GIS :
an introduction for Recorders

or beyond MapMate & Excel

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Outline

- **Introduction**
  - GIS in BSBI context
  - Focus on specific aspects
  - QGIS & Data
- **Common Principles**
  - Key things to know
  - Stuff which can be ignored

- **Some basic Processes**
  - Base Maps
  - Progress Maps (from data)
  - Maps for print/web
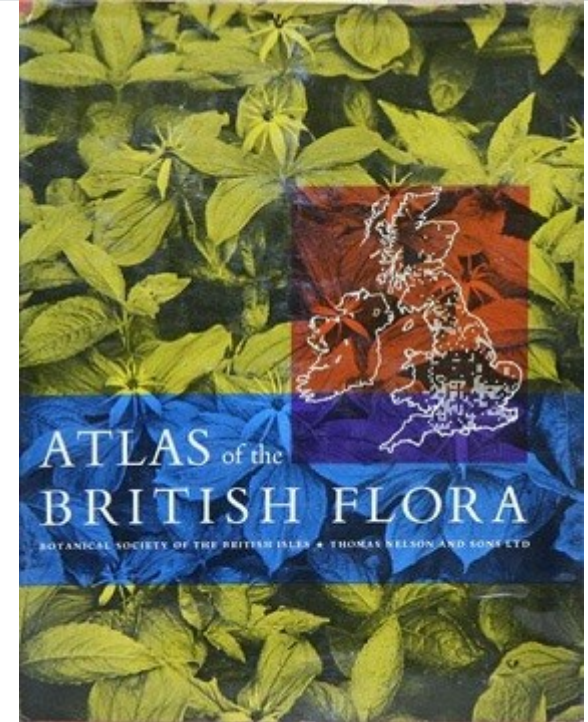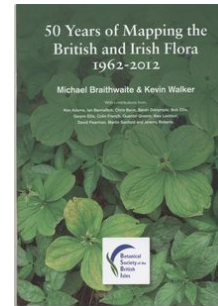 - Distribution maps
- **Learning more**

A little history

- **Invented around 1960 in Canada**
  - Used mainframe computers
- **Desktop GIS appeared in the 1980s**
  - Still very specialised & expensive
- **Widespread usage by 2000**
  - Including nature conservation
  - But costs limited skill base
- **Open Source GIS in 2000s**
  - Free, initially less powerful
- **Democratised in 2010s**
  - Rapid improvement of free software
  - Availability of Open Data from 2010

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BUT...

50 Years of Mapping the British and Irish Flora 1962-2012

Michael Braithwaite & Kevin Walker

ATLAS of the BRITISH FLORA

BOTANICAL SOCIETY OF THE BRITISH ISLES ★ THOMAS NELSON AND SONS LTD

GIS: Toolbox for Geographical Data

- **Creation**
- **Manipulation**
- **Viewing & Visualisation**
- **Exploration**

- **Maps**
- **Analysis**
- **Producing Outputs**
  - Images
  - Printed Maps
  - Input for DTP

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QGIS : Free & Open GIS software

- **Developed by OSGeo**
  - worldwide consortium of companies & universities
  - since 2002
- **Long-term stable releases available**
  - Now on version 3.
- **Comparable to ArcGIS (market leader)**
- **Free**
- **Easy to install**
- **Multiplatform (Macs, PCs & Linux)**

- **Extended by add-on 'Plug-ins'**
  - Notably FSC Tools (no support for Irish Grid)
- **Support available**
  - User Groups in UK
    - Scotland
    - South East
    - Google+ Group
  - Widely used:
    - Local authorities
    - RSBP / Woodland Trust
    - BAS Mapping Group (Magic)
    - ? some Wildlife Trusts
  - FSC run courses

Available (Open) Data of Interest

- **Vice county boundaries**
  - GB: NBN; Ireland: OSM
- **General geographic data**
  - OSGB Open Data
  - Osi/OSNI more limited
  - OpenStreetMap
- **Admin boundaries (all 3 OS)**
- **Elevation & contours**
  - OSGB (25 m)
  - SRTM (30 m)
  - EA/NRW (1-2 m, but partial)

- **Habitat/Landuse/Landcover**
  - Natural England (many datasets)
  - SNH (only via WMS?)
  - NRW (Phase 1 etc)
  - EEA (Corine & Urban Atlas)
  - CEH (Crop Map)
- **Other records**
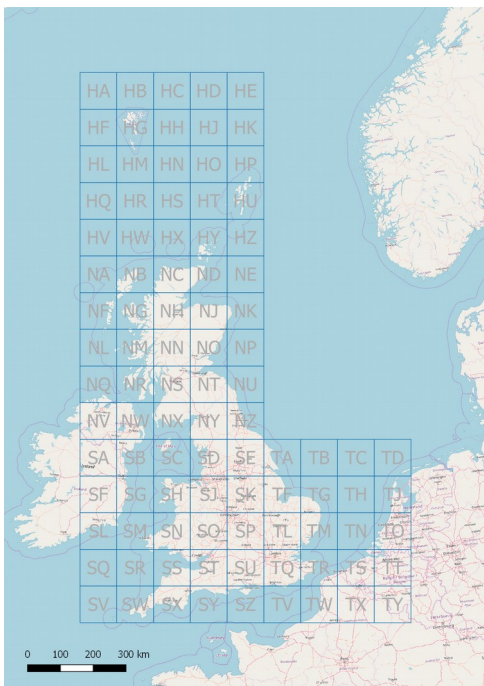 - NBN/GBIF
- **Geology**
  - BGS only (1:625k scale only)

Common Principles

- **Data**
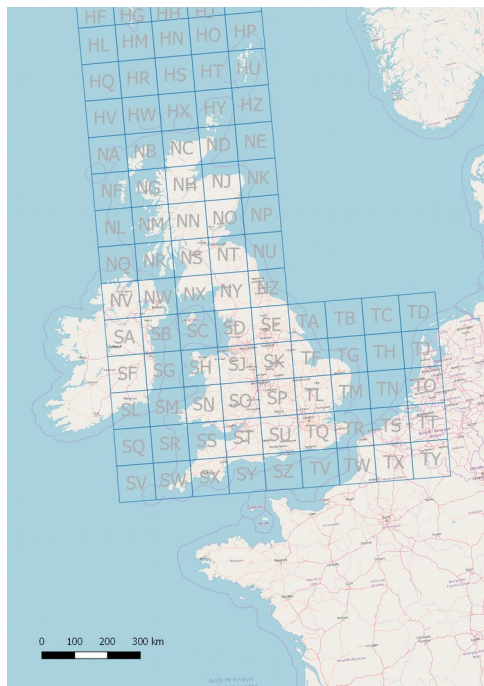- **Layers**
- **Projections**
- **Grid References**

Layers

- **Data is held in set of ordered layers (a project)**
  - Crucial for map making
  - 'Painter's Algorithm'
- **Each of a consistent type**
  - Points, lines, areas etc
  - One to many elements
- **Layers can be styled**

- **Vector layers are attributed**
  - Basically tabular data
- **Layers can be filtered**
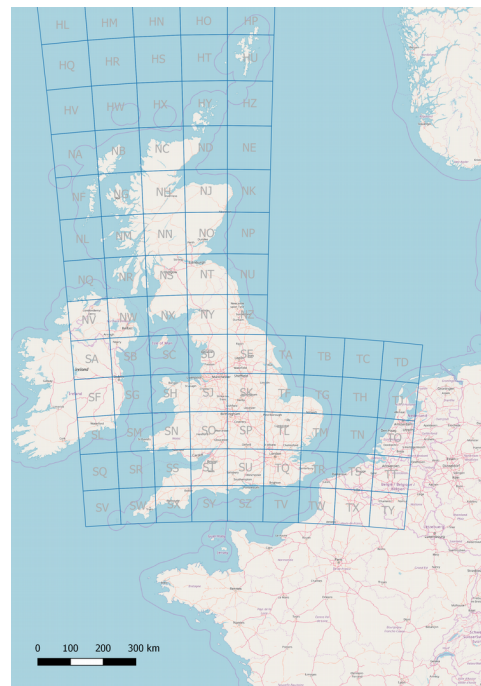 - Vectors by attributes
  - Rasters by pixel values

Projections

OSGB (27700) OS*i*/OSNI (29002) Webmaps (3857) WGS84 (4326)

Showing 100k grid squares of British Grid. Numbers in brackets are EPSG references)

GIS & Grid References: A WARNING

- **GIS Software is designed to work with hundreds of different projections.**

- **It deals in x & y co-ordinates as numeric values**

- **Classic grid references will not be interpreted as locations**
  - Exceptionally the FSC tools do know about OSGB GRs.

- **100km Grid Squares also have numeric x,y co-ordinates at their origin (SJ is 300 000, 300 000; C is 400 000, 200 000)**

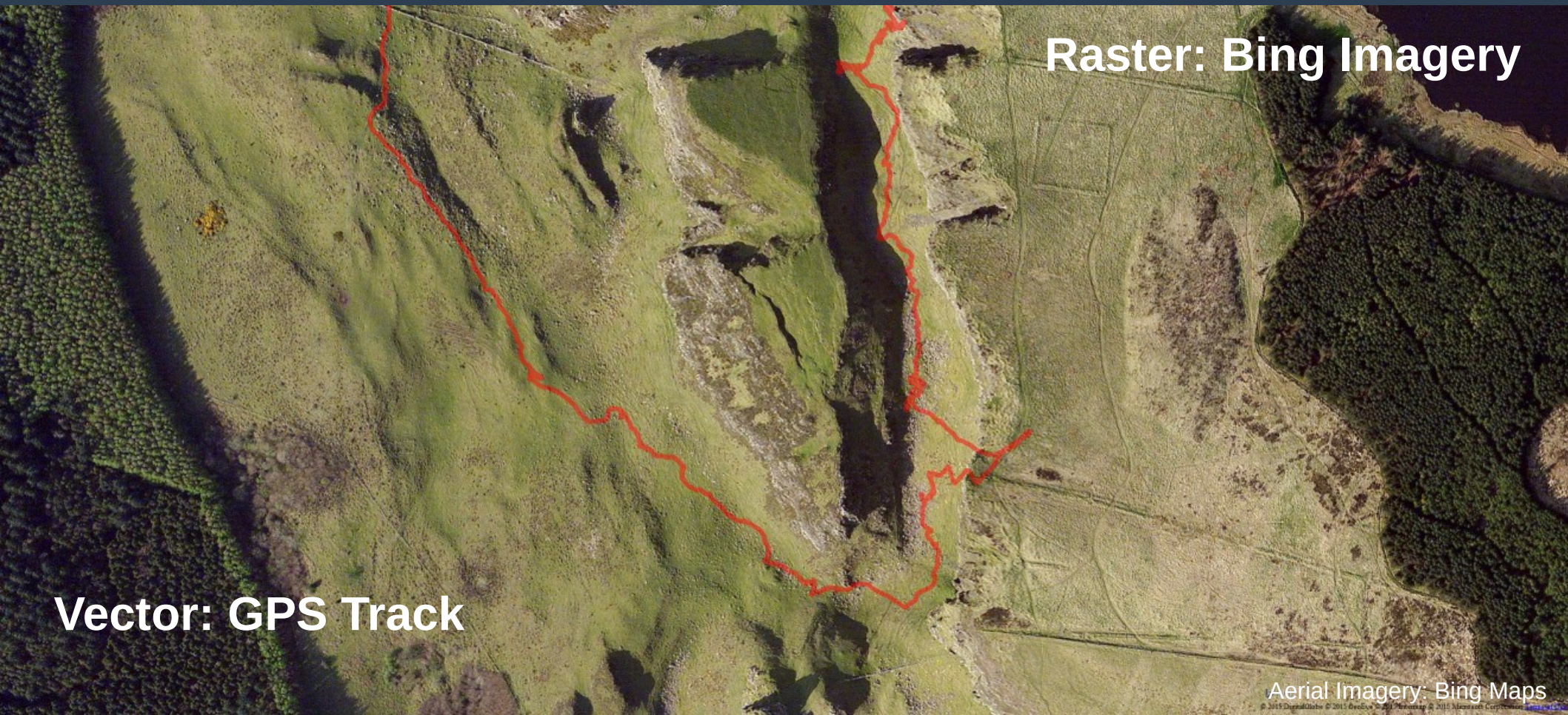- **Files of GIS data for monads, tetrads, hectads are useful.**

Types of Data

Vector

- Points, lines, areas etc.

- Available as data (files) or services
- Many file formats:
  - **Shapefiles**
  - MapInfo
  - GPX (GPS), KML (Google Earth)
  - Geojson
  - **CSV** with co-ordinates

Raster

- 2D array of pixels or other data
- Associated information about the area covered ('georeferenced')
  - Internal to data (GeoTIFF)
  - External 'world' file
- Each pixel represents a given area on the ground
  - e.g. imagery: 30m Landsat 25 cm Google, 3 cm drone.
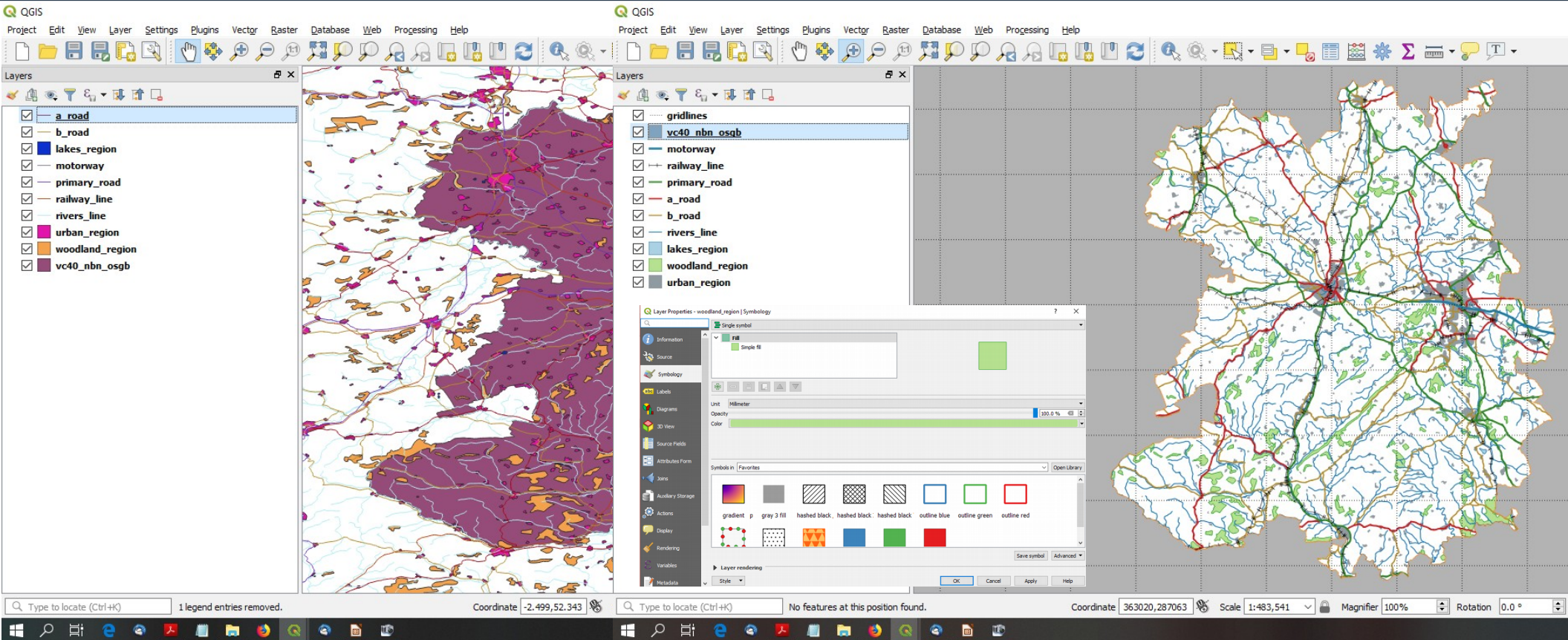
Types of Data

Raster: Bing Imagery

Vector: GPS Track

Aerial Imagery: Bing Maps

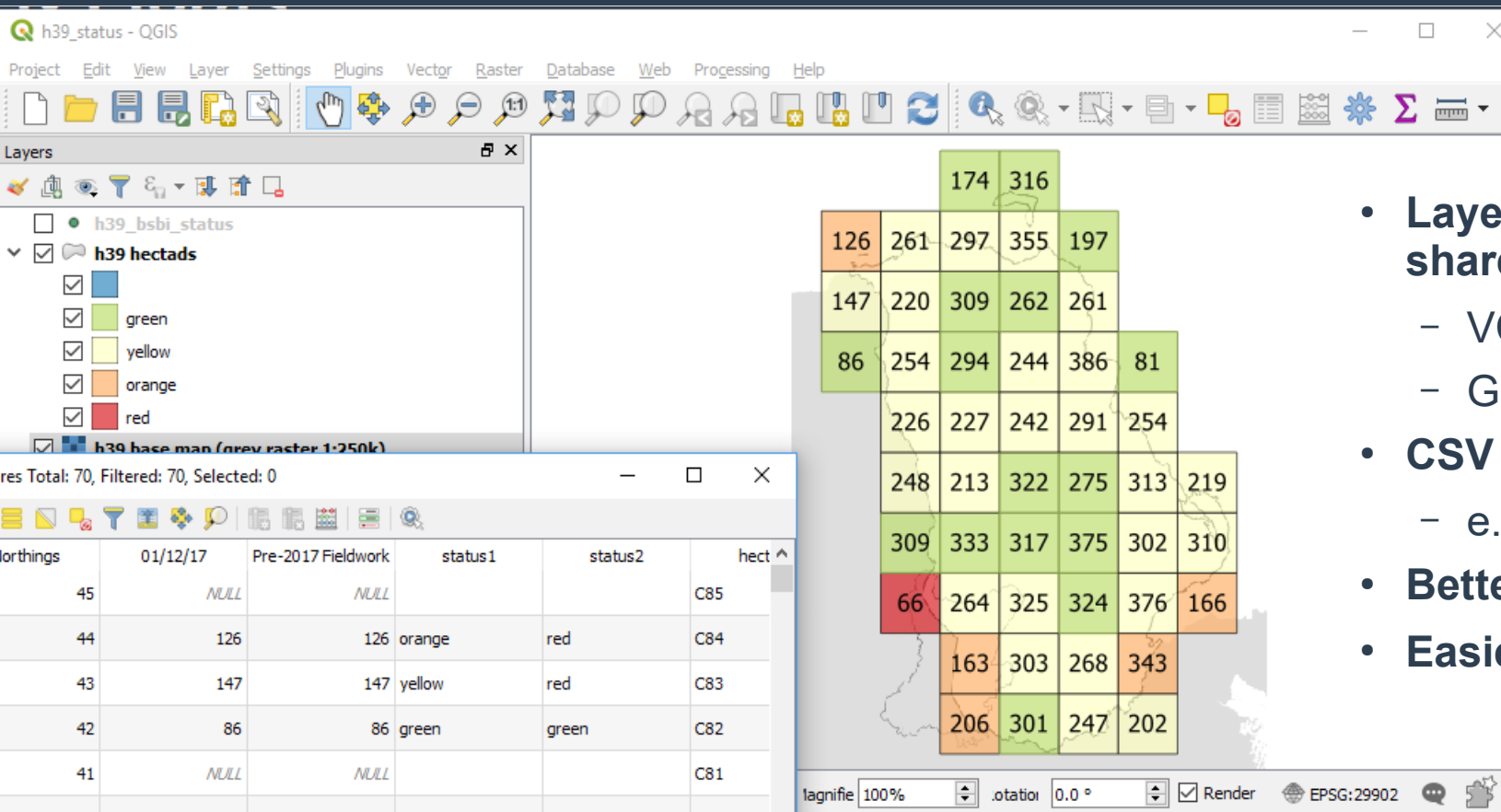# Basic Tasks in QGIS

Map data © OpenStreetMap Contributors 2017

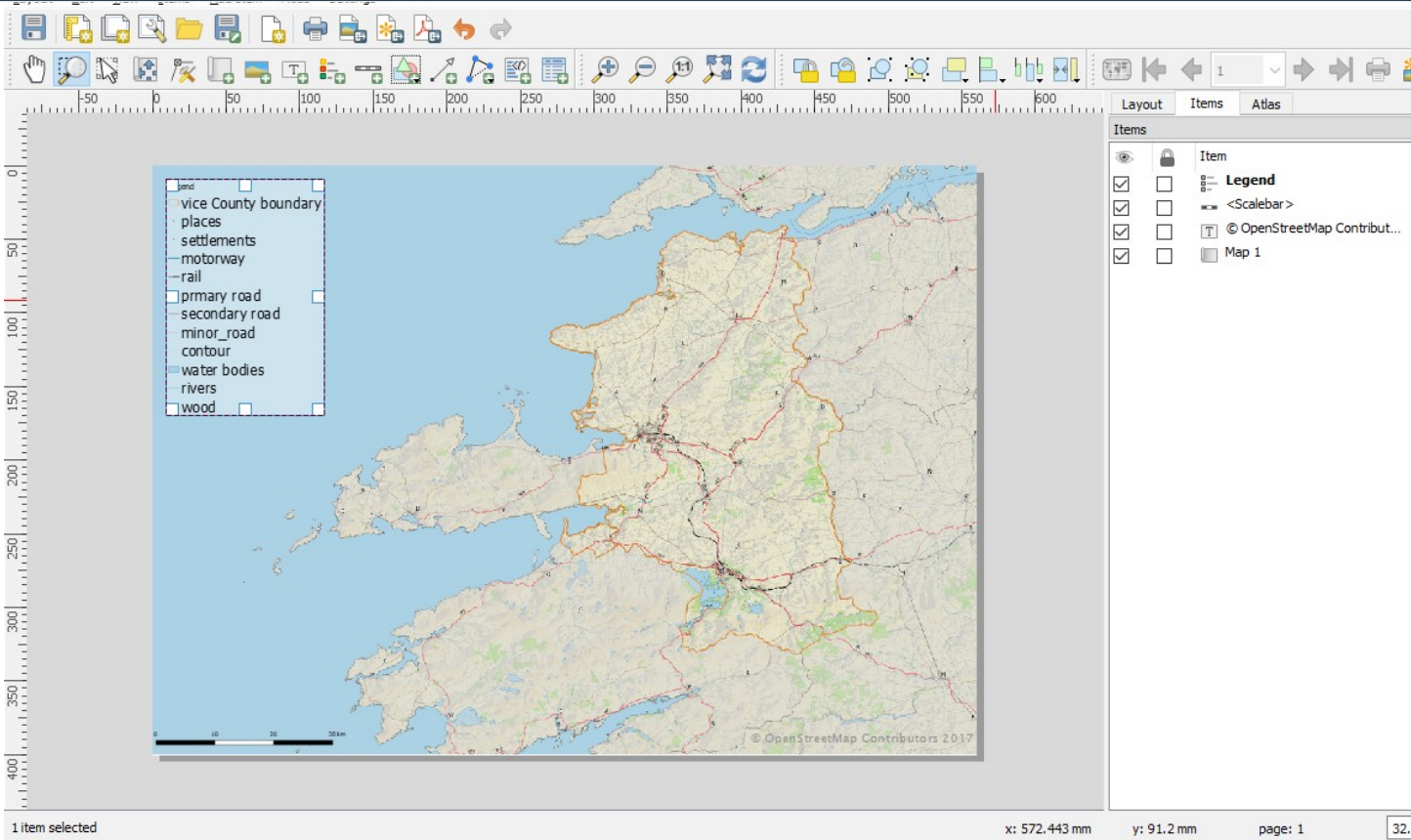# QGIS Basics: Creating a simple VC base map
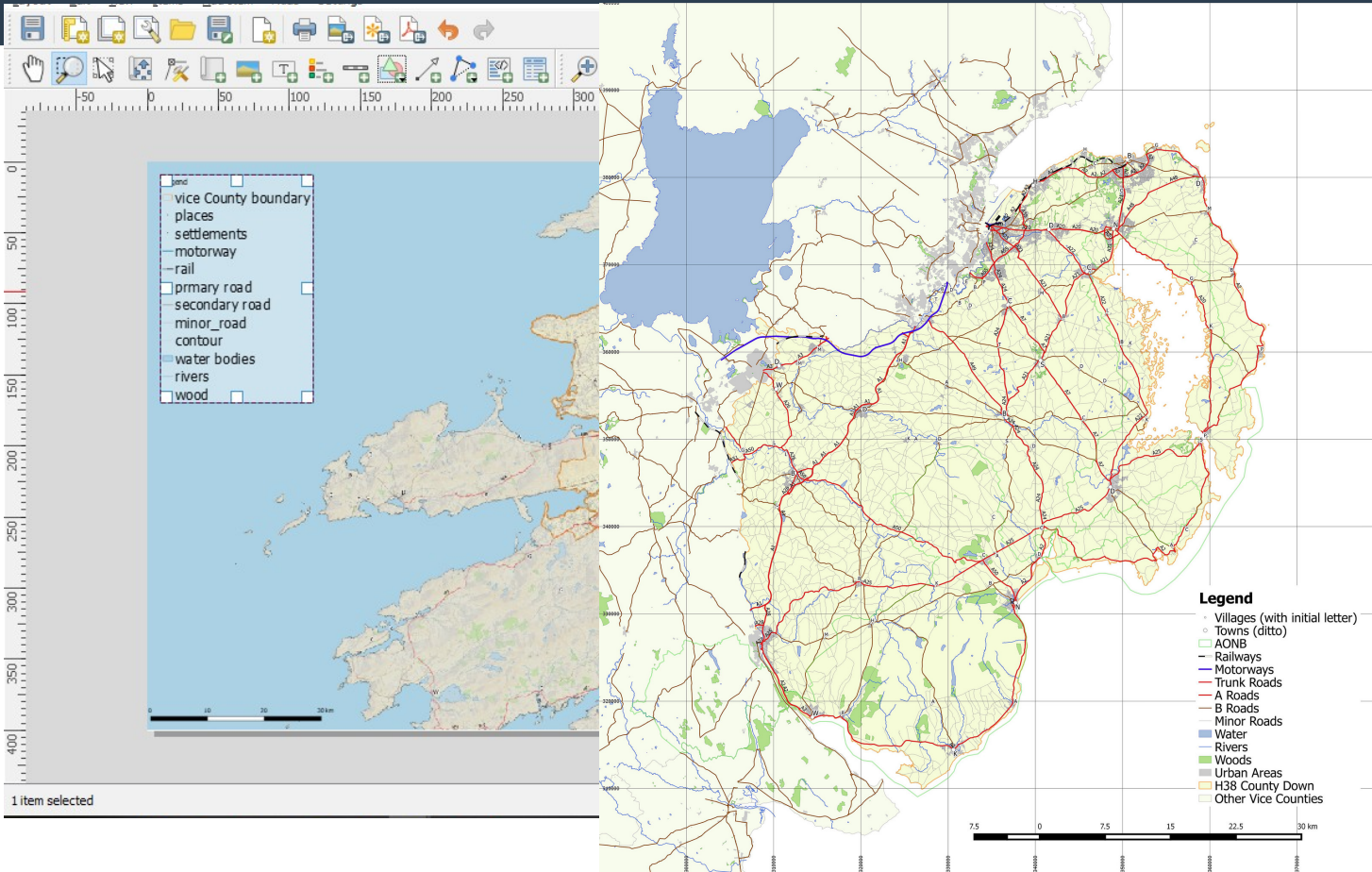
QGIS Basics: Progress Reporting

- **Layers can be linked on a shared attribute**
  - VC Number
  - Grid Square name
- **CSV or S/s data as a layer**
  - e.g., from MapMate
- **Better quality reporting**
- **Easier to maintain**

QGIS Basics: Print (& other output) Layout

- **Like a drawing package**
- **Layout elements**
  - 1 or more maps (e.g., Shetland in a box)
  - Map furniture (scale, legend, title, N arrow, grids, copyright)
- **Control styling**
- **Scale & bounds**
- **Templates**
- **Output size**
- **Output formats**
  - Image, SVG, PDF

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Resources & Learning More

- **Today**
  - I'm here all day for queries/demos/workshop sessions
- **DVD with Open Data & QGIS Installation**
  - Copies with Louise & Country Reps
- **Video showing principles in action**
  - https://vimeo.com/271445019 (~ 10 minutes, no commentary)

- **Maps for MapMate**
  - Ireland only at present (on DVD)
  - Other VCs & alternative styles by request
-

Maps & Floras

- … new Flora of Sussex ... arrived … so I looked for a map to refresh my memory of locations … surely a decent map is a prerequisite of a county Flora?

- **David Pearman**
  letter in *BSBI News* Sept 2018 *p.* 80.

- This vast tome, measuring 7cm thick and weighing several kilograms, sets out to be 'the first post-modernist county flora' ….On the other hand, the normally obligatory distribution maps are dispensed with. In the author's view, dot maps are insufficiently detailed …

- **Peter Marren's review of Mick Crawley's *Flora of Berkshire.***
  British Wildlife, December 2005

Supplementary Slides

Data: Open Data Portals

- **Great Britain**
  - OS(GB) Open Data
  - BGS
- **England**
  - Natural England
  - Environment Agency
- **Wales**
  - Natural Resources Wales

- **Scotland**
  - SNH
- **Northern Ireland**
  - OSNI Open Data https://www.nidirect.gov.uk/services/osni-open-data-portal
- **Republic of Ireland**
  - OSI Open Data https://data-osi.opendata.arcgis.com/
- **EEA**
- **OpenStreetMap**
  - Geofabrik Download server
  - Overpass-Turbo
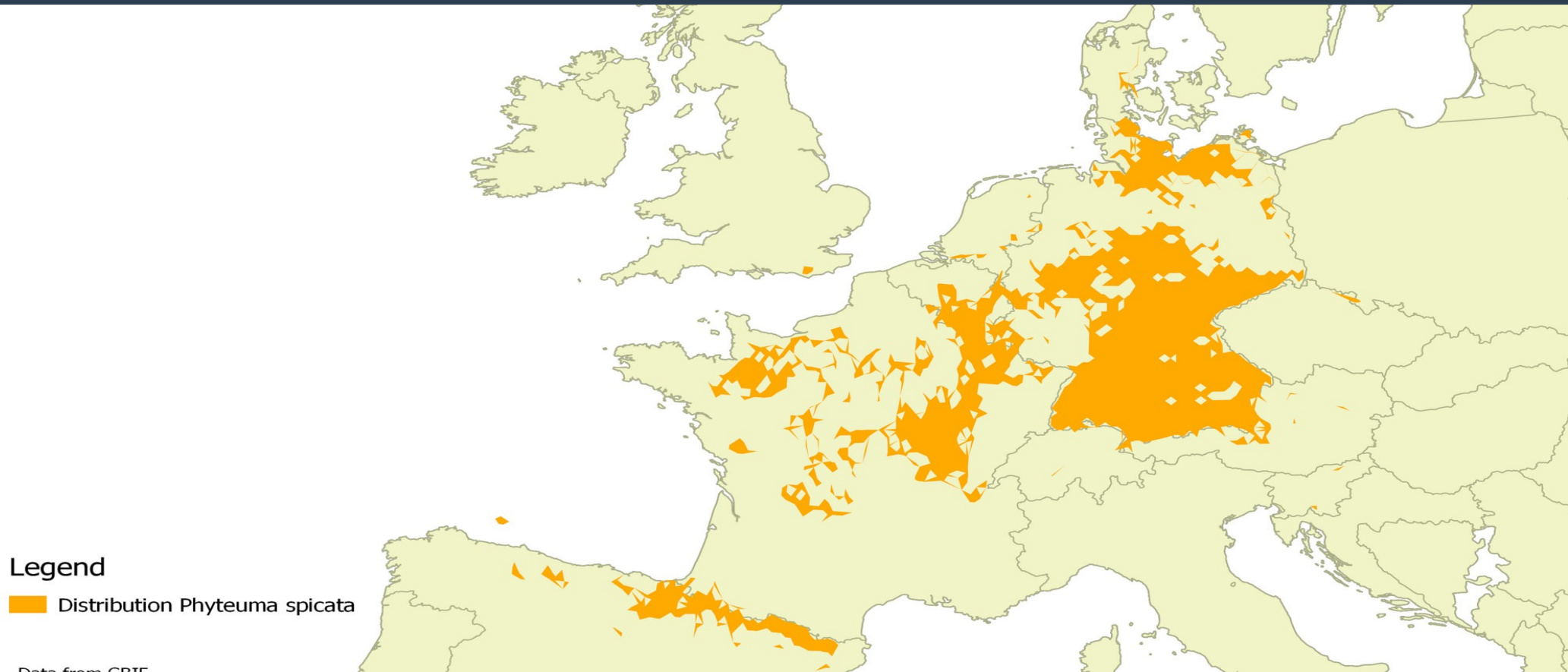
Examples of Vector Data

- **Plant records!**

- **Boundaries:**
  - Vice Counties
  - SSSI/ASSI, NNR/LNR, etc
  - Administrative
- **Habitats**
  - CCW Phase 1 for Wales
  - NVC mapping SNH
  - NE Priority Habitats
- **Landuse/landcover**
  - EEA Corine
- **General geographical features**
  - Roads
  - Waterways (centre lines & areas)
  - Woods
  - Place names

- **2D array of pixels or other data**

- **Pictures (scans of maps)**
- **Many web maps**
- **Aerial & Satellite Imagery**
- **Elevation models**
- **Map 'tiles' (web maps)**

Examples of Raster Data

- **Pictures**
  - Old maps
- **Many web maps**
- **Aerial & Satellite Imagery**
- **Elevation models**
- **Map 'tiles' (web maps)**

- **2D array of pixels or other data**

- **Pictures (scans of maps)**
- **Many web maps**
- **Aerial & Satellite Imagery**
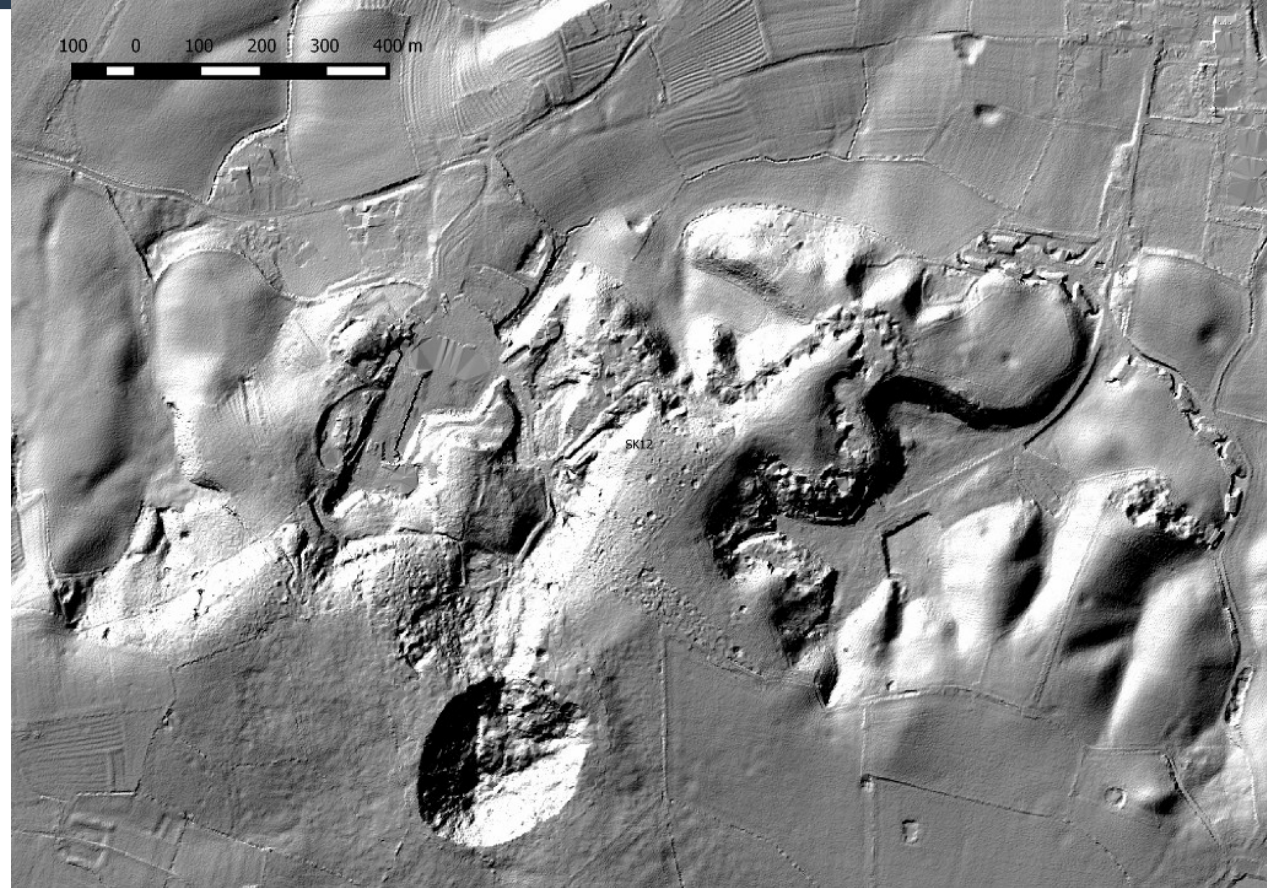- **Elevation models**
- **Map 'tiles' (web maps)**

Gallery of Examples

Legend
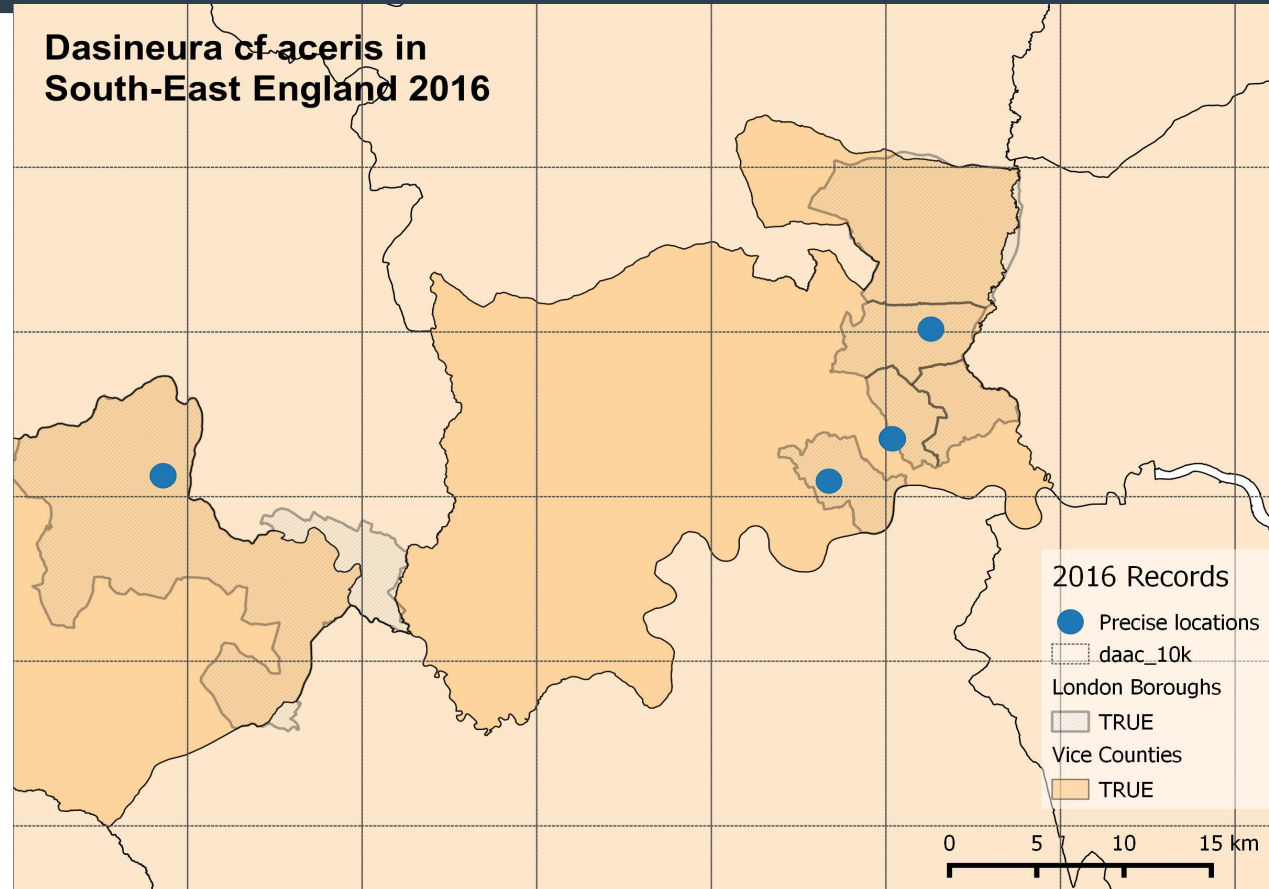
⬛ Distribution Phyteuma spicata

Data from GBIF

Fauld Crater, Digital Surface Model

- **Created from Environment Agency Lidar**

- **Use Raster Hillshade option**

- **Crater(s) caused by explosion in ordnance store in old gypsum mine 1944,**
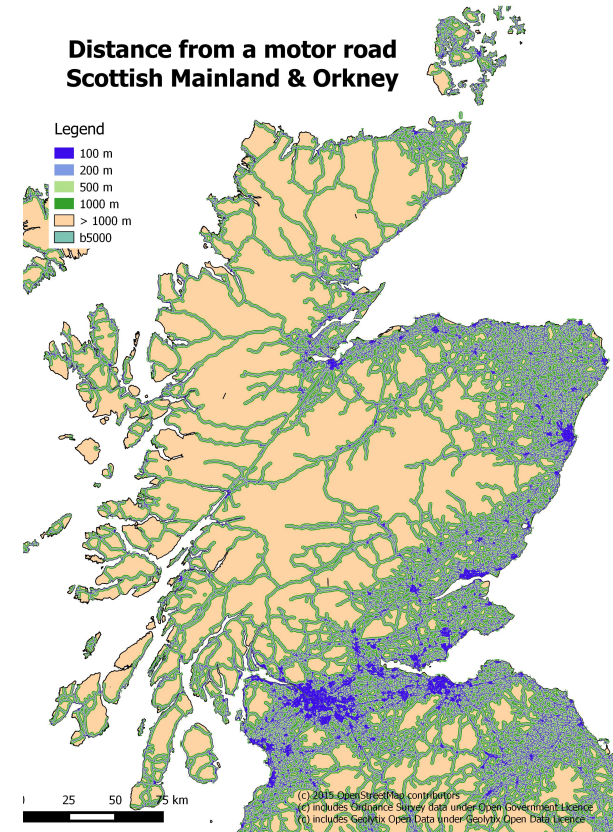
Gall new to B&I: Dasineura cf aceris

- **CSV file of records (lat/lon, vc, local auth, recorder)**

- **Combined with**
  - NBN VC shapes
  - OS Boundary Line shapes

Dasineura cf aceris in
South-East England 2016

2016 Records
- Precise locations
- daac_10k

London Boroughs
- TRUE

Vice Counties
- TRUE

0   5   10   15 km
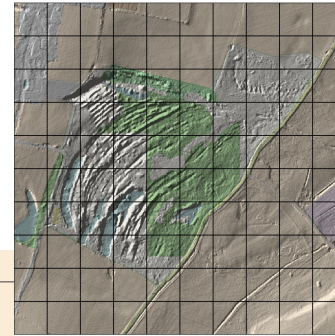
Distance of places from nearest road

- **Prepared for Hugh Warwick**
  - Author of *Edgescapes*
  - Hedgehog expert/enthusiast
  - By chance we have a mutual friend
- **Use road shape (from OpenStreetMap)**
  - Buffer roads by increasing distances
  - Overlay areas so that smaller distances are on top.

Distance from a motor road
Scottish Mainland & Orkney

Legend
- 100 m
- 200 m
- 500 m
- 1000 m
- > 1000 m
- b5000

25   50   75 km

(c) 2015 OpenStreetMap contributors
(c) includes Ordnance Survey data under Open Government Licence
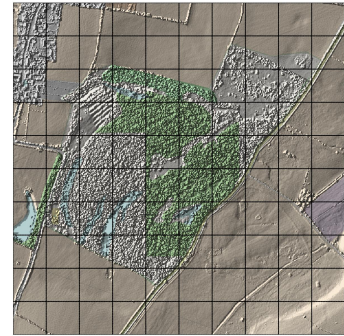(c) includes Geolytix Open Data under Geolytix Open Data Licence

Ufton Fields Nature Reserve, VC38

- **Prepared for me & Coventry NHS**
  - Gall recording field meeting
  - Share detailed location finds
- **Use :**
  - OpenStreetMap base map
  - EA Lidar data
  - Contours from Lidar data
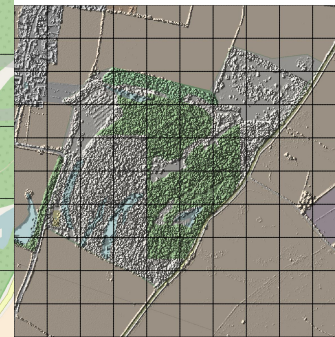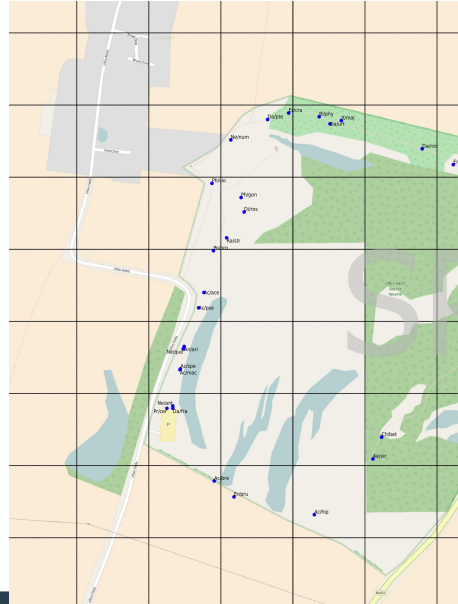 - Grid overlay in composer
  - Composer for layout

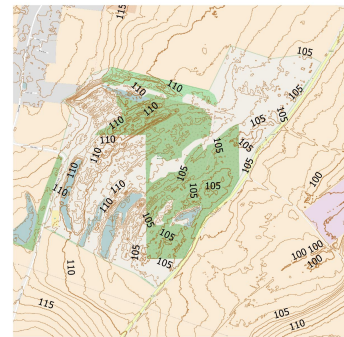**Ufton Fields Nature Reserve:
Environment Agency Lidar Data**

Hill-shaded Digital Terrain Model DTM).
This shows the pattern of workings well. Useful for assessing where damper patches of ground may exist.

Hill-shaded Digital Surface Model (DSM).
This shows the elevation of surface features (buildings, hedges, walls & vegetation). As much of Ufton Fields is wooded this is ot so easy to interpet.

Hill-shaded difference between DSM & DTM.
By subtracting the ground elevation from the surface elevation this now shows the relative heights of man made and natural features above ground.

Contours derived from DTM.
Contours at 1 metre interval were extracted from the DTM and are plotted here with 5 and 10 m contours shown more strongly. Similar contours can be extracted from other

(c) OpenStreetMap contributors (base map) and Crown Copyright 2017 (Lidar data)

Birmingham Street Trees, VC38

- **Prepared for me**

  - Check sample of trees in Birmingham open data

  - 1% sample (180ish)

    - Centre of city
    - QEH/University, Edgbaston

- **Data use :**

  - OpenStreetMap base map

  - Trees from Birmingham council

  - Quick colour coding by species/taxon

Birch species distribution: Polar Projection

- **Prepared for me**
  - *Semudobia* spp.
    - Galls in catkins & fruits
    - Cryptic spp?
- **Data use :**
  - AFE maps
    - Areas digitised
  - Polar projection
  - Print Layout

Legend

Betula humilis

 Betula humilis

Betula nana

 Betula nana

Betula pubescens

 Betula pubescens

Betula pendula

 Betula pendula

 betula_nana_ex_senhm_3411d

Distribution of Betula spp. (ex Atlas Flora Europeae,USGS) displayed in a circumpolar projection