



SandSnap - Amassing A Nationwide Beach Grain Size Database

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AAPA Harbors and Nav Committee
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SandSnap



Our Beaches Need Your Help!

Do you want to be part of studying our beaches? All you need is your **smartphone** and a **U.S. coin** to participate! **SandSnap** is a community developed database of **beach sand grain sizes** collected from your photographs. This data is used by researchers and local officials to learn more about coastal dynamics and make better management decisions.



How to participate:

- 1 Scan the QR code.
- 2 Go to the beach and find a **sandy area clear of debris** such as shells, sticks, etc.
- 3 Smooth the sand and place a **U.S. coin**. *Quarter, dime, nickel, penny all work!*
- 4 **Snap a picture!** *Make sure to focus on the sand and not the coin, and try to avoid shadows.*
- 5 Upload your picture, **fill out the form**, and submit. You're done!

SCAN ME



Snap a picture and become a citizen scientist!



Thank you for your help!

Your participation makes a difference in your community!



US Army Corps of Engineers

Objective: Amass a National Beach Sand Grain Size Database

Why: - To Increase BU Opportunities
- Improve Coastal Resilience Quantification

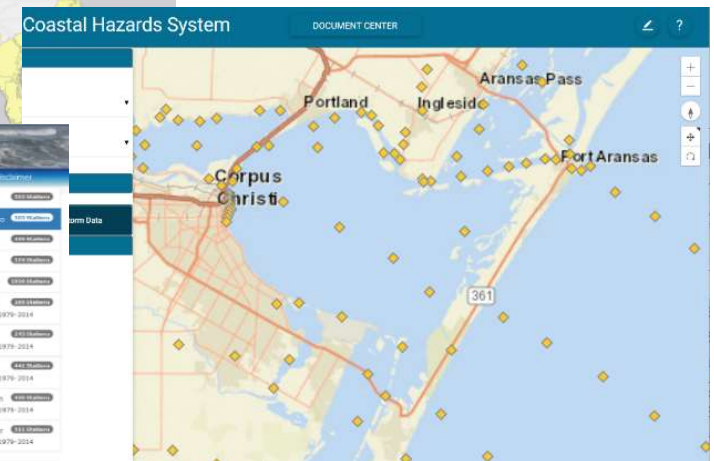
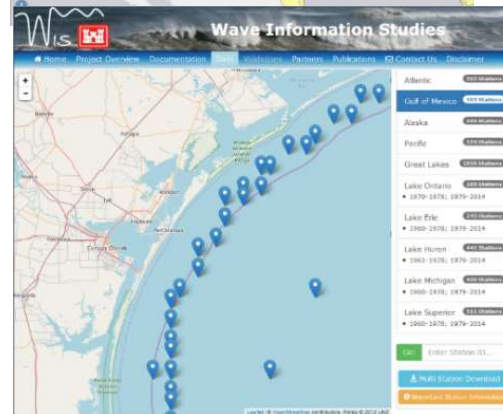
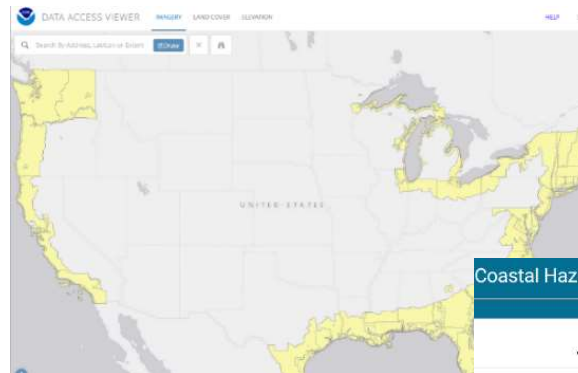
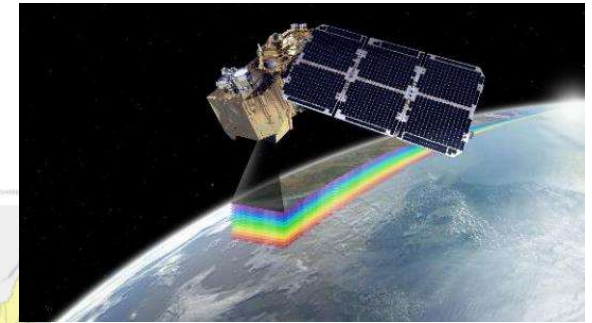
sandsnap-erdcchl.hub.arcgis.com



Motivation

Coasts are a Data Rich Environment

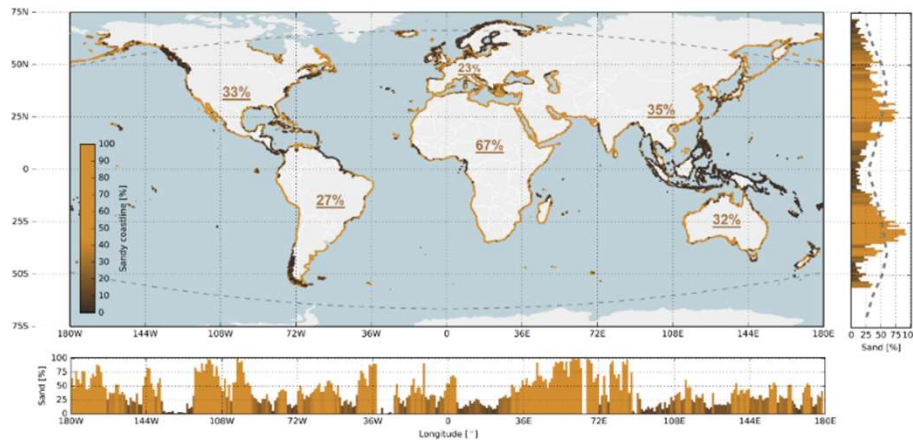
- **Topo & Bathymetric**
 - LiDAR
 - Photogrammetry
- **Shoreline Position**
 - Satellite and Aerial Imagery
- **Wave Information**
 - Buoys
 - WIS
 - Coastal Hazard System



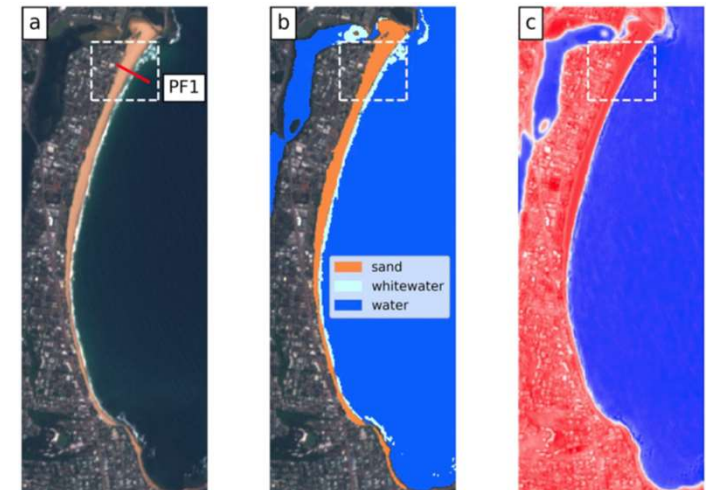
But what's the beach made of?

Beach Sand Grain Size Database Uses

- Large-scale Preliminary Studies
- Depth of Closure Studies
- Analysis of Spatial and Temporal Gradation Variation
 - Improved Life Cycle Analysis and Uncertainty
 - Beach Compatibility
 - Increase BU opportunities



Luijendijk et al. (2018)



Vos et al. (2019)

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

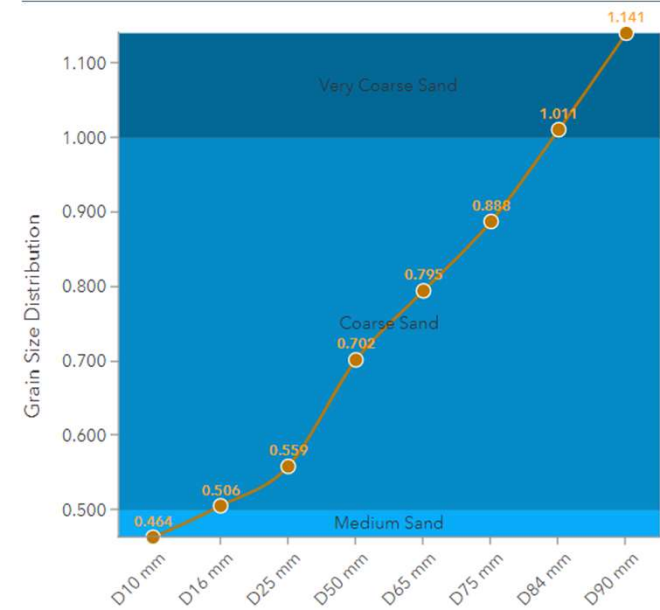
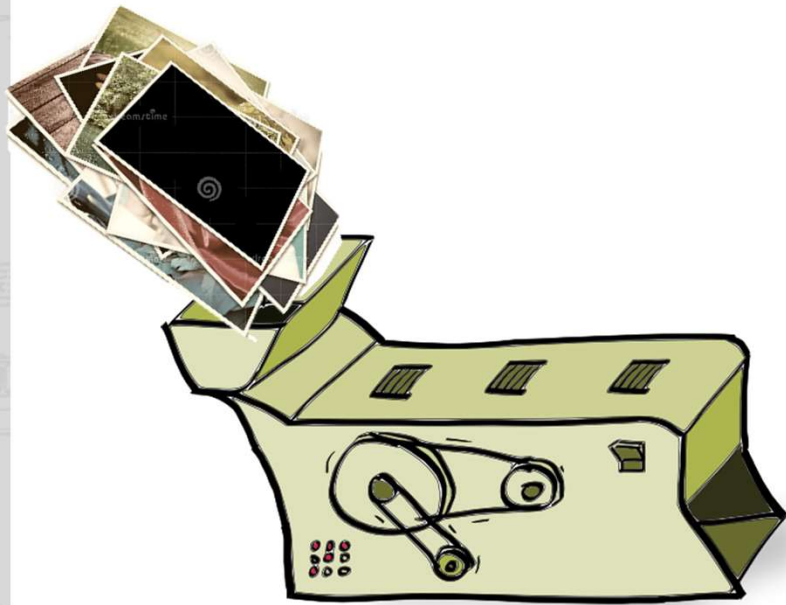
Notes
Note additional observations here like if the sample was taken before or after a storm, if the beach looks different, or if you used a different sand snap. Whatever it is.

Scan Me!

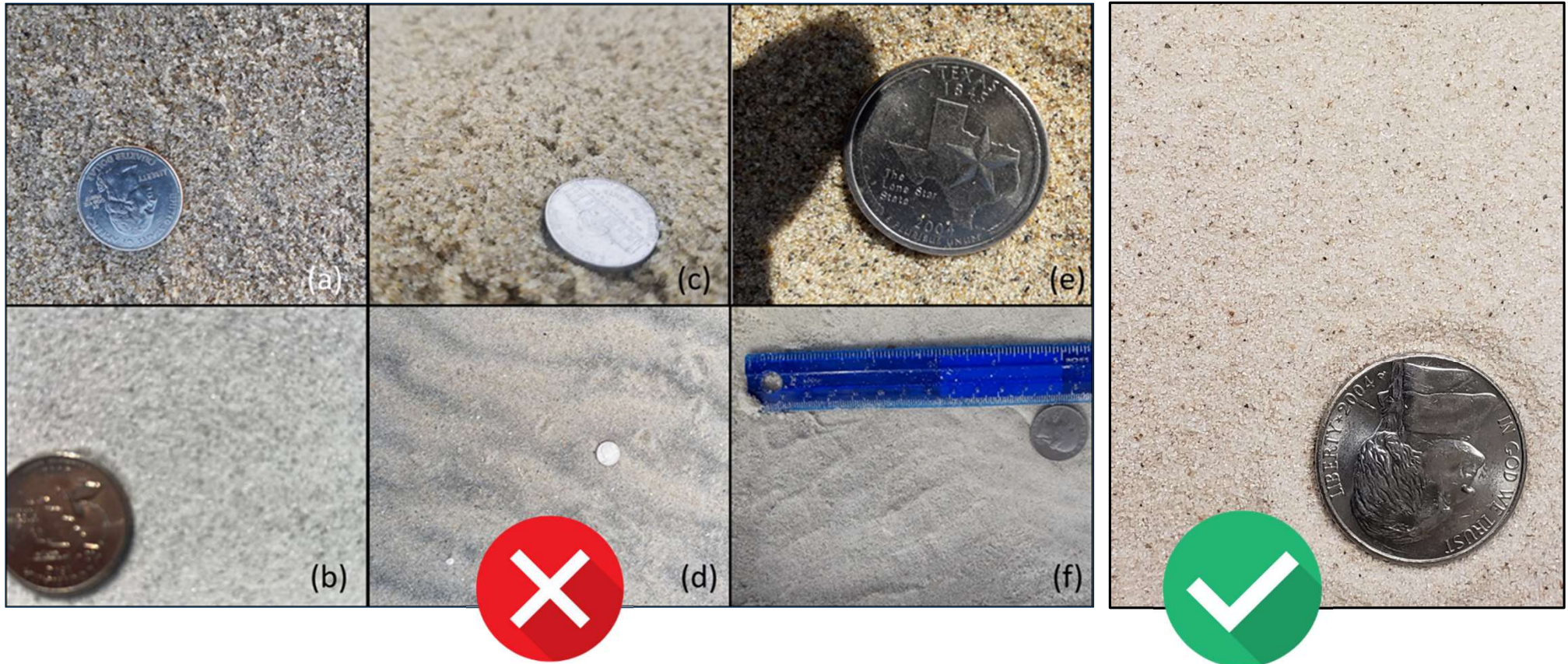


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You take the photo, the machines do the work

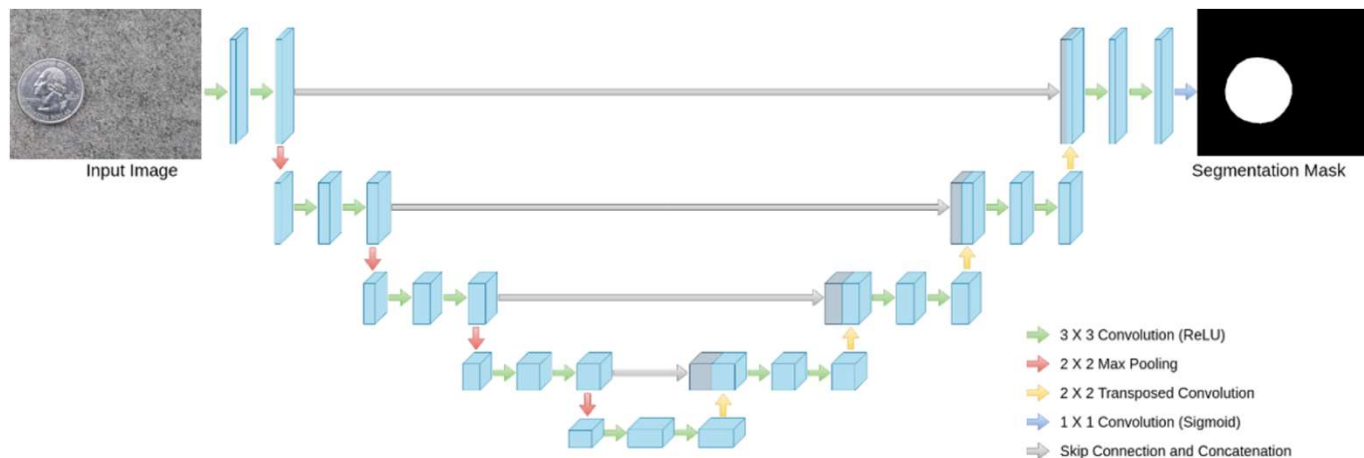


Good vs. Bad “SandSnaps”



Machine Learning: Coin Detection

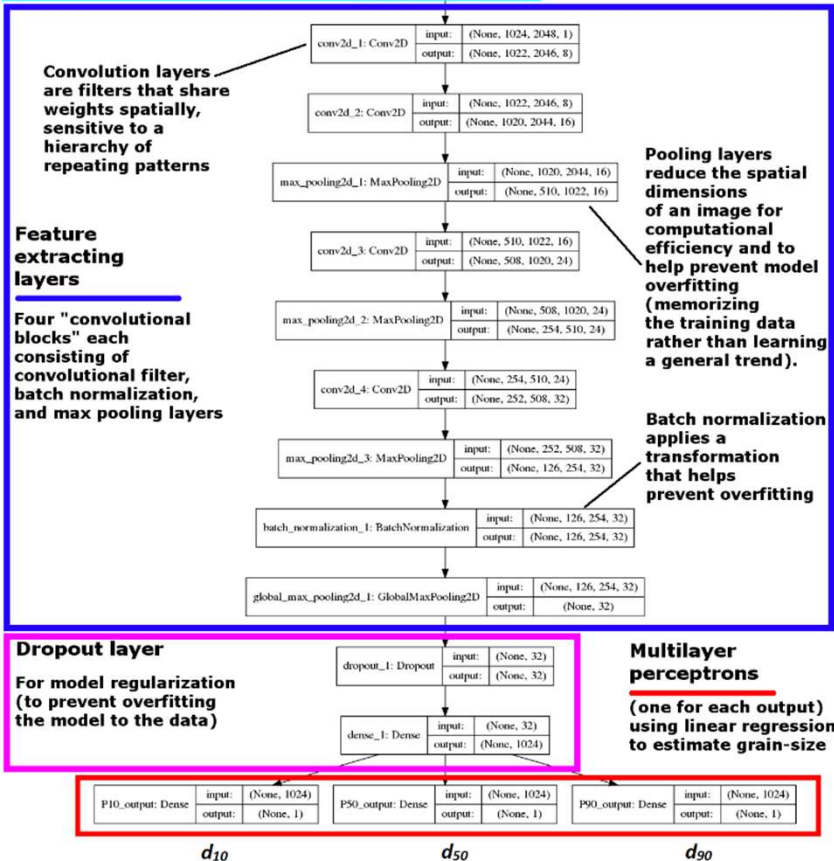
- Detect coin pixels versus sand pixels.
 - U-Net (Ronneberger et al. 2015).
 - Fully convolution neural network.
- Individual models tended to underestimate portions of coins.
 - Combination of results from 5 distinct models.
- RANSAC model on “coin pixels” to estimate diameter/centroid.
- Functions:
 - Where is the coin.
 - How large is it in pixels – for mm/px.
 - Divide parent images up into 1024 x 1024 pixel coinless sub-images.



Input image
(1024 x 1024 x 3 pixels)



SediNet model
for beach grain size



Machine Learning: SediNet

- SediNet (Buscombe 2019):
 - Deep Learning Model
 - Convolutional Neural Network with multiple processing layers
 - Estimates grain size information from imagery
 - <https://github.com/MARDAScience/SediNet>
 - Can estimate up to 9 numeric grain size metrics
 - Can also calculate categorical variables (grain shape, population, color)
 - Uses GPU for computations with tensorflow package in Python
- <12% d_{50} error from *in situ* test images
- Can be trained on a wide range of sediments – applied more generally

Buscombe 2019

SandSnap Database



= Data point



Collaborations

UNIVERSITY of WASHINGTON

 Oregon State University

 PEPPERDINE UNIVERSITY

 USC
University of Southern California

 CALIFORNIA STATE UNIVERSITY CHANNEL ISLANDS

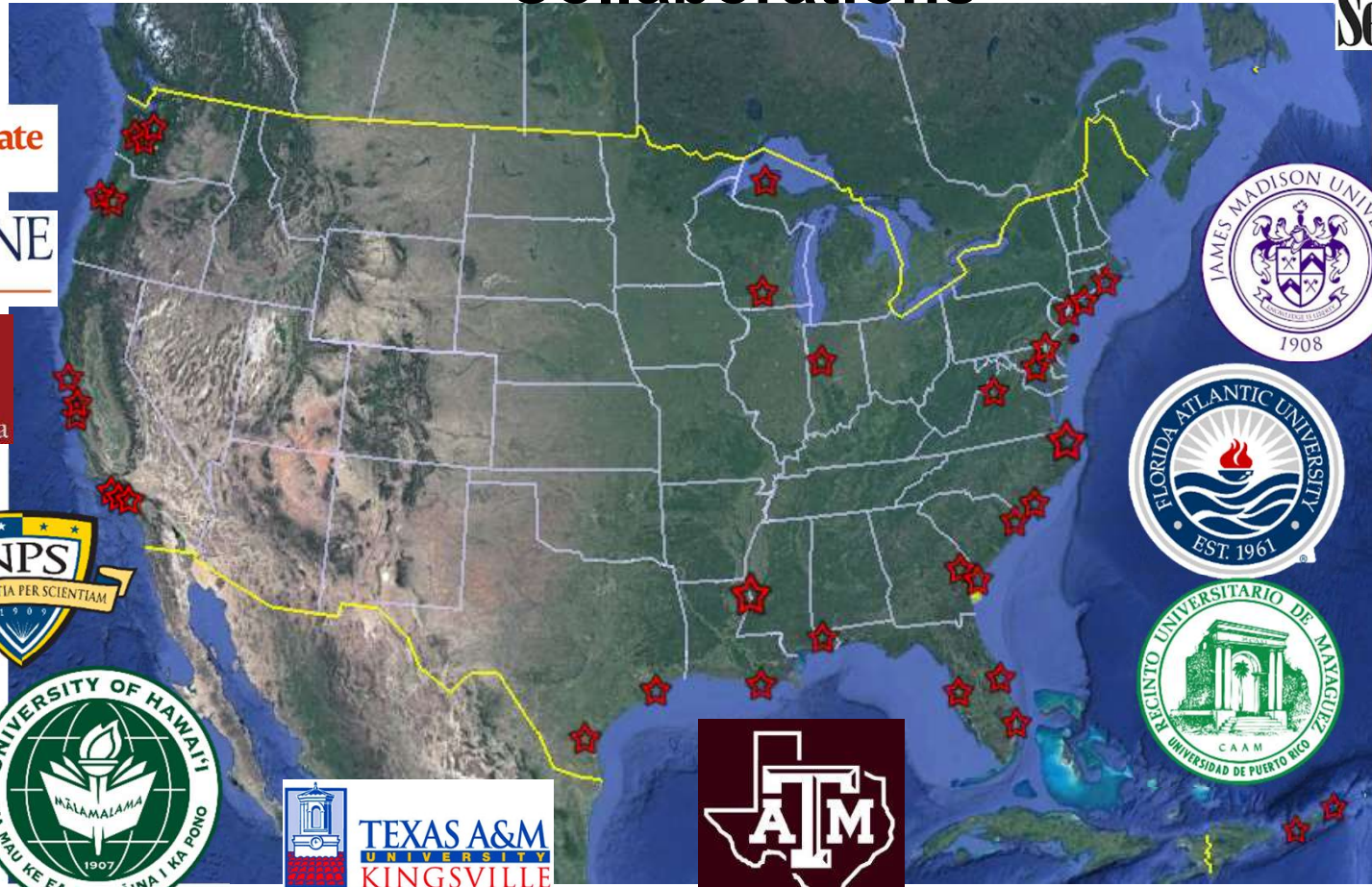
 NPS
PRAESTANTIA PER SCIENTIAM 1909

 OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES 1927

 UNIVERSITY OF HAWAII
MĀLAMALAMA 1907
UA MAU KE EA O KA 'ĀINA I KA PONO

 TEXAS A&M UNIVERSITY KINGSVILLE

 ATM



 Sea Grant

 STEVENS INSTITUTE of TECHNOLOGY
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 JAMES MADISON UNIVERSITY 1908

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UNIVERSITY OF SOUTH ALABAMA

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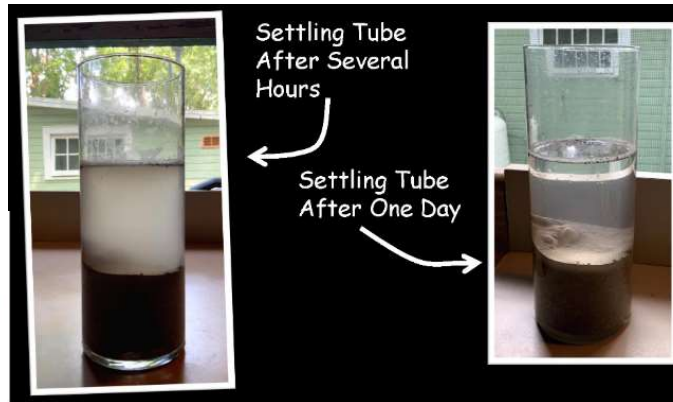
 CHL COASTAL & HYDRAULICS LABORATORY

Outreach Efforts – K-12 Outreach



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



Library Bag Test Locations:

- John Jermain Memorial Library in Sag Harbor, NY
- Thomas B. Norton Library in Gulf Shores, AL

Outreach Efforts – ASBPA Conference



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

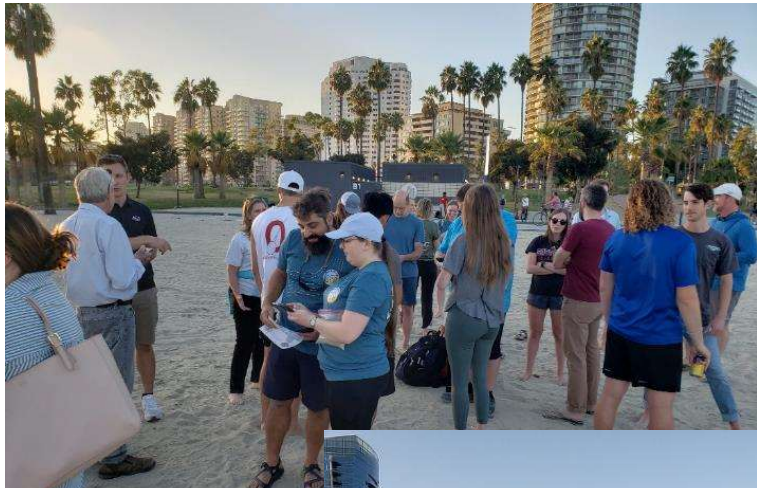


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Outreach Efforts –CSBPA “Snap the Sand”

Sept. 15-30, 2022



Snap the Sand!

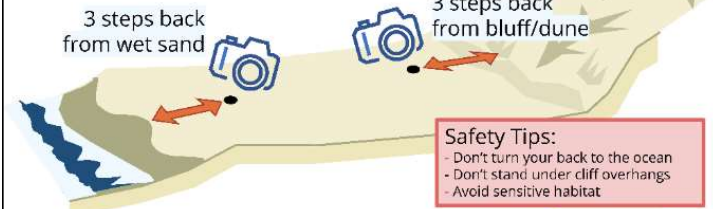


California's Beaches Need Your Help!

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 & Call to Action

SandSnap Web Application is fully operational

CALL TO ACTION

- Participation is needed for **SUCCESS**
- Participate by collecting imagery from your favorite beach



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