To bend the curve of terrestrial biodiversity, place agency centre stage

Si quieres cambio verdadero, camina distinto
Calle 13

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Leclère et al.[1] have outlined the possibility of a biodiversity transition for the 21st century, a line of thinking equivalent to the Forest Transition theory and what it says about forest cover globally[2]. The authors use a suite of global models to explore the impacts on global biodiversity of interventions on land-use, consumption and production patterns. They outline six strategies that have the potential to stop the downfall of global terrestrial biodiversity by 2050 and redress it to a pre-1970 level by 2100. Although robust, sophisticated and well-illustrated, the conclusions of this paper cannot alone be used to frame a post-2020 biodiversity strategy.

Leclère et al.'s models[1] are silent on a critical variable: How humans make decisions. Integrating human decision-making process in land-use change models and placing these models at the centre of the negotiation processes will improve the odds of bringing about the biodiversity transition.

Leclère et al.[1] focus on agricultural land-use change, rightly considered the major driver of biodiversity loss. They model price fluctuations when demand changes, based on the assumption of a change in global equilibrium between supply and demand, and include reasonable assumptions about growth, environmental responses, and technological progress. The models predict how the global system will respond *if* humanity behaves in a certain way, all other things held constant. If we can increase production, reduce trade barriers, change consumption patterns, reduce waste, increase protected areas, restore terrestrial habitats and avoid surprises, the curve would bend upwards. The challenge, however, is that we are collectively unwilling, unprepared, or unable to behave like this.

We do not yet know how to adequately represent or integrate human behaviour models in land-use change models. Representations of human decision-making in such models are often not grounded in theory but limited to correlations with macro-drivers. When they are, the theories used generally derive from economics (i.e. the rational and self-interested *Homo economicus* and associated optimisation algorithms)[3]. Human decision-making differs systemically from these models by virtue of the adaptive strategies, heuristics, and resultant biases that people display[4] along with the context-dependent way that people value outcomes[5]. To represent human decision-making, the models use probabilities and utility functions, disregarding critical features of human agency—the capacity to act independently and make our own free choices—that would affect model outputs[6]. Humans' cognitive biases and bounded rationality, the roles of intuition, affect, and society in

shaping preferences, are all disregarded or undervalued[7]. While the models can be used to explore the consequences of a set of behavioural changes on future scenarios, they (1) fail at capturing how we make choices and (2) are silent on how to achieve change that is dependent on these choices.

Capturing how we make choices

Greater recognition of human agency across scales is a vital step for future global scenario development[8]. Agent-Based Models have been used with success to represent more explicit forms of decision[3], but not yet at the global scale covered by Leclère et al.[1] An alternative to partial or cumbersome representations of human decision-making is the integration of humans into the models themselves, and using the models as a context for choice experiments or strategy games. In these games, decisions over land-use change and the outcomes of these decisions depend on the decisions of others and the interaction with the system limits and rules. This framework for trade-offs and synergies (e.g. between conservation and development) becomes a powerful negotiation tool[9] and allows for the co-design of future scenarios, the development of counterfactuals and the redesign of the system rules[8].

How change happens

We change when (i) our peers themselves change (ii) or when we change peers[10]. Psychology and behavioural sciences have demonstrated that knowledge and hence behaviour is a communal entity[11]. People's opinions mostly come from those around them[10]. Bending the curve means changing the direction the world is moving. This requires changing the decisions a majority of humans make. Since we make the choices we make owing for a large part to our community, opinions do not change one person at a time. Change is exponential rather than linear[11]. To make the transition

happen, it might be enough to change the decisions of the proportion of the population necessary to reach the tipping point when ideas spread rapidly, resulting in new majority norms[12]. When there is a critical mass, entire societies can come to think about things differently[10,11]. Independently of their outcome, movements such as Black Lives Matter demonstrate how millions of people can suddenly take to the streets.

Making change happen

The way we come to a decision on which actions to take might be more important than the actions we decide to take. Consider this *reductio ad absurdum*: An agent making decisions by always flipping a coin. Were that agent to adopt a different form of decision-making process, her entire life would be transformed. Hence we propose there is a third way for change to happen: (iii) by changing the way we make choices.

We will take one more step towards the biodiversity transition if we intentionally redesign our decision-making process. This can be done in practice by giving decision-makers agency over the models. Decision-makers can become the core of the land-use change models by accepting the invitation to be both players and designers in these models. The models can then be the subject of debate from within, their limitations identified and assumptions revealed through use, play and dialogue[8]. Decision-makers accepting such invitations would be the ones developing the counterfactuals and future scenarios, and exploring the long-term impact of their strategies. Decisions stemming from such a process would emerge from consensus over explicit models that have been subject to debate and refinement.

These redesigned models are no longer 'black boxes', as the strategies and outcomes are immediately transparent and made explicit by the behaviours and

interactions of the decision-makers themselves. Such models can enable a dialogue between different scales of decision-making, from the village council to the Ministry office, from the Board of Directors to the General Assembly of the United Nations. Games and models will not dissolve existing power structures and asymmetries, nor the inequalities these create. They reveal them, as they highlight the winners and losers of the strategies that are contemplated, making them impossible to ignore[13]. Engaging decision-makers in systems-changing discussions can be done using games designed to represent the trade-offs, feedback loops, conflicts and synergies behind land use decisions[14].

The risk for the biodiversity vision outlined by Leclère et al.[1] is that it takes the same path as previous discussions on forest and climate, failing to elicit effective action in the time frame the urgency dictates. Hybrid models combining (i) the best available representations of the world system and (ii) with human decision-making at their core, (iii) actively used, played and discussed by decision-makers, have the potential to bring about the biodiversity transition. They can be developed and used at the CBD COP to help redesign a more effective post-2020 Biodiversity framework.

Leclère et al.'s models[1] show that a transition is possible. One way forward is to integrate human agency deeply into the models, and then give humans agency over them. Our responsibility as agents of change begins now.

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