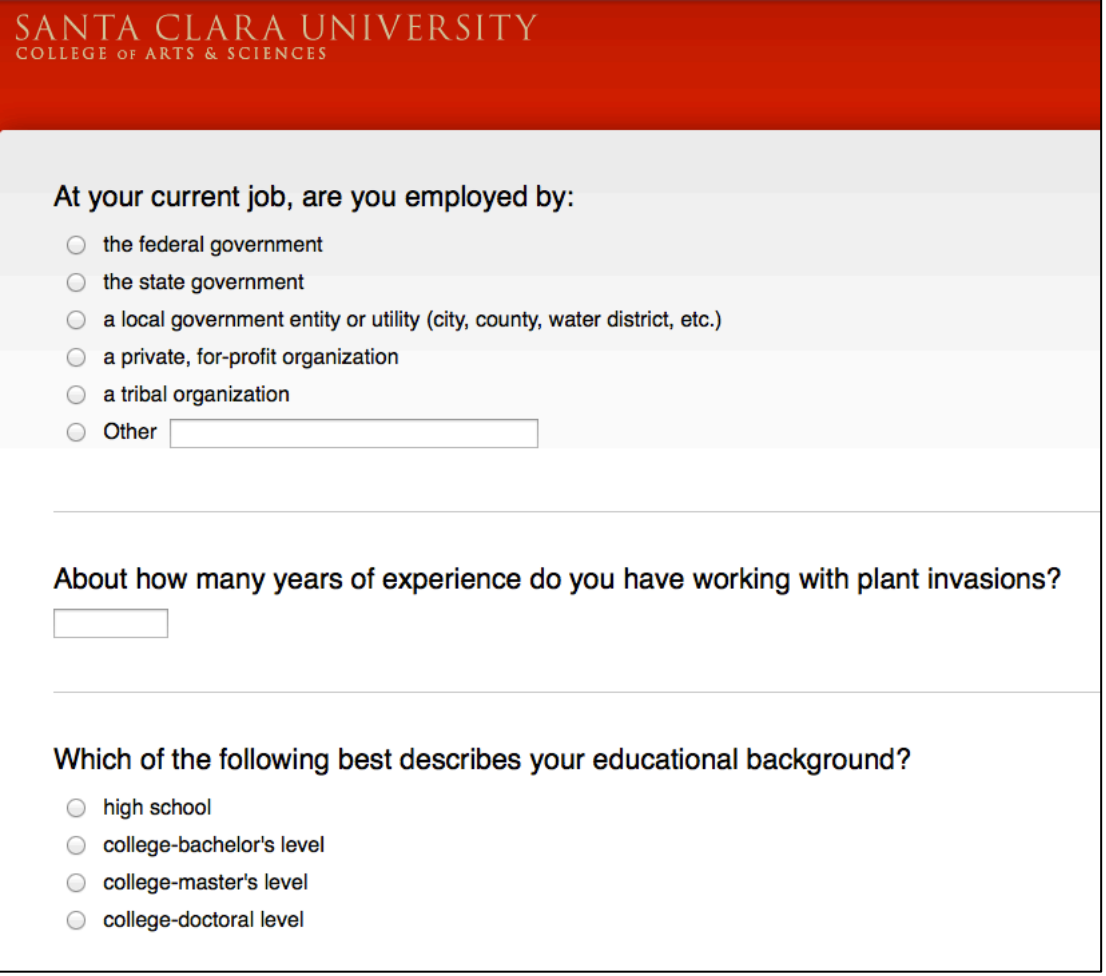
Bridging the Information Gap between Land Managers and Research Scientists

Virginia Matzek *Santa Clara University*



Step 1: "What managers want"

In February 2012, we surveyed 207 California resource managers who deal with plant invasions.

- Where do managers go for scientific information?
- What kind of information do they generate for themselves?
- What kind of information do they want more of?

Step 2: "What managers get"

We searched the 2007-2011 contents of these 20 journals for invasive plant articles meeting one of these criteria:

- California author
- California fieldsite
- California's "Most Un-Wanted" plants

What kind of managers took our survey?

57% work for governments or tribes
43% in nonprofits or consulting/practitioner firms

More than half have 10+ years of experience in field

48% have advanced degrees (master's or Ph.D.)

31% do all the decision-making, 69% do some of it

Credit: USFWS

N= 207 respondents

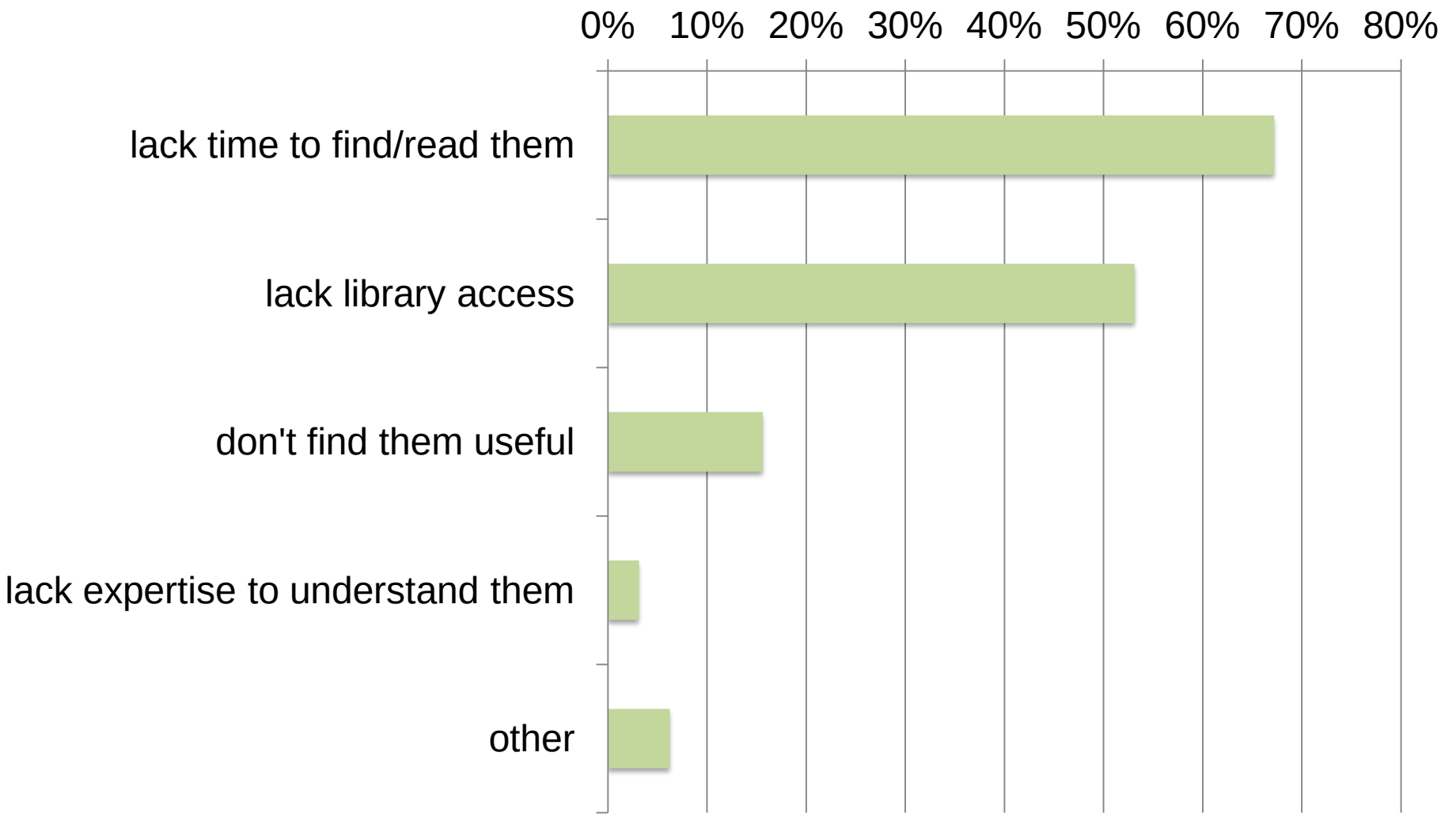
Where they go for scientific information (in rank order)

1. Conversations with other managers (2.56)
2. Their own experiments or monitoring (2.75)
3. Syntheses of research (books/websites) (3.04)
4. Attendance at symposia/conferences (3.57)
5. Peer reviewed journal articles (4.34)

Dead last!

Among those who never read peer-reviewed journals, the reasons are:

N=64
Multiple answers possible



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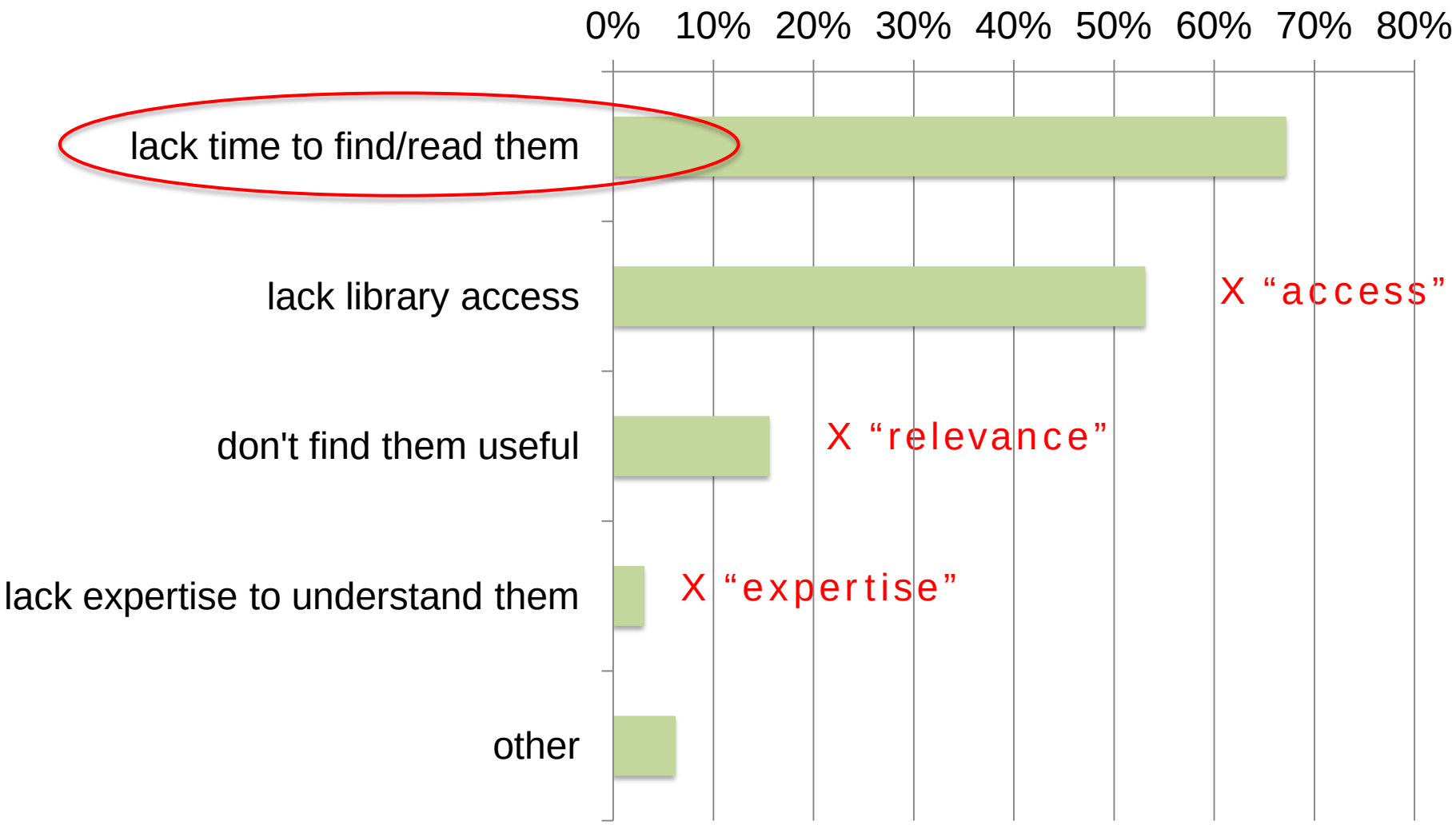
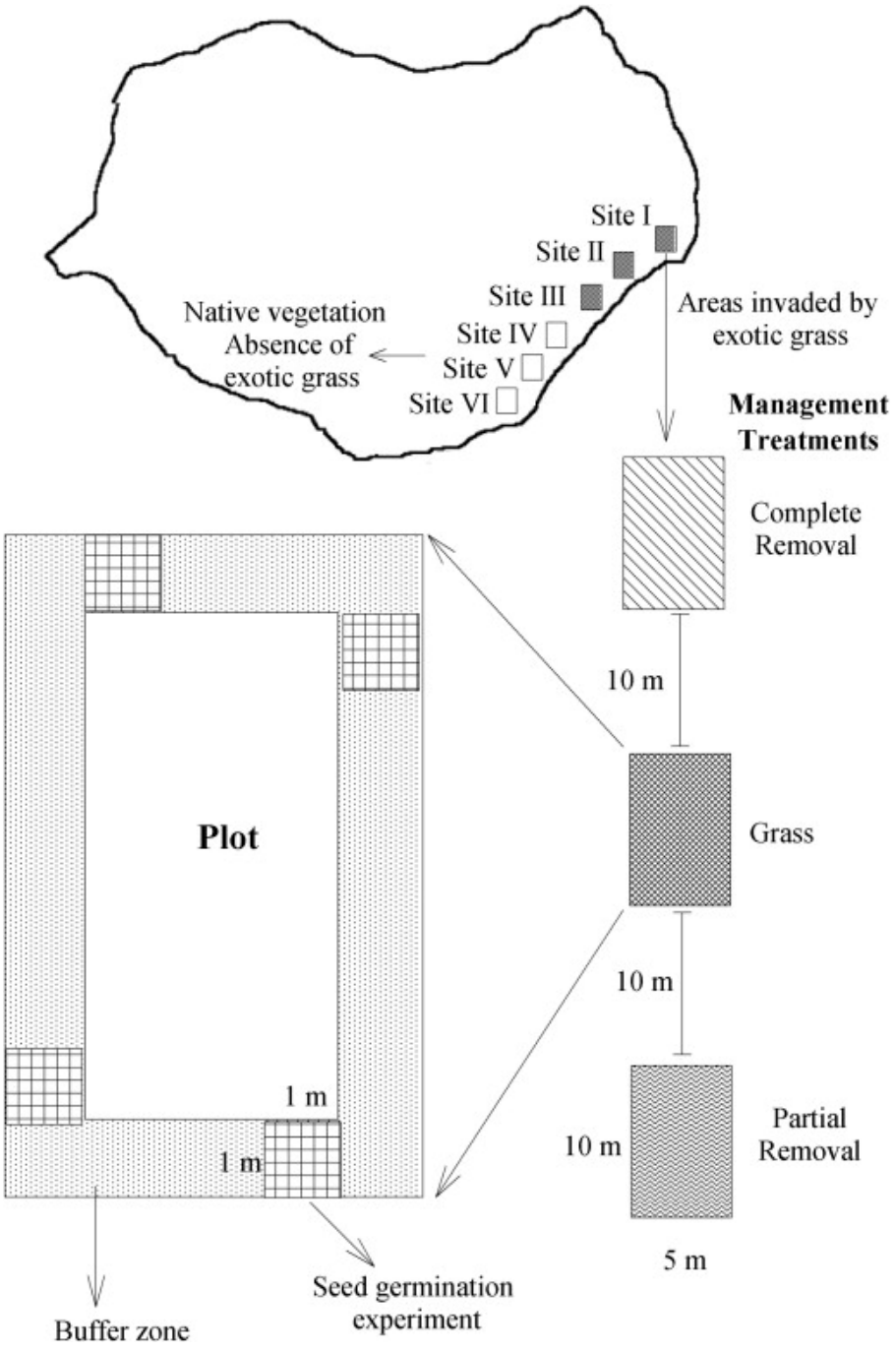
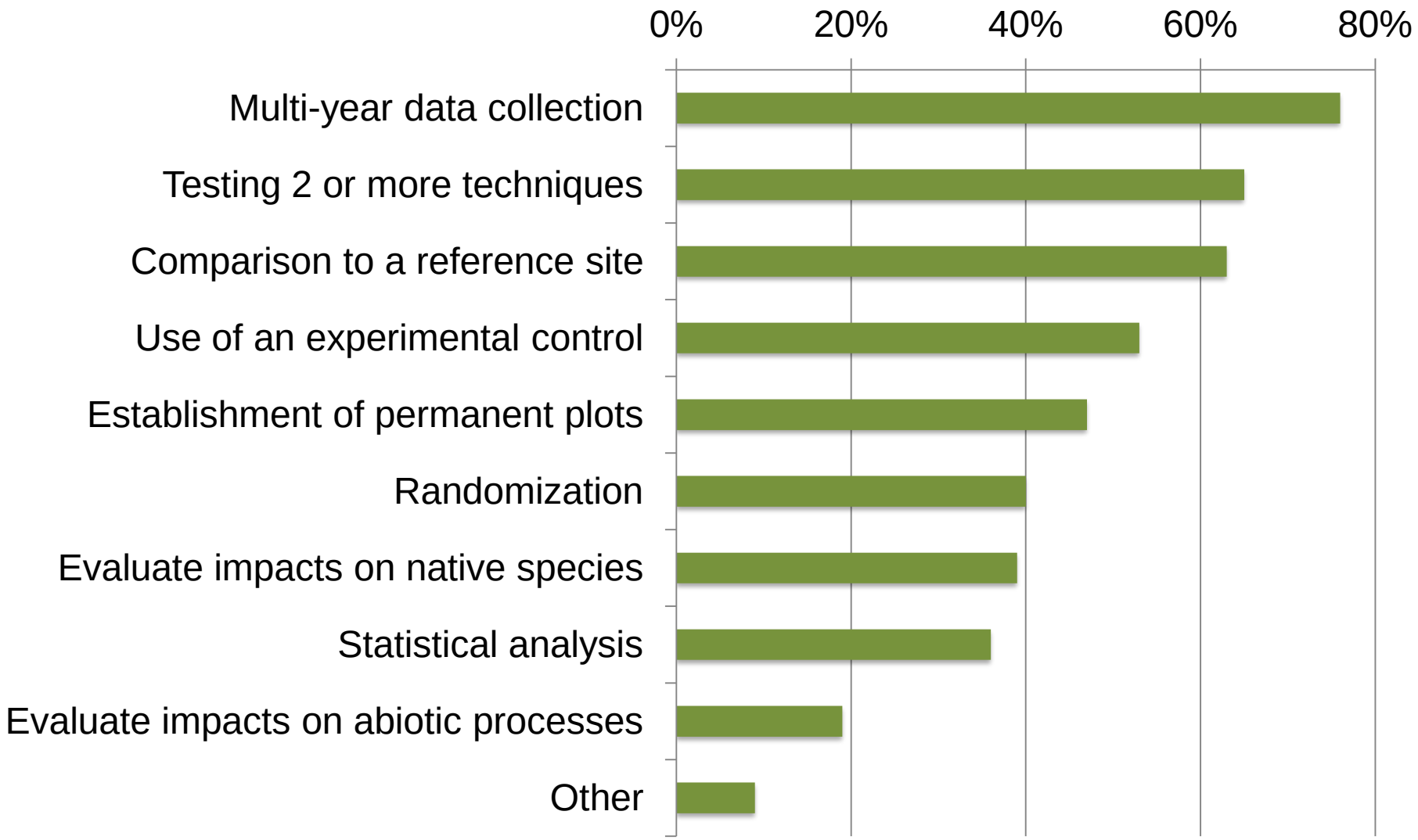


What about the experiments that managers do?

88% of managers use their own experiments or monitoring to get scientific information useful to manage invasions

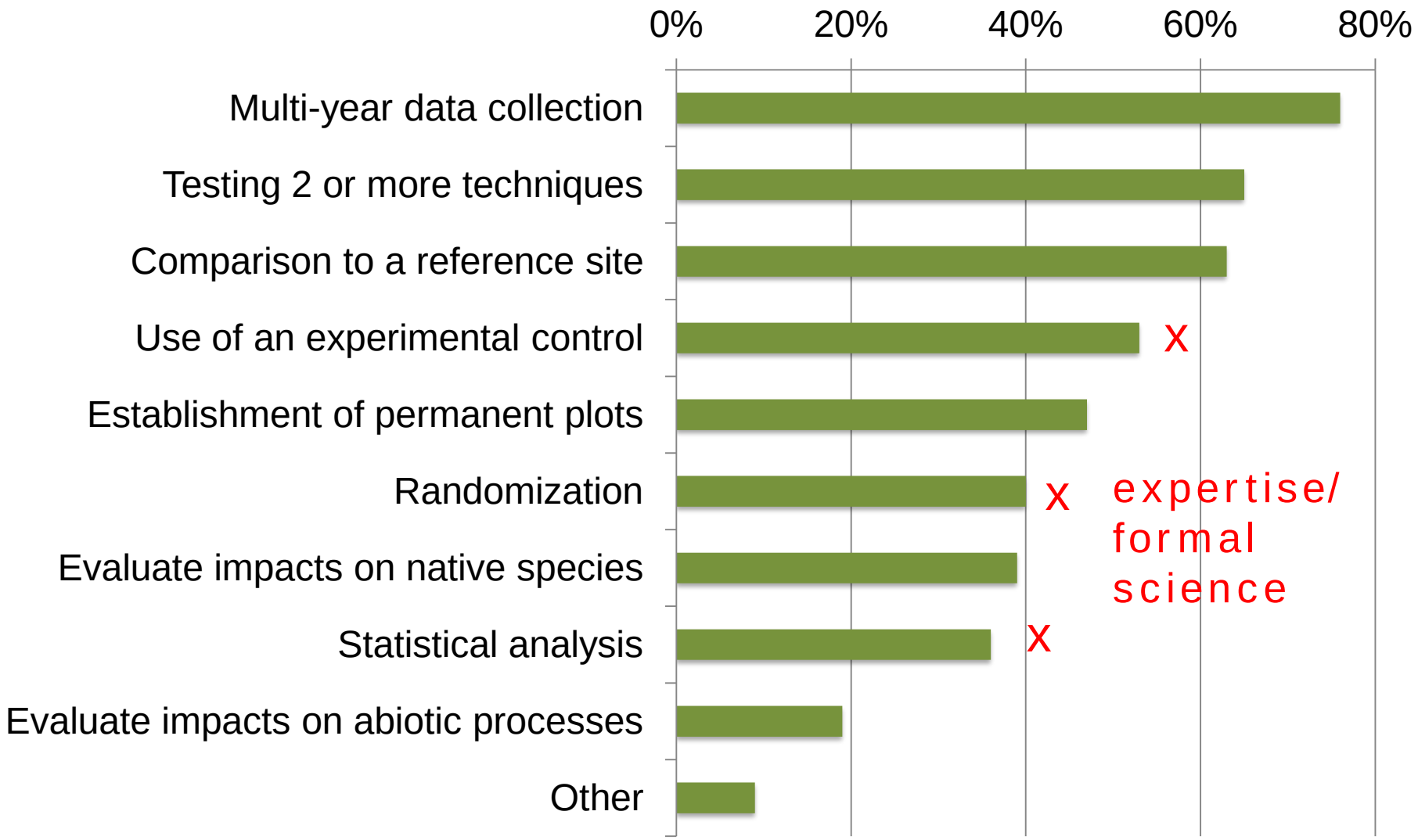


What are the components of managers' science?



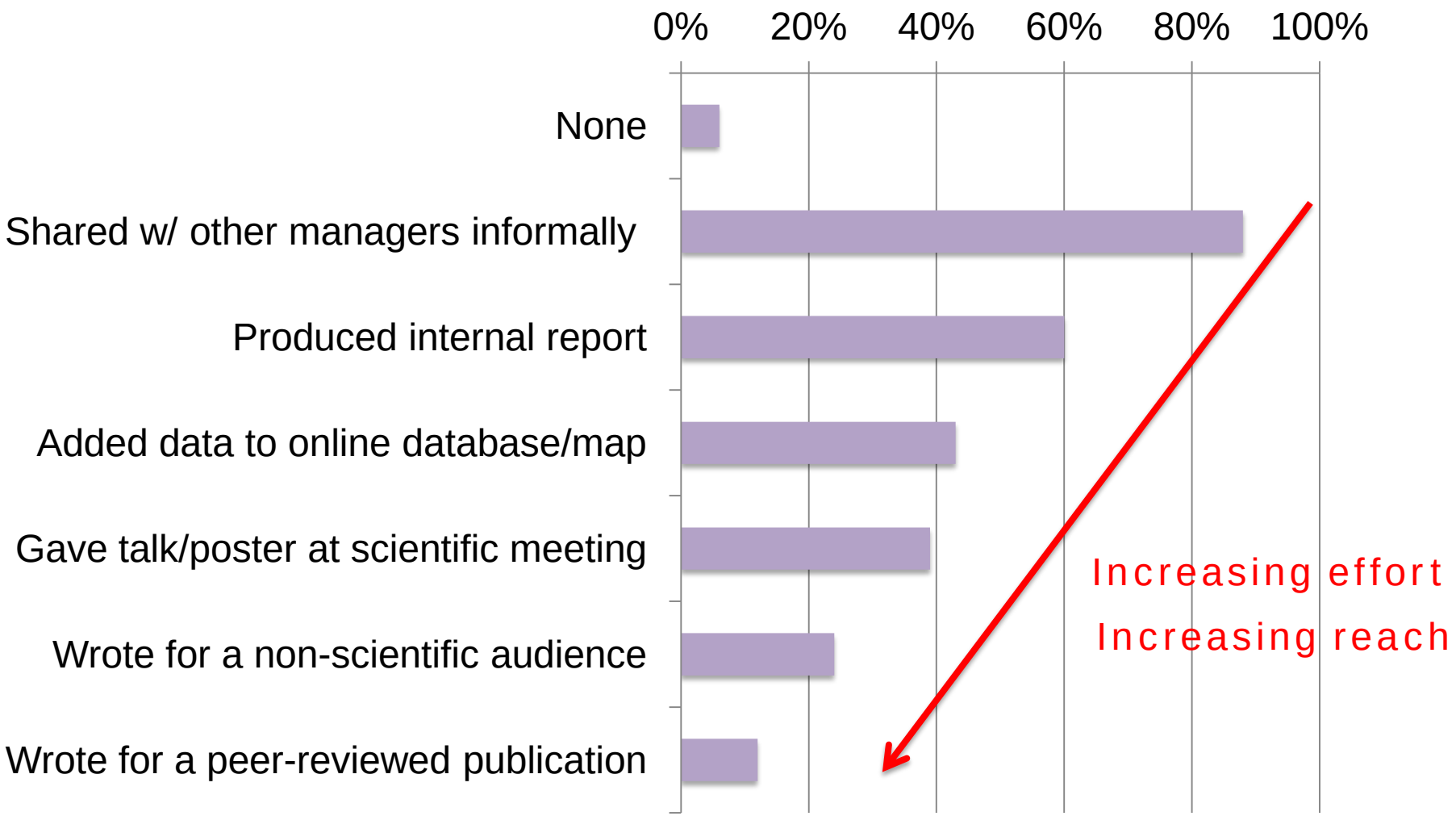
N=179
Multiple answers possible

What are the components of managers' science?



N=179
Multiple answers possible

Do managers disseminate their experimental results?



N=178
Multiple answers possible

An open-ended question:
"What research questions do you need answered, to be more effective at managing plant invasions?"

...ranging from the ultra-specific to the very general

"How long do *Sesbania* seeds last in the soil?"

"Which invasive species pose the greatest risks?"

....and from the practical to the philosophical

"What mechanical methods work best for aquatic invaders?"

"Taking a 'geologic time' view of California history, is it morally right to eradicate invaders?"

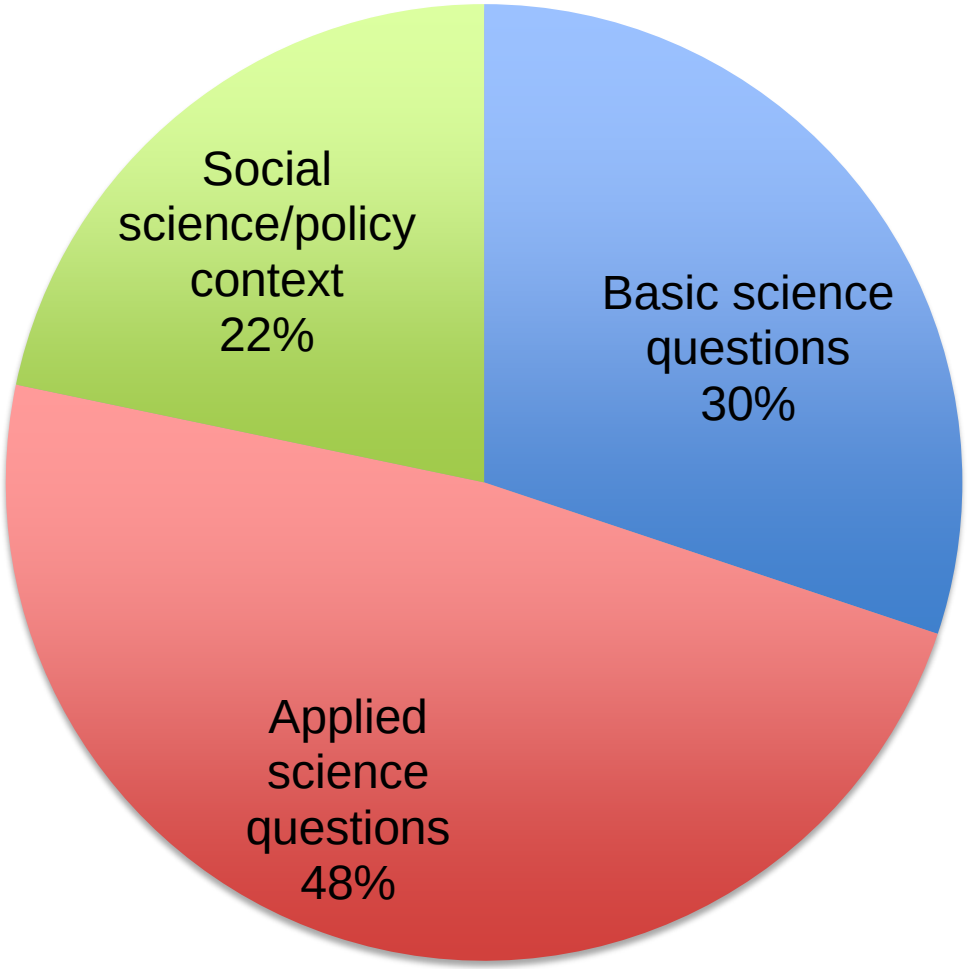
Our data didn't divide naturally into basic science vs. applied science…there was a 3rd category

"What are the sociological barriers to coordination and cooperation between land managers and private land owners?"

"How can we convey the negative impacts of invasive species and the importance of conservation to laypersons who don't understand ecology?"

"Which organizations are effective and which are a waste of time except for the social/networking benefits?"

The distribution among the categories suggests a strong need for interdisciplinary research.



N=405 separately coded responses

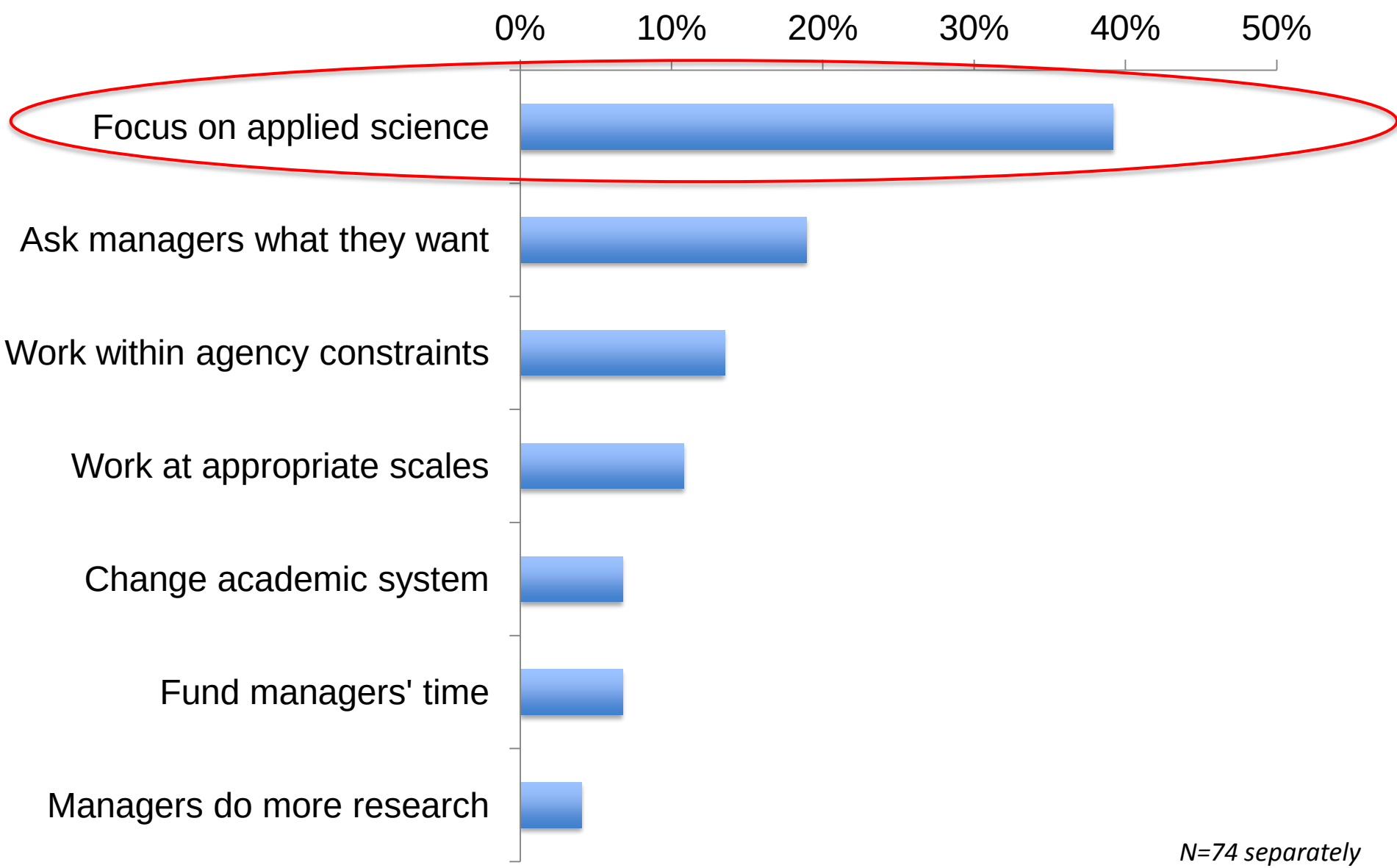
What suggestions do managers have for closing the knowing-doing gap?

"Deal with the problem of scale. Research is often at the square-meter level, but management occurs at the thousand-hectare level."

"I find that researchers give options that need an unlimited budget. Some budgets would be spent just trying to come up with the materials needed."

"We need more studies that exceed the length of time it takes to get a graduate degree."

Managers' suggestions for bridging knowing-doing gap



N=74 separately coded

Step 2: "What managers get"

- California author
- California fieldsite
- California's "Most Un-Wanted" plants

Total: 354 articles

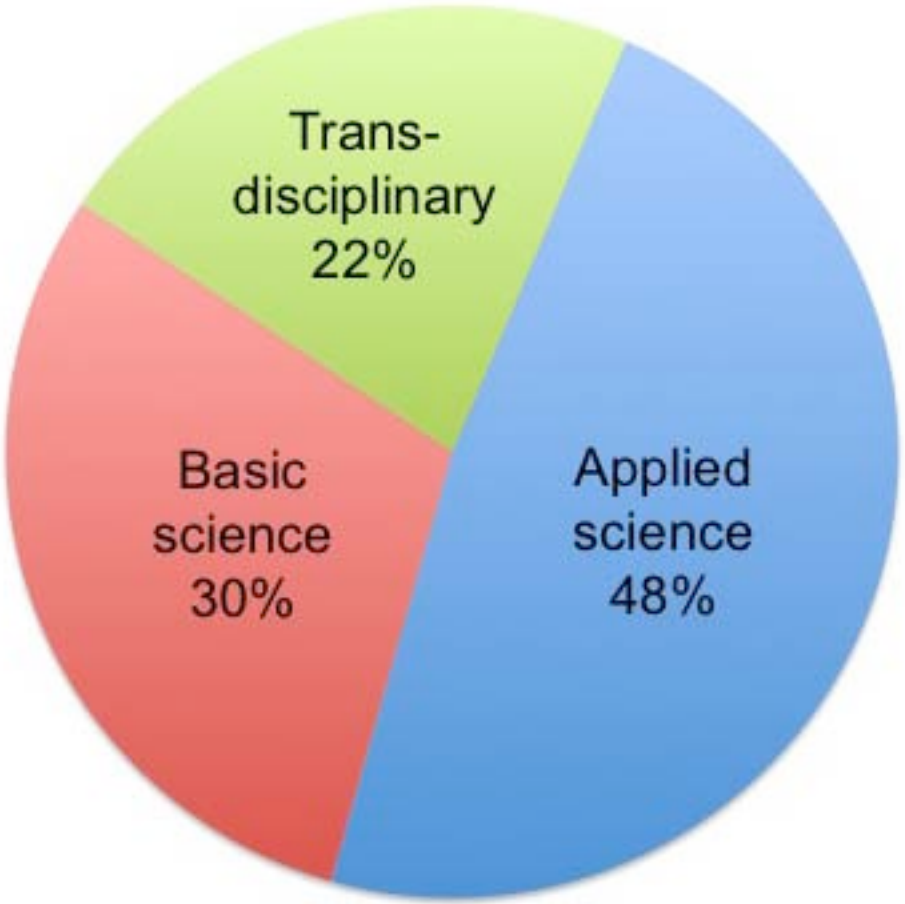
We read and classified each article by these criteria:

- Species coverage
- Nature of California relevance
- Type of experiment
- Areal extent of fieldwork
- Temporal extent of study
- Time lag before publication
- Applied/basic/transdisciplinary
- Manager-identified topic of interest
- Cal-IPC topic of interest
- Management implications (if basic)
- Costs specified (if applied)

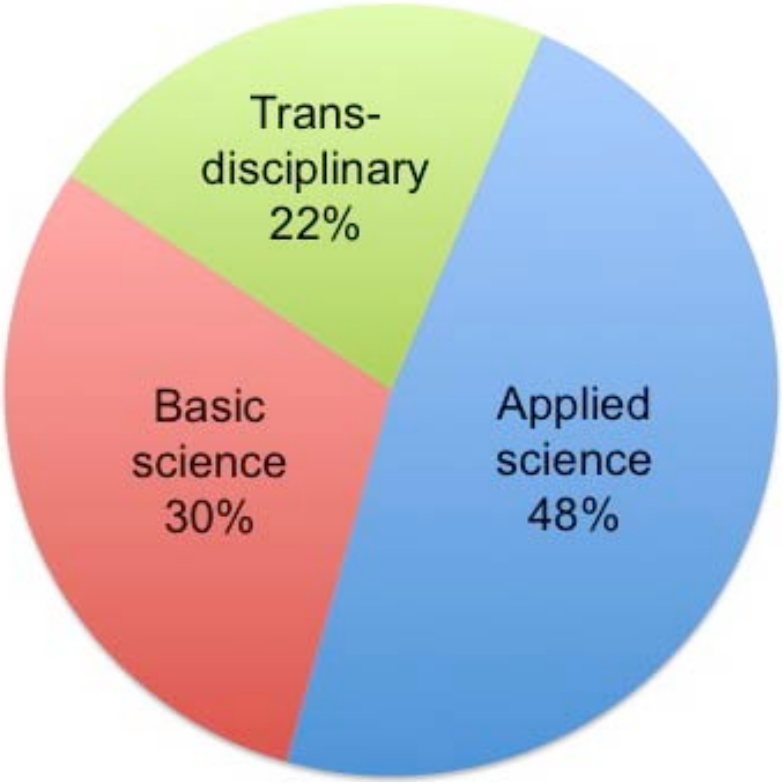
Alternanthera philoxeroides	species	field-manipulative	single site, single habita	one year/sea	5	Applied	biocontrol (natural ene
Lythrum salicaria	species	greenhouse	pots/greenhouse	one year/sea	5	Basic	evolution of invasivene
Spartina alterniflora	Inst&species	modeling	N/A	N/A	n/a	Basic	mathematical or GIS m
Genista monspessulana	all three	field-manipulative	multi sites, single habita	2 or 3 years	10	Basic	N/A
Genista monspessulana	all three	field-observational	multi habitats	2 or 3 years	5	Basic	evolution of invasivene
Centaurea solstitialis	Field&Specie	field-manipulative	multi habitats	2 or 3 years	6	Basic	invasibility/invasion re
Spartina alterniflora	species	field-observational	single site, single habita	can't tell	can't tell	Basic	impacts of invaders on
invasive pines	institutional	greenhouse	pots/greenhouse	one year/sea	can't tell		trait comparison (invad
Centaurea solstitialis	all three	greenhouse	pots/greenhouse	N/A	5	Basic	N/A
Centaurea maculosa	species	field-observational	single site, single habita	2 or 3 years	4	Basic	impacts of invaders on
Bromus tectorum	species	field-manipulative	single site, single habita	2 or 3 years	5	Applied	N/A
Bromus tectorum	species	field-manipulative	single site, single habita	4 or 5 years	4	Basic	propagule pressure (pa
Delairea odorata	all three	greenhouse	pots/greenhouse	one year/sea	8	Basic	N/A
Egeria densa	all three	field-observational	single site, single habita	one year/sea	3	Basic	impacts of invaders on

Each paper was initially coded by 2 or 3 individuals independently; discrepancies were resolved upon a second read

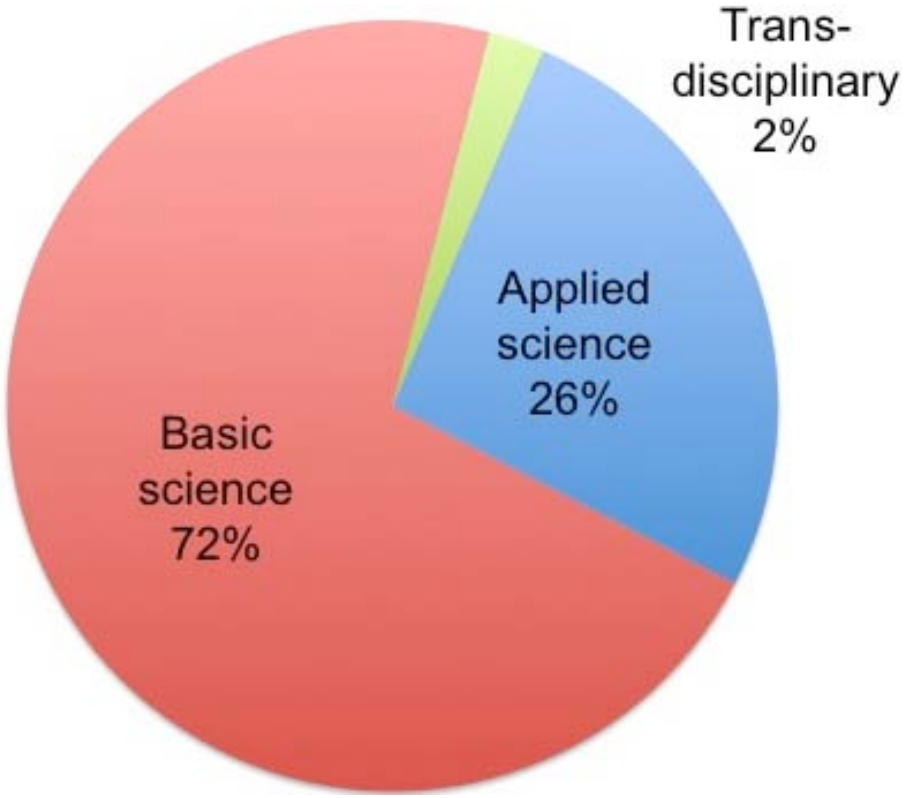
Managers want a mix of basic, applied, and transdisciplinary research—heavy on the applied.



The actual mix is much heavier on basic science.



desired



actual

When scientists do basic research, do we give explicit management recommendations?

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Recommendations Made

Mentioned in Passing

Not Mentioned

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Recommendations Made

Mentioned in Passing

"This understanding can help us predict where and when facilitation may be strong or weak, but is also important for developing conservation strategies."

"We feel this study yielded information of value to grassland managers struggling to prevent exotic weed invasions."

Not Mentioned

When scientists do basic research, do we give explicit management recommendations?

Recommendations Made

"Our findings clearly suggest that active management for natural hydrograph characteristics downstream from dams is likely to decrease the likelihood of Tamarix *establishing dominance over native species in riparian ecosystems."*

"Based on the results of this work, however, employing control methods for *Lythrum* in Ladner marsh is not warranted."

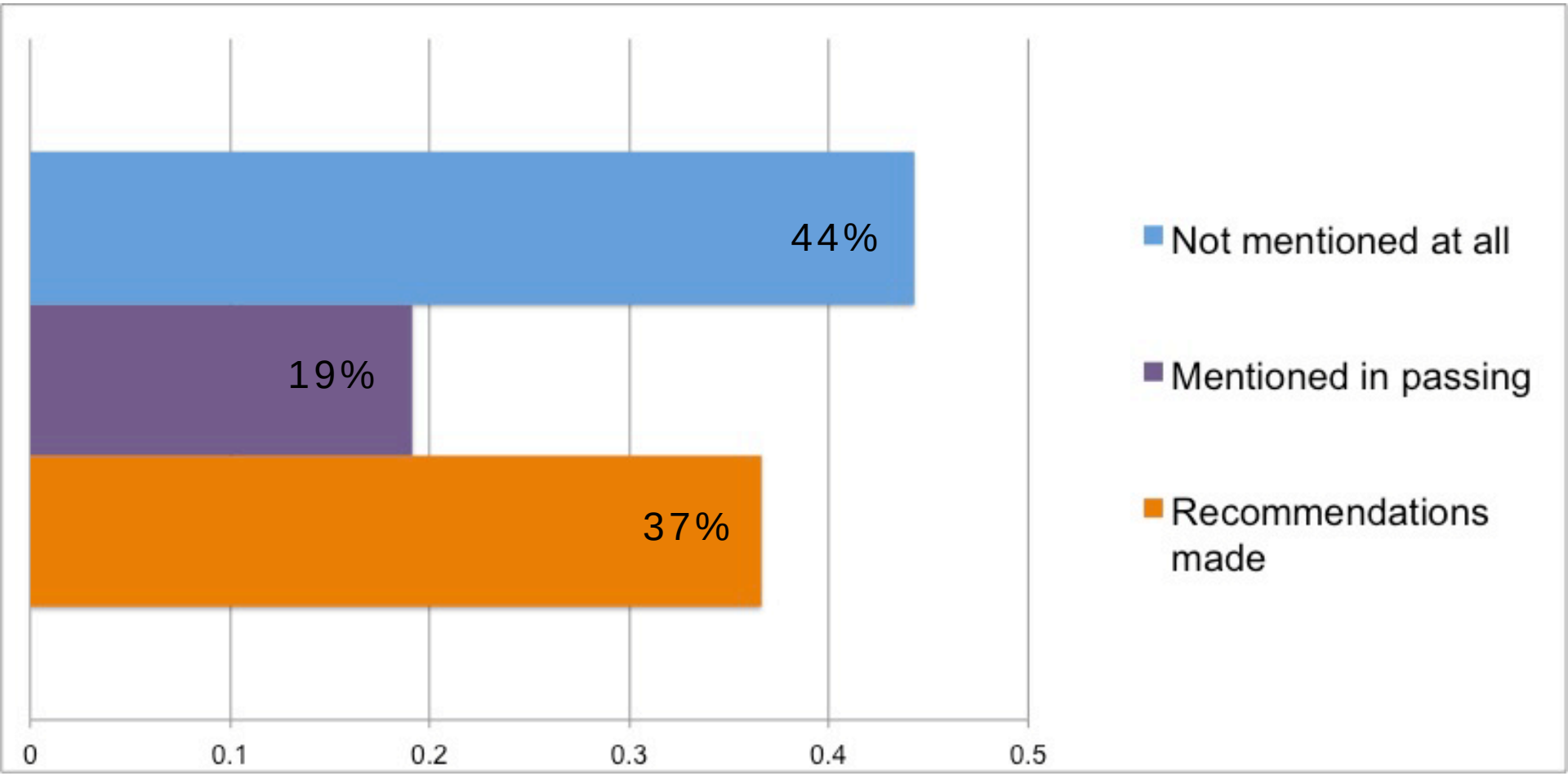
Mentioned in Passing

"This understanding can help us predict where and when facilitation may be strong or weak, but is also important for developing conservation strategies."

"We feel this study yielded information of value to grassland managers struggling to prevent exotic weed invasions."

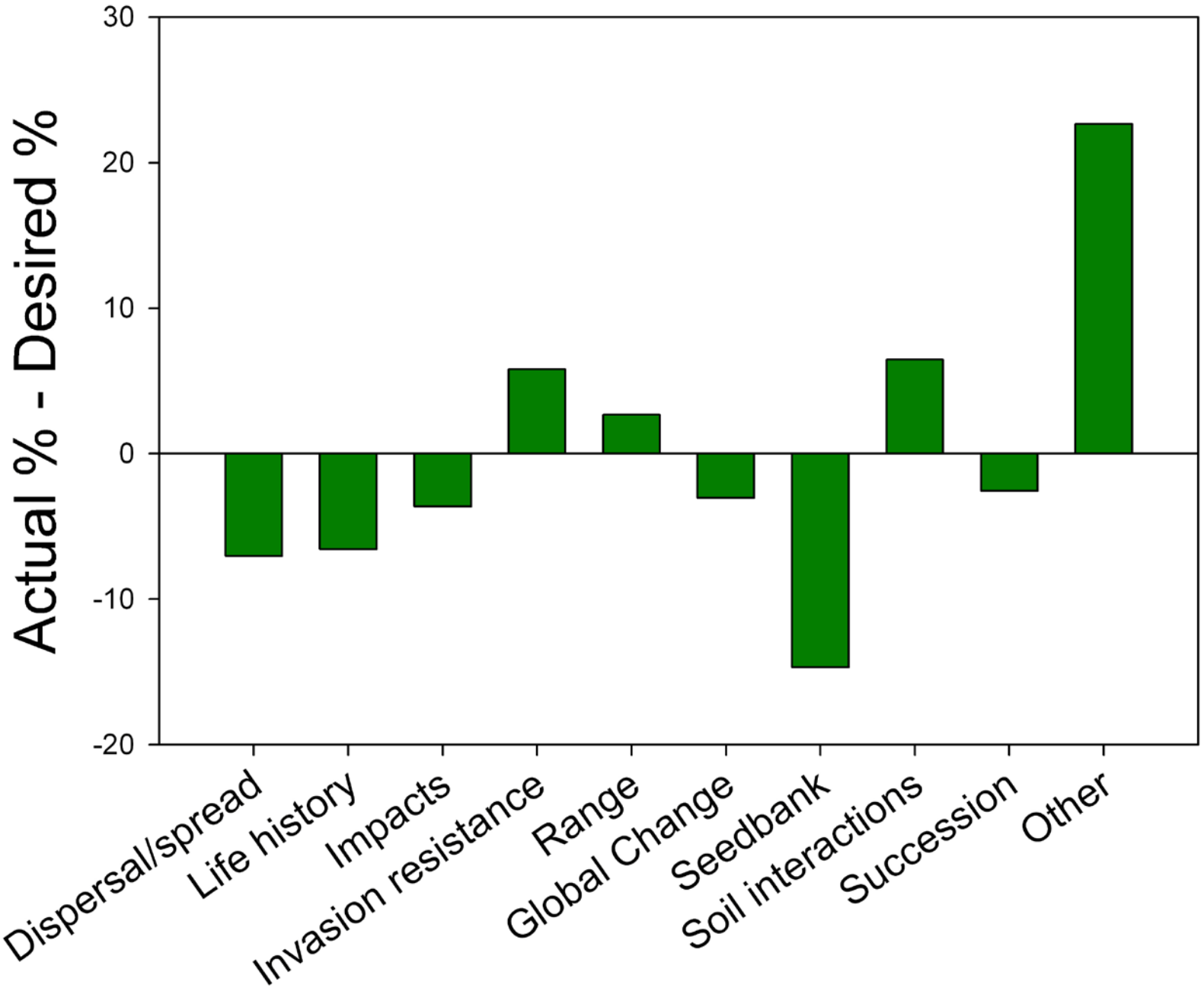
Not Mentioned

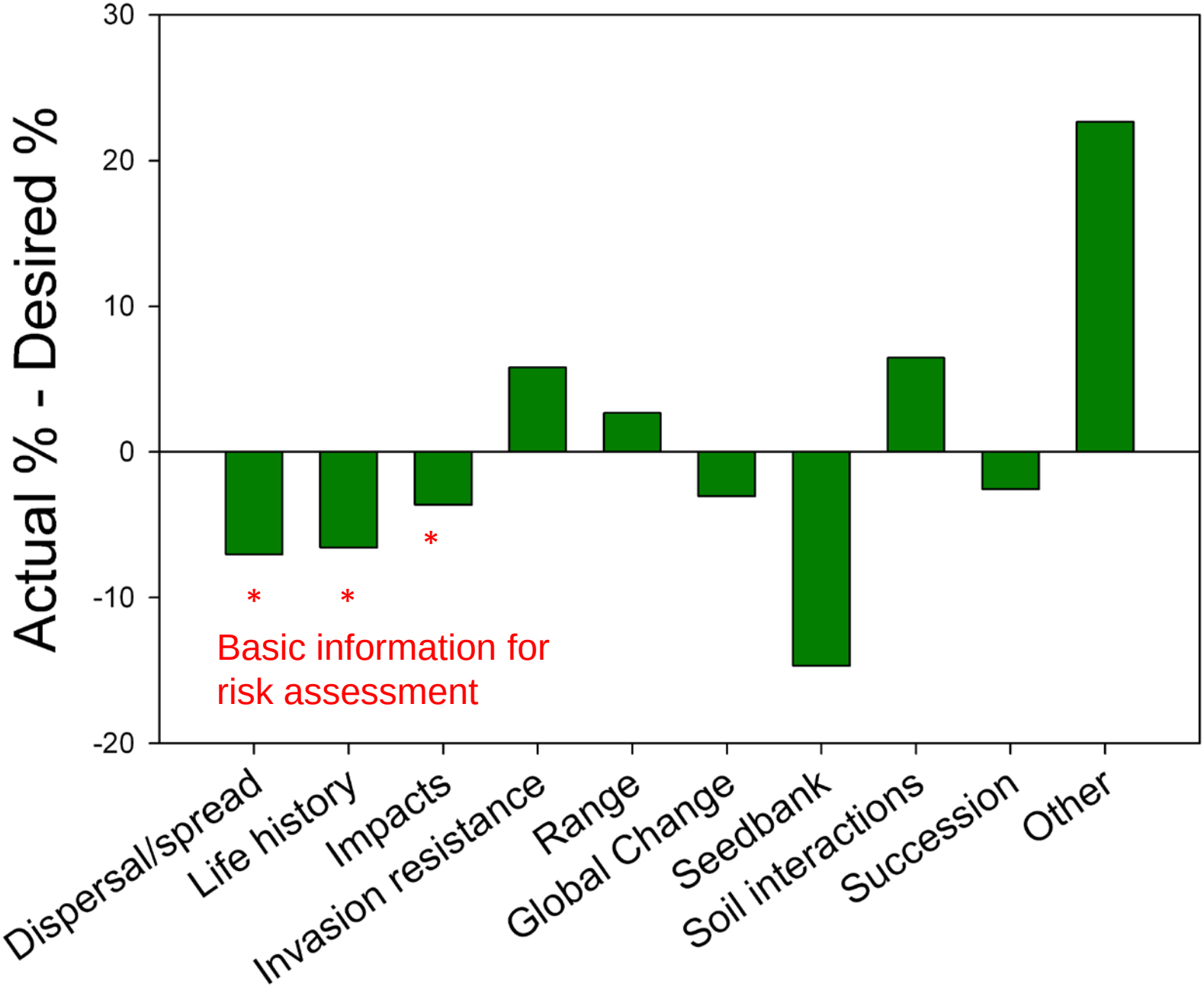
A majority of basic research papers at least tried to make a management connection…

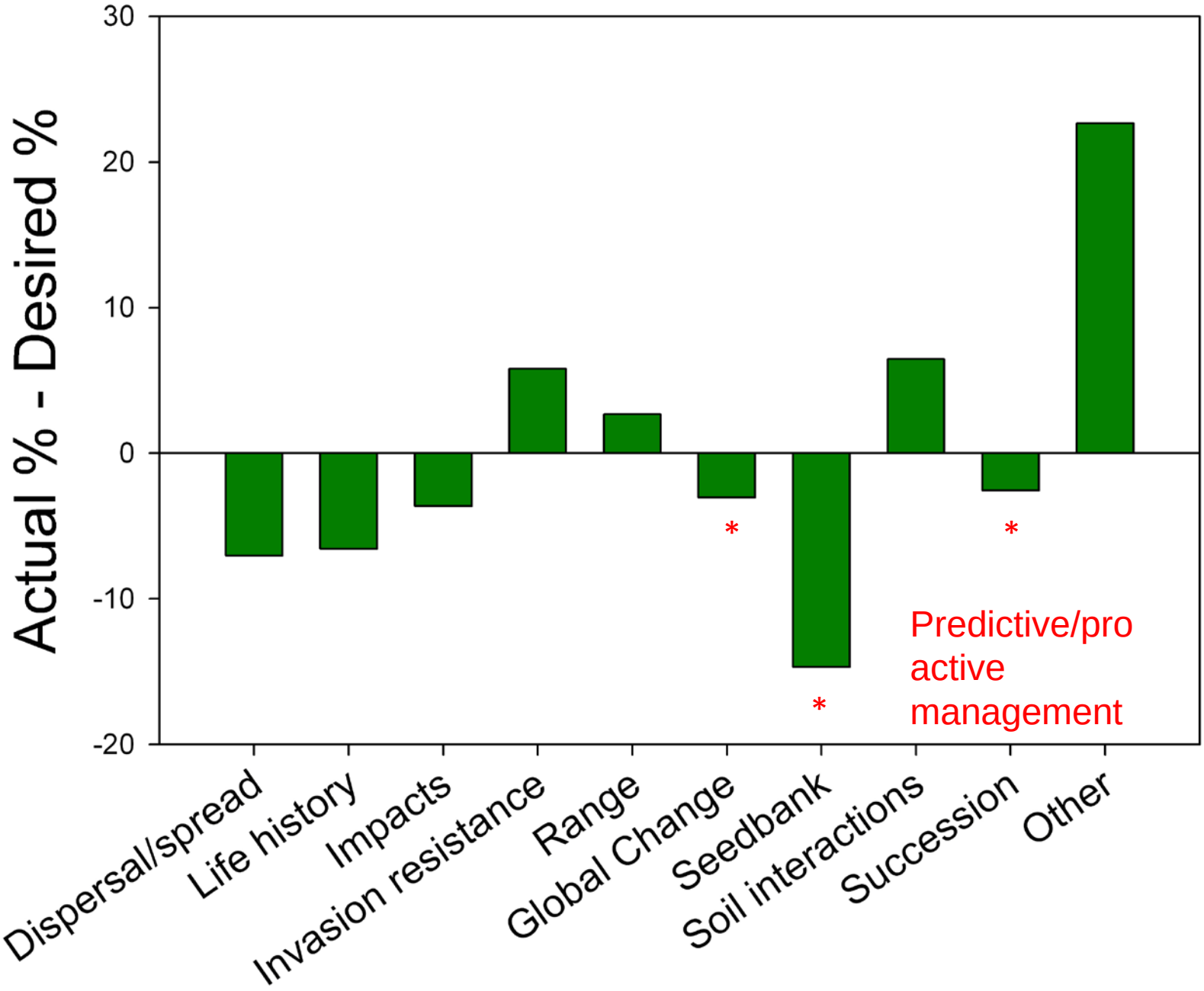


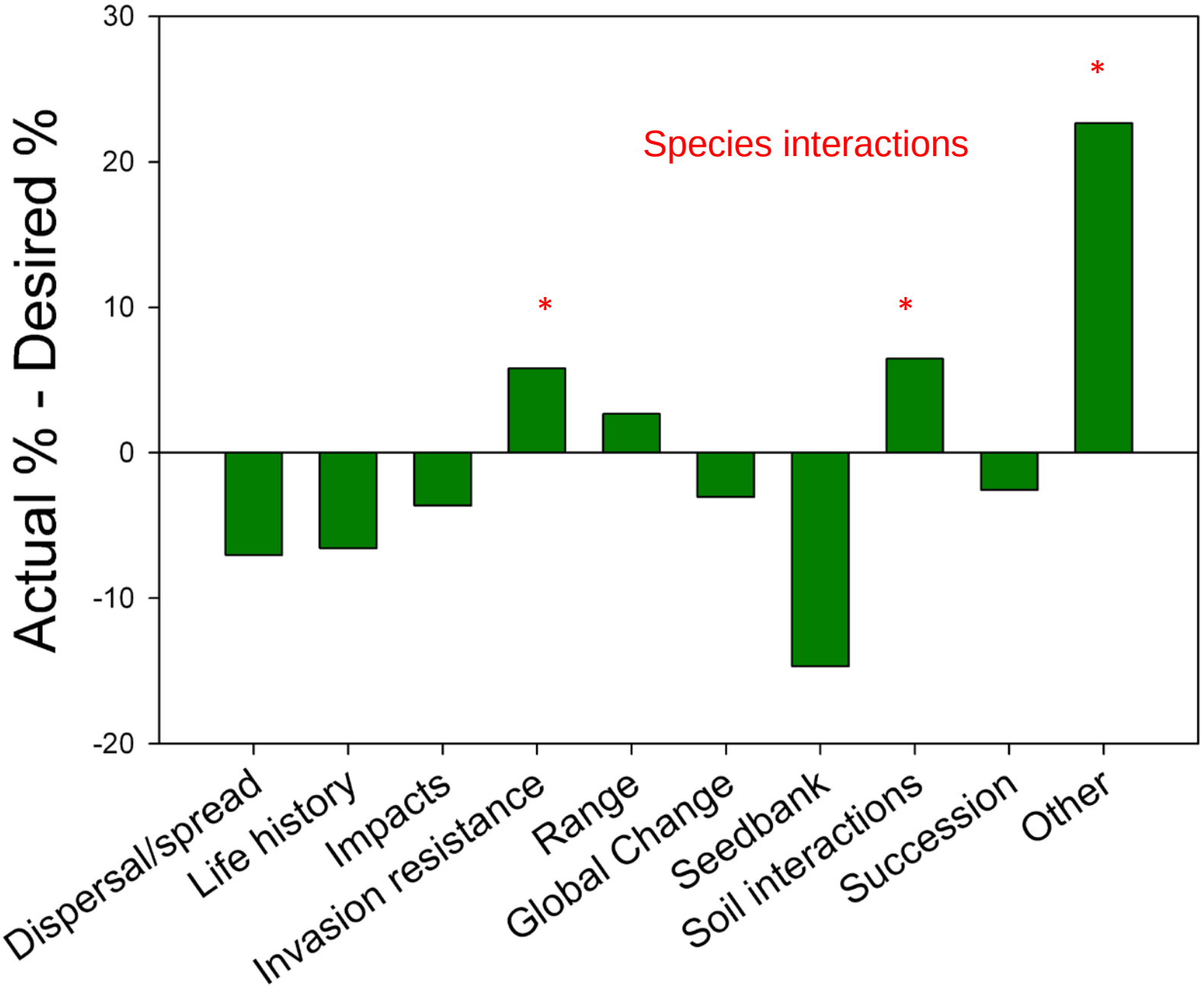
…and more than a third were explicit in making recommendations for managers.

How do basic research topics in the literature match up with managers' choices?

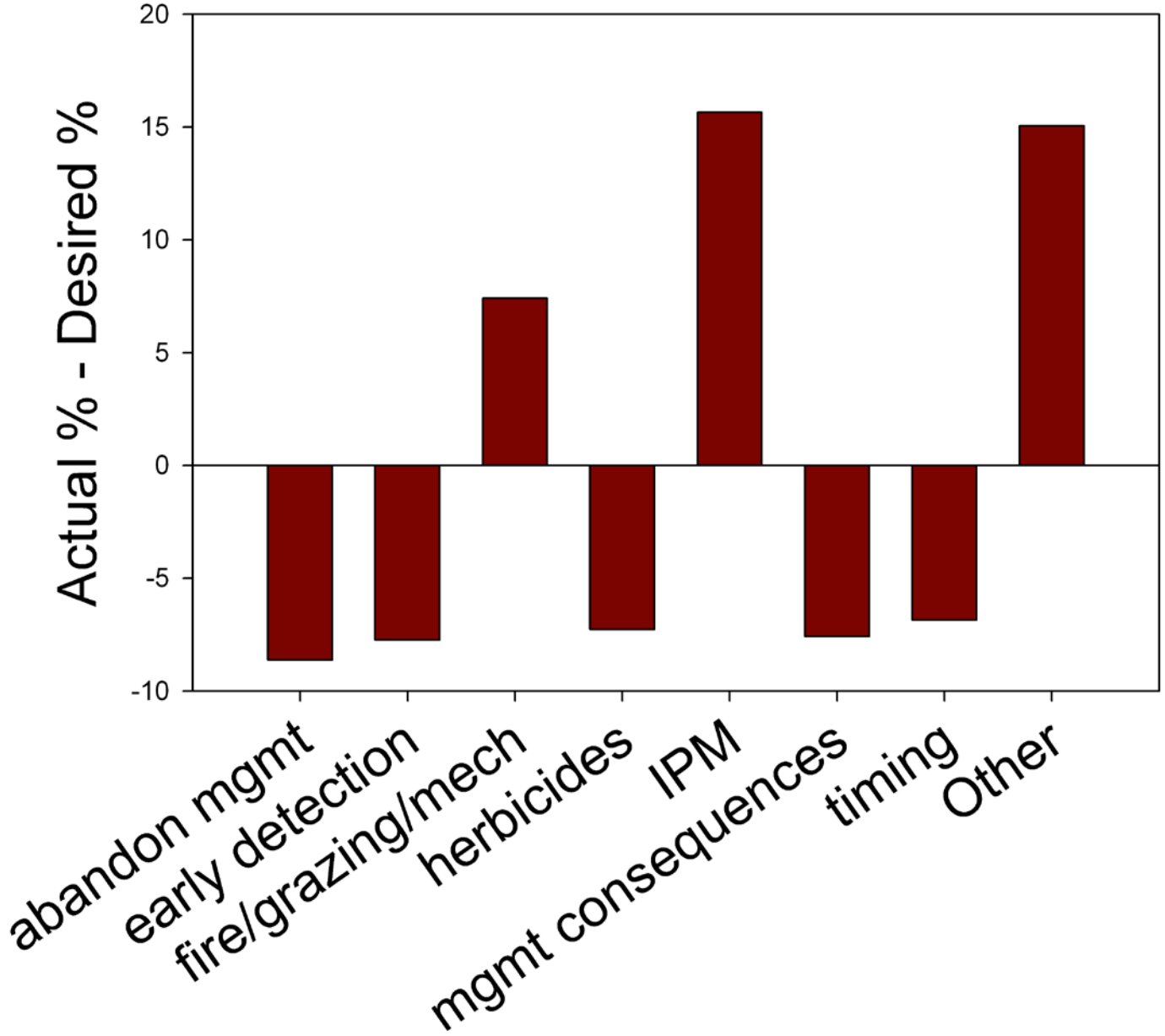

Actual % - Desired %
30
20
10
0
-10
-20
Dispersal/spread
Life history
Impacts
Invasion resistance
Range
Global Change
Seedbank
Soil interactions
Succession
Other

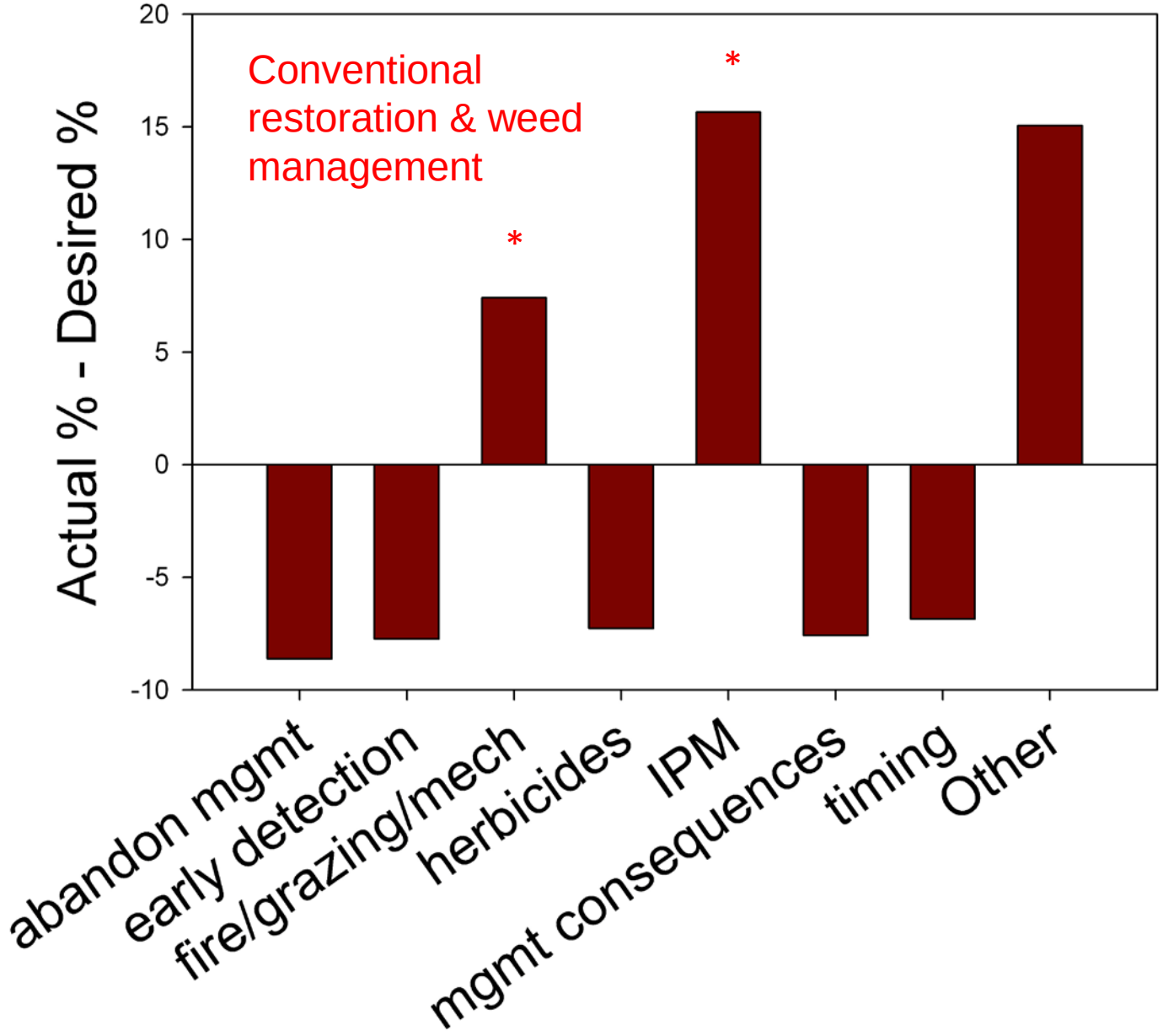

Actual % - Desired %
30
20
10
0
-10
-20
*
*
*
Basic information for
risk assessment
Dispersal/spread
Life history
Impacts
Invasion resistance
Range
Global Change
Seedbank
Soil interactions
Succession
Other

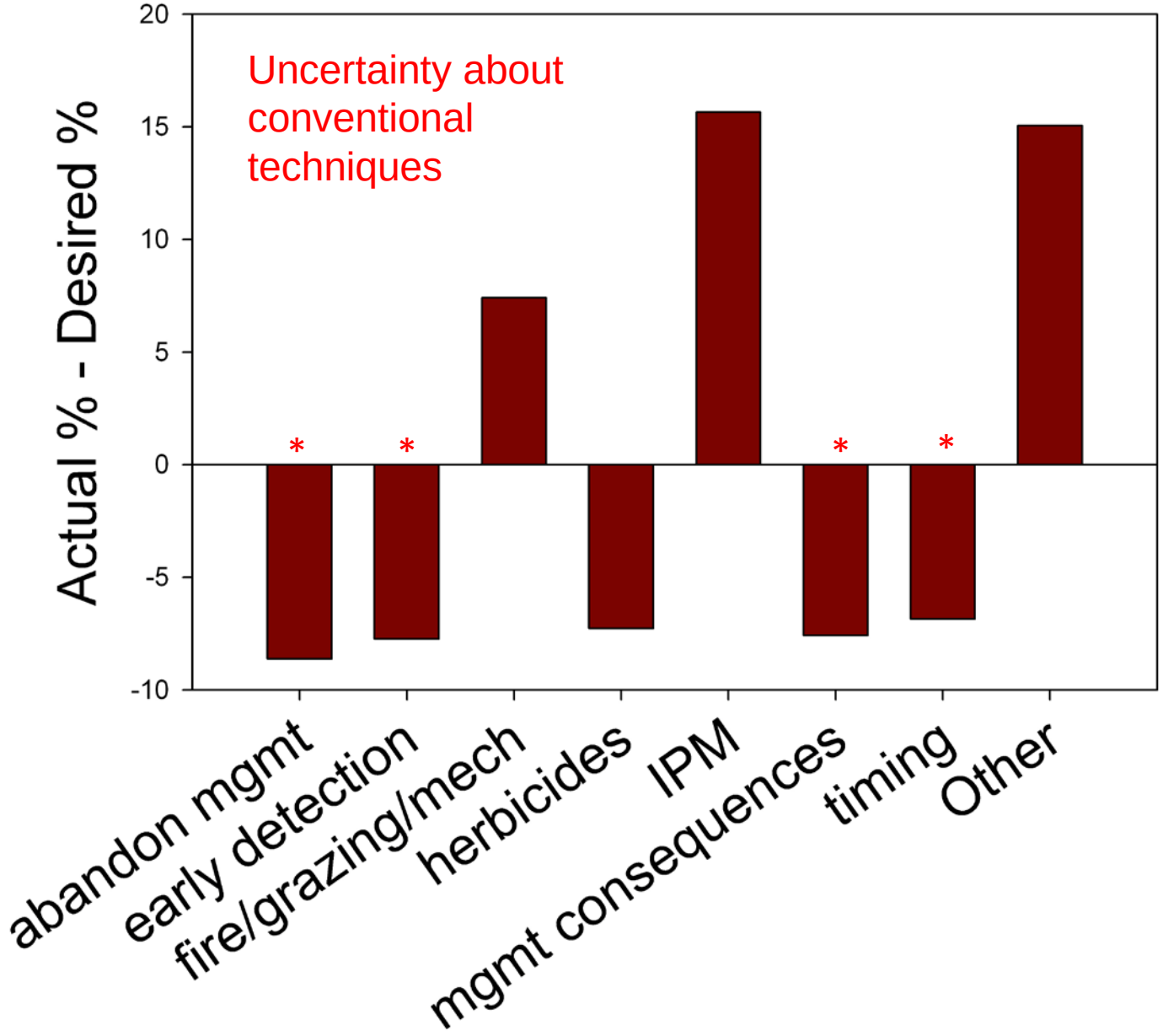

Actual % - Desired %
30
20
10
0
-10
-20
*
*
*
Predictive/pro active management
Dispersal/spread
Life history
Impacts
Invasion resistance
Range
Global Change
Seedbank
Soil interactions
Succession
Other


Species interactions
Actual % - Desired %
30
20
10
0
-10
-20
*
*
*
Dispersal/spread
Life history
Impacts
Invasion resistance
Range
Global Change
Seedbank
Soil interactions
Succession
Other

How do *applied* research topics in the literature match up with managers' choices?


Actual % - Desired %
20
15
10
5
0
-5
-10
abandon mgmt
early detection
fire/grazing/mech
herbicides
IPM
mgmt consequences
timing
Other


Conventional
restoration & weed
management
*
*
Actual % - Desired %
20
15
10
5
0
-5
-10
abandon mgmt
early detection
fire/grazing/mech
herbicides
IPM
mgmt consequences
timing
Other


Uncertainty about conventional techniques
Actual % - Desired %
20
15
10
5
0
-5
-10
*
*
*
*
abandon mgmt
early detection
fire/grazing/mech
herbicides
IPM
mgmt consequences
timing
Other

Managers want *timely* information.
How long does it take us to get papers out?

3.7 yrs

Lag time = publication year – year of last dated experimental observation

Excludes reviews, meta-analyses, modeling, and theory papers; n=278

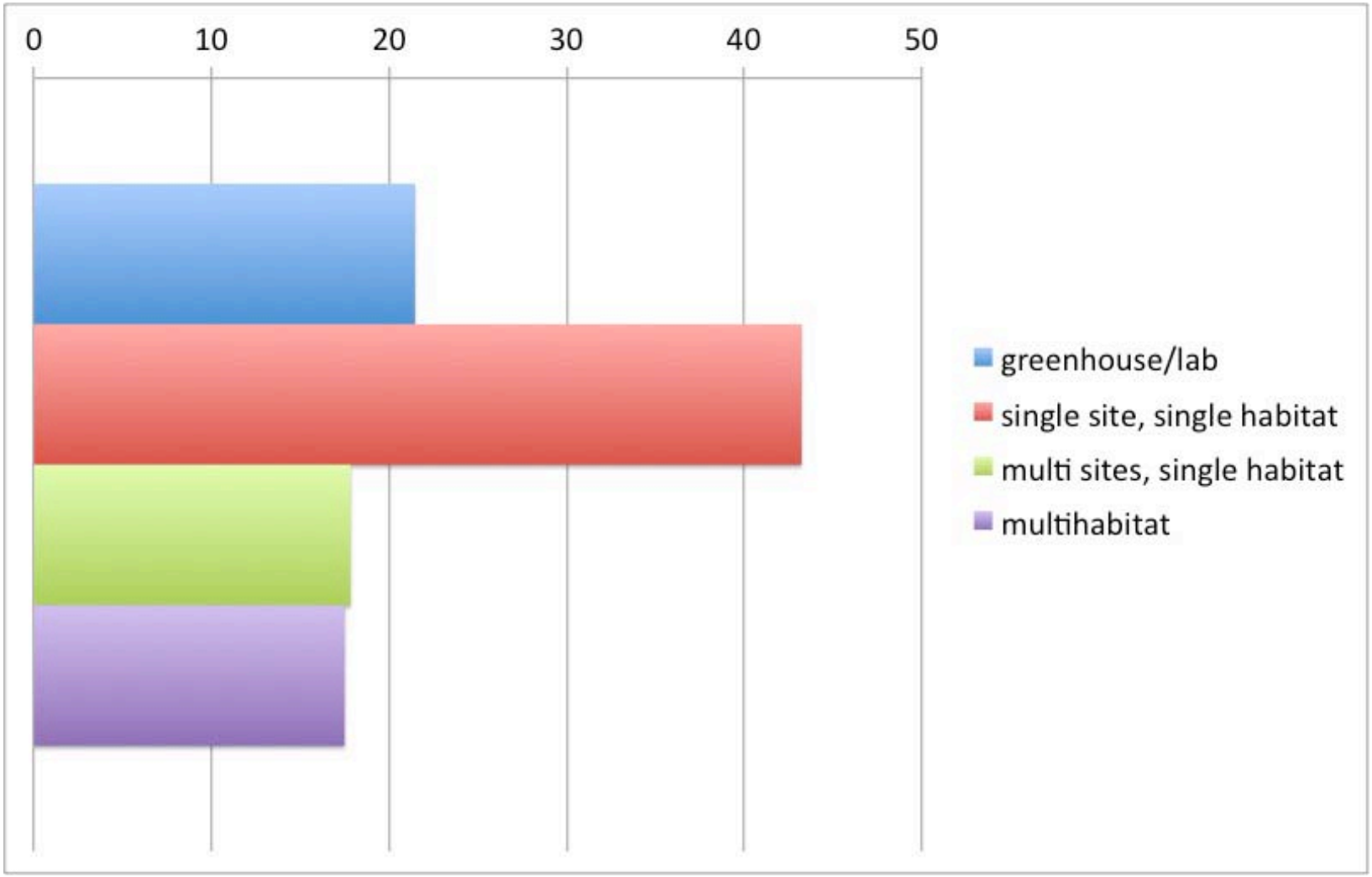
Managers have *tight budgets*.
How often do we mention the cost of treatment?

2% (detailed in $ or hrs)

11% (relative costs)

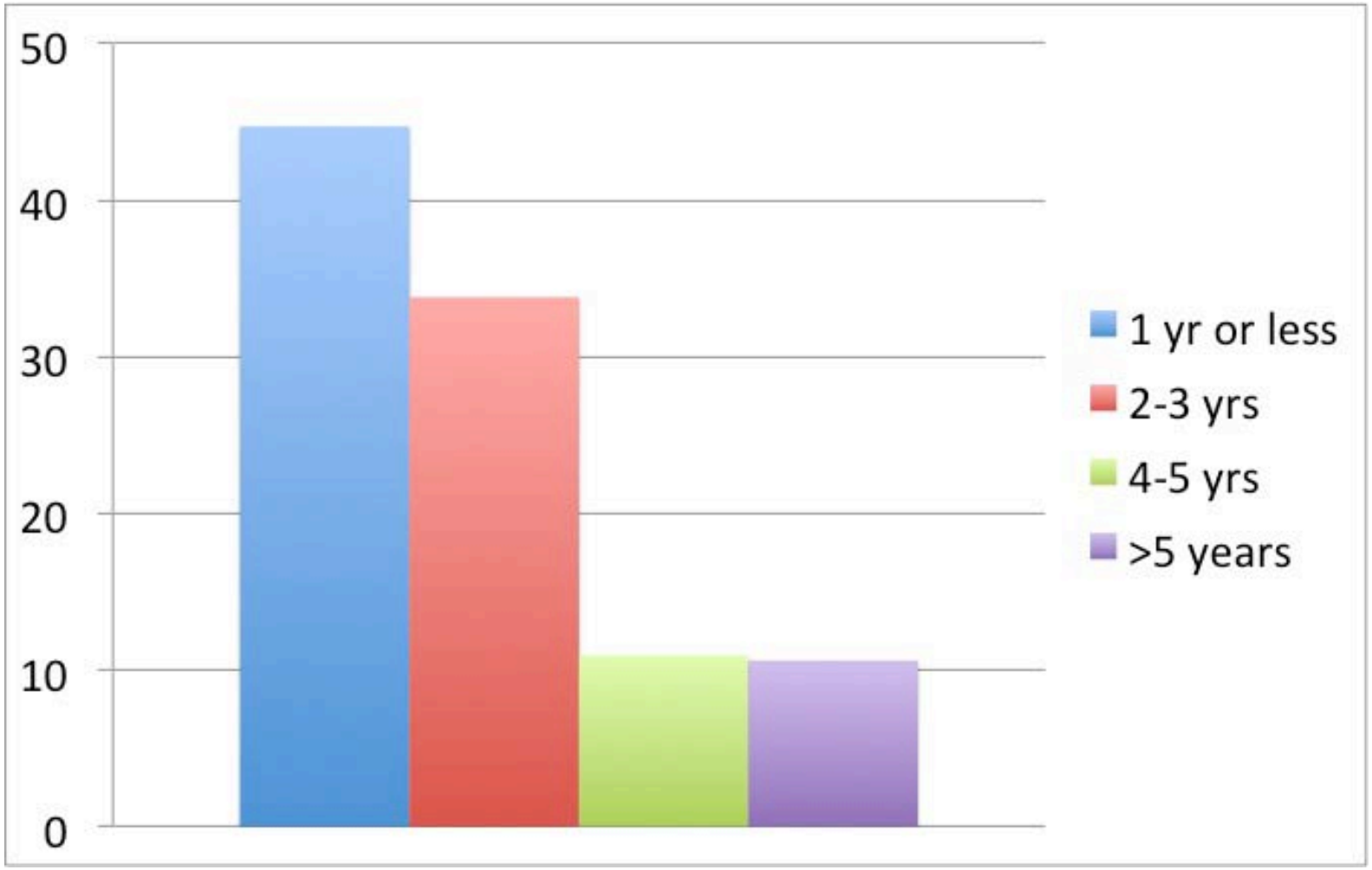
Papers with an applied focus only (n= 97)

Managers work at watershed scales.
What is the *spatial* scope of scientists' work?



Experimental work only; excludes reviews, meta-analyses, modeling, and theory papers; n=303

Managers implement control for decades. What is the *temporal* scope of scientists' work?



Fieldwork, greenhouse experiments, and remote sensing only; n=275

Managers contend with scores of invaders. How *wide* is the literature's species distribution?

yellow starthistle

37%

spotted knapweed

cheatgrass

tamarisk

Excludes theoretical work; studies in which exotic species were not specified; and papers on species that do not occur in California; n=308

Managers contend with scores of invaders. How *wide* is the literature's species distribution?

Meanwhile, of the 41 most impactful wildland invaders in the state:

7 are represented by a single study each

6 do not appear at all in the database

What scientists could do better:

1. Recognize, and spell out, the management implications of basic research on how invaders interact in communities and ecosystems.

2. Work with managers to design research projects that answer questions of interest to both parties.

What scientists could do better:

3. Publish in open-access journals that are freely accessible to anyone with an Internet connection.

4. Disseminate results through informal channels; talk to management audiences.

What scientists could do better:

5. Make friends with the social scientists who can address the transdisciplinary research questions asked by managers.

What scientists could do better:

6. Use the “experiment that is management” to expand the spatial scale and temporal scale of research.

What managers could do better:

1. Communicate your research needs to scientists. Is there an undergrad level, master's level, Ph.D. level question you want someone to answer? Is your invader "understudied"?

What managers could do better:

2. Think experimentally when starting management actions, even if just to get “quick and dirty” data.

3. Communicate your findings more widely, through articles, symposia, online mapping, etc.

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vmatzek@scu.edu

The “what managers want” part is published…open-access of course!

Conservation Letters

LETTER

Closing the knowing–doing gap in invasive plant management: accessibility and interdisciplinarity of scientific research

Virginia Matzek[1], Justin Covino[1], Jennifer L. Funk[2], & Martin Saunders[1]

[1] Department of Environmental Studies & Sciences, Santa Clara University, 500 El Camino Real, Santa Clara, CA 95053, USA
[2] Department of Biological Sciences, Chapman University, Orange, CA 92866, USA

Keywords
Ecosystem management; interdisciplinary; invasive species; managers; practitioners; research–implementation gap; restoration.

Correspondence
Virginia Matzek, Department of Environmental Studies & Sciences, Santa Clara University, 500 El Camino Real, Santa Clara, CA 95053, USA.
Tel: 408 551 6006; fax: 408 554 2312.
E-mail: vmatzek@scu.edu

Abstract

Like many conservation disciplines, invasion biology may suffer from a knowing–doing gap, where scientific research fails to inform management actions. We surveyed California resource managers to evaluate engagement with scientific research and to identify research priorities. We examined managers' access to information, judgment of the usefulness of existing research, ability to generate scientific information, and priorities for future research. We found that practitioners rely on their own experience, and largely do not read the peer-reviewed literature, which they regard as only moderately useful. Less than half of managers who do research carry out experiments conforming to