International NNBF
Guidelines Meeting
Fall 2017

Guidelines on the Use of Natural and Nature-Based Features for Sustainable Coastal and Fluvial Systems

October 30, 2017

Todd S. Bridges, Ph.D.

Senior Research Scientist, Environmental Science

US Army Corps of Engineers

Creating Value through Alignment…

- What opportunities are there for achieving better alignment of natural and engineered systems?
  - Can improved alignment reduce risks to life, property and ecosystems?
  - What range of services can be produced through such alignment?
  - What are the science and engineering needs in order to achieve better alignment?

Sustainable Solutions Vision: "Contribute to the strength of the Nation through innovative and environmentally sustainable solutions to the Nation's water resources challenges."

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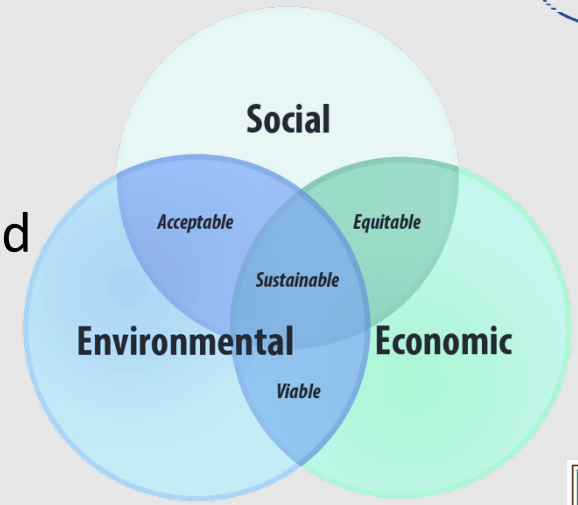
Engineering With Nature™…

…the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental and social benefits through collaborative processes.

Key Elements:

- Science and engineering that produces operational efficiencies
- Using natural process to maximum benefit
- Broaden and extend the benefits provided by projects
- Science-based collaborative processes to organize and focus interests, stakeholders, and partners

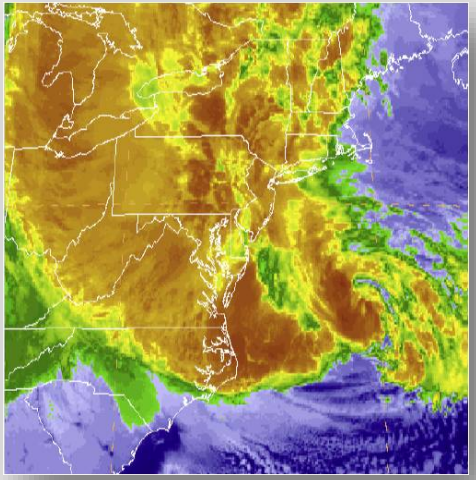


www.engineeringwithnature.org

Value and Use of Natural Systems

Following Hurricane Sandy:

- Risk industry-based tools used to quantify the economic benefits of coastal wetlands
  - Temperate coastal wetlands saved more than $625 million in flood damages.
  - In Ocean County, New Jersey, salt marsh conservation can significantly reduce average annual flood losses by more than 20%.



COASTAL WETLANDS AND FLOOD DAMAGE REDUCTION

Using Risk Industry-based Models
to Assess Natural Defenses in the Northeastern USA

October 2016

UNIVERSITY OF CALIFORNIA SANTA CRUZ
The Nature Conservancy
Wildlife Conservation Society
LLOYD'S TERCENTENARY RESEARCH FOUNDATION

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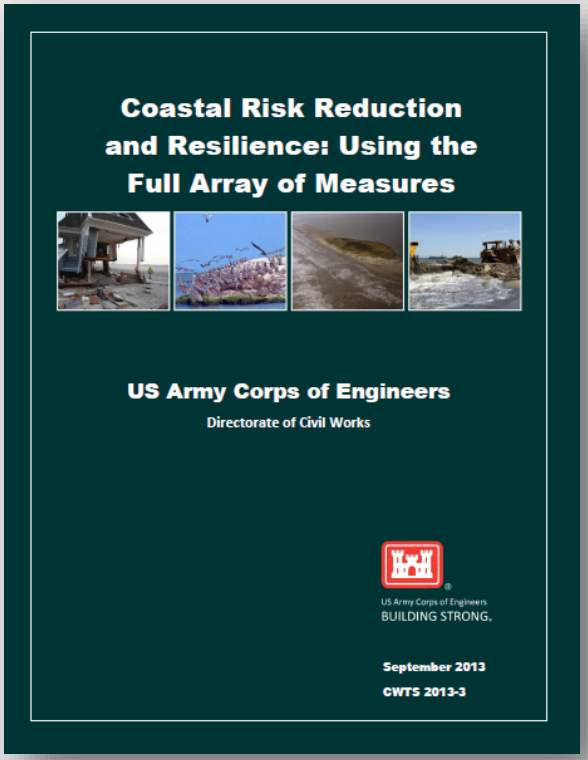
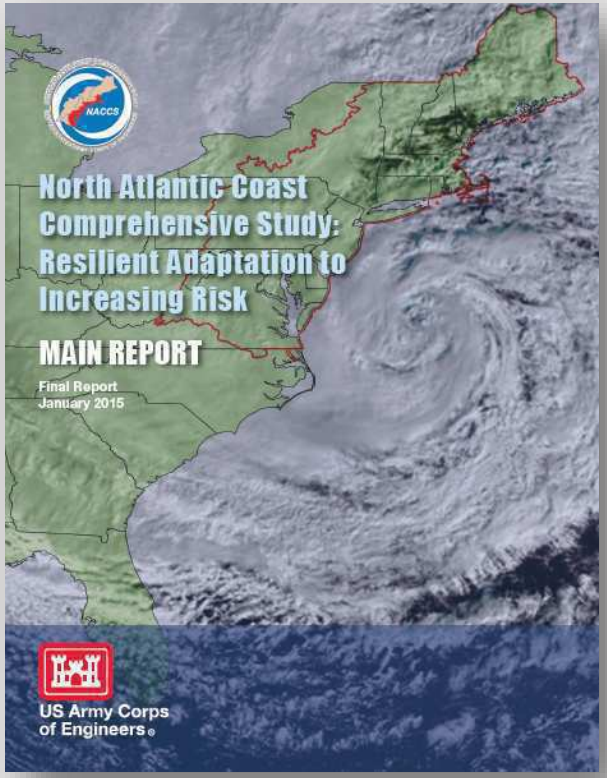
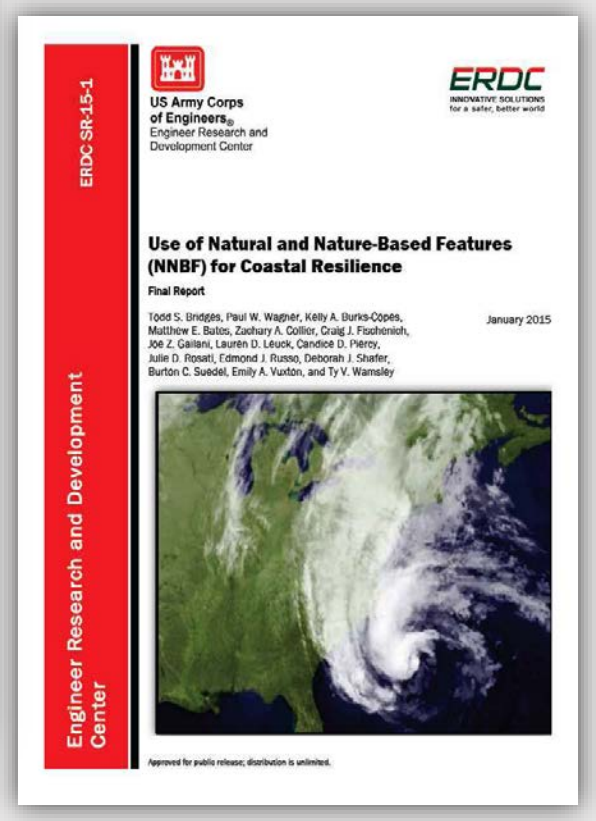
The North Atlantic Coast Comprehensive Study







http://www.nad.usace.army.mil/CompStudy

Engineering Performance: NNBF

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Natural and Nature-Based Infrastructure at a Glance

GENERAL COASTAL RISK REDUCTION PERFORMANCE FACTORS:
STORM INTENSITY, TRACK, AND FORWARD SPEED, AND SURROUNDING LOCAL BATHYMETRY AND TOPOGRAPHY

Dunes and Beaches

Benefits/Processes

Break offshore waves

Attenuate wave energy

Slow inland water transfer

Performance Factors

Berm height and width

Beach Slope

Sediment grain size and supply

Dune height, crest, width

Presence of vegetation

Vegetated Features: Salt Marshes, Wetlands, Submerged Aquatic Vegetation (SAV)

Benefits/Processes

Break offshore waves

Attenuate wave energy

Slow inland water transfer

Increase infiltration

Performance Factors

Marsh, wetland, or SAV elevation and continuity

Vegetation type and density

Oyster and Coral Reefs

Benefits/Processes

Break offshore waves

Attenuate wave energy

Slow inland water transfer

Performance Factors

Reef width, elevation and roughness

Barrier Islands

Benefits/Processes

Wave attenuation and/or dissipation

Sediment stabilization

Performance Factors

Island elevation, length, and width

Land cover

Breach susceptibility

Proximity to mainland shore

Maritime Forests/Shrub Communities

Benefits/Processes

Wave attenuation and/or dissipation

Shoreline erosion stabilization

Soil retention

Performance Factors

Vegetation height and density

Forest dimension

Sediment composition

Platform elevation

NACCS NNBF Framework

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ORGANIZATIONAL ALIGNMENT

EVALUATION

IMPLEMENTATION

Iterate as Needed

Identify and Organize Stakeholders, Partners and Authorities

Define Physical and Geomorphic Setting

Assess Vulnerability and Resilience

Identify NNBF Opportunities
- Formalize NNBF Objectives
- Identify NNBF Alternatives
- Define NNBF Performance Metrics

Evaluate NNBF Alternatives
- Tier 1
- Tier 2
- Tier 3

Advance through Tiers as Appropriate

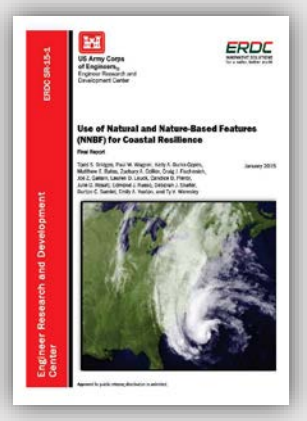
Select NNBF Alternatives

Design Implementation Plan: Elaborate Operational and Engineering Practices

Implement NNBF Alternative

Monitor for Performance and Assess Ecosystem Goods and Services

Feedback



The Private Sector: Caterpillar Corporation's *Restoring Natural Infrastructure Summit* 4 November 2015, New York City

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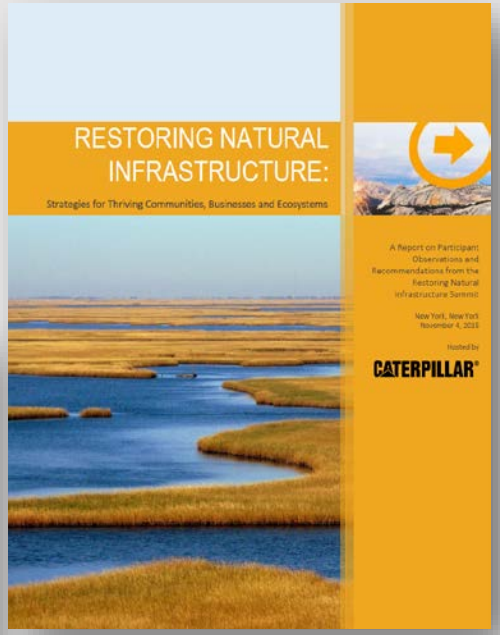

http://www.caterpillar.com/en/company/sustainability/natural-infrastructure.html

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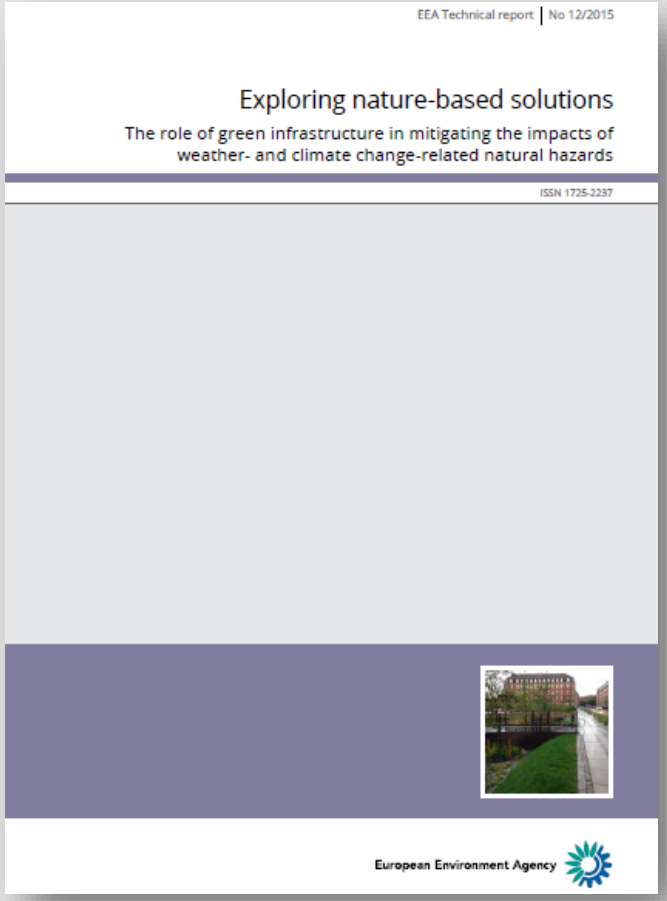
Exploring nature-based solutions: the role of green infrastructure in mitigating the impacts of weather- and climate change-related natural hazards

"…instead of automatically defaulting to grey solutions like dikes and pipes for flooding, we first should look at restoring floodplains or wetlands. Rather than building sea walls, we need to think about conserving sand banks...Planners should compare green to grey and identify new opportunities for investing in nature, including a combination of green and grey approaches when nature-based solutions alone are insufficient. As planners explore how to accommodate infrastructure demands in the future, the lesson is clear: think about green before investing in grey."

EEA Technical Report No 12/2015


EEA Technical report | No 12/2015

Exploring nature-based solutions

The role of green infrastructure in mitigating the impacts of weather- and climate change-related natural hazards

ISSN 1725-2237

European Environment Agency

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World Bank Principles and Implementation Guidance for Nature-Based Flood Protection

NBFP Workshop, 11-13 April 2017

Laws and Mandates: Water Infrastructure Improvements for the Nation Act (WIIN Act) 2016

SEC. 1184. Consideration of measures.

(a) Definitions.—In this section, the following definitions apply:

(1) NATURAL FEATURE.—The term "natural feature" means a feature that is created through the action of physical, geological, biological, and chemical processes over time.

(2) NATURE-BASED FEATURE.—The term "nature-based feature" means a feature that is created by human design, engineering, and construction to provide risk reduction in coastal areas by acting in concert with natural processes.

(b) Requirement.—In studying the feasibility of projects for flood risk management, hurricane and storm damage reduction, and ecosystem restoration the Secretary shall, with the consent of the non-Federal sponsor of the feasibility study, consider, as appropriate—

(1) natural features;

(2) nature-based features;

(3) nonstructural measures; and

(4) structural measures.

Declaration on Nature-Based Solutions Being Considered during COP23 in Bonn, 6-17 Nov 2017

DRAFT V. 28 09 2017

HIGH-LEVEL DECLARATION
Nature-based solutions for water under climate change

We, representatives of governments, international and national organizations, donors, national and transboundary basin organizations, local authorities, civil society and companies, research organizations, support the integration of nature-based solutions into the Marrakech Partnership for Global Climate Action.

...

We commit to:

- Include nature-based solutions in our international, regional, national, basin and local long-term strategies and policies on climate change and resources management.

- Raise awareness on the necessity to operationalize research works on nature-based approaches by promoting nature-based solutions and this declaration towards our peers.

- Make sure that nature-based solutions are providing co-benefits for human well-being and development as well as biodiversity.

...

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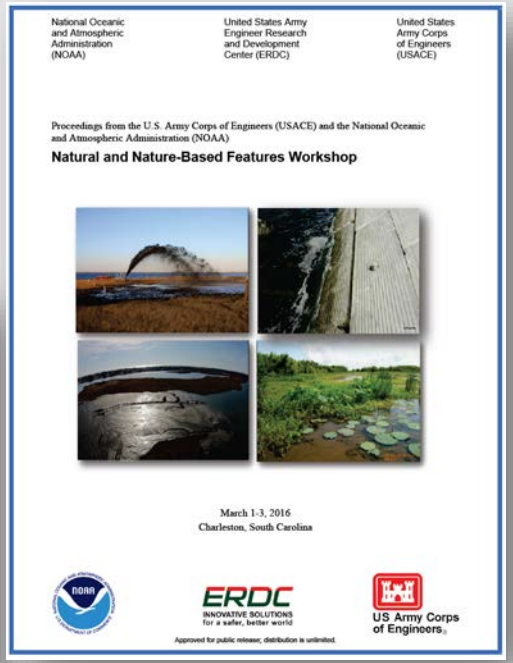
Collaboration: USACE – NOAA Workshop on Natural and Nature-Based Features Charleston, SC; 1-3 March 2016



National Oceanic and Atmospheric Administration (NOAA)

United States Army Engineer Research and Development Center (ERDC)

United States Army Corps of Engineers (USACE)

Proceedings from the U.S. Army Corps of Engineers (USACE) and the National Oceanic and Atmospheric Administration (NOAA)

Natural and Nature-Based Features Workshop

March 1-3, 2016
Charleston, South Carolina

ERDC
INNOVATIVE SOLUTIONS for a safer, better world

US Army Corps of Engineers

Approved for public release; distribution is unlimited.

www.engineeringwithnature.org (NNBF)

Fort Pierce City Marina, Florida

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USACE Philadelphia District: Back Bay NJ

Mordecai Island

Stone Harbor

Avalon

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Onehunga Bay Foreshore Restoration Auckland, New Zealand

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Humber Estuary; Alkborough, UK

(Increased Flood Storage Capacity)

Chehalis Basin Floodplain Restoration

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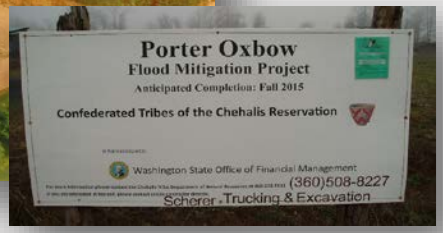

RAMBOLL ENVIRON

THE CHEHALIS TRIBE

Noordwaard, The Netherlands

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Purpose: Develop guidelines for using NNBF to provide engineering functions relevant to flood risk management while producing additional economic, environmental and social benefits.

- Publish NNBF technical guidelines by 2020:
  - Multi-author: government, academia, NGOs, engineering firms, construction companies, etc.
  - Addressing the full project life cycle: planning, design, engineering, construction, and maintenance
  - Guidelines in 4 Parts
    - Overarching
    - Coastal Applications
    - Fluvial Applications
    - Conclusions

US Army Corps of Engineers
NOAA
The Nature Conservancy — Protecting nature. Preserving life.
Deltares — Enabling Delta Life
Biohabitats
LimnoTech
Rijkswaterstaat — Ministry of Infrastructure and the Environment
Great Lakes Commission
Stanford University
CAT
EDF Environmental Defense Fund — Finding the ways that work
KIOST — Korea Institute of Ocean Science & Technology
RAMBOLL
ecology and environment, inc. — Global Environmental Specialists
HR Wallingford
Tonkin+Taylor
ANCHOR QEA
Environment Agency

Guidelines Table of Contents

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NNBF

Part 1: Informing the Use of NNBF

- Preface/Definitions
- Introduction
- Principles for Use of NNBF in Coastal and Fluvial Systems
- Community Engagement
- General NNBF Framework
- System Considerations and Combining Elements
- Analysis of NNBF Benefits
- Monitoring, Maintenance, and Adaptive Management

Part 2: Coastal Systems

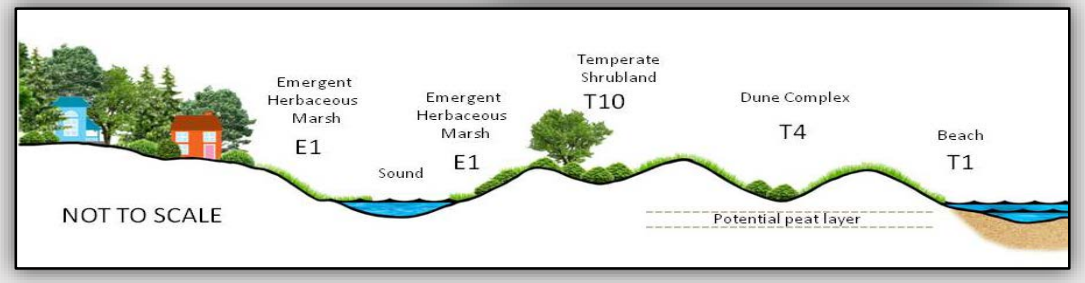
- Introduction
- Beaches and Dunes
- Wetlands and Intertidal Areas
- Islands
- Reefs
- Sub-Aquatic Vegetation
- Upland Plant Communities
- Enhancing Environmental Value of Conventional Infrastructure

Part 3: Fluvial Systems

- Introduction
- Applying NNBF at Watershed Scale
- Applying NNBF at Sub-Watershed Scale
- Naturalizing Techniques

Part 4: Conclusion

- Summation and Future Directions



Development Approach

- Voluntary project team
- Editorial Board
- Individual Chapter Teams, with Co-Leads
- Peer review of final product
- Periodic, in-person working meetings combined with virtual engagement and drafting

International NNBF Guidelines: Team Meeting #1; United States; Vicksburg, MS; 25-26 October, 2016

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International NNBF Guidelines: Team Meeting #2; United Kingdom; 10-13 July, 2017

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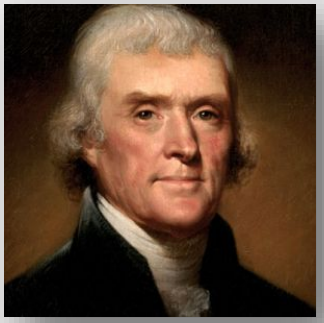
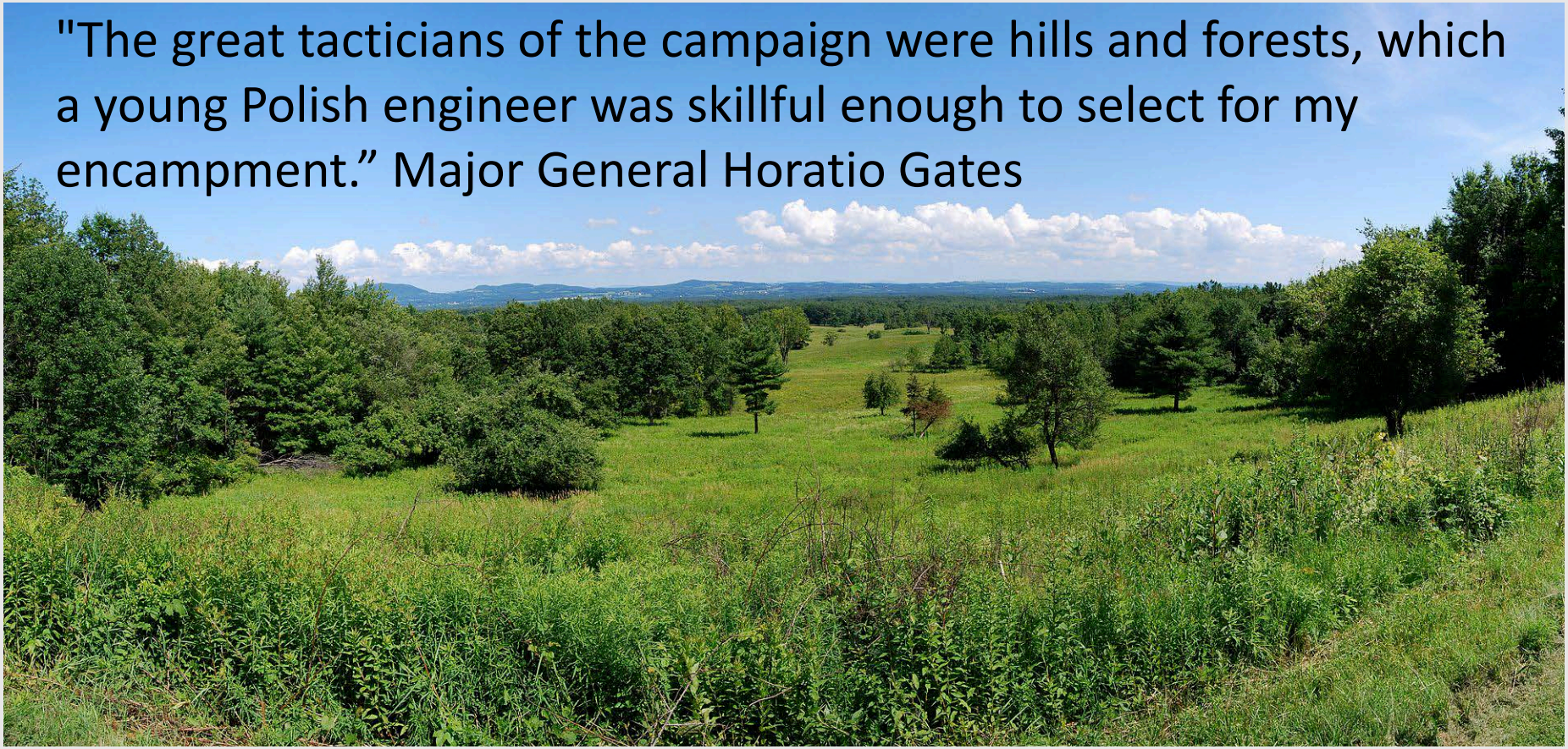


The Pursuit of Resilience…

"I endeavor to keep their attention fixed on the main objects of all science, the freedom & happiness of man."

Thomas Jefferson to Tadeusz Kosciuszko, 1810

The Battlefield at Saratoga