Historical Maps and the Future of Land Use

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Lancaster University

John Singer Sargent. ***Carrara: Quarry I.*** 1911. Watercolor over graphite pencil, with wax resist on paper, Sheet: 35.6 x 50.2 cm (14 x 19 3/4 in.). Museum of Fine Arts, Boston; The Hayden Collection—Charles Henry Hayden Fund. https://jstor.org/stable/community.10660488.

Landscape Change & Conservation with MapReader

LCCM is a collaborative, multidisciplinary project:

- David Alexander, Research & Data Analyst, Peak District National Park
- Kirsty Lilley, LCCM Research Associate, Lancaster University
- Katherine McDonough, Lecturer in Digital Humanities, Department of History, Lancaster University
- Rosie Wood, Data Scientist, The Alan Turing Institute

With partners at:

- South Downs National Park
- National Library of Scotland (NLS)

MapReader was developed during **Living with Machines** and **Data/Culture** at The Alan Turing Institute. Contributors include:

- Kaspar Beelen, SAS
- Tim Hobson, Turing
- Kasra Hosseini, Zalando (formerly Turing)
- Josh Rhodes, Durham
- Jon Lawrence, Exeter
- Andy Smith, Turing
- Kalle Westerling, Chainguard (formerly Turing)
- Daniel Wilson, UCL
- Rosie Wood, Turing
- *& with thanks to LwM PI Ruth Ahnert, QMUL*

Also in collaboration with the NLS & the NEH-AHRC-funded **Machines Reading Maps** project.

DEPTFORD
SOUTH EASTERN RAILWAY
LONDON & GREENWICH RAILWAY
GREENWICH BRANCH
SOUTH COAST RAILWAY
THAMES JUNCTION BRANCH
LONDON RAILWAY
LONDON BRIGHTON & SOUTH COAST
EAST LONDON RAILWAY
LONDON BRIGHTON
Animal Charcoal Works
Alpha Villas
Blackhorse Place
Bridge Place
Tar Works
Tar Distillery
Blackhorse Br.
Emily Pla.
Greenfield Place
Cooperage
Mast Pond
Saw Mill
Basin
Timber Yard
ROYAL
DOCKYARD
Gas Works
Coldblow Farm
Necker Br.
Victoria
DORKING ROAD
ABINGER ROAD
FOX ROAD
STREET
Post
B.M.5.8
B.M.10.8
B.M.4.9
B.M.10.4
B.M.12.0
B.M.12.9
B.M.13.8
B.M.12.4
B.M.13.6
B.M.17.1

Observing Complex Landscapes in Britain, Past and Present

With large-scale continuous data about historical and contemporary land use, what methods can we use to ***measure & analyse landscape complexity over time****?*

Historically-informed decision making: What role should historical data play?

Communicating about the links between past, present, and future: What tools are needed to change minds about modifying landscapes?

Credit: Olivia Vane for visualisation, National Library of Scotland for map images & metadata

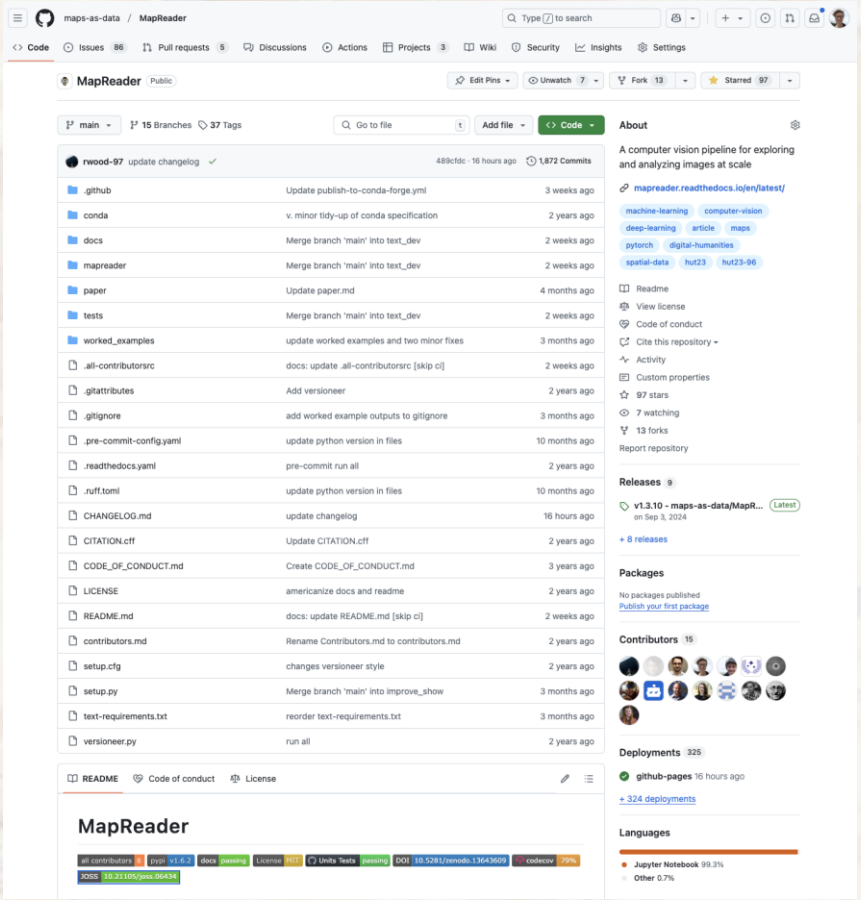
MapReader

…performs 2 tasks:

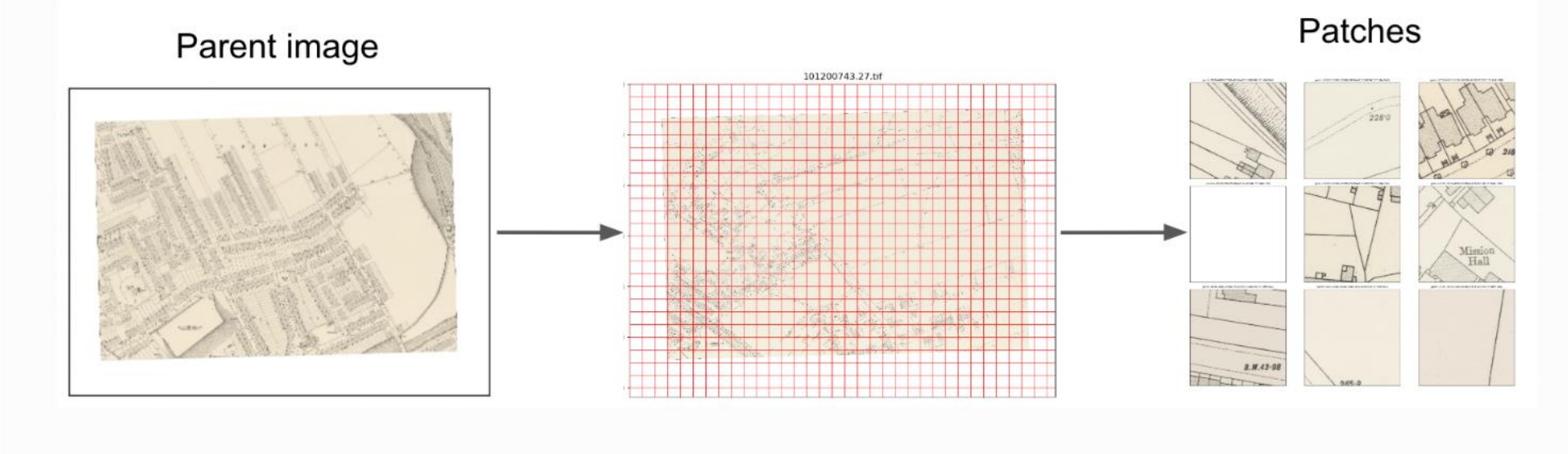
1. **Classify map regions (patches) with concepts that have a visual signal**

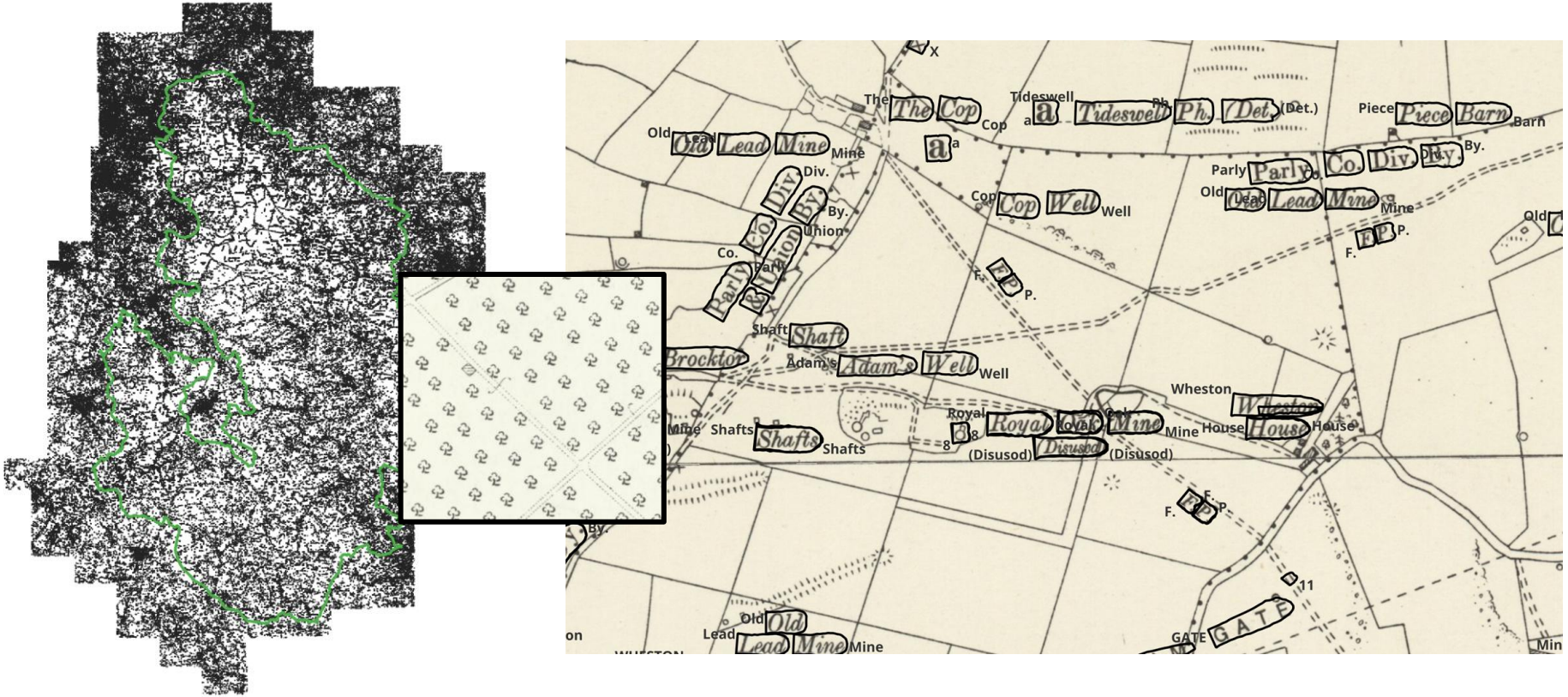
1. **Find and transcribe text (text spotting, or “OCR for maps”)**

github.com/maps-as-data/MapReader



MapReader: ‘Patches’ as a New Shape for Historical Research





Peak District National Park Text Bounding Polygons + Vegetation Type Patches →

Environmental Histories of UK Land Use to Inform Future Land Use

Maps, Mirrors, Mines

Maps are not a 'mirror' or 'ground truth' of the historical landscape - even very accurately surveyed maps!

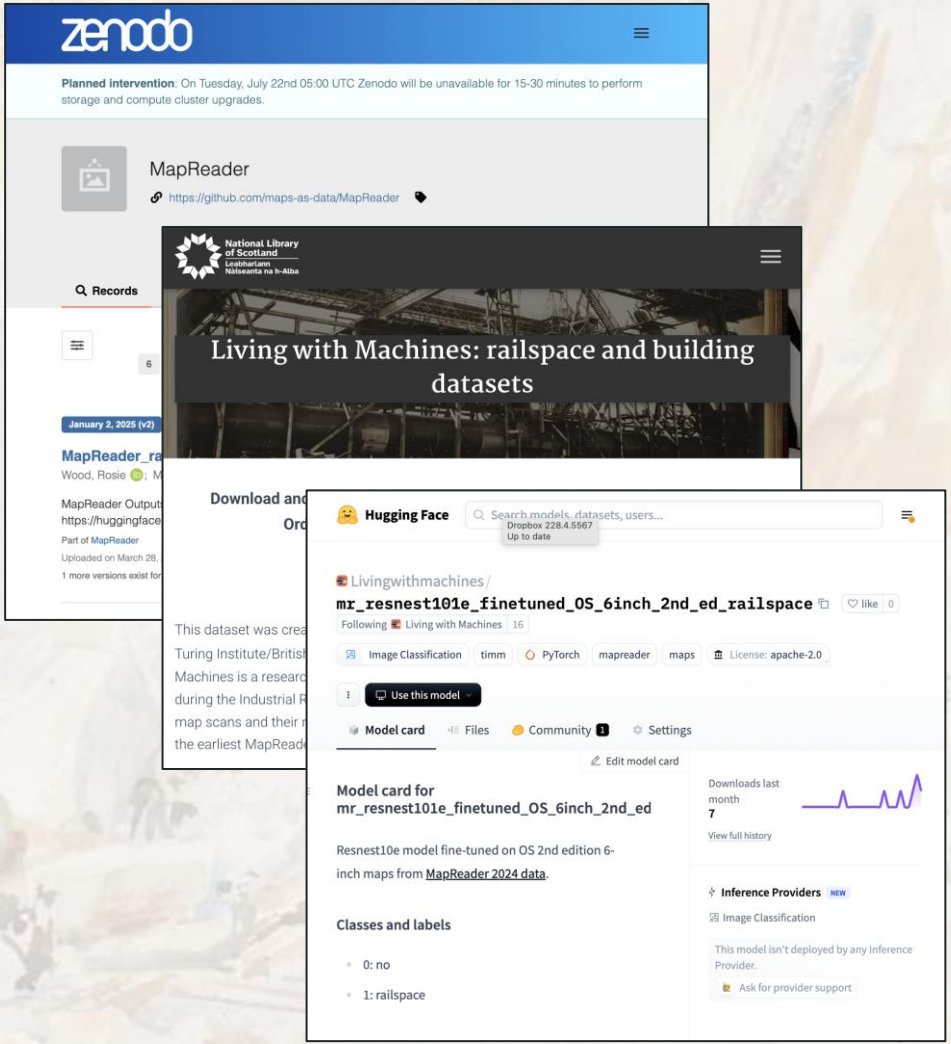
Because of this, **MapReader** **is not an extractive tool digging up facts**: it's an interpretative tool guided by user perspectives that creates new layers of data about map contents, in other words, it enables **question-appropriate data collection and exploration**

Stop historical **data 'mining'/'extraction'** & insisting on overly-precise data

Start developing methods that **formalise critical distance between researchers, sources & 'the past'**

Open Code & Data

1. **Tools & models** used to derive data from public, historical map collections should be open source.
2. **Data** derived from public historical map collections should be open, not provided as Data-as-a-Service (DaaS).
3. Academic & policy-oriented **data re-use & analysis** should be equally open.



MapReader & Landscape Observatory

MapReader is a sandpit for thinking with map content and metadata to critically create structured data for onward linking and analysis.

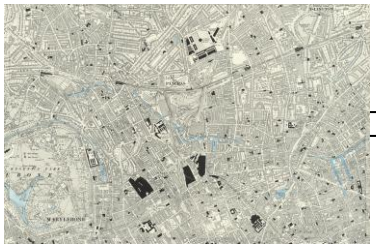
We have privileged software design and methods that:

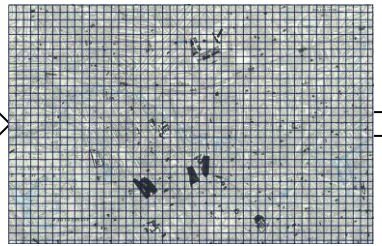
- Illuminate understudied cartographic elements, like text
- Encourage interpretation over extraction, with patches
- Foster stronger connections between researchers, collections & curators

MapReader is being adopted around the world for historical and environmental research. In Britain, **we are partnering with the LO and the new Imago Data Service (Liverpool) to create Open Land Datasets for key OS map features.**

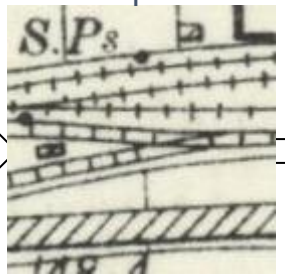
Classification pipeline

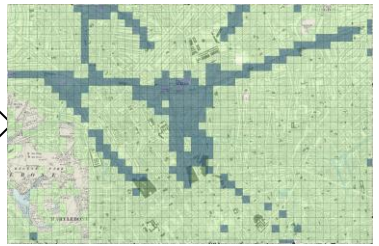
Download	Load	Annotate	Classify
Optional: - Download maps (Tileservers & IIIF)	- Load image files - Load metadata - Patchify	- Annotate patches based on visual features	- Train classifier - Predict labels





railspace



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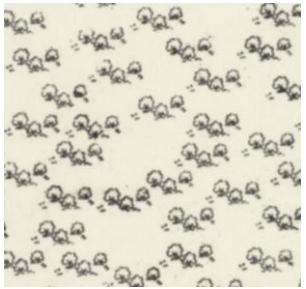
Open Land Data for Britain

Field boundaries

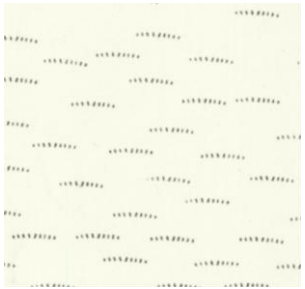
Dew ponds

Vegetation types



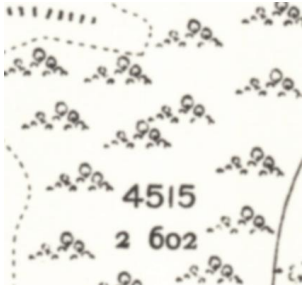
Deciduous trees

Coniferous trees



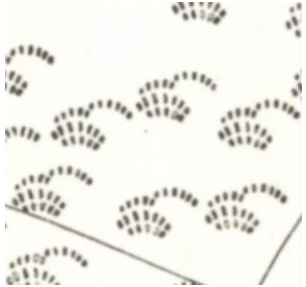
Heath/grassland

Orchards



Bushes/scrub

Marshes/reeds



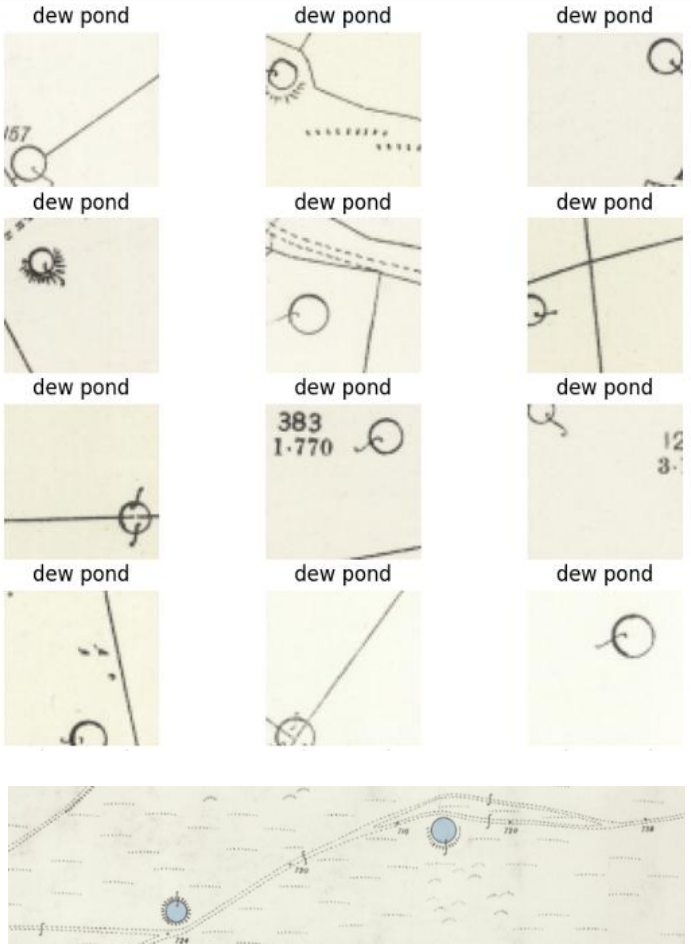
Gorse/furze/whin

Parks/gardens

Slide credit: Kirsty Lilley

Dew ponds ◯

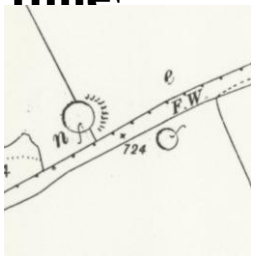
- Historic environment / cultural heritage
- Land management through time
- Loss, but also restoration and new ponds
- Combination of historic maps, aerial photography, and remote sensing (e.g. LiDAR) → creating historic datasets and monitoring pond loss/change <u>at scale</u>
- Spatial results and quantification
  - Locations - past and present
  - % loss since 25” 2nd ed. surveys/revisions
  - Relationship with other vegetation or map feature e.g. boundaries, text



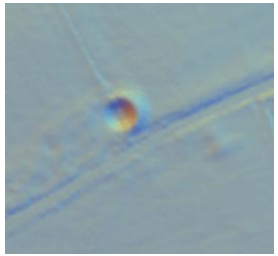
Slide credit: Kirsty Lilley

Combining Results: Patch ‘Diversity’

- Each 100m x 100m patch w/vegetation, etc. = **presence/absence data**
- Patch diversity or **environmental ‘messiness’ over time?**

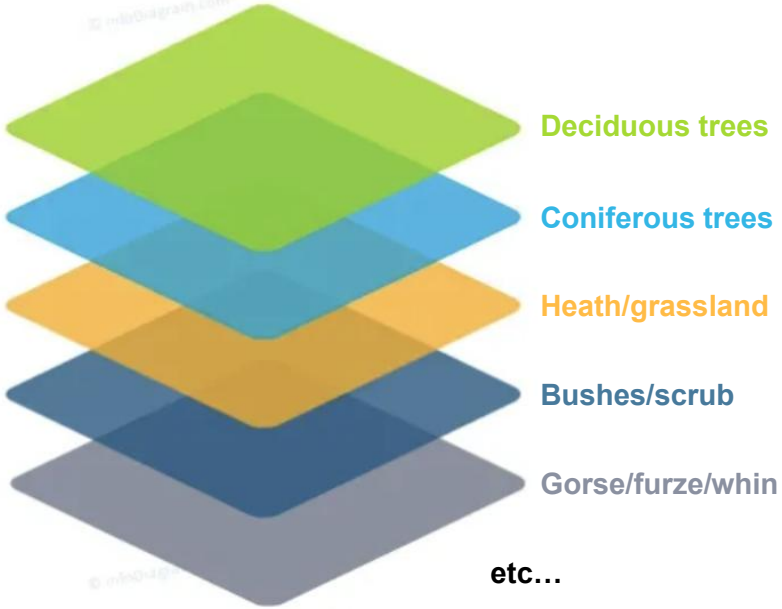


25” (2nd ed.) OS maps



LiDAR (DTM)

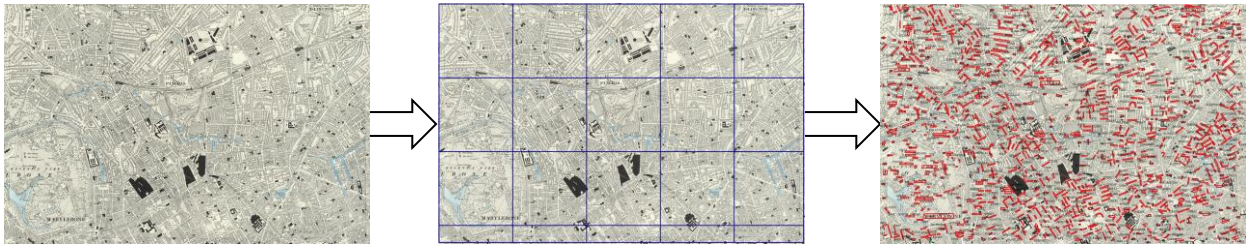
Aerial imagery (Google Satellite)

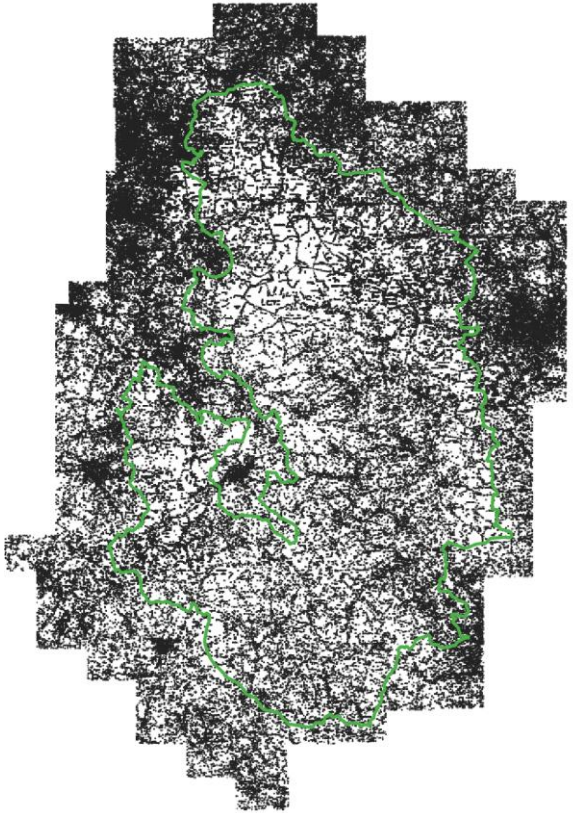


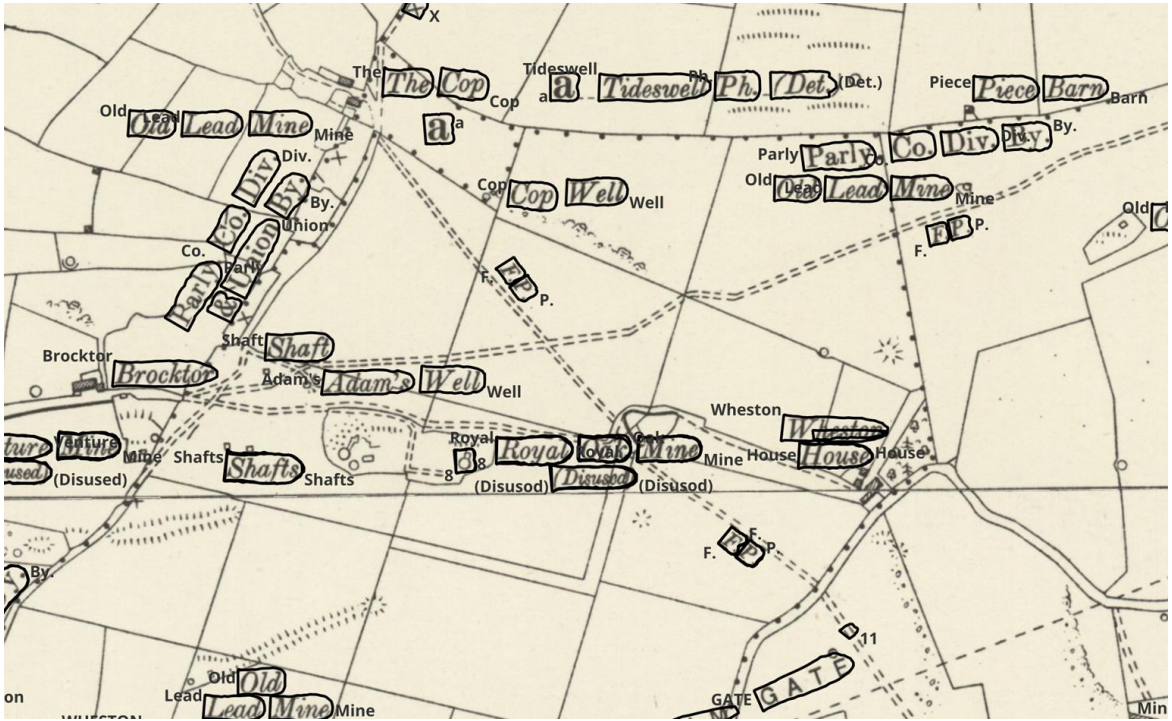
Slide credit: Kirsty Lilley

Text Spotting Pipeline

Download	Load	Spot text
Optional: - Download maps (Tileservers & IIIF)	- Load image files - Load metadata - Patchify	- Detect and recognise text







Peak District Text Bounding Boxes & Transcriptions

Text on Maps

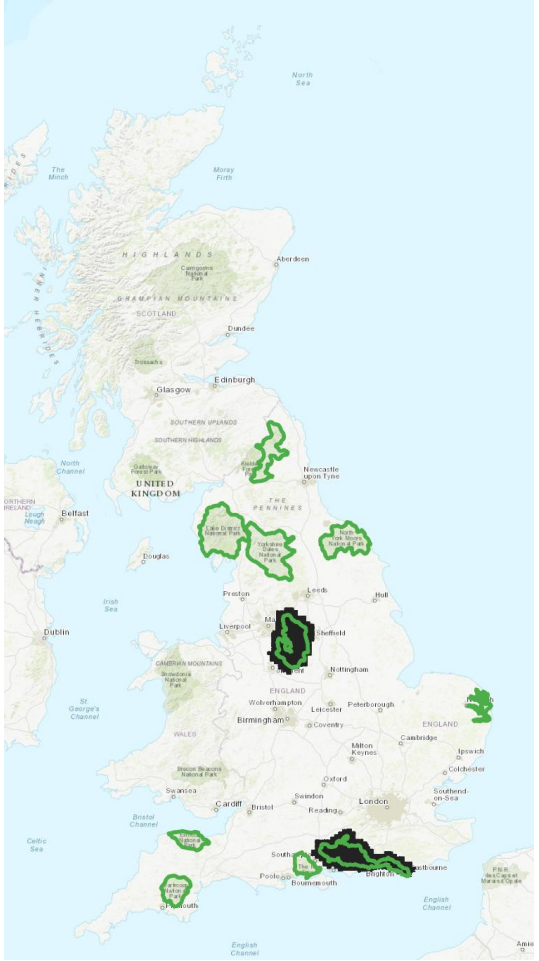
What can we learn from collecting all text on maps?

How does text provide signals for historical features that might not be visually distinctive on a map?

Can text characterise areas of the landscape, helping us identify clusters of areas that are similar to each other?

Are there patterns in named places within or across landscapes?

Is density of text itself a useful proxy for development levels?

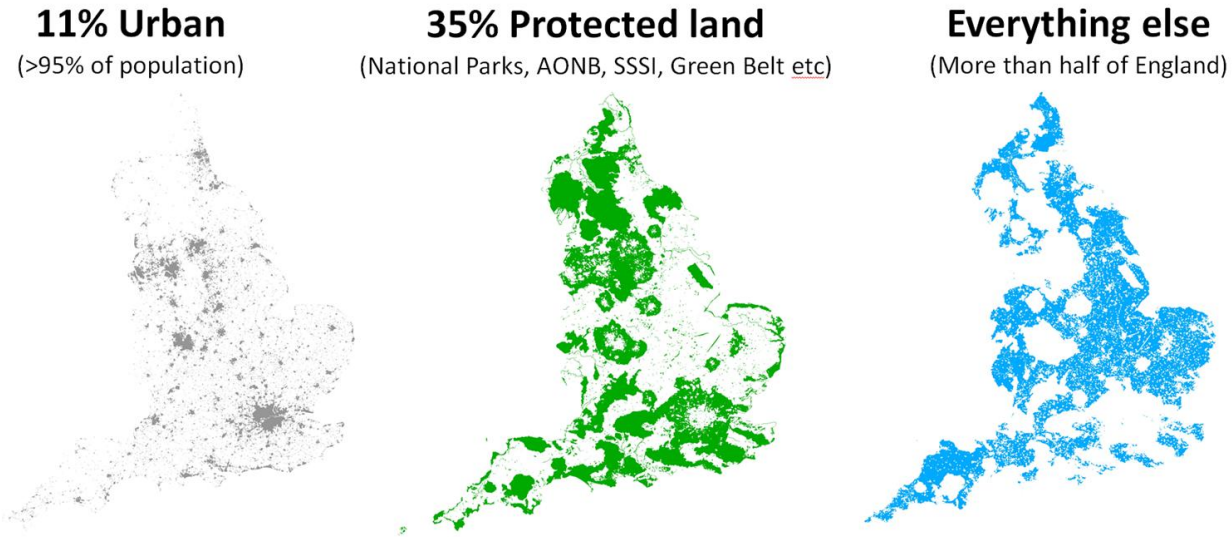


National Park Boundaries (England) with Text Bounding Boxes for SD and PD

Text on Maps: PD & SD Basic Statistics

Series	Total words	No. maps	Average words per map
Peak District, 6 inch	242,721	273	889
South Downs, 6 inch	203,300	335	606
Peak District, 25 inch	718,332	784	916
South Downs, 25 inch	518,646	1137	456

Landscape Observatory



Open Land Data at a (multi-)**national scale:** not just within Protected Landscapes

Slide credit: David Alexander

LCCM Outcomes

Open datasets for 2 pilot areas: South Downs & Peak District National Parks

Models

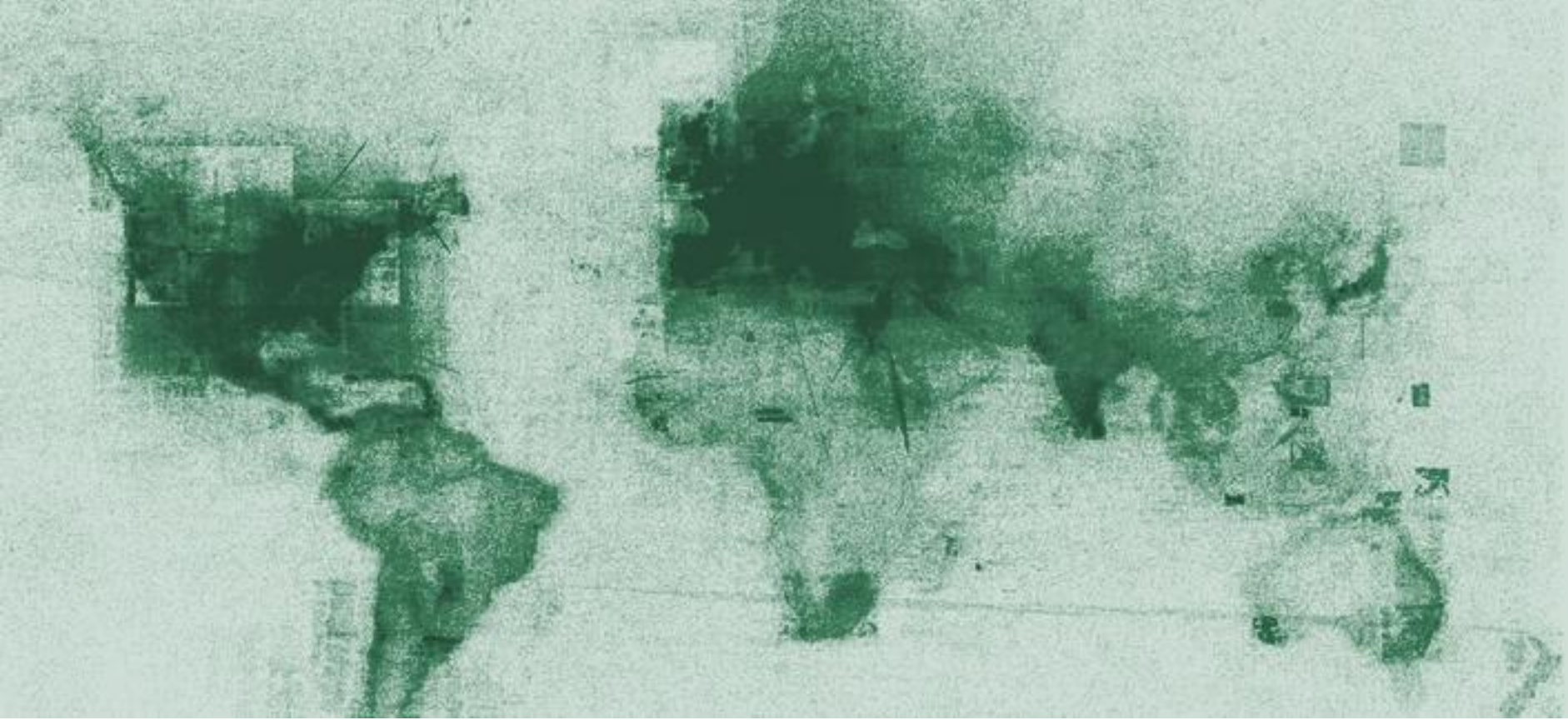
MapReader code

Findable on NLS Data Foundry & **viewable** in NLS web-based viewer

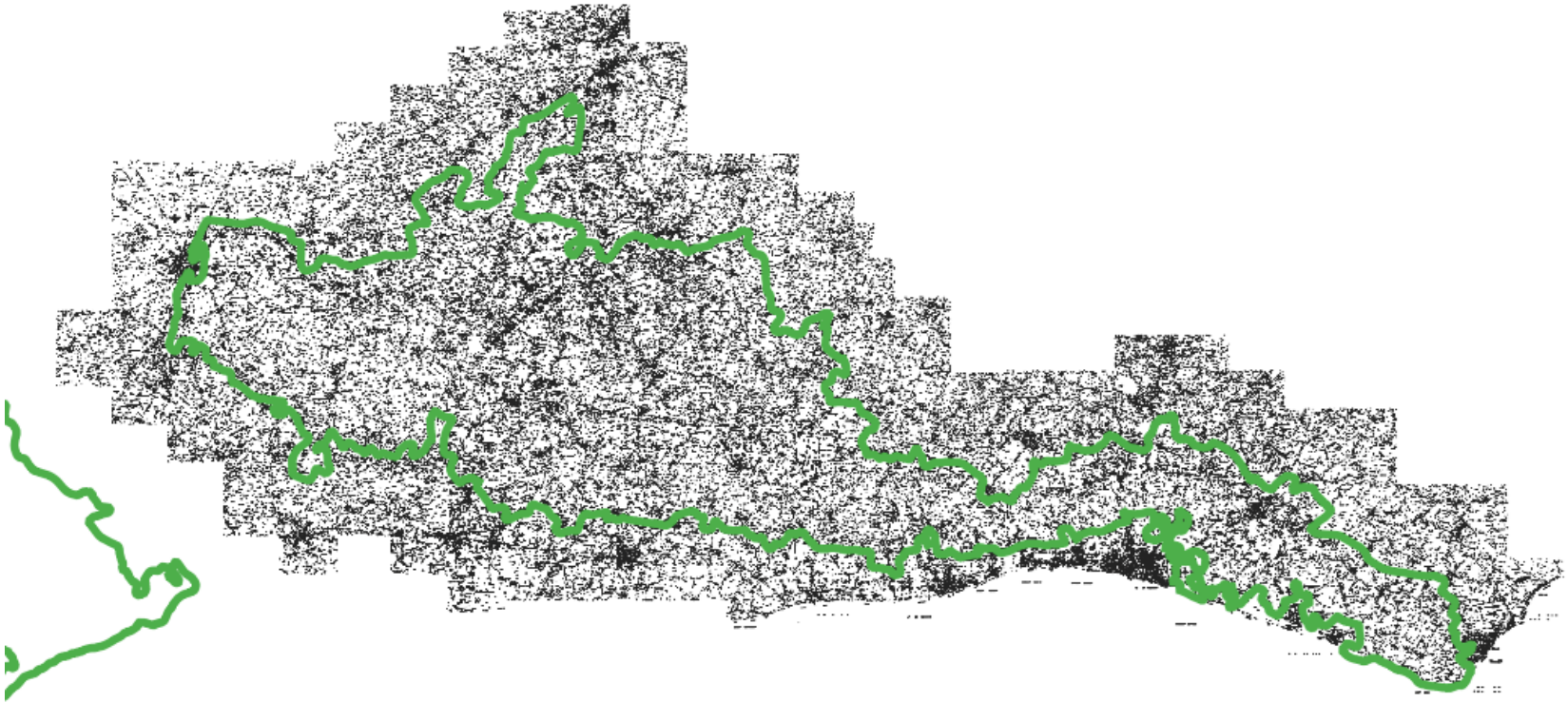
Data paper introducing datasets (for *Environmental Data Science*)

Policy paper setting out a shared, multidisciplinary vision on the impact working with data derived from maps can have on future land use policy (for *History & Policy*)


Thank you



110 million words from on 57k maps ca. 1450-2020 (David Rumsey Map Collection). Dataset created by my AHRC-NEH Machines Reading Maps project.



South Downs Text Bounding Boxes

Most common words - OS 6 inch 2nd edition

Peak District

All words:

- b., m., f., p., w, p, old, lane, quarry, s.

More than 2 characters:

- old, lane, quarry, house, wood, farm, spring, mill, hill, road

South Downs

All words:

- f., p., b., m., w, p, farm, old, pit, chalk

More than 2 characters:

- farm, old, pit, chalk, copse, wood, house, lane, lodge, hill

Most common words - OS 25 inch 2nd edition

Peak District

All words:

- f., p., b., m., w., old, i., p, r., s.

More than 2 characters:

- old, well, lane, lead, quarry, house, farm, wood, mill, spring

South Downs

All words:

- f., b., p., w, m., r., p, h., old, pit

More than 2 characters:

- old, pit, farm, chalk, copse, wood, house, union, lane, hill

Text & Time: Capturing the Past & Future

Text & Time: Fonts