

NSDPI SUMMER RESEARCH · LITERATURE REVIEW

Natural Objects and Environmental Processes as Defense Infrastructure

A literature review on the historical use of nature for national security and the ecological initiatives of the People's Republic of China.

Brooke Livergood · Jane McGuiggin · Maeve Myers · Peter Sullivan



INTRODUCTION

Global Threat to Defense Infrastructure

YANGTZE BASIN, CHINA



PLA DISASTER RESPONSE

CAMP ARIFJAN, KUWAIT



USA FLOOD RESPONSE

INTRODUCTION

Global Threat to Defense Infrastructure

TIN CITY, ALASKA



LONG RANGE RADAR SITE

TISKI, RUSSIA



AIRFIELD RUNWAY

INTRODUCTION

Nature's Impact on U.S. National Security Infrastructure

~5,000

installations managed by the U.S. Department of War

33%

Installations located in regions experiencing or threatened by sea level rise

\$15B+

spent by the DoW to address climate threats and extreme weather

A global concern. Around the world, defense establishments increasingly treat natural systems as security infrastructure to be protected, weaponized, and rebuilt.

Lessons Learned from the Literature

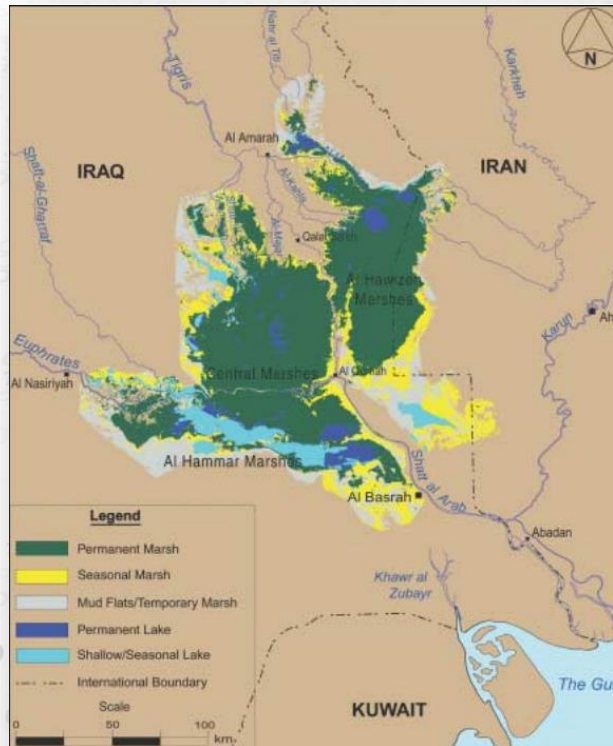
01 Infrastructure built for ecological and environmental purposes often carry latent defense value – and vice versa.

02 Long-term ecological infrastructure consistently relies on adaptive management

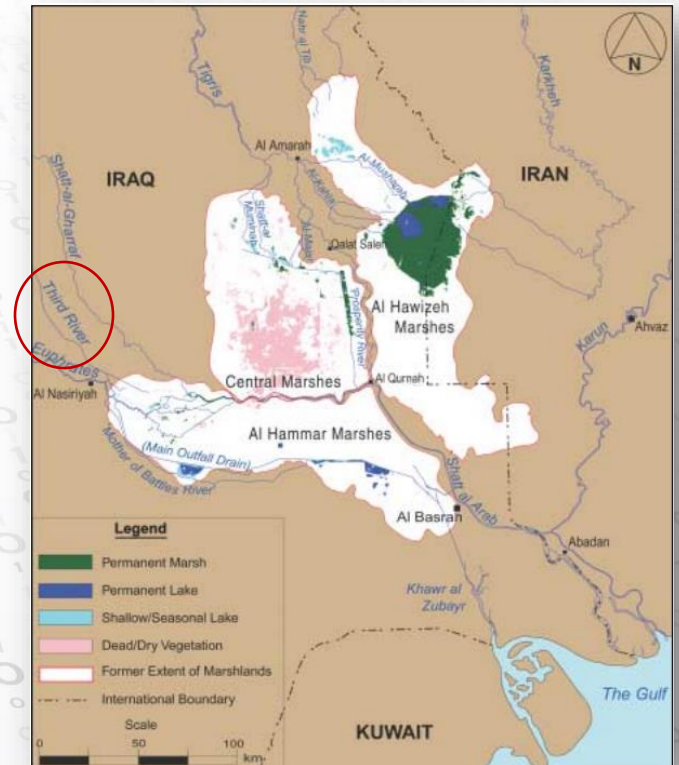
03 Military use of natural landscapes often disregards long-term ecological and environmental consequences

Draining of the Mesopotamian Marshlands

- Covers up to 20,000 square kilometers and is home to approximately 400,000 people.
- Drainage took place from 1991 to 1993.
- Third River Project.
- 172 km Channel diverts water from Marshlands.
- 85% of Marshlands lost by the year 2000.



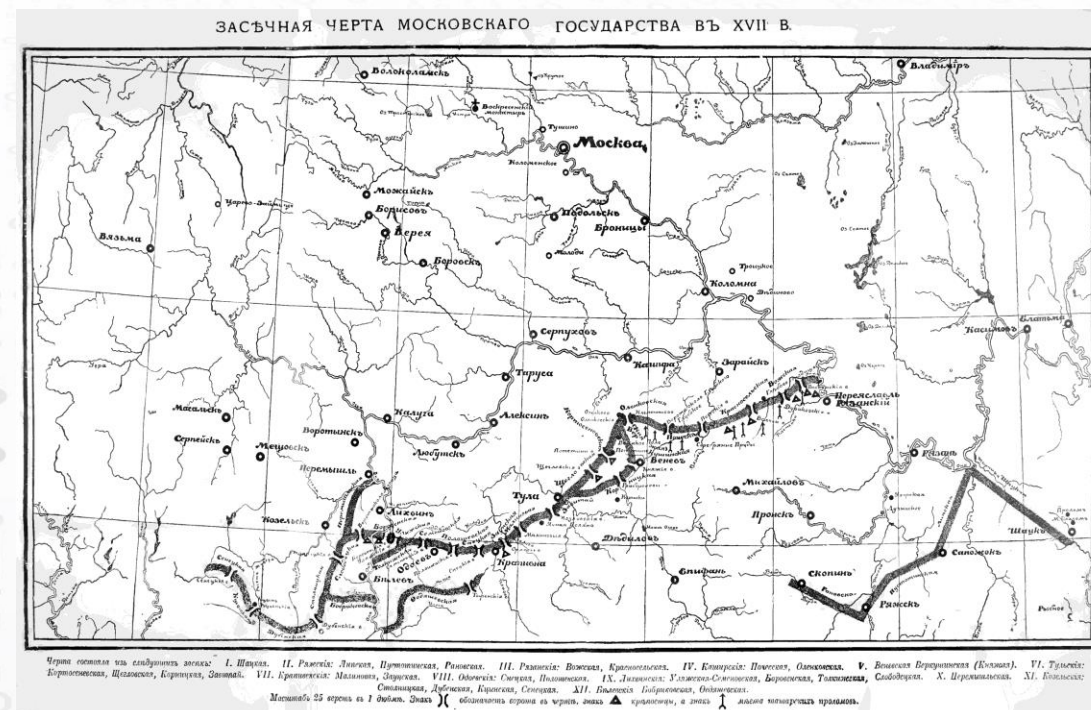
Mesopotamian Marshlands: Land Cover 1973-76



Mesopotamian Marshlands: Land Cover 2000

The Great Abatis Border of Russia

- Initially, a natural defense system formed by fallen trees to defend from Crimean Tartars.
- In the 16th century, Russia deliberately felled and arranged these trees as an abatis
- The line was maintained and modernized over generations to match updated technology.
- Russia adapted to adversaries' strengths and expanded on the natural landscapes



Засечная черта — the Great Abatis Line of the Muscovite state

Inundations in the Battle of Irpin River

- Ukrainian engineers used computer programs to visualize the impact of the flooding to minimize flood risk.
- Flooding in the Irpin River reached 1 km in width.
- Analysis of waterlines on trees suggests that water levels rose by 3 meters.



Framework from the Literature

01 Infrastructure built for ecological and environmental purposes often carry latent defense value – and vice versa.

02 Long-term ecological infrastructure consistently relies on adaptive management.

03 Military use of natural landscapes often disregards long-term ecological and environmental consequences.

Chinese modification of natural landscapes provides valuable insight – and fundamentally underscores its relevance for national security.

Resilient Coastlines- Fujian Province

- Effective, cost efficient, self-repairing
- Gains in water quality
- Increasing openness across CCP to natural infrastructure



Artificial Islands in the South China Sea

MISCHIEF REEF



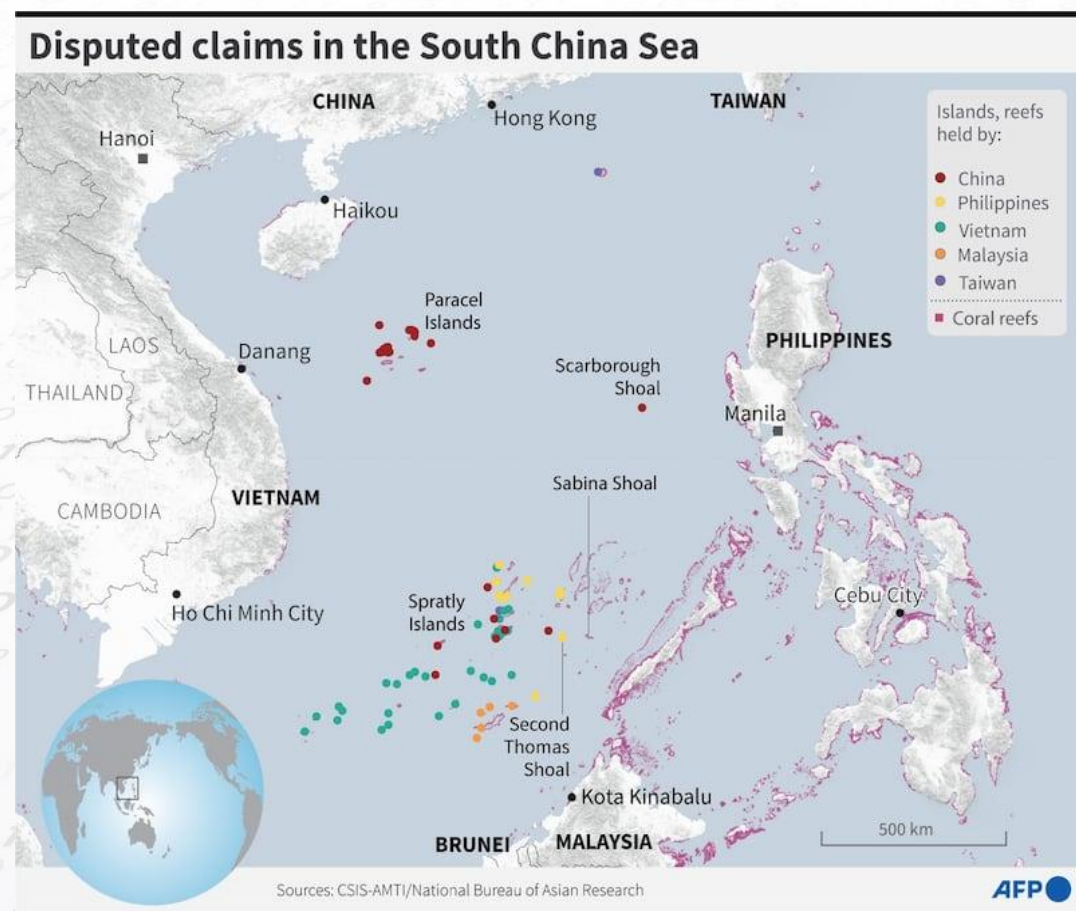
FIERY CROSS



SUBI REEF



Artificial Islands



- 3,200 acres of artificial land created by PRC.
- 7,000 acres of coral reefs have been destroyed since 2013.
- Outposts are at risk of flooding and environmental degradation.

Lessons Learned

China provides a valuable case study and insight into how a major power incorporates environmental initiatives into defense planning.

01 EVIDENCE

Scientific research supports the use of natural systems to enhance resilience, sustainability, and military effectiveness.

02 SIMILAR ENVIRONMENTAL VULNERABILITIES

Permafrost thawing, sea-level rise, coastal erosion, pollution, desertification.

03 POTENTIAL CONSEQUENCES

Balancing national security objectives with environmental stewardship requires proactive planning and long-term management.

Research Next Steps

- Examine how major global powers continue to fortify their naval bases — manmade versus natural — as awareness of environmental threats increases.
- What happens once we build this infrastructure? How can adversaries leverage our own infrastructure against us?
- What do adaptive management practices look like in the modern day?

THANK YOU

Brooke Livergood · Jane McGuiggin · Maeve Myers · Peter Sullivan
NSPC / NSDPI Summer Researchers — Summer 2026



APPENDIX

I

What's the Problem

Elaboration on the "So What?"

II

Environmental Threats

Pollution, scarcity, desertification, degradation, permafrost.

III

Initiatives

Five flagship programs across the PRC.

IV

Case Studies

Historical Uses of Natural Landscape for Defense

APPENDIX

What Problem Are We Trying to Solve?

01

What Problem Are We Addressing?

01 A blind spot at scale

The Department of Defense is not thinking about defense infrastructure in this way — at least, not at scale.

02 A direct contribution

This work feeds the actual purpose of the broader project.

03 A persuasive case

It helps researchers convince DoW practitioners that natural landscapes and architecture are a viable, historically grounded resilience option.

04 An efficient one

Natural processes and landscapes can be efficient and cost-effective.

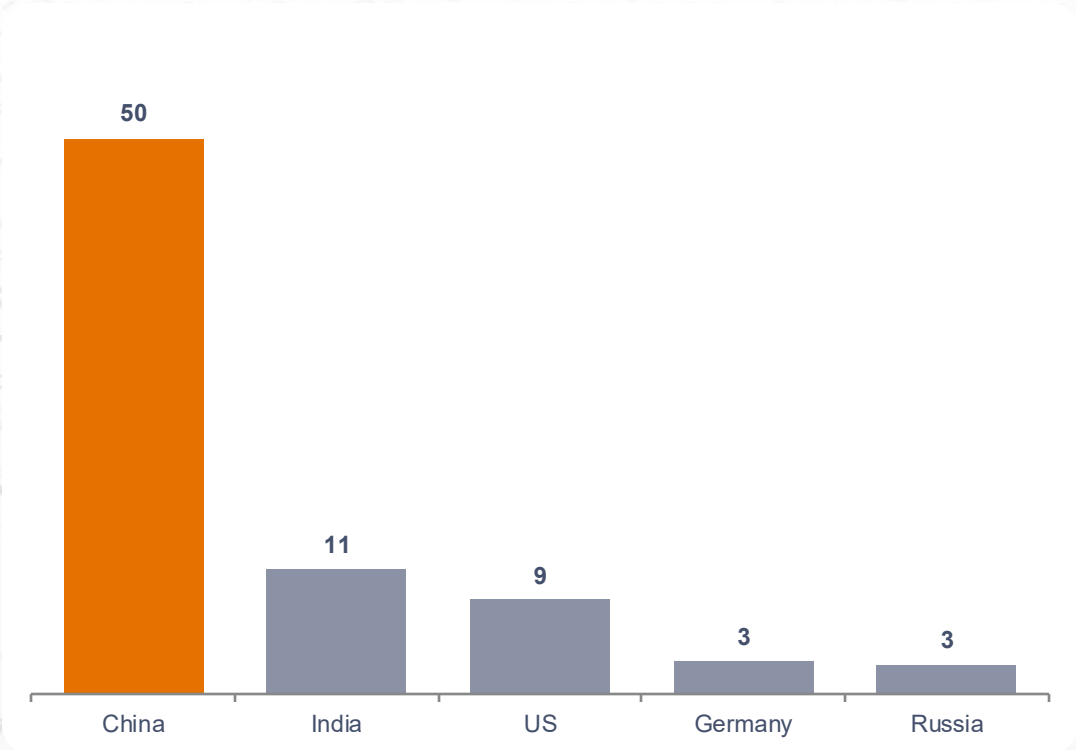
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Environmental Threats to China

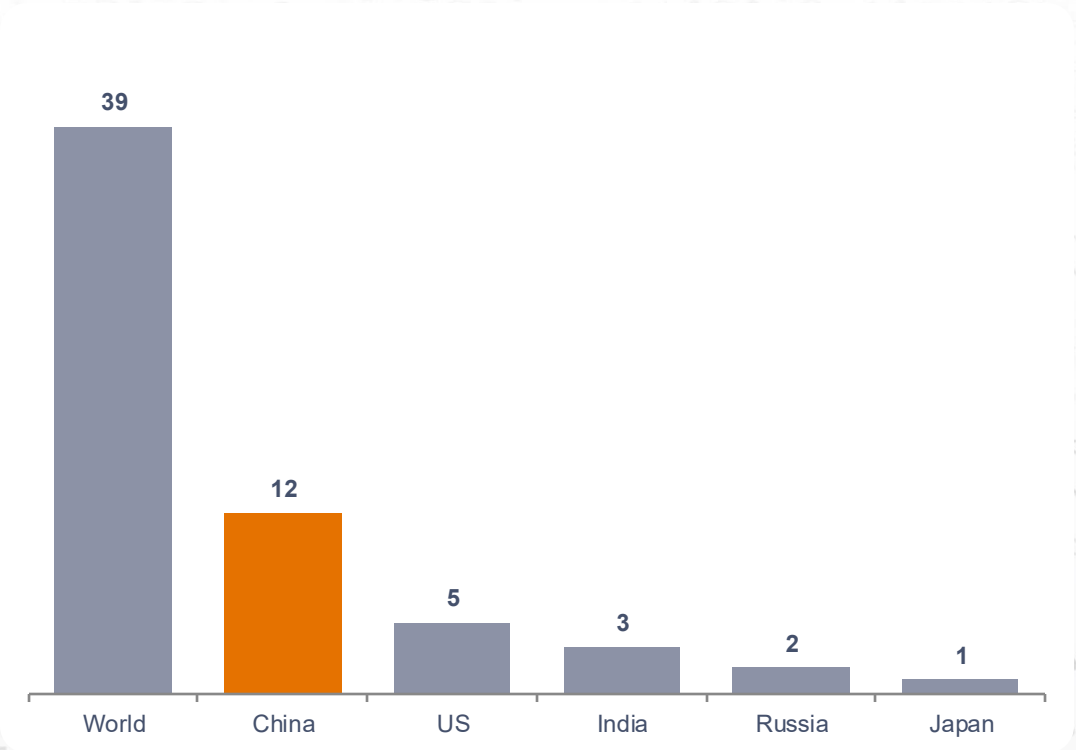
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Pollution

% of Global Coal Consumption



2024 CO₂ Emissions (billions of tons)



Pollution & Water Scarcity

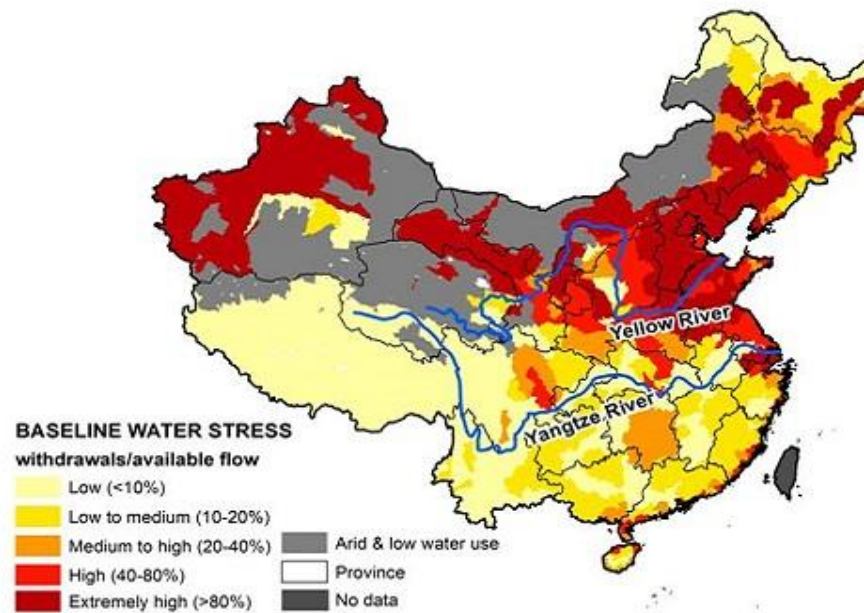
716 kilotons

of plastic were dumped into China's rivers in 2015.

280M+

people in China lack access to safe drinking water.

Freshwater Baseline Water Stress China 2010



Source: WRI

IPE Blue Map

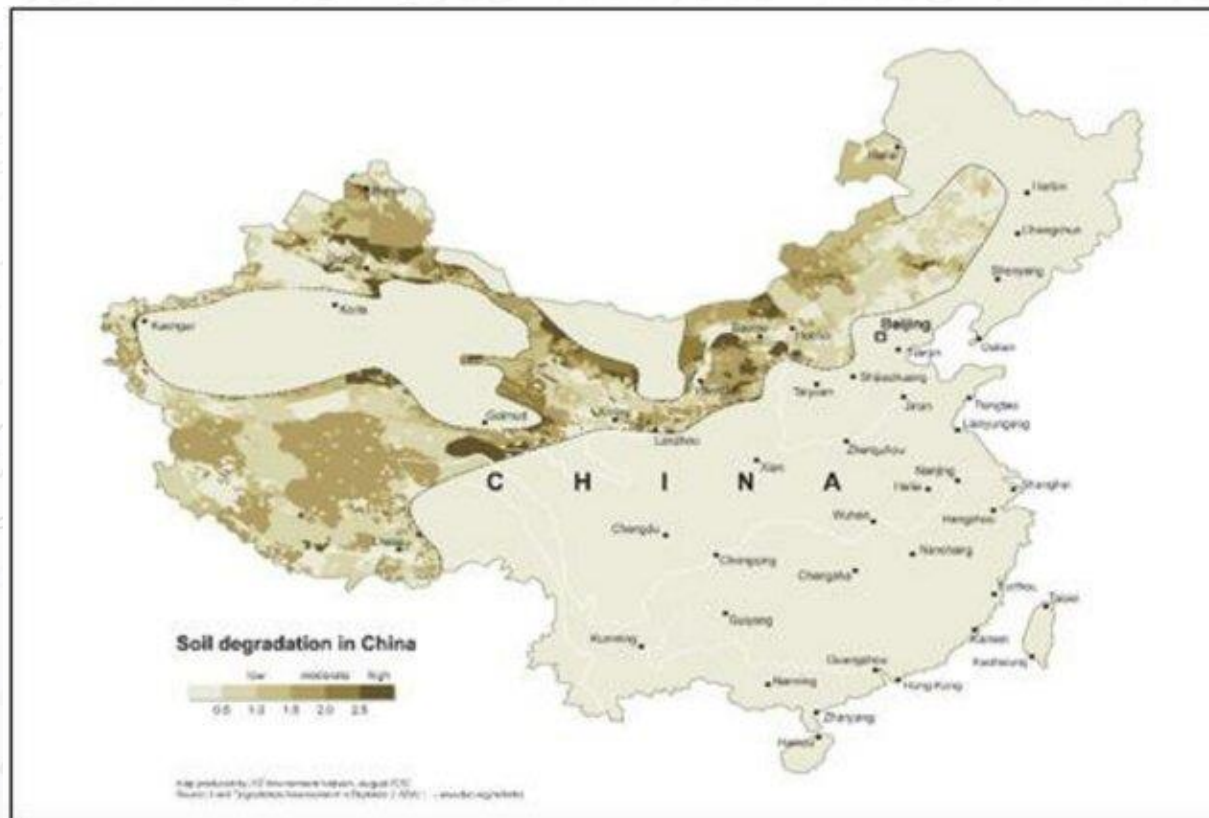
National Drinking Water Quality Map



Source: IPE report "Expansion of water quality monitoring and information disclosure - First release of national water quality map", 2019

Desertification

Raises concerns about food and water scarcity.



Coastal & Marine Degradation

126M

people living in flood-prone cities that produce 40% of national GDP

32

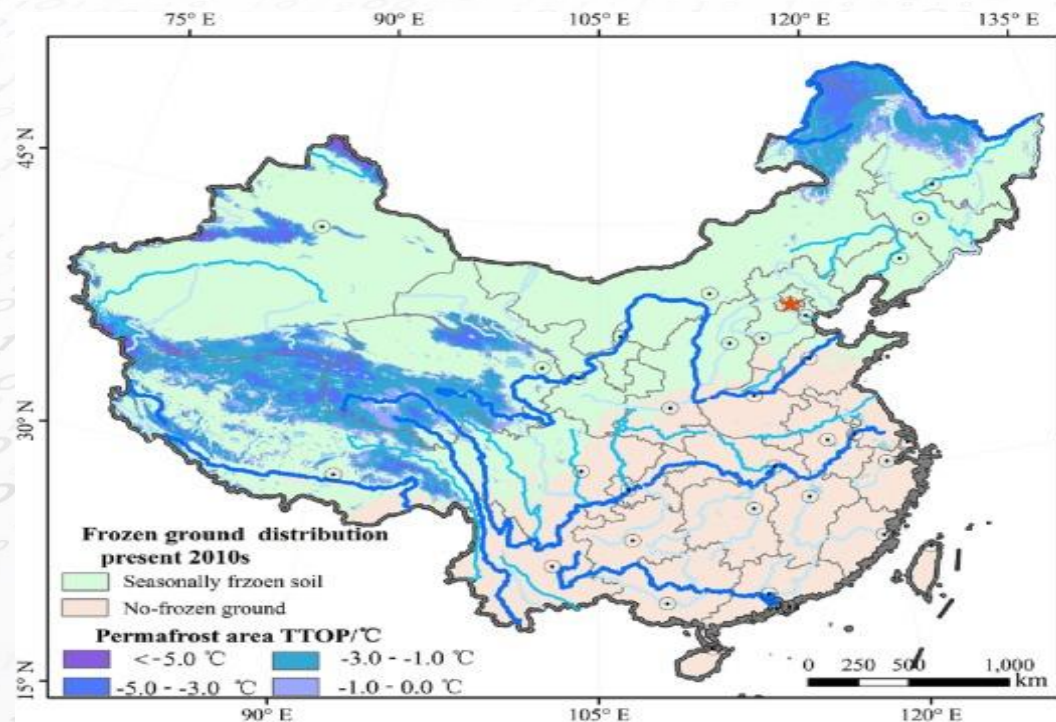
cities affected by land subsidence — Shanghai now sits in a concave shape

Mangrove loss

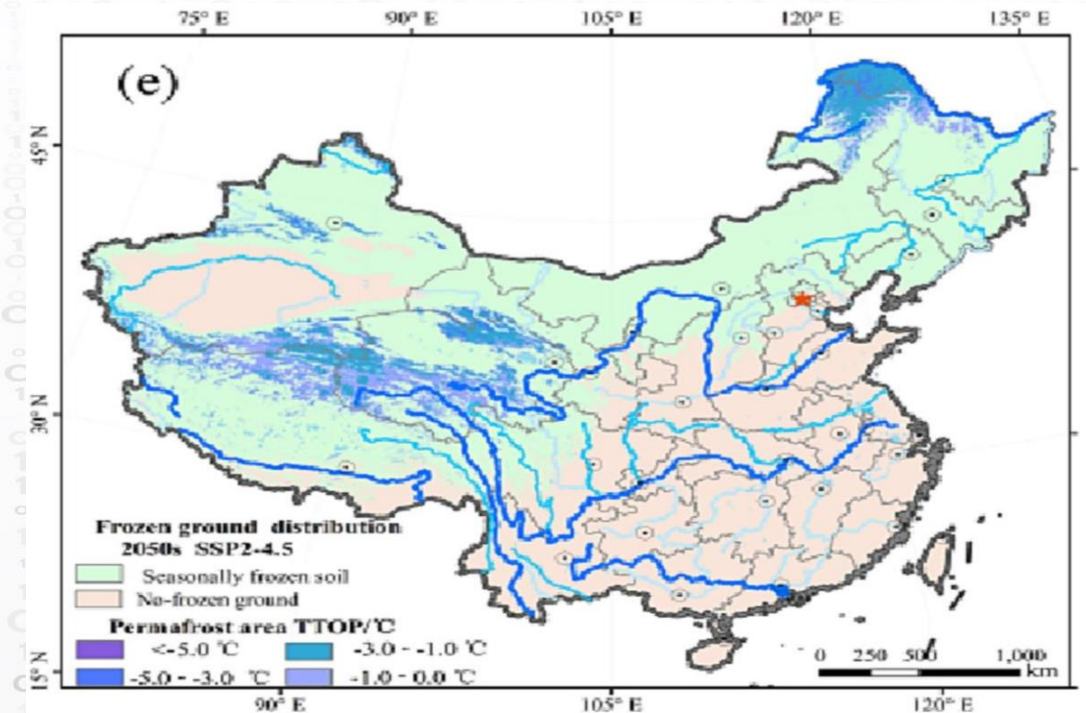
Continued loss of natural mangrove forest — even as China plans to plant more.

Permafrost

Frozen-ground distribution is projected to shrink markedly by mid-century.



Present (2010s)



Projected (2050s, SSP2-4.5)

APPENDIX

Chinese Initiatives

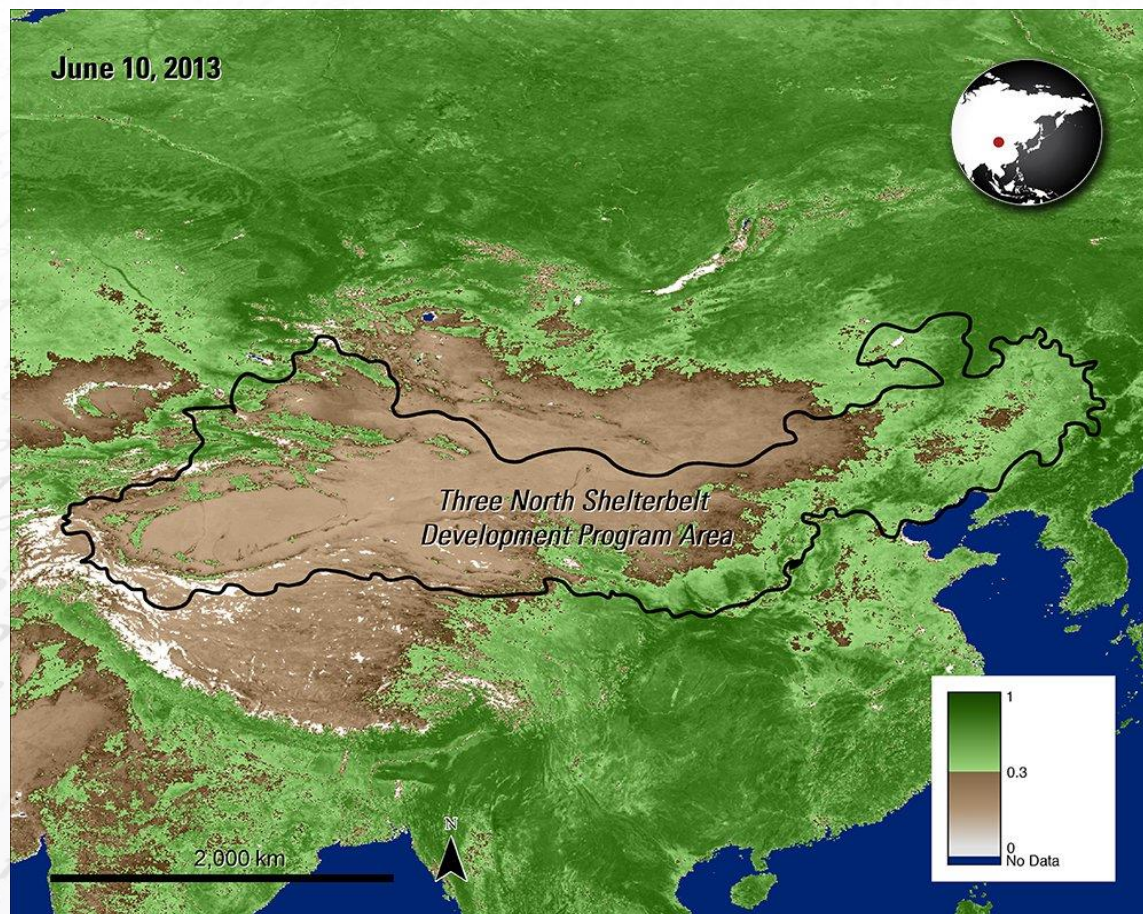
03

Five Flagship Programs

Where ecology, engineering, and national security converge across the PRC.

01	Great Green Wall 66B+ trees planted since 1978 to push back deserts.	66B+
02	Underground Network ~3,000 mi of hardened tunnels for second-strike reach.	3,000 mi
03	Artificial Islands 27 dredged outposts across the Spratly & Paracel chains.	27
04	Mega-Dams Clean energy and upstream leverage.	98,000+
05	Coastal Restoration Mangroves & living shorelines rebuild resilience.	

The “Great Green Wall”



66 billion+

trees planted since the 1978 Three-North Shelterbelt Program

~4,500 km

belt along the Mongolia, Kazakhstan & Kyrgyzstan borders

Activities in the South China Sea

“Ecological militarization”: 27 dredged outposts across the Spratly & Paracel chains — 3,200+ acres of new land, with ~4,600 acres of coral buried since 2013.

MISCHIEF REEF



FIERY CROSS



SUBI REEF



The “Great Wall Project” Underground

~3,000 mi

of hardened passageways carved into mountains and rock, first revealed by 2008 satellite imagery

KNOWN / SUSPECTED SITES

Shipuzhen · Jianggezhuang (Qingdao) · Yulin (Hainan) · PLARF
Base 67 · Beijing Military City



Dams



98,000+

dams across China.

~4,500 km

belt along the Mongolia, Kazakhstan & Kyrgyzstan borders

Coastal & Marine Restoration

- Over two decades, China has pivoted from hard seawalls to nature-based defense — mangroves and artificial reefs.
- Hard infrastructure is costly (Shanghai seawalls ~\$7M/km); a 600 m mangrove belt can absorb up to 1.4 m of storm surge.
- Fujian’s “living shorelines” double as strategy — the province hosts PLA deep-water ports and maritime militia.

LIVING-SHORELINE RESULTS

+33%

average coastal-resilience gain across 54 cities, 2012–2022

45% → 85% high-quality (Category II) coastal waters in Fujian

18,000 ha of new mangroves planned along the southern coast this year

APPENDIX

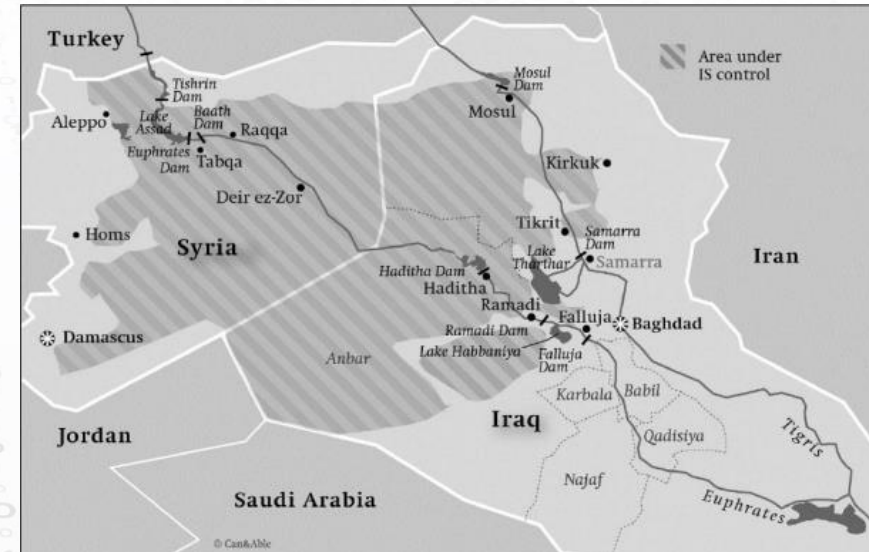
Case Studies

How the historical cases translate into guidance for protecting U.S. defense infrastructure.

04

The Weaponization of Dams by the Islamic State of Iraq & Syria

- By late 2012, ISIS controlled all major dams within Syria, and starting in 2014, it had expanded control along the Tigris and Euphrates.
- Used Dams for controlled Inundations (Abu Ghraib)
- After capturing the Taqba Dam, ISIS could release 11 million cubic meters of water in Syria and cut electricity to major cities.
- Withheld water access from the Euphrates Valley until occupied populations acquiesced to their authority.



Dams on the Euphrates and Tigris under Islamic State Control

CASE STUDIES

The Battle of the Irpin River, 2022

Ukrainian forces breached upstream dams and flooded the Irpin floodplain, turning the river into a natural barrier that helped halt the Russian advance on Kyiv.



11 MARCH 2022 — before



18 MARCH 2022 — floodplain inundated

Manipulation of the Syracuse Harbor in the Peloponnesian War

- Syracusans reinforced the harbor with stakes to impede the Athenian attack.
- Athenian ships were obstructed by the stakes.
- The Stakes disrupted naval operations by forcing Athenian sailors to dive to remove them, rerouting enemy movements, and giving Syracuse defenders more time to prepare for the attack.



Map of Syracuse Harbor