Global biodiversity hotspots in India: significant yet under studied

In the year 2000, Myers *et al.*[1] demarcated 25 global biodiversity hotspots in the world for the first time, to which in 2009 were added another 9 hotspots[2] based on the criteria of exceptional concentration of endemic plants and higher degree of anthropogenic pressure. India accommodates part of four global biodiversity hotspots – the Himalaya, the Western Ghats, Indo-Burma and Sundaland, which are facing challenges due to anthropogenic disturbance and climate change. Nonetheless, there is no comprehensive study on these biodiversity hotspots, which reports the current status of vegetation cover, plant species richness and these hotspots.

The biodiversity hotspots situated in densely populated tropical countries are experiencing dynamics due to urbanization, agricultural expansion and rapid economic development. The four biodiversity hotspots in India are under undue pressure due to climate change-induced warming and drought, which are taking a toll on the plants of these diverse eco-regions. In 2006, Cincotta *et al.*[3] reported higher human population density in the hotspots located in the tropics, where the Western Ghats accommodated the highest human population density (>300 persons/sq. km) among all global hotspots. According to the Census of India 2011 report, the population in cities like Mumbai has crossed 1000 persons/sq. km, which poses direct threat of anthropogenic disturbance to the diverse eco-regions situated in the surrounding areas. The rate of climatic warming in the Himalaya is exceeding the global warming rates, which could accelerate the climate change-induced poleward migration of plants that could lead to break-up of native flora of the Himalaya hotspot. Most of the vegetation cover of Indo-Burma hotspot exhibits high level of forest fragmentation due to shifting cultivation practices. Extreme events such as tsunami have caused tremendous loss of vegetation cover in the Andaman–Nicobar Islands, which form part of Indo-Burma and Sundaland hotspots.

Climate change-induced species shifts in distributional range of plants from other biodiversity hotspots have been observed and predicted by various researchers across the globe. However, there is a lack of such studies on plants of biodiversity hotspots in India, which could provide better insights on climate change adaptation and mitigation. In the face of climate change, it is the right-time to modify existing Protected Area networks to minimize its effects on biodiversity. The estimates of forest cover published by Forest Survey of India in 2009 faced criticism. Recently published vegetation type map of India could be used to generate vegetation cover statistics of the vegetation types in the hotspots using satellite datasets. The potential of geospatial tools and techniques should be utilized to generate vegetation type map of the biodiversity hotspots in India, with consistent spatio-temporal scale and vegetation classification.

In such a scenario there is an urgent need of a comprehensive study on the biodiversity hotspots in India, which could address the questions by providing accurate and up-to-date estimates of vegetation types, plant species richness, endemism, anthropogenic disturbance and future predictions of climate change-induced species shifts, which could help in effective conservation prioritization of the biodiversity hotspots in the country.

1. Myers, N., Mittermeier, R. A., Mittermeier, C. G., Da Fonseca, G. A. and Kent, J., *Nature*, 2000, **403**, 853–858.
2. Conservation International; http://www.conservation.org/where/priority_areas/hotspots (accessed on 5 February 2014).
3. Cincotta, R. P., Wisnewski, J. and Engelman, R., *Nature*, 2006, **404**, 990–992.

V. S. CHITALE[1,2,*]
M. D. BEHERA[1]
P. S. ROY[3]

[1]*Centre for Oceans, Rivers, Atmosphere and Land Sciences,*
Indian Institute of Technology,
Kharagpur 721 302, India
[2]*International Centre for Integrated Mountain Development,*
Khumaltar, GPO 3226, Nepal
[3]*University Centre for Earth and Space Sciences,*
University of Hyderabad,
Hyderabad 500 046, India
**e-mail: vschitale@iitkgp.ac.in*

The nature of scientific collaboration

The beta version of the Nature Index (http://www.natureindex.com/) allows us to make a simple comparison of the countries and institutions around the world that contributed to some of the highest quality research during the calendar year 1 September 2013–31 August 2014. Only articles from a small and select group of journals (68 in all) are counted. Arguably these are the journals most favoured by the scientific community as the place to publish their best research. Flawed as it is by such a narrow and targetted approach, the tables that can be generated still allow us to interrogate the database for general trends and patterns. One interesting angle is about how institutions and countries collaborate.

Three measures are available within the index: the raw article count (AC); the fractional count (FC); and a weighted fractional count (WFC). A country or institution is given an AC of 1 for each article that has at least one author from that country or institution. As an article can have multiple authors from many institutions and countries, it will mean multiple counting of articles. This artefact can be removed using fractional counting so that an article can be shared between authors, institutions and countries. WFC is the weighted version of the FC, to correct for the fact that astronomy and astrophysics journals are over-represented by a factor of 5 in the index (i.e. a weighting factor of 0.2 is applied to the fractional count of

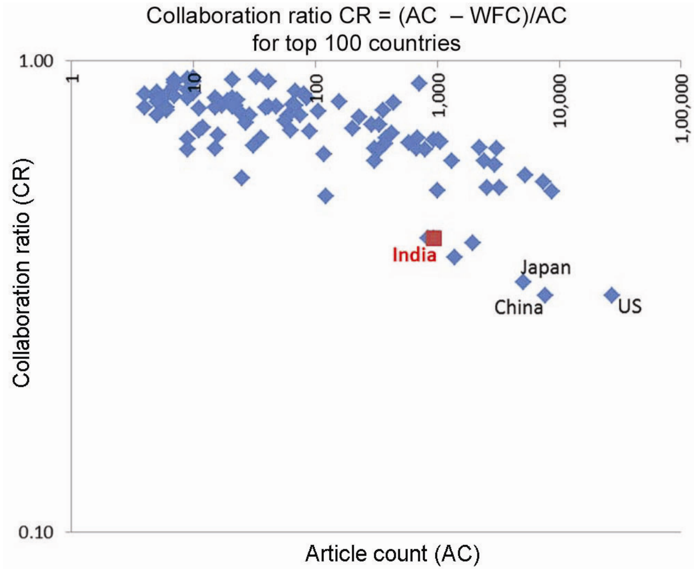

Figure 1. The scatterplot of CR versus AC for the top 100 countries from Nature Index 2014.

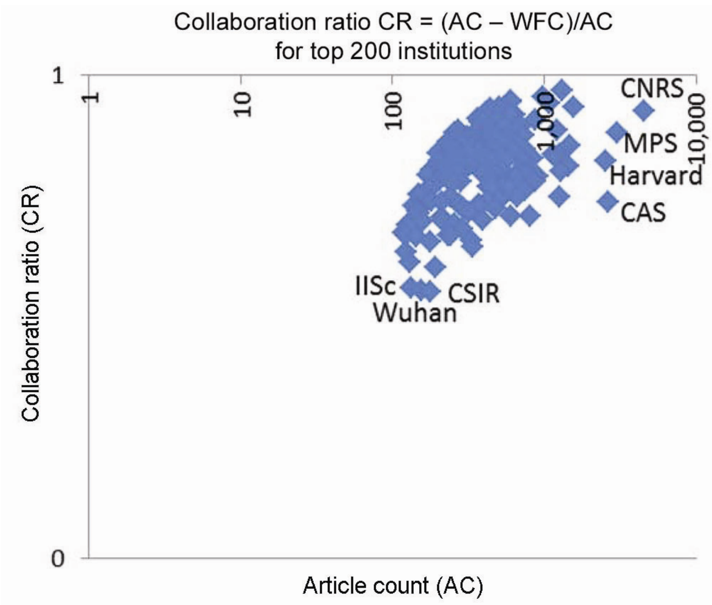

Figure 2. The scatterplot of CR versus AC for the top 200 institutions from Nature Index 2014.

articles from astronomy and astrophysics journals).

The collaboration ratio CR = (AC – FC)/AC or CR = (AC – WFC)/AC is a measure of the degree of collaboration, ranging from 0 (no collaboration) to a value not exceeding 1, where there is very high collaboration. Figure 1 displays the scatterplot of CR versus AC for the top 100 countries from Nature Index 2014. We see that large countries like the US, China, India and Japan collaborate the least. The highest collaboration ratios are seen for Georgia (0.93), Cameroon and Iraq (0.92), and Venezuela and Mongolia (0.91), which are all small in terms of their scientific output in these chosen journals.

Figure 2 shows the scatterplot of CR versus AC for the top 200 institutions from Nature Index 2014. The trend is now reversed. The larger institutions are more likely to collaborate. The lowest collaboration ratio at 0.36 has been registered by the Council of Scientific and Industrial Research (CSIR) and the Indian Institute of Science (IISc) from India, and Wuhan University from China. Of the six institutions that show the most collaboration, five are from France and one from the US. They are: Pierre and Marie Curie University (Paris 6) with CR = 0.93; National Aeronautics and Space Administration (USA) with CR = 0.90; National Institute for Health and Medical Research of France with CR = 0.89; Joseph Fourier University (France) with CR = 0.88; University of Paris Sud (Paris 11) also with CR = 0.88, and the Atomic Energy and Alternative Energies Commission (CEA) of France with CR = 0.87. Other significantly large players like the French National Centre for Scientific Research (CNRS), Max Planck Society (MPS), Harvard University and the Chinese Academy of Sciences (CAS) also have high degrees of collaboration. Given that CSIR (India) has a structure similar to that of CNRS, MPS or CAS, it would seem that CSIR scientists collaborate much less than they should.

Another intriguing question that these findings raise is: Why do large countries not collaborate while large institutions tend to do so?

As promised by Campbell and Grayson[1], 'the Nature Index will find a niche among the tools that research organizations use to track and quantify research outputs and to develop comparisons across peer institutions'.

1. Campbell, N. and Grayson, M., *Nature*, 2014, **515**, S49.

GANGAN PRATHAP

CSIR National Institute for Interdisciplinary Science and Technology,
Thiruvananthapuram 695 019, India
e-mail: gp@niist.res.in