

# MuseumPests.net

Integrated Pest Management for Cultural Heritage

## 2019 SURVEY DATA

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Land acknowledgement: Today I am speaking to you from the ancestral land of the Seneca Nation, part of the Haudenosaunee or Iroquois Confederacy. I would like to acknowledge their stewardship of this beautiful place and pay my respects to their communities, past, present, and future.

In 2019, the MuseumPests Working Group conducted a worldwide survey to capture recent trends; the survey took two years to write; a committee effort for sure! The group has periodically used surveys to gauge and guide priorities since the group's first meeting in 2002.

## Research questions



I will start by saying that we learned as much from the process as we did from the results!

Our survey team included curators, conservators, collection managers, conservation scientists and pest management professionals. None of us are data scientists. The data we received is complex and we weren't able to answer all of our research questions. But what we learned from this experience will inform the design of future surveys.

## Research questions

1. Who is doing IPM (Integrated Pest Management)?
2. What resources have been put towards IPM?
3. Are pest populations increasing or decreasing? Are decreases related to greater resources or awareness?
4. What methods are being used to treat pest issues?
5. How are resources such as MuseumPests.net being used?

We were hoping to learn how the field of cultural heritage IPM has developed over the past 20 years since our group started.

1. Who is doing IPM? Can we see trends in the types of institutions?
2. What resources have been put towards IPM and have they changed over time?
3. Our group believed that there are increased resources for and awareness of IPM, but have these had an impact?
4. Can we see trends in how institutions are responding to the introduction of pest management programs?
5. Can we see if MuseumPests website is meeting the needs of our community?

# IPM History – Growing Awareness

Fig. 5.14 Institutions Reporting Causes of Significant Damage to Collections

Improper storage or enclosure	7%
Water or moisture	6%
Light	5%
Obsolescence of playback equipment, hardware, or software	4%
Airborne particulates or pollutants	3%
Handling	3%
Pests	2%
Prior treatment(s) or restoration	2%
Vandalism	1%
Fire	.04%

## 2004 Heritage Health Index

## 2014 Heritage Health Index

**Table 6. Sources of Damage or Loss among Institutions that Reported Damage or Loss in the Past Two Years by Institution Type**

CAUSE	ALL INST.	ARCHIVE	HISTORICAL SOCIETY	MUSEUM	SCIENTIFIC COLLECTION	LIBRARY
Percentage of institutions that reported damage/loss within the past 2 years	32%	25%*	32%	36%*	32%	26%*
<b>Environmental</b>						
Water or moisture	56%	74%*	56%	57%	41%*	55%
Improper storage or enclosure	45%	50%*	29%*	46%	44%	50%*
Physical/chemical deterioration	41%	34%*	36%*	40%	43%	45%
Light	35%	32%*	44%*	36%	10%*	33%
Pests	22%	4%*	23%*	35%*	54%*	12%*
<b>Human</b>						
Airborne particulates or pollutants	15%	9%*	12%	17%	4%*	16%
Handling	4.4%	50%*	28%*	42%	4.4%	54%*
Equipment obsolescence	2.4%	64%*	26%	18%*	3%*	32%*
Prior conservation treatment/restoration	7%	27%*	2%*	7%	3%*	6%
Vandalism	2.0%	6%*	20%	21%	1%*	22%
<b>Random</b>						
Natural disaster	10%	6%*	2%*	12%	6%*	10%
Fire	2%	3%	0.2%*	3%	0%*	0.2%*

\* Indicates that the percentage reported for the institutional type is outside a 95% confidence interval on the percentage for all institutions (All Inst.) reported in the first column in red. Italicized text indicates findings based on a contingency item (i.e., the top row highlighted in green is the screening item), including only those institutions that indicated they had experienced damage/loss with the past two years.

We wanted to start by pointing out that we can see some important trends when we look at data from other large scale surveys like the Heritage Health Index projects of 2004 and 2014/

This data tells us that an interest and awareness in IPM has seen a historical increase.

When comparing the 2004 data to the 2014 data, pest damage rises from 2% to 27%; while we cannot speculate about a rise in pest populations, we can potentially attribute this to increased awareness and vigilance in monitoring and maintaining pest free environments.

# Data Logistics

How you ask the Question and What results to you get when you choose a subset of the total data are critical WHICH conclusions are valid

Figure 4. Sources of Damage or Loss among Institutions that Reported Damage or Loss in the Past Two Years

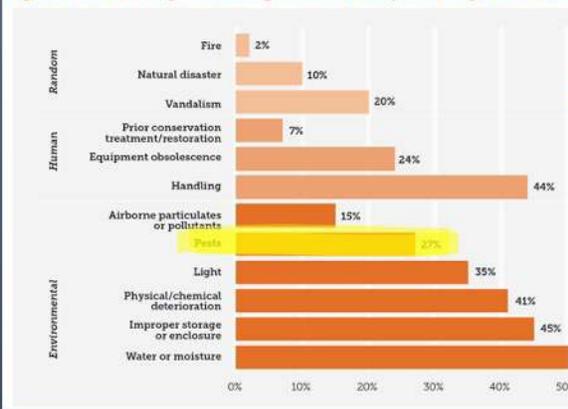


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Light	35%	32%*	44%*	36%	10%*	33%
Pests	27%	4%*	23%*	35%*	54%*	12%*
Airborne particulates or pollutants	15%	9%*	12%	17%	4%*	16%
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Prior conservation treatment/restoration	7%	27%*	2%*	7%	3%*	6%
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Natural disaster	10%	6%*	2%*	12%	6%*	10%
Fire	2%	3%	0.2%*	3%	0%*	0.2%*

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Our data presented difficulties in geographic distribution, types of museums represented, how we characterized institutional size – by budget, budgets for IPM, size of collections, number of staff, etc.

It is worth noting that other surveys, such as the Heritage Health Index surveys appear to have been saddled with similar problems. For example, when we look at the report for the 2014 data set and hone-in on “Pest” as a source of damage, we see that the total data indicates a 27% total, but a much higher percentage of 54% for Scientific collections, which only account for 773 institutions out of the total 31 thousand respondents, or 1 %.

Similar problems exist for our data; for example, the total number of respondents was 377, and for some sets, we were confronted with very small numbers, like the 2 respondents for Scientific Collections. In addition, any time we reduced the data set to look at relationships between survey questions, we confronted problems with data reliability.



We received responses from 377 institutions worldwide, as distributed through various listservs.

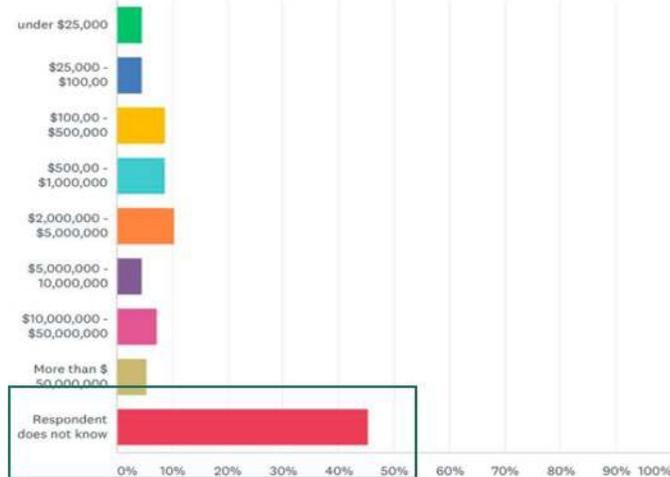
Our survey was in English, so the geographic distribution seen here is unsurprising. We received the most responses from general and natural history museums and the fewest from science and technology museums.

Other geographical data surprised us; for example, all the historic house/site institution respondents were from North American continent. Note too that we received no responses from the African continent and only one from South America.

## PM Resource Allocation

What is your institution's annual budget for fiscal 2019 (choose one)

Answered: 260 Skipped: 110

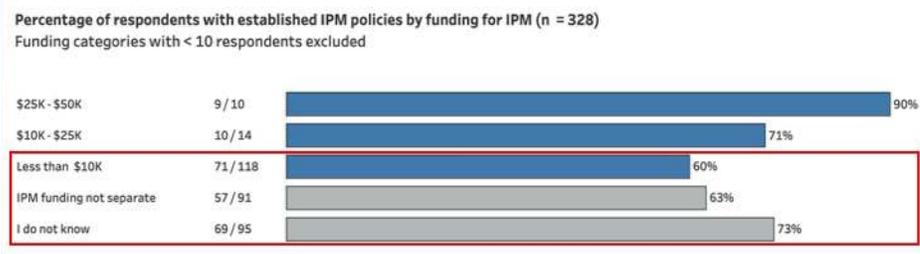
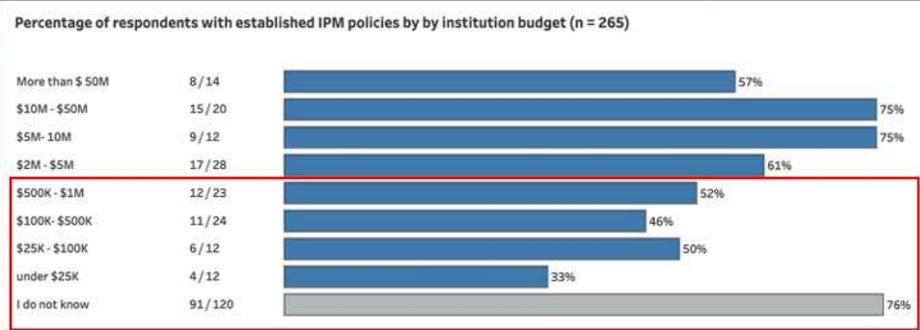


We wanted to know if there was a correlation between the type of institution, general annual budgets, and percentage of funding expended on pest management.

But the results were difficult to interpret, because it was clear that the majority of respondents could not or did not report about their institutional or departmental budgets.

Please note that when we used this data to expose or illustrate other trends by combining data from several questions, our ability to make definitive conclusions is marred by small numbers in some data sets.

## FUNDING: More money = More pest management?



Where budget information is available, funding for pest management activities still appears to be low. Less well funded institutions have the lowest funding resources for IPM. This is also true for institutions with established IPM policies.

Note the consistently large percentage of respondents who are not aware of their institutional budgets, nor whether funding for IPM is separately funded. Also note that for institutions with higher budgets for IPM, the percentage of institutions with IPM policies is quite high at 90%.

## IPM Policies by Institutional type

Percentage of respondents with established IPM policies by institution type (n = 263)

Institution categories with < 10 respondents excluded



When correlated institutional type with IPM policy, we noted that historic house, archives, and libraries represent the lowest number of respondents with IPM policies.

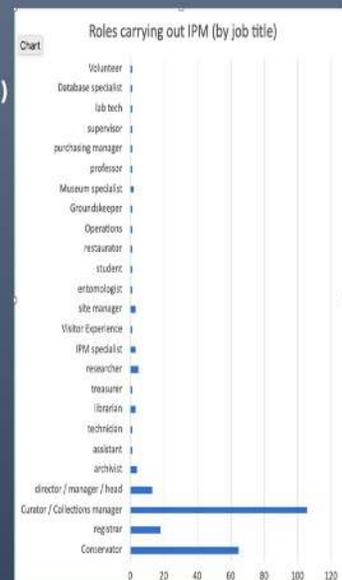
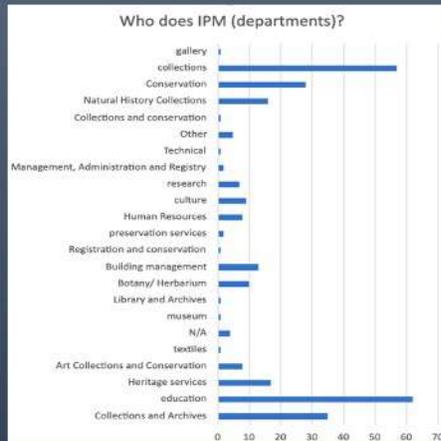
We postulated that the gradual decrease in percentages above may correlate with size of institution, but with the complexity of the data, we were unable to reach definitive conclusions about size AND type as compared to IPM policy.

## Data Logistics

Who does IPM (How you ask the question can determine the quality of data)

We asked:

- If Respondents were filling out the data for their institution or department
- WHO is responsible for IPM activities
- The NUMBER of people
- The PERCENTAGE of TIME
- Departmental name
- Respondent title
- Respondent role
- Free Responses

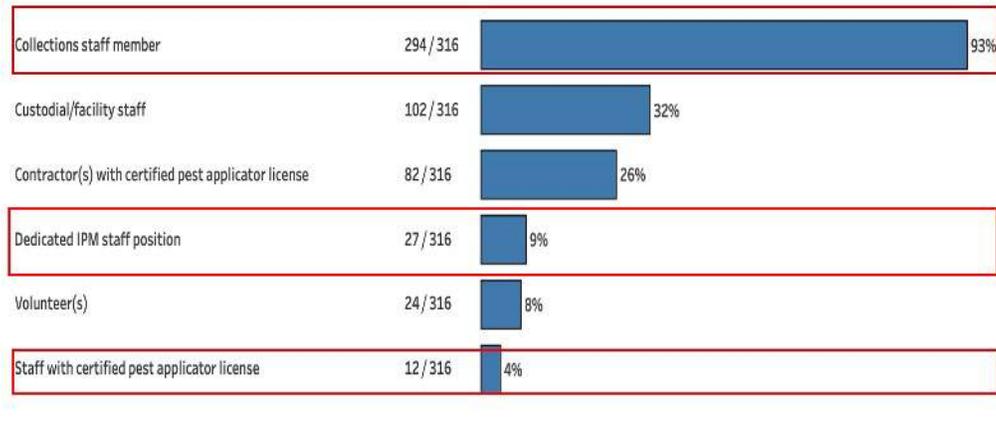


Data problems were exemplified by a series of questions we asked to home in on who does IPM and we ended up with multiple graphs showing a wide range of smaller categories for various titles, roles, and responsibilities.

However, the overwhelming and simple conclusion was that most IPM in cultural heritage institutions is performed by those directly involved in collection care.

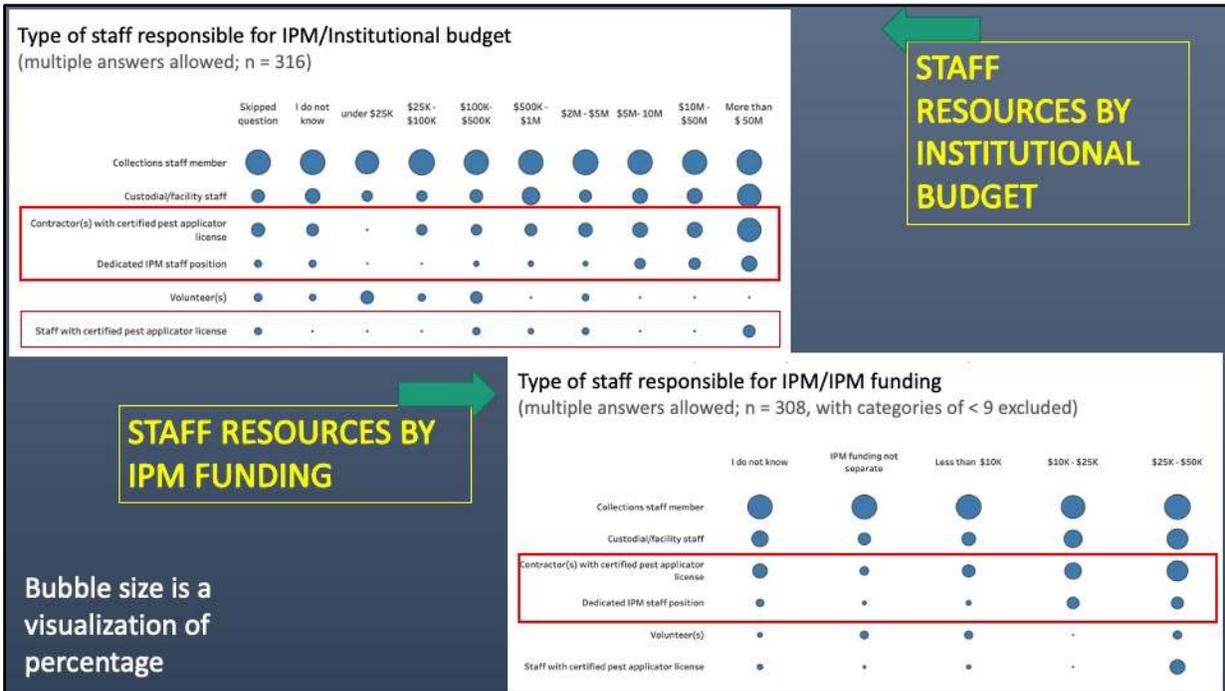
## WHO DOES IPM?

Type of staff responsible for IPM (multiple answers allowed; n = 316)



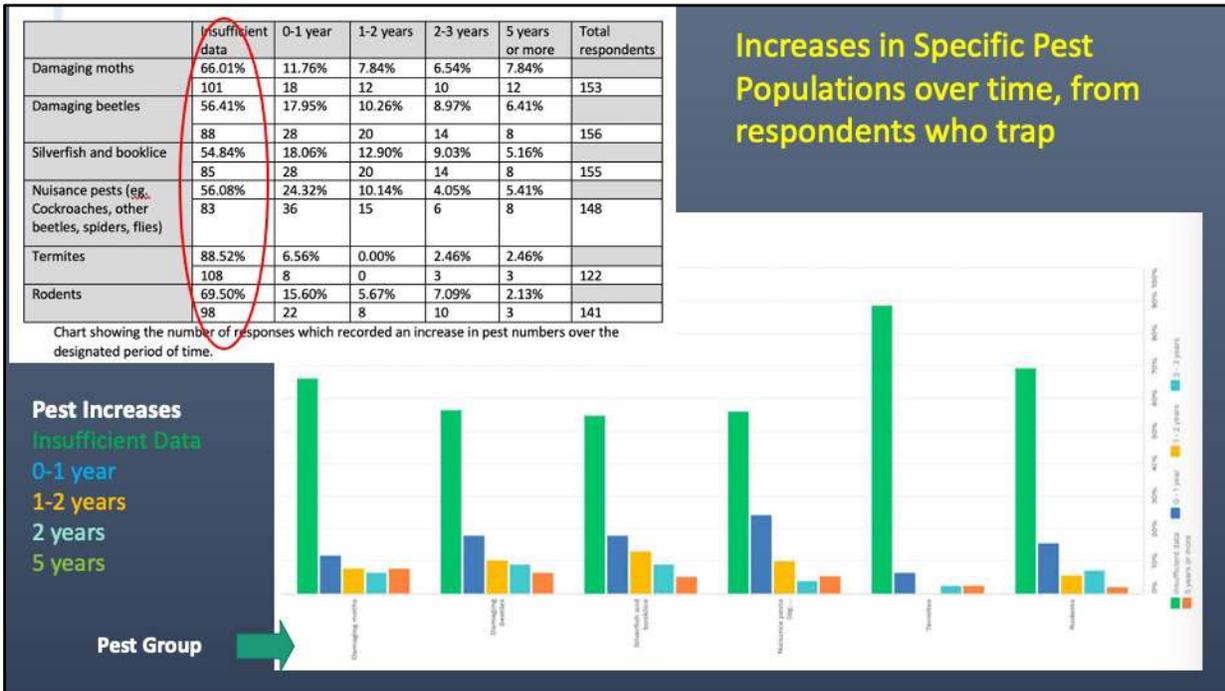
This question from the actual survey summarized what we concluded; that IPM is

- Mainly carried out by collections staff
- And that
- There are few institutions with dedicated IPM staff positions or with individuals that maintain a pest applicator license



Correlating budget with IPM responsibility shows that institutions with the highest budget size also are most likely to have a dedicated IPM staff position, are more likely to use contractors with certified pest licenses, and also have the highest percentages of staff with certified pest applicator licenses. You can see this by looking for the largest size bubbles for the data rows mentioned.

Institutions with a dedicated IPM position are rare and seem to be concentrated among large institutions that have large IPM budgets.



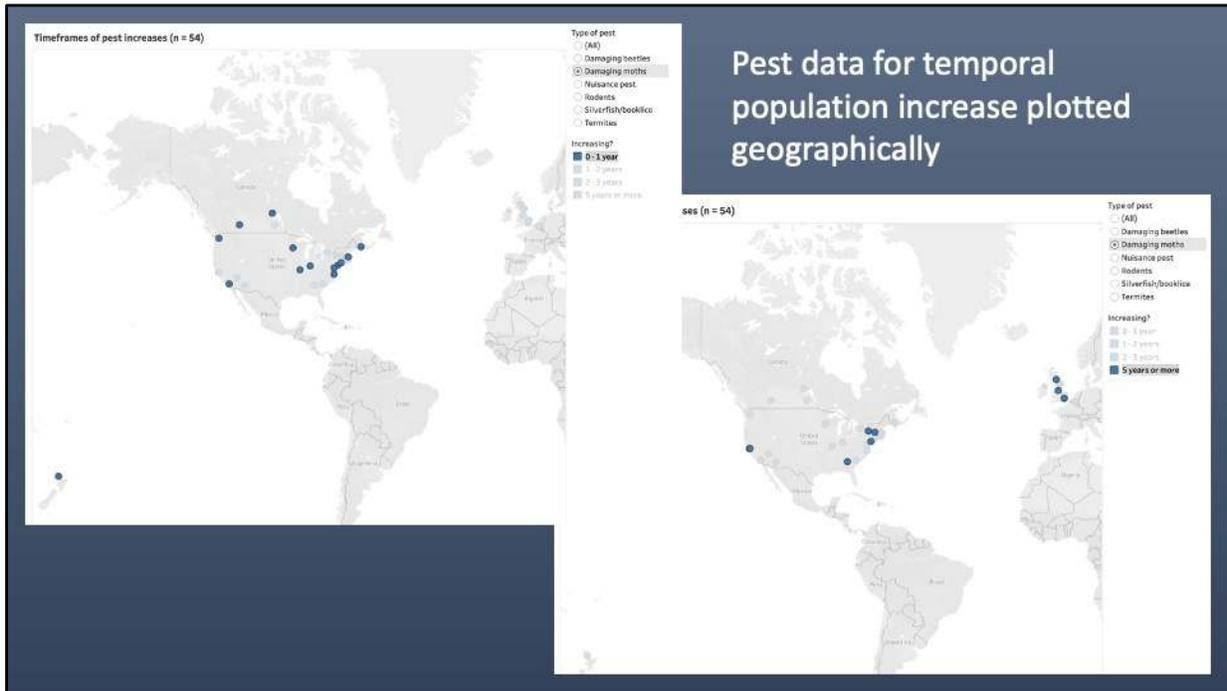
We were interested to see if there were noticeable trends in pest populations and we struggled with how to collect this data in a way that would allow wide participation and reduce the need for our respondents to mine their own data with specificity.

For simplicity, we categorized pests into six large groups: moths, damaging beetles, silverfish and booklice, nuisance pests, termites, and rodents. We asked about temporal frequency of occurrences and how often remediation efforts were triggered, but the data was very difficult to interpret.

Clearly, one take away seen from the size of the green bars is that most people said they had insufficient data to answer this question, and this is from respondents who did indicate that they were trapping and recording. Our attempts to correlate increases, decreases, types of pests, and triggered responses all revealed confusing and uninformative pictures of the data.

It is unclear whether respondents didn't mine their own data accurately and fully respond to the survey questions, or whether we could have asked the questions in a different way.

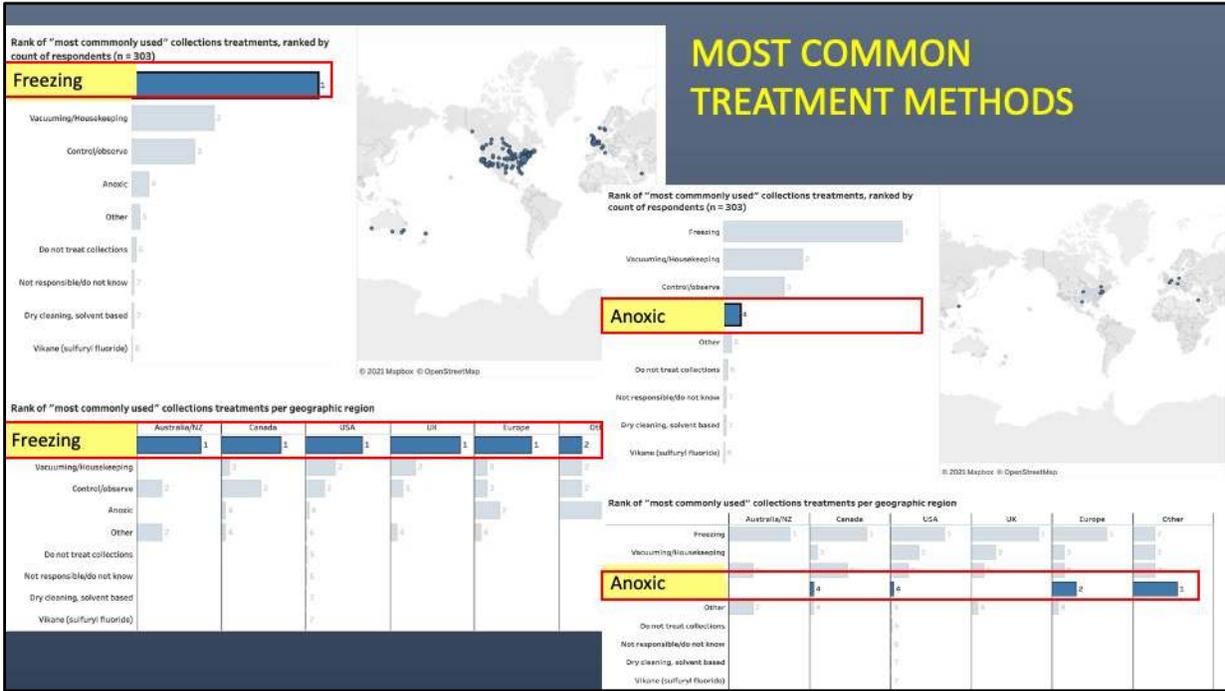
If you look at the progression of bar heights, with representing the most recent, you will see that there does seem to be a slight increase in pest captures for each pest category over time, with perhaps a larger increase for nuisance pests. Whether this is an artifact of increased vigilance or better memory for most recent pest evidence cannot be ascertained.



## Pest data for temporal population increase plotted geographically

When we correlated temporal data with geographical locations, some interesting results emerged:

- Damaging moths were noted with temporal increase in northern Europe and in the north American continent, and we see incidences reported largely in coastal areas.
- In contrast, damaging beetles, and silverfish and book lice showed much wider geographical spreads and we could not see patterns as clearly.



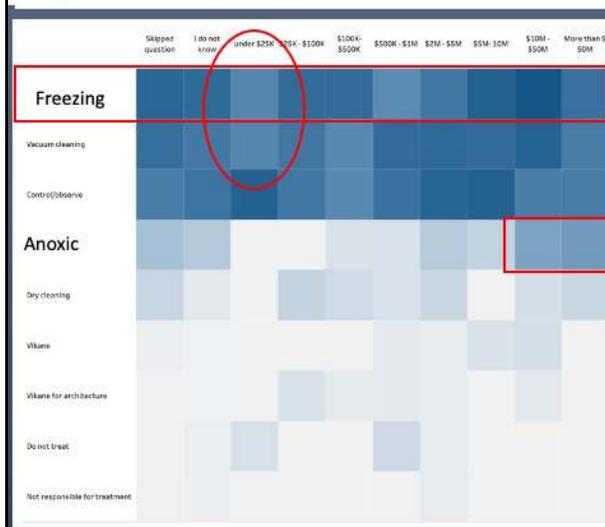
We also collected data about treatments used on collections, within buildings, and exterior spaces. For treatment of collection items:

- Low temperature (or freezing) was the most commonly used treatment, both by count and geographic distribution.
- The number of respondents using anoxia was very low and plotting it geographically resulted in significant differences.
- The highest percentage is seen in Canada and the U.S. No one in Australia or the UK is using these gaseous treatments.

## Treatments for Collections vs Budget and funding for IPM

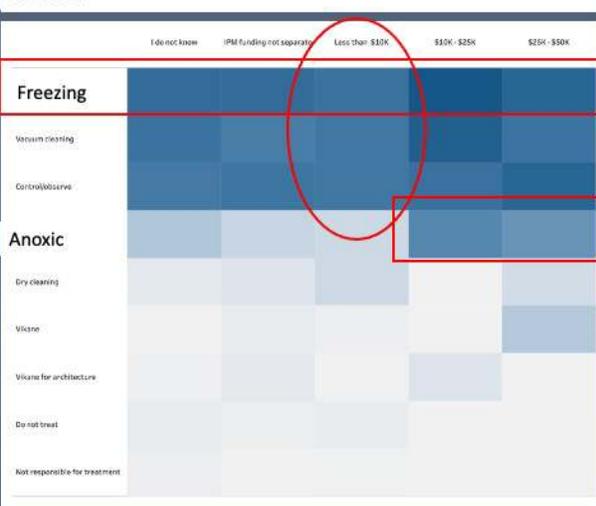
### Collection Treatments by Institutional budget

Multiple answers allowed; n = 303



### Collection Treatments by IPM Funding

Multiple answers allowed; n = 295, funding categories with < 9 excluded

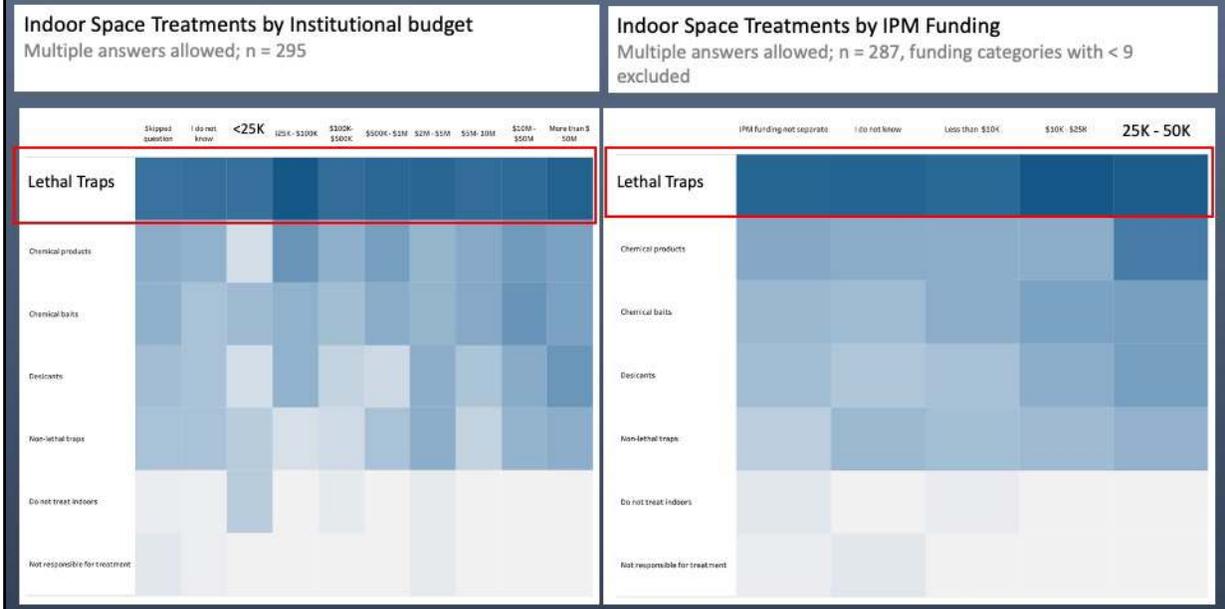


These heat maps correlate budgets with treatment options and are visualizations based on density of responses. The intensity of shading indicates higher percentages.

For treatment of collections, note that freezing represents the most common treatment, except in institutions that have the lowest budgets - under 25 K and less than 10 K for IPM funding.

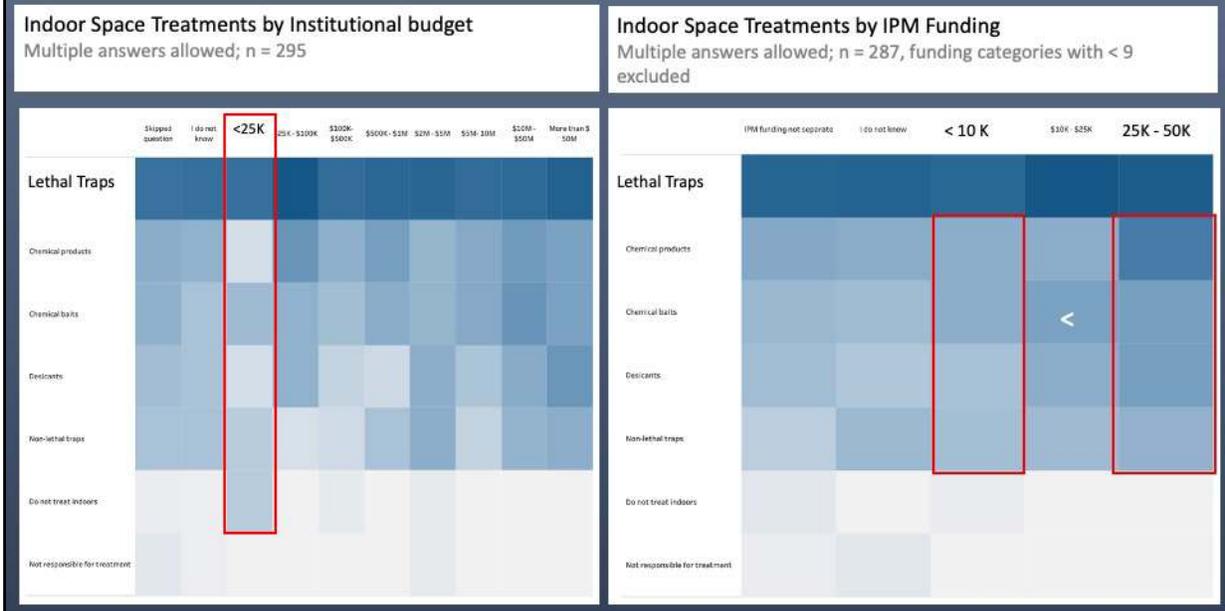
Also note that institutions with higher budgetary frameworks are more apt to use anoxia, suggesting that there is a financial barrier to performing these treatments.

## Treatment for Indoor Spaces vs Budget and funding for IPM



For indoor spaces, our initial data showed that trapping and the use of chemical products were the most common indoor treatments used, with lethal traps leading at approximately 82%.

## Treatment for Indoor Spaces vs Budget and funding for IPM

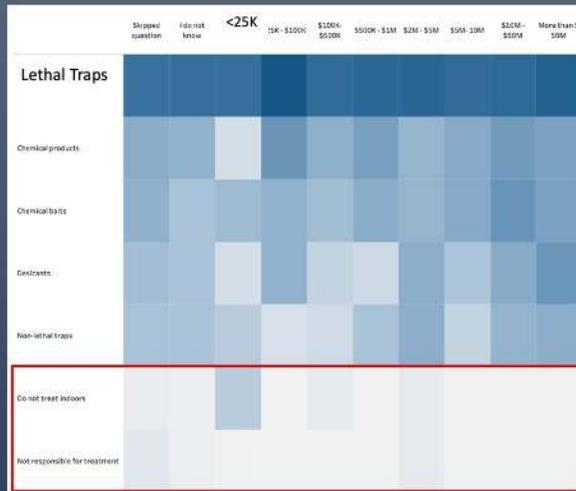


Additionally, lower funded institutions did not report the use of chemical baits and desiccants as frequently as higher funded institutions, especially for institutions with IPM funding.

## Treatment for Indoor Spaces vs Budget and funding for IPM

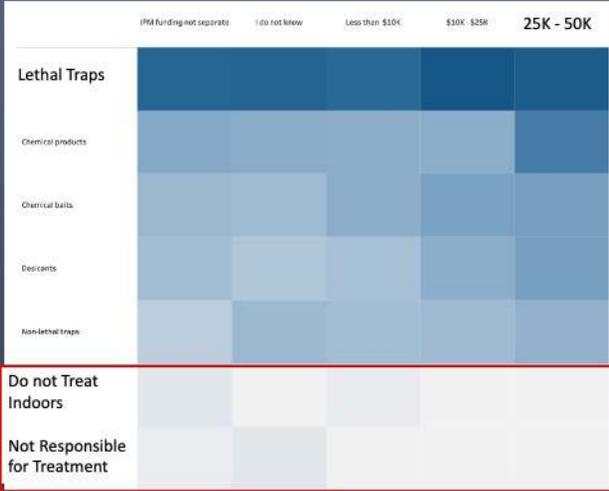
### Indoor Space Treatments by Institutional budget

Multiple answers allowed; n = 295



### Indoor Space Treatments by IPM Funding

Multiple answers allowed; n = 287, funding categories with < 9 excluded



Note that across the board, “do not treat indoors” and “not responsible for treatment” is very weakly reported across all funding categories, and for institutions with IPM policies, a shift to white, indicating that these institutions do consider treatment of indoor areas part of their purview

## Outdoor Spaces vs Budget and funding for IPM

### Outdoor Spaces Treatment by Institutional Budget

Multiple answers allowed; n = 273



### Outdoor Spaces Treatment by Institutional Budget

Multiple answers allowed, n = 265, funding categories with , 9 excluded



For outdoor spaces, we uncovered a few trends:

- A significant percentage indicated that their institution never treats these areas or that they are not responsible for treating them.

## Outdoor Spaces vs Budget and funding for IPM

**Outdoor Spaces Treatment by Institutional Budget**  
Multiple answers allowed; n = 273



**Outdoor Spaces Treatment by Institutional Budget**  
Multiple answers allowed, n = 265, funding categories with , 9 excluded



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- Institutions in the budgetary middle range were more likely to use chemical products, suggesting use of licensed contractors.

## Outdoor Spaces vs Budget and funding for IPM

**Outdoor Spaces Treatment by Institutional Budget**  
Multiple answers allowed; n = 273

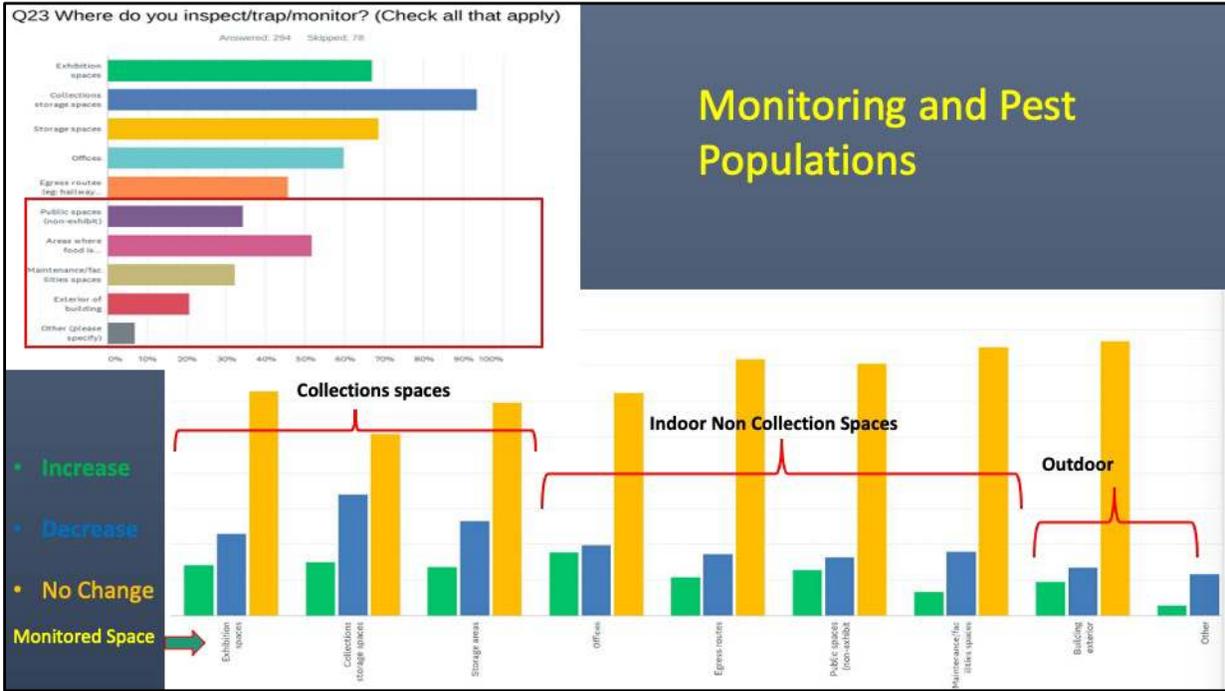


**Outdoor Spaces Treatment by Institutional Budget**  
Multiple answers allowed, n = 265, funding categories with , 9 excluded



We think this data indicates the need for more engagement between collections care professionals and contracted pest applicators.

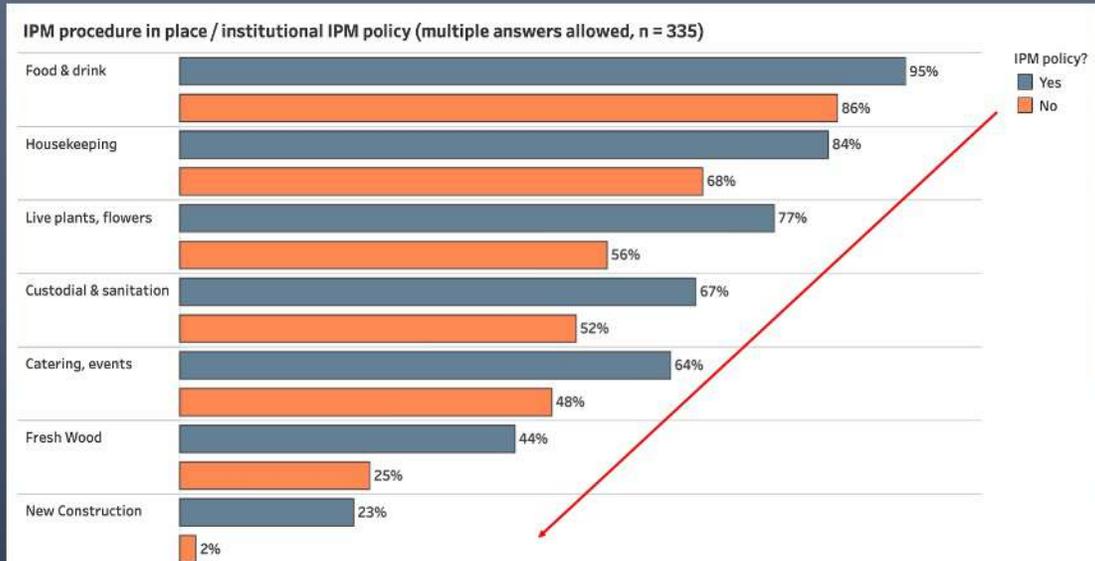
And perhaps this is an opportunity to educate our community about the efficacy and necessity of exclusion strategies and promote them on MuseumPests.net.



We asked where monitoring takes place. It seems we are most focused on collection, storage and exhibition spaces and least on egress routes, public spaces, maintenance spaces, and exteriors.

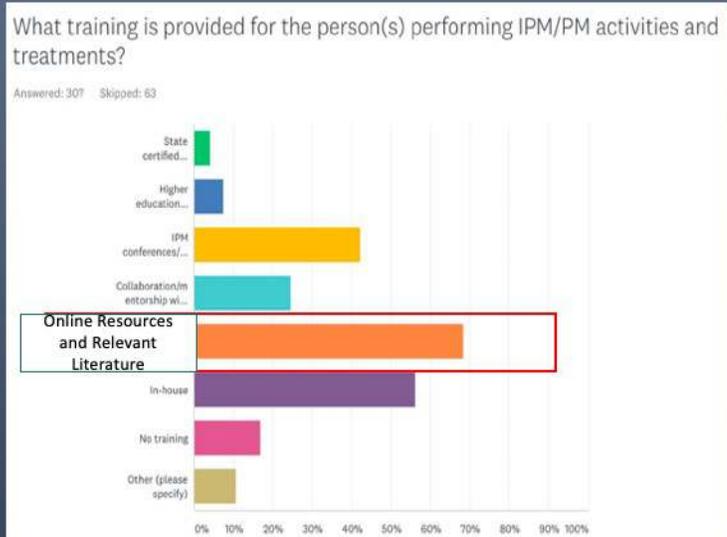
Data collected on change in location of pest populations demonstrates that in monitored spaces, pest populations generally stayed the same, but for those that reported a change in pest populations, more reported a decrease. However, if you look at the size of decrease, you will notice that spaces of more concern to collections professionals such as storage spaces reported higher decreases than spaces like building exteriors.

## IPM Procedures for Activities that Present Risk



This is mirrored when you look at types of IPM policies and procedures, where fresh wood, new construction and catering/event show the lowest percentages for both institutions with and without IPM policies.

## Education

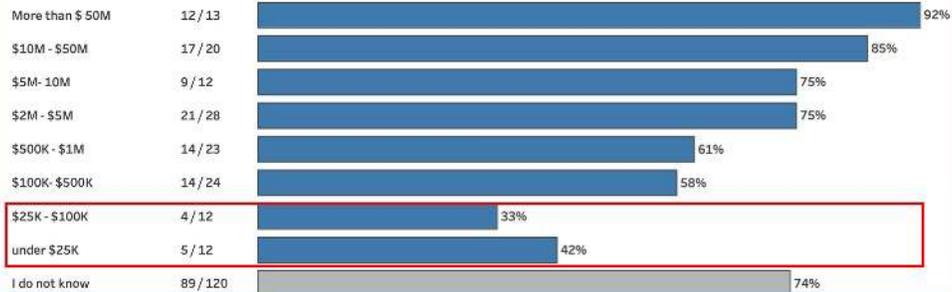


We also looked at what is needed to advance the efficient use of IPM in cultural heritage institutions.

The orange bar shows that online resources and relevant literature were seen as the most needed and most used, and that in-house training is a close second.

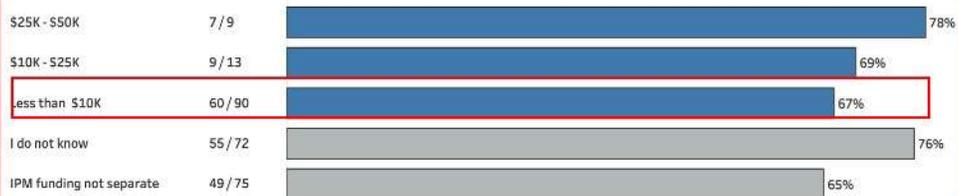
## USE of MUSEUMPESTS.NET

### Use of museumpests.net and institution budget (n = 264)



### Use of museumpests.net and funding for IPM (n = 259)

Funding categories with < 9 respondents excluded



When we correlated use of the MuseumPests website with institutional budget, we saw a clear relationship between budget size and awareness; note that use of the site decreases with decreasing budget range.

This suggests we need to make more effort to reach smaller, lower funded institutions.

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## Conclusions:

- We are using IPM!
- Budgets are still limited for pest management activities.
- Build alliances with pest management professionals.
- Think strategically about how we present information on treatments.
- Spread the word about MuseumPests.net and other trusted resources.
- The relationship between the reported pest data and whether IPM is making inroads in helping to control pest populations is unclear or too complex to parse from this survey.
- We probably need to do another survey!

We've spent a lot of time trying to map and understand our complex data. We think we see the following trends:

We ARE using IPM in our approach to control pest populations. Many institutions have invested time and effort in creating policies, procedures, and guidelines to limit pest activity.

Funding for IPM activities still appears to be low. We lack museum professionals who are educated in pest management at an academic or licensed level.

IPM tasks are performed mainly by collections staff. However, we see many mid-sized institutions contracting pest management work, so this may be an area where we want to explore alliances with pest control professionals.

Knowing that low temperature, or freezing, is the predominant treatment choice for collections, and that anoxia has geographic and fiscal limitations, we can tailor how we present information on the MuseumPests Solutions pages. We will need to indicate on our website what solutions are available or legal in different areas of the world.

The cultural heritage community relies on online resources for pest management information. We need to ensure that under resourced institutions know about our site.

We were unable to draw any irrefutable conclusions from our data about increases or decreases in pest activity or whether IPM is making inroads in helping to control pest populations in cultural heritage collections.

We realized that we could have constructed the survey with more clarity and specificity. For example, we chose to allow open text answers to many questions, and the results were difficult to quantify and include in our data sets. We also neglected to ask some basic questions that now seem obvious. We also wondered if there might be another way to collect data about pest increases and pest response.

Thank you especially to Julie Unruh for jumping in and learning to use Tableau to visualize the data in ways that allowed us to look at relationships between survey questions.

We learned a lot from these data visualizations and we look forward to presenting some of our more nuanced analyses in future presentations. And in some future year we'll integrate what we learned in another survey....but that is for the future!

# MuseumPests.net

Integrated Pest Management for Cultural Heritage

Thank you to all who took the time to respond to the survey!



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Thank you to everyone who took the time to take this survey; your responses have contributed to construction of a world wide picture of how the cultural heritage community uses IPM.

And thank you to everyone who participated in helping to construct the survey and review the results!