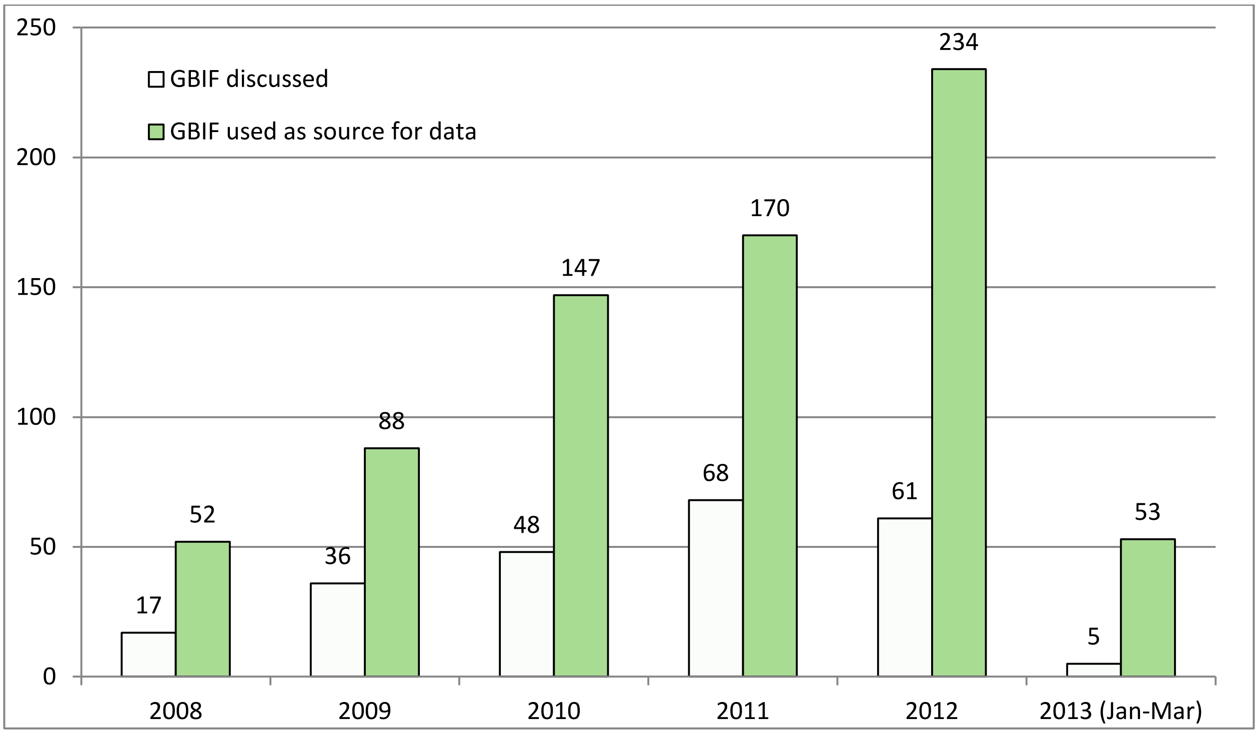
GBits Science Supplement

No. 7, February-March 2013

Welcome to this seventh edition of the GBits Science Supplement. It provides a summary of research published during February and March 2013 for which the Global Biodiversity Information Facility (GBIF) has been cited as a source of data.

The supplement opens with summaries of some illustrative examples of recent uses of the data accessible through GBIF. Recent journal articles discussing GBIF's role are also highlighted. These are followed by references and links to studies identified during the two months, grouped around their relevance to the Aichi Biodiversity Targets.[1] A wider selection of papers including those discussing and mentioning GBIF can be found in the GBIF Public Library in the Mendeley academic social network platform.

The supplement is published alongside the bimonthly GBits newsletter, which provides a range of news about biodiversity data publishing from around the GBIF community. If you are not already a subscriber, you can access GBits here and follow the instructions if you would like to sign up.



Use and discussion of GBIF in scientific literature, 2008-13 (number of peer-reviewed, published research papers)

[1] http://www.cbd.int/sp/targets/

Invasive species and public health

PREDICTING SPREAD OF ALLERGENIC INVASIVE PLANTS IN EUROPE

Examples: Cunze, S., Leiblein, M.C. & Tackenberg, O., 2013. Range Expansion of *Ambrosia artemisiifolia* in Europe Is Promoted by Climate Change. *ISRN Ecology*, 2013, pp.1–9. Available at: http://www.hindawi.com/isrn/ecology/2013/610126/.

Follak, S. et al., 2013. Invasion dynamics of three allergenic invasive *Asteraceae* (*Ambrosia trifida*, *Artemisia annua*, *Iva xanthiifolia*) in central and eastern Europe. *Preslia*, 85, pp.41–61. Available at: http://www.preslia.cz/P131Follak.pdf.

Summary: The common ragweed (*Ambrosia atermisiifolia* L.) is a plant native to North America, introduced accidentally to southeastern Europe in the 19th century. It has since become widespread in parts of the continent. Typically growing in urban wasteland and overgrown fields, it is a significant human health risk because many people are allergic to its pollen.

In the first study (Cunze et al.), a team in Germany aimed to predict whether the invasive plant was likely to shift its range in Europe due to climate change. To do this, the researchers tested various models that map the habitats suitable for a species to live in, based on the conditions of temperature and rainfall in the places where it has been observed, and projections for how climate change would affect the locations of suitable habitats (ecological niche models).

To generate the models, the research used GBIF to identify 2,016 records of the ragweed's occurrence in its native North America, and 2,779 records from its invasive range in Europe - together with past climate records and forecasts for climate change based on various scenarios. It compared the results for current suitable habitats with independent data on the regions where ragweed has been reported.

The study found that when only the European occurrences were used, the model produced implausible results. The authors concluded that this was due to sampling bias among the European records available through GBIF when the models were generated (in 2009). While many ragweed records were published from Germany and other parts of northern Europe, few or no records were available from regions where the plant was known to be a problem such as in Italy and Hungary.

However, when the GBIF-mediated data from the plant's native range in North America were used to generate the models, there was a much better match with known occurrences in Europe. On this basis, the researchers predicted that climate change would enable the ragweed to thrive in many more parts of Europe, with potential invasions possible over huge areas including northern France, Germany, the Benelux countries, Czech Republic, Poland, the Baltic States, Belarus and wide parts of Russia.

In view of the high cost of the plant's spread in terms of human health (estimated at €110m per year in Hungary, for example), the authors conclude there is a strong need for control measures to minimize the further spread of common ragweed.

The study has attracted attention from German-language media, including an article in the online version of Die Welt (http://www.welt.de/gesundheit/article115002629/Ambrosia-verbreitet-ihren-Schrecken-in-Europa.html) which mentions that the research relied on data accessed through GBIF.

In a separate study by researchers based in Austria, Follak et al. analysed the history of invasions by three wind-pollinated plant species closely related to common ragweed that are also highly allergenic but have received less attention. Also using data accessed through GBIF among other sources, the study looked at the relative influence of temperature, precipitation land use and types of habitat in past spread – and through this analysis, identified substantial parts of central and eastern Europe at risk from future invasions. Because of the significant potential impact on public health, the authors recommend monitoring future spread of these species, and urgent implementation of management strategies including raising awareness and early control.

Threatened species and protected areas

USING MODELS TO INFORM CONSERVATION POLICIES

Examples: Mota-Vargas, C. & Rojas-Soto, O.R., 2012. The importance of defining the geographic distribution of species for conservation: The case of the Bearded Wood-Partridge. *Journal for Nature Conservation*, 20(1), pp.10–17. Available at: http://linkinghub.elsevier.com/retrieve/pii/S1617138111000422.

Mota-Vargas, C. et al., 2012. Geographic and ecological analysis of the Bearded Wood Partridge *Dendrortyx barbatus*: some insights on its conservation status. *Bird Conservation International*, pp.1–15. Available at: http://www.journals.cambridge.org/abstract_S0959270912000329.

Summary: These two studies from researchers in Mexico examined how models based on data such as those accessible through GBIF can help to improve knowledge about the distribution of species with a restricted range, and so inform conservation policy.

Both studies looked at the case of the Bearded Wood-Partridge (*Dendrortyx barbatus*), an elusive bird found only in the temperate forests of the Sierra Madre Oriental mountain range of Mexico. It is classified as 'vulnerable' by the IUCN Red List, but has a higher risk status of 'endangered' under Mexican national legislation, and there has been disagreement over time about its risk of extinction. The distribution map shown by IUCN suggests the species is split into three separate populations separated by large distances along the range.

The first study looked at five different methods of using the small number of records available for the species, to help define its actual distribution. A total of 41 historical records were obtained from various sources including GBIF. It found that ecological niche modelling provided the best results, and suggested that decisions on species conservation, especially for those with limited geographic ranges, should be supported by models using this method.

The second study used the expanded range predicted by the team's model to target field research to seek new records for the Bearded Wood Partridge. Using the technique of playing a recording of the bird's call and listening for a reply, the researchers obtained 95 new records, suggesting that the species was more common than previously thought. Many of the new occurrences were outside the range as currently shown on the expert maps. The authors suggest that the bird should no longer be classed as endangered by the Mexican authorities, and that IUCN should redefine its geographical range, although it should still be regarded as a vulnerable species.

Climate change and marine biodiversity

MODELLING THE FUTURE FOR MARINE SPECIES IN THE NORTH SEA UNDER CLIMATE CHANGE

Example: Jones, M.C. et al., 2013. Predicting the Impact of Climate Change on Threatened Species in UK Waters. PloS one, 8(1), p.e54216. Available at: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3551960&tool=pmcentrez&rendertype=abstract.

Summary: This study by researchers in the United Kingdom, United States and Canada used a range of different models to explore the potential impact of climate change on marine species in the North Sea by 2050. The data used for the study included more than 5,000 records of 18 fish and crustacean species accessed via GBIF, including commercially targeted species like Norway lobster (*Nephrops norvegicus*) and Atlantic cod (*Gadus morhua*), and critically endangered species such as angelshark (*Squatina squatina*) and common skate (*Dipturus batis*).

The study projected that on average, species would move northwards by approximately 27km each decade. The researchers found there would be relatively small changes in the overlap of ranges between commercially exploited and threatened species, easing concerns about possible increases in accidental catches of rare species due to climate change. The study also predicted only small adverse consequences from climate change on the ability of marine protected areas to provide suitable habitat for the threatened species.

However, the models used by the researchers showed wide variations in the projections for individual species, and the authors argue that this shows the value of using multiple models to construct best and worst case scenarios, and apply a precautionary approach to protecting the marine environment given the uncertain response of threatened species in the face of climate change.

The study was funded by the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) of the United Kingdom´s Department for Environment, Food and Rural Affairs (Defra) as part of the Adapting to Climate Change in the Marine Environment (ACME) project; the National Geographic Society, and the Natural Sciences and Engineering Research Council of Canada.

The lead author of the study, Miranda Jones of CEFAS and the University of East Anglia, commented: “I do consider GBIF to be a very important source of data in this study and for species distribution modelling that uses presence only techniques in general.

“This is because it provides a source of occurrence data on many species for which little may be known concerning their biological or ecological preferences. It also enables people to study species' distributions for scales or areas which might otherwise be limited by logistics and cost.”

Evolutionary theory

WHY THE TROPICS ARE MORE BIODIVERSE THAN TEMPERATE REGIONS

Example: Jansson, R., Rodríguez-Castañeda, G. & Harding, L.E., 2013. What can multiple phylogenies say about the latitudinal diversity gradient? A new look at the tropical conservatism, out-of-the-tropics and diversification rate hypotheses. *Evolution*. Available at: http://onlinelibrary.wiley.com/doi/10.1111/evo.12089/pdf.

Summary: This study by researchers from Umeå University, Sweden, tested various hypotheses for why ecosystems become relatively less rich in species as you move away from the Equator and towards the poles.

The two major competing explanations are the 'tropical conservatism hypothesis', suggesting that most branches of the tree of life originate in the older tropical environments, and that it is relatively rare for species in a lineage to move into temperate latitudes – thus leaving more species in the tropics; and the 'out of the tropics model' proposing that transitions of related species from the tropics to temperate zones are quite common, meaning that a large proportion of temperate species have tropical origins.

To test these and other hypotheses, the researchers selected 111 published phylogenies, or evolutionary trees, documenting relationships between species of mammals, birds, insects and flowering plants. Using GBIF-mediated occurrence data, they divided all the species and other taxa in these trees into those with tropical ranges, temperate ranges, and those spanning both zones.

The study then analysed the patterns for how and when branches of these clades or related groups had made a transition from tropical to temperate latitudes, and vice versa. It found that the most common type of transition was the expansion of tropical lineages to include temperate latitudes, suggesting that adaptation to new climatic conditions may not represent a major obstacle for many clades. The authors suggest their results lend support to the 'out of the tropics' model and contradict many predictions of the tropical conservatism hypothesis.

Discussion of GBIF

Amano, T. & Sutherland, W.J., 2013. Four barriers to the global understanding of biodiversity conservation: wealth, language, geographical location and security. *Proceedings. Biological sciences/ The Royal Society*, 280(1756), p.20122649. Available at: http://www.ncbi.nlm.nih.gov/pubmed/23390102.
Summary: The GBIF database (www.gbif.org) was one of four used in this study to analyse variations among countries in biodiversity data available online. A country's GDP, language, security levels and its proximity to the country hosting the database are shown as playing important roles in explaining differences.

Katsanevakis, S. et al., 2013. Implementing the European policies for alien species – networking, science, and partnership in a complex environment. *Management of Biological Invasions*, 4(1), pp.3–6. Available at:
http://www.reabic.net/journals/mbi/2013/1/MBI_2013_1_Katsanevakis_etal2.pdf.
Summary: This article defines the role of various institutions and networks involved in

implementing European policies on invasive alien species. Samy Gaiji from the GBIF Secretariat is one of the authors of this paper.

Skøien, J.O. et al., 2013. A Model Web approach to modelling climate change in biomes of Important Bird Areas. *Ecological Informatics*, 14, pp.38–43. Available at: http://linkinghub.elsevier.com/retrieve/pii/S1574954112001203.
Summary: Authors of this paper show how interoperable web services that offer or process data, such as the GBIF data portal, can be used in conjunction with each other to predict the impacts of climate change on species distributions. The example described in the article uses such modelling to evaluate the impact of climate change on the distribution of an endangered African bird species – Grauer's swamp warbler. Éamonn Ó Tuama, from the GBIF Secretariat, is one of the authors of the paper.

Research citing GBIF as a source of data, Feb-Mar 2013

Grouped by relevance to Aichi Biodiversity Targets

Strategic Goal B – Reduce direct pressures and promote sustainable use

Target 7. Sustainable agriculture

Manda, S., Saborido, A.S. & Dubois, M., 2013. Control of Conyza spp. with Glyphosate – A Review of the Situation in Europe. *Plant Protection Science*, 49(1), pp.44–53. Available at: http://www.agriculturejournals.cz/web/PPS.htm.

Target 9. Invasive alien species

Katsanevakis, S. et al., 2013. How many marine aliens in Europe? *Management of Biological Invasions*, 4. Available at: http://www.reabic.net/journals/mbi/2013/Accepted/MBI_2013_Katsanevakis_etal_correctedproof.pdf.

Major, K.C. et al., 2013. Regeneration dynamics of non-native northern red oak (Quercus rubra L.) populations as influenced by environmental factors: A case study in managed hardwood forests of southwestern Germany. *Forest Ecology and Management*, 291, pp.144–153. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0378112712007293.

Vandekerkhove, J., Cardoso, A.C. & Boon, P.J., 2013. Is there a need for a more explicit accounting of invasive alien species under the Water Framework Directive? *Management of Biological Invasions*, 4.

Wetterer, J.K., 2013. Worldwide spread of the difficult white-footed ant, Technomyrmex difficilis (Hymenoptera: Formicidae). *Myrmecological News*, 18, pp.93–97.

Target 10. Climate change impacts

Pomati, F. et al., 2012. Effects of re-oligotrophication and climate warming on plankton richness and community stability in a deep mesotrophic lake. *Oikos*, 121(8), pp.1317–1327. Available at: http://doi.wiley.com/10.1111/j.1600-0706.2011.20055.x

Ralston, J. & Kirchman, J.J., 2012. Predicted range shifts in North American boreal forest birds and the effect of climate change on genetic diversity in blackpoll warblers (Setophaga striata). *Conservation Genetics*, online. Available at: http://www.springerlink.com/index/10.1007/s10592-012-0418-y.

Strategic Goal E: Enhancing implementation

Target 19. Improve the science base

Ballesteros-Mejia, L. et al., 2013. Mapping the biodiversity of tropical insects: species richness and inventory completeness of African sphingid moths. *Global Ecology and Biogeography*. Available at: http://doi.wiley.com/10.1111/geb.12039.

Benito, B.M., Cayuela, L. & Albuquerque, F.S., 2013. The impact of modelling choices in the predictive performance of richness maps derived from species-distribution models: guidelines to build better diversity models R. B. O'Hara, ed. *Methods in Ecology and Evolution*. Available at: http://doi.wiley.com/10.1111/2041-210x.12022.

Bucklin, D.N. et al., 2012. Climate downscaling effects on predictive ecological models: a case study for threatened and endangered vertebrates in the southeastern United States. *Regional Environmental Change*. Available at: http://www.springerlink.com/index/10.1007/s10113-012-0389-z.

Cocquyt, C., Jüttner, I. & Kusber, W.-H., 2013. Reinvestigation of West African Surirellaceae (Bacillariophyta) described by Woodhead and Tweed from Sierra Leone. *Diatom Research*, pp.1–9. Available at: http://www.tandfonline.com/doi/abs/10.1080/0269249X.2012.752411.

Grossmann, M.M., Lindsay, D.J. & Fuentes, V., 2013. A redescription of the post-larval physonect siphonophore stage known as Mica micula Margulis 1982, from Antarctica, with notes on its distribution and identity. *Marine Ecology*, 34, pp.63–70. Available at: http://doi.wiley.com/10.1111/maec.12026.

Gür, H., 2013. The effects of the Late Quaternary glacial-interglacial cycles on Anatolian ground squirrels: range expansion during the glacial periods? *Biological Journal of the Linnean Society*. Available at: http://doi.wiley.com/10.1111/bij.12026.

He, K. et al., 2012. Karyotype of the Gansu Mole (Scapanulus oweni): Further Evidence for Karyotypic Stability in Talpid. *Mammal Study*, 37(4), pp.341–348. Available at: http://www.bioone.org/doi/abs/10.3106/041.037.0408.

Hertz, A., Lotzkat, S. & Köhler, G., 2013. New distribution records and variation of the two common lowland salamanders Bolitoglossa colonnea (Dunn, 1924) and B. lignicolor (Peters, 1873) in Panama (Amphibia: Caudata: Plethodontidae). *Check List*, 9(1), pp.83–91. Available at: http://www.checklist.org.br/getpdf?NGD151-12.

Hobbs, C.R. & Baldwin, B.G., 2013. Asian origin and upslope migration of Hawaiian Artemisia (Compositae-Anthemideae) M. Carine, ed. *Journal of Biogeography*, online. Available at: http://doi.wiley.com/10.1111/jbi.12046.

Jaruwattanaphan, T., Matsumoto, S. & Watano, Y., 2013. Reconstructing Hybrid Speciation Events in the Pteris cretica Group (Pteridaceae) in Japan and Adjacent Regions. *Systematic Botany*, 38(1), pp.15–27. Available at: http://openurl.ingenta.com/content/xref?genre=article&issn=0363-6445&volume=38&issue=1&spage=15.

Johansson, V., Ranius, T. & Snäll, T., 2013. Epiphyte metapopulation persistence after drastic habitat decline and low tree regeneration: time-lags and effects of conservation actions H. Bugmann, ed. *Journal of Applied Ecology*. Available at: http://doi.wiley.com/10.1111/1365-2664.12049.

Leroux, S.J. et al., 2013. Mechanistic models for the spatial spread of species under climate change. *Ecological Applications*, online, p.130128134444003. Available at: http://www.esajournals.org/doi/abs/10.1890/12-1407.1.

Masson, R. & Kadereit, G., 2013. Phylogeny of Polycnemoideae (Amaranthaceae): Implications for biogeography, character evolution and taxonomy. *TAXON*, 62 (February), pp.100–111.

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Premoli, A.C. et al., 2012. Ecological Niche Modeling Meets Phylogeography to Unravel Hidden Past History of Key Forest Genera in Plant Geography: Podocarpus and Nothofagus. *Natureza & Conservação*, 10(December), pp.160–168. Available at: http://www.abeco.org.br/wordpress/wp-content/uploads/nec-vol-10-2/09_nc_v10n2_021S-2012.pdf.

Randin, C.F. et al., 2013. Do the elevational limits of deciduous tree species match their thermal latitudinal limits? *Global Ecology and Biogeography*, online. Available at: http://doi.wiley.com/10.1111/geb.12040.

Rodríguez-Gómez, F., Gutiérrez-Rodríguez, C. & Ornelas, J.F., 2013. Genetic, phenotypic and ecological divergence with gene flow at the Isthmus of Tehuantepec: the case of the azure-crowned hummingbird (Amazilia cyanocephala) M. Carine, ed. *Journal of Biogeography*. Available at: http://doi.wiley.com/10.1111/jbi.12093.

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