Sustainable and Climate Change Resilient Remediation is the Future of Contaminated Site Management

28 March 2023

Conference on Innovations in Climate Resilience

Columbus, Ohio

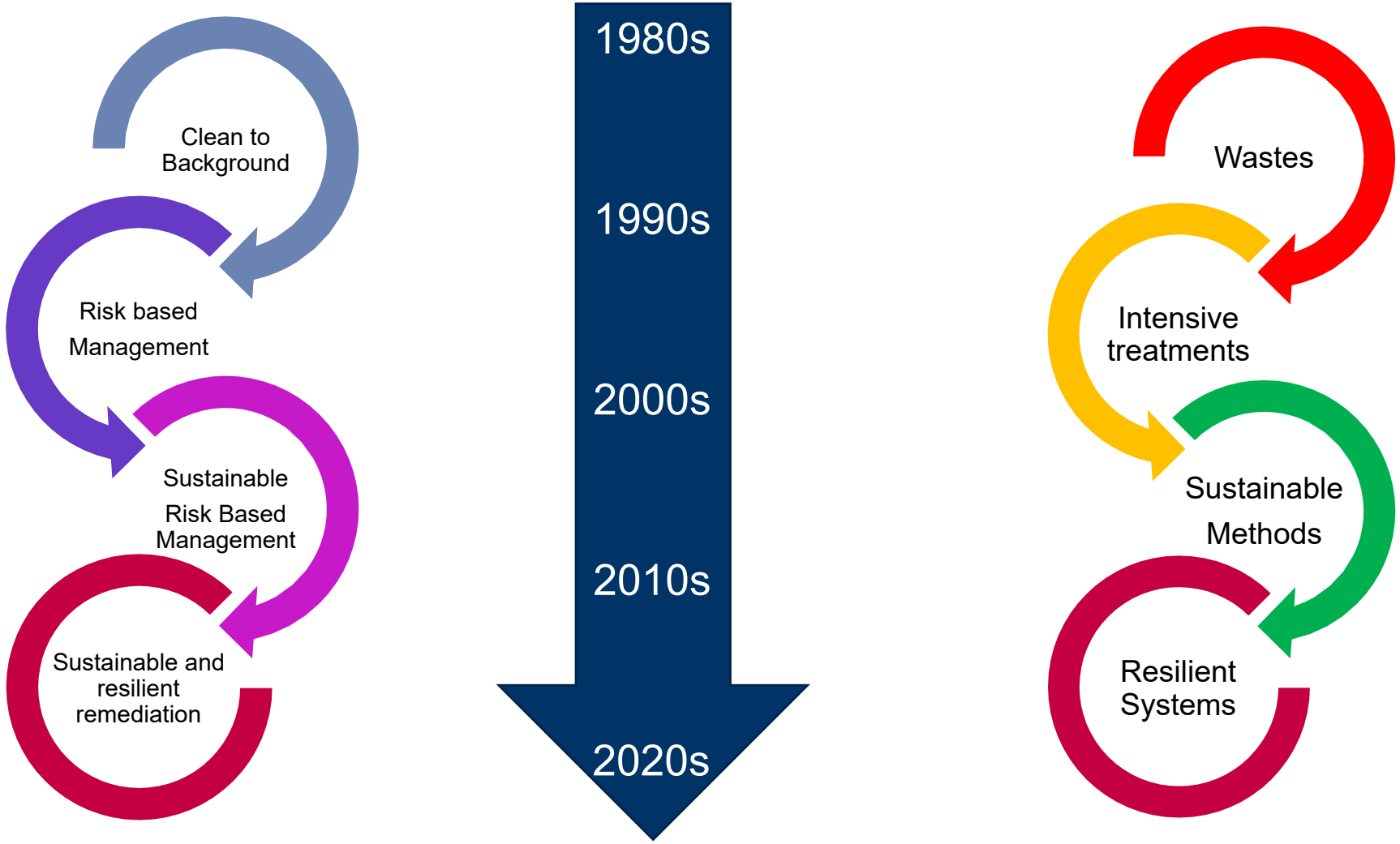
The business of sustainability

ERM

Agenda


Introduction – Sustainable and Resilient Remediation
Decarbonization
Remediation Resiliency
Practical Application

Remediation – evolution of policy and practice

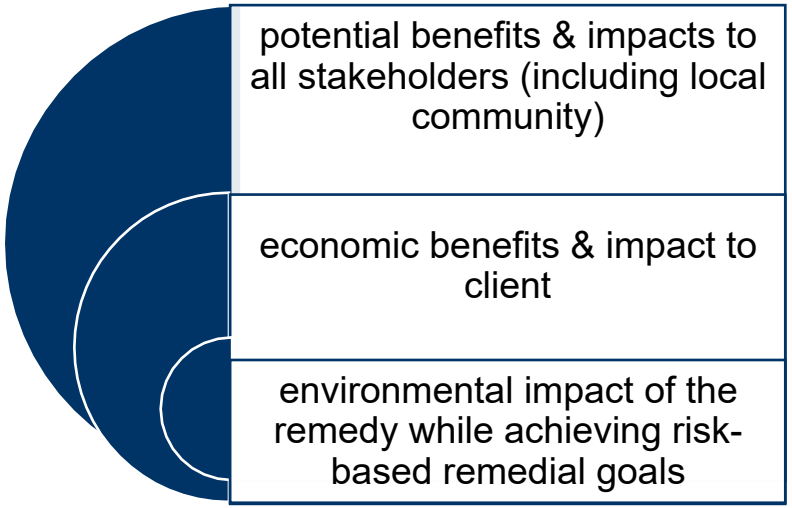


Sustainable Risk Based Land Management

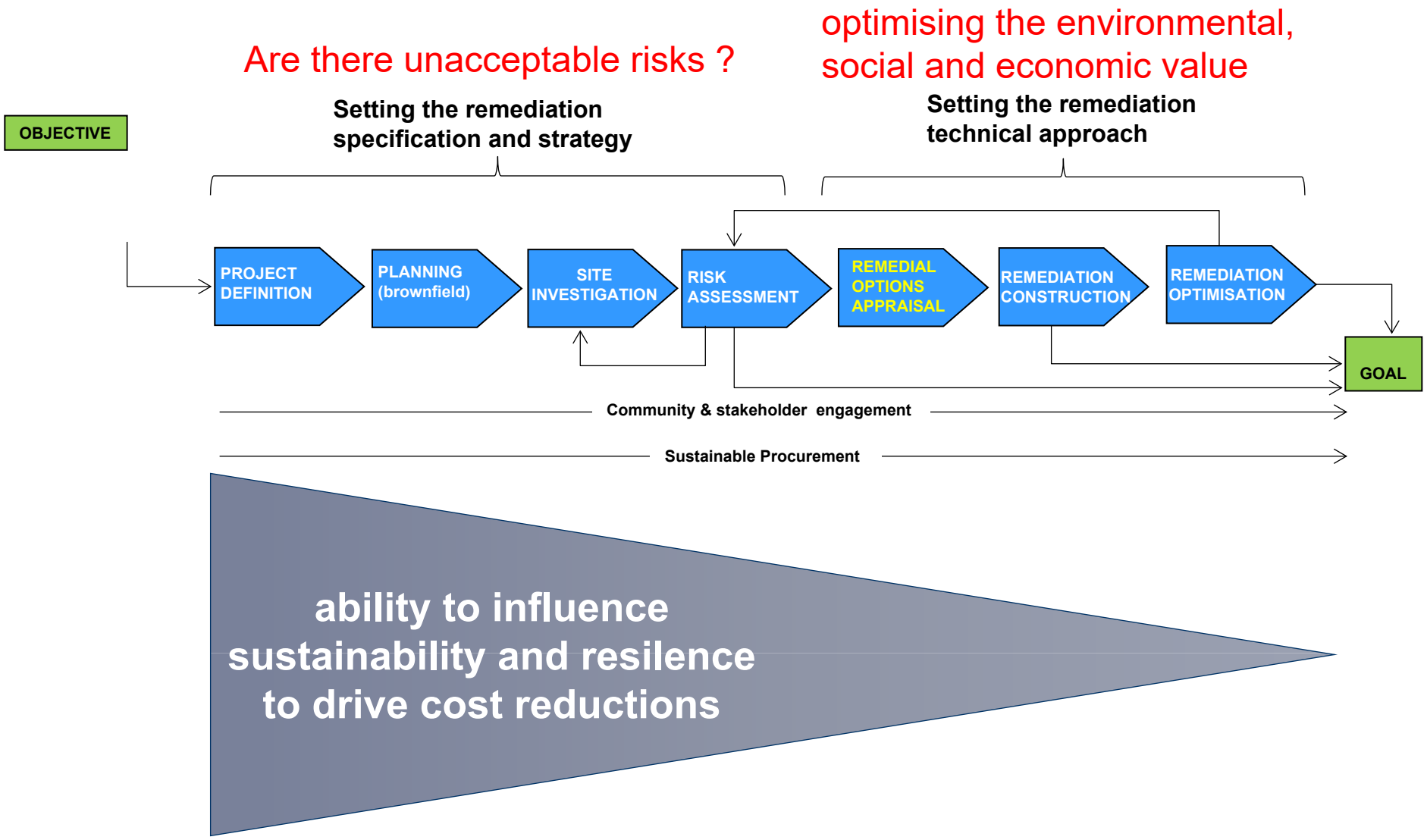
We still need to mitigate the risks but there is increasing recognition of bigger picture

Remediation itself can have costs & benefits

Recognise and maximise the overall environmental, social and economic benefits and minimise impacts



Sustainability and Resilience at Site Specific Level



Tiered approach to Sustainable and Resilient Remediation

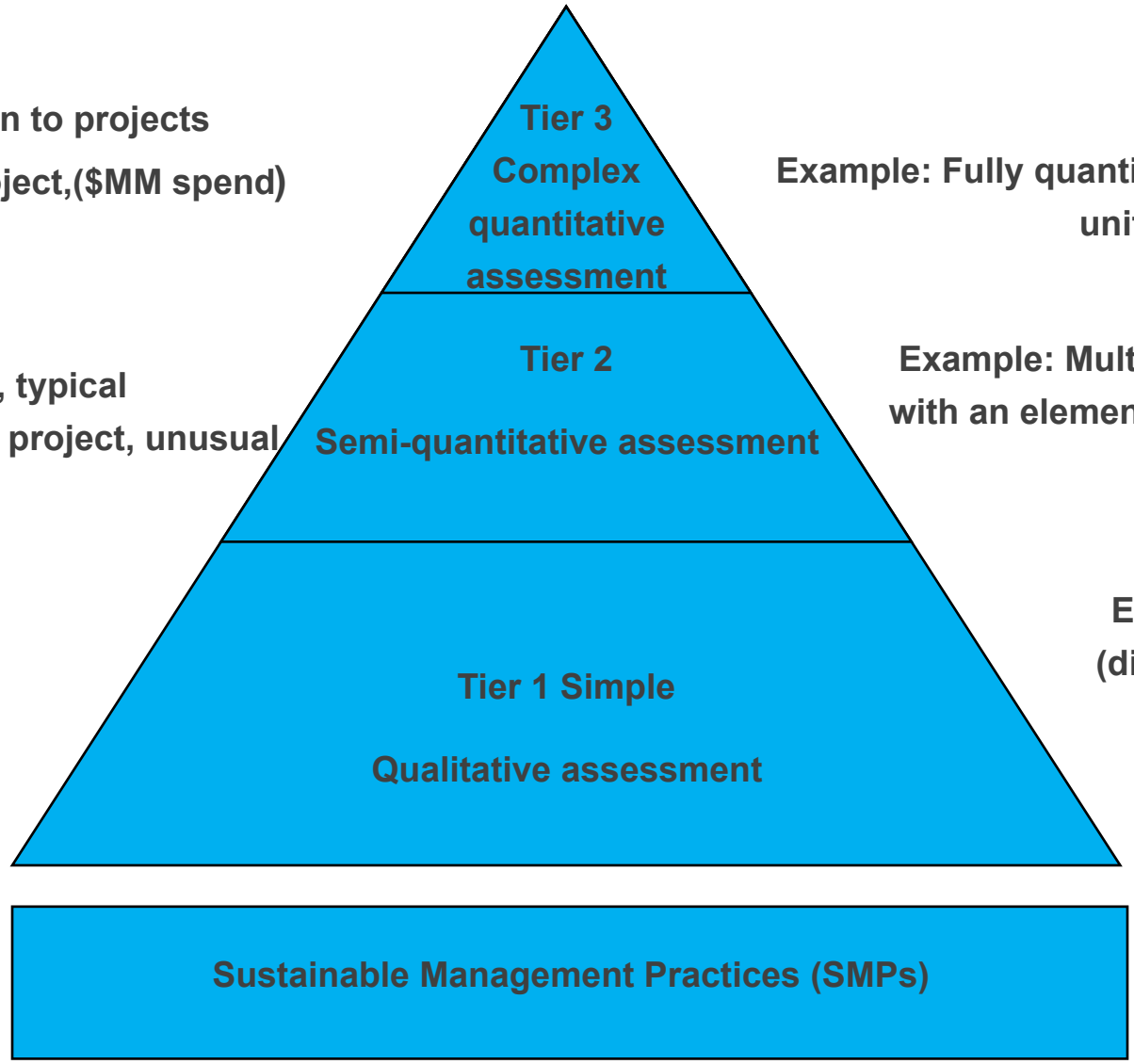
Possible **application to projects**

Complex, large project,($MM spend)

Complex retail site, typical manufacturing site project, unusual site setting

Typical retail site project

Theoretically all projects



Example: Fully quantitative with unified units (e.g., monetary)

Example: Multi-Criteria Analysis with an element of quantification

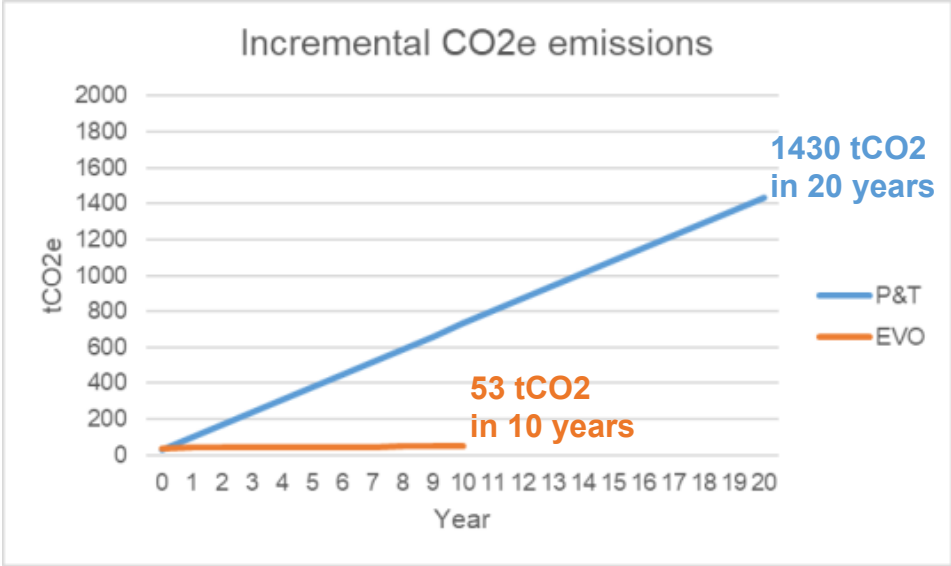
Example: Qualitative (discussion or simple spreadsheet)

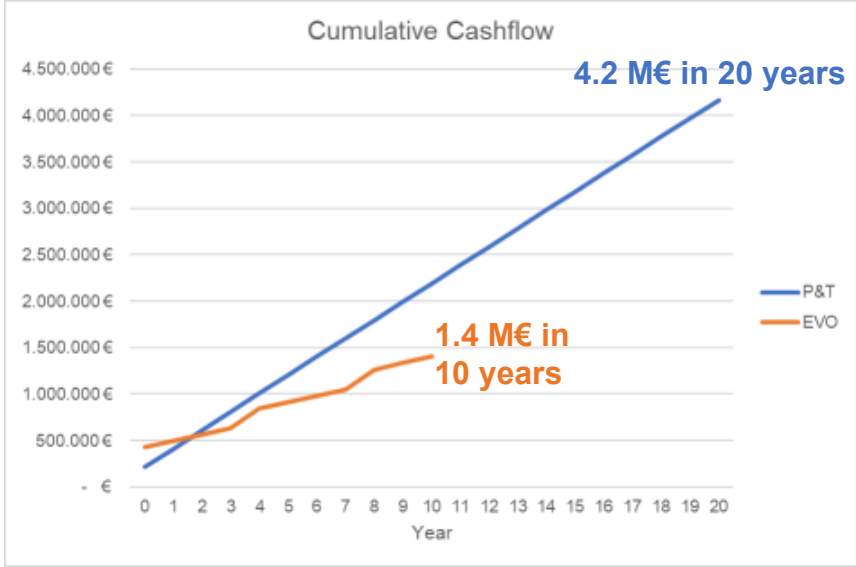
Example: Select from checklist

Decarbonization

Carbon Footprint and Cost Evaluation – P&T vs ISBR

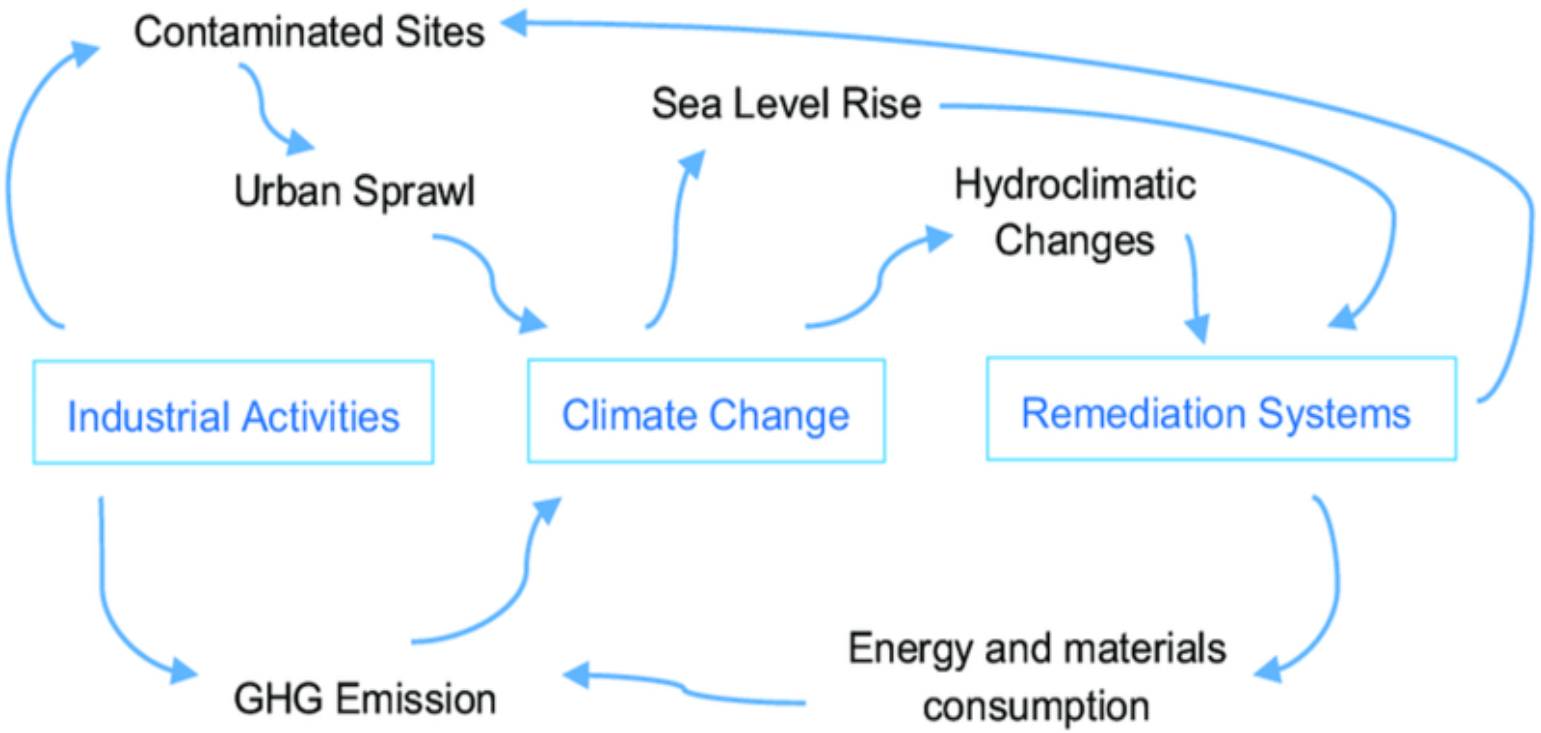
- The installation activities of EVO and Pump & Treat similar Carbon Footprint – between 30 and 40 tons CO2e
- The average yearly O&M CF of the current in situ bioremediation approach is 2,1 tCO2e/year, i.e. 33 times lower than Pump & Treat yearly O&M
- Source area bio reduces the total lifespan of the plume management activities from 20 years for Pump & Treat to 10 years for in situ bio.
- The total CF of in situ bio lifetime (53 tCO2e) is exceeded by Pump & Treat in less than 1 year of operation
- Total Pump & Treat installation and operation CF (over 20 years) >1400 tons CO2e, more than 25 times that of bioremediation option (~10 years)



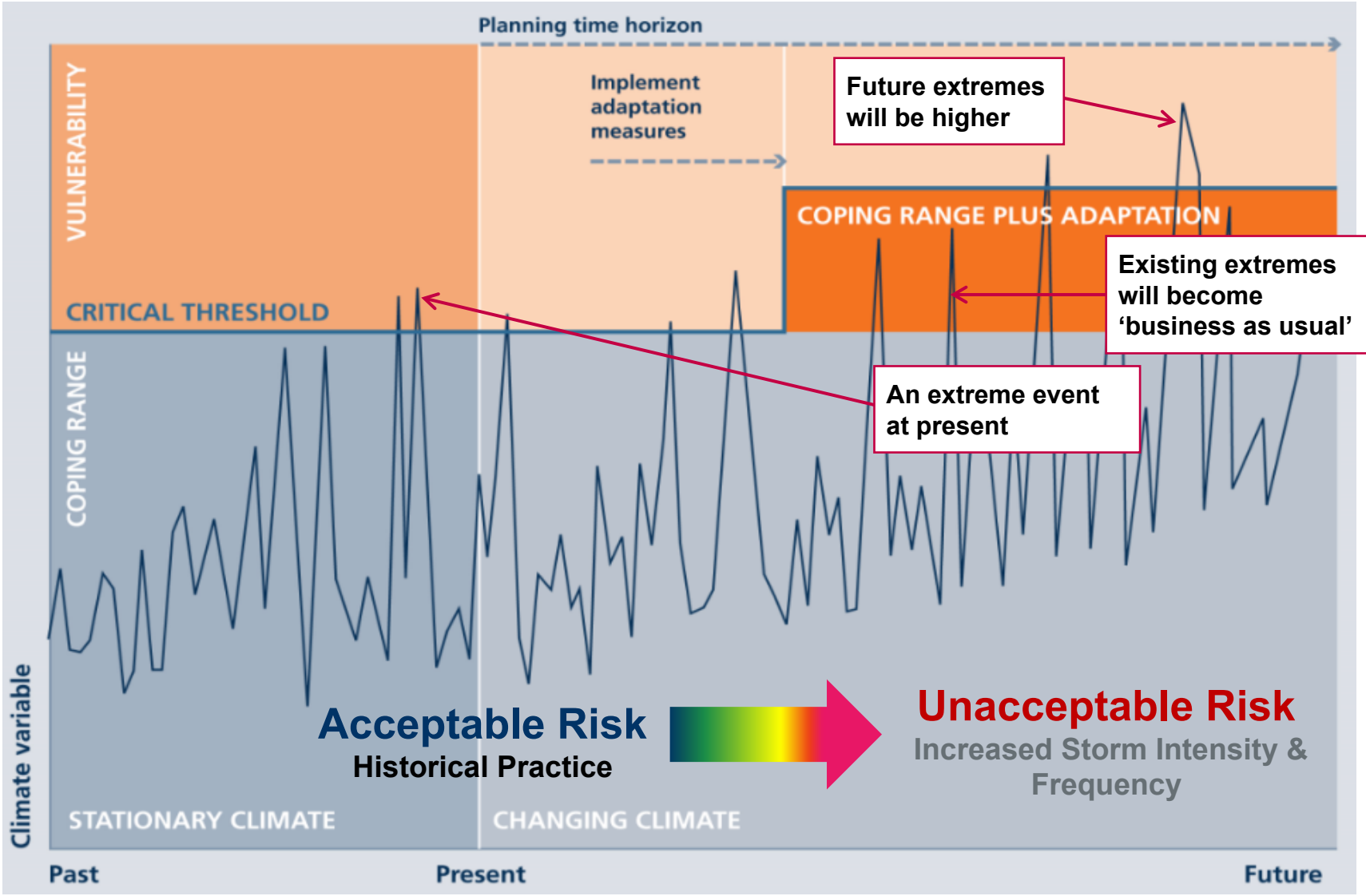


Remediation Resiliency to Climate Change

Climate Change and Remediation Feedback Loop

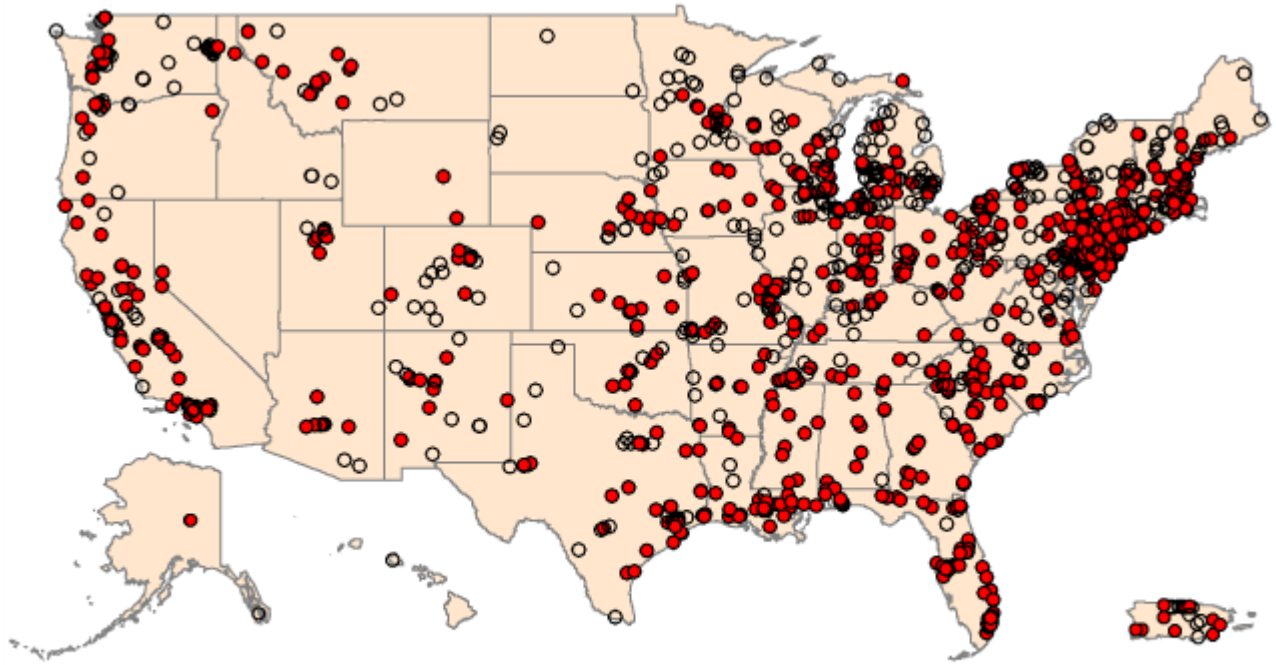


Critical Threshold – Coping with Climate Change



Remediation Resiliency to Climate Change?

- Following the 2017 extreme hurricane season EPA OLEMs' Office of Superfund Remediation and Technology Innovation (OSRTI), in collaboration with EPA Regions 2, 4, 6 created report on Remedy Resilience at Superfund NPL and SAA Sites: Analysis of 2017 Hurricane Season
- October 2019 US Government Accountability Office (GAO) writes - Superfund EPA Should Take Additional Actions to Manage Risks from Climate Change
- January 2021; Executive order 14008 - Executive Order on Tackling the Climate Crisis at Home and Abroad



Sources: GAO analysis of Environmental Protection Agency, Federal Emergency Management Agency, National Oceanic and Atmospheric Administration, and U.S. Forest Service data; MapInfo (map). | GAO-20-73

Hurricane Florence (2018): 1000-year Event

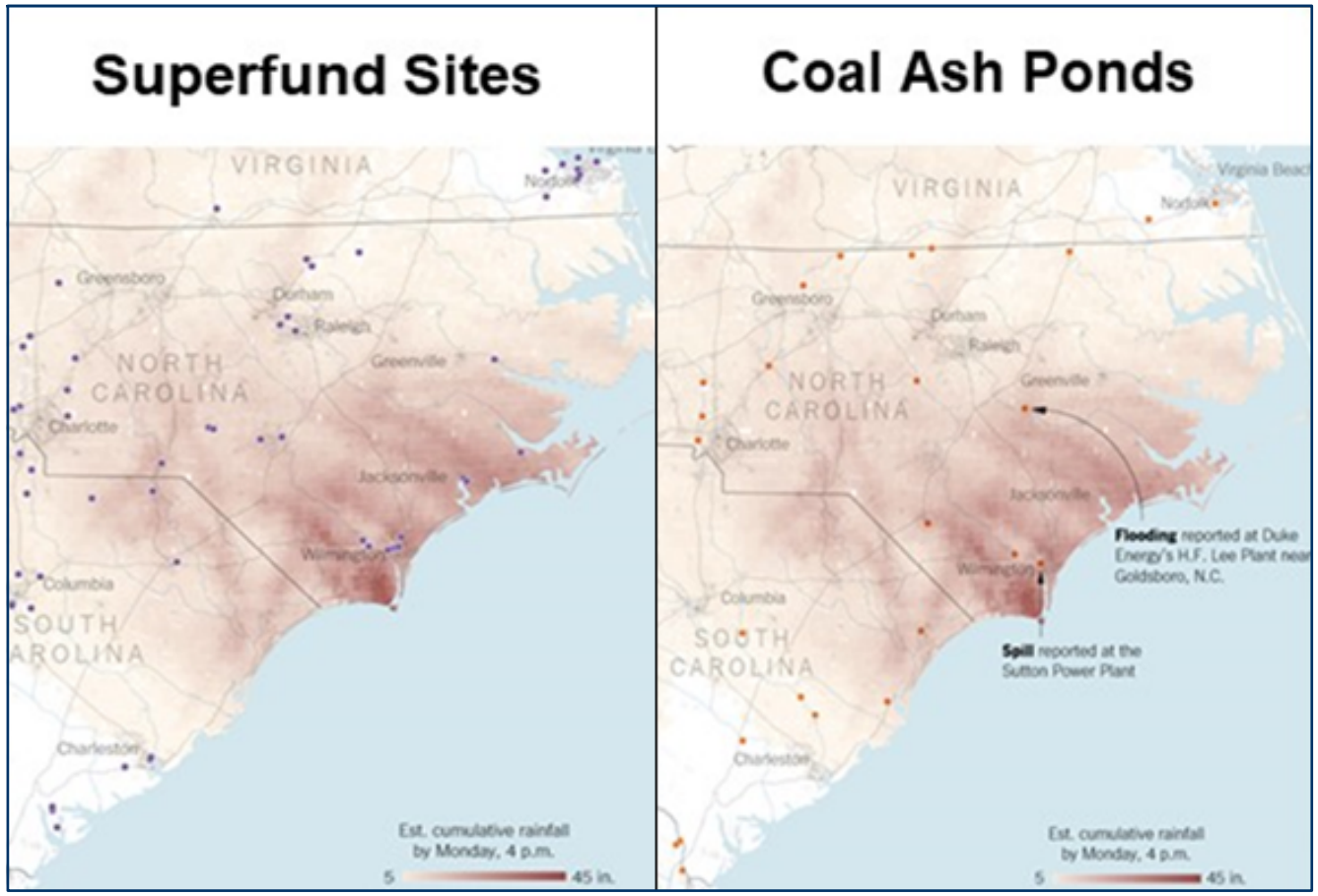
Pacific Standard

NEWS IN BRIEF ECONOMICS EDUCATION ENVIRONMENT SOCIAL JUSTICE FEATURES

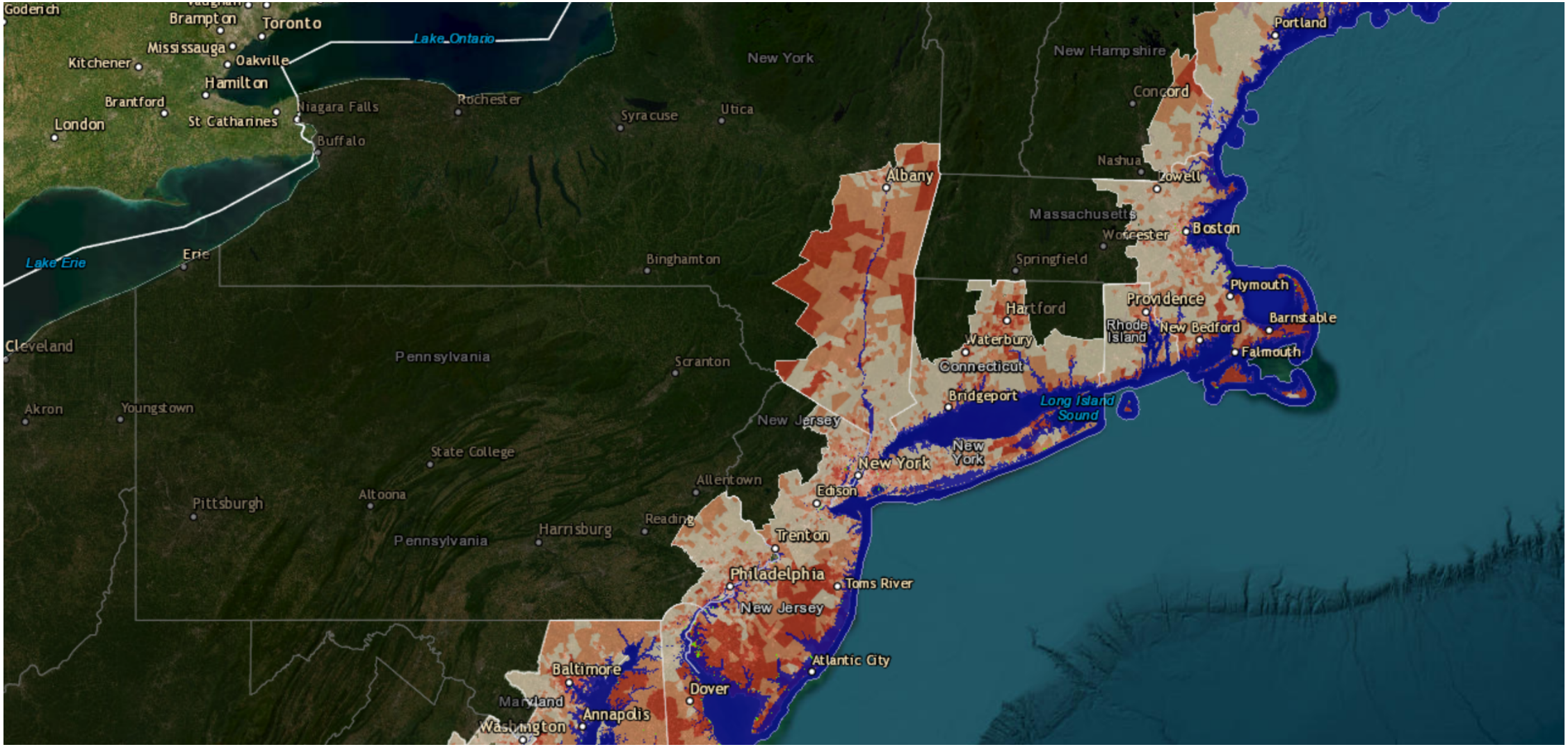
HURRICANE FLORENCE HAS ALREADY FLOODED PITS OF TOXIC WASTE IN NORTH CAROLINA

ENVIRONMENT

Still awaiting a proper cleanup, Superfund sites in eastern NC at risk from Hurricane Dorian



SLR Vulnerability – NOAA SLR Viewer



[Sea Level Rise Viewer (noaa.gov)]

Demo Client

Screening Level Physical Climate Change Risk Assessment

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Filters

Country
All

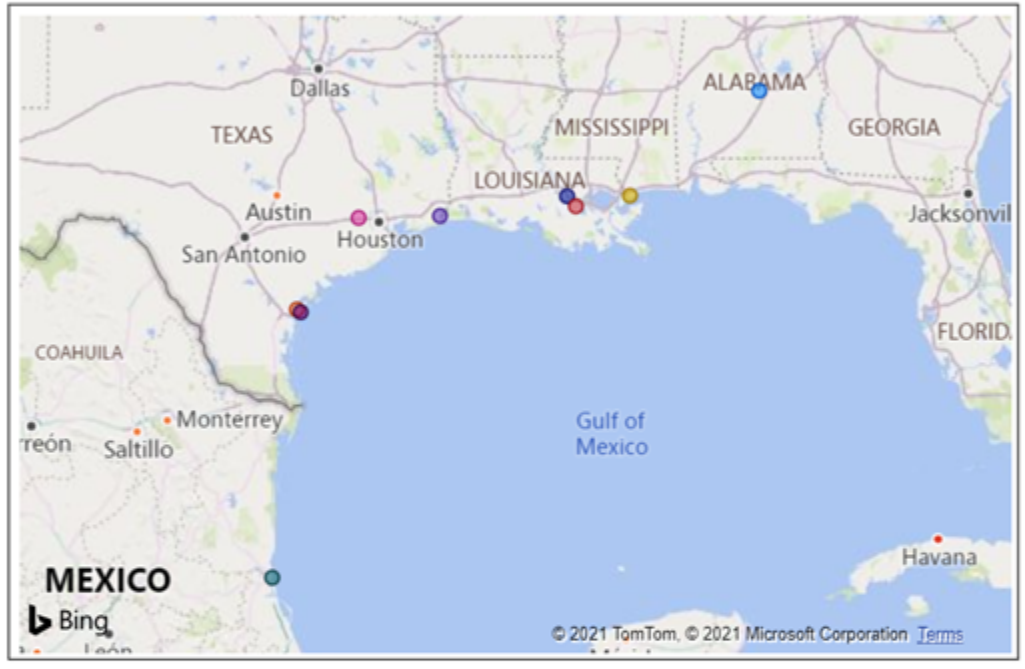
Location Type
Inland

Natural Hazard
- Select all
- Water Stress
- Riverine Flood
- Drought
- Cyclone
- Sea Level Rise
- Storm Surge
- Extreme Heat
- Landslides
- Coastal Flood

Climate Scenario
- RCP 4.5
- RCP 8.5

Time Frame
- Baseline
- 2030
- 2050
- 2080

Hazard Summary



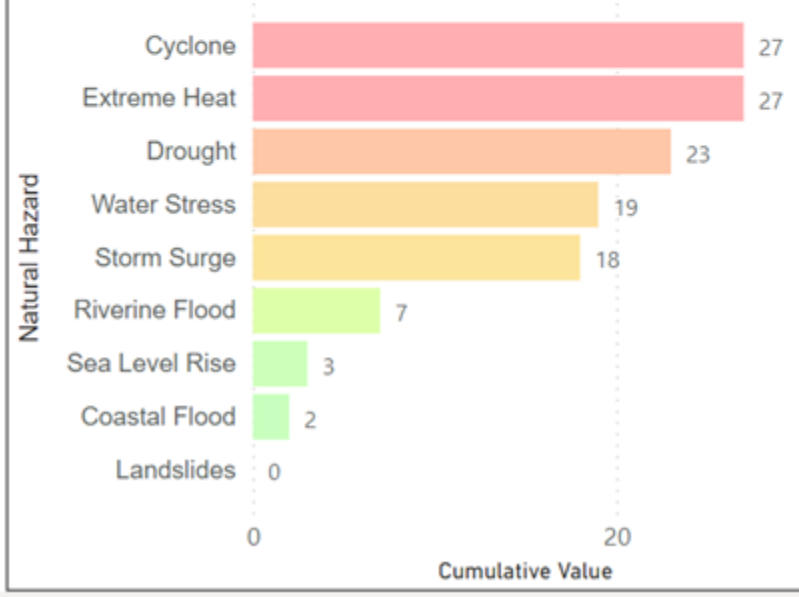
Natural Hazard	Coastal Flood	Cyclone	Drought	Extreme Heat	Landslides	F
Asset	2030	2030	2030	2030	2030	
Burkville_AL	None	High	Medium	High	None	N
Geismar_LA	None	High	Medium	High	None	L
Gregory_TX	None	High	High	High	None	N
Ingleside_TX	None	High	High	High	None	N
Katy_TX	None	High	High	High	None	N
Port-Arthur_TX	Low	High	High	High	None	L

Vulnerability Assessment

Asset Ranking

Climate Scenario	RCP 8.5
Asset	2030
Port-Arthur_TX	17
Tampico	17
Port-Bienville_MS	15
Ingleside_TX	14
St-James-Parish_LA	14

Hazard Ranking



Practical Application

Nature Based Solutions – Constructed Treatment Wetlands

Constructed pond/wetland closed-loop recirculation system during installation

Constructed pond/wetland closed-loop recirculation system 1 year after installation

Images on left show before and after installation of constructed pond/wetland with closed loop recirculation (zero discharge) to treat perchlorate and nitroaromatics in surface water runoff and shallow groundwater in Arkansas.

- 1 to 3m deep, ~ 11,000 cubic meters
- Float system pumps anoxic TOC rich water back to infiltration trench
- Successfully capturing impacted surface water
- Providing treatment of shallow impacted groundwater

Images on the right show free water surface (FWS) and subsurface flow (SSF) wetland field pilot testing to treat waste discharge from a pharmaceutical landfill in Japan

Long-term, nature based, low cost treatment that is considered a sustainable management practice (SMP) designed to be resilient to extreme weather events.

FWS Dynamic Reactor

SSF Dynamic Reactor

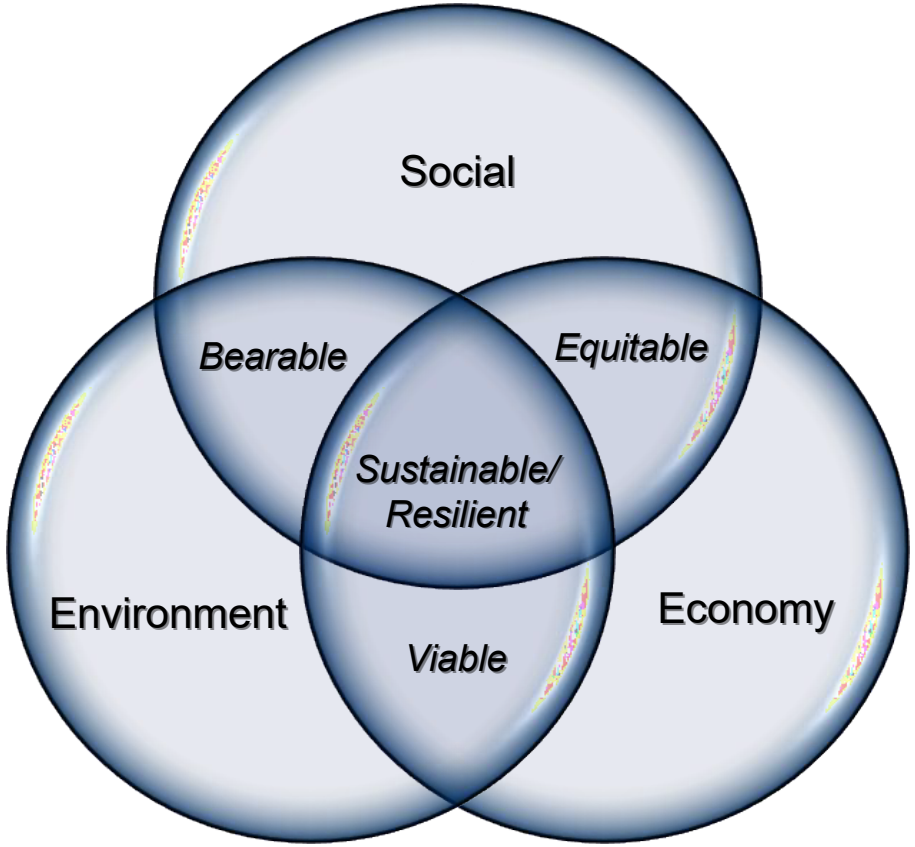
Sustainable and Resilient Remediation in Practice

Sample Remediation SBMPs

Implement a plan to evaluate sustainability criteria/indicators for each project
Include an assessment of sustainability and resiliency to climate change during remedy selection
Discuss ways to maximise positive benefits to local communities/stakeholders with client
Evaluate carbon footprint for major activities and implement a CO2 emissions reduction plan
Implement a sustainable procurement plan for each project/site when applicable
Optimise the efficiency of remediation systems to meet the environmental, social and economic objectives for projects
Promote circular economy - Reduce, reuse and recycle where possible. Plan activities to reduce waste and push concepts down to subcontractors/suppliers.
Consider how climate change extreme weather events may affect the efficacy (resiliency) of your remediation strategy to meet long-term performance objectives

Site specific implementation – Lessons Learned

- Need a clear understanding of project boundaries/constraints – time/regulatory framework etc.
- Biggest opportunity to develop a sustainable and resilient outcome can be at planning stage – considering future land use and remedy selection
- A robust CSM and QRA are fundamental to a sustainable solution
- Incorporate Sustainability and Resilience at a level equal to complexity and possible benefits
- Dashboards can provide engagement tool and provides transparency in decision making – can help with reporting, regulatory and stakeholder engagement



Summary

- Sustainable and resilient remediation continues to evolve and now includes climate change considerations
- SRR applicable to single projects and whole portfolios
- Alignment of SRR with broader corporate sustainability goals is likely to increase as industry incorporates SDGs, ESG and climate change considerations and policies flow down
- Potentially significant cost savings while meeting remedial goals as well as SDGs, ESGs and reduced CC risk
- The recent extreme weather related events highlight the importance of incorporating resilience into remedy selection and implementation
- Our experience has identified that the more complex the remedial strategy the less sustainable and less resilient

Thank you

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