



SANDSNAP: DIGITAL GRAIN-SIZE IMAGERY ANALYSIS AND ENGAGING CITIZEN SCIENTISTS

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COASTAL INLETS RESEARCH PROGRAM

FY23 IN PROGRESS REVIEW

Tiffany Burroughs

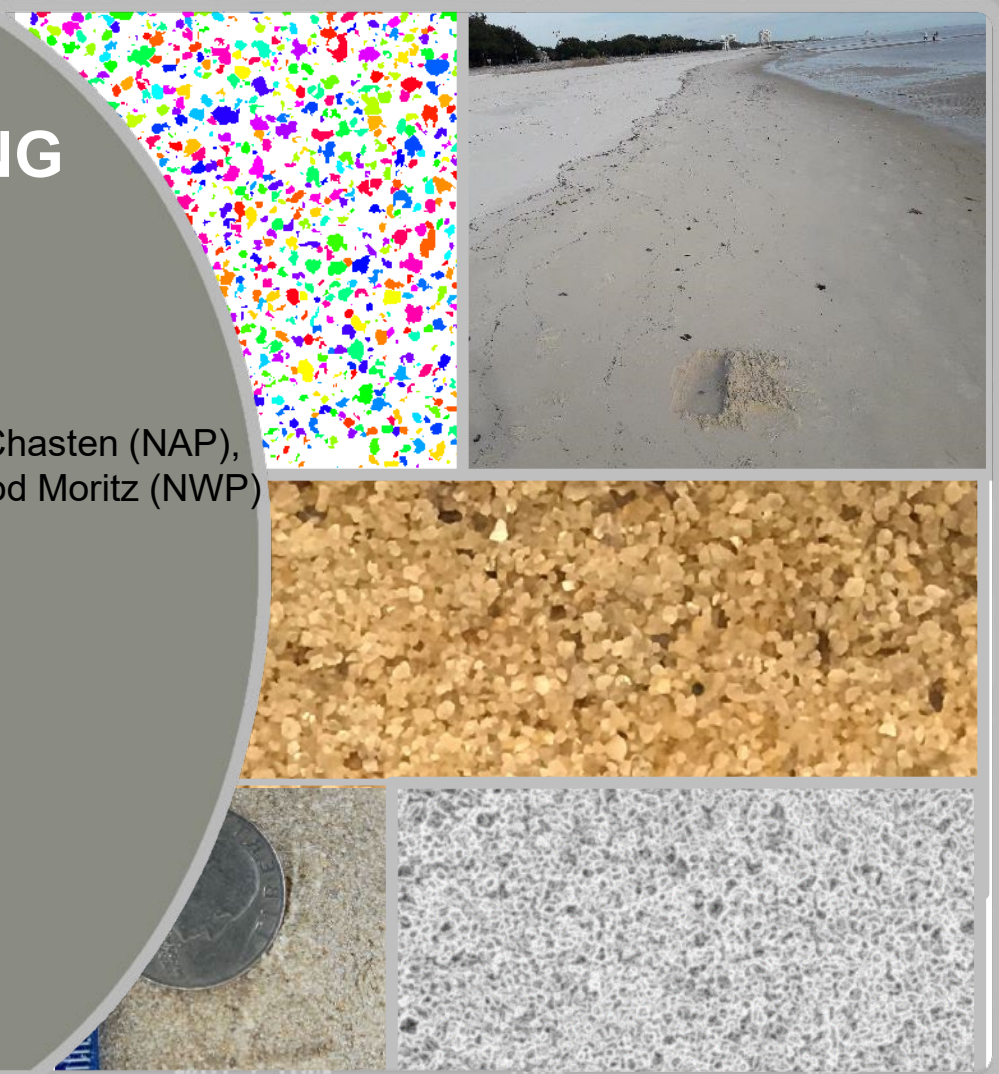
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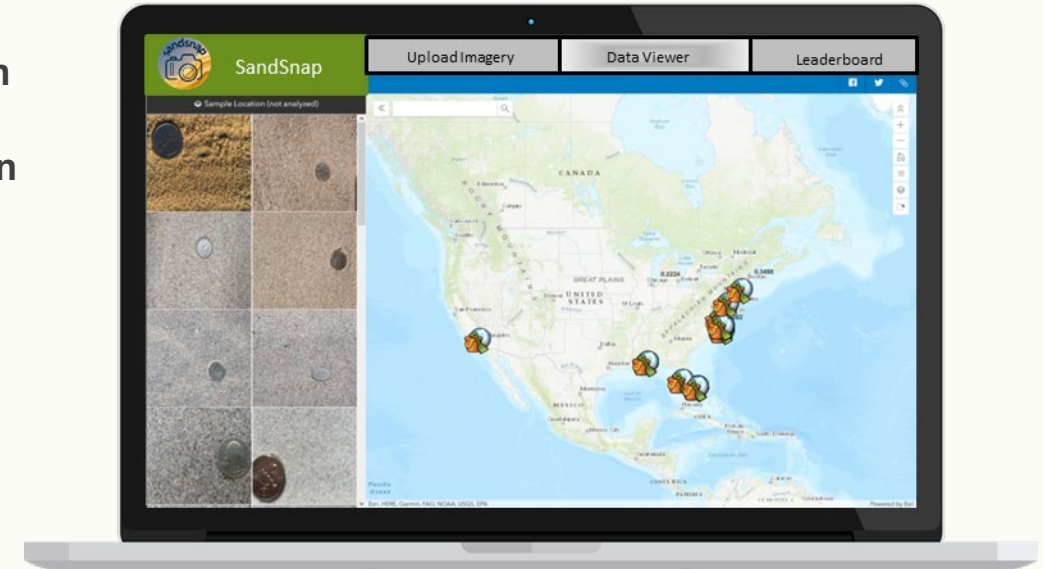
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ERDC
ENGINEER RESEARCH & DEVELOPMENT CENTER

Problem Statement

- The lack of a nationwide beach grain size database is a fundamental knowledge gap in the composition of our beaches and coastlines.
 - Grain size often has the largest uncertainty in sediment transport modeling (Soulsby, 1997).
 - Lack of grain size information also inhibits beneficial reuse of dredge material.
- It is unfeasible to collect beach grain size data on a nationwide scale with traditional methods (e.g., sample collection and sieve analysis).
- This deficiency critically limits USACE morphology modeling capability.
- SON's:
 - 2020-NAV-1528: Creating a Beach Sediment Database through "Citizen Scientist" Engagement
 - 2020-FRM-1529: Creating a Beach Sediment Database through "Citizen Scientist" Engagement - Improve Beach-Fill CRSM Performance
 - 2020-ENV-1528 Creating a Beach Sediment Database through "Citizen Scientist" Engagement
- USACE R&D Priorities:
 - Mitigate and adapt to climate change
 - Support resilient communities
 - Revolutionize and accelerate decisions making



Capability and Strategic Impact Statement

This project will create a nationwide beach grain size database from cell phone images collected by citizen scientists, creating up to \$1M/year in value.

This database will improve regional-scale studies and capture spatial and temporal gradation variations to improve nourishment life cycle analysis and uncertainty, and increase range of beach compatible sediment. Additionally, engaging citizens in the data collection will garner more public support for USACE coastal projects.



Sampling Methodology

1.



2.



3.

17:20 survey123.arcgis.com — Private

What coin did you include in the picture?*
Please use a US coin. Images with other coins will be batch processed at a later date.

Penny

Nickel

Dime

Quarter

Location on Beach
Where on the beach did you collect this sample?

- The **berm** is the dry part of the beach where you would set up your beach chair.
- The **swash** is the wet part of the beach sloping into the water.
- The **dune** is the sand hill on the beach. Careful not to damage any vegetation on the dune.

Dune

Berm

Swash

Other

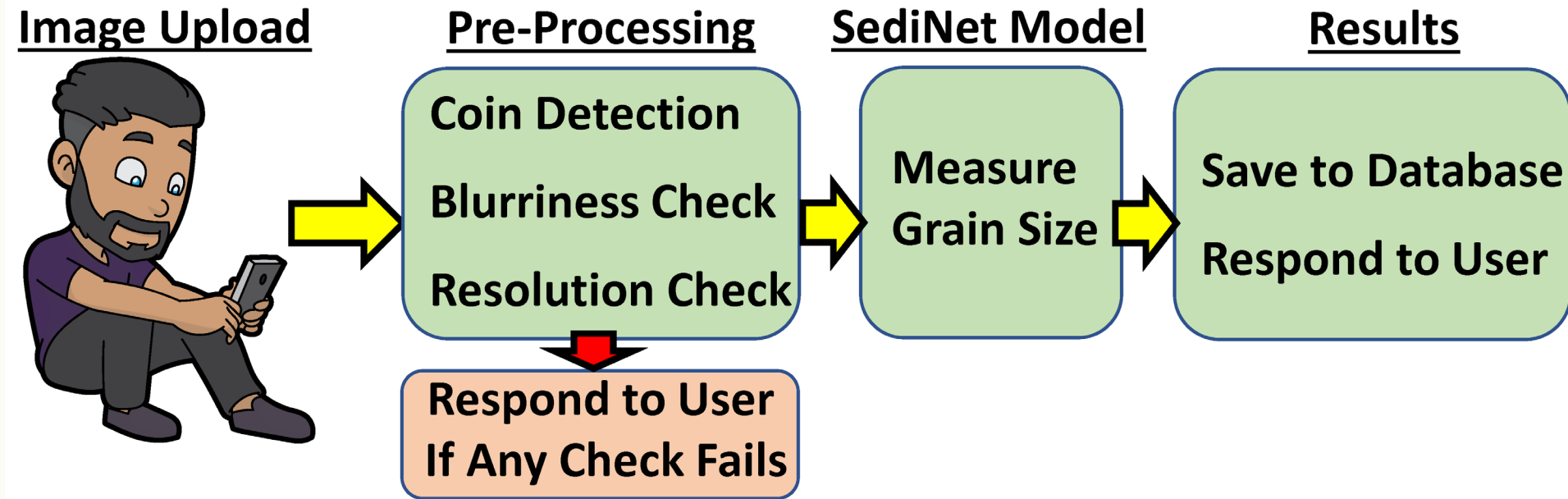
Notes
Note additional observations here like if the sample was taken before or after a storm, if the beach looks different, or if you used a different scale than a coin. Whatever it is,

Scan Me!

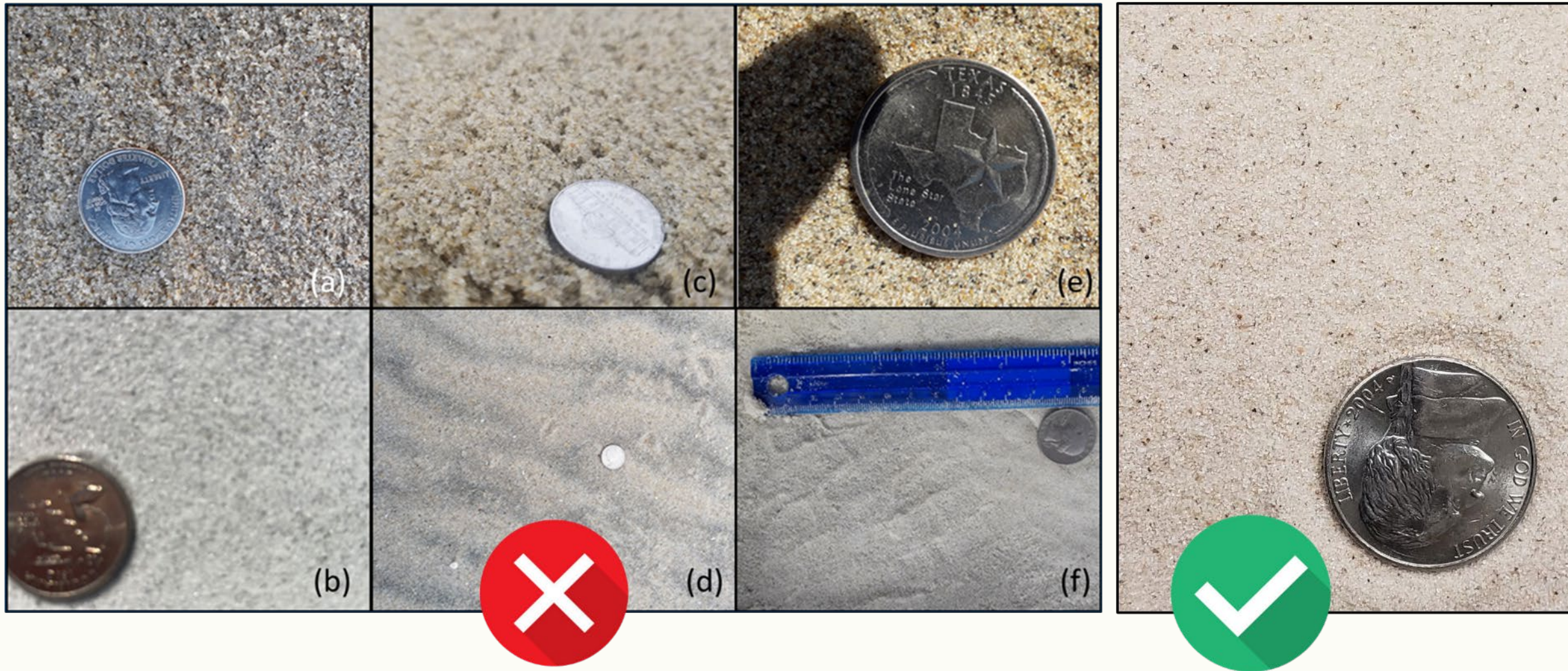


sandsnap-erdchl.hub.arcgis.com

Image Processing



Good vs. Bad “SandSnaps”





SandSnap Database

sandsnap-erdchl.hub.arcgis.com

= Data point

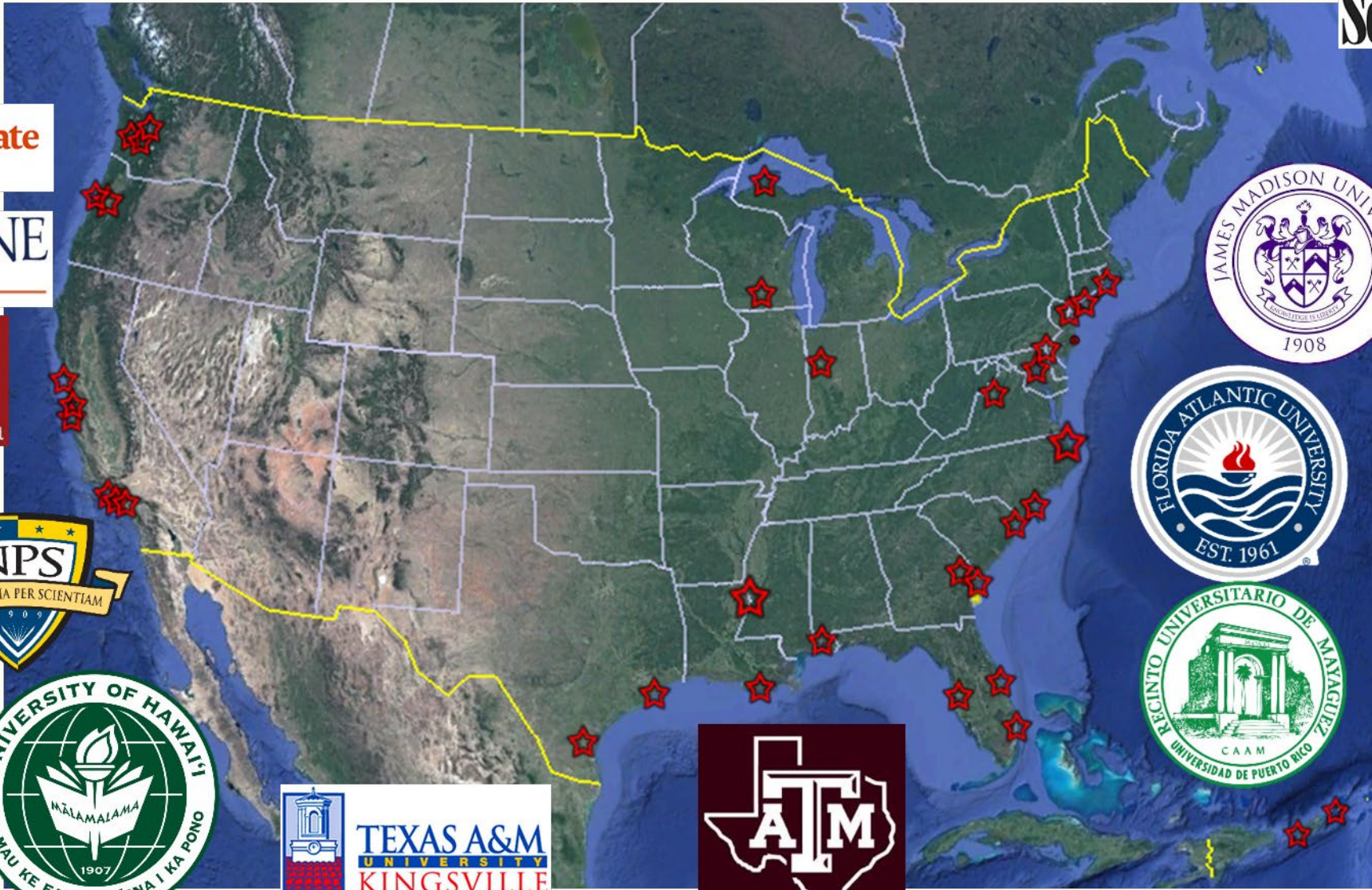
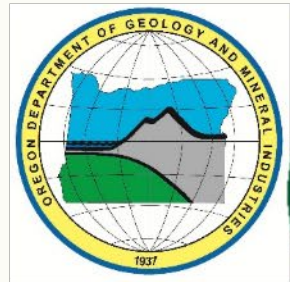


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Collaborations



UNIVERSITY of WASHINGTON



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Accuracy – ASBPA Conference



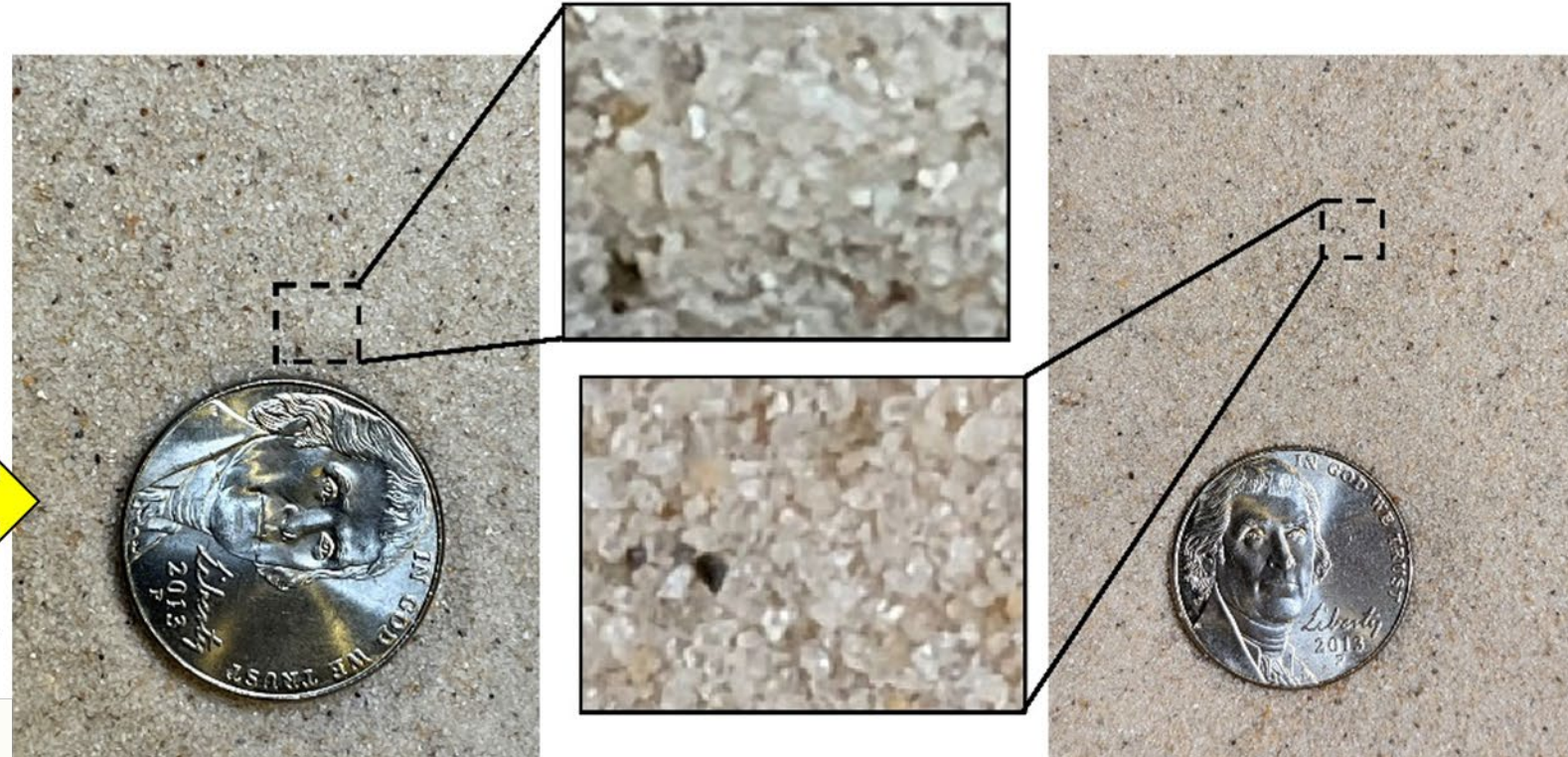
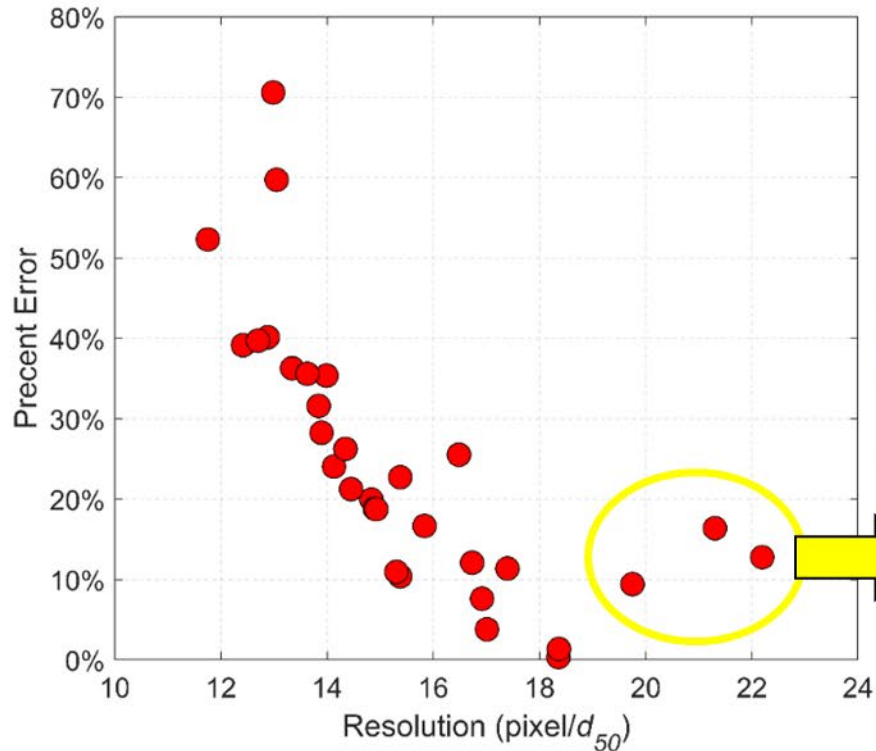
- Booth w/Demo
- Presentation
- SandSnap training on the beach

“...the folks who developed this at ERDC, simply need to be congratulated. It’s absolutely fantastic!”

“I love these citizen science initiatives, and this is one of the best I’ve ever seen.”

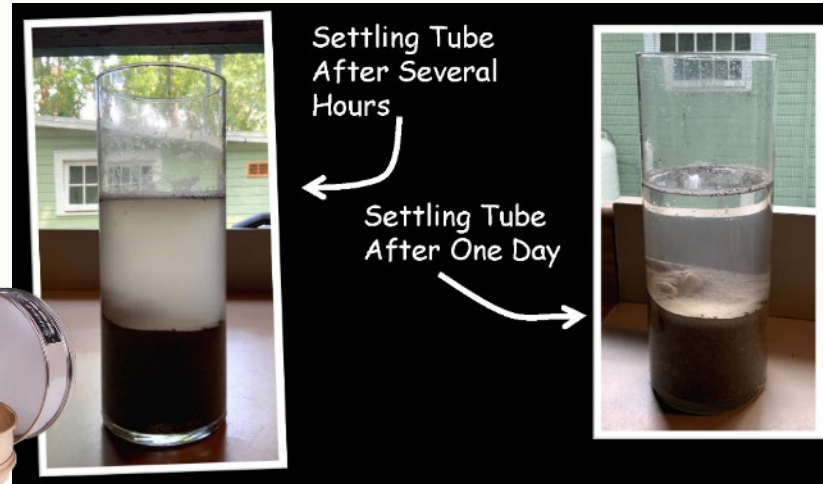
Peter Ravella, American Shoreline Podcast

ASBPA Booth Experiment Observations



- $n=31$
- Mean error for $d_{50} = 21.9\%$
- Error for full gradation ($d_{10} - d_{90}$): 20-31%
- Higher error on tails of gradation percentiles

Outreach Efforts – K-12



Initiatives:

- Library “Discovery Bags”
- In-person event activities
- Class lesson plans
- Science Fair Projects

STEM Activities:

- “Sorting It Out” – Sieve & Sand Castle
- “That Settles It” – Settling Tube
- “Digging In Deeper” – Petri Dish & Hand Lens
- “It’s a Snap” – SandSnap

Outreach Efforts –CSBPA “Snap the Sand”

Sept. 15-30, 2022



Snap the Sand!

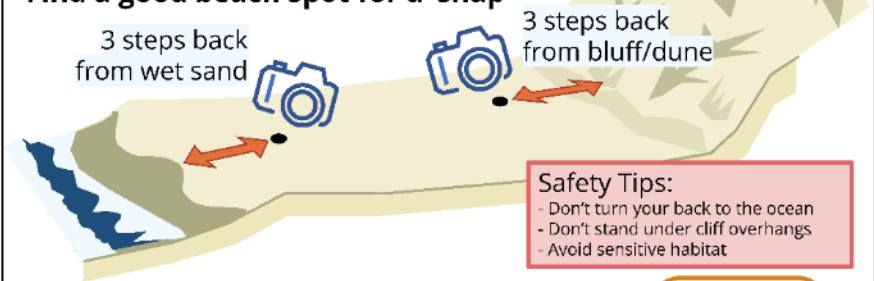


California's Beaches Need Your Help!

Do you want to be part of studying our beaches? Ever wonder why some plants and animals live on certain beaches or how beaches respond to big storm waves? All you need is your smartphone and a U.S. coin to participate!

Scientists and engineers understand how beaches change by looking at the size of sand grains. Sand grain size tells us about plant and animal habitat or how a beach will recover from erosion. **SandSnap** is a community developed database of beach sand grain sizes from photographs. Your photos will help build a national database about beaches!

Find a good beach spot for a 'snap'



Safety Tips:

- Don't turn your back to the ocean
- Don't stand under cliff overhangs
- Avoid sensitive habitat


Instructions on taking good 'snaps'

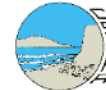
1. Scan **QR code** to open SandSnap.
2. Find **sandy area clear of debris** (shells, sticks).
3. Smooth sand; place a **U.S. coin**. *Quarters, dimes, nickels, pennies all work!*
4. **Snap** a picture! Focus on sand and not coin; try to avoid shadows.
5. Upload your picture, **fill out form**, and submit. You're done!



No cell service? No problem!

Have internet access? Use the  button to zoom in on mobile's location; upload SandSnap photo.

Out of range of cell service? Note where photo taken (*Examples: Near the headlands OR Between trailheads to beach*)
Once back in cell service, manually click and set the  to your noted location. Upload photo; complete form. Under **Notes**, put "location approximated"



Brought to you by the California Shore and Beach Preservation Association in collaboration with the US Army Corps of Engineers. <https://ashpa.org/california/>

An actual SandSnap!



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Summary

FY22 Milestones

- **Live Interactive SandSnap Web App**
 - ▶ <https://sandsnap-erdcchl.hub.arcgis.com/>
 - ▶ ~800 submissions to date.
- **Conferences**
 - ▶ AGU-Oceans Sciences
 - ▶ ASBPA conference
- **Presentations**
 - ▶ Coastal Working Group
 - ▶ Network for Engineering With Nature
 - ▶ ERDC's RD22 Workshop
 - ▶ ERDC Comprehensive Water Risk Management Collaboration Symposium
 - ▶ COPRI-CSEC lunch and learn
 - ▶ Great Lakes Dredging Meeting
 - ▶ Florida International University Surfrider Foundation
 - ▶ HR Wallingford Collaboration Workshop
 - ▶ California Beach Watch
 - ▶ & Others
- **Other Media**
 - ▶ SandSnap instructional YouTube video
 - ▶ Power of ERDC Podcast
 - ▶ Beyond the Gates Radio Show
 - ▶ American Shoreline Podcast
 - ▶ SandSnap Forbes Science Article
- **Outreach**
 - ▶ 2 Library Discovery Bags (Gulf Shores, AL public library)
 - Presented by the Deputy Commander of SAM
 - Interactive presentation to more than 75 children and their parents.
 - ▶ “Snap the Sand” Event w/ California Shore and Beach Preservation Association
 - ▶ DNREC-led booth Delaware Coast Day (cancelled due to weather)
 - ▶ Developed a Class Lesson Plan
 - ▶ Developed Science Fair Project



Summary

FY23 Progress

- **Conferences & Presentations**
 - ▶ ICCE 2022
 - ▶ Coastal Sediments 2023
 - ▶ ASBPA 2023
 - ▶ CIRN 2023
- **Social Media in Development**
- **High-Impact JP**
- **V1.1 of SandSnap**
 - ▶ Fix bugs identified in V1.0
 - ▶ Release imminent
- **V2.0 of SandSnap**
 - ▶ Improved coin detection model – *complete*
 - ▶ Improved grain size model – *complete*
 - ▶ Improved pre-processing techniques – *in progress*
 - ▶ Add Euro coins – *complete*
 - ▶ Admin console improvements - *complete*



May 2023: National Nature Summit in Hirtshals, Denmark – Nature Walk for the public and will include SandSnap's along 3 transects