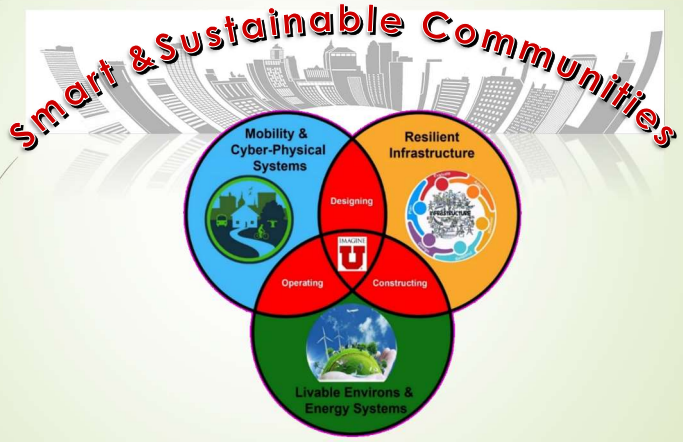
Learning to Ask the Right Questions – Global Warming Impacts to Infrastructure



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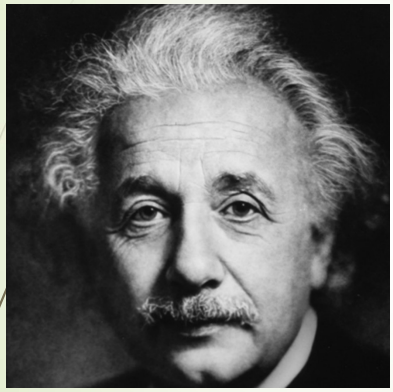
Albert Einstein and Questioning



"If I had an hour to solve a problem and my life depended on the solution, I would spend the first 55 minutes determining the proper question to ask… for ***once I know the proper question, I could solve the problem in less than five minutes****."*

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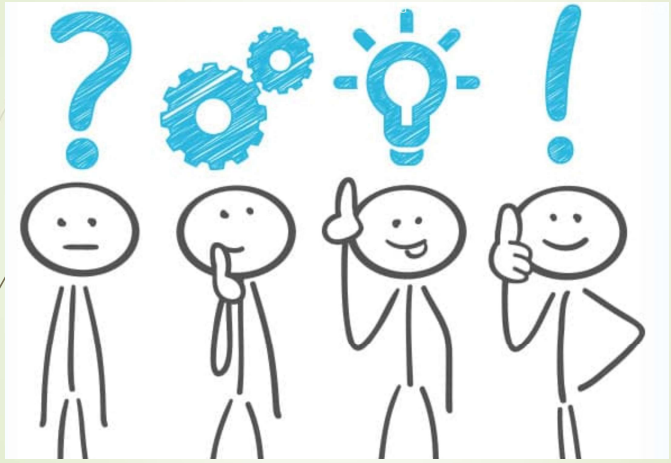
Questioning & Problem Solving



Question Formulate Generate Implement

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Asking the Right Questions

- Leads to the ability to:
  - Create solutions
  - Make decisions
  - Formulate plans

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Solving Complex Problems Takes Teamwork

"If you want to go fast, go alone. If you want to go far go together."

African proverb

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What Are the Right Questions About Climate Change?

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What Are the Right Questions About Climate Change?

- ***Is climate change really occurring?***
- ***What is climate change doing to the environment?***
- ***What is climate change doing to our infrastructure?***
- ***What can <u>SOCIETY</u> DUE TO slow climate change?***
- ***What can I do as an INDIVIDUAL to slow climate change?***

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• *Is climate change really occurring?*

World Scientists' Warning of a Climate Emergency

WILLIAM J. RIPPLE, CHRISTOPHER WOLF, THOMAS M. NEWSOME, PHOEBE BARNARD, WILLIAM R. MOOMAW, AND 11,258 SCIENTIST SIGNATORIES FROM 153 COUNTRIES (LIST IN SUPPLEMENTAL FILE S1)

Scientists have a moral obligation to clearly warn humanity of any catastrophic threat and to "tell it like it is." On the basis of this obligation and the graphical indicators presented below, we declare, with more than 11,000 scientist signatories from around the world, clearly and unequivocally that planet Earth is facing a climate emergency.

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- ***What is climate change doing to the environment?***

Especially disturbing are concurrent trends in the vital signs of climatic impacts. Three abundant atmospheric **GHGs (C02, methane, and nitrous oxide**) continue to increase, as does global **surface temperature**. Globally, **ice** has been rapidly **disappearing**, evidenced by declining trends in minimum summer Arctic sea ice, **Greenland and Antarctic ice sheets**, and **glacier thickness** worldwide. **Ocean heat content**, **ocean acidity**, **sea level**, area burned in the United States, and extreme weather and associated damage costs have all been trending upward; Climate change is predicted to **greatly affect marine, freshwater, and terrestrial life, from plankton and corals to fishes and forests** (IPCC 2018, 2019). These issues highlight the urgent need for action.

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- ***What is climate change doing to infrastructure?***

Civil and Environmental Engineers are Guardians of Infrastructure

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Climate Change Impacts to Infrastructure

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High Temperature Extremes

It takes a lot of energy to cool our living spaces

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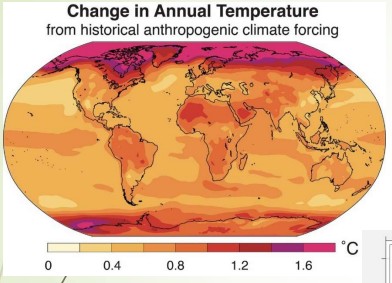
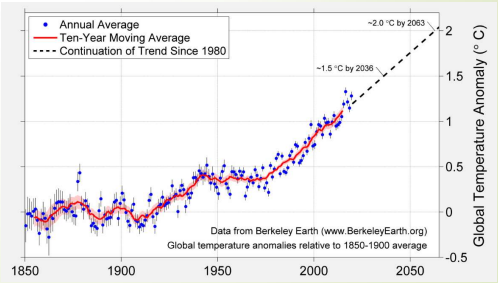
High Temperature Extremes



https://news.stanford.edu/press-releases/2019/04/22/climate-change-wnomic-inequality/



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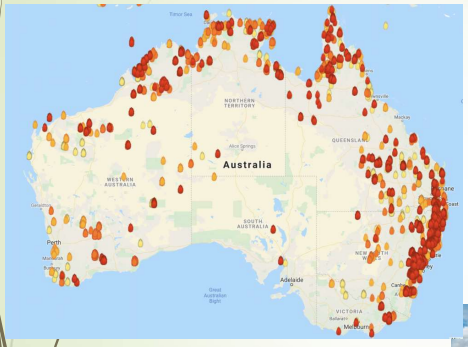
High Temperature Extremes and Drought



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High Temperature Extremes and Wildfires

https://youtu.be/iS_111GVbuE

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Stronger Winds can be fun . . . But are destructive

https://youtu.be/2HJcaNQnCJY

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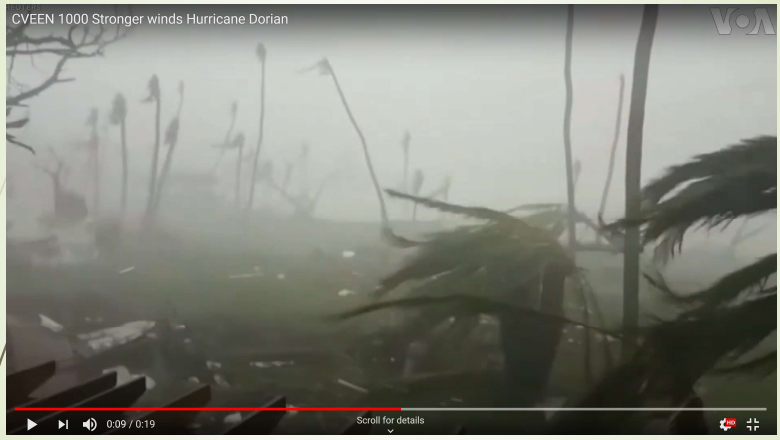
Stronger Winds - Hurricane Dorian

Stronger Winds - Hurricane Dorian



https://youtu.be/aF75ZKE6haM

Typhoon and Wind Action

https://youtu.be/T7MfWAuU4dk

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Flooding and Erosion

View of flooded New Orleans in the aftermath of Hurricane Katrina

https://www.youtube.com/watch?v=7unlPvNxLLA

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Heavy Rainfall & Mudslides

https://youtu.be/4DyqTN0LldI

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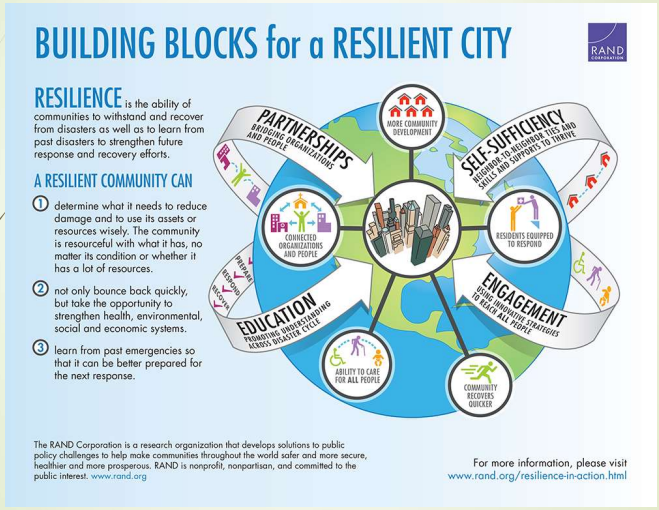
- ***What can <u>SOCIETY</u> DUE TO slow climate change?***



They must become more resilient!

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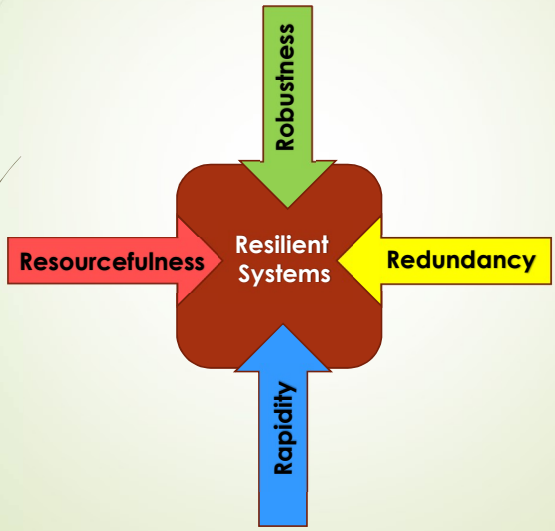
The Engineering Four R's of Resiliency



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Resourcefulness

Making Do with What You Have

Making Alternative Functions

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Resourcefulness

Having Resources

Lack of Resources

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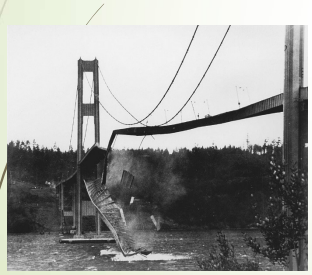
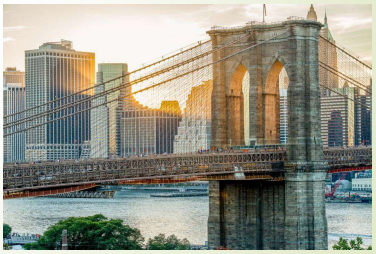
Robustness (Strength)

Fragile ⟷ Robust



Tacoma Narrows Bridge, Washington



Brooklyn Bridge, New York

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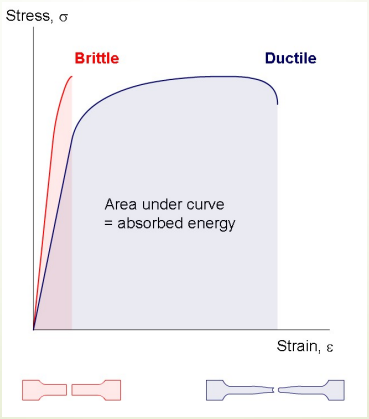
Robustness (Ductile)

Brittle ⟷ Flexible



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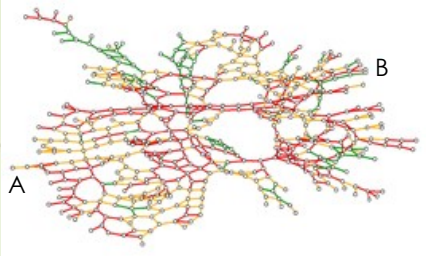
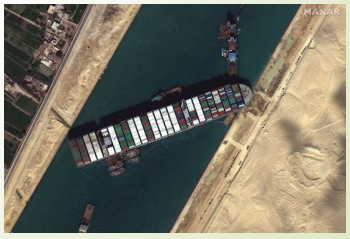
Redundancy



Traffic Network with Redundancy



Maritime Network with Choke Point

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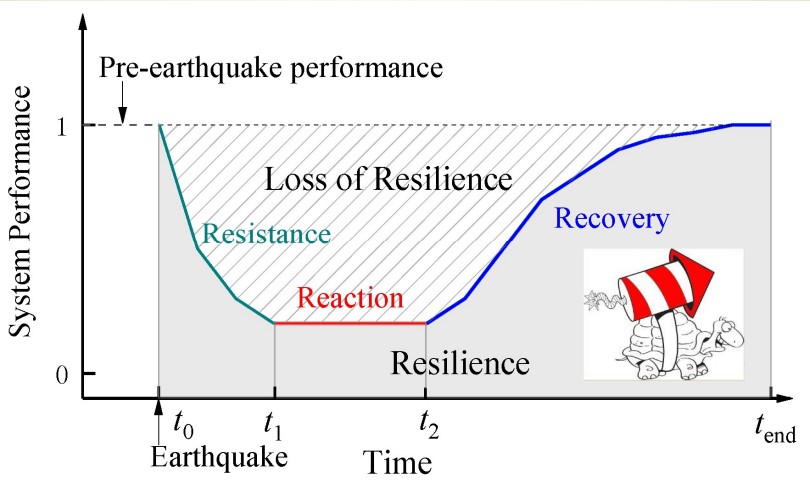
Redundancy

Cell Phone Network (non-functional)

Ham Radio Communication (functional)

Rapidity



- ***What can <u>SOCIETY</u> DUE TO slow climate change?***

Protect and Restore Ecosystems

https://aida-americas.org/en/blog/5-ways-our-governments-can-confront-climate-change

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- ***What can <u>SOCIETY</u> DUE TO slow climate change?***

Support Small Agricultural Producers

https://aida-americas.org/en/blog/5-ways-our-governments-can-confront-climate-change

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- ***What can <u>SOCIETY</u> DUE TO slow climate change?***

Promote Green Energy

https://aida-americas.org/en/blog/5-ways-our-governments-can-confront-climate-change

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- ***What can <u>SOCIETY</u> DUE TO slow climate change?***

Combat Shot-lived Climate Pollutants

https://aida-americas.org/en/blog/5-ways-our-governments-can-confront-climate-change

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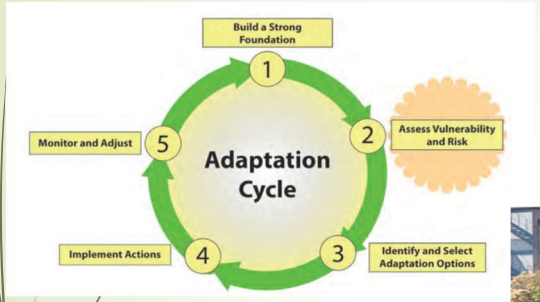
- ***What can <u>SOCIETY</u> DUE TO slow climate change?***



https://portals.iucn.org/library/sites/library/files/documents/PAG-024.pdf

BET ON ADAPTATION, NOT JUST MITIGATION

https://aida-americas.org/en/blog/5-ways-our-governments-can-confront-climate-change

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- ***What can I do as an INDIVIDUAL to slow climate change?***

1. Speak up!
2. Power your home with renewable energy.
3. Weatherize, weatherize, weatherize.
4. Invest in energy-efficient appliances.
5. Reduce water waste.
6. Actually eat the food you buy—and make less of it meat.
7. Buy better bulbs.
8. Pull the plug(s).
9. Drive a fuel-efficient vehicle.
10. Maintain your ride.
11. Rethink planes, trains, and automobiles.
12. Shrink your carbon profile.

https://www.nrdc.org/stories/how-you-can-stop-global-warming

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Thank You!!

https://www.civil.utah.edu/

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