



# SEAHA

EPSRC CENTRE FOR DOCTORAL TRAINING  
IN SCIENCE AND ENGINEERING IN  
ARTS HERITAGE AND ARCHAEOLOGY

## What is the future for our earthen heritage? Modelling the risk of environmentally-driven deterioration at sites located in dryland areas

Jenny Richards, Jerome Mayaud, Richard Bailey, and Heather Viles

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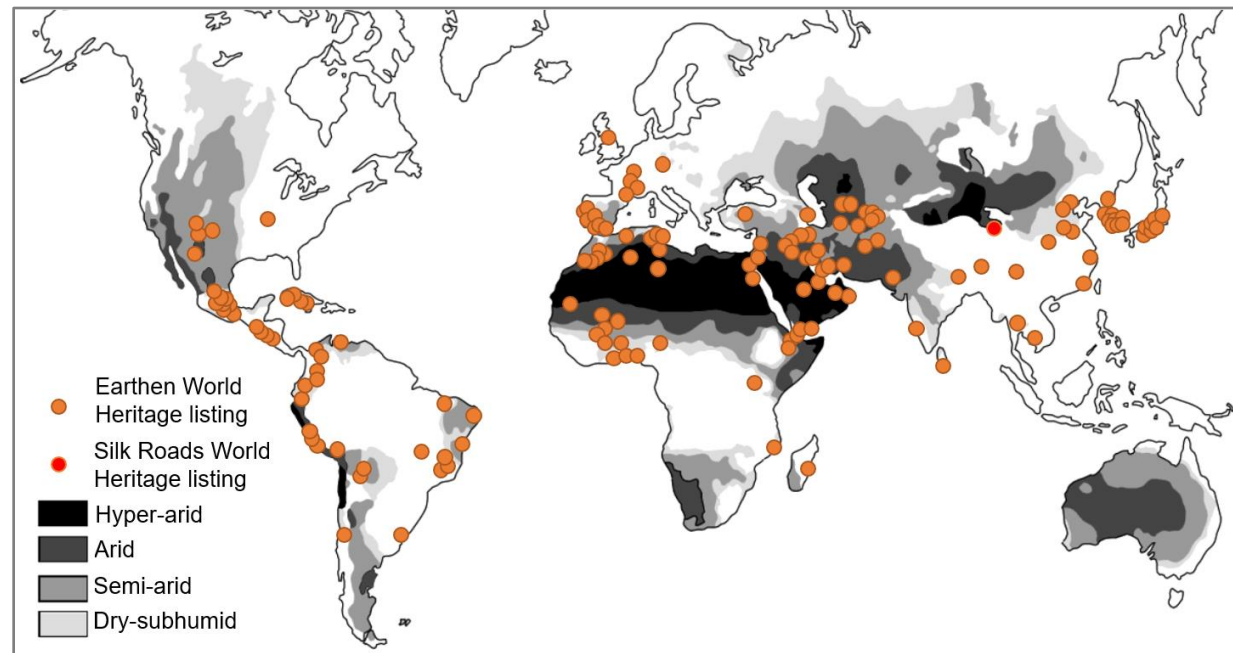
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# Earthen Heritage

Earthen heritage forms  
~10% of UNESCO's World  
Heritage List

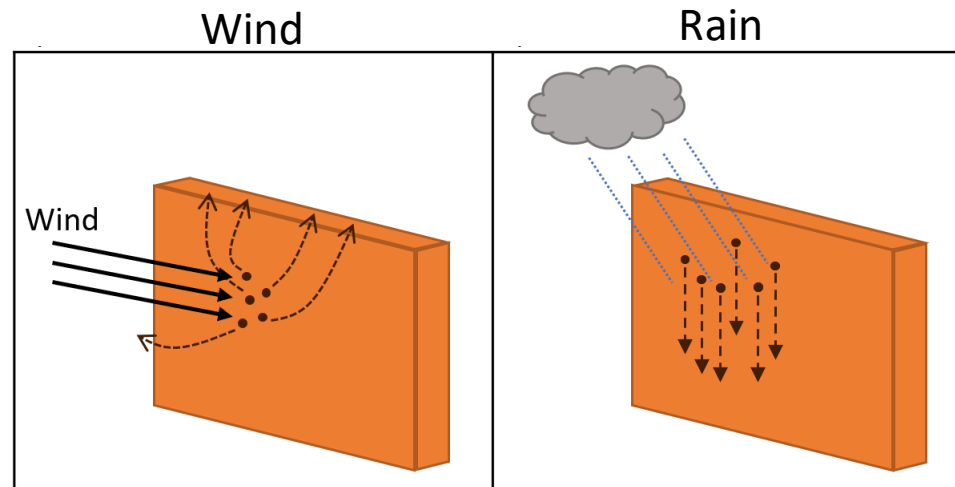
Sites are generally  
concentrated in dryland  
environments



# Earthen Heritage

Environmental processes such as wind, sediment movement and rain can cause in extensive deterioration

We need to understand how multiple environmental processes interact and impact earthen heritage to improve the effectiveness of conservation strategies



# Field site: Suoyang Ancient City

Suoyang is an archaeological site built from rammed earth in the Han (206 BC–220 AD) and Tang (618 – 907 AD) dynasties. It was abandoned ~400 years ago.

The site consists of an Inner City wall (500 by 500 m<sup>2</sup>), outer city walls, houses, stables, archery platforms, an extensive ancient irrigation network and a Buddhist monastery

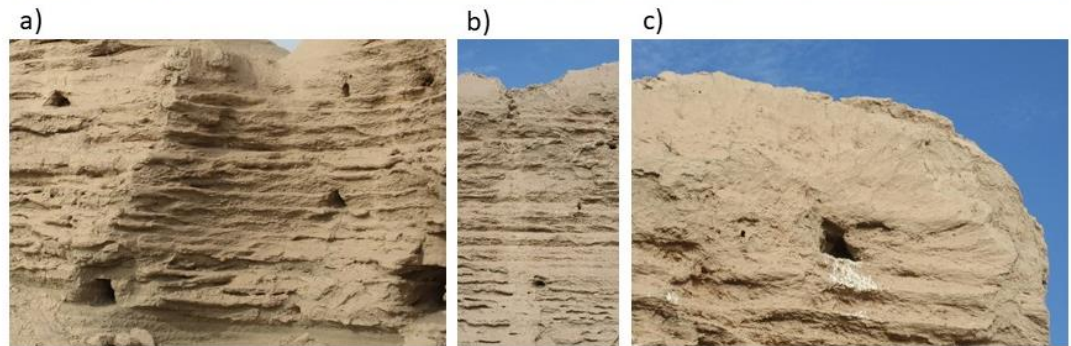
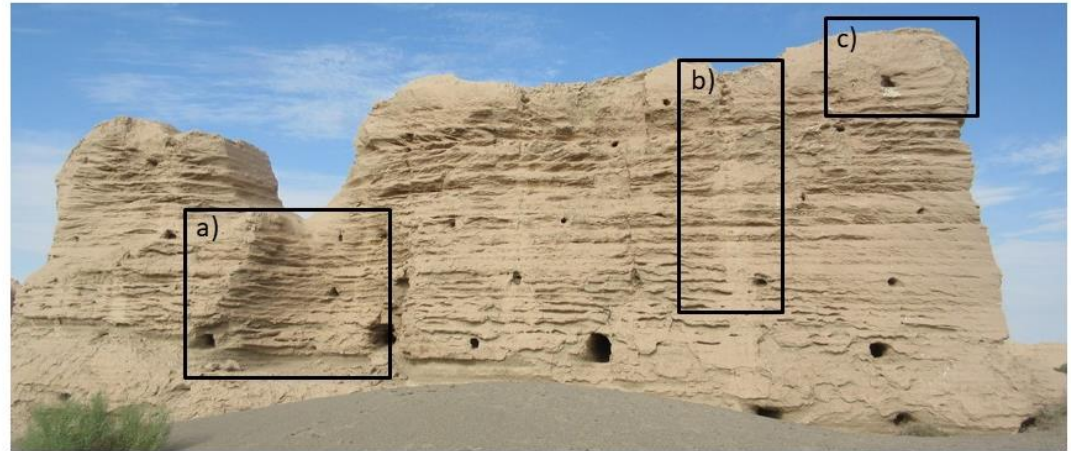
In 2014, Suoyang was listed as one of 33 sites on the Silk Roads World Heritage Site



# Suoyang Ancient City: Drivers of deterioration

Environmental processes such as wind and rain cause the formation of a range of deterioration features, including:

- a) pitting
- b) gullies and slurry
- c) polishing



# Modelling the risk of deterioration

Developed the Vegetation and Sediment TrAnsport Model for Heritage Deterioration (ViSTA-HD) from the ViSTA model developed by Mayaud et al (2017) and field data collected at Suoyang

ViSTA

AGU PUBLICATIONS

JGR

Journal of Geophysical Research: Earth Surface

RESEARCH ARTICLE

10.1002/2016JF004096

**A coupled vegetation/sediment transport model for dryland environments**

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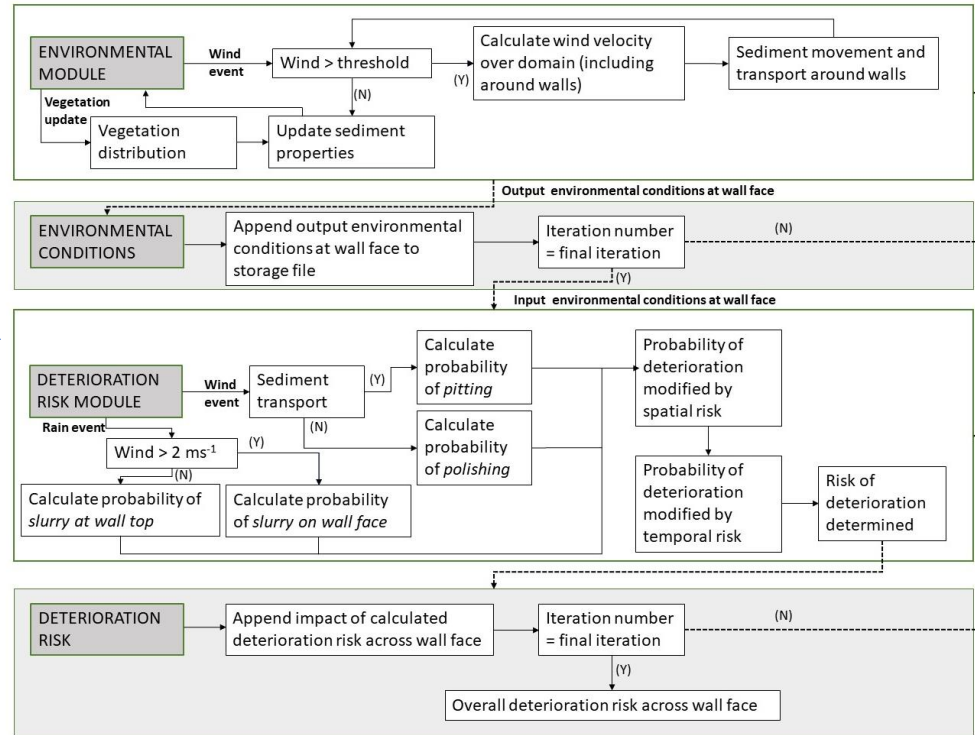
**Key Points:**

- A new coupled vegetation/sediment transport (ViSTA) model for dryland environments is presented
- The technical aspects of the ViSTA

Field data



## ViSTA-HD



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Introduction

Site

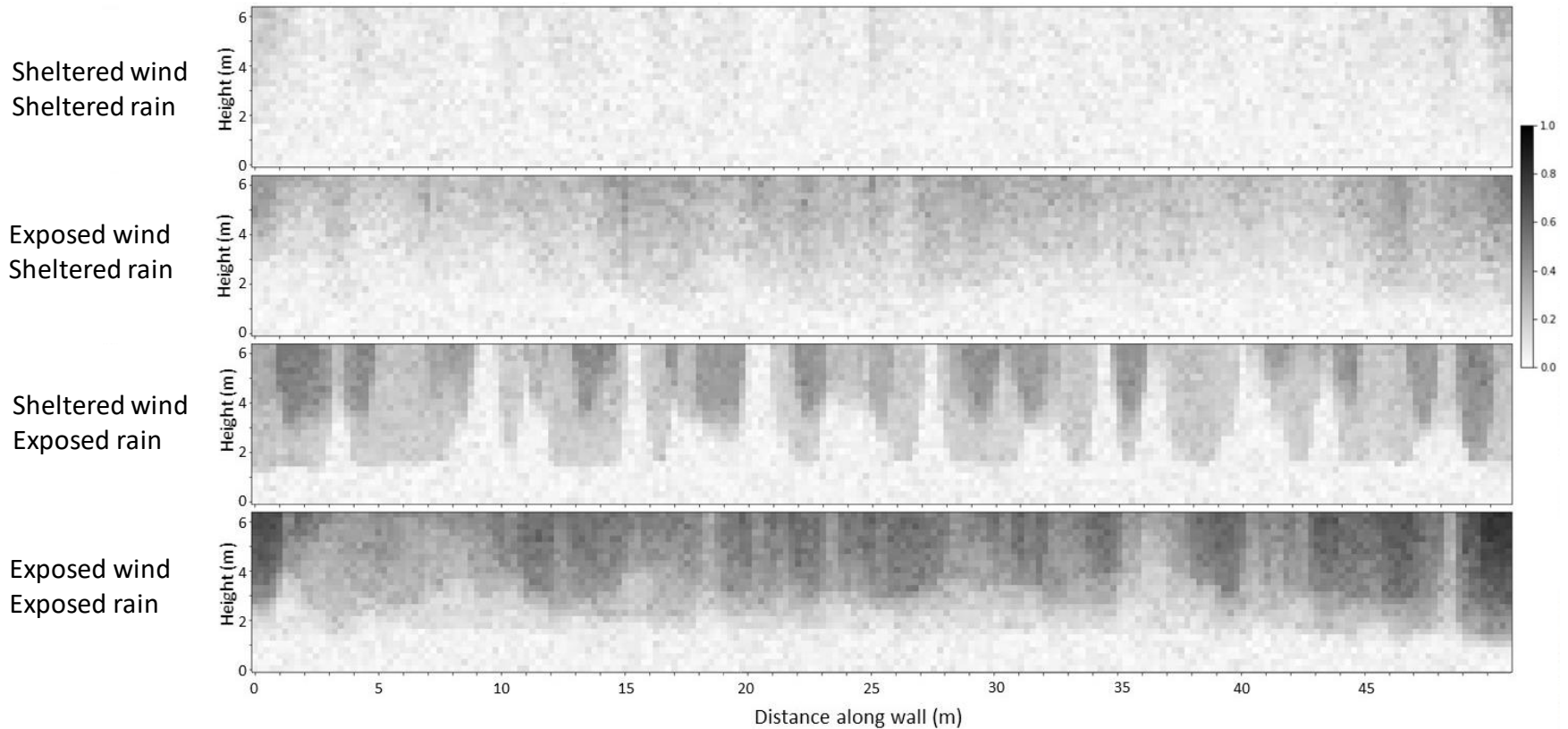
Methods

Results

Implications

# Deterioration risk on wall faces under four different climatic conditions

0 = very low risk of deterioration; 1 = very high risk of deterioration



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Introduction

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# Implications

Interactions between environment and deterioration are complex

ViSTA-HD captures variation in deterioration risk under different climatic scenarios

ViSTA-HD could be used to investigate changes in deterioration risk under future climatic and conservation scenarios





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collaboration and help in the field

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**For more information:**

**Richards J., Mayaud, J., Zhan, H., Wu, F., Bailey, R. and Viles, H.  
Modelling the risk of deterioration at earthen heritage sites in  
drylands. *Earth Surface Processes and Landforms*. Accepted.**



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