

on the principal and interest repayments equalling about US\$74 million and US\$28 million, respectively¹⁷.

Summary

There is no agreement on how developed countries should meet the agreed target of raising US\$100 billion annually by 2020 for financing mitigation, adaptation, forest-loss prevention (REDD+) and technology development and transfer for developing countries.

Developed countries have been urged to mobilize additional finance from a variety of options, including alternative sources. We have proposed one alternative source: the relief of debt servicing on long-term bilateral debt owed by developing countries to developed countries. If this principle were adopted generally, it could contribute approximately one-third of the US\$100 billion per year target. However, bilateral debt agreements are negotiated on a case-by-case basis. Therefore debt relief for climate finance swaps should also be negotiated on a case-by-case basis by the parties directly involved.

The proposed solution would also help ameliorate several other climate finance challenges. Importantly, reducing debt-servicing payments would help resolve

the issue of developed countries providing climate finance for mitigation and adaptation in developing countries while at the same time curtailing their abilities to mitigate and adapt. □

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COMMENTARY:

The social heart of global environmental change

Heide Hackmann, Susanne C. Moser and Asuncion Lera St. Clair

The environmental challenges that confront society are unprecedented and staggering in their scope, pace and complexity. Unless we reframe and examine them through a social lens, societal responses will be too little, too late, and potentially blind to negative consequences.

The debate on global environmental change is shifting from a predominant focus on biophysical processes to a focus on societal processes and concerns interacting with the climate and environment¹. As the growing importance of the IPCC's Working Group II and III in the Fifth Assessment Report (AR5) clearly shows, critical issues like food production, the reduction

of emissions, transformation of energy systems and land-use change are human concerns that put people at the heart of climate challenges.

More prominently than ever before, the IPCC report offers an end-to-end picture of what climate change means for societies and natural systems, and why we should be concerned about possible imminent humanitarian emergencies. The report

pays close attention to what an increase in average global surface temperature of up to 4 °C might look like; it assesses our current understanding of how to reduce the risks of the dramatic and catastrophic impacts this rise in temperature may cause². The report's message is clear: there is still time to prevent the most dramatic changes and we have many options to reduce the risks — through adaptation, mitigation

Box 1 | The transformative cornerstones framework: six social frames for global environmental change¹⁵.

Cornerstone 1: Historical and contextual complexity

What are the interconnected drivers of global change? What are the historical trajectories that have led to the current situation? What are the interdependencies of peoples' vulnerabilities to these and other social processes, and how do risks, impacts, perceptions, experiences and responses differ across the world, across social classes, gender, race, or faith, and between personal or professional identities?

Cornerstone 2: Consequences

What are the current and future threats from global environmental change and their impacts on people and communities? What are the diverse realities of living with such change?

Cornerstone 3: Conditions and visions for change

How does social change — at the individual and collective levels — happen, and what directions might it take? What kind of leadership and other capacities are required for successful change to occur?

Cornerstone 4: Interpretation and subjective sense-making

What are the values, beliefs, interests, worldviews, hopes, needs and desires that underlie people's experiences of and responses (or lack thereof) to global change? What shapes the personal narratives and social discourses about the nature of the world and the environment, and thus people's views on the necessity for a transformation?

Cornerstone 5: Responsibilities and ethics

What does it take to foster global and intergenerational solidarity and justice? What are the obligations, duties and responsibilities to poor and vulnerable people, to future generations, and to the other-than-human environment?

Cornerstone 6: Governance and decision-making

How are decisions made in the face of uncertainty? What pathways are available for influencing policy-making? What determines the success or failure of political agreements? What drives political will?

and equitable sustainable development approaches^{2,3}. The window of opportunity, however, is closing and will require the initiation of major reductions in carbon dioxide emissions within the next ten to fifteen years. Most environmental trends are negative, accelerating, and in some cases mutually reinforcing; the consequences of these changes are real and unfolding now, affecting individuals and communities everywhere.

Importantly, people and societies are no longer viewed as external to (or merely a simplistic black box within) the Earth system but as an integral and differentiated part of it — creating the problems and holding the key to their solution. Specific contexts — such as geographic, cultural or personal — matter and affect how drivers and responses unfold. Equally important are the many other challenges that affect those contexts^{4–6}. The interaction of climate change problems with social crises such as poverty, multidimensional inequalities and growing social discontent, and the inevitable trade-offs across communities, sectors, space and time all make climate change a 'wicked' problem⁷.

This is the Anthropocene⁸. But this recognition poses more questions than it answers; questions about fundamental human responsibilities and opportunities that call on the social sciences to conduct analyses, offer interpretation and help society create meaning.

The reframing implied in the narrative of the contributions to AR5 is articulated in the *World Social Science Report 2013*⁹. Demanding a bolder, more creative and integrated social science, the report offers

three main messages that point to how we may build the capacity for meeting the challenges laid out in the AR5. The social sciences must help to fundamentally reframe climate and environmental change as a social, rather than physical, problem. The social sciences must be much more engaged with policy and society and become key players in the quest for solutions that work for the benefit of people and the planet. And the social sciences must become more open to new ways of producing and sharing knowledge to reach policymakers, businesses and civil society before the window of opportunity closes. This is poignantly echoed by Weaver and colleagues¹⁰, whose work specifically focuses on global change science in the US context, but is just as applicable elsewhere.

It all begins with the way we think about the challenges facing us.

Social nature of environmental change

It is remarkable that we keep perceiving problems that are caused by humans, that inflict harm on humans (and the life support systems on which they depend) and that can only be solved by humans in terms of their biophysical nature, as matters of molecules, shifts in atmospheric dynamics or ecosystem interactions, imbalances in elemental cycles or merely as collapsing environmental systems. Clearly, the problems we face are all of these things. But we should not assume that lay audiences and policymakers see the relevance of these global challenges to daily decisions and actions, or that humans grasp the implications of these issues in

terms of how to change policy or take new, more relevant decisions. Likewise, we should not assume that such framings will arouse the passions of those less fascinated by science, less inclined to consider long-term consequences or the complexities of systems, or those less aware of the acute human dependence on stable, functioning natural systems.

Of course, framing is not the only thing that needs to change to get people's attention and motivate action. But we believe an essential ingredient for success would be to reframe the issues at stake in terms that put humans at the centre of global environmental change — for three fundamental reasons⁹.

First, we can no longer disentangle social and environmental systems and problems; they are inseparable. Second, in the Anthropocene, humans are fundamentally and massively altering the Earth from the state it was in just a few centuries ago — a remarkable and unprecedented condition of human existence. And third, in response to the challenges before us, society will have to either deliberately seek out, or be involuntarily subjected to, profound societal transformation.

In short, we live in the Anthropocene in which humans collectively exert geologic force on the planet and thereby alter its very functioning; we also live in an era in which we have — maybe for the last time — the opportunity to become truly *Homo sapiens* (wise, sensible and judicious) by being reflective, resourceful and, in all our actions, responsible for our past, present and future¹¹.

The environment as a social issue

To reframe and reinterpret global environmental change as a social process means deviating from several decades of physical science dominance of global change research. As indicated by the IPCC AR5, this is where the major gaps in research are today. The way issues are framed matters because it shapes what is perceived as important and why, and guides actions in particular directions^{12,13}. To open up possibilities for solutions that are innovative, feasible and acceptable, we now need framings that promote the social, political, economic and cultural nature of climate change, and prioritize people's beliefs and values, their behaviours, practices and the institutions that guide them¹⁴. We need to understand the consequences of environmental change for the everyday lives of people, their interpretations of such change and their visions for possible and effective response options.

This is the focus that the social sciences bring, and why they must be more centrally involved in global change research and in the search for solutions.

How to reframe global environmental change in social terms is elucidated by the six transformative cornerstones of social science research on global change¹⁵. This knowledge framework identifies key questions we need to answer if research on environmental problems is to contribute to more effective, equitable and durable solutions. It can also help tap into societal concerns and human passions in unprecedented ways and constructively mobilize humans for their own future (Box 1).

Making it practical

Framing these issues through a social lens should not, however, simply transfer from one domain of science to another. Finding effective, durable solutions to climate and broader environmental changes requires the joint efforts of experts from all domains of science with decision-makers and stakeholders. But this does make social science knowledge indispensable knowledge and requires leadership from the global social science community. What does that mean in practice? We highlight six priority action steps from the *World Social Science Report 2013*⁹.

First, social scientists, along with their funders and those who shape science policy, should promote the understanding that global environmental change is a priority domain par excellence in the social sciences. Second, research funders, scientific institutions, international

councils and associations and research teams need to ensure that social scientists are included from the beginning in research projects to identify and frame socio-environmental priorities, to ensure the success of a solutions-oriented, integrated science of global change for sustainability. Third, social scientists, wherever they work, should respond proactively to the ever-growing demand for social science knowledge on global change and sustainability, and take the lead in deepening our understanding of key concerns. Fourth, they need to develop new (and modify existing) concepts, tools and methods to better understand the dynamics of complex social-ecological systems, and reveal the connections between environmental, socio-political, economic and cultural vulnerabilities and crises.

Finding effective, durable solutions to climate and broader environmental changes requires the joint efforts of experts from all domains of science with decision-makers and stakeholders. But this does make social science knowledge indispensable knowledge and requires leadership from the global social science community.

Fifth, decision-makers at all levels — in the public, private and civil sectors — need to prioritize the appointment of social scientists, in all disciplines, to scientific advisory bodies, expert committees and working groups intended to provide advice on global environmental change and related policy options. And finally, there must be a willingness among those engaged in evidence-based policy-making to recognize the validity and importance of context-sensitive and qualitative knowledge about the full complexity of the human world in the design and implementation of policy.

More demanding than a revolution

Reframing, together with the action steps listed above, constitutes a key strategy alongside a broader set of required changes for integrating the social perspective more fully into research and practice¹⁰, giving the sustainability transformation a better start

and a better chance of long-term success in both environmental and social terms.

The picture emerging from the IPCC reports is — or should be — a deeply disturbing one. As Bruno Latour once wisely cautioned, however, just invoking an apocalypse won't do it¹⁶; and, indeed, the change needed in the social and neighbouring sciences, as well as in broader society is more demanding than instigating a revolution. We will need far greater endurance. Framing, as was recognized four decades ago¹⁷, directs and organizes our attention. If physical frames obscure the human causes, impacts and solutions, then reframing environmental change as quintessentially social is a fundamental, strategic act that shapes what we perceive and everything we might do. Why would we do any less for our future? □

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