their organizations are “very concerned” about climate change with higher “not at all concerned” (5%) and “not applicable” (4%) answers than individual respondents.

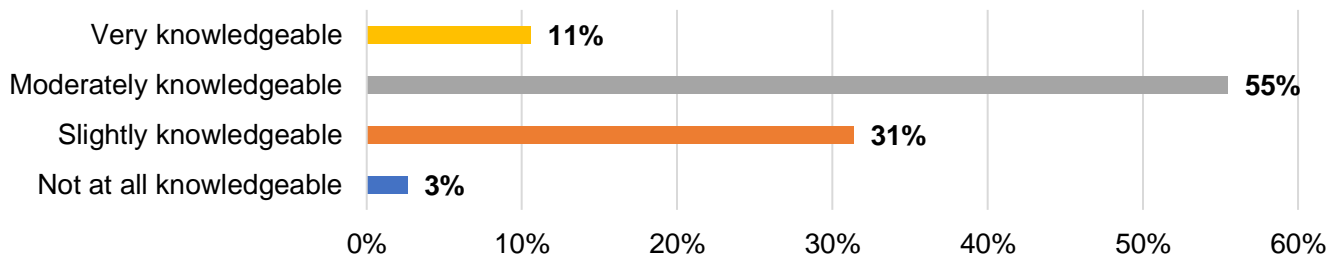


Overall, respondents indicated a higher level of individual concern than their organizations, with the biggest gaps between “very concerned” answers noted between individuals and local, state/provincial, and federal government participants.



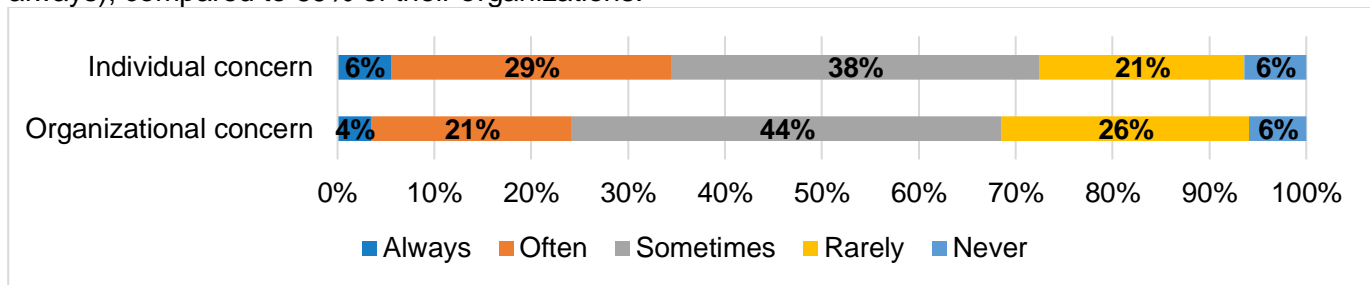
Level of knowledge about the nexus of invasive species management and climate change (n=303)

Respondents indicated that they are very (11%), moderately (55%), or slightly (31%) knowledgeable about climate change, with only 3% indicating that they are not at all knowledgeable.








Extent to which climate change is currently incorporated into invasive species management decisions (n=298)

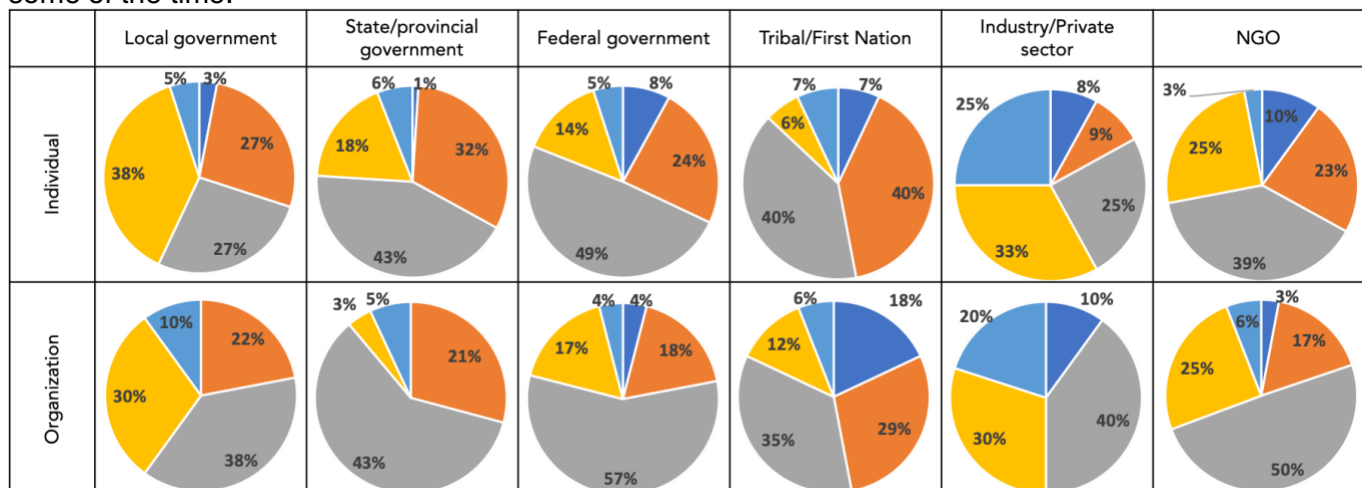
Seventy-three percent (73%) of respondents indicated that, as individuals, they integrate climate change into invasive species management at least some of the time (e.g., 38% sometimes, 29% often, and 6% always), compared to 69% of their organizations.



Of the top-represented sectors among survey respondents, those working in the water resources field had a higher indication of rarely or never integrating climate change into invasive species management decisions (44%) compared to overall respondents (27%) and those representing education/outreach (23%), invasive species (24%), natural resources management (28%), and species/habitat conservation and restoration (25%).

			Always	Often	Sometimes	Rarely	Never
		<i>Percentage of All Respondents</i>	6%	29%	38%	21%	6%
<i>Rankings by Sector (those representing >5% of all respondents)</i>		Education/Outreach	0%	38.5%	38.5%	15%	8%
		Water Resources	6%	25%	25%	44%	0%
		Invasive Species	6%	29%	41%	18%	6%
		Natural Resources Management	10%	29%	33%	22%	6%
		Species/Habitat Conservation and Restoration	3%	25%	47%	21%	4%

Respondents from Tribal/First Nation and federal government entities indicated that they are more likely than other agencies and organizations to integrate climate change into invasive species decisions at least some of the time.

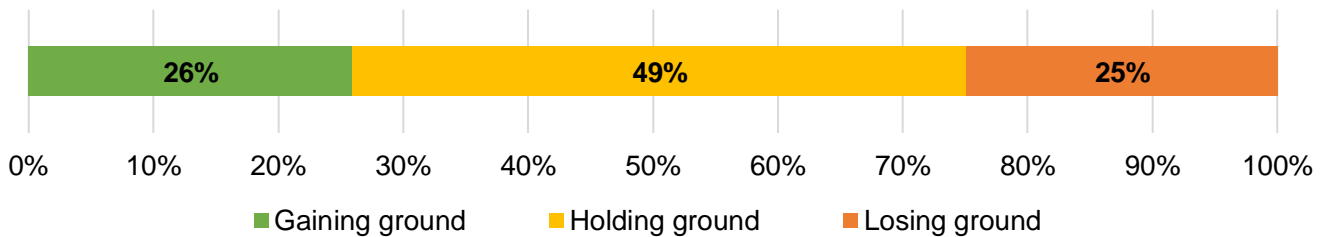


Examples of how climate change is being incorporated into invasive species management activities

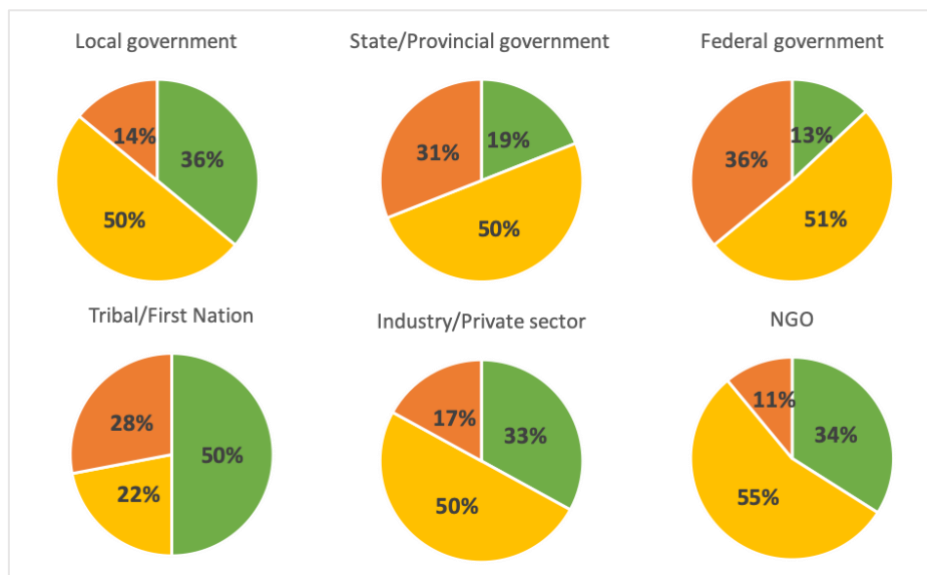
- Monitoring stream temperatures and potential changes in the distribution of native and non-native species
- Evaluating how non-native species affect the ability of habitats to recover from droughts and wildfires
- Modeling to time pest survey and eradication activities
- Choosing revegetation materials based on temperature and precipitation projections (e.g., using species expected to fare better in a hotter, drier future)
- Investing in landscape-scale restoration rather than small-scale and/or isolated restoration projects to build habitat resistance and resilience
- Prioritizing the protection and recovery of ecosystem functions rather than the management of specific species
- Revegetating disturbed sites and using climate models to determine which species and in what configuration(s) will best survive
- Collecting seed from various locations and aiming for high diversity (i.e. multiple species and phenotypes) in planting

Success in managing invasive species (n=301)

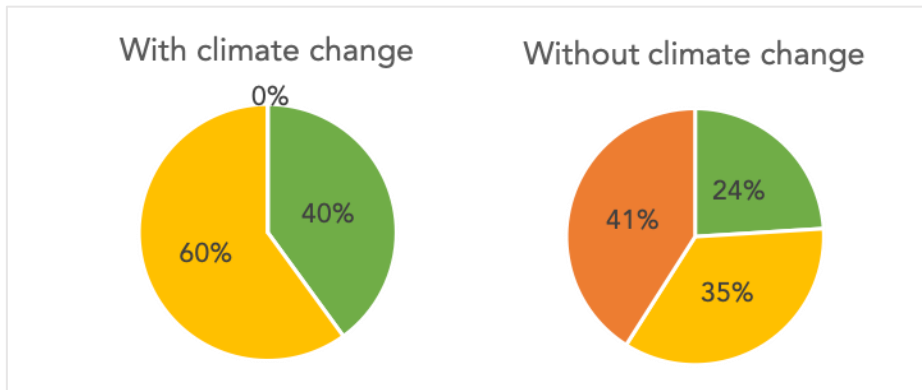
Twenty-five percent (25%) of respondents indicated that they are losing ground against invasive species, while 49% are holding ground and 26% are gaining ground.



Federal and state/provincial representatives indicated less optimism that management efforts are helping to gain ground on invasive species (13% and 19%, respectively).

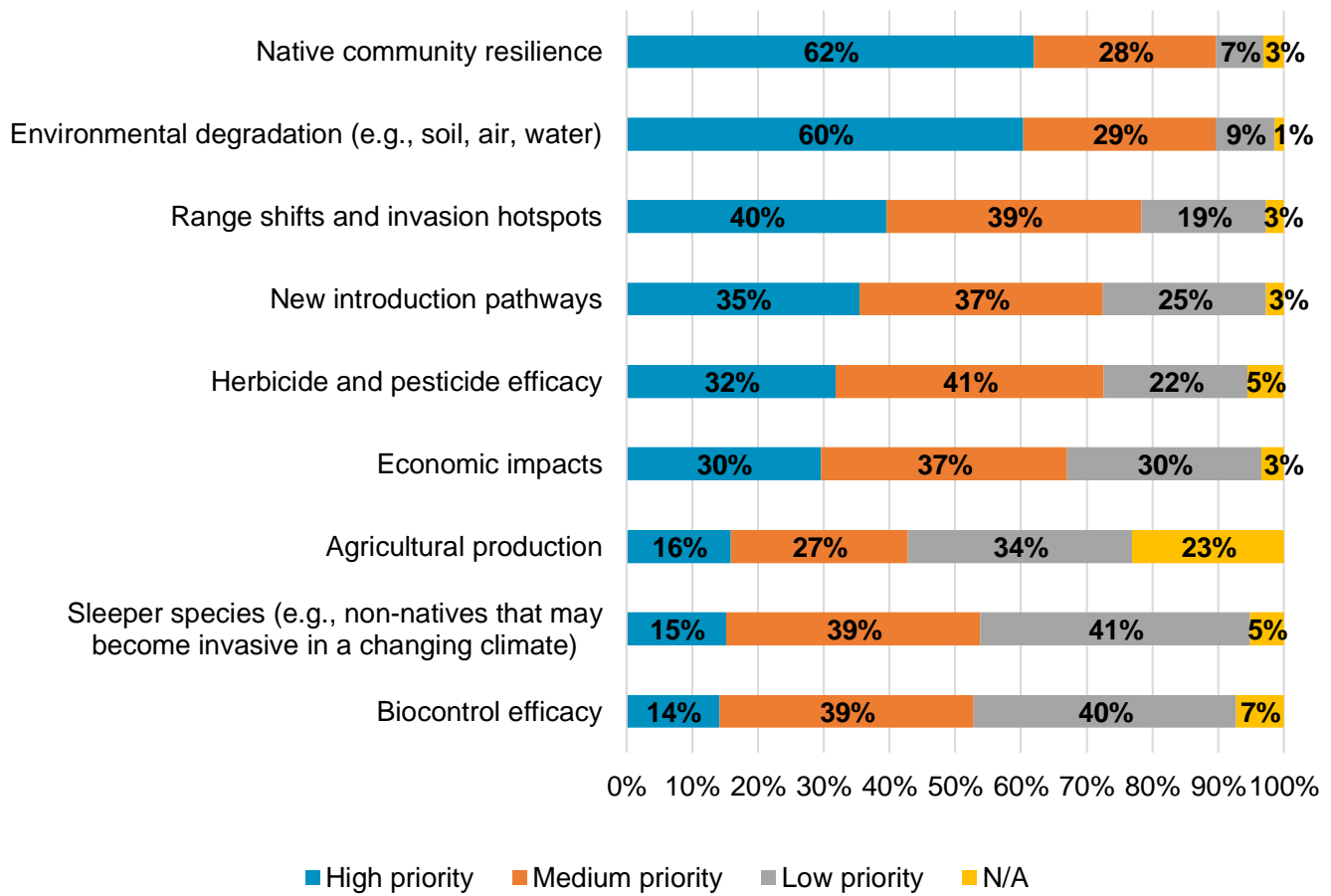


Among respondents whose organizations currently incorporate climate change into invasive species management activities, 0% indicate they are losing ground. Those who are not considering climate change indicate that they are losing ground (41%).



Priorities related to invasive species management in a changing climate (n=294)

Respondents were asked to reflect on priorities for integrated climate change and invasive species management. The highest priorities across all respondents were native community resilience (62%) and environmental degradation (e.g., soil, air, water) (60%), while the lowest priorities were sleeper species (e.g., non-natives that may become invasive) (41%) and biocontrol efficacy (40%).



Invasive species that pose the greatest threat to management goals currently and in the next 10-20 years

Participants were asked to reflect on which invasive or non-native species pose the greatest threat to their management goals both currently and within the next 10–20 years. These species lists include 234 plants (68%), animals (28%), and pathogens (3%). The most frequently mentioned species under both current and future threats are zebra mussels (*Dreissena polymorpha*), reed canary grass (*Phalaris arundinacea*), knotweeds (*Polygonum spp.*), and scotch broom (*Cytisus scoparius*). Several species were listed more frequently as future concerns compared to current priorities, including the emerald ash borer (*Agrilus planipennis*, +67%), puncture vine (*Tribulus terrestris*, +133%), and North Africa grass (*Ventenata dubia*, +550%). Eighteen species, including 12 plants and six animals, are only listed as “future” threats. A complete list of species is included in the Appendix.

Top five most frequently mentioned invasive or non-native species or species groups that are current or future threats to management priorities.

Greatest threat to <u>current</u> management goals (n=1017)	Greatest threat to management goals <u>in the next 10–20 years</u> (n=740)
Reed canary grass = 48	Quagga mussels (<i>Dreissena bugensis</i>) = 40
Blackberry species (e.g., <i>Rubus spp.</i> , <i>Rubus armeniacus</i> , <i>Rubus bifrons</i> , <i>Rubus laciniatus</i>) = 47	Zebra mussels = 39
Knotweeds = 42	Knotweeds = 34
Scotch broom = 39	Reed canary grass = 30
Zebra mussels = 38	Scotch broom = 22

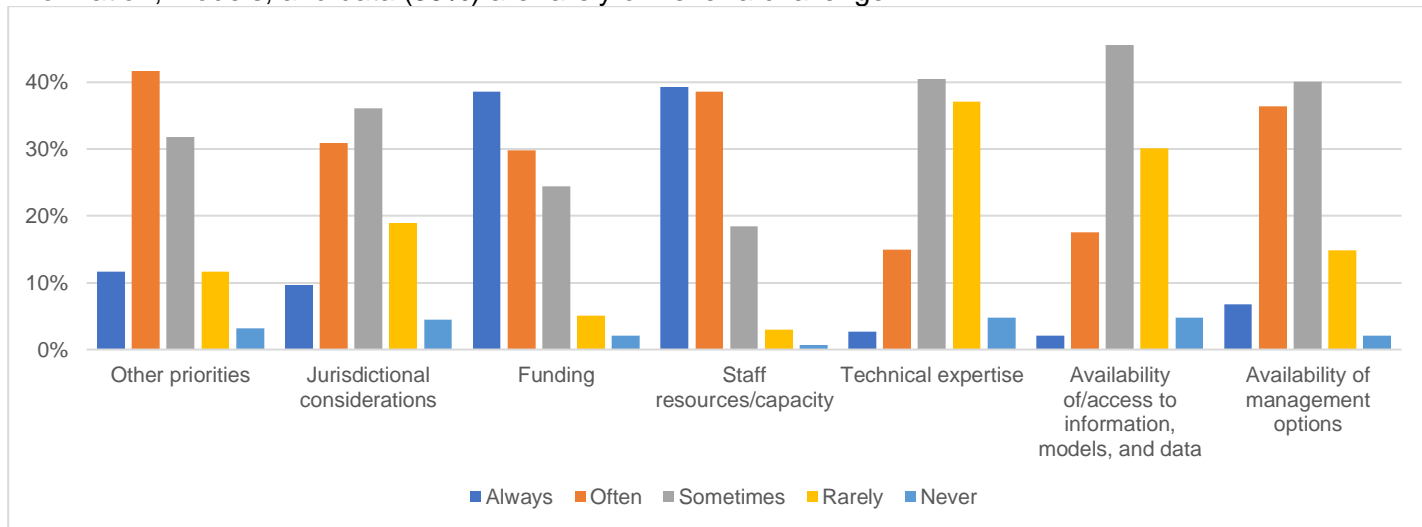
Species listed only as future threats in the region.

<i>Bambusoideae</i>	Bamboo
<i>Carduus nutans</i>	Musk thistle
<i>Cichorium intybus</i>	Chicory
<i>Cortaderia selloana</i>	Pampas grass
<i>Digitaria spp.</i>	Crabgrasses
<i>Melaleuca quinquenervia</i>	Broad-leaved paperbark
<i>Nanozostera japonica</i>	Japanese eelgrass
<i>Pelargonium spp.</i>	Geraniums
<i>Prunus padus</i>	Bird cherry
<i>Saccharum ravennae</i>	Ravenna grass
<i>Tamarix spp.</i>	Salt cedar
<i>Thymelaea passerina</i>	Spurge flax
<i>Channidae / Channa spp.</i>	Snakehead fish
<i>Eriocheir sinensis</i>	Mitten crab
<i>Linepithema humile</i>	Argentine ant
<i>Oithona davisae</i>	Invasive zooplankton
<i>Corbicula fluminea</i>	Asian clam
<i>Pseudodiaptomus forbesi</i>	Invasive zooplankton

Limitations

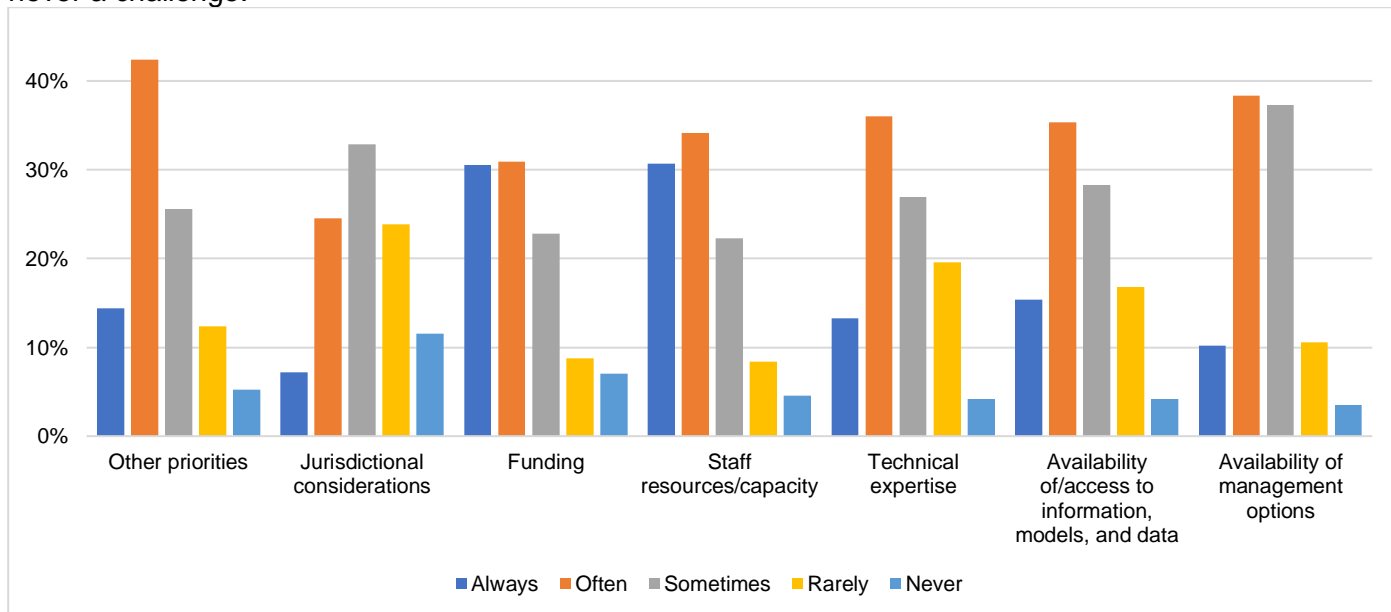
Challenges associated with successfully managing invasive species (n=298)

Participants were asked to indicate which factors affect their ability to successfully manage invasive species and how frequently these limitations are experienced. Among the factors that are always or often a challenge, the most frequently mentioned were staff resources and capacity (78%), funding (68%), and other priorities of importance (53%), while technical expertise (42%) and availability of and access to information, models, and data (35%) are rarely or never a challenge.

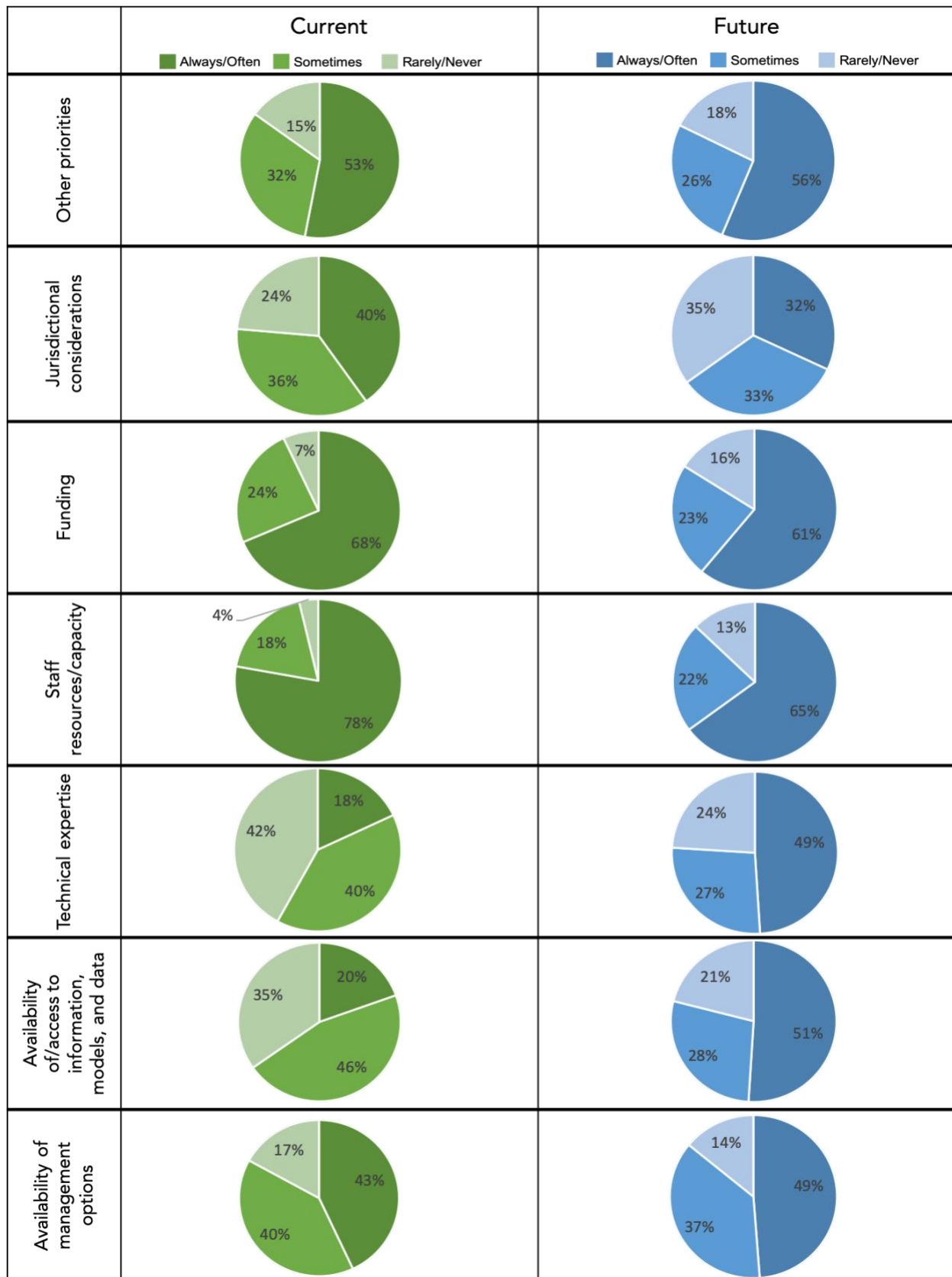


Challenges associated with incorporating climate change into invasive species management (n=287)

Participants were asked to indicate which factors affect their ability to integrate climate change into invasive species management and the frequency of these limitations. Among the factors that are always or often a challenge, the most frequently mentioned were staff resources and capacity (65%), funding (61%), and other priorities (57%), while jurisdictional considerations (35%) and technical expertise (24%) are rarely or never a challenge.



Under both current and future conditions, consistent challenges include staff capacity, funding, and other priorities. Of the factors that are *always* or *often* a concern to respondents, several become more important with the onset of climate change, with the largest increases in technical expertise and the availability of and/or access to information, models, and data.

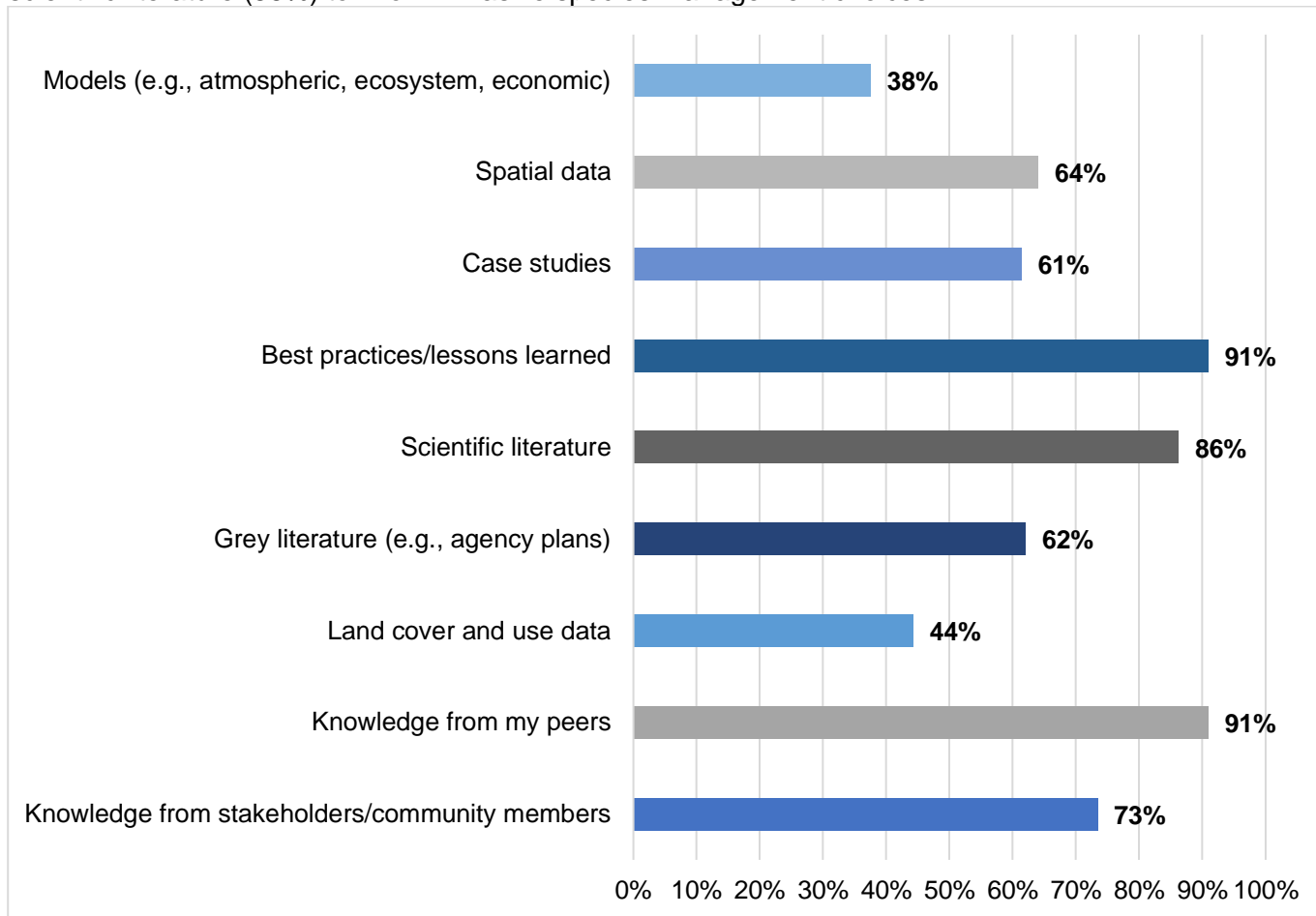


Decision-Making Needs: Knowledge, Products, and Services

Participants were asked what information they use to make decisions as well as what is needed to make more informed decisions in a changing climate.

Information currently used to make decisions on invasive species (n=298)

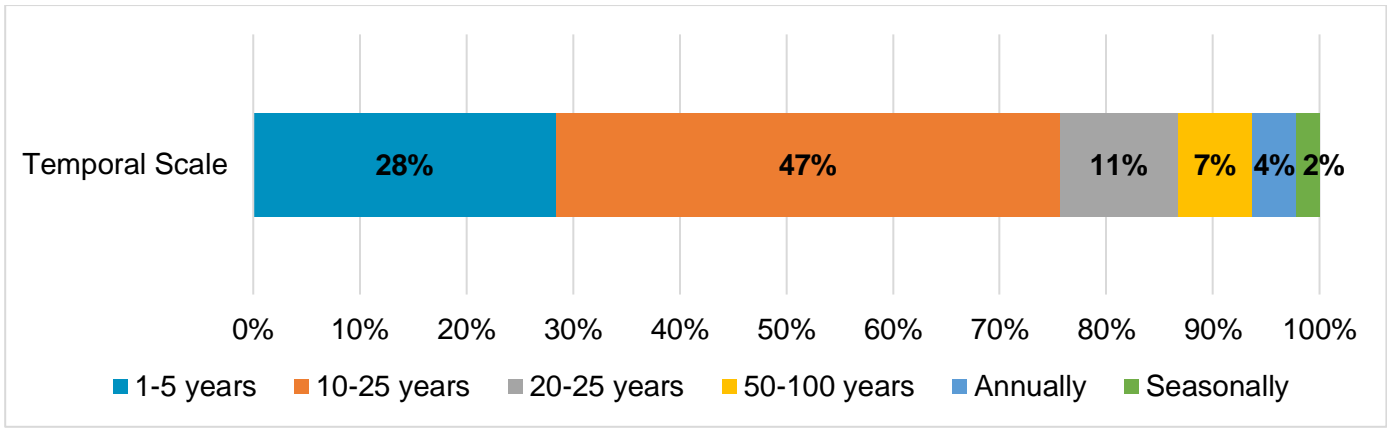
Most respondents rely on best practices and lessons learned (91%), knowledge from peers (91%), and scientific literature (86%) to inform invasive species management choices.



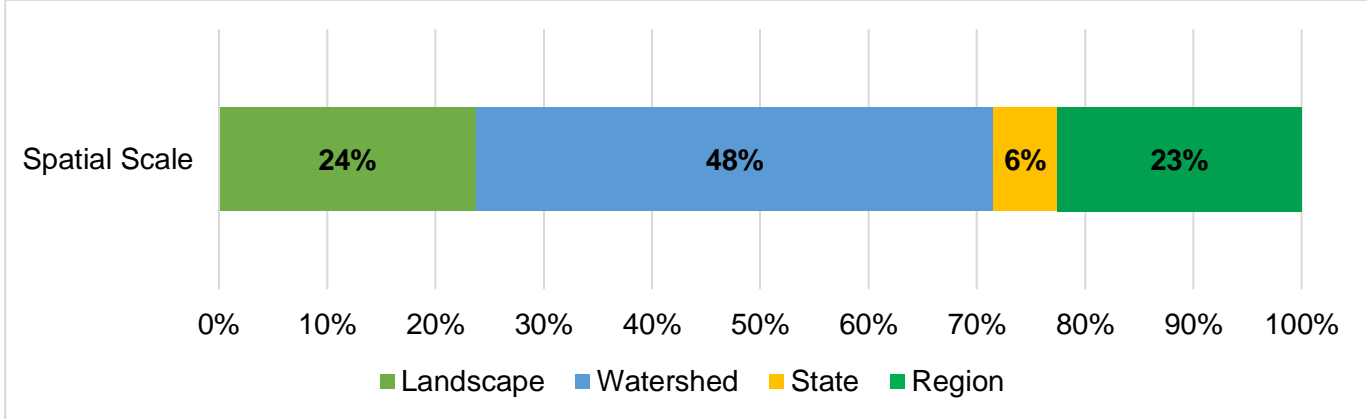
Temporal and spatial scales of climate projections needed to best manage invasive species (n=272)

Participants were asked to reflect on the ideal temporal and spatial scales for climate projections to best manage invasive species. A timeframe of 10–25 years was largely preferred by respondents (47%) with over 65% of respondents indicating a preference for projections of at least 10 years. Some respondents indicated that temporal scales of agency management plans and climate projections do not line up:

- “Almost everything I do is on a short-term timescale (1–5 years). I have to show results now...and have very few resources to work towards a 5–25 year timescale or longer nor agency patience to wait.”
- “It would be ideal to have climate projections that match the temporal and spatial scales for agency strategic plans, and incorporate those projections as part of the strategic goals and annual work plans.”
- “My agency has some institutional resistance to using timescales longer than 20–30 years.”



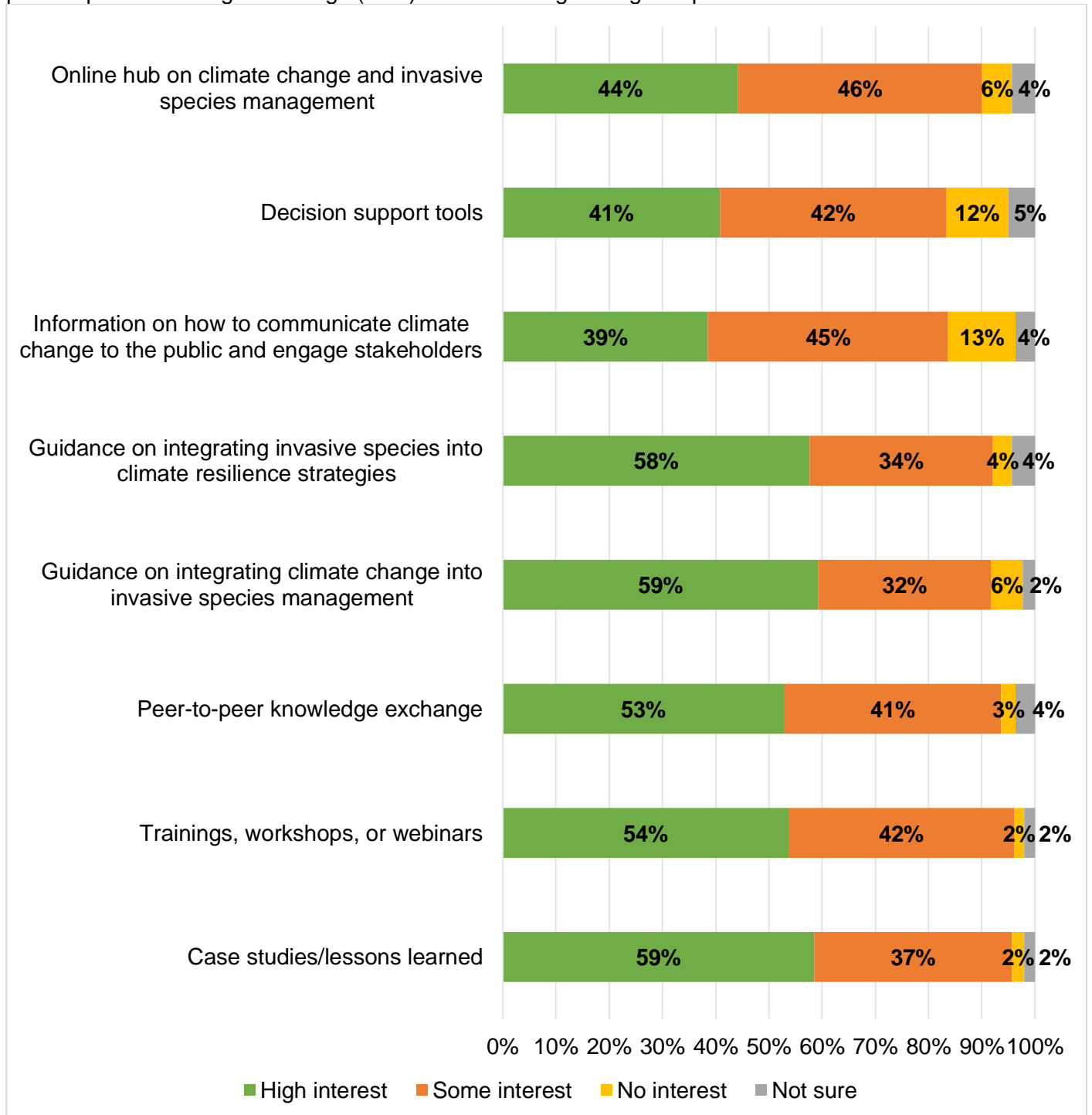
With respect to spatial scales of projections, most respondents preferred a watershed scale (48%). Many respondents indicated that all four spatial scales are relevant depending on the invasive species and the affected ecosystem(s). Comments submitted by respondents indicated some confusion over the difference in terminology between *landscape*, *watershed*, and *region*, however, so supplementary surveys should clarify the differences and similarities between these terms.



At least one respondent indicated that more refined projections will only get invasive species managers so far: “More science is great, but if we don’t have an inclusive decision-making process of how to prioritize across scales, and when to stop controlling certain species, the science can only be sort of helpful.”

Desired products/activities from NW RISCC (n=303)

Participants were asked to identify what products or activities the NW RISCC Network could provide to better support practitioners. Case studies (59%), targeted guidance (59%), workshops/webinars (54%), and peer-to-peer knowledge exchange (53%) ranked among the highest preferences.



Appendix: Current and future species/species groups of concern.

* Indicates species has not yet been observed/recorded in the Northwest.

Scientific Name	Common Name	Current Concern	Future Concern	Habitat Type	Species Type
<i>Angelica</i> spp.	Wild celery	X		Aquatic	Plant
<i>Butomus umbellatus</i>	Flowering rush	X	X	Aquatic	Plant
<i>Elodea</i> spp.	Elodea	X	X	Aquatic	Plant
<i>Hydrilla verticillata</i>	Hydrilla	X	X	Aquatic	Plant
<i>Iris pseudacorus</i>	Yellow flag iris	X	X	Aquatic	Plant
<i>Ludwigia hexapetala</i>	Water primrose	X	X	Aquatic	Plant
<i>Ludwigia peploides</i>	Floating primrose-willow	X	X	Aquatic	Plant
<i>Ludwigia</i> spp.	Primrose-willow, water primrose	X	X	Aquatic	Plant
<i>Lysimachia vulgaris</i>	Garden loosestrife	X	X	Aquatic	Plant
<i>Lythrum salicaria</i>	Purple loosestrife	X	X	Aquatic	Plant
<i>Myriophyllum aquaticum</i>	Parrot feather	X	X	Aquatic	Plant
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	X	X	Aquatic	Plant
<i>Myriophyllum</i> spp.	Milfoil	X	X	Aquatic	Plant
<i>Nymphoides peltata</i>	Yellow floating heart	X	X	Aquatic	Plant
<i>Phalaris arundinacea</i>	Reed canary grass	X	X	Aquatic	Plant
<i>Phalaris canariensis</i>	Canary grass	X		Aquatic	Plant
<i>Phragmites australis</i>	Common reed	X	X	Aquatic	Plant
<i>Potamogeton crispus</i>	Curlyleaf pondweed	X	X	Aquatic	Plant
<i>Schoenoplectus mucronatus</i>	Ricefield bulrush, Bog bulrush	X	X	Aquatic	Plant
<i>Spartina</i> spp.	Cordgrasses	X	X	Aquatic	Plant
<i>Typha angustifolia</i>	Narrowleaf cattail	X	X	Aquatic	Plant
<i>Nanozostera japonica</i>	Japanese eelgrass		X	Aquatic	Plant
<i>Oithona davisae</i> *	Invasive zooplankton		X	Aquatic	Animal
<i>Scirpoides holoschoenus</i> *	Roundhead bulrush	X		Aquatic	Plant
<i>Myxobolus cerebralis</i>	Whirling disease	X	X	Aquatic	Pathogen
<i>Didymosphenia geminata</i>	Didymo / Rock snot	X	X	Aquatic	Diatom
<i>Ameiurus nebulosus</i>	Brown bullhead	X	X	Aquatic	Animal
<i>Cambarus</i> spp. / <i>Orconectes</i> spp. / <i>Procambarus</i> spp.	Crayfish	X	X	Aquatic	Animal
<i>Carassius auratus</i>	Goldfish	X	X	Aquatic	Animal

Scientific Name	Common Name	Current Concern	Future Concern	Habitat Type	Species Type
<i>Centrarchidae</i>	Sunfishes	X	X	Aquatic	Animal
<i>Chelydra serpentina</i>	Common snapping turtle	X		Aquatic	Animal
<i>Ctenopharyngodon idella</i>	Grass carp	X	X	Aquatic	Animal
<i>Cygnus olor</i>	Mute swan	X		Aquatic	Animal
<i>Cyprinus carpio</i>	Common carp	X	X	Aquatic	Animal
<i>Dreissena bugensis</i> *	Quagga mussels	X	X	Aquatic	Animal
<i>Dreissena polymorpha</i> *	Zebra mussels	X	X	Aquatic	Animal
<i>Esox lucius</i>	Northern pike	X	X	Aquatic	Animal
<i>Esox masquinongy</i>	Muskie (Muskellunge)	X		Aquatic	Animal
<i>Hypophthalmichthys molitrix</i> *	Silver carp	X	X	Aquatic	Animal
<i>Hypophthalmichthys nobilis</i> *	Bighead carp	X	X	Aquatic	Animal
<i>Hypophthalmichthys spp.</i> *	Asian carp	X	X	Aquatic	Animal
<i>Lithobates catesbeianus</i>	American bullfrog	X	X	Aquatic	Animal
<i>Micropterus dolomieu</i>	Smallmouth bass	X	X	Aquatic	Animal
<i>Micropterus salmoides</i>	Largemouth bass	X	X	Aquatic	Animal
<i>Micropterus spp.</i>	Bass species	X	X	Aquatic	Animal
<i>Channidae / Channa spp.</i> *	Snakehead fish		X	Aquatic	Animal
<i>Oncorhynchus mykiss</i>	Rainbow trout	X	X	Aquatic	Animal
<i>Orconectes rusticus</i>	Rusty crayfish	X	X	Aquatic	Animal
<i>Perca flavescens</i>	Yellow perch	X	X	Aquatic	Animal
<i>Pomoxis spp.</i>	Crappies	X	X	Aquatic	Animal
<i>Potamopyrgus antipodarum</i>	New Zealand mud snail	X	X	Aquatic	Animal
<i>Salmo trutta</i>	Brown trout	X	X	Aquatic	Animal
<i>Salvelinus fontinalis</i>	Brook trout	X	X	Aquatic	Animal
<i>Salvelinus namaycush</i>	Lake trout	X	X	Aquatic	Animal
<i>Sander vitreus</i>	Walleye	X	X	Aquatic	Animal
<i>Trachemys scripta elegans</i>	Red-eared slider	X		Aquatic	Animal
<i>Xenopus laevis</i>	African clawed frog	X		Aquatic	Animal
<i>Eriocheir sinensis</i> *	Mitten crab		X	Aquatic	Animal
<i>Corbicula fluminea</i>	Asian clam		X	Aquatic	Animal
<i>Pseudodiaptomus forbesi</i>	Invasive zooplankton		X	Aquatic	Animal

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<i>Perciformes</i>	Perch-like fishes	X	X	Aquatic	Animal
<i>Carcinus maenas</i>	European green crab	X	X	Aquatic/ Terrestrial	Animal
<i>Polygonum spp.</i>	Knotweed	X	X	Aquatic/ Terrestrial	Plant
<i>Myocastor coypus</i>	Coypu, Nutria	X	X	Aquatic/ Terrestrial	Animal
<i>Acer pseudoplatanus</i>	Sycamore	X	X	Terrestrial	Plant
<i>Adelges tsugae</i>	Hemlock woolly adelgid	X	X	Terrestrial	Animal
<i>Aegilops cylindrica</i>	Jointed goatgrass	X		Terrestrial	Plant
<i>Aegopodium podagraria</i>	Goutweed	X	X	Terrestrial	Plant
<i>Agilus auroguttatus*</i>	Goldspotted oak borer	X	X	Terrestrial	Animal
<i>Agilus planipennis*</i>	Emerald ash borer	X	X	Terrestrial	Animal
<i>Agropyron cristatum</i>	Crested wheat grass	X		Terrestrial	Plant
<i>Ailanthus altissima</i>	Tree of heaven	X	X	Terrestrial	Plant
<i>Alliaria petiolata</i>	Garlic mustard	X	X	Terrestrial	Plant
<i>Ammophila arenaria</i>	European beach grass	X		Terrestrial	Plant
<i>Ammophila breviligulata</i>	American beachgrass	X		Terrestrial	Plant
<i>Amorpha fruticosa</i>	Indigo-bush	X		Terrestrial	Plant
<i>Anchusa arvensis</i>	Annual bugloss	X	X	Terrestrial	Plant
<i>Anchusa officinalis</i>	Common bugloss	X	X	Terrestrial	Plant
<i>Anoplophora chinensis*</i>	Citrus long-horned beetle	X	X	Terrestrial	Animal
<i>Anoplophora glabripennis*</i>	Asian longhorned beetle	X	X	Terrestrial	Animal
<i>Arctium</i>	Burdock	X	X	Terrestrial	Plant
<i>Arrhenatherum elatius</i>	Tall oatgrass	X		Terrestrial	Plant
<i>Artemisia spp.</i>	Sagebrush	X	X	Terrestrial	Plant
<i>Arum italicum</i>	Italian arum	X	X	Terrestrial	Plant
<i>Arundo donax</i>	Giant reed	X	X	Terrestrial	Plant
<i>Arundo spp.</i>	Arundo	X	X	Terrestrial	Plant
<i>Asteraceae</i>	Thistles	X	X	Terrestrial	Plant
<i>Bactrocera spp.</i>	Fruit fly	X	X	Terrestrial	Animal
<i>Bambusoideae</i>	Bamboo		X	Terrestrial	Plant
<i>Batrachochytrium dendrobatidis</i>	Chytridiomycosis, Amphibian chytrid fungus	X	X	Terrestrial	Pathogen
<i>Berteroa incana</i>	Hoary alyssum	X	X	Terrestrial	Plant

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<i>Bouteloua dactyloides</i>	Buffalograss	X		Terrestrial	Plant
<i>Brachypodium sylvaticum</i>	False brome	X	X	Terrestrial	Plant
<i>Bromus inermis</i>	Smooth brome	X	X	Terrestrial	Plant
<i>Bromus tectorum</i>	Cheatgrass	X	X	Terrestrial	Plant
<i>Brucella spp.</i>	Brucellosis	X	X	Terrestrial	Pathogen
<i>Buddleja davidii</i>	Butterfly bush	X	X	Terrestrial	Plant
<i>Calystegia sepium</i>	Hedge bindweed	X	X	Terrestrial	Plant
<i>Carduus acanthoides</i>	Plumeless thistle	X	X	Terrestrial	Plant
<i>Carduus nutans</i>	Musk thistle		X	Terrestrial	Plant
<i>Carduus pycnocephalus</i>	Italian thistle	X	X	Terrestrial	Plant
<i>Centaurea diffusa</i>	Diffuse knapweed	X	X	Terrestrial	Plant
<i>Centaurea melitensis</i>	Maltese star thistle	X		Terrestrial	Plant
<i>Centaurea montana</i>	Mountain bluet, corn flower	X	X	Terrestrial	Plant
<i>Centaurea pratensis, Centaurea x moncktonii</i>	Meadow knapweed	X	X	Terrestrial	Plant
<i>Centaurea solstitialis</i>	Yellow star-thistle	X	X	Terrestrial	Plant
<i>Centaurea spp.</i>	Knapweed	X	X	Terrestrial	Plant
<i>Centaurea stoebe</i>	Spotted knapweed	X	X	Terrestrial	Plant
<i>Cerambycidae</i>	Longhorn beetle	X		Terrestrial	Animal
<i>Ceruellla virgata</i>	Vineyard snail	X	X	Terrestrial	Animal
<i>Chondrilla juncea</i>	Rush skeletonweed	X	X	Terrestrial	Plant
<i>Cichorium intybus</i>	Chicory		X	Terrestrial	Plant
<i>Cirsium arvense</i>	Canada thistle, creeping thistle	X	X	Terrestrial	Plant
<i>Cirsium palustre</i>	Marsh thistle	X	X	Terrestrial	Plant
<i>Cirsium spp.</i>	Thistles	X	X	Terrestrial	Plant
<i>Cirsium vulgare</i>	Bull thistle	X		Terrestrial	Plant
<i>Clematis orientalis</i>	Oriental clematis	X	X	Terrestrial	Plant
<i>Clematis spp.</i>	Clematis	X		Terrestrial	Plant
<i>Clematis vitalba</i>	Old man's beard	X	X	Terrestrial	Plant
<i>Conium maculatum</i>	Poison hemlock	X	X	Terrestrial	Plant
<i>Convolvulus spp.</i>	Bindweeds	X	X	Terrestrial	Plant
<i>Cortaderia selloana</i>	Pampas grass		X	Terrestrial	Plant
<i>Cotoneaster spp.</i>	Cotoneaster spp.	X		Terrestrial	Plant
<i>Crataegus monogyna</i>	Common hawthorn, English hawthorn	X	X	Terrestrial	Plant
<i>Cronartium ribicola</i>	White pine blister rust	X	X	Terrestrial	Pathogen
<i>Crupina vulgaris</i>	Common crupina	X	X	Terrestrial	Plant

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<i>Culicidae</i>	Mosquitoes	X	X	Terrestrial	Animal
<i>Cynoglossum officinale</i>	Houndstongue	X	X	Terrestrial	Plant
<i>Cytisus scoparius</i>	Scotch broom	X	X	Terrestrial	Plant
<i>Daphne laureola</i>	Spurge laurel	X	X	Terrestrial	Plant
<i>Dendrobaena veneta</i>	European nightcrawler	X	X	Terrestrial	Animal
<i>Digitaria spp.</i>	Crabgrasses		X	Terrestrial	Plant
<i>Dipsacus fullonum</i>	Common teasel	X	X	Terrestrial	Plant
<i>Dipsacus spp.</i>	Teasel	X	X	Terrestrial	Plant
<i>Echium vulgare</i>	Blueweed	X	X	Terrestrial	Plant
<i>Elaeagnus angustifolia</i>	Russian olive	X	X	Terrestrial	Plant
<i>Elymus spp.</i>	Wildrye	X	X	Terrestrial	Plant
<i>Euphorbia esula</i>	Leafy spurge	X	X	Terrestrial	Plant
<i>Euphorbia oblongata</i>	Oblong spurge	X	X	Terrestrial	Plant
<i>Fallopia spp.</i>	Buckwheat	X		Terrestrial	Plant
<i>Felis silvestris catus</i>	Cats	X	X	Terrestrial	Animal
<i>Ficaria verna,</i> <i>Ranunculus ficara</i>	Lesser celandine	X	X	Terrestrial	Plant
<i>Fiorinia externa</i>	Elongate hemlock scale	X	X	Terrestrial	Animal
<i>Galega officinalis</i>	French lilac, Goatsrue	X	X	Terrestrial	Plant
<i>Geranium lucidum</i>	Shiny geranium	X	X	Terrestrial	Plant
<i>Geranium robertianum</i>	Herb robert	X	X	Terrestrial	Plant
<i>Gypsophila spp.</i>	Baby's breath	X	X	Terrestrial	Plant
<i>Hedera helix</i>	English ivy	X	X	Terrestrial	Plant
<i>Hedera hibernica</i>	Irish ivy	X	X	Terrestrial	Plant
<i>Hedera spp.</i>	Ivy	X		Terrestrial	Plant
<i>Heracleum mantegazzianum</i>	Giant hogweed	X	X	Terrestrial	Plant
<i>Hieracium aurantiacum</i>	Orange hawkweed	X	X	Terrestrial	Plant
<i>Hieracium caespitosum</i>	Yellow hawkweed	X		Terrestrial	Plant
<i>Hieracium spp.</i>	Hawkweed	X	X	Terrestrial	Plant
<i>Holcus mollis</i>	German velvet grass	X		Terrestrial	Plant
<i>Hordeum marinum</i>	Mediterranean barley	X		Terrestrial	Plant
<i>Hypericum perforatum</i>	St. John's wort	X	X	Terrestrial	Plant
<i>Ilex aquifolium</i>	English holly	X	X	Terrestrial	Plant
<i>Impatiens capensis</i>	Orange jewelweed, Spotted touch-me-not	X	X	Terrestrial	Plant
<i>Impatiens glandulifera</i>	Himalayan balsam, Policeman's helmet	X	X	Terrestrial	Plant
<i>Impatiens spp.</i>	Impatiens	X	X	Terrestrial	Plant
<i>Isatis tinctoria</i>	Dyer's woad	X	X	Terrestrial	Plant
<i>Jacobaea vulgaris</i>	Tansy ragwort	X	X	Terrestrial	Plant

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<i>Lamium galeobdolon</i>	Yellow archangel	X	X	Terrestrial	Plant
<i>Lamium spp.</i>	Lamium	X		Terrestrial	Plant
<i>Lens culinaris</i>	Lentils	X	X	Terrestrial	Plant
<i>Lepidium draba</i>	Whitetop	X	X	Terrestrial	Plant
<i>Lepidium latifolium</i>	Broadleaved pepperweed, Perennial pepperweed, tall whitetop	X	X	Terrestrial	Plant
<i>Leucanthemum vulgare</i>	Oxeye daisy	X	X	Terrestrial	Plant
<i>Ligustrum vulgare</i>	Common privet	X		Terrestrial	Plant
<i>Linaria dalmatica</i>	Dalmatian toadflax	X	X	Terrestrial	Plant
<i>Linaria vulgaris</i>	Yellow toadflax	X	X	Terrestrial	Plant
<i>Linepithema humile</i>	Argentine ant		X	Terrestrial	Animal
<i>Lumricina</i>	Earthworms	X		Terrestrial	Animal
<i>Lycorma delicatula</i> *	Spotted lanternfly	X	X	Terrestrial	Animal
<i>Lymantria dispar asiatica</i>	Asian gypsy moth	X	X	Terrestrial	Animal
<i>Lymantria dispar dispar</i>	European gypsy moth	X	X	Terrestrial	Animal
<i>Lythrum spp.</i>	Loosestrife	X	X	Terrestrial	Plant
<i>Melaleuca quinquenervia</i> *	Broad-leaved paperbark		X	Terrestrial	Plant
<i>Melissa officinalis</i>	Lemon balm	X	X	Terrestrial	Plant
<i>Mentha pulegium</i>	Pennyroyal	X		Terrestrial	Plant
<i>Mus spp.</i>	Mice	X		Terrestrial	Animal
<i>Onopordum acanthium</i>	Scotch thistle	X	X	Terrestrial	Plant
<i>Ovis aries</i>	Feral sheep	X	X	Terrestrial	Animal
<i>Pelargonium spp.</i>	Geraniums		X	Terrestrial	Plant
<i>Phasianus</i>	Pheasant	X	X	Terrestrial	Animal
<i>Photinia spp.</i>	Photinia	X		Terrestrial	Plant
<i>Phytophthora ramorum</i>	Sudden oak death	X	X	Terrestrial	Pathogen
<i>Phytophthora spp.</i>	Phytophthora	X	X	Terrestrial	Pathogen
<i>Pisum sativum</i>	Peas	X	X	Terrestrial	Plant
<i>Polygonum cuspidatum</i>	Japanese knotweed	X	X	Terrestrial	Plant
<i>Polygonum polystachyum</i>	Cultivated knotweed, Himalayan knotweed	X		Terrestrial	Plant
<i>Polygonum sachalinense</i>	Giant knotweed	X	X	Terrestrial	Plant
<i>Polygonum x bohemicum</i>	Bohemian knotweed	X	X	Terrestrial	Plant

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<i>Popillia japonica</i> *	Japanese beetle	X	X	Terrestrial	Animal
<i>Potentilla recta</i>	Sulphur cinquefoil	X	X	Terrestrial	Plant
<i>Prunus laurocerasus</i>	Cherry laurel	X		Terrestrial	Plant
<i>Prunus padus</i>	Bird cherry		X	Terrestrial	Plant
<i>Pseudogymnoascus destructans</i>	White-nose syndrome	X	X	Terrestrial	Pathogen
<i>Pueraria montana</i>	Kudzu	X	X	Terrestrial	Plant
<i>Python spp.</i>	Pythons	X	X	Terrestrial	Animal
<i>Ranunculus repens</i>	Creeping buttercup	X		Terrestrial	Plant
<i>Rattus spp.</i>	Rats	X	X	Terrestrial	Animal
<i>Rhaponticum repens</i> , <i>Acroptilon repens</i>	Russian knapweed	X	X	Terrestrial	Plant
<i>Rubus armeniacus</i>	Himalayan blackberry, Armenian Blackberry	X	X	Terrestrial	Plant
<i>Rubus bifrons</i>	Himalayan blackberry	X		Terrestrial	Plant
<i>Rubus laciniatus</i>	Evergreen blackberry	X	X	Terrestrial	Plant
<i>Rubus spp.</i>	Blackberry	X	X	Terrestrial	Plant
<i>Saccharum ravennae</i>	Ravennagrass		X	Terrestrial	Plant
<i>Salix x sepulcralis</i>	Weeping willow	X		Terrestrial	Plant
<i>Salsola tragus</i> / <i>Kali tragus</i>	Russian thistle	X		Terrestrial	Plant
<i>Salvia aethiopis</i>	Mediterranean sage	X	X	Terrestrial	Plant
<i>Scolytinae</i>	Bark beetle	X	X	Terrestrial	Animal
<i>Silybum marianum</i>	Milk thistle	X	X	Terrestrial	Plant
<i>Solanum dulcamara</i>	Bittersweet nightshade	X	X	Terrestrial	Plant
<i>Solenopsis spp.*</i>	Fire ants	X		Terrestrial	Animal
<i>Strix varia</i>	Barred owl	X	X	Terrestrial	Animal
<i>Sus scrofa</i>	Feral pigs, Feral swine	X	X	Terrestrial	Animal
<i>Taeniatherum caput-medusae</i>	Medusahead	X	X	Terrestrial	Plant
<i>Tamarix spp.</i>	Salt cedar		X	Terrestrial	Plant
<i>Tanacetum vulgare</i>	Common tansy	X	X	Terrestrial	Plant
<i>Thymelaea passerina</i>	Spurge flax		X	Terrestrial	Plant
<i>Tragopogon dubius</i>	Western salsify	X	X	Terrestrial	Plant
<i>Triadica sebifera</i>	Tallow tree, Chinese tallow	X	X	Terrestrial	Plant
<i>Tribulus terrestris</i>	Puncture vine	X	X	Terrestrial	Plant
<i>Triticum spp.</i>	Wheat	X	X	Terrestrial	Plant
<i>Ulex spp.</i>	Gorse	X	X	Terrestrial	Plant
<i>Ulmus pumila</i>	Siberian elm	X		Terrestrial	Plant

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<i>Ventenata dubia</i>	Ventenata grass / North Africa Grass	X	X	Terrestrial	Plant
<i>Ventenata spp.</i>	Ventenata	X	X	Terrestrial	Plant
<i>Verbascum thapsus</i>	Common mullein	X	X	Terrestrial	Plant
<i>Vespa mandarinia</i>	Asian giant hornet	X	X	Terrestrial	Animal
<i>Vulpia myuros</i>	Annual fescue, Rat's-tail fescue	X	X	Terrestrial	Plant
<i>Xyleborus monographus</i> *	Mediterranean oak borer	X	X	Terrestrial	Animal

