# Climate change impacts on the built environments: Adaptation strategies for coastal areas of islands

KOICA-ESCAP Joint Capacity Building Training Programme on
Digital Technologies for Addressing Climate Change Impacts in The Pacific
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# Talk Flow

0 Ice-breaking – understanding

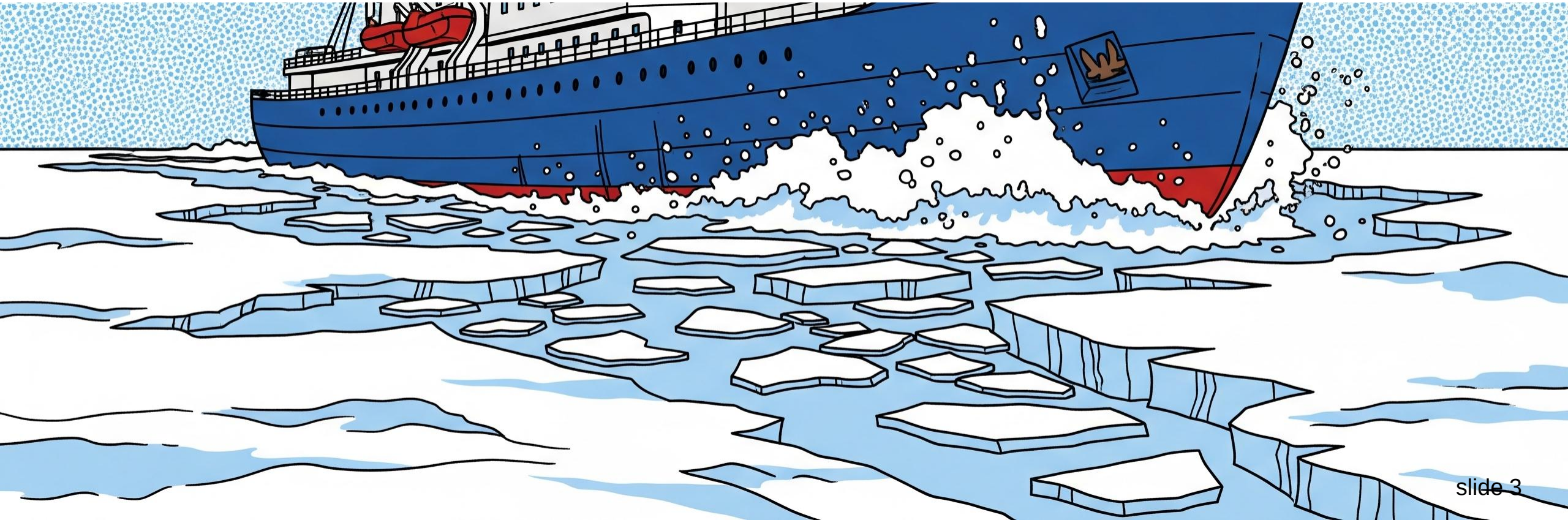
1 Built environments

20-min break

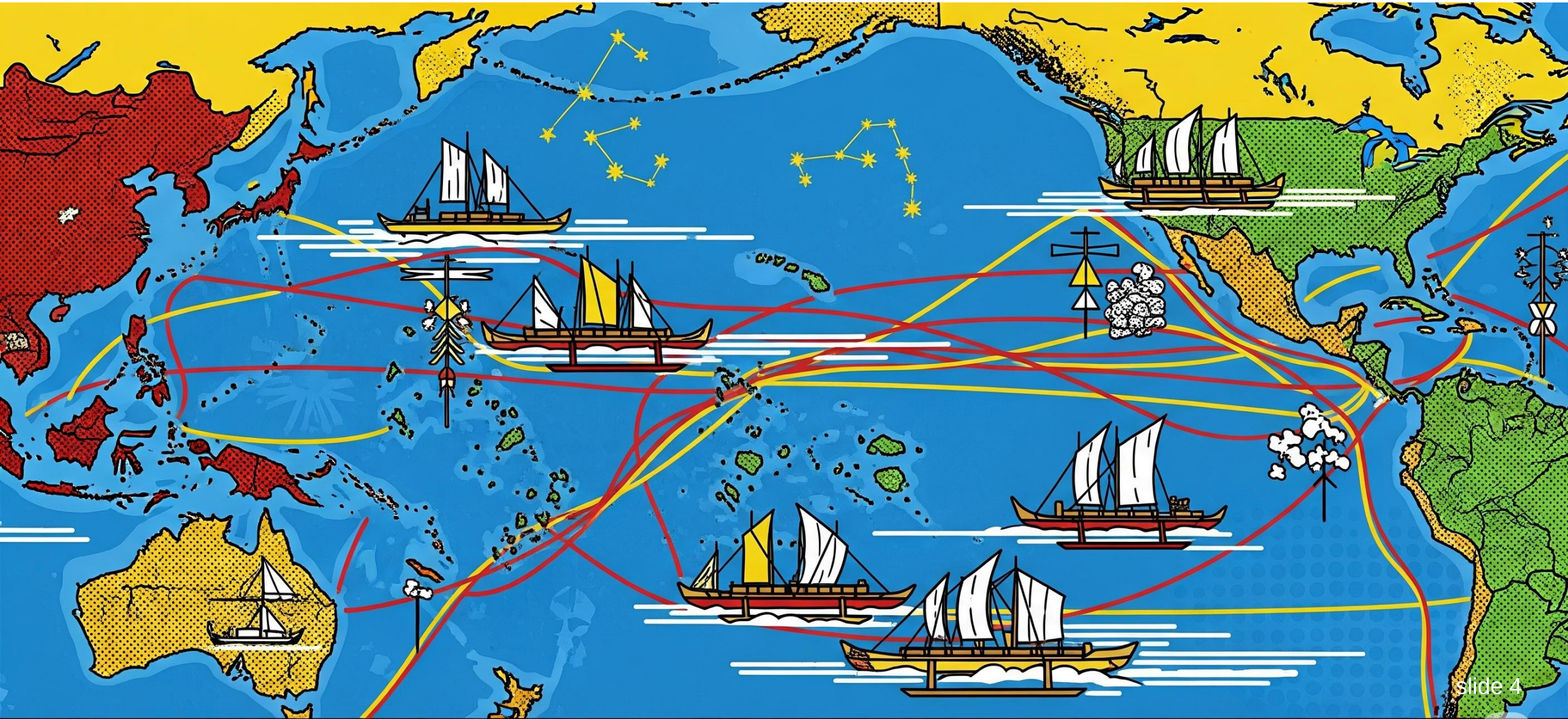
2 Nature-based solutions

3 Adaptation strategies for coastal areas of islands

# Ice-breaking – understanding



# Oceanian People—Masters of the Seas



# In what ways do ancient Oceanian navigators inspire modern society?

| Ancient Capability | Modern Equivalent Technology | Industry/Application |
|---|---|---|
| Great dual-hulled sailing ships | Catamarans and trimarans built with advanced composites and hydrodynamic design | Marine transportation, leisure yachting, naval architecture |
| New navigation techniques | Satellite-based GPS, inertial navigating systems, electronic chart display and information system (ECDIS) | Commercial shipping, defense navigation systems |
| New ways of storing foods, water, and seeds | Cold-chain refrigeration, vacuum sealed packaging, reverse osmosis desalination, hermetic seed banks | Food logistics, water treatment, seed conservation |
| Nurturing fire on board | Fuel cells, marine diesel generators, portable battery packs, approved marine galley stoves | Onboard power generation, emergency energy supply, maritime safety equipment |

# Major numbers of four nations

- Fiji, Samoa, Solomon Islands, and Tonga

| Nations | Population (2025) | Yearly change | Density (P/km$^2$) | Land area (km$^2$) | Median age | Urban Pop. (%) |
|---|---|---|---|---|---|---|
| Fiji | 933,154 | +0.47% | 51 | 18,270 | 28 | 61% |
| Samoa | 219,306 | +0.59% | 77 | 2,830 | 20 | 16% |
| Solomon Islands | 838,645 | +2.37% | 30 | 27,990 | 21 | 23% |
| Tonga | 103,742 | –0.42% | 144 | 720 | 21 | 26% |
| South Korea | 51,667,029 | –0.1% | 531 | 97,230 | 45.6 | 82.4% |

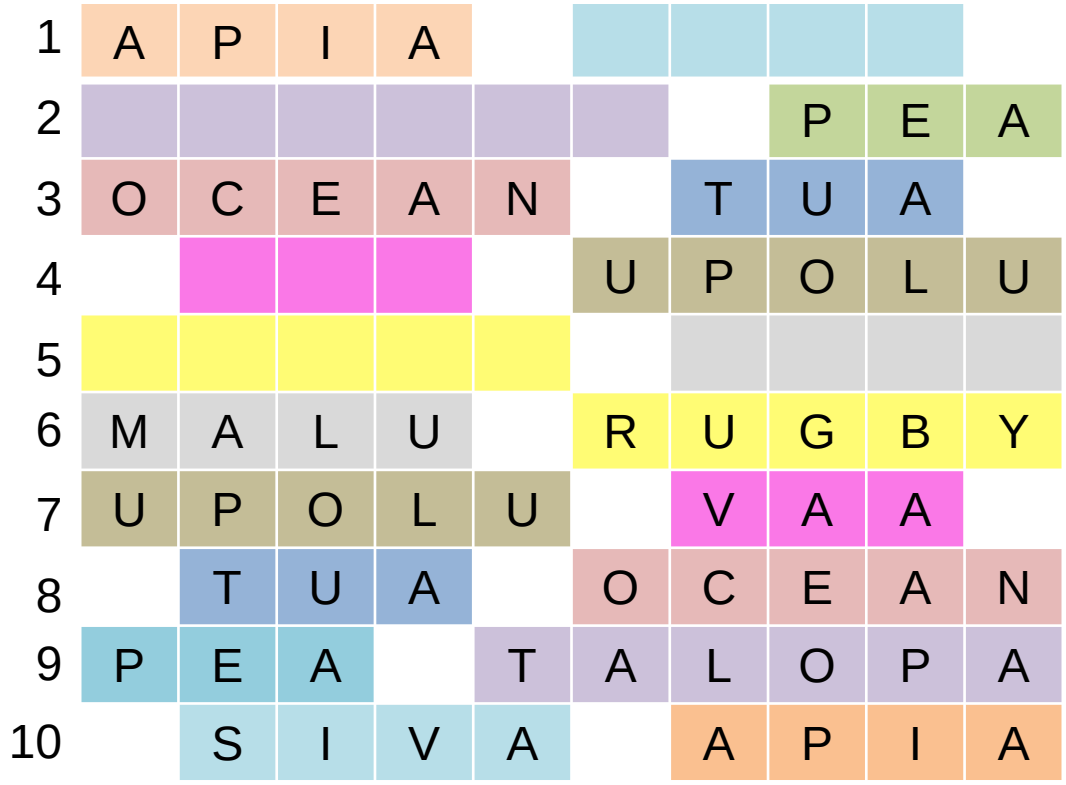
# Fiji

- Mapping puzzle: Fiji

| | |
|---|---|
| a. Capital city of Fiji | Suva |
| b. Traditional Fijian () made from kava root | Yangona |
| c. Fiji's national () team nickname | Flying Fijians |
| d. Famous Fijian golfer, winner of multiple majors | Vijay Singh |
| e. Main island of Fiji | Viti Levu |
| f. Fijian word for "hello" or "hi" | Bula |
| g. Popular Fijian sport besides (  ) | Soccer |

# Samoa

- Samoa crossword puzzle




Traditional dance

“hello” in Samoan

Female tattoo

National-team sport

Outrigger canoe

# the Solomon Islands

- Endemic birds in the Solomon Islands



( ) cockatoo

Ultramarine kingfisher

Rennell fantail

Makira moorhen

( ) megapode

# Tonga

- Famous cultural aspects of Tonga – four core values

  1. Mutual respect
  2. Sharing and cooperation
  3. Humility and generosity
  4. Loyalty and Commitment

- Dance and music bring Tongan heritage of life.

  5. Tawalunga, Nose Flute, Lali, and Fire dances ► a living storybook

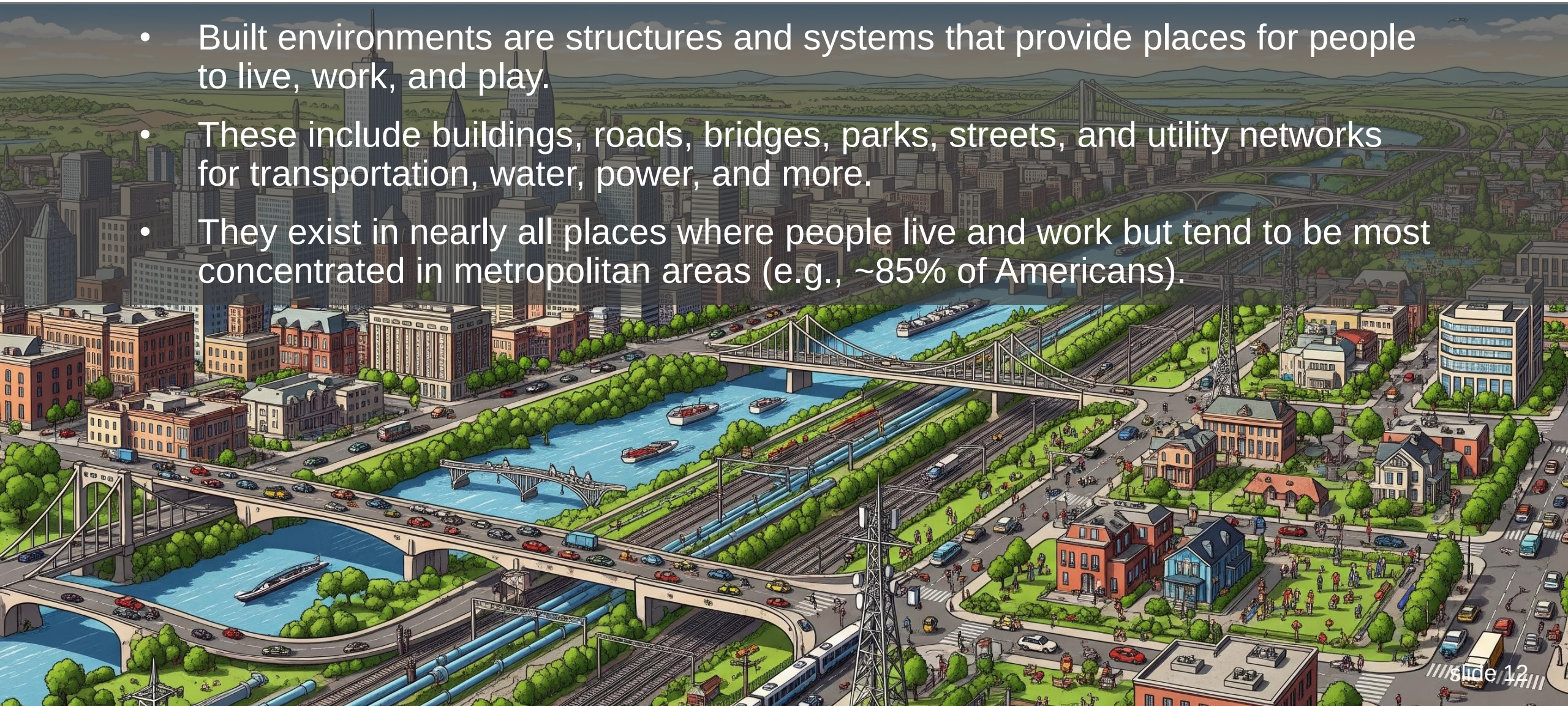


# 1 Built environments

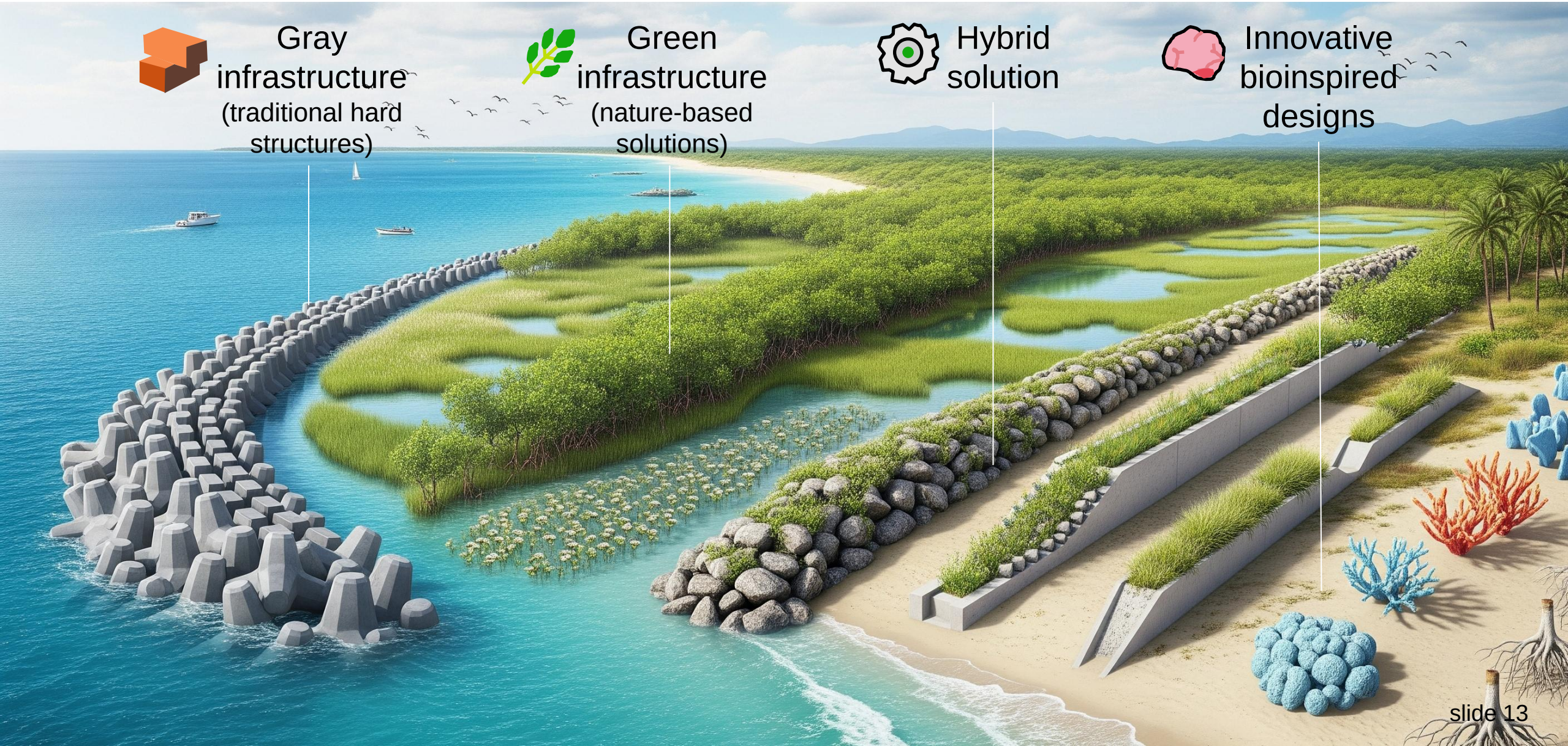
1. Built environments
2. Built environments in the Pacific Islands

# Built environments

- Built environments are structures and systems that provide places for people to live, work, and play.
- These include buildings, roads, bridges, parks, streets, and utility networks for transportation, water, power, and more.
- They exist in nearly all places where people live and work but tend to be most concentrated in metropolitan areas (e.g., ~85% of Americans).



# Built environments for coastal protection and enhancement



# Gray infrastructure – traditional hard structures

- These are engineered solutions that focus primarily on defense.



## Seawalls

- Vertical or sloped walls that block wave energy.



## Breakwaters

- Offshore barriers that reduce wave intensity before it reaches the shore.



## Groynes (Groins)

- Structures perpendicular to the coast that trap sediment and reduce erosion.



## Revetments

- Sloped structures placed on banks or cliffs to absorb wave energy.



## Bulkheads

- Retaining walls that stabilize shorelines and prevent land loss.

# Green infrastructure – nature-based solutions

- These mimic or restore natural systems to provide protection and ecological benefits.



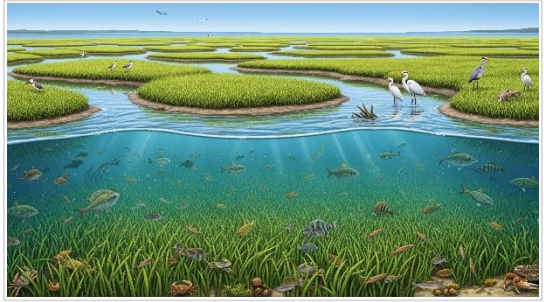
## Living shoreline

- A nature-based solution to coastal protection that uses natural materials (e.g., plants, sand, and oyster reefs) to stabilize the shoreline, reduce erosion, and enhance habitat.



## Mangrove restoration

- Process of rehabilitating degraded or destroyed mangrove ecosystems, which are vital for biodiversity, climate resilience, and coastal protection.



## Saltmarshes and seagrasses

- Coastal ecosystems help reduce erosion and provide essential habitat for marine and coastal species.



## Dune restoration

- Process of rehabilitating and stabilizing coastal sand dunes that are vital for protecting inland areas from flooding and erosion.

# Hybrid solutions

- Combine engineered structures with ecological enhancements.



## Eco-engineered seawalls

- Hard structures designed with crevices or textures to support marine life.



## Living breakwaters

- Breakwaters that also provide habitat for oysters or fish.



## Gabions with vegetation

- Wire cages filled with rocks and planted with native species.

# Innovative bioinspired designs

- Inspired by nature’s own engineering.



## Biomimetic reefs

- Artificial reefs designed to mimic coral structures



## TetraPOTs

- Modular units that support mangrove growth while acting as wave barriers.



## Nature-based play and community spaces

- Coastal parks and infrastructure that double as flood defenses.

# Built environment indicators

ASTDR Land Reuse Health Program. https://www.atsdr.cdc.gov/land-reuse-health-program

- Built environment indicators measure the implementation of activities and achievement of outcomes related to the physical components of the spaces where we live and work. The indicators include:



Walkability



Number, type, size, and condition of abandoned properties



Number of vacant building put back in beneficial use



Number and location of new construction permits



Size, type, number, and usage of green space or recreational areas



Number of structures and lots cleaned up and redeveloped.

# Healthy built environment Indicators

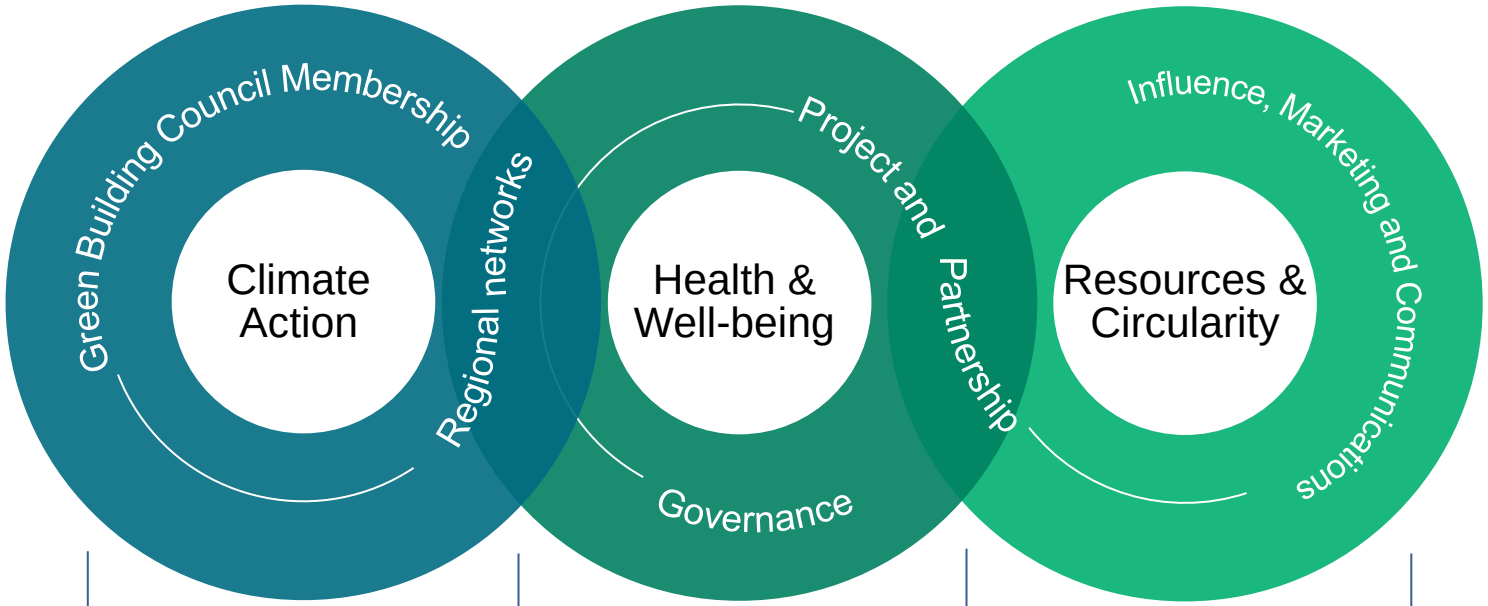
UNSW, City Futures Research Center. https://cityfutures.ada.unsw.edu.au/research/city-wellbeing/

- The healthy built environment Indicators consist of 33 key questions designed to measure how well a specific locality—or even a whole local government area—supports the health and well-being of its residents and other users.



# Sustainable built environments

World Green Building Council, 2025. What is a sustainable built environment? https://worldgbc.org/.




Total decarbonization of the built environment.

A built environment that delivers healthy, equitable, and resilient buildings, communities, and cities.

A built environment that supports the regeneration of resources and natural systems, providing socio-economic benefits through a thriving circular economy.



# Sustainable built environments – building

- It is a building that minimizes its environmental impact while supporting both people and economy. It can be achieved by:



## Energy efficiency

- Use less energy and water.



## Material sourcing

- Use sustainable materials and maintain closed material loops.



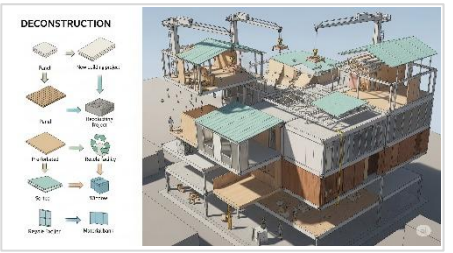
## Design

- Design for deconstruction and resilience to climate change.



## Operation

- Include life-cycle energy analysis and asses thermal performance.

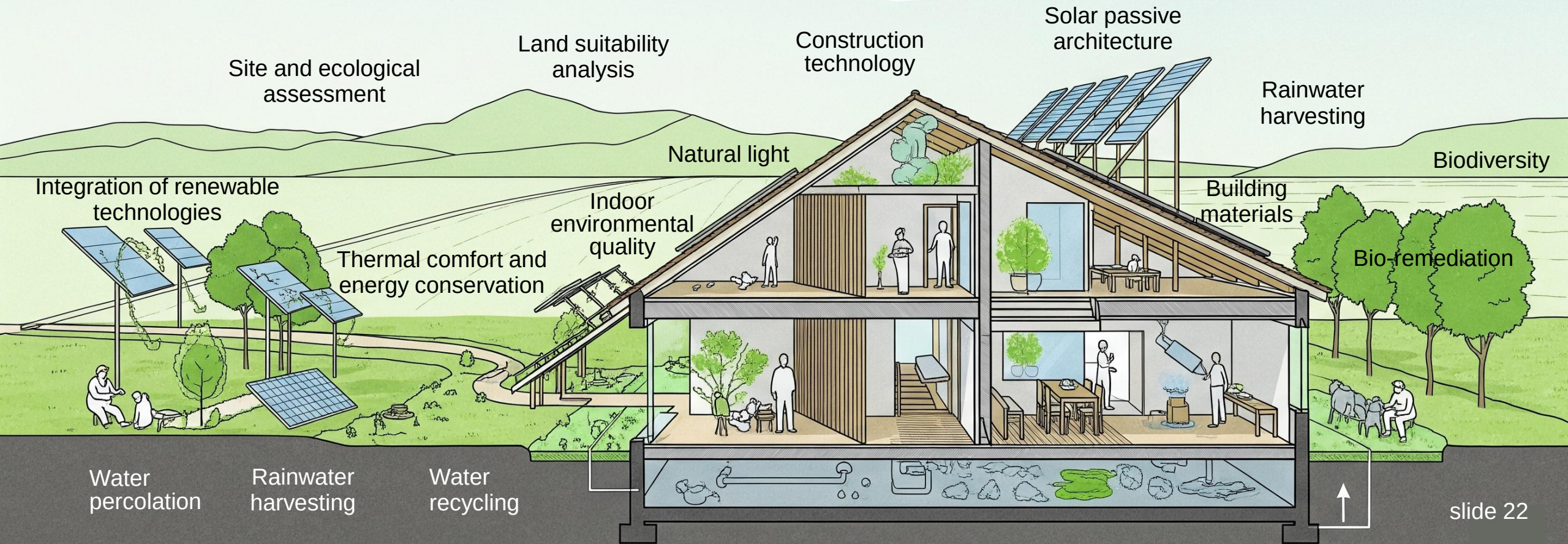



## End of life

- Consider how the building will be reused after decommissioning.

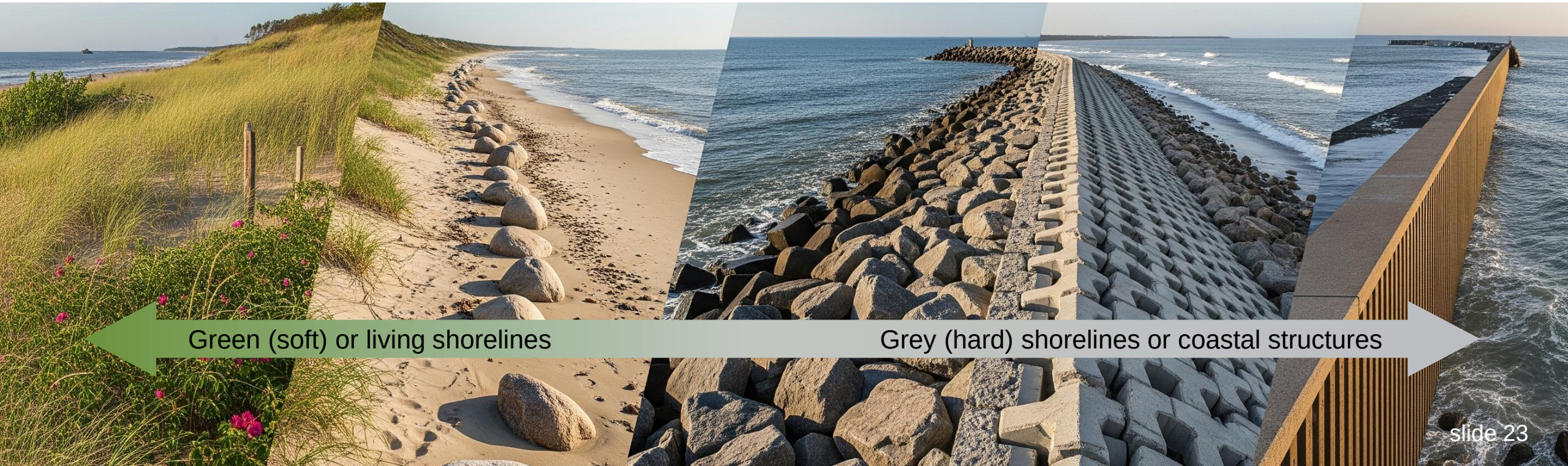
# Sustainable architecture

- Sustainable architecture—also known as green architecture or environmental architecture—has various characteristics:



# Living shorelines

- Living shorelines are protected and stabilized shorelines made of natural materials such as plants, sand, and rock.
- They provide a natural alternative to hard shoreline stabilization methods like revetments/bulkheads and offer numerous benefits.



# Living shorelines belong to natural (or green) infrastructure

- Natural infrastructure uses existing natural areas, as well as engineered solutions that mimic natural processes.



# Benefits of living shorelines

- Living shorelines – why we should choose them.



## Salt marsh stores carbon

- One square mile of salt marsh stores the carbon equivalent of 76,000 gallons of gas annually.



## Salt marshes trap sediments

- Salt marshes trap sediments from tidal waters, allowing them to build elevation as sea levels rise.



## Multifunction of Living shorelines

- Living shorelines improve water quality, provide fisheries habitat, increase biodiversity, and promote recreation.

# Benefits of living shorelines

- Living shorelines – why we should choose them.



## Living shorelines are natural barriers to waves

- Salt marshes and oyster reefs act as natural barriers to waves. A 15-foot stretch of salt march can absorb 50% of incoming wave energy.



## Living shorelines are more resilient against storm

- Living shorelines are more resilient against storms than bulkheads.

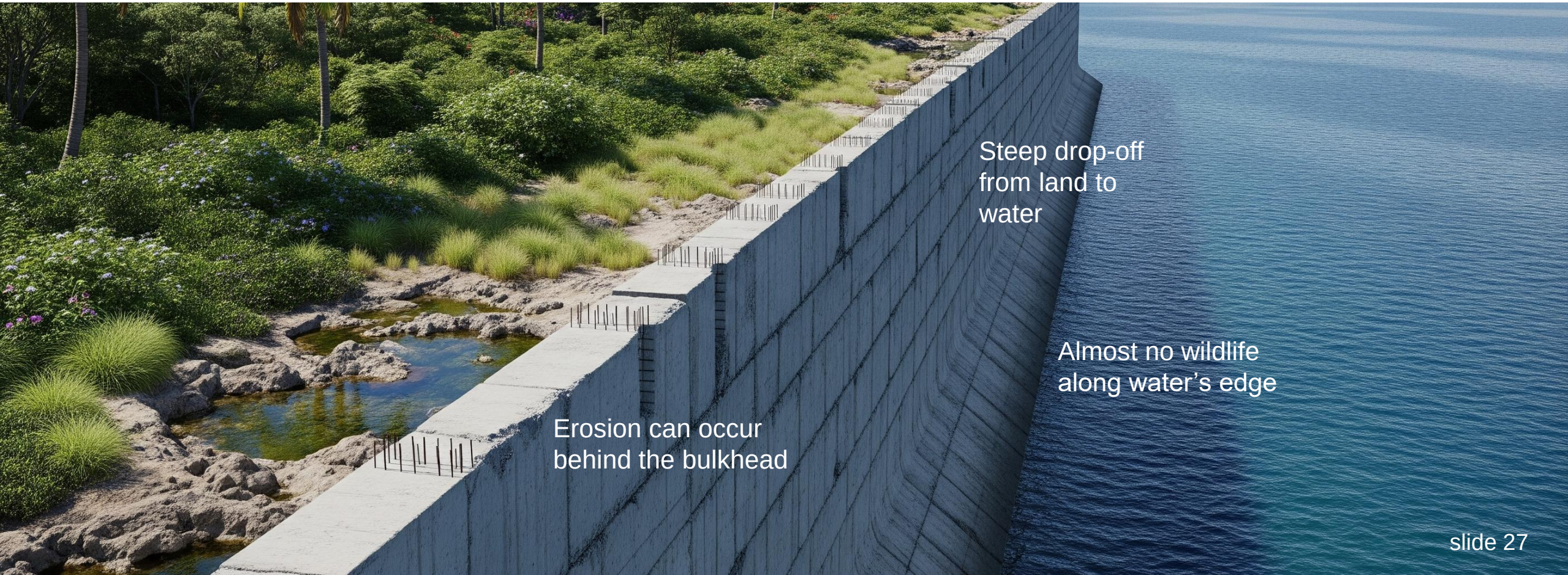


## Hard shorelines decrease fisheries & biodiversity

- By 2020, 33% of shorelines in the U.S. will be hardened, reducing fisheries habitat and biodiversity.

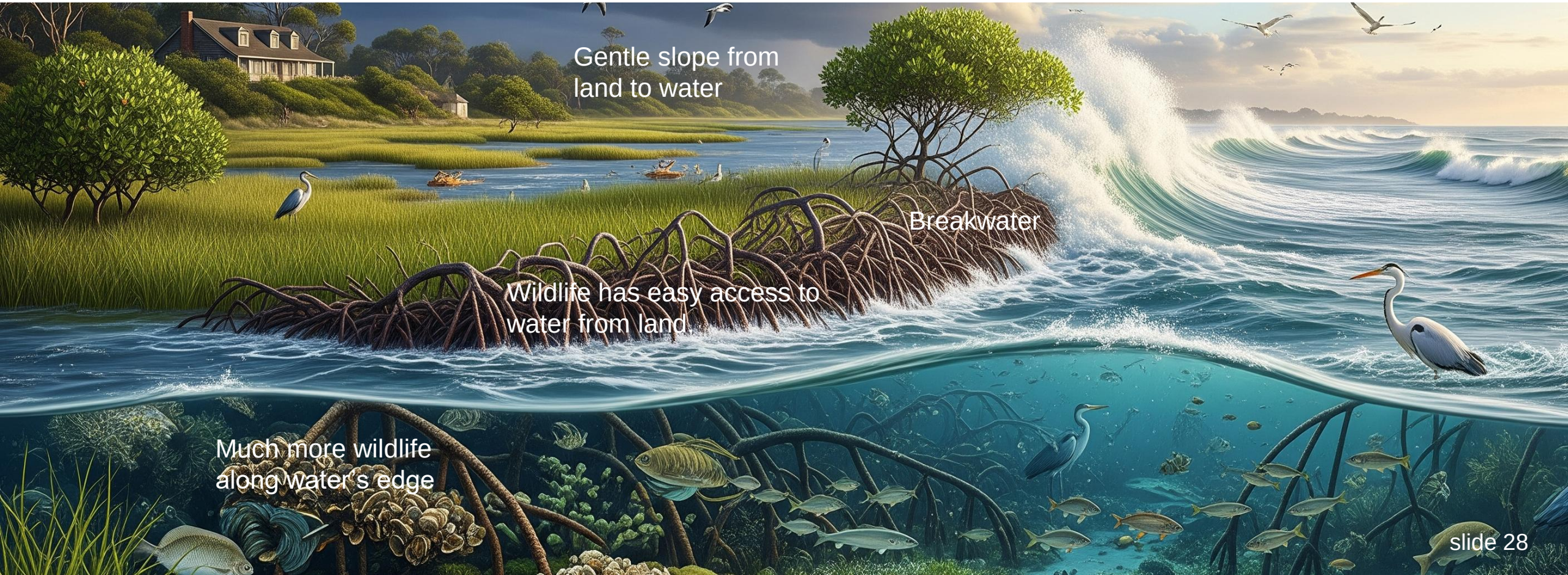
# Hard infrastructure vs. living shorelines

- Hard infrastructure, such as retaining walls, abruptly severs the ecological connection between the coast and the water.



# Hard infrastructure vs. living shorelines

- Not only do living shorelines defend land against destructive waves, but they also provide crucial habitat for fish and wildlife.



# Living shorelines with oyster reefs

- The benefits of rebuilding healthy oyster reefs include:



## Filtering

- Filtering fertilizer runoff from farmland, resulting in cleaner water.



## Providing strong foundations

- Providing strong foundations by anchoring sediment and preventing erosion.

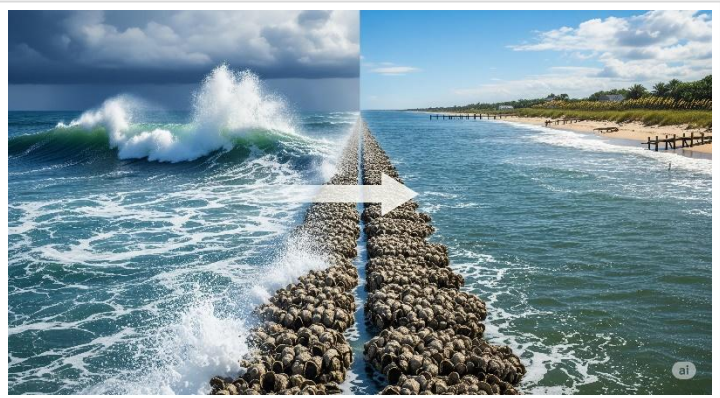


## Future-proofing

- Future-proofing coastlines as reefs grow with rising sea levels.

# Living shorelines with oyster reefs

- The benefits of rebuilding healthy oyster reefs include:



## Abating wave energy

- Abating wave energy to protect coasts from daily tides and storm surges.



## Creating new habitats

- Creating new habitats where marine life thrives, supporting both ecosystems and recreational fishing.

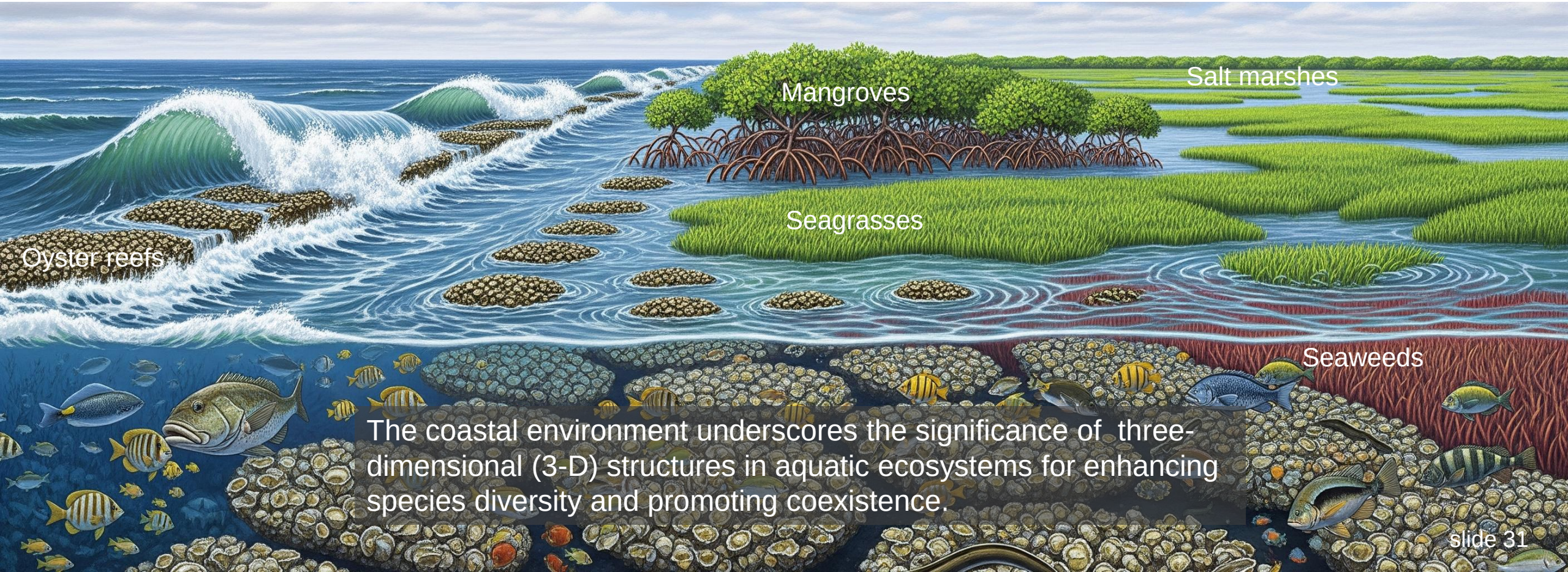


## Boosting oyster populations

- Boosting oyster populations, which benefits the fishing industry.

# Habitat complexity

- Coastal habitat complexity provides more niches and diverse ways of exploiting the environmental resources and increase species diversity.



# Built environments in Pacific Islands

- Traditional architectural forms
  - Pacific Island architecture is renowned for its traditional buildings that reflect deep cultural meanings and environmental adaption.
  - Three emblematic forms are:

| Feature | Bure Kalou (Fiji) | Fale (Samoa) | Nakamal (Vanuatu) |
|---|---|---|---|
| Primary function | Worship, community gatherings | Daily living, ceremonies | Chief's council, communal meetings |
| Structure | Elevated platforms, carvings | Skeleton frame, no walls | Open hall with gabled roof |
| Materials | Hardwood posts, thatch, bamboo | Timber poles, palm thatch | Timber, bamboo, palm – thatched roof |
| Cultural Symbolism | Connection to the divine | Openness, communal transparency | Social structure, decision-making |

# Materials use and sustainability

- The choice and sourcing of materials demonstrate a sustainable ethos:



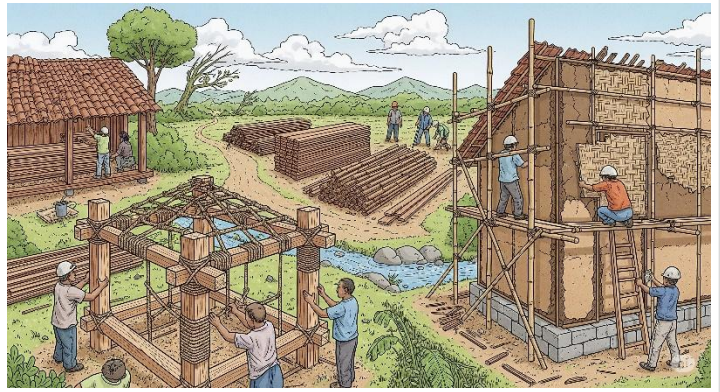
## Local, renewable resources

- Thatch (pandanus, palm), hardwoods, bamboo and coral stone.



## Passive climate control

- Elevated floors for airflow, steep thatch roofs for rain runoff, and open walls for natural ventilation



## Least-waste construction

- Lashings instead of nails, modular repairs, and reuse of materials after cyclones or seasonal wear.

# Adapting to environment and climate resilience

- Built environments across the Pacific Islands showcase deliberate resilience strategies.



## Elevated platforms

- Raise structures above flood and termite risks.



## Flexible framing

- Lightweight lashed connections absorb seismic and cyclonic forces.
- Flexible connections and slender pile-foundation systems are key factors in lightweight construction.



## Modern coastal defenses

- Many communities now construct seawalls made of rock or concrete blocks to combat sea-level rise and storm surges (e.g., the Ebeye barrier in the Marshall Islands).

# Historical and contemporary influences

- Since European contact and late-20th-century development, island architecture has evolved.



## Architectural heritage

- Churches, courthouses and government halls are built in brick or stone—often blending Gothic or neoclassical motifs with local materials.



## Modern fusion

- Concrete, steel, and glass have been integrated alongside traditional forms, as seen in resorts, urban residences, and public buildings in Suva, Apia, and Port Vila.



## Asian and global aesthetics

- Rooflines and ornamental woodwork drawn from Chinese, Japanese, or Southeast Asian models enrich new constructions on Fiji's Viti Levu and beyond.

# Preservation challenges and future threats

- Pacific built heritage faces mounting risks.



## Climate change

- Rising seas, coastal erosion, and intensified cyclones undermine foundations, displace communities, and threaten freshwater aquifers.



## Economic constraints

- High costs of maintenance and seawall upgrades often outpace rural communities' budgets, rendering many structures vulnerable within one to two years of construction.



## Heritage at risk

- Colonial-era buildings and indigenous communal space are increasingly endangered, prompting documentation and conservation initiatives.

# Safeguarding the Pacific Islands' built heritage

- In our next class, we will discuss five strategies for safeguarding the Pacific Islands' built heritage.





# 2 Nature-based solutions

1. Nature-based solutions (NbS)
2. NbS in Pacific Islands

# Nature-based Solutions (NbS)

- Nature-based solutions are actions to protect, sustainably manage, and restore natural or modified ecosystems, addressing societal challenges effectively and adaptively while simultaneously providing human well-being and biodiversity.

Addressing societal challenges effectively and adaptively

Human well-being

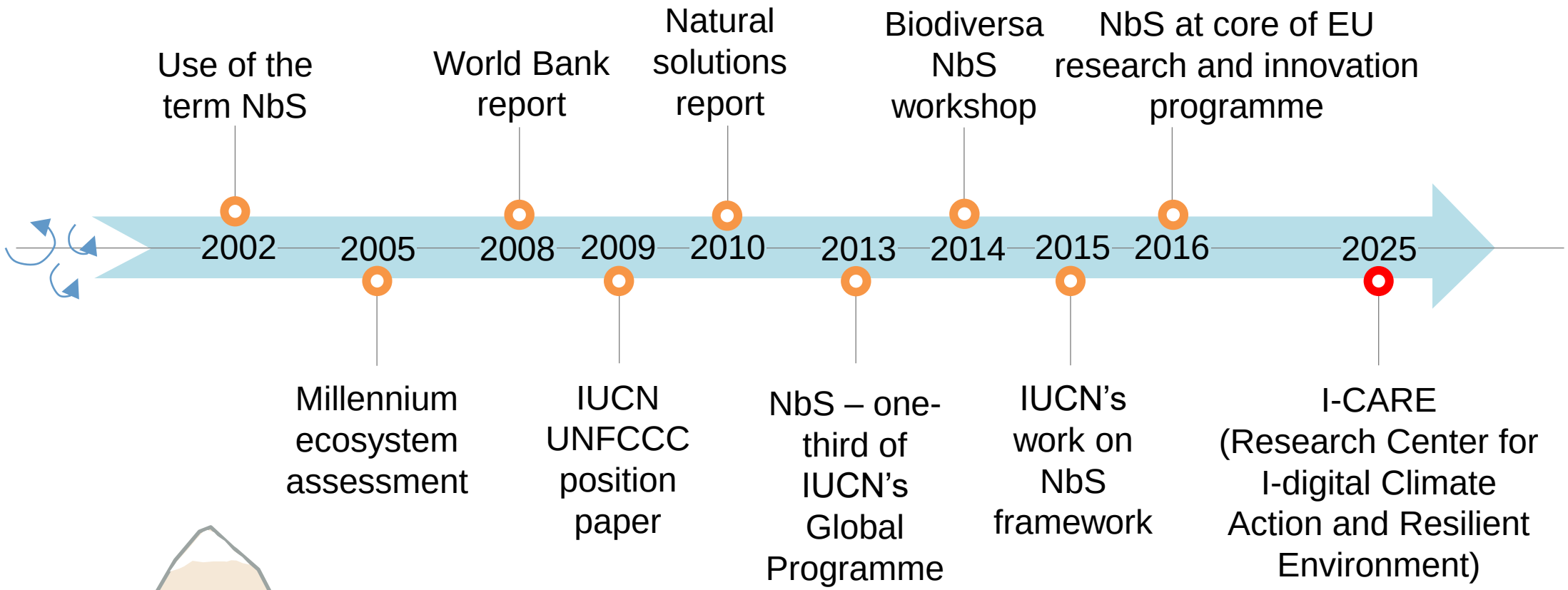


Biodiversity



# NbS timeline

- Major milestones in the evolution of the NbS concept:

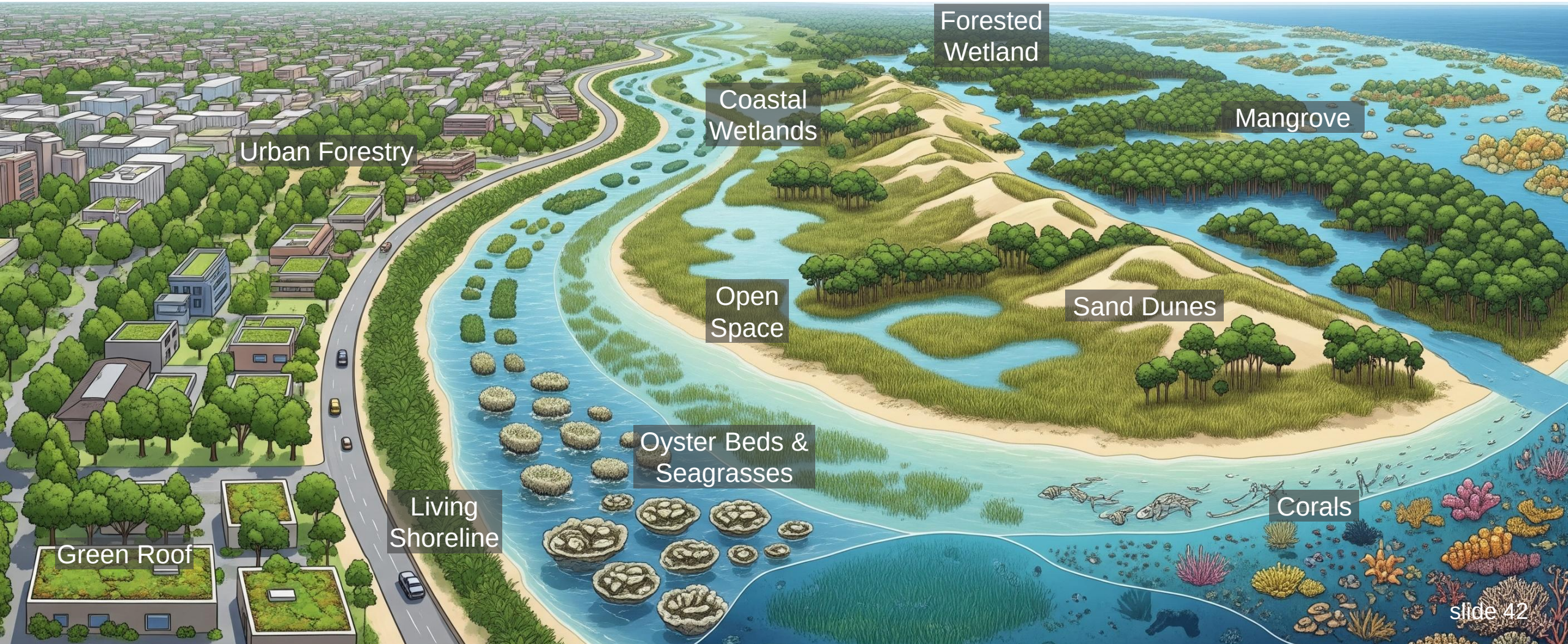


# NbS vs. SBE

- Comparison by focus, examples, and key concepts

| | NbS | SBE |
|---|---|---|
| Approach | NbS actively utilizes natural systems to solve problems and provide benefits. | SBE is primarily concerned with mitigating the negative impacts of human activities on the environment. |
| Scope | NbS can encompass a broader range of natural systems and landscapes. | SBE focuses on the design and management of human-made structures and spaces. |
| Intervention | NbS can involve a range of interventions, from minimal (restoring existing ecosystems) to more significant ones (creating new ecosystems). | SBE often involves direct human intervention in design and construction. |

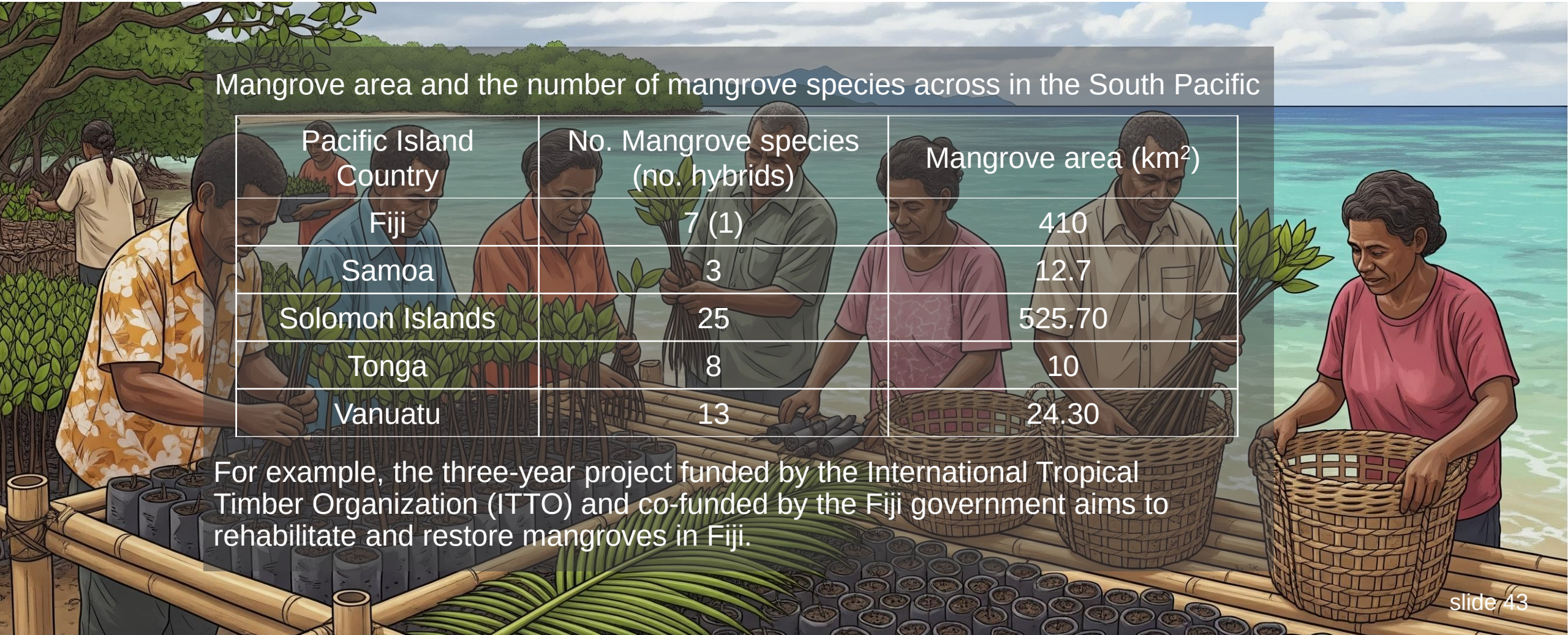
# Various NbS options



# Ex: Mangrove rehabilitation and restoration in Fiji

Ministry of Forestry, Fiji, 2022, Community-based management guideline for mangrove rehabilitation and restoration in Fiji.

- Mangrove is an ecosystem popular in the South Pacific.



Mangrove area and the number of mangrove species across in the South Pacific

| Pacific Island Country | No. Mangrove species (no. hybrids) | Mangrove area ($km^2$) |
|---|---|---|
| Fiji | 7 (1) | 410 |
| Samoa | 3 | 12.7 |
| Solomon Islands | 25 | 525.70 |
| Tonga | 8 | 10 |
| Vanuatu | 13 | 24.30 |

For example, the three-year project funded by the International Tropical Timber Organization (ITTO) and co-funded by the Fiji government aims to rehabilitate and restore mangroves in Fiji.

# Ex: Mangrove rehabilitation and restoration in Fiji

- Preparation of mangrove seedlings raised in mangrove nursery for replanting



Replanting onto the inter-tidal mudflats area, Taveuni



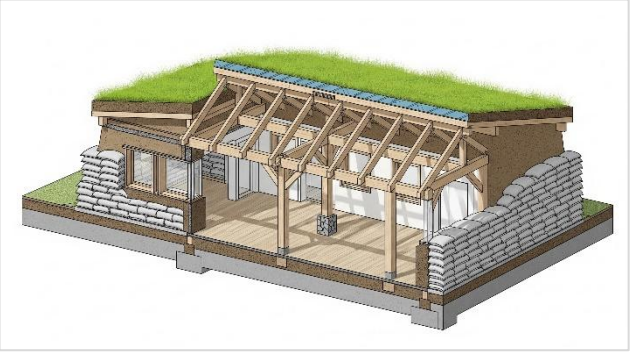
Consultation with communities/workshop

# Ex: Earthbag building

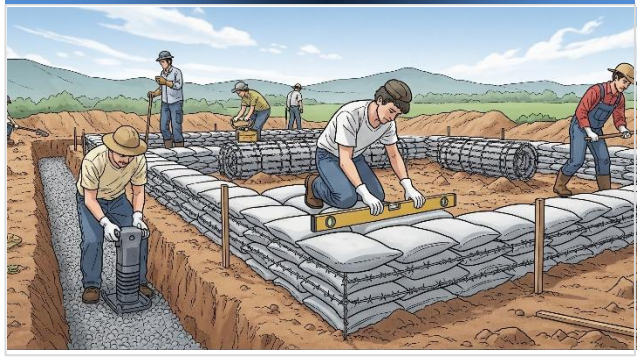
https://www.themudhome.com/earthbagbuilding.html

- Earthbag techniques demonstrate how rural housing can be low-carbon, durable, and self-sufficient.

Step 1 – Design



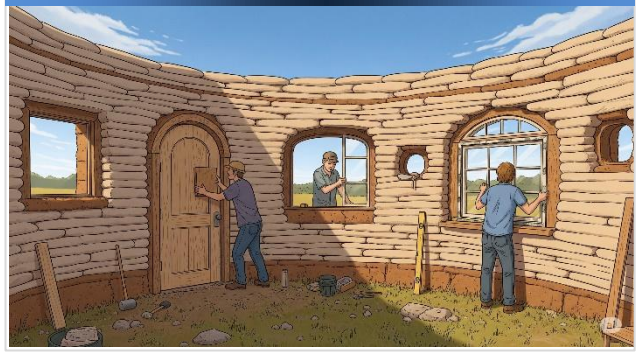
Step 2 – Foundation



Step 3 – Walls



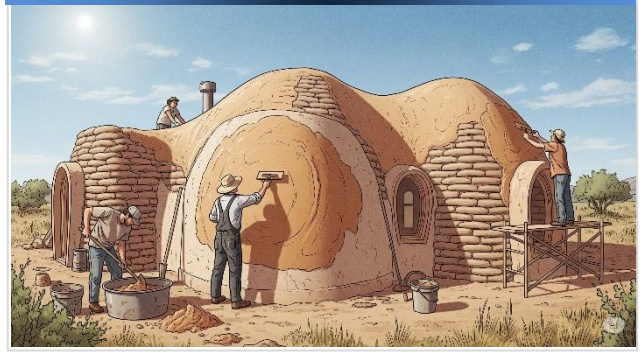
Step 4 – Windows/Door



Step 5 – Roof



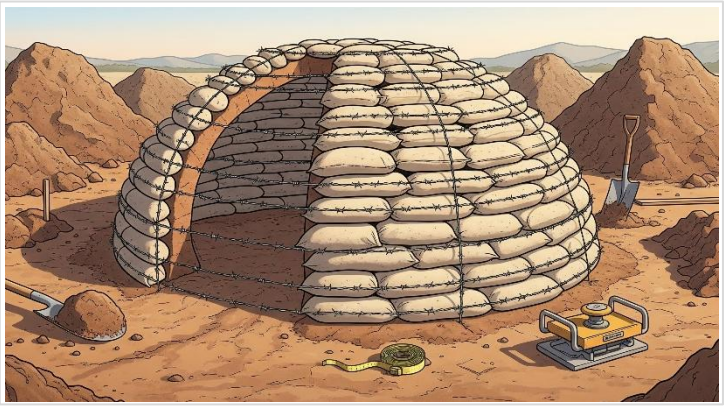
Step 6 – Plastering



# Ex: CalEarth superadobe structures

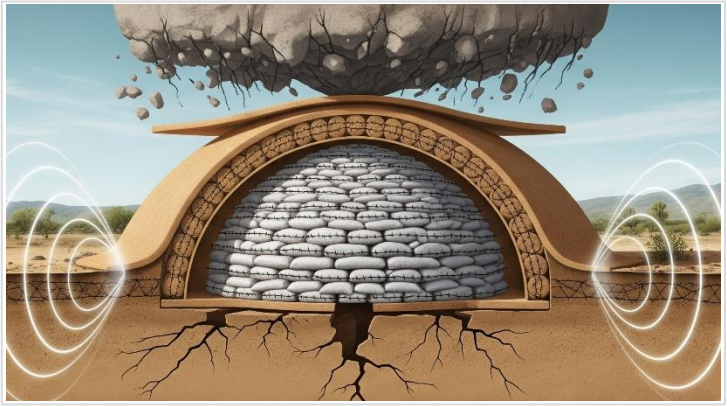
https://calearth.org/pages/what-is-superadobe

- Superadobe is a form of earth bag architecture.



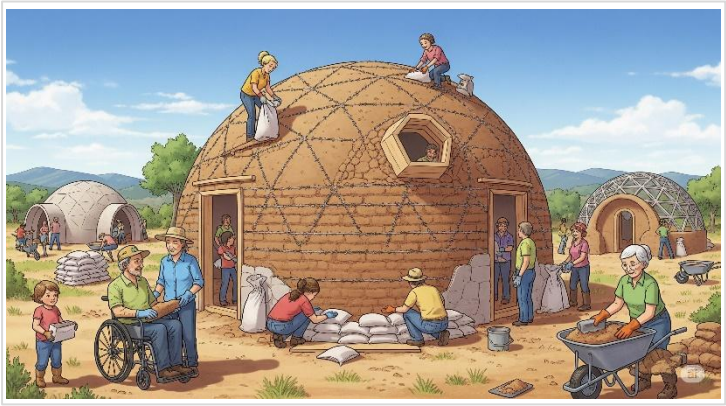
## Constructable with simple materials

- It can be constructed using long sandbags (superadobe bags), barbed wire, on-site earth, and a few tools.



## Meet California's earthquake code tests

- It can withstand twice the load that would crush a pitched-roof house and meets California's stringent earthquake code tests.



## Buildable by anyone

- Anyone can build—either alone or with a group.

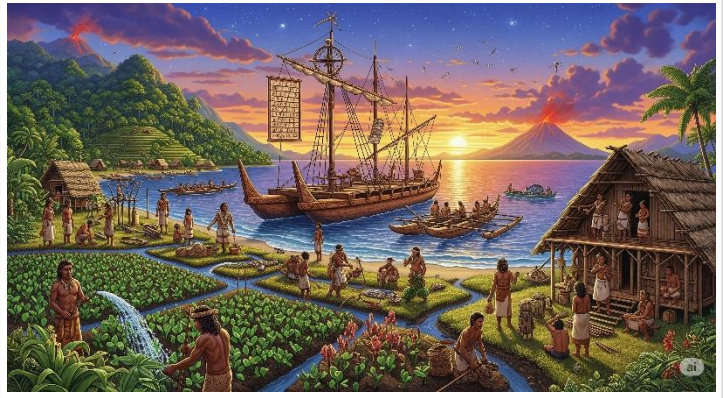
# Nature-based solutions (NbS) in Pacific Islands

- Nature-based solutions in the Pacific balance ecological integrity, cultural continuity, and community well-being.



## Local knowledge and integrating modern design

- They draw on generations of local knowledge while integrating modern design and technology to withstand a changing climate, and preserve fragile island ecosystems.



## Pacific traditional knowledge (TK)

- Pacific Island peoples did not survive on islands far from continents for millennia by luck but by design, a concept articulated through Pacific TK.



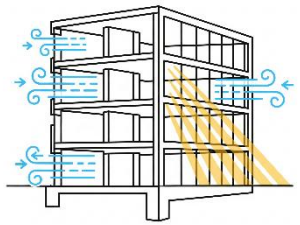
## Setting a global example for a sustainable future

- By weaving ancestral wisdom into cutting-edge practices, Pacific communities are pioneering resilient, low-carbon, and culturally vibrant built environments.

# Key principles



Use of locally sourced, renewable materials



Climate-responsive design that maximize natural ventilation and daylight



Low-carbon energy systems (e.g., solar, passive cooling)



Integration with natural landscapes to protect biodiversity



Community-led planning and capacity building

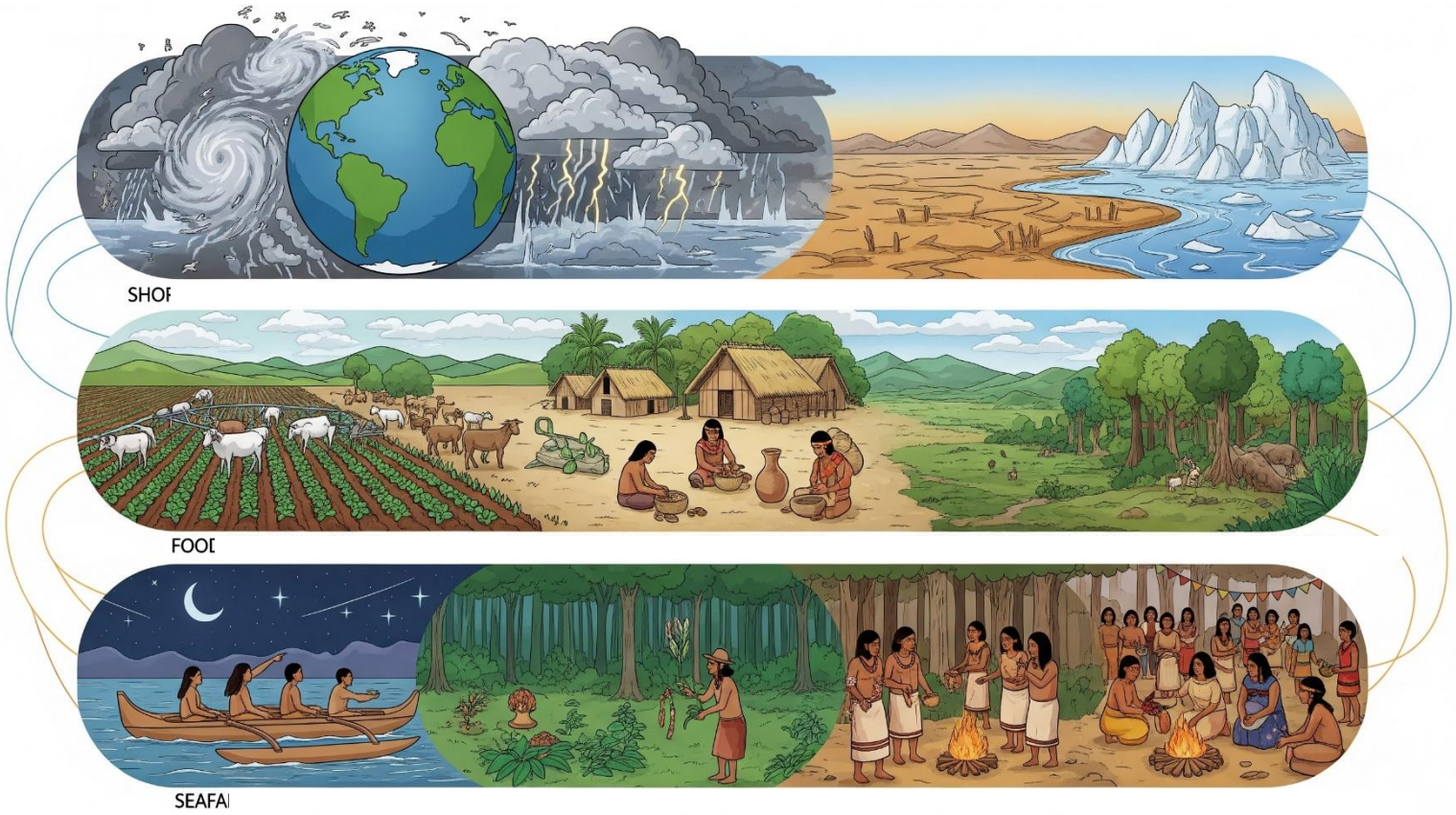


Resilience to cyclones, sea-level rise and other hazards

# Domains of traditional knowledge in the Pacific Islands

Nunn et al., 2024. Traditional knowledge for climate resilience in the Pacific Islands. WIREs Climate Change 15(4), e882.

- Domains of traditional knowledge in the Pacific Islands and relevance to climate change and climate variability:




►Tier 1 domains:
- Climate Change (long-term)
- Climate Variability (short-term)

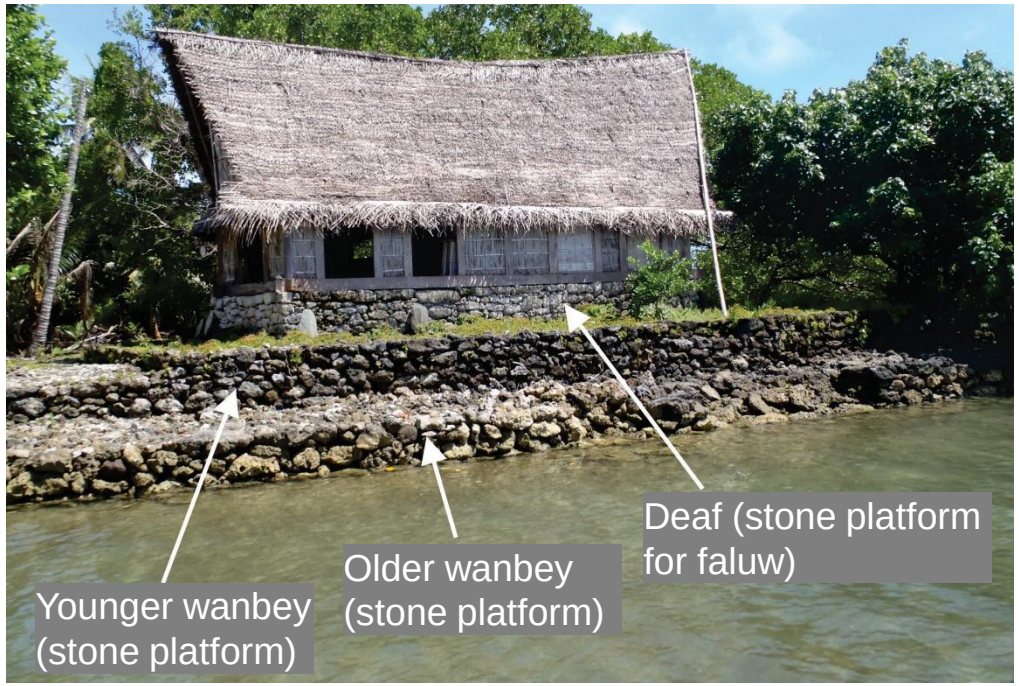
► Tier 2 domains:
- Food + Water Security
- Settlement + House Construction
- Traditional Ecological Knowledge
- Environmental Conservation

► Tier 3 domains:
- Seafaring + Navigation
- Traditional Medicine
- Sustainable Cultural Practice
- Cultural Resilience

# Local practice: Wanbey – a stone platform

Nunn et al., 2024. Traditional knowledge for climate resilience in the Pacific Islands. WIREs Climate Change 15(4), e882.

- The faluw (men's house) at Waalooy, Maap, Yap, shows how an extra stone platform (i.e., the younger wanbey) was added to accommodate rising sea levels– a TK (traditional knowledge)-based adaptation to climate change.

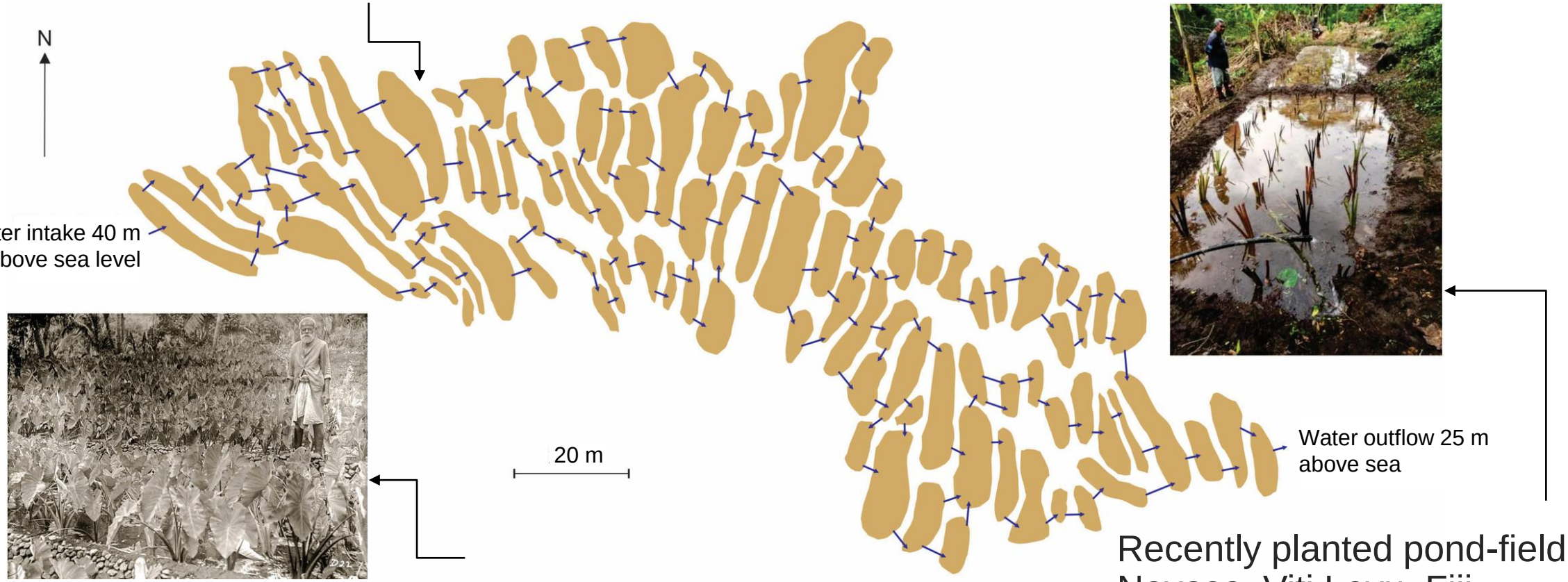





# Local practice: Nadagota – taro terrace system

Nunn et al., 2024. Traditional knowledge for climate resilience in the Pacific Islands. WIREs Climate Change 15(4), e882.

The taro terrace system (Nadagota) at Ravitaki, Kadavu, Fiji in 1992.
The system contained 112 separate pond-fields with an average size of 51 $m^2$.






Taro terraces on Ovalau, Fiji, ~1910.



Recently planted pond-field in Navosa, Viti Levu, Fiji.

# Local practice: Fale (houses)

- Traditional Samoan fale (houses) often utilize woven mat walls that can be rolled up or opened to allow for airflow, reduce wind pressure during storms, and help manage humidity.
- This design feature is a key part of their resilience to the tropical climate.



# Local practice: Bures (wood-and-straw hut, similar to cabin)

Aquino et al., 2021. Inclusive resilience: Incorporating the indigenous into the ... In: Integrated Research on Disaster Risks.

- Fijian bures are constructed from locally felled timber—mangrove near coasts and hardwoods inland—and use minimal metal fastenings to allow them to flex during quakes and cyclones.



How can these structures be incorporated into the post-disaster (e.g., cyclones) reconstruction framework?

① Perspectives of key stakeholders on resilient housing.

② Recognition of indigenous materials and methods in the building code,

③ Inflexibility of government programs and policies regarding informal practices.

# Use of locally harvested materials

- Building on traditional wisdom, contemporary Pacific projects emphasize:



Green building standards that align with SDGs (energy, water, and waste)



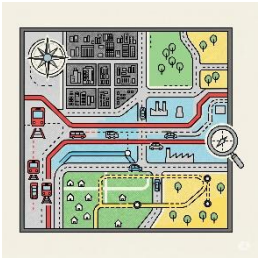
Microgrid Integration combining rooftop solar with community battery storage



Coastal adaption through living shorelines, mangrove restoration, and elevated walkways



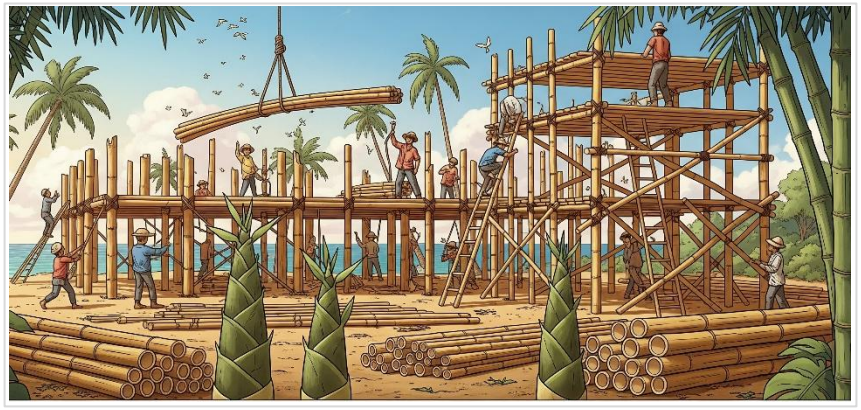
Modular construction using recycled materials to speed rebuilds after disasters



Urban planning that maintains cultural spaces, enforces setback rules, and protects settlements

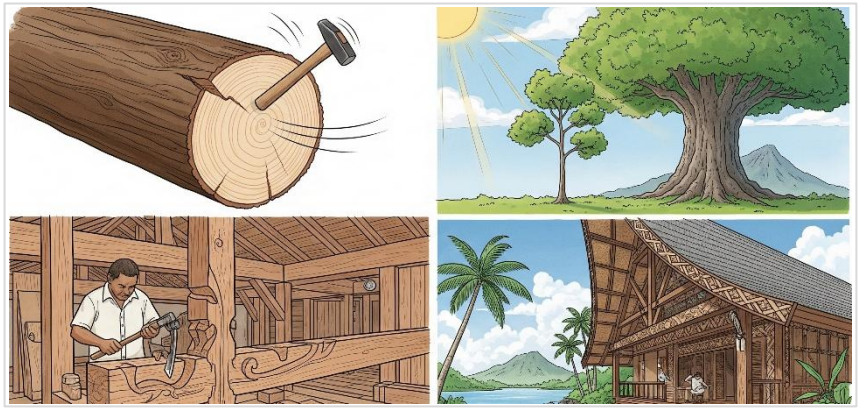
# Modern and hybrid Approaches

- Locally harvested materials – bamboo and timbers



## Bamboo

- Properties: Fast-growing, high tensile strength
- Typical uses: Framing, scaffolding



## Timbers

- Properties: Durable, renewable
- Typical uses: Structural beams, cladding

# Modern and hybrid Approaches

- Locally harvested materials – pandanus/palm and coral stones



## Pandanus/Palm

- Properties: light weight, breathable
- Typical uses: roofing, wall mats

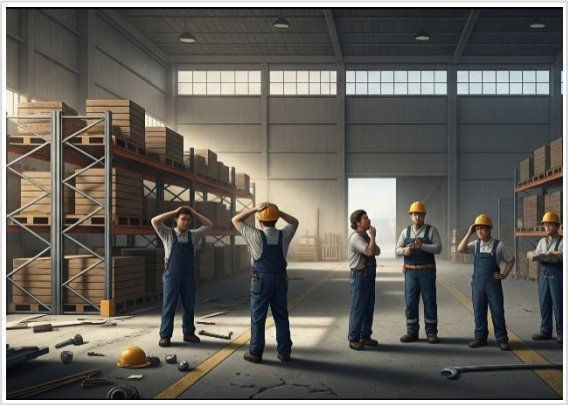



## Coral stones

- Properties: natural insulation, fire-resistant
- Typical uses: foundations, retaining walls

# Challenges

- The challenges can be classified into:



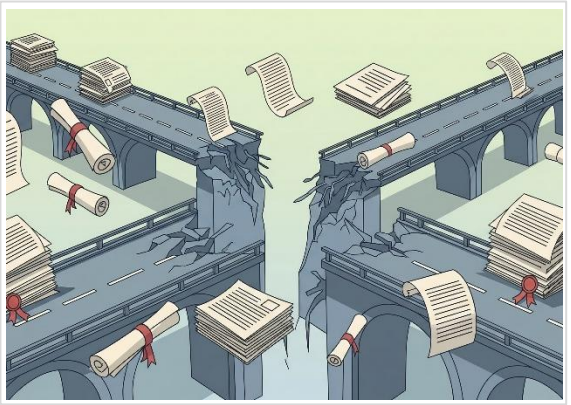
## Material shortages

- Reliance on imported concrete and steel drives up costs and emissions.



## Technical capacity

- There is a need for training in green design, maintenance, and data-driven planning.



## Policy gaps

- Few building codes mandate low-carbon or resilience criteria.



## Cultural integration

- Bridging traditional norms with modern safety standards is essential.

# Opportunities

- Nature-based solutions in the Pacific Islands have the following opportunities:



Strengthening partnerships among governments, universities, and local builders.



Implementing locally adapted designs through grants and streamlined permitting.

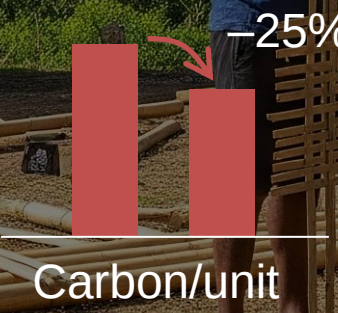


Expanding research on the performance of traditional materials under future climate scenarios.

# Case snapshot: Fiji bamboo project

- Goal: Promote bamboo as an affordable, durable alternative to imported timber.
- Approach
  - Establish nurseries for high-yield bamboo species.
  - Provide hands-on workshops for architects and carpenters.
  - Construct pilot homes demonstrating thermal comfort and seismic resilience.
- Early impact: a 30% reduction in material costs and a 25% drop in embodied carbon per unit compared to conventional wood framing.



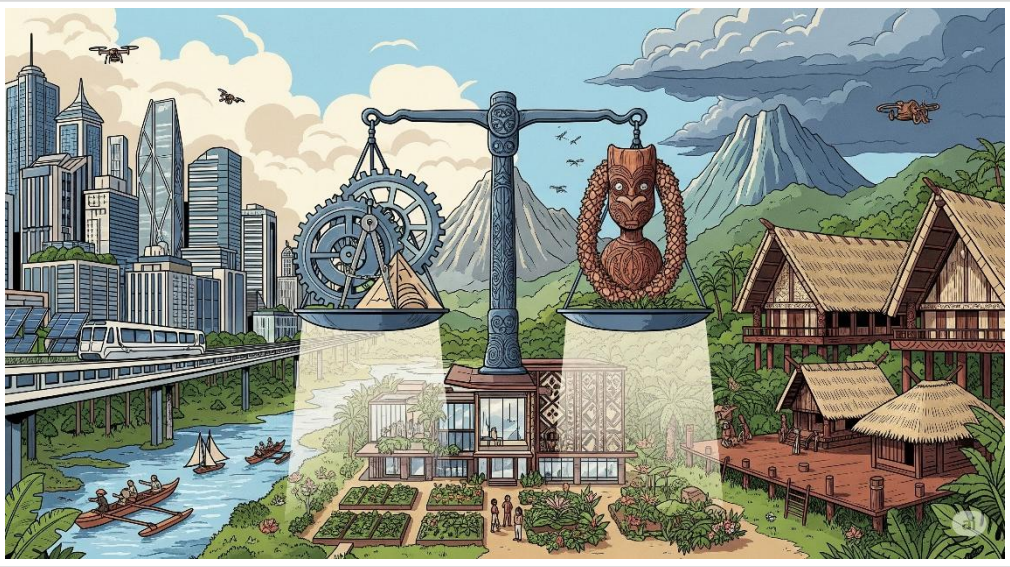
# 3 Adaptation strategies for coastal areas



# Adaptation strategies for coastal areas of (Pacific) islands

## Fostering resilient + traditional wisdom 01

- Fostering resilient, culturally grounded built environments in the Pacific requires balancing modern engineering with traditional wisdom, ensuring that communities maintain their identity and adaptability in the face of environmental change.



## Blending + adaptive planning 02

- By blending hard and nature-based defenses with adaptive planning, community leadership, and sustainable financing, coastal built environments in the Pacific Islands can withstand the accelerating impacts of climate change while safeguarding cultural heritage and livelihoods.



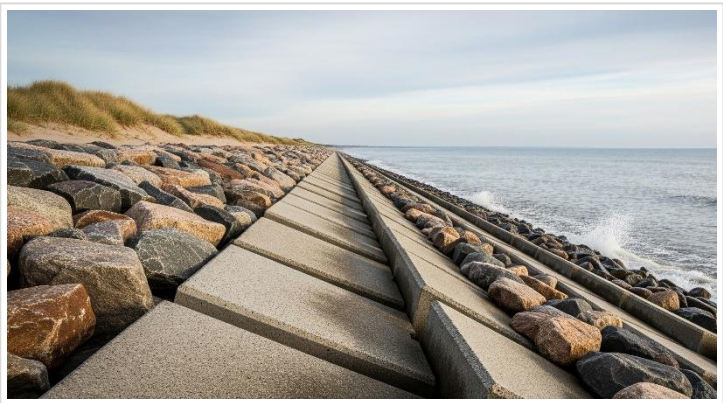
# Coastal defense structures

- Coastal communities frequently deploy engineered barriers to shield shoreline infrastructure from storm surges and erosion.



## Seawalls and breakwaters

- Seawalls and breakwaters absorb or reflect wave energy to reduce coastal inundation.



## Revetments

- Revetments use sloping layers of stone or concrete for gradual energy dissipation.



## Storm surge barriers

- Storm surge barriers—such as gates or levees—protect critical zones during extreme weather events.

# Elevated and flexible infrastructure

- Raising or floating buildings accommodate rising tides and flood events without requiring constant repair.



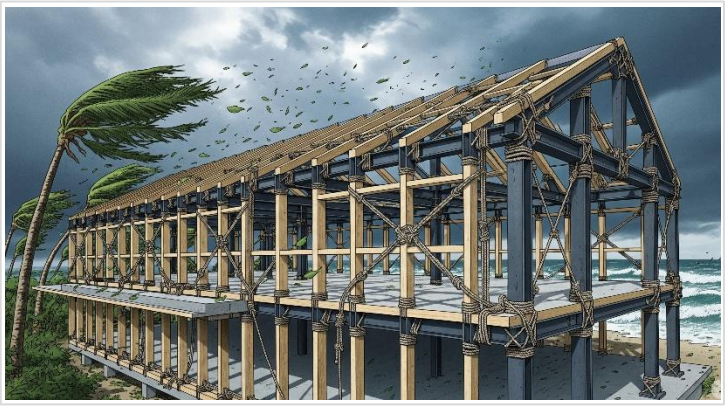
## Stilted homes

- Stilted homes elevate living spaces above projected water levels.



## Floating platforms

- Floating platforms and modular “sea villages” adapt dynamically to sea-level fluctuations.



## Flexible timber or steel frames

- Flexible timber or steel frames, with lashed connections, enhance structural resilience to cyclones.

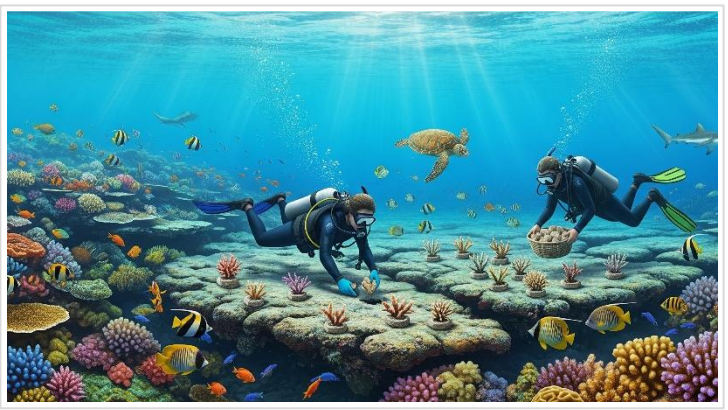
# Ecosystem-based adaption (EbA)

- Restoring and conserving natural habitats leverages ecosystem services for coastal protection.



## Mangrove reforestation

- Mangrove reforestation stabilizes sediments and attenuates waves.



## Coral reef rehabilitation

- Coral reef rehabilitation dissipates wave energy before it reaches the shore. Coral reefs reduce average total wave energy by 97% and wave height by 84%.

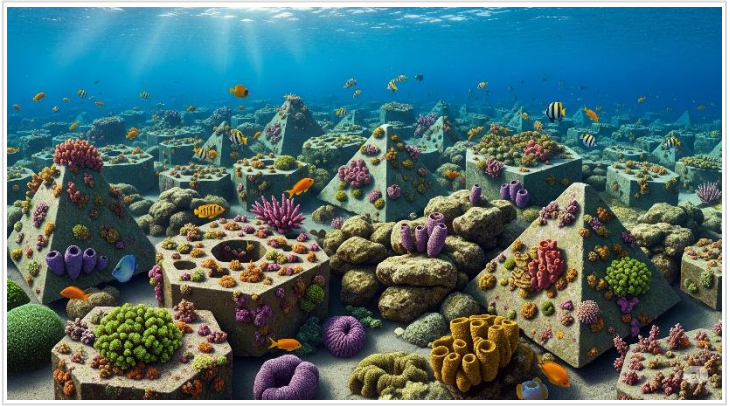


## Beach nourishment (seawalls or retreat)

- Beach nourishment replenishes sand to buffer storm-driven erosion. These EbA often deliver co-benefits for fisheries, biodiversity, and other ecosystem services.

# Ecosystem-based adaption (EbA)

- Marine habitat enhancement structures help improve marine environments by restoring existing habitats and creating new ones.



## Hard-substrate reef modules

- They provide stable surfaces for colonization by corals, sponges, and algae.



## Biogenic and biodegradable habitats

- They are nuilt from natural materials such as oyster shell, coir logs, or recycled wood.

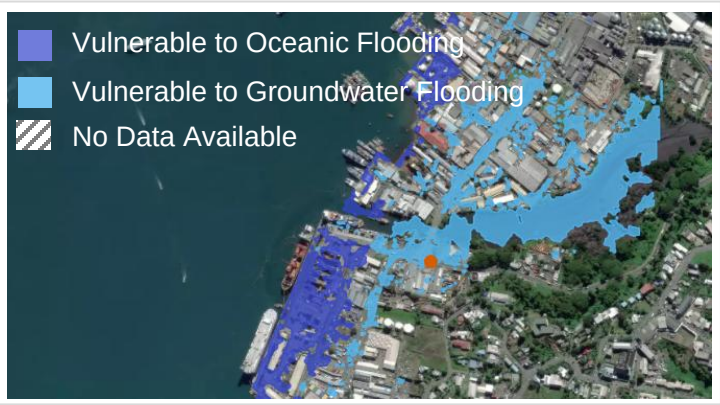


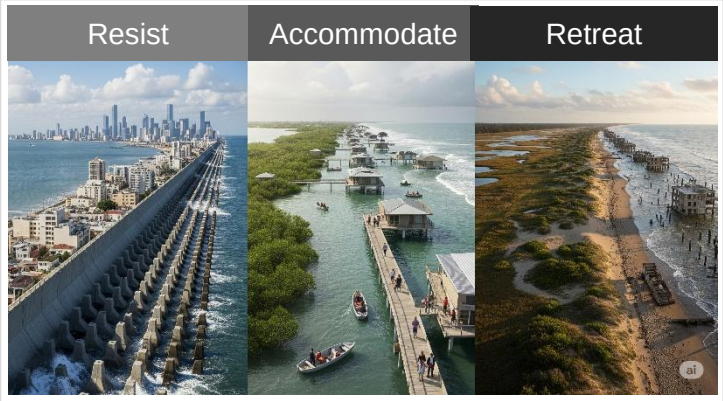
## Hybrid and adaptive shoreline structures

- They combine engineered elements (e.g., breakwaters, groynes) with vegetation or reef tiles.

# Climate-smart coastal planning

- Integrating climate risks into land-use and infrastructure design ensures long-term resilience.






## Participatory risk mapping

- Participatory risk mapping guides the siting of housing, roads, and public facilities away from high-hazard zones.

## Zoning regulations

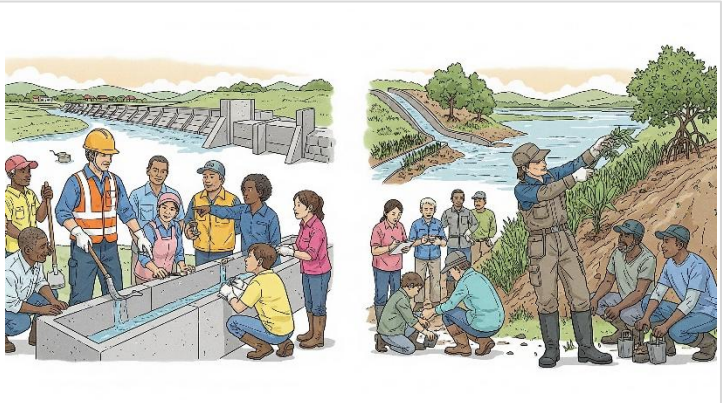
- Zoning regulations enforce “retreat zones,” where new development is restricted or prohibited, providing long-term risk reduction.

## National and local development plans

- Mainstreaming climate adaptation into national and local development plans secures funding and policy support.

# Community empowerment and knowledge sharing

- Grassroots involvement fosters ownership and leverages traditional ecological knowledge.



## Community-based training

- Community-based training builds local capacity for maintaining both engineered and natural defenses.



## Rehabilitation of traditional wells

- Traditional wells are rehabilitated with concrete covers and vegetative buffers to ensure freshwater security.

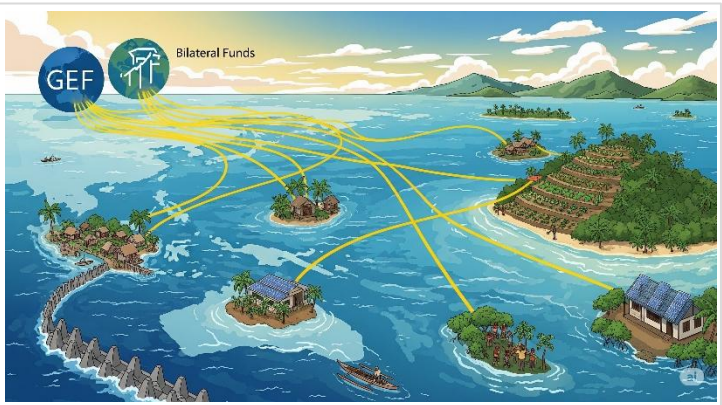


## Peer-to-peer exchange

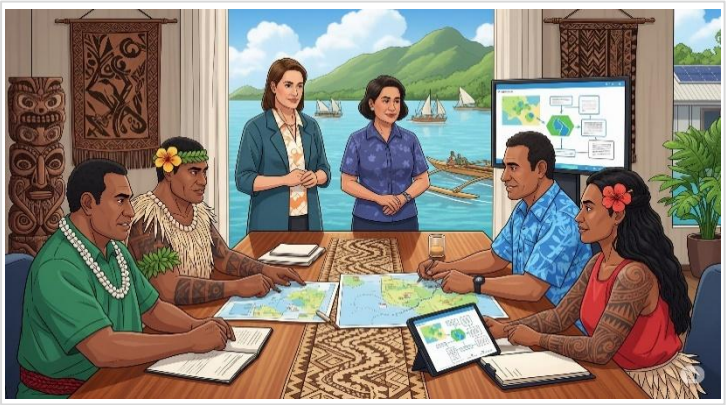
- Peer-to-peer exchanges across islands share best practices and lessons from pilot projects.

# Financing and governance mechanisms

- We need to seek multilateral climate funds and integrated policy frameworks.





## Use of regional initiatives

- Regional initiatives such as the Pacific Adaptation to Climate Change (PACC) Programme channel funds from the Global Environment Facility (GEF) and bilateral sources into pilot interventions.

## Public-private partnerships

- Public–private partnerships under USAID's Coastal Community Adaptation Projects (C-CAP) leverage technical expertise for small-scale infrastructure projects.

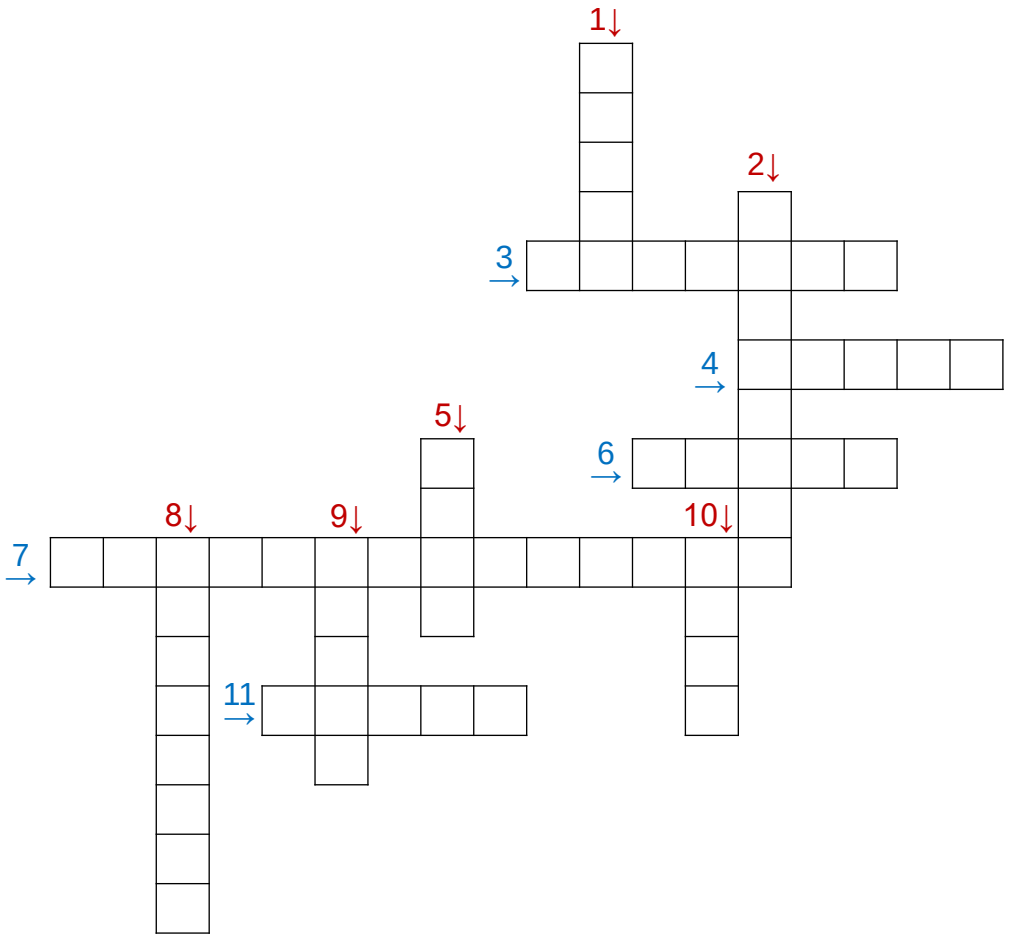
## Local council empowerment

- National policies that empower local councils and recognize customary tenure systems streamline project approvals and ensure cultural compatibility.

# Summary table and key strategies

| Category | Measures (not limited) | Example |
|---|---|---|
| Hard engineering | Seawalls, breakwaters, storm surge barriers | Samoa's Lauli'i seawall |
| Elevated/floating infrastructure | Stilted houses, floating platforms | Maldivian "sea villages" concept |
| Ecosystem-based adaptation | Mangrove reforestation, coral reef restoration, beach nourishment | Marshall Islands' mangrove belt |
| Climate-smart planning | Risk mapping, retreat zoning, mainstreaming adaptation into planning | PACC's coastal zone management pilots |
| Community engagement | Local training, traditional well rehabilitation, inter-island workshops | "Oneisomw" traditional wells project (Micronesia) |
| Financial and governance | GEF grants, USAID C-CAP, local council empowerment | PACC and C-CAP funded community works |

# Review – crossword puzzle




## Across

3. A ___ protects the town from the rising tide.
4. A color used to indicate nature-based solutions.
6. The ___ caused significant damage to coastal areas.
7. Essential ___ such as bridges and roads cam be affected by rising sea levels.
11. A stony formation on the sea floor, often made of the skeletons of tiny marine animals.

## Down

1. A building for human habitation.
2. A type of tree with roots that grow in saltwater.
5. Difficult to break or damage.
8. Not sinking; resting on the surface of water.
9. An island nation in Polynesian known for its natural beauty.
10. A submerged ridge of rock or coral lying beneath the surface of the sea.

Thank you for your attention.

