San Juan National Historic Site – Coastal Resilience Challenge

Theme: *Islands of Identity – Culture, Defense, and Conservation*
Featured Site: San Juan National Historic Site (Puerto Rico)
NGSS Standards: 3-5-ETS1-1, 3-5-ETS1-2, 3-5-ETS1-3

Engage

Show photos of El Morro and San Cristóbal fortresses overlooking the ocean. Ask:

- *"Why do you think people built such strong walls here 500 years ago?"*
- *"What do you think San Juan needs protection from today?"*
  Students write one sentence predicting a **modern threat** (storms, hurricanes, erosion, rising seas).

Explore

Challenge: Build a model system to protect San Juan from storm surge.
Materials: trays of sand/soil (shoreline), small blocks/boxes (city buildings), popsicle sticks, clay, foil, rocks, moss/grass, spray bottles (waves), fans (wind).

Steps:

1. Place "city" structures near the shoreline.
2. Construct **defenses** using both **natural features** (plants, dunes, reefs) and **engineered features** (walls, levees, elevated structures).
3. Test by creating waves with spray bottles and wind with fans.

4. Record how well each design works.

Explain

Groups share results:

- Which features slowed or absorbed water best?
- Did combined natural + engineered systems outperform single ones?
  Teacher connection: San Juan's walls once kept out invaders, but today reefs, mangroves, and seawalls are needed to protect against climate change and hurricanes.

Elaborate

Extend the challenge:

- Redesign based on what was learned in testing.
- Compare to real-world examples of coastal resilience in Puerto Rico.
- Ask: *"How does protecting cultural treasures like San Juan also protect people and nature?"*

Evaluate

- Students sketch and label their final design with natural + engineered elements.
- Write a reflection: *"If I were an engineer in San Juan, I would protect the city by…"*
- Exit ticket: One fact learned about the forts and one idea about conservation today.