



# Twenty-five years of GCB: Putting the biology into global change

The study and impact of global change has undergone dramatic transformations over the last 25 years. Global change in the early 1990s was viewed predominantly as the domain of the physical and chemical sciences, with biology very much a junior partner. Just 28 of the 365 pages of the first Intergovernmental Panel on Climate Change (IPCC) Scientific Assessment in 1991 were devoted to biology and ecosystems. Global Circulation Models of the time either ignored biology, or while using exact equations for physicochemical processes, represented the biosphere with simple equations and assumptions, with sparse or no basis in observed data.

In 1994, a small group of biologists recognized an urgent need to found a journal that would promote biology in the context of global change by providing a single forum and point of focus for the community that became *Global Change Biology* (GCB). We could not have dreamt then that the mission of promoting biology within global change would have resulted today in 5,500 articles, with 5,000 of those primary research articles, cited over a third of a million times. GCB has risen to be consistently ranked number 1 in Biodiversity Conservation as well as become among the top two journals carrying full primary research articles in both Environmental Sciences and Ecology (InCites JCR). We differ from most of the other highly cited journals in these categories, not simply in carrying predominantly original research articles, but also in allowing authors the space to convey to the readership what was done and how, for full scientific evaluation and transparency.

This issue celebrates 25 years of GCB with perspectives from distinguished past and present Editors of the journal and authors of transformative articles, reflecting on scientific advances made in the previous 25 years, and providing an outlook for future research directions. Some of these articles highlight how the journal achieved and continues to achieve many firsts. Research published in GCB identified the technological opportunities of eddy-covariance techniques to determine fluxes between the surface and atmosphere, highlighted here by Baldocchi (2019). The technique was used to provide the first proof that no-till agriculture did result in a net flux of carbon from the atmosphere over a period of several years (Bernacchi, Hollinger, & Meyers, 2005) and continues to inform environmentally sustainable agriculture (Ming et al., 2019). We have achieved broad representation in both terrestrial and aquatic systems. GCB was among the first to bring attention to coral impacts (Falkowski, 1995), continued through to here with reviews from Founding Editor Paul Falkowski's Laboratory (Drake et al., 2019) and Editors Suggett and Smith (2019). The journal has not simply reported new discoveries on impacts, but developments in Earth System representations, and means of adaptation and amelioration. The journal has also explored behavioral, plastic, and evolutionary

strategies of marine species for dealing with variable environments (Byrne, Foo, Ross, & Putnam, 2019; Kroeker et al., 2019; Miller, Ota, Sumaila, Cisneros-Montemayor, & Cheung, 2018).

Bioenergy and bioproducts, and their value and impacts were major early examples of intervention, but so successful that we had to form a highly successful sister journal *GCB Bioenergy & Bioproducts for the Bioeconomy*, to avoid unbalancing GCB. This heritage is reflected in the article from the laboratory of the Founding Editor, Chris Field (Reid, Ali, & Field, 2019).

It is not just the huge loss of biodiversity and biological capacity to offset global change that GCB represents, but the immediate effects on our food system, highlighted in recent issues (Thomey, Slattery, Köhler, Bernacchi, & Ort, 2019; Zhu, Zhuang, Archontoulis, Bernacchi, & Müller, 2019). Simultaneously we have been at the forefront of highlighting new global threats, such as microplastics (de Souza Machado, Kloas, Zarfl, Hempel, & Rillig, 2018); new approaches to dealing with nitrogen use (Yan, Pan, Lavallee, & Conant, 2019) and key under-researched components of the global carbon cycle, such as rhizodeposition (Pausch & Kuzyakov, 2018), while hugely improving the representation of biology in ecosystem (Hanson & Walker, 2019) and Earth System Models (Fisher et al., 2018; Piao et al., 2019) and important global databases (Kattge et al., 2011, 2019; Luyssaert et al., 2007).

The impacts that have been reported in the pages of GCB remind us of the huge urgency of achieving zero net emissions and avoiding mass extinctions, for there is no PLANet B and we need action and not interminable discussion of what would be best.

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The fact that IPCC over the years have changed the name of the report of Working Group 1 from "Scientific Assessment" to "The Physical Science Basis," shows we still have work to do in gaining recognition for the pivotal role of biological systems. That is, to continue to promote, through the science of our authors, the fact that biology and ecosystems are not simply victims of global change, but highly integral, critical, and highly complex parts of change. What we cannot celebrate at 25 years is progress by the world in addressing global change. As we move into the next half-century, there is an urgent need to keep to the Paris Agreement. The alternatives are starkly presented here in the comprehensive GCB primer by Editor Sage (2019). GCB will be adding increased focus to the biology of means of offsetting and adapting to change, as represented in this issue (Lavallee, 2019; Prosser, Hink, Gubry-Rangin, & Nicol, 2019; Sihi, Davidson, Savage, & Liang, 2019; Smith et al., 2019), and further develop our strong social media presence.

We thank not only the Authors of this Silver Anniversary Special Issue, but all the Authors who have contributed transformative science to *GCB* and our distinguished Editors who have given their time to create and advance the journal, which has become such a central resource for our community and in understanding the global change.

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