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The rapid decrease of biodiversity studies in well-researched areas – the case of Poland

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Abstract: Loss of biodiversity is one of the most urgent issues for humankind. Therefore, lots of research try to win the race for diversity recognition before it's lost studying the biodiversity hotspots. The problem rises in some well-studied parts of the world, where due to the nonchalant scientific policy of governments, biodiversity science seems to be far behind the ongoing change in ecosystems. The case of Poland (Central Europe) serves as an example of long term, erroneous policy leading to the constant fall of diversity-related branches of science.

Key words: global change, policy, science, funding, publishing, biological diversity.

In a time of human-induced transformation of the environment, the preservation of biological diversity has become an urgent concern (WEF, The Global Risks Report, 2020). The assessment of biological diversity includes studies on both qualitative nature of biodiversity – the number of species – but also dynamics and quantity of the particular components of ecosystems – populations with their long established properties, such as the density of individuals, sex and age structure, and their variability across time. With the advent of new methods of studying and measuring biodiversity, it seems we are fully aware of the condition of the environment and all the processes, positive and negative, affecting it. It also might seem that, unlike the insufficiently studied tropics (Baker *et al*. 2019), the long-studied territories of the Old World, where scientific methodology originated, are under constant monitoring of all its crucial parameters of the environment and its biological components. It would seem, at least in well-researched area of Poland, that not only is the biodiversity well recognised and measured, but that we also know exactly the nature and extent of its variability, and we can easily distinguish natural processes from human-induced (Oleksyn & Reich 1994). Growing evidence suggests that such thinking is far from the truth (Kunin 2019, Seibold *et al*. 2019). In our opinion, Poland is quickly approaching a critical moment when the knowledge of biological components of the environment and their variability will collapse. There are many factors contributing to this knowledge disintegration, but the most

important is the level of state-funded scientific research. This state of affairs is exemplified in Poland, where studies of biodiversity have been increasingly neglected by consecutive political administrations.

Poland has a 200+ year-old tradition of biodiversity studies. From the end of the 18th Century and through the 19th, despite political turmoil, many scientists studied the fauna of Central Europe, including the vast territories of Poland. Specimen collections from these studies are now deposited in Museums across Europe, including also in Poland, surviving both World Wars. In the 20th Century, such studies continued with increasing intensity up to 1990's, leading to significant improvements in our knowledge of species composition of the diverse territories of modern-day Poland (Trojan 1998). There remained, however, blank spots on the biodiversity map of Poland, concerning even the most precious and best-preserved habitats: some groups of animals have not been studied at all in Białowieża Forest, the only old-growth forest left in Poland (Banaszak 2008). After transformation of the political and economic system during the 1990's, state funding for biodiversity scientific research not only did not increase, but was in steady decline. The attitude of political and scientific elites has led to its diminishing in importance.

From the beginning of the 21st Century, we may observe in scientific policy an increasing pressure on publishing in journals with well-established recognition and high bibliometric scores (Figure 1, box 1). However, editors of such high ranked journals are not interested in publishing papers dealing with local biodiversity (e.g. particular country regions or systematic groups) (2). Scarce papers (3) reach low number of citations (4), because there are no papers in indexed journals to be cited. Low numbers of articles published in high-ranked journals affect the local journals (blue color). Papers published in local journals are mostly cited by local journals (5) (Table 1), which results in low chances of rising journal rank (6) (although as results from Table 1, papers in such journals are relatively often cited). This further discourages editorial boards of aspiring journals to biodiversity-related topics (7), and the number of biodiversity papers published by specialists consecutively decreases (8).

Financial support is prioritized for authors publishing in high-ranked journals. Every four years, scientific units such as university faculties are evaluated on their scientific output based on a ministerial list of journals, ordered hierarchically mainly based on bibliometric indicators. The position of and hence the funding for the University depends mostly on the total publication score. The journals' list is republished irregularly, and biodiversity-related (ecological, taxonomic, faunistic) journals rank below the median score for the list e. g. in entomology, among 16 existing journals, only one is put on the ministerial list scoring 20 points per 200 possible.

Several Polish journals are publishing taxonomic and faunistic data, with well-established peer-review policy administered by editorial offices consisting of specialist, often well recognized in the world, but these either have the lowest rank on the ministerial list or are absent from it (effectively a rank of "0"), despite relatively high citation ratios (Table 1). As a result, many authors are discouraged to publish in such journals (9) or favor publishing on biodiversity hotspots, while local faunas become increasingly neglected. Such discouragement predominately comes from faculty administrators, institutional colleagues working in other domains, or funding agencies that reject applications (10).

The process described above also discourages young scientists and students from pursuing faunistic studies. The current scientific policy in Poland rewards researchers who earn overhead money for their units, 10-40 % of the total grant amount. As a consequence,

the scientific interest of the young generation is directed towards the most eye-catching, most up-to-date subjects of science. Meanwhile, taxonomic biodiversity specialists are not replaced upon retirement, and scientific associations recruit fewer members, thankfully substituted by amateurs, albeit only partially (11). Faunistic data require years to be gathered and published, often needing specialized knowledge, manual skills and field experience, e.g., to collect specimens, study cryptic ecologies, observing changes in the environment over time. Specimen identification keys become increasingly out of date, while existing ones in English discourage local amateurs. The scientific generation that flourished in the 1990's is now starting to retire, and fewer successors are being hired to continue research on a decreasing number of taxa (12). The cycle closes and the state of knowledge on biodiversity and habitat conditions, paradoxically to ongoing world debate, only diminishes (13).

In the digital era there are scattered, individual data on biological diversity, resulting mostly from amateurs and so-called citizen scientists (Silvertown 2009, Goula *et al.* 2012). This seems to be a partial solution to compensate for the lack of specialists, however, this sort of science also has its limits. Taxonomic and faunistic research often requires a well-curated and rich scientific collection for comparisons and documentation, and assembling such a collection usually takes decades (Holmes *et al*. 2016). Amateur data, often in the form of photographs, although may be enough for proper species identification, not always provide serious scientific documentation for further research. On the other hand, each single observation, however documented, may work as a single bit of information. Single means little, but when collected in hundreds and thousands through years and on a vast area, may in time become big data for further analysis (La Salle *et al*. 2016, Kissling *et al*. 2018, Rund *et al.* 2019). With the computational abilities of modern and future computers, such observations may reveal still unobvious patterns and cycles of the variability of the environment (Belbin & Williams 2015, Eskildsen *et al.* 2015). If only there were enough input, which in case of decrease of good taxonomists and faunistic data seems to become less probable. And it seems, that now more stress is put on the digitization of existing collections rather than new collections in a world of rapid biodiversity loss (Ellwood *et al.* 2015, Page *et al.* 2015).

Additionally, amateurs usually suffer even more from lack of funding than professional scientists, and while open access publishing is supposed to make science available, yet it is more and more expensive. Thus, open access in its current form effectively contradicts its goals, becoming unaffordable for many cooperating amateurs and scientists dealing with a lack of funding, which as we stated above, severely affects local biodiversity studies.

The conditioning of biodiversity research and researchers, their funding and publishing the results, their interdependence with state policy and astonishingly low prestige among other scientists, in case of Poland seems to be a sort of a Gordian knot. Perhaps it is not only a problem for Poland because, as reported by Neff (2017), a similar situation also took place in Mexico a few decades earlier and did not contribute to support ecological issues in that country. In a world where scientific research and publishing are more and more dependent on funding (Peterson *et al.* 2018), especially in countries with relatively high social expenditure, which may afford relatively low-cost studies on biodiversity, it is astonishing that scientists encounter this sort of problems. Given the high rate of biodiversity loss, all regions, even those seemingly well-studied, require support. That is, unless we regard European biodiversity immune to further anthropogenic impact.

Table 1. Citation data of two local Polish faunistic journals, representative for discipline, from years 2010-2019. Number of citations was calculated by Scopus results scored by each paper and similarly, by number of citations in Google Scholar for total number of citations.

	No. of articles	No. of Scopus citations	No. of all citations	Citations/ article
Acta entomologica silesiana	152	69	328	2.16
Fragmenta Faunistica	136	158	429	2.94

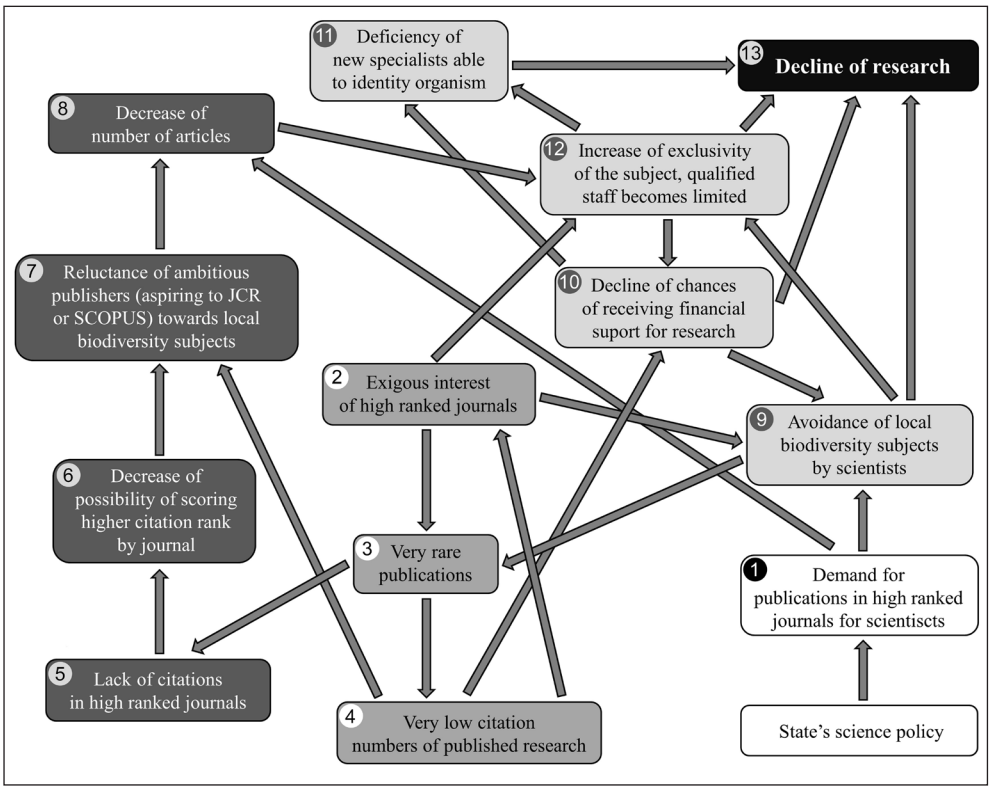

Fig. 1. Interrelations between government and editorial policies leading to a decrease of biodiversity research (numbers are referred to in main text).

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