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Letter

Saving the World with Satire: A Response to Chapron *et al.*

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In their article 'A final warning to planet Earth', Chapron *et al.* [1] categorically reject the agenda outlined in the recently published 'World scientists' warning to humanity: a second notice' by Ripple *et al.* [2] and 15 364 scientist signatories. Additionally, and even more surprising, Chapron *et al.* return a stark warning from humanity to planet Earth, while endorsing overpopulation and overconsumption. For example, they put forth several positions including 'we want more stuff', 'there is no longer a need to preserve filthy and dangerous wildlife', 'growth must indefinitely prevail unrestricted', and 'we seek a second planet'. Such positions are destructive, offensive, and ridiculous, but they may reflect a bit of truth in how some people view the world. We therefore find the satirical approach by Chapron *et al.* [1] to be humorous, refreshing, and potentially effective in helping make progress on the environmental crises identified by Ripple *et al.* [2].

Satire is 'the use of humor, irony, exaggeration, or ridicule to expose and criticize people's stupidity or vices' [3]. In addition to being entertaining, satire makes people think by helping readers see things in a different light. One of the more frequently cited uses of satire concerned a 1729 proposal from Jonathan Swift to poor and overpopulated Ireland to eat its well-nursed, young, and healthy children 'stewed, roasted, baked or boiled' as a solution to the country's economic predicament [4]. The use of satire to compel readers to ponder societal issues is well entrenched in comic strips (e.g., Figure 1). But in scientific publications, the use of satire to call

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Figure 1. Satirical Cartoon Illustrating the Gap between Scientists and Policy Makers. Image courtesy of Union of Concerned Scientists/Justin Bilicki.

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attention to conservation challenges has had a limited appearance (but see [5,6]). Such limited uptake may reflect the formal nature of the scientific process, but Chapron *et al.* [1] demonstrate that there may be a place for satire in scientific journals after all. Conservation lends itself to satire because it is a value-laden topic full of social, political, and ethical obstacles [6]. We thus applaud Chapron *et al.* [1] for their use of satire and encourage others to do so too where appropriate, even if the views being expressed are sadly closer to reality than exaggeration. After all, the joke is on us. Nature has been around for a few billion years and will be around for a good while longer. Nature needs us a lot less than we need her. With that in mind, and understanding Earth's new and potentially destructive climate, we have, of course, also booked our seats to the 'second planet' along with Chapron and his mates [1], leaving those unwilling to put up with the admittedly rather hefty price tag and terrible interstellar food to stew, roast, bake, or boil on Earth a little longer.

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Letter

On Embedding Meta-ecosystems into a Socioecological Framework: A Reply to Renaud *et al.*

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Spatial flows of organisms and resources are increasingly recognized as key elements of ecosystem functioning [1,2]. In a previous article [3], we called for an update of the meta-ecosystem framework, a key conceptual and theoretical framework regarding spatial dynamics [4]. Specifically, we identified ways to better integrate different types of flows connecting ecosystems and their specific spatio-temporal scales to improve our understanding of ecosystem couplings. Building on this article, Renaud *et al*. [5] wrote that, to be more predictive and operational, the meta-ecosystem framework should also explicitly include the socioecological mechanisms underlying the impacts of human societies on these flows. Their rationale is that sociocultural mechanisms govern the way human society interacts with ecosystems and influence spatial flows connecting ecosystems. Renaud *et al*. provide some case studies of such influence; for instance, with the perception of the ivory trade [6].

We see some potential value of such a socioecological perspective; for example, to address specific questions about dynamical feedbacks between humans and the environment (e.g., on the environmental sustainability of human practices [7]). However, it is noteworthy that human-induced effects on meta-ecosystem dynamics are already integrated within the variation in spatial flow values considered in meta-ecosystem models (e.g., variance and mean quantity/quality of flows) [4]. Thus, studying the effects of processes acting at different scales on ecosystem functioning can already be achieved with the existing meta-ecosystem framework while avoiding additional layers of complexity that might reduce interpretability and understanding.

As we illustrate with a strongly human-shaped landscape in our previous article [3], human activities influence the spatial flows linking ecosystems in various ways. This includes increasing some flows (e.g., leaching of agricultural fertilizers to aquatic systems), regulating the species driving other spatial flows, or even modifying the landscape configuration itself. We here explain one well-known example of the role of human activities in meta-ecosystems including all of these aspects (Figure 1A). Goose populations in the southern USA increased massively following agricultural intensification in the 1960s because the geese shifted their diets from feeding in wetlands to feeding on the augmented resources in agroecosystems [8]. This resource augmentation was of course triggered by socioeconomic changes in farming practices and had effects on local meta-ecosystems (i.e., runoff into waterways). In the context of global meta-ecosystems, the subsequent increase in flows of migratory birds dramatically affected arctic tundra ecosystems [8], and this effect was partly modulated by hunting along the geese's migratory routes, in itself a sociocultural phenomenon.

Thus, along with Renaud *et al*. [5] and others working on socioecological linkages [9,10], we agree that culture and mental models are central to the people–nature relationship and a crucial link in the decision pathway leading to environmental regulation of anthropic impacts on nature (e.g., land use management, hunting rules; Figure 1B, arrow 1). However, these