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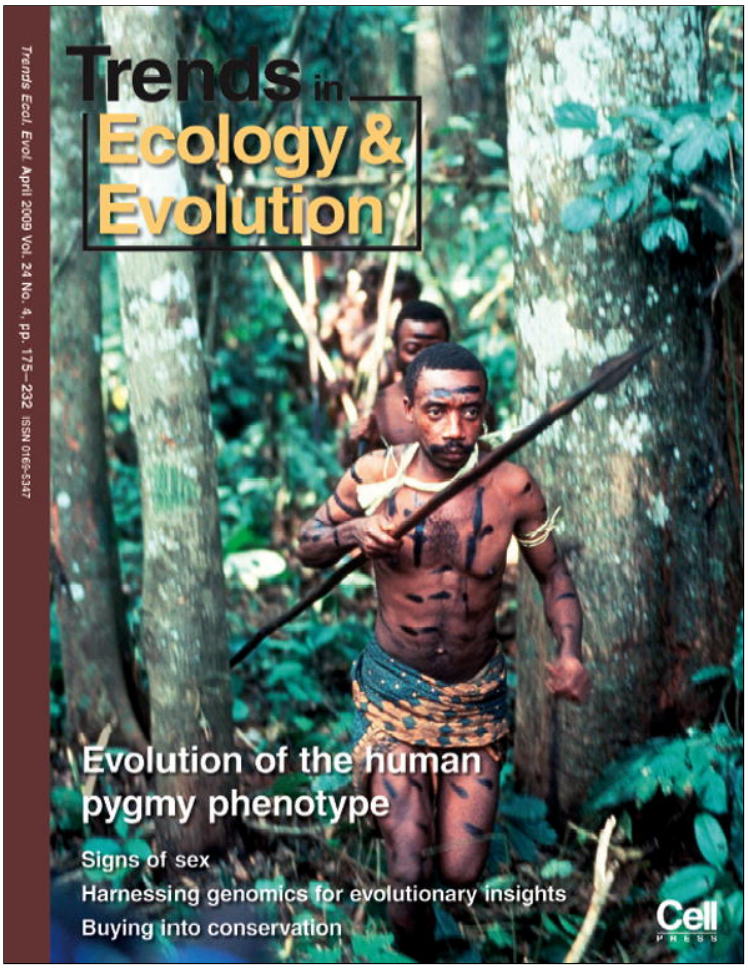

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resources, the greater the desire should be to use those resources as wisely as possible.

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Letters

Improving Wikipedia: educational opportunity and professional responsibility

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The rise of user-generated Internet content (i.e. 'Web 2.0') has resulted in dramatic changes in the way that scientific information is collected and disseminated. One notable example is Wikipedia (http://www.wikipedia.org), the user-written online encyclopedia with millions of users worldwide. In the 7 years since its inception it has become a staple of the academic community, increasingly used by faculty and students to develop lectures and study aids, research topics for papers and as a source of background information while studying or conducting research.

The widespread use of Wikipedia stems from three major advantages it has over many other reference sources. The first is accessibility – in addition to being available to anyone with an Internet connection, Wikipedia currently contains entries written in over 200 languages. Second, online entries can be updated immediately as new information becomes available. Finally, and perhaps most controversially [1,2], entries are collectively written and fact checked by the global community of Wikipedia users – what Halavais and Lackaff [3] refer to as 'populist participation' and which they and others argue produces content of quality equal to that of more traditional printed media. Although some have suggested that the lack of 'expert' authors or peer review will inevitably result in entries containing misleading or incorrect information [4], a recent review of entries from a diversity of disciplines (although none from ecology) found that the frequency of errors in Wikipedia was comparable to that in the online edition of the *Encyclopedia Britannica* [5].

As part of a graduate seminar on plant–animal interactions, we set out to assess the quality and content of Wikipedia entries with an ecological focus. To do so, we critiqued entries on five major categories of plant–animal interactions: frugivory, herbivory, pollination, granivory and seed dispersal. We found that the entries were generally limited in both breadth and depth, included only cursory lists of citations and occasionally devoted attention to topics that were at best marginally relevant (one memorable example was the discussion of 'fruitarians' – people who consciously adopt a strictly frugivorous diet – in the entry on frugivory).

We then evaluated the process for editing Wikipedia entries by uploading revisions to the entries we critiqued (see Supplementary Material online for the original and revised entries, as well as descriptions of the major shortcomings and revisions). We found the process straightforward and efficient, particularly once we learned the protocol for proposing and implementing changes (Figure 1). Editing was also simplified by adhering to Wikipedia's clearly established framework for page organization, reference management and the inclusion of tables and pictures (see http://en.wikipedia.org/wiki/Wikipedia:-First_steps). We were occasionally frustrated by interactions with an intransigent author who rapidly and repeatedly reverted our revisions – something that might be common when editing entries on controversial topics.

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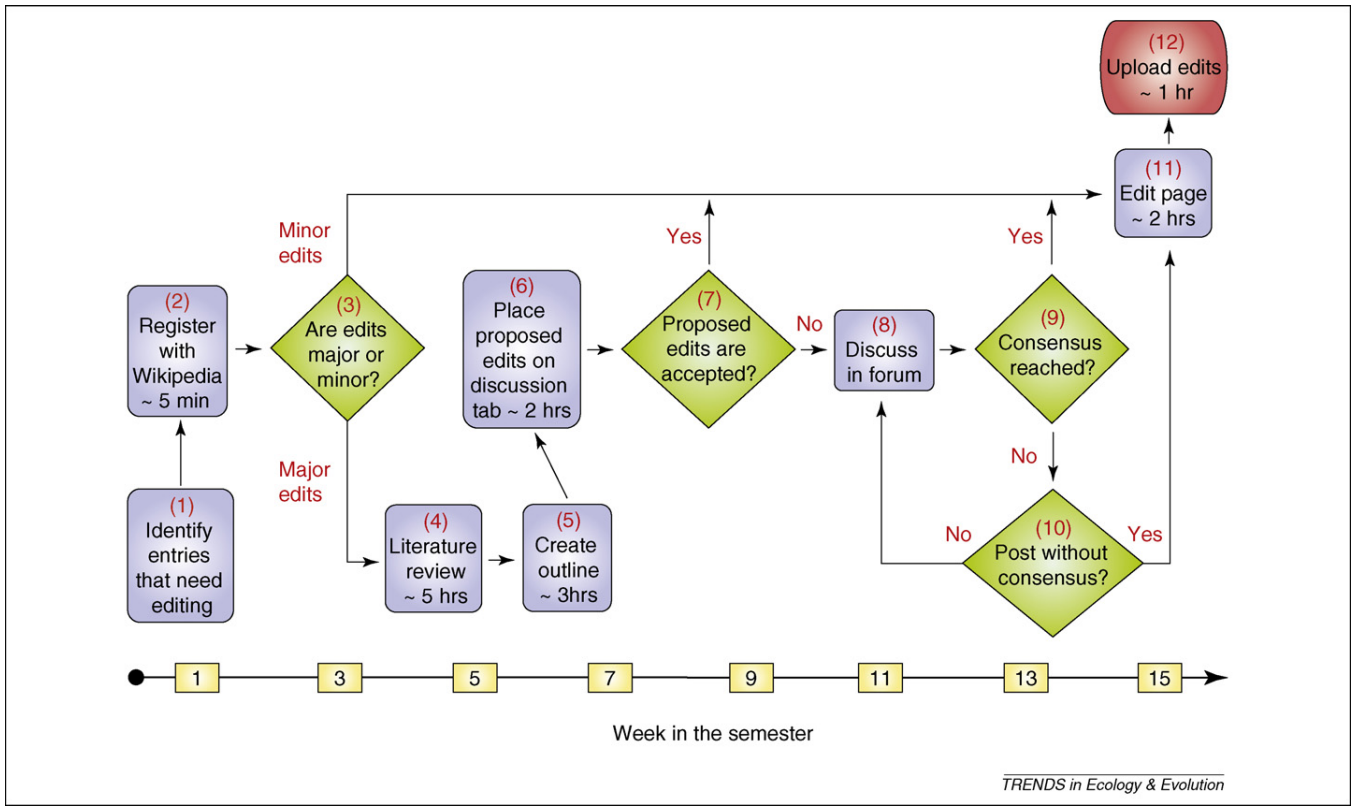

Figure 1. Flow chart illustrating the process of editing Wikipedia with a suggested timeline for a semester-long project. (1) The identification of deficient Wikipedia articles can be done by the instructor or by students. (2) The first step in editing entries is the creation of a Wikipedia account (http://en.wikipedia.org/wiki/Special:UserLogin) and a user page with areas of expertise. (3) The scope of the revisions depends on the quality of the entry – major edits include restructuring, adding/deleting or editing substantial sections, whereas minor edits include expanding sections, grammatical edits or inserting references. (4) A literature review leads to selection of key references to be cited within the text. Citations can be added from a short-cut key on the editing page. (5–6) Proposed changes should first be presented on the discussion/talk page (http://en.wikipedia.org/wiki/Wikipedia:Talk_page) to receive feedback from other Wikipedia users. (7–9) Discussion of the changes continues until consensus is reached. (10) If consensus cannot be reached, changes can still be posted; however, this might lead to changes being reverted by other users. (11–12) Wikipedia has helpful tutorials for editing entries (http://en.wikipedia.org/wiki/Wikipedia:Tutorial) as well help pages, such as the sandbox tool (http://en.wikipedia.org/wiki/Wikipedia:About_the_Sandbox), which allows users to work on drafts without modifying the article.

However, we nonetheless found the experience to be rewarding, similar in scope and time commitment to writing a more traditional term paper (Figure 1) and extremely valuable as an exercise in critical thinking and communication skills.

We believe users of Wikipedia seeking information on ecological topics should continue to approach these entries critically, and strongly encourage readers to refer to the 'Article Rating' and other tools available on the 'Discussion' tab for assessing and discussing entry quality. With Wikipedia and other online sources of information increasingly at the nexus of science and society, we also argue researchers in ecology and evolutionary biology can and should play an active role in improving the quality of these entries [6]. Although we recognize that the time, professional incentives and public recognition for doing so are limited, we believe that improvements to this now ubiquitous reference source are particularly important given the increasingly public debates on ecological and evolutionary topics. The revision of Wikipedia entries can easily be incorporated into undergraduate and graduate courses, the service activities of student organizations, laboratory meetings, extension programs and the annual meetings of professional societies. It could even become part of publishing articles in peer-reviewed journals. For example, *RNA News* now requires that authors submitting manuscripts to one section of the journal include a Wikipedia entry for peer review that is uploaded upon the manuscript's acceptance [7]. Activities such as these could greatly enhance the quality of scientific information available to a global audience, increase the diversity of participants in the process of disseminating this information, create mechanisms by which to gain formal recognition for doing so and provide opportunities to develop the public outreach and education skills encouraged by funding agencies, professional organizations and universities [8].

Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.tree.2009.01.003.

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Letters

Personality and life-history productivity: consistent or variable association?

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In an interesting article, Biro and Stamps [1] suggest that consistent individual variation in behavioural traits (animal personality) can be explained by associations with traits involved in life-history (LH) tradeoffs. Such associations would favour personality traits when individuals differ consistently in rates of biomass production through growth or reproduction (LH productivity). We agree that LH tradeoffs are likely to be important in shaping personality traits, but we suggest that correlations between personality traits and LH productivity can often vary between environments.

To date, most empirical tests of associations between LH productivity and personality have used measures of LH productivity under captive conditions and/or domesticated species [1]. Compared to nature, life in captivity is often accompanied by changes in availability of resources such as shelter, space and nutrition, and by changes in predation pressure and social environment, which generally becomes more homogeneous [2]. Variation in these environmental factors can change the relative payoffs (i.e. food intake, growth) of alternative behaviours, thereby modifying the strength and direction of association with LH tradeoffs. In oystercatchers (*Haematopus ostralegus*), for instance, aggressiveness increases food intake on preferred mussel beds when competitor densities are high, but this effect disappears at lower densities [3]. We suggest that associations between personality traits and LH productivity are more dynamic in the presence of variable natural selection pressures than in homogeneous (e.g. captive) environments, where directional selection can result in more stable associations between personality and LH productivity. A meta-analysis [4] supports this view, showing that associations between reproductive success (a proxy of fecundity) and three different personality traits (boldness, exploration and aggressiveness) become more variable when only studies of wild animals are considered.

Studies comparing associations between LH productivity and personality traits over an environmental gradient in nature are still scarce, yet some evidence suggests heterogeneous effects of personality traits on LH productivity in more complex environments (e.g. [5–11]). Bold, domesticated rainbow trout (*Oncorhynchus mykiss*), for example, grew faster than more cautious wild trout in natural lakes with high predation pressure, but not consistently in lakes without predators [5–7]. Apart from predation pressure [5–8], other factors such as habitat complexity [9] and food availability [5,10,11] might also affect associations between LH productivity and personality. In addition, these associations could be weakened if individuals experience a range of contrasting environmental conditions over their life span [12]. Such variable associations might be frequent in nature and indicate complex interactions between environmental heterogeneity and behavioural payoffs.

In conclusion, we share Biro and Stamps's [1] opinion that more empirical studies are needed to clarify the association between personality traits and LH productivity and their role in maintaining natural variation in personality traits. However, future research should primarily focus on measures of LH productivity in natural populations to gain more insight into the role of environmental variability in shaping effects of behavioural traits on LH productivity.

Disclosure Statement

B.A. and J.I.J. have no conflicts of interest to declare that could inappropriately influence the here presented work.

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