

# “Fossils in the Cloud”

## Advancing the Broader Impacts of iDigBio through Paleocollections

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# Talk Outline

- Rationale and strategy
- PIRE and Fossils of Panama digitization project
- STEM Teachers Partnership
- Fossil clubs, digitization & the FOSSIL project
- Wrapup: Intended outcomes and goals

# Rationale

- Why paleocollections?
- Approx. 100 million fossil specimens are curated in non-federal natural history museums in the U.S.
- Once these are digitized into a Cloud for research, they become available for education and outreach (E&O) to downstream users.
- **Downstream User**—someone who uses digitized paleocollections other than for research.

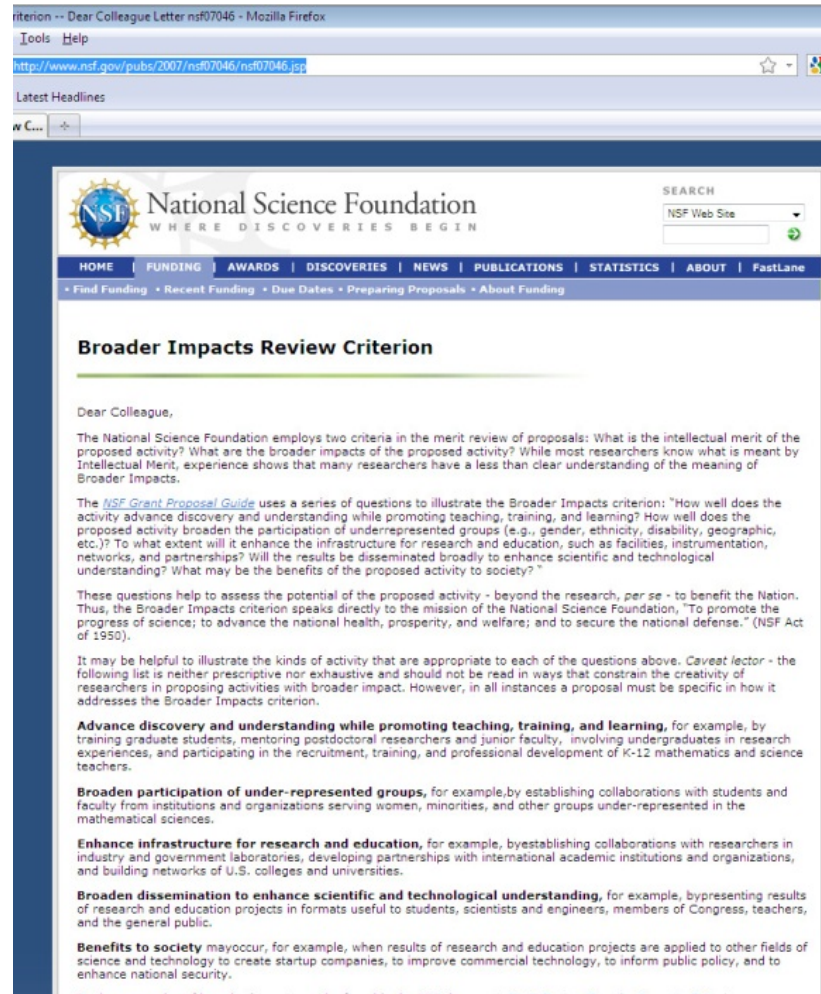
# Strategy

- The potential for downstream uses of digitized data are mind-boggling, for example--
  - Formal K12 education
  - Museums, other informal learning settings
  - Volunteers, citizen scientists
- Although Broader Impacts are an expectation of merit review, in the research directorates (R&RA), funding is limited for these activities.
- For iDigBio, we have used the limited funding from BIO to leverage BI for paleocollections, so--
  - Partner (“piggy-back” ) with existing projects
  - Leveraging for new projects from other NSF directorates.



# Broader Impacts framework NSF document July 2007\*

1. Advance discovery and understanding while promoting teaching, training, and learning
2. Broaden participation of underrepresented groups
3. Enhance infrastructure for research and education
4. Broad dissemination to enhance scientific and technological understanding
5. Benefits to Society



The screenshot shows a web browser window displaying the National Science Foundation (NSF) website. The page title is "Broader Impacts Review Criterion". The NSF logo is visible at the top left, with the tagline "WHERE DISCOVERIES BEGIN". A navigation menu includes links for HOME, FUNDING, AWARDS, DISCOVERIES, NEWS, PUBLICATIONS, STATISTICS, ABOUT, and FastLane. Below the menu, there are links for "Find Funding", "Recent Funding", "Due Dates", "Preparing Proposals", and "About Funding". The main content area begins with "Dear Colleague," followed by an introduction to the NSF's two criteria for merit review: Intellectual Merit and Broader Impacts. The text explains that the Broader Impacts criterion is designed to assess the potential of proposed activities beyond the research itself, focusing on the benefit to the Nation. It lists five key areas of focus: 1. Advance discovery and understanding while promoting teaching, training, and learning; 2. Broaden participation of under-represented groups; 3. Enhance infrastructure for research and education; 4. Broad dissemination to enhance scientific and technological understanding; and 5. Benefits to society. Each area is accompanied by a brief example of how it might be achieved.

\*<http://www.nsf.gov/pubs/2007/nsf07046/nsf07046.jsp>

# Panama PIRE\*

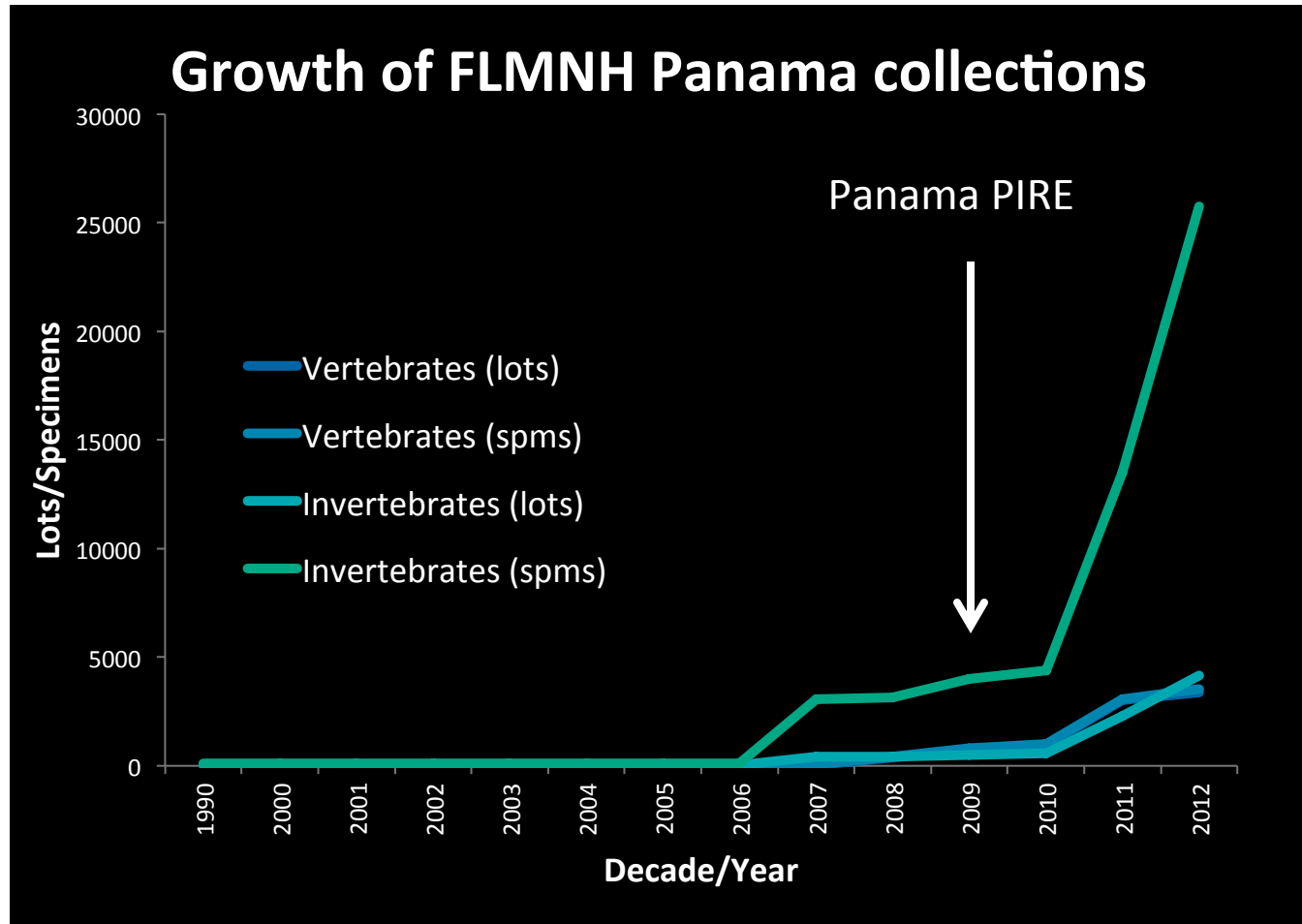


\*Partnerships in International Research & Education  
NSF 0966884



Block of 19-million-year-old fossils  
Cucaracha Formation, Panama

# Goal—digitize Panama specimens in FLMNH



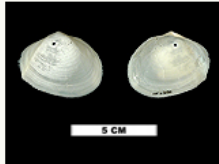
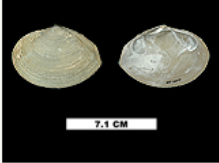










# Develop on-line atlas e.g., FLMNH Florida fossil bivalves

Firefox | Image Gallery Results | Invertebrate Pale... | www.flmnh.ufl.edu/invertpaleo/gallery.asp?gallery=Florida Mollusca-Bivalvia

Google

**Collections**  
Degree Programs  
Staff & Volunteers  
Current Research  
Student Post-Docs, Grants & Awards  
Resources & Links

 4.92 CM	 4.85 CM	 5 CM
MACROCALLISTA MACULATA	GLOBIVENUS RUGATINA	LEPORIMETIS INSTRIATA
 7.1 CM	 5.55 CM	 1.7 CM
SEMELE PERLAMELLOSA	CHAMA MACEROPHYLLA	BRACHTECLAMYS ANTILLARUM
 1.55 CM	 4 MM	 4 CM
GREGARIELLA CORALLIOPHAGA	LIMATULA SUBOVATA	ANADARA AEQUALITAS
 3.5 CM	 6.3 CM	 2.97 CM
SPONDYLUS AMERICANUS	MODIOLUS AMERICANUS	HIATELLA ARCTICA

EN 10:56 AM 5/30/2013

Integrated Digitized Biocollections



# Miocene Gatun Formation, Panama



# PCP PIRE Teach

## Research Experience for STEM Teachers

(NSF 1237203\*, 1321453\*, 1377275\*\*)



Centenario Bridge, Panama, 2012



# Teachers and students: Gatun, Panama



# Engaging underserved learners



Gatun Panama, 2013



# Evening reflection and brainstorming, Panama, 2013

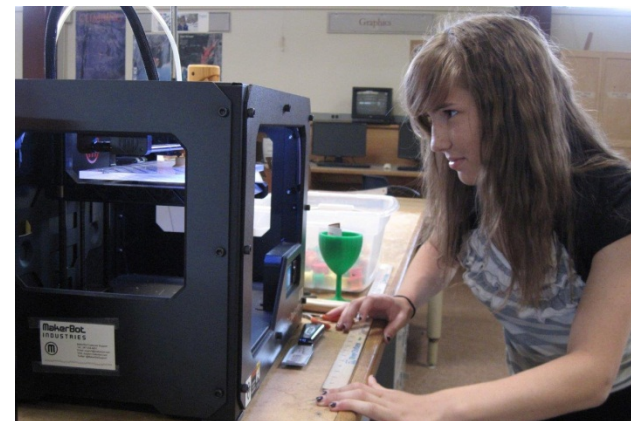


# Learning & digitization in the classroom

Pilot project 2014



AP Biology, Harbor High, CA, 2012





# Fossil clubs, digitization & the FOSSIL project



“Fossils in the Cloud” talk  
—SW Florida Fossil Club

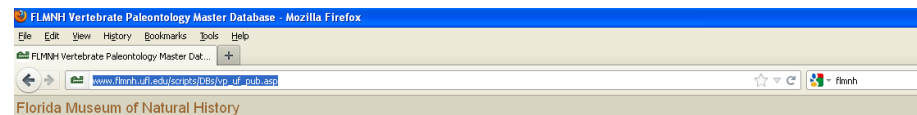


# Evolution of paleocollections workflow

20<sup>th</sup> century

CATALOGUE OF FOSSIL VERTEBRATES		FLORIDA STATE	
Number	Name	Locality	Age
100276	...	...	...
100277	...	...	...
100278	...	...	...
100279	...	...	...
100280	...	...	...
100281	...	...	...
100282	...	...	...
100283	...	...	...
100284	...	...	...
100285	...	...	...
100286	...	...	...
100287	...	...	...
100288	...	...	...
100289	...	...	...
100290	...	...	...
100291	...	...	...
100292	...	...	...
100293	...	...	...
100294	...	...	...
100295	...	...	...
100296	...	...	...
100297	...	...	...

21<sup>st</sup> century



**Search the Vertebrate Paleontology Master Database**  
285,301 Lots - 443,723 Specimens

- For printing of output, select Report Style  
 - Selecting a search type of "Wildcard" will allow for wildcard searching on all search fields  
 - Selecting a search type of "Exact" or not selecting one will cause all search fields to require exact input

Return <input type="text" value="50"/> Records:	<input type="text" value="Class"/>	<input type="text" value="Order"/>	<input type="text" value="Family"/>	<input type="text" value="Genus"/>
Style: <input type="text" value="Table"/>	<input type="text" value="Species"/>	<input type="text" value="Nature of Specimen"/>	<input type="text" value="Site Key"/>	<input type="text" value="Site"/>
Sort: Catalog Number - Default	<input type="text" value="Country"/>	<input type="text" value="State"/>	<input type="text" value="County"/>	<input type="text" value="Epoch"/>
Search Type: - Select Type - <input type="button" value="Query Database"/>	<input type="text" value="Land Mammal Age"/>	<input type="text" value="Formation"/>	<input type="text" value="Catalogue Number"/>	<input type="text" value="Data Source"/> Entire Database
<input type="button" value="Reset"/>				

[Collection Database Page](#) | [Vertebrate Paleontology Home](#) | [Search other Databases](#) | [FLNMH Home](#)

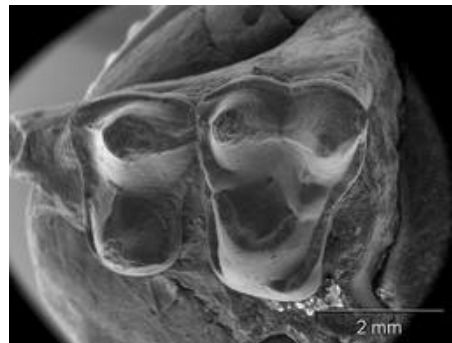


# Digital Imaging of fossil collections

- 2 dimensional—relatively easy, digital photo



- 3 dimensional—more advanced technology



# Advantages of digital imaging

Assuming that specimen data and images are uploaded to the cloud, then:

- Fossil specimens can be studied without having to go to the museum.



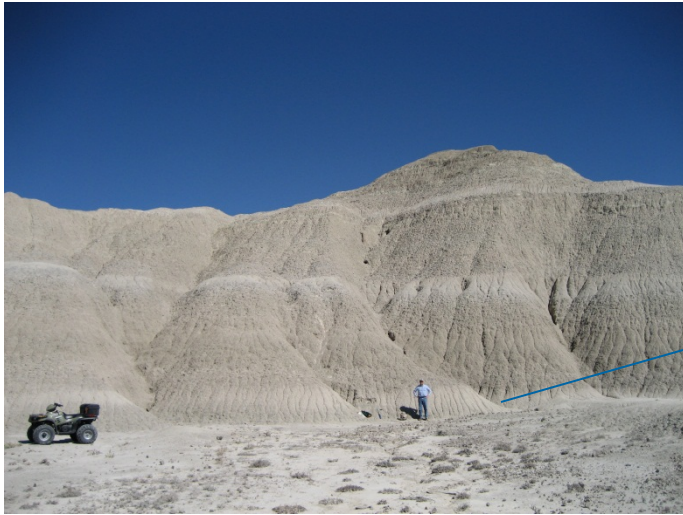
- Some techniques, e.g., 3-D images can be non-invasive when previously they were not.
- 2-D and 3-D printouts and exact replicas



# Applications of 3D printing technology



# Fossil clubs and lifelong learning



Nebraska badlands



What is it?

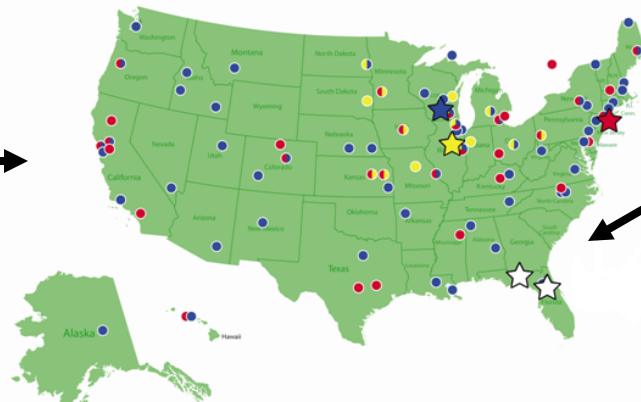


# How will this work for fossils?



- For printing of output, select Report Style  
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Style: <input type="text" value="Table"/>	<input type="text" value="Species"/>	<input type="text" value="Nature of Specimen"/>	<input type="text" value="Site Key"/>	<input type="text" value="Site"/>
Sort: <input type="text" value="Catalog Number - Default"/>	<input type="text" value="Country"/>	<input type="text" value="State"/>	<input type="text" value="County"/>	<input type="text" value="Epoch"/>
Search Type: <input type="text" value="- Select Type -"/>	<input type="text" value="Land Mammal Age"/>	<input type="text" value="Formation"/>	<input type="text" value="Catalogue Number"/>	<input type="text" value="Data Source"/>
<input type="text" value="Query Database"/>				<input type="text" value="Entire Database"/>
<input type="button" value="Preset"/>				



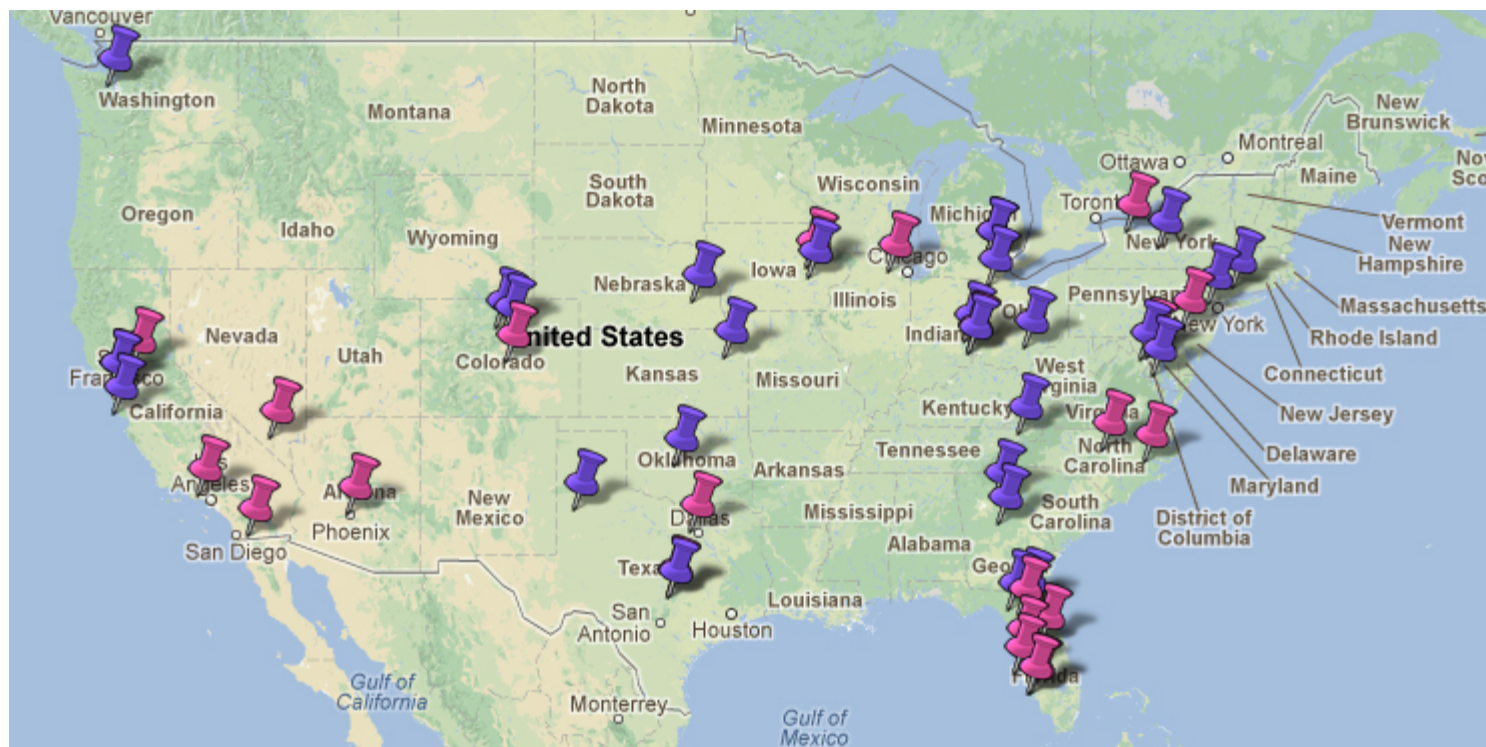
- Feedback indicates high degree of interest among amateur paleontologists
- Willingness to be trained and volunteer to help curator digitize collections.

# Common themes and FAQs

- How can I learn to digitize my collections?
- What data do I need to capture?
- Can I donate these to a museum, or display on the web?
- I'd like to help museums (volunteerism)
- Can I upload my collections to the cloud?
- Can the portals have common names or visual (image) recognition?

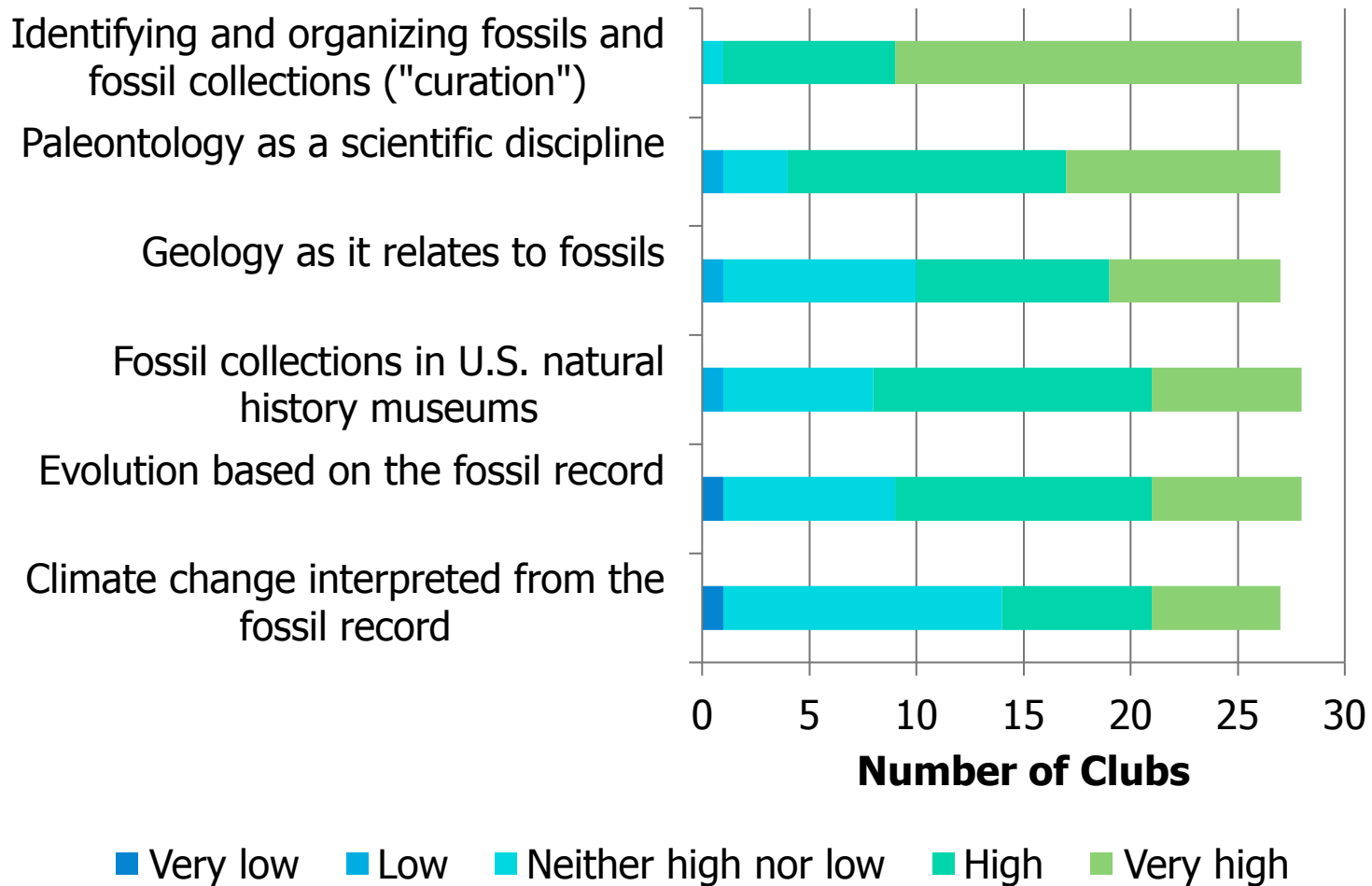
# FOSSIL project\*

(Fostering Opportunities for Synergistic STEM with Informal Learners)



- Networked between fossil clubs (red) and professional paleontologists
- More added recently
- “Big data” digitization impressed reviewers as learning model

# Members' Interest in Science Topics



# FOSSIL Activities

- The two target audiences will collaborate in cyberenabled learning
- Activities will be mediated by myFOSSIL Community of Practice (CoP)
- Fossil club members will be trained about digitization
  - To help professionals with collections
  - Some will digitize their own fossil collections



The screenshot shows the myFOSSIL website interface. At the top, there is a banner image of people in a museum setting. Below the banner, the text reads "A space to collaborate, learn and engage in the science of paleontology." There are social media icons for Facebook, Twitter, and YouTube, along with a "Sign up for our eNews" button. A sidebar on the right contains a navigation menu with items like "myFOSSIL", "Community Members", "What's Online?", "Learning Activities", "Fossil Collections", "Field Trips", "Volunteer Opportunities", "Calendar of Events", "Wiki Space & Blogs", "Annual Meeting", and "How to Join". The main content area features an "Announcements" section with a "TITANOBOA MONSTER SNAKE" poster and a "Calendar" section. At the bottom, there are logos for the Florida Museum of Natural History, the University of Florida, and iDigBio, along with contact information for myFOSSIL.



## Wrap-up:

### Intended outcomes—Paleocollections E&O

- Bring digitized paleocollections to downstream users
- K12 outreach—formal education
- Lifelong learning in fossil clubs
- Feedback loop—these target audiences could engage in the national digitization effort

### Overarching strategic goal:

Through **access** and **education**, downstream users better understand the **value** and **relevance** of digitized collections in the 21<sup>st</sup> century society.