

Measuring the Locality Data Sets of Herbaria Festuca Species in England Using Google Earth

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Abstract: In this study, we used herbarium data to determine the locality data sets of Festuca species that are common in England and well represented in the University of Reading Herbarium (RNG). In this study, considerable number of specimens have been mainly utilized. We explored the localities at which herbarium specimens of Festuca species were collected and then the locality coordinates of these herbaria specimens were mapped using Google Earth. This study showed that most species Festuca species were concentrated abundantly in the south of England more than the north which agree with their recorded coordinates.

Key words: Festuca species, Herbaria specimens, mapping, coordinates, England, Google Earth.

INTRODUCTION

Herbarium, museum data sets which preserved as dried plants have been recorded as a source of information with approximately 350 million specimens over 4,000 herbaria worldwide (Calinger et al. 2013). According to Panchen *et al.* (2012), herbarium collection started approximately over 100 years ago. Historical data, play an important role in many researches (Haggerty *et al.* 2010). Herbaria collection can be allocated across the world in botanical gardens and universities especially (Panchen, 2011). *Festuca* is considered one of the largest genera of the (Poaceae), with wide distribution in temperate and alpine areas (Bouchenak- Khelladi *et al.* 2008). *Festuca* is

considered one of the largest genera of the (Poaceae), with wide distribution in temperate and alpine areas. Economically, *Festuca* species are important, especially *F. rubra* (Red *Festuca*), and *F. arundinacea* (Tall *Festuca*) species that are used commonly as a forage for livestock or for fine lawns respectively (Gaut *et al.* 2000). Most comprehensive studies are intended to examine wide range of species at abroad geographical range (Fitter & Fitter, 2000; Miller-Rushing & Primak, 2008). Many studies have investigated the effects of genetics and environmental factors on the variations of phenological response across wide geographical range (Etterson & Shaw, 2001).

MATERIALS AND METHODS

Festuca was selected as a genus well represented in the England. Ten species of *Festuca* were considered in this study: *F. altissima* All., *F. arundinacea* Schreb., *F. filiformis* Pourret, *F. gigantea* (L.) Vill., *F. heterophylla* Lam., *F. ovina* L., *F. pratensis* Huds., *F. rubra* L., *F. trachyphylla* Hack., and *F. vivipara* (L.) Sm. (Table 1). In total, 741 specimens were recorded that had been collected over a period of 164 years between 1838-2002.

The University of Reading herbarium specimens (RNG) was the main source of specimens. Further specimens were included from Royal Botanic Gardens, Kew (K), and University of Oxford herbarium (OXF) (Table 1).

Species	Number of specimens (RNG)	Number of specimens KEW	Number of specimens Oxford	Total number of specimens
<i>Festuca altissima</i> All.	22		11	33
<i>Festuca arundinacea</i> Schreb.	84	23		107
<i>Festuca filiformis</i> Pourret.	22	25		47
<i>Festuca gigantea</i> (L.) Vill	38		14	52
<i>Festuca heterophylla</i> Lam.	17	10		27
<i>Festuca ovina</i> L.	78	19		97
<i>Festuca pratensis</i> Huds.	52	19		71
<i>Festuca rubra</i> L.	235			235
<i>Festuca trachyphylla</i> Hack.	18			18
<i>Festuca vivipara</i> (L.) Sm.	42	12		54
Total	608	108	25	741

Table 1. Number of *Festuca* specimens at University of Reading herbarium (RNG), Royal Botanic Gardens, Kew (K), and University of Oxford herbarium (OXF) used in this study.

For the measuring of locality data sets, species coordinates were downloaded from Wikipedia Software Geo Hack using locality data from specimen labels (Wik-media, 2014). The point localities of collection used to obtain the altitude and longitude, could not be inferred for every specimen, because not every specimen had locality information. For each species, the localities at which herbarium specimens were collected were mapped using Google Earth. When more than one specimen was allocated at the same location, they were treated as one specimen for clear display on Google Earth. A KML excel file was used to upload this locality information to Google Earth (Table 2).

	A	B	C	D	E
1	Latitude	Longitude	Name	Description	Icon
2	43°36'34.86"N	116°12'23.30"W	BAM	Art museum	12
3	43 36 33.22	-116 12 18.40	Roses	Nice garden	111
4	43.608879028	-116.20320277	Zoo	Great visit	186

Table 2. Samples plotted on Google Earth

The Results

Results show that most of *Festuca* species are concentrated abundantly in the south of England more than the north, with the exception of *F. vivipara* which distributed predominantly in the north figures (1-10). Most species presented a gradual reduction in density across the north. The extensive number of specimens were allocated specifically at 51-52 S, and 56-55 N. However, *F. filiformis* spread across all England without being concentrated. Species vary relatively in the amount of their density at the same coordinates regarding the number of each species. For example, *F. ovina*, and *F. pratensis* allocated strongly at 51 S more than other species. The study present significant paucity in species collection at Ireland, except 1-2 specimens about for *F. arundinacea*, *F. gigantea*, *F. ovina*, and *F. pratensis*.

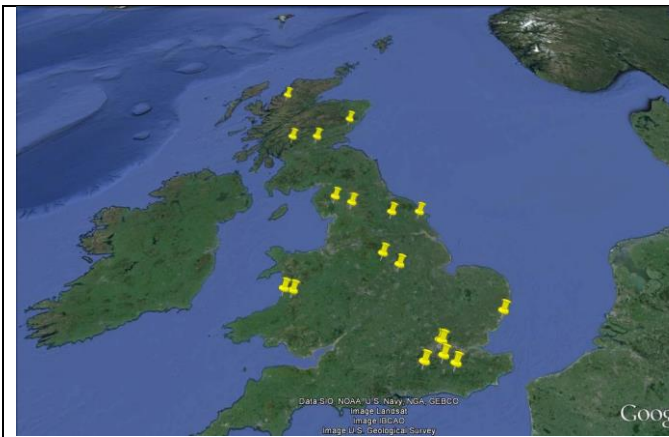


Figure 1. Specimens distribution for *F. altissima* across UK displays on Google earth

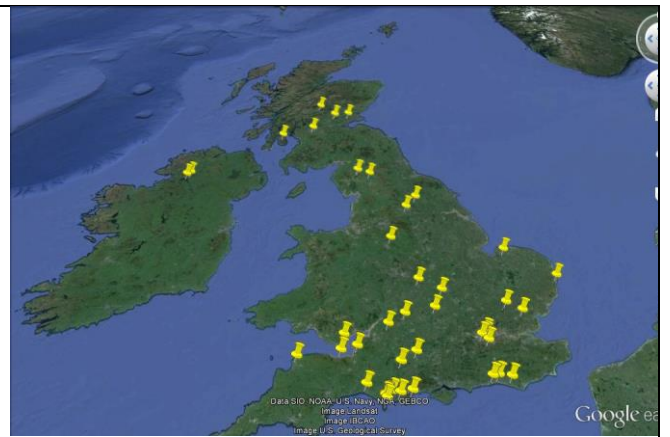


Figure 2. Specimens distribution for *F. arundinacea* cross UK displays on Google earth.

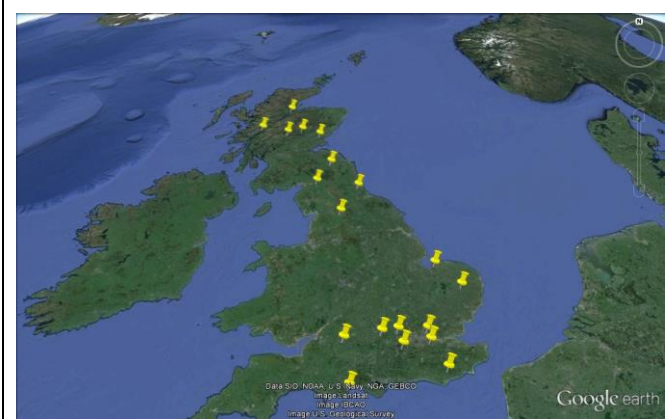


Figure 3. Specimens distribution for *F. filiformis* across UK displays on Google earth



Figure 4. Specimens distribution for *F. gigantea* cross UK displays on Google earth

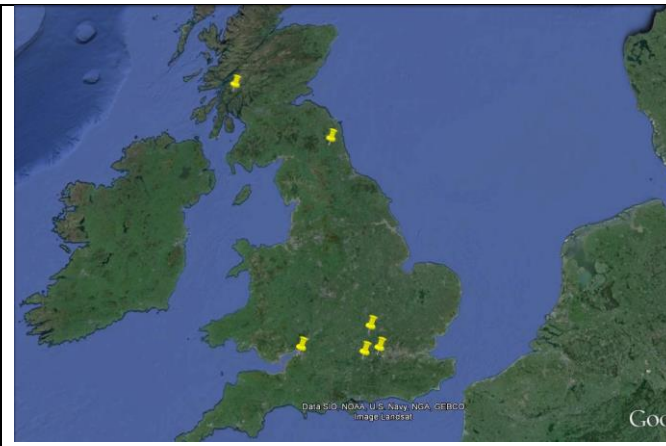


Figure 5. Specimens distribution for *F. heterophylla* across UK displays on Google earth

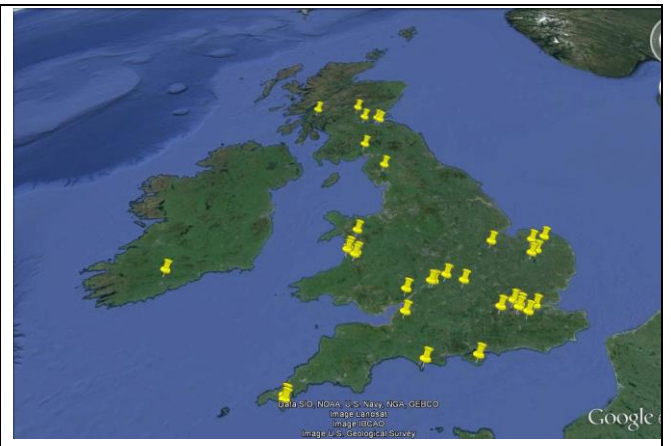


Figure 6. Specimens distribution for *F. ovina* across UK displays on Google earth

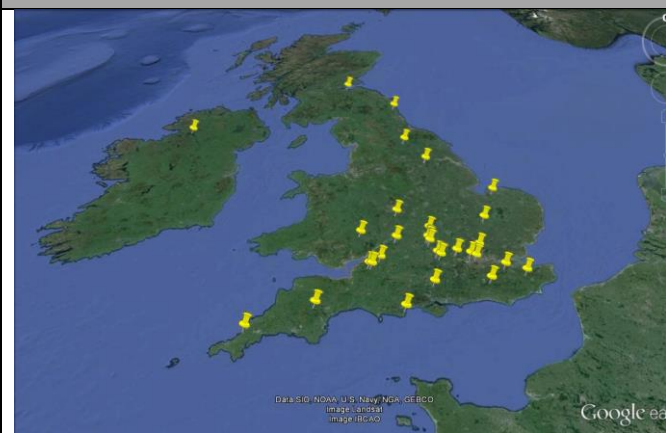


Figure 7. Specimens distribution for *F. pratensis* across UK displays on Google earth

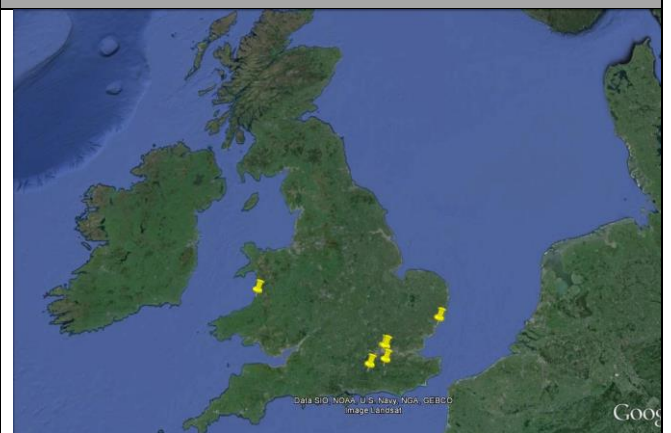


Figure 8. Specimens distribution for *F. trachyphylla* across UK displays on Google earth

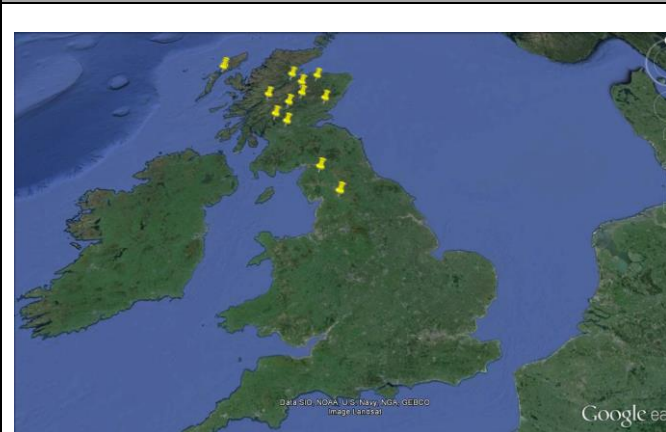


Figure 9. Specimens distribution for *F. vivipara* across UK displays on Google earth

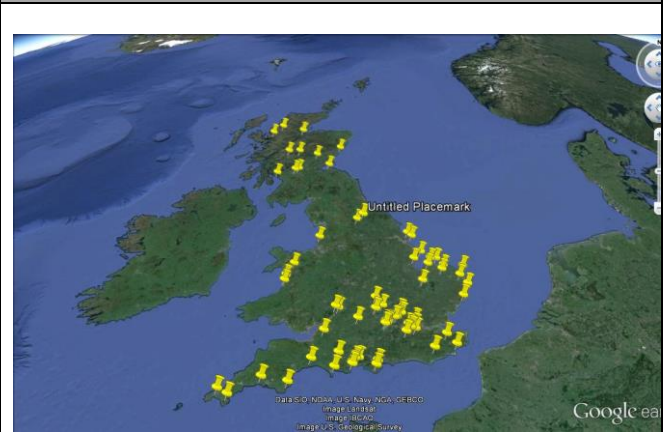


Figure 10. Specimens distribution for *F. rubra* across UK displays on Google earth

Figures (1-10) represent the distribution of the *Festuca* species specimens cross United Kingdom UK displays on Google earth

DISCUSSION

Mapping locality data sets for *Festuca* species showed that most species were concentrated abundantly in the south of England more than the north with the exception of *F. vivipara* which distributed only over the north of UK. This result completely agrees with what this study recorded of the coordinates of *Festuca* species which allocated mainly over the latitude (50-54°N) in the south, further to the latitude (55-58°N) across the north. This study as well as Kefala, (2014) have encountered many obstacles for concern; firstly, limited location information (latitude, altitude etc.), which prevent effective comparison. Secondly, many gaps between years of collections leading to distort results. Primack, (2009) suggested that due to the site-specific location, species might be able to respond to climate change more than other species. Moreover, this result was confirmed additionally by climate incorporating which revealed that *Festuca* species that included in this study are spring flowering species. Lavoie and Lachance, (2006) pointed that reduction in plants collection has been found in each of Canada and United States, without any decline found in British Isles recent collections. This explain that *Festuca* species are warmer responder's species and respond greatly in the south more than in the north regarding to the warm temperature of southern collected areas. This study showed that the average latitude for the five species was ranged from 52-54, which consider within the lower latitude. This was expected as most of *Festuca* species were concentrated greatly in southern of UK at the lower latitudes. Latitude could be a vital role in promoting flowering shift, which is contributed to our conduction of future climate change implications (Calinger *et al.* 2013 & Hulme, 2014).

References:

1. **Bouchenak-Khelladi, Y., Salamin, N., Savolainen, V., Forest, F., Van der, B.M., Chase, M.W., and Hodkinson, T.R., 2008.** Large multi-gene phylogenetic trees of grasses (Poaceae) progress towards complete tribal and generic level sampling. *Molecular Phylogenetic and Evolution*, 47, pp. 488-505.
2. **Calinger, K.M., Queen borough, S., and Curtis, P.S., 2013.** Herbarium specimens reveal the footprint of climate change on flowering trends across north-central North America. *Ecology Letters*, 16(8), pp.1037–1044.
3. **Etterson, J.R. & Shaw, R.G., 2001.** Constraint to adaptive evolution in response to global warming. *Science (New York, N.Y.)*, 294(5540), pp.151–154.
4. **Fitter, A. H. & Fitter, R.S.R., 2002.** Rapid changes in flowering time in British plants. *Science (New York, N.Y.)*, 296(5573), pp.1689–1691.
5. **Gaut, B. S., Tredway, L. P., Kubik, C. , Gaut, R. L., and Meyer, W., 2000.** Phylogenetic relationship and genetic diversity among members of the *Festuca*- *Lolium* complex (Poaceae) based on ITS sequence data. *Plant Syst. Evolu*, 224, pp. 33-53.
6. **Hulme, P.E., 2011.** Contrasting impacts of climate-driven flowering phenology on changes in alien and native plant species distributions. *New Phytologist*, 189(1), pp.272–281.
7. **Kefala, L., 2014.** The suitability of herbarium data in studying flowering phenology in the grass family. *BSc Biological science, University of Reading*
8. **Primack, R.B.& Miller-Rushing, A.J., 2009.** The role of botanical gardens in climate change research, *New Phytologist*, 182, pp.303–313.
9. **Lavoie, C. & Lachance, D., 2006.** Phenology of Plant Species Across Large Areas. *American journal of botany*, 93(4), pp.512–516.
10. **Miller-Rushing, A.J. & Primack, R.B., 2008.** Global Warming and Flowering Times in Thoreau's Concord: a Community Perspective. *Ecology*, 89(2), pp.332–341. Available at: <http://dx.doi.org/10.1890/07-0068.1>.

11. **Panchen, Z., 2011.** The flowering response of greater Philadelphia native piedmont plants to long term climate change. *Thesis, University of Delaware.*
12. **Panchen, Z. A., Primack, R. B, Anisko, T., and Lyons, R. E., 2012.** Herbarium specimens, photographs, and field observations show Philadelphia area plants are responding to climate change. *American Journal of Botany*, 99(4), pp.751–756.
13. **Primack, R.B.& Miller-Rushing, A.J., 2009.** The role of botanical gardens in climate change research, *New Phytologist*, 182, pp.303–313.