NATURAL HISTORY MUSEUM

Phenology of UK Plants
Orchids and Zooniverse

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Department of Life Sciences
Natural History Museum

Agrimonia eupatoria

Robbirt *& al.* 2011 and UK specimens of *Ophrys sphegodes* Mill

Journal of Ecology

Journal of Ecology 2011, **99**, 235–241 doi: 10.1111/j.1365-2745.2010.01727.x

Validation of biological collections as a source of phenological data for use in climate change studies: a case study with the orchid *Ophrys sphegodes*

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Summary

1. The scarcity of reliable long-term phenological data has severely hindered the study of the responses of species to climate change. Biological collections in herbaria and museums are potential sources of long-term data for such study, but their use for this purpose needs independent validation. Here we report a rigorous test of the validity of using herbarium specimens for phenological studies, by comparing relationships between climate and time of peak flowering derived from herbarium records and from direct field-based observations, for the terrestrial orchid *Ophrys sphegodes*.

2. We examined herbarium specimens of *O. sphegodes* collected between 1848 and 1958, and recorded peak flowering time directly in one population of *O. sphegodes* between 1975 and 2006. The response of flowering time to variation in mean spring temperature (March–May) was virtually identical in both sets of data, even though they covered different periods of time which differ in extent of anthropogenic temperature change. In both cases flowering was advanced by *c.* 6 days per °C rise in average spring temperature.

3. The proportion of variation in flowering time explained by spring temperature was lower in the herbarium record than in direct field observations. It is likely that some of the additional variation was due to geographical variation in collection site, as flowering was significantly earlier at more westerly sites, which have had warmer springs, over their range of 3.44° of longitude.

4. Predictions of peak flowering time based on the herbarium data corresponded closely with observed peak flowering times in the field, indicating that flowering response to temperature had not altered between the two separate periods over which the herbarium and field data were collected.

5. *Synthesis.* These results provide the first direct validation of the use of herbarium collections to examine the relationships between phenology and climate when field-based observational data are not available.

Key-words: biological collections, climate change, flowering time, herbarium specimens, natural history collections, *Ophrys sphegodes*, Orchidaceae, phenology, spring, temperature

Introduction

Phenological events respond directly to climate. Recent climate change has undoubtedly affected the timing of development and seasonal events in many groups of organisms, including amphibians (Beebee 1995), birds (Crick *et al.* 1997), fungi (Kauserud *et al.* 2008) and plants (Sparks & Carey 1995; Fitter & Fitter 2002). Understanding the effects of recent climate change is a vital step towards predicting the consequences of future change. Moreover, only by elucidating the responses of individual species will we be able to predict the potentially disruptive effects of accelerating climate change on species interactions.

Detecting phenological trends in relation to long-term climate change is not straightforward. Because trends can be concealed by short-term inter-annual climate variation

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NHM Origins and Evolution Initiative: UK Phenology Project

- 20,000 herbarium sheets imaged and transcribed
- Volunteer contributed taxonomic revision, morphometric and plant/insect pollinator data compiled
- Extension of volunteer work to extract additional phenology data from other UK museums and botanic gardens
- 7,000 herbarium sheets curated and mounted
- Collaboration with BSBI/Herbaria@Home
- Preliminary analyses of orchid phenology underway

Robbirt *& al.* (2011) . Validation of biological collections as a source of phenological data for use in climate change studies: a case study with the orchid *Ophrys sphegodes*. *J. Ecol.*

Brooks, Self, Toloni & Sparks (2014). Natural history museum collections provide information on phenological change in British butterflies since the late-nineteenth century. *Int. J. Biometeorol.*

Johnson *& al.* (2011) Climate Change and Biosphere Response: Unlocking the Collections Vault. *Bioscience*.

Specimens of *Gymnadenia conopsea* (L.) R.Br

Orchid Observers

Phenology of UK Plants
Orchids and Zooniverse

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Natural History Museum

ZOONIVERSE

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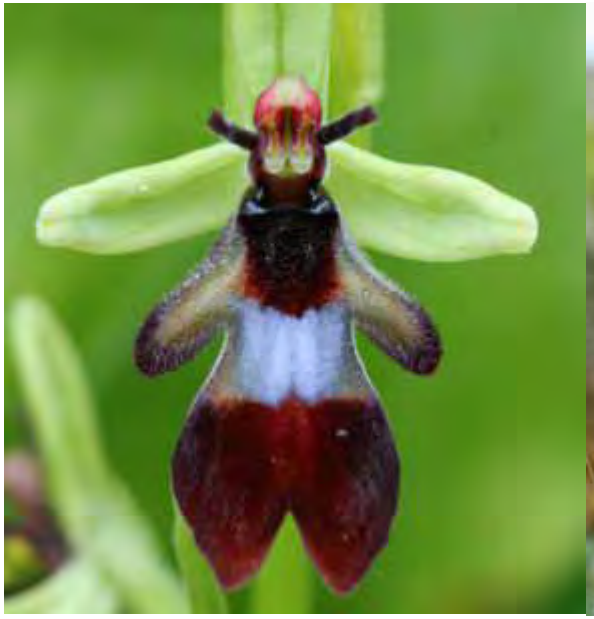
56 species of wild orchid in the UK

29 taxa selected for this study

Anacamptis morio
Anacamptis pyramidalis
Cephalanthera damasonium
Coeloglossum viride
Corallorhiza trifida
Dactylorhiza fuchsii
Dactylorhiza incarnata
Dactylorhiza maculata
Dactylorhiza praetermissa
Dactylorhiza purpurella
Epipactis palustris
Goodyera repens
Gymnadenia borealis
Gymnadenia conopsea
Gymnadenia densiflora
Hammarbya paludosa
Herminium monorchis
Neotinea ustulata
Neottia cordata
Neottia nidus-avis
Neottia ovata
Ophrys apifera
Ophrys insectifera
Orchis anthropophora
Orchis mascula
Platanthera bifolia
Platanthera chlorantha
Pseudorchis albida
Spiranthes spiralis



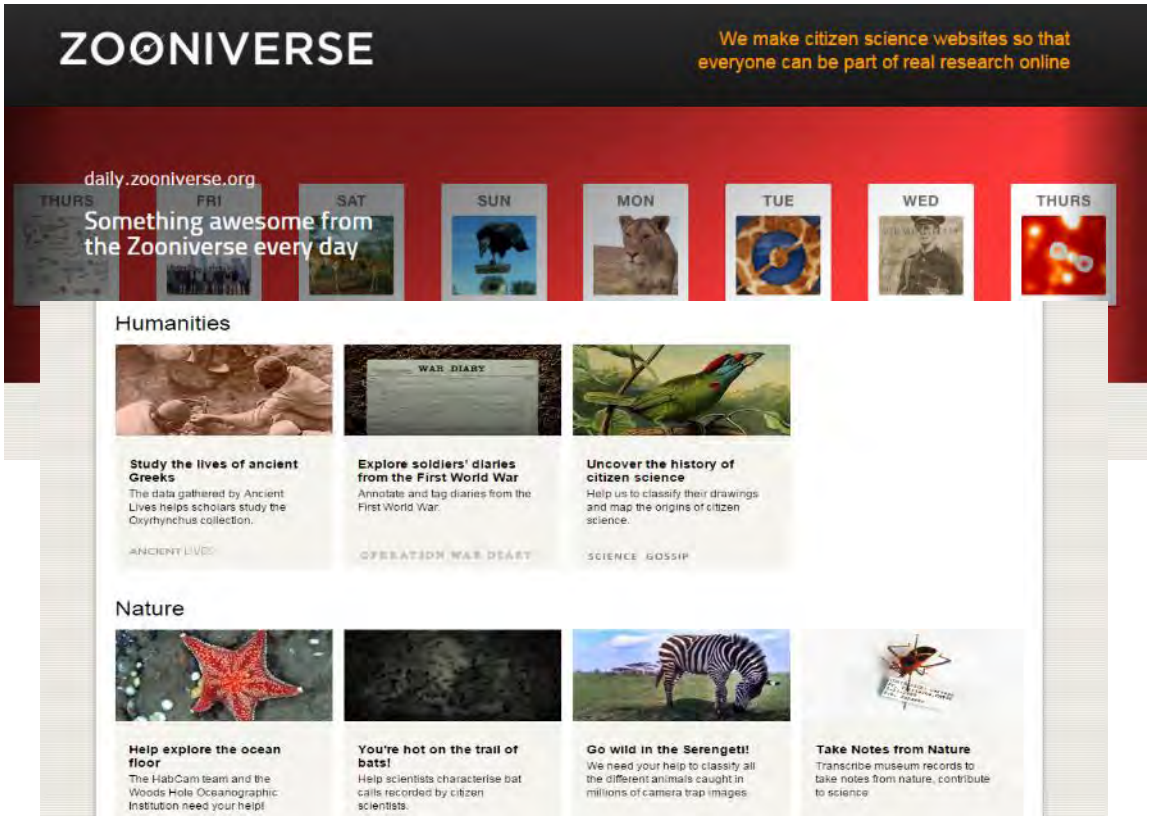
Fly orchid (*Ophrys insectifera*)

Participants:

1. **Online – classification**
   Classify museum specimens

2. **In the field – gathering new data**
   Find and photograph orchids in flower

3. **Online – classification**
   Classify field images



The Zooniverse is a collection of web-based citizen science projects that use the efforts and ability of volunteers to help scientists and researchers deal with the flood of data that confronts them.

1,312,121 people taking part worldwide

Space

[Radio Galaxy Zoo]

[Disk Detective]

[Planet Hunters]

[Galaxy Zoo]

[The Milky Way Project]

[Planet Four]

Natural World

[Snapshot Serengeti]

[Floating Forests]

[Penguin Watch]

[Cyclone Center]

[Plankton Portal]

[Condor Watch]

Humanities

[Old Weather]

[Operation War Diary]

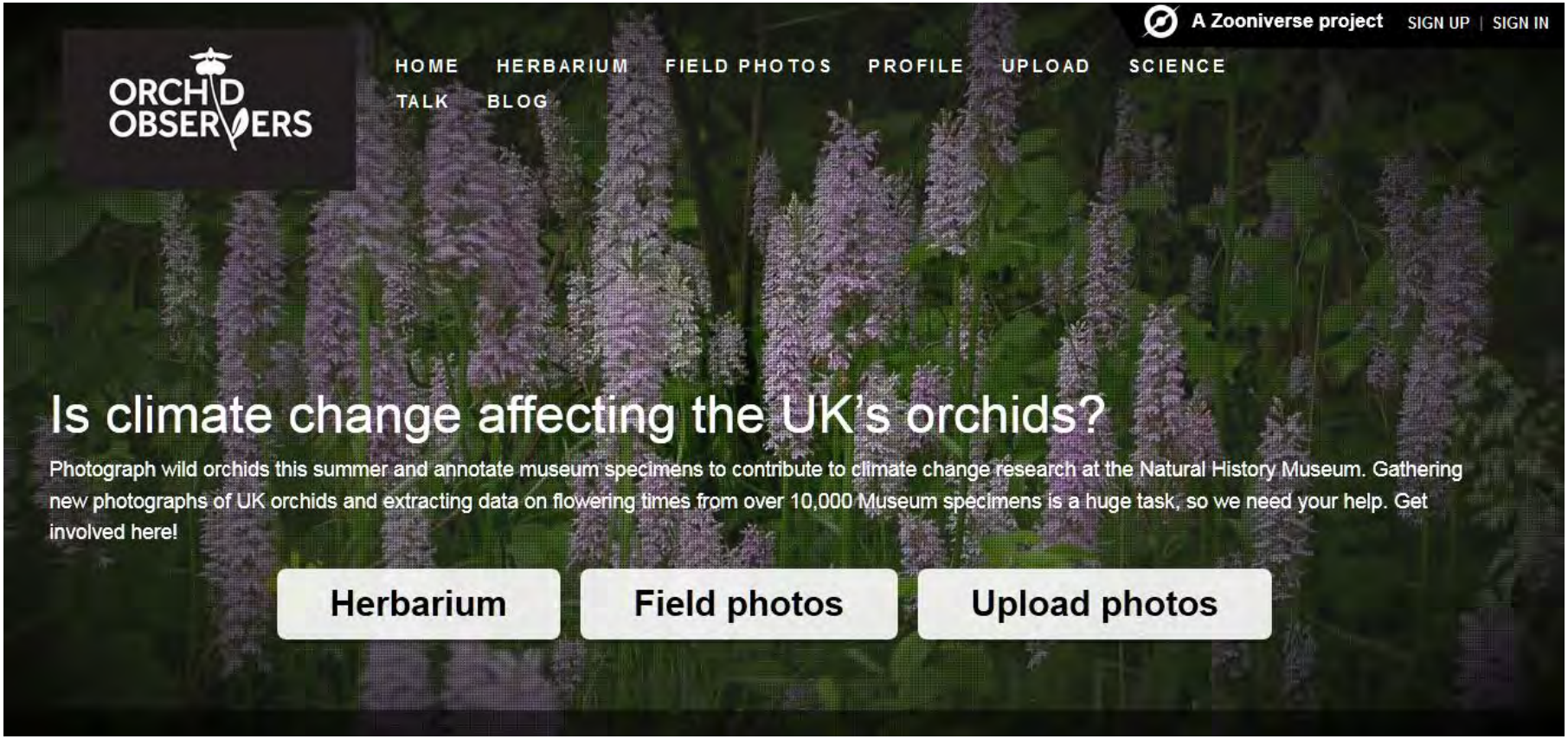
[Notes from Nature]

[Ancient Lives]

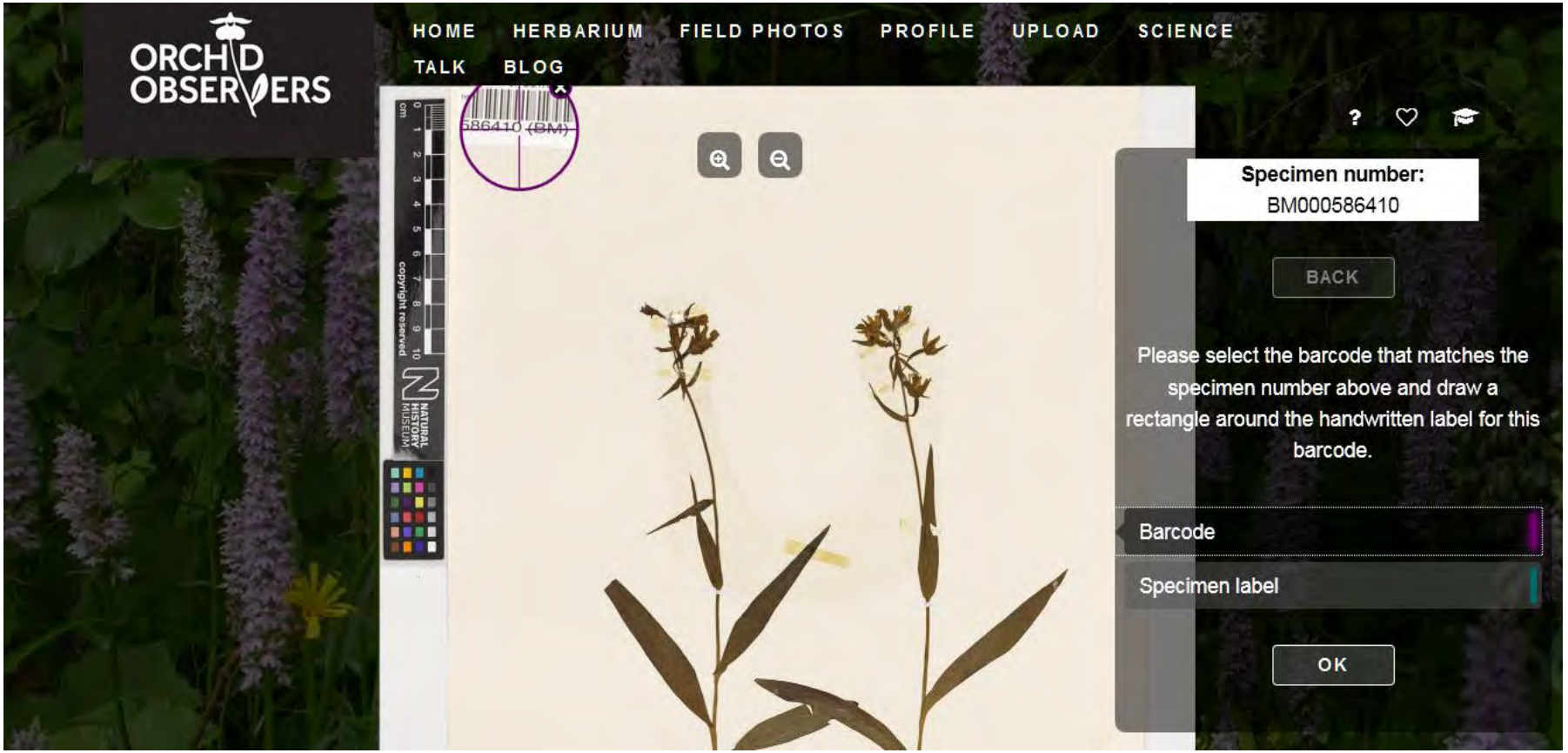
Biology & Physics

[Worm Watch Lab]

[Cell Slider]


A Zooniverse project
SIGN UP | SIGN IN
ORCHID OBSERVERS
HOME
HERBARIUM
FIELD PHOTOS
PROFILE
UPLOAD
SCIENCE
TALK
BLOG
Is climate change affecting the UK's orchids?
Photograph wild orchids this summer and annotate museum specimens to contribute to climate change research at the Natural History Museum. Gathering new photographs of UK orchids and extracting data on flowering times from over 10,000 Museum specimens is a huge task, so we need your help. Get involved here!
Herbarium
Field photos
Upload photos

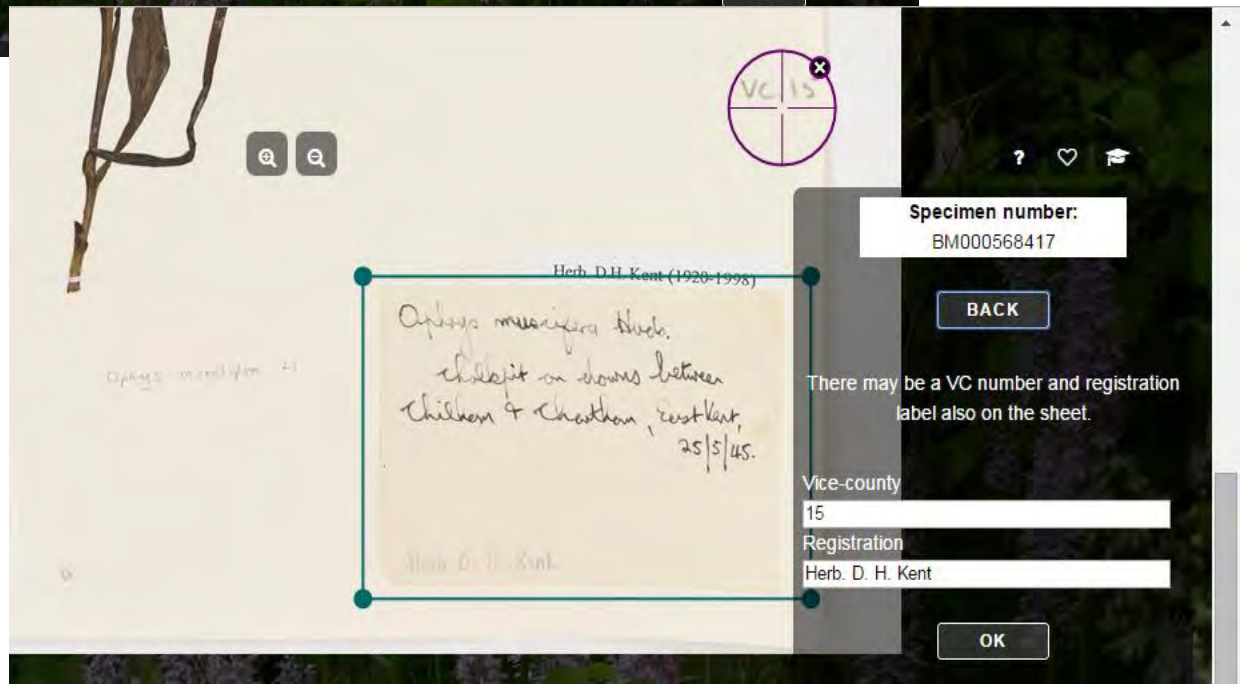
Herbarium



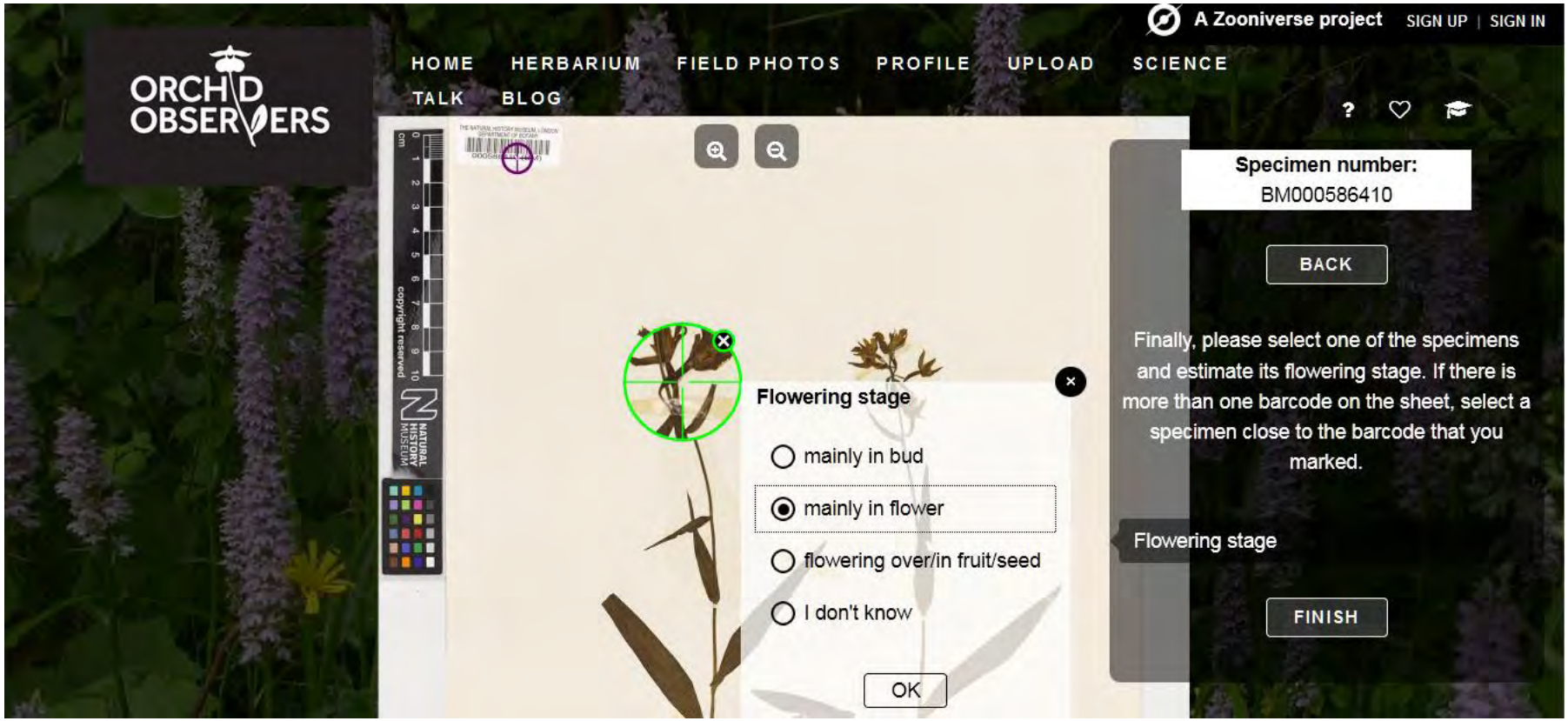
- Over 10,000 digitised herbarium sheets

Herbarium


ORCHID OBSERVERS
HOME
HERBARIUM
FIELD PHOTOS
PROFILE
UPLOAD
SCIENCE
TALK
BLOG
kathcas79
SIGN OUT
Herb. D.H. Kent (1920-1998)
Ophrys insectifera Linn.
chalkpit on downs between
Chilham & Chartham, East Kent,
25/5/45.
Herb D. H. Kent.
Specimen number:
BM000568417
BACK
Verify the written specimen label
Species
Ophrys insectifera L.
Date
25/05/1945
Locality
Downs between Chilham and Chatham
Label comments
Habitat: chalkpit
OK


VC 15
Herb. D.H. Kent (1920-1998)
Ophrys insectifera Linn.
chalkpit on downs between
Chilham & Chartham, East Kent,
25/5/45.
Specimen number:
BM000568417
BACK
There may be a VC number and registration label also on the sheet.
Vice-county
15
Registration
Herb. D. H. Kent
OK

Herbarium


ORCHID OBSERVERS
A Zooniverse project
SIGN UP | SIGN IN
HOME
HERBARIUM
FIELD PHOTOS
PROFILE
UPLOAD
SCIENCE
TALK
BLOG
Specimen number:
BM000586410
BACK
Finally, please select one of the specimens and estimate its flowering stage. If there is more than one barcode on the sheet, select a specimen close to the barcode that you marked.
Flowering stage
FINISH
Flowering stage
mainly in bud
mainly in flower
flowering over/in fruit/seed
I don't know
OK
copyright reserved
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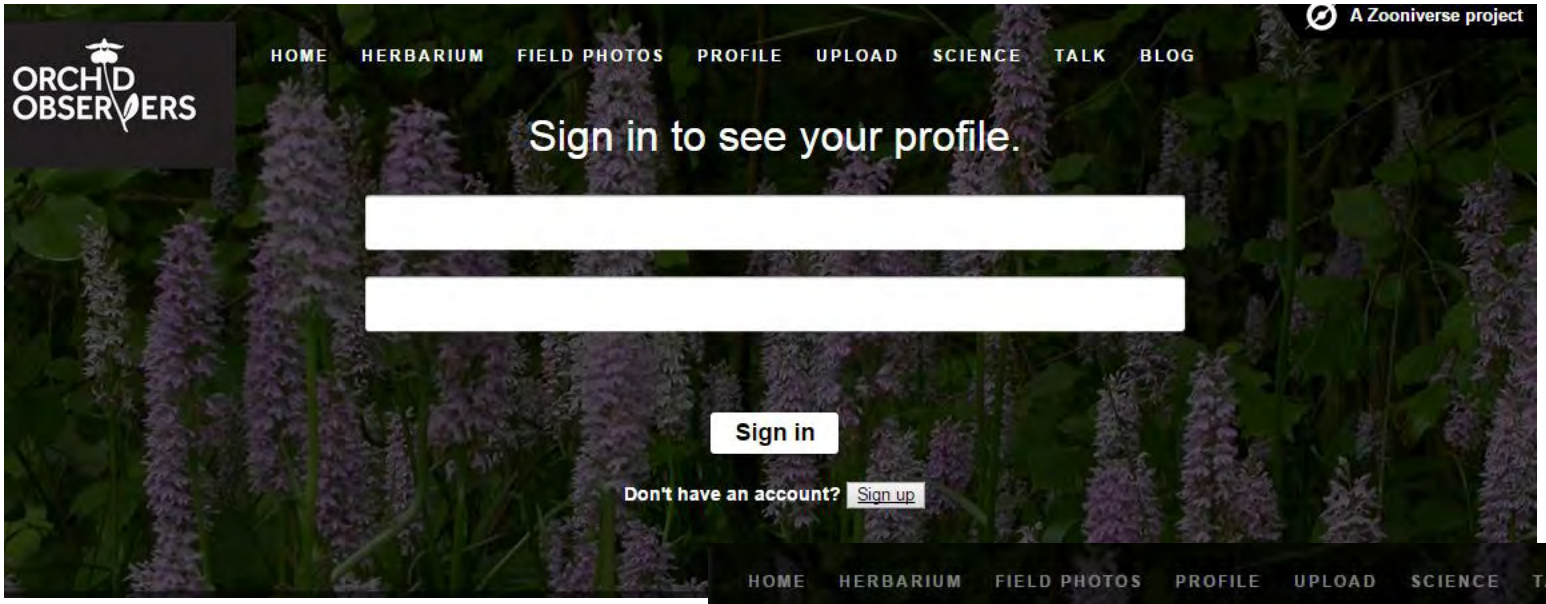
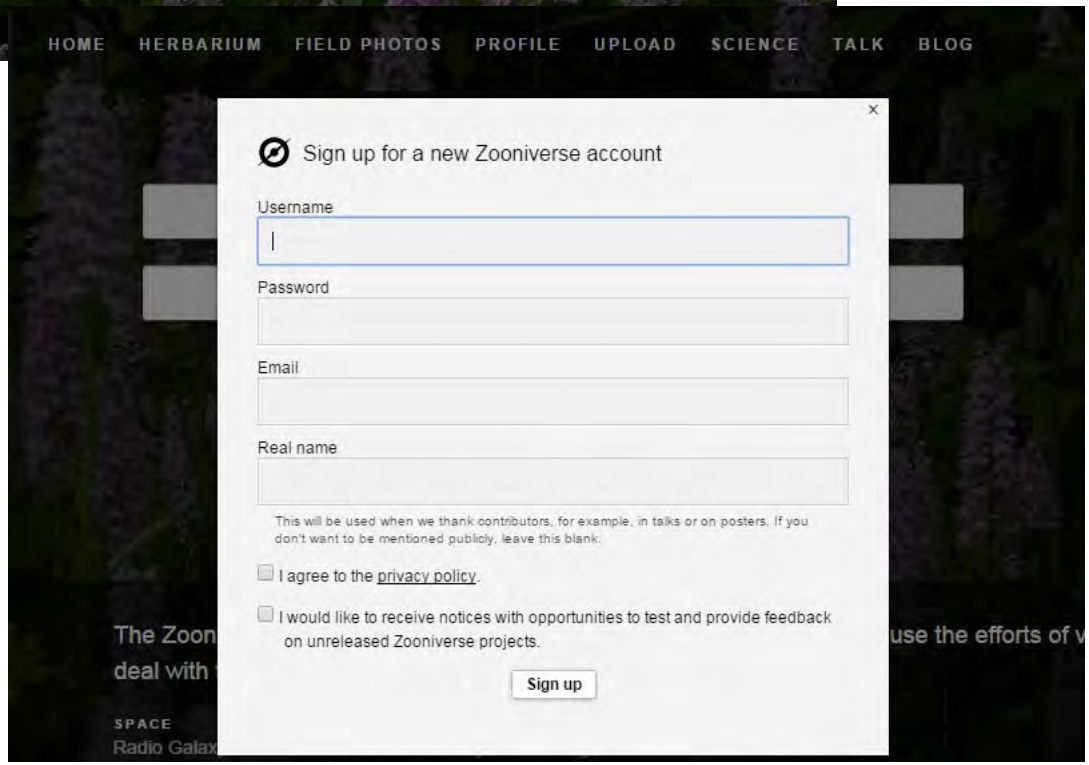
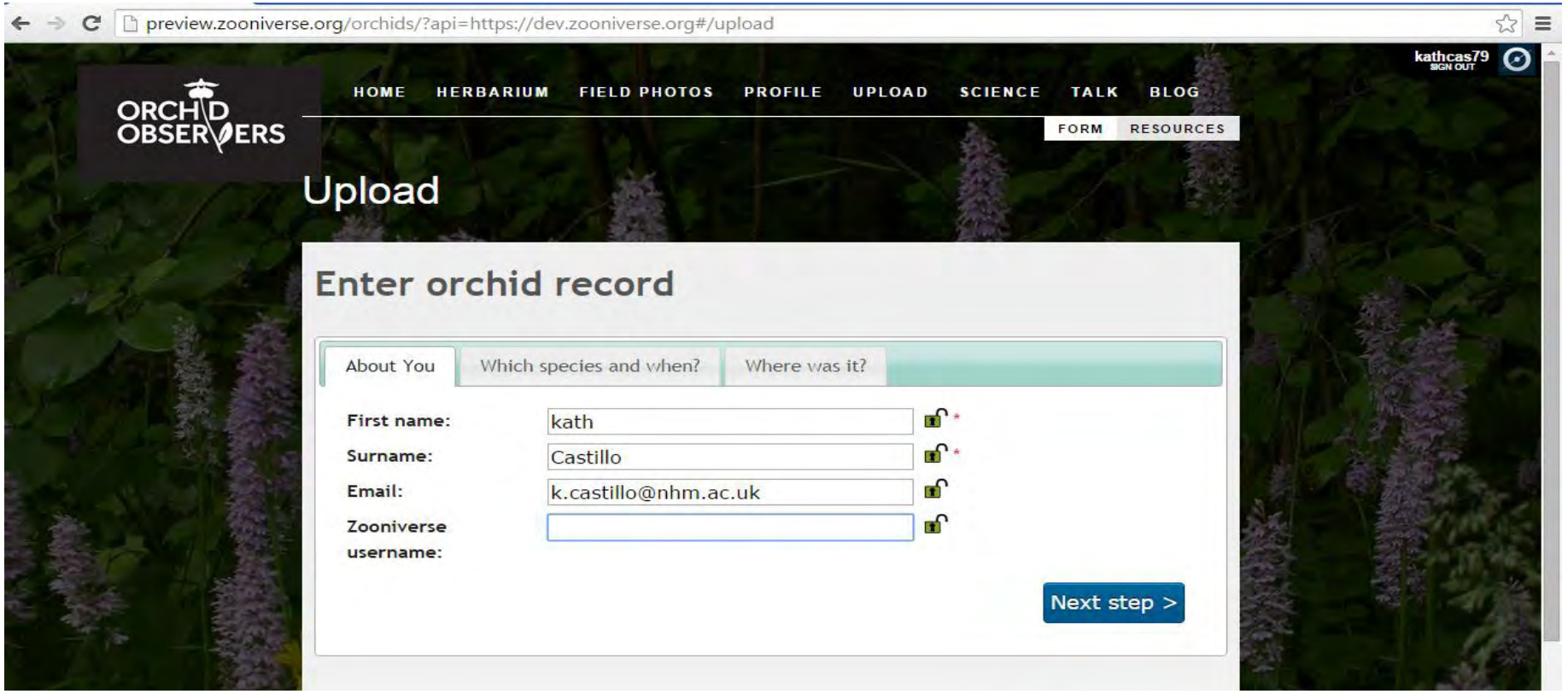




- Sign up on the website to upload photos

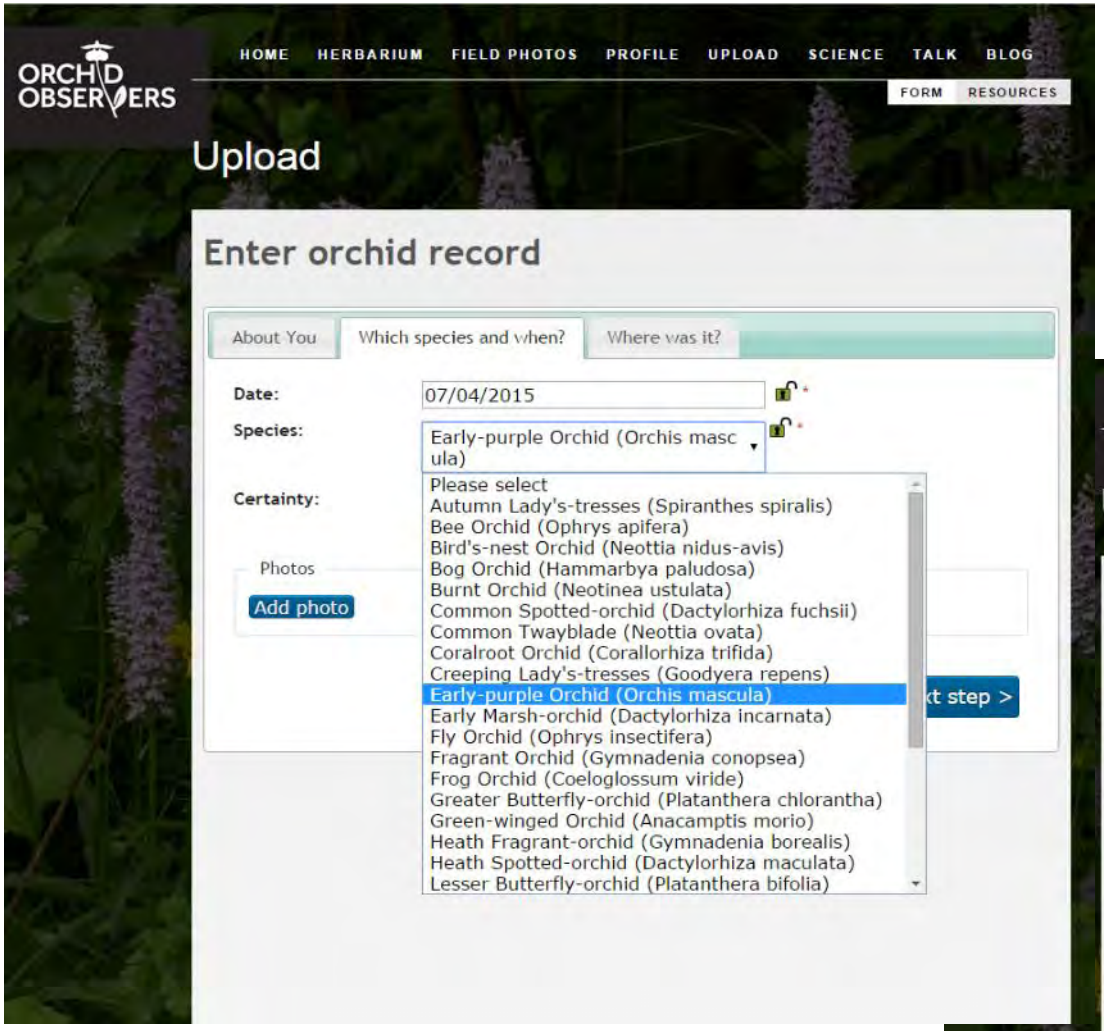
The same account will get you into all Zooniverse projects

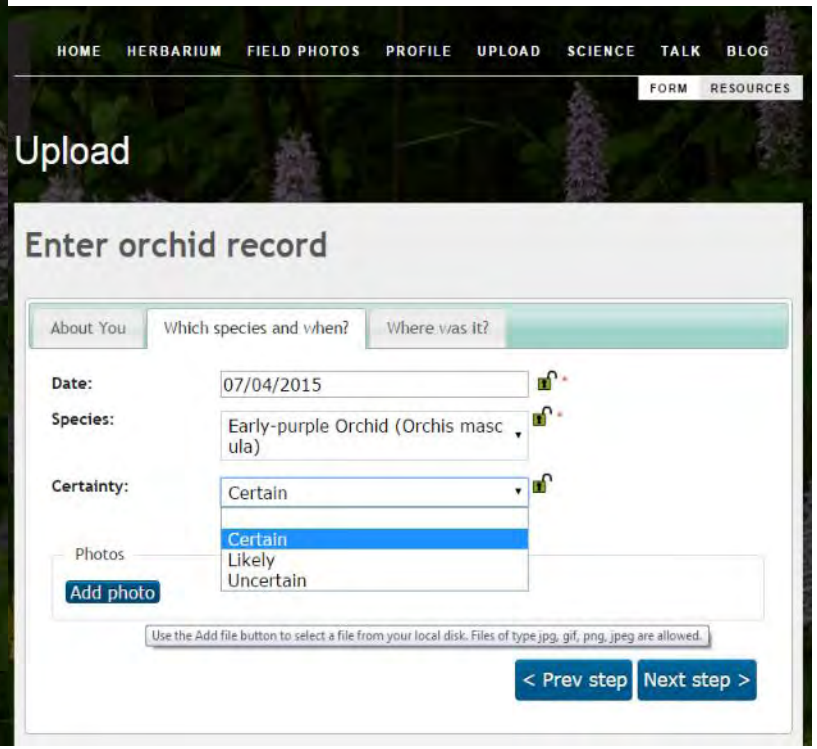
Upload



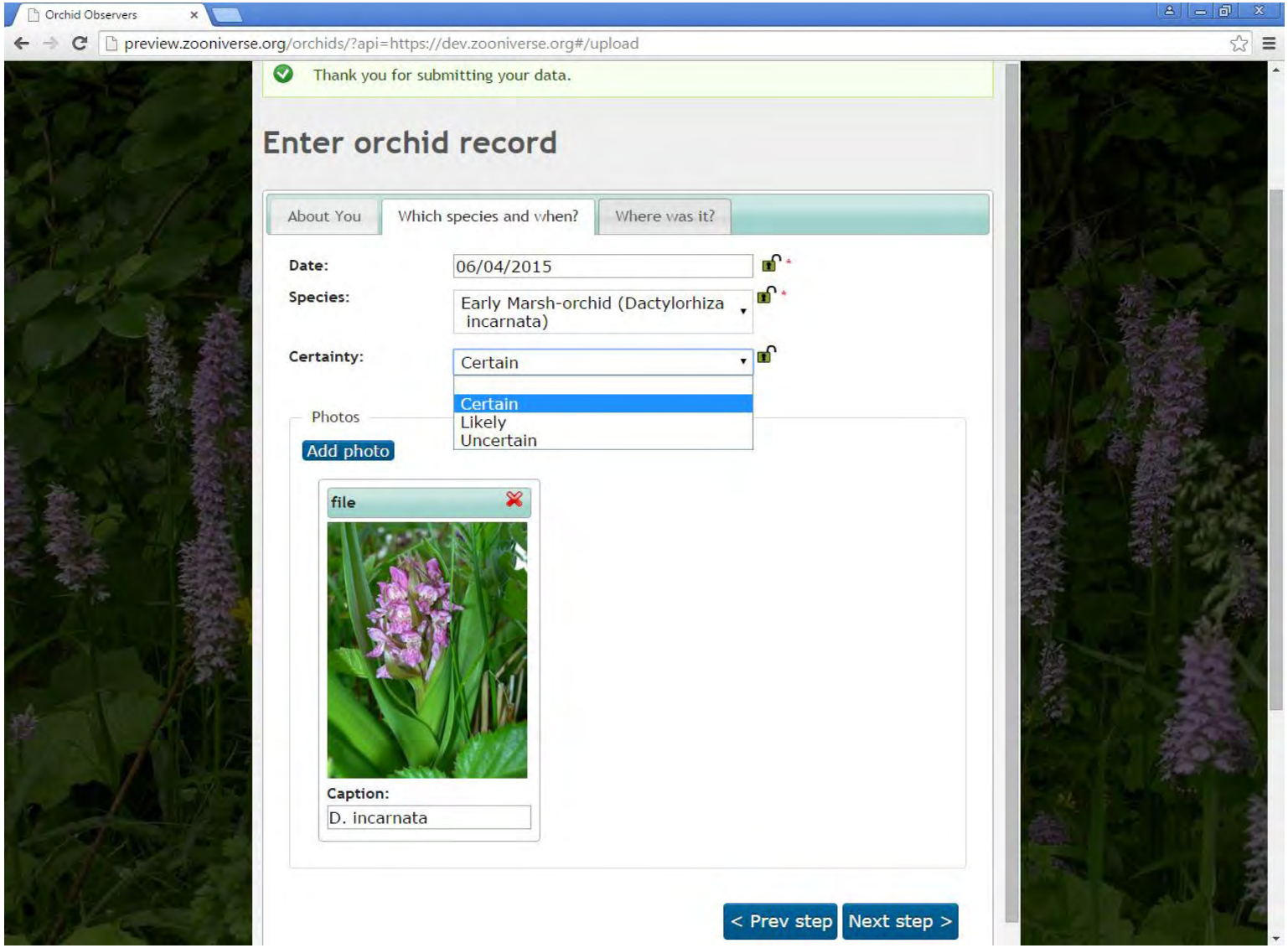
- Create field record and upload photographs

Upload



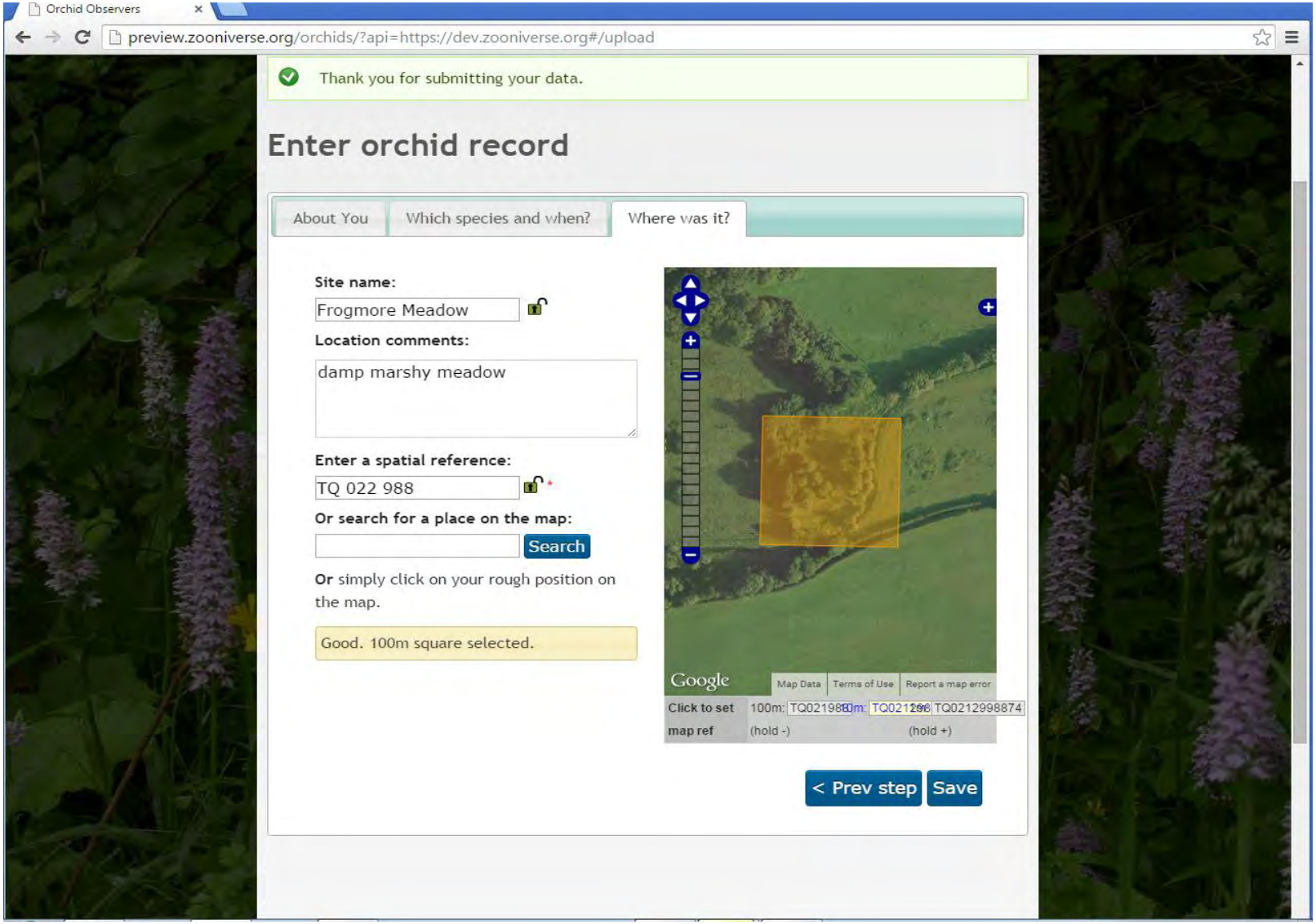


- Record date photographed
- Record species - select from drop down list of the 29 orchid taxa



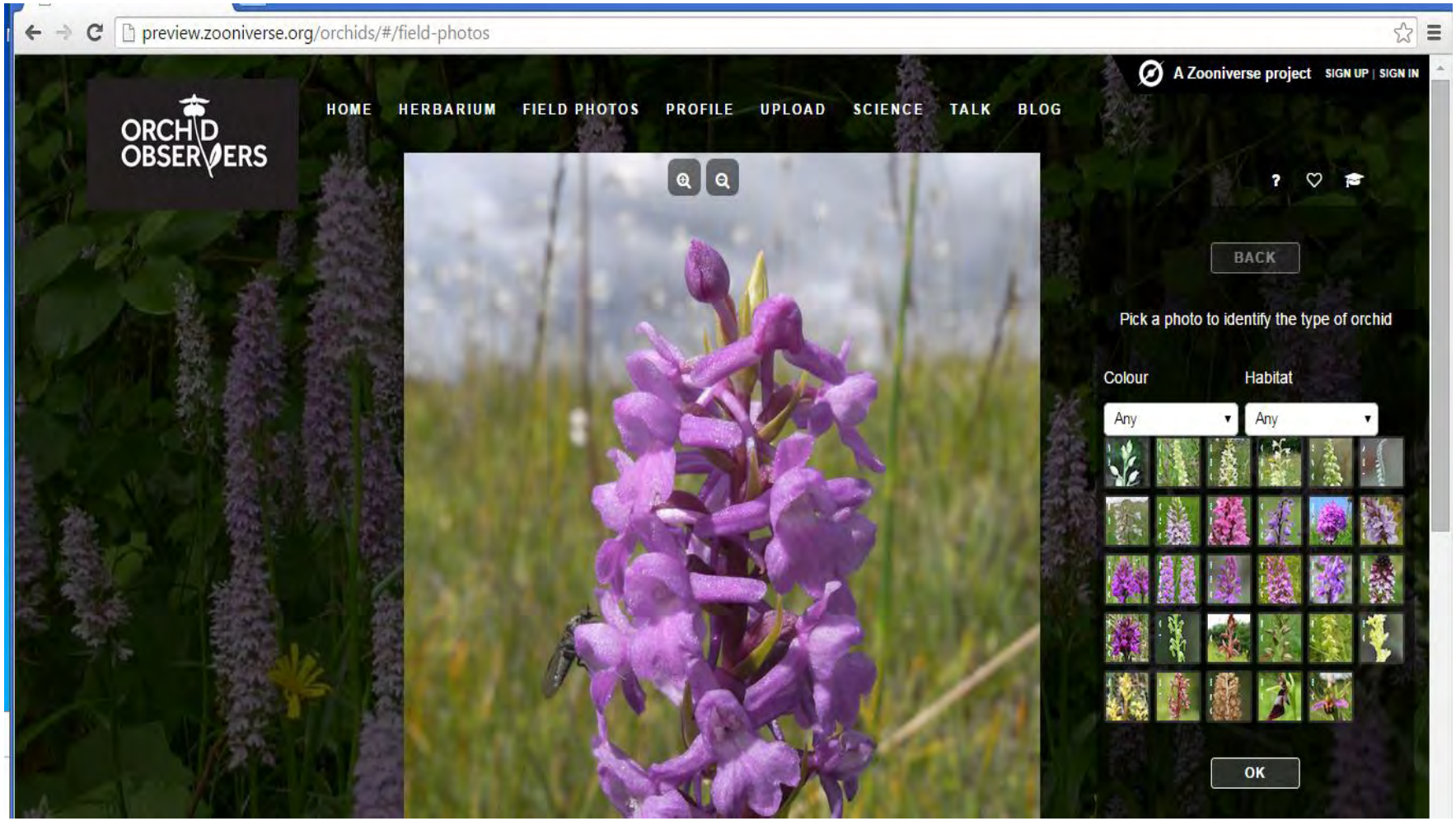
- Add photo (up to 4 per record)

Upload



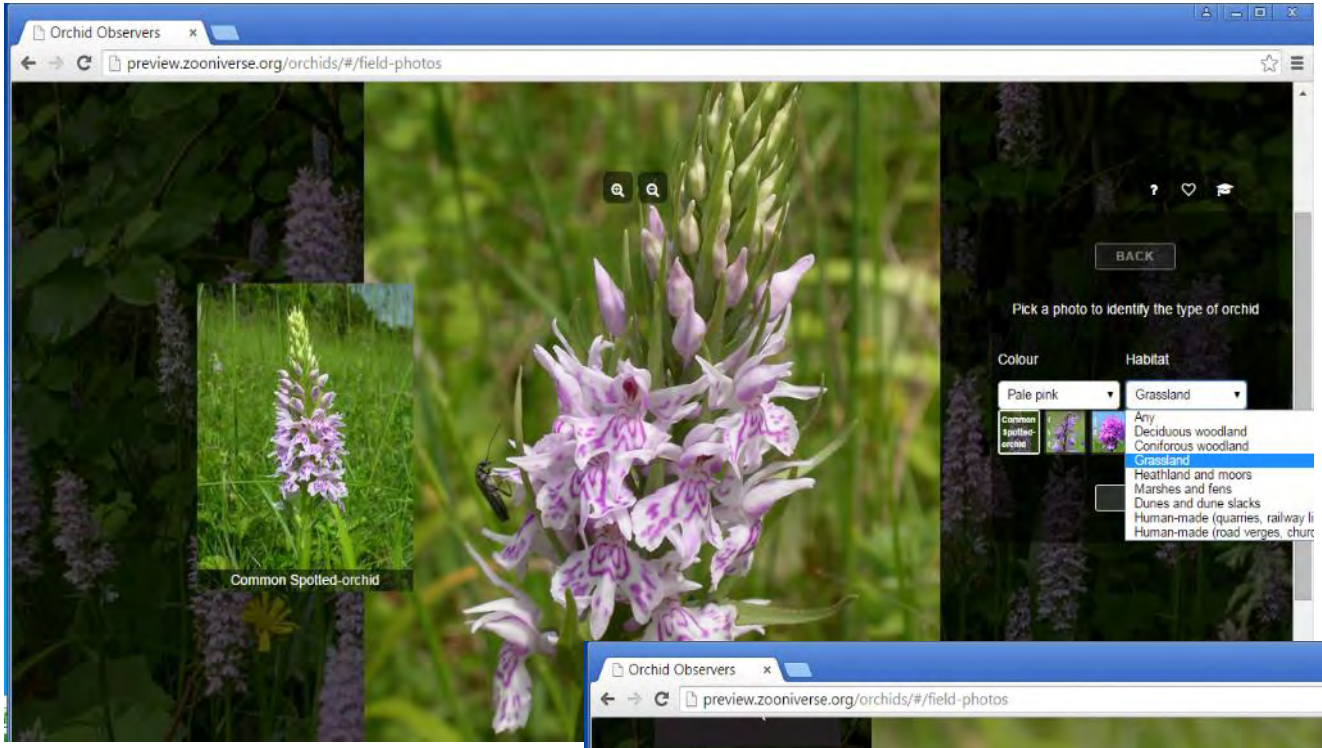
- Enter location and a spatial reference

Field Photos

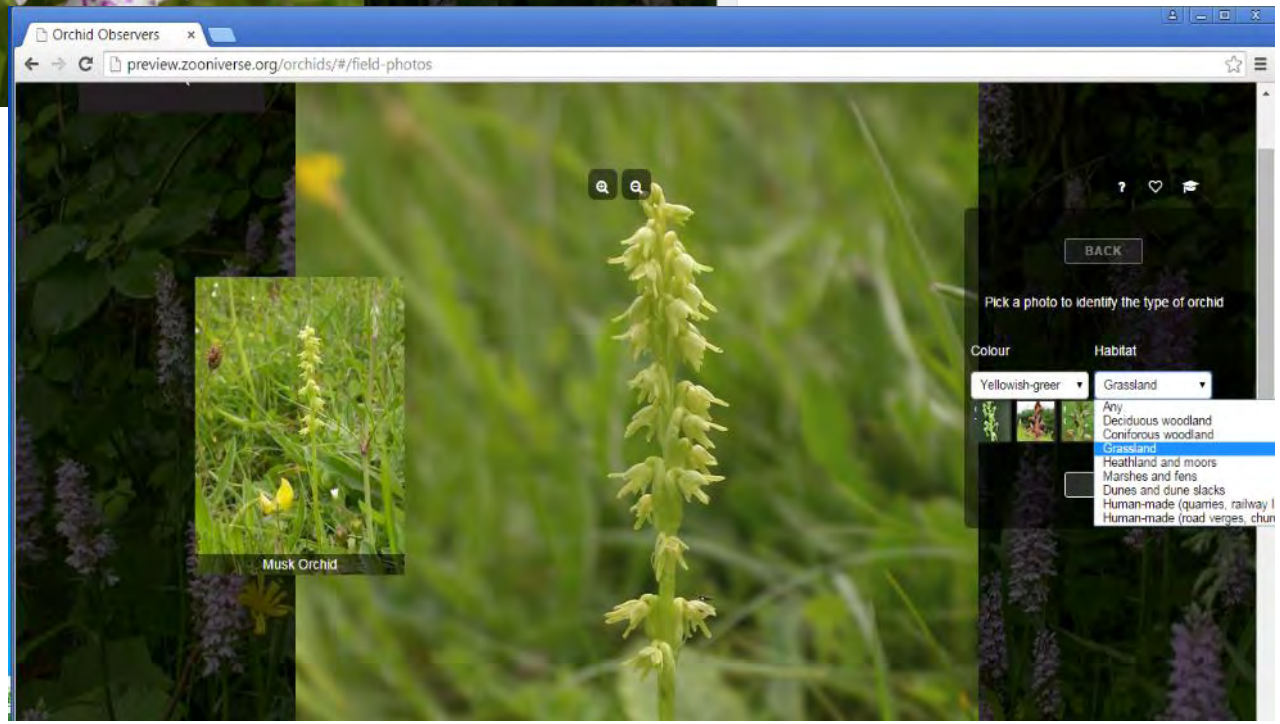


- classify species

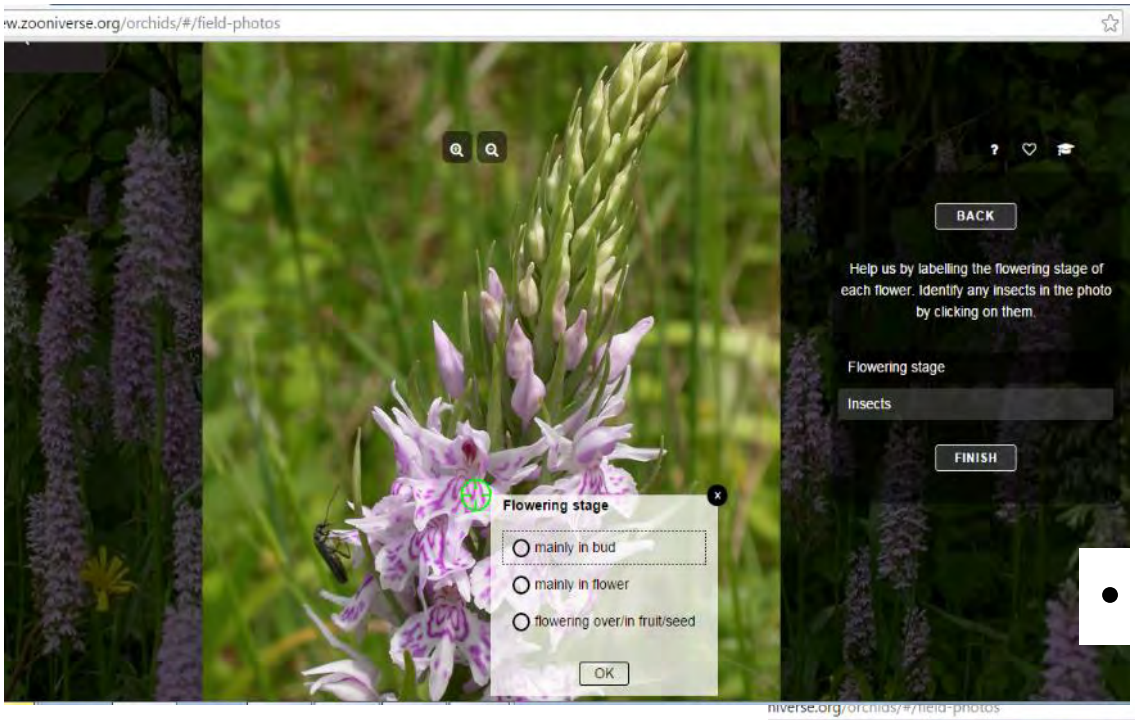
Field Photos



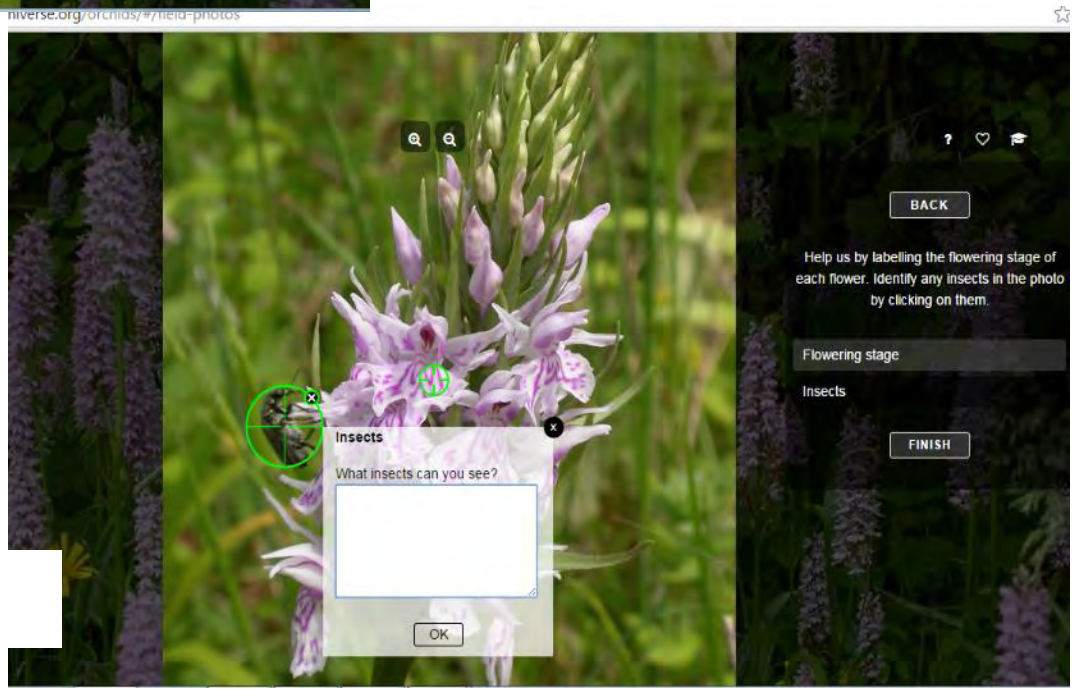
- classify species



Field Photos



- Estimate flowering stage



- Identify any insects

CONSTRUCTING SCIENTIFIC COMMUNITIES

www.orchidobservers.org

Arts & Humanities Research Council

UNIVERSITY OF OXFORD

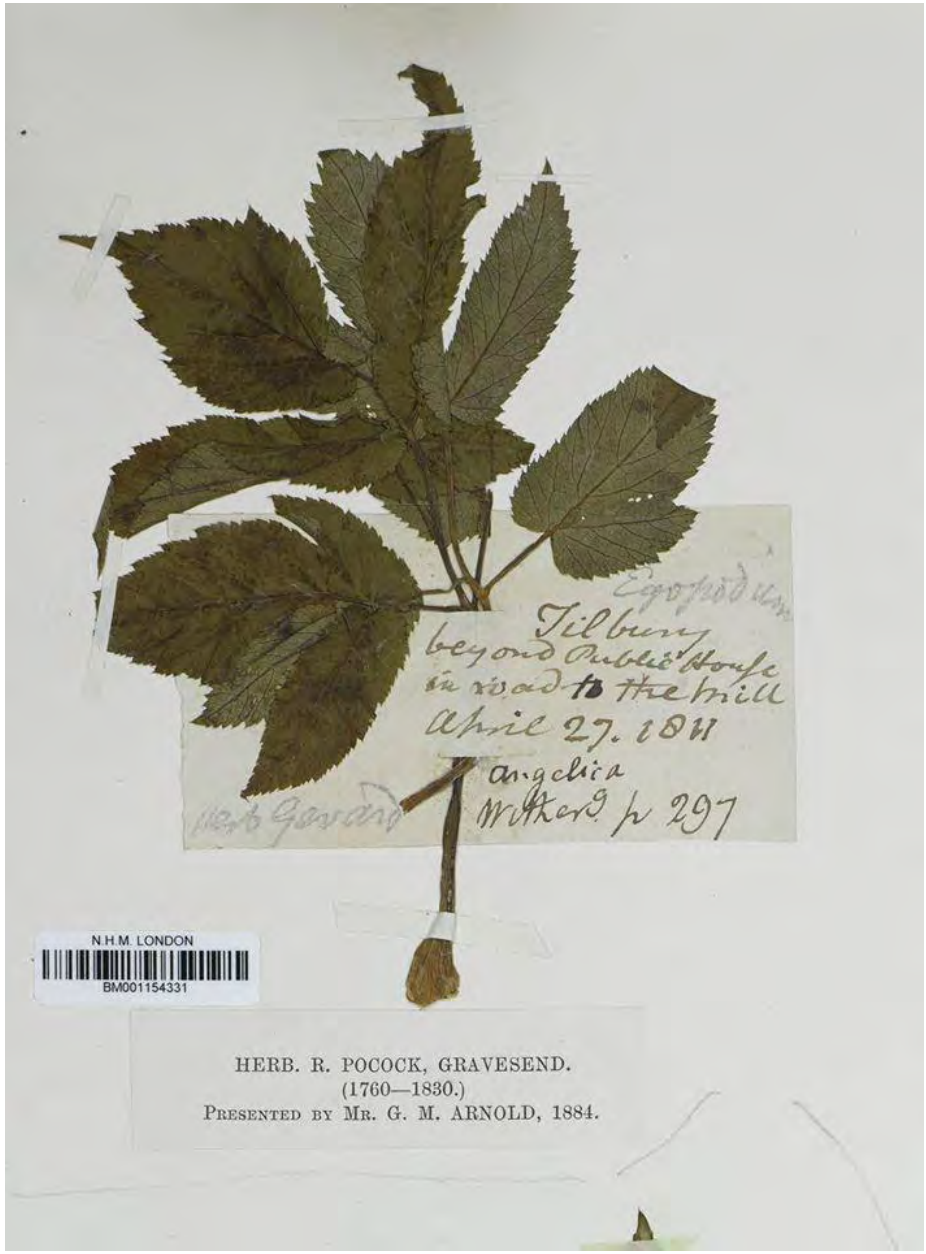
ZOONIVERSE

NATURAL HISTORY MUSEUM

Robert Pocock Herbarium Project

- Community lead project discovering the botany and history of their town through the life of Robert Pocock and his herbarium.
- NHM staff providing access to collections, training on how to handle collections and database specimens

"On Tuesday we went to the Natural History Museum in London to collect the final set of scans of the Robert Pocock herbarium specimens. …..So what's special about this specimen of ground-elder? It was the last one to be found and the total now stands at 220……As if often the case Pocock gives us the exact location of where and when he found the plant. I will probably get the ferry across the Thames and go and look for the plant myself!" – *Malcolm Jennings (project lead) 6th November 2014*



Specimen of ground-elder – *Aegopodium podagraria.* *Collected by Robert Pocock 'Tilbury, beyond Public House in road to the Mill. April 27 1811'.*

http://pocockherbarium.blogspot.co.uk/
https://www.facebook.com/pages/Robert-Pocock-Herbarium-Project/333265860142783