SPRINGER NATURE

SUSTAINABLE DEVELOPMENT SOLUTIONS NETWORK
A GLOBAL INITIATIVE FOR THE UNITED NATIONS

HARNESSING SCIENCE FOR A SUSTAINABLE FUTURE: NARROWING THE POLICY, RESEARCH, AND COMMUNITY DIVIDE

White paper

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I. Mobilizing science for a sustainable future: The sea change needed

We are facing a time of unprecedented acute, complex, and transboundary sustainable development challenges. They include the increased emergence of zoonotic diseases linked to ongoing environmental destabilization and declining planetary health (Petrikova et al., 2020, Jowell and Barry, 2020); the rapid degradation of lands, habitat, and biodiversity; growing urbanization; and increasing air pollution that kills millions every year (Cohen et al., 2017). But this is also a time of great opportunity. The COVID-19 pandemic is a serious setback for sustainable development and has further hindered efforts to achieve the Sustainable Development Goals (SDGs) (Naidoo and Fisher, 2020, *Nature*, 2020b, Sachs et al., 2020), but it has united the world's researchers like never before and has shone a spotlight on the importance of science in the development of solutions to the most severe challenges we will likely face in our lifetime.

As one of the world's preeminent research publishers and as a leading global organization working to mobilize scientific and technological expertise for sustainable development, Springer Nature and the UN Sustainable Development Solutions Network (SDSN) recognize that scientific knowledge and expertise are vital for diagnosing our planet's most acute challenges and developing solutions. While the scientific and policymaking communities are often siloed, the COVID-19 pandemic has shown that there are opportunities to bridge divides and learn from these experiences. To fully harness science for a sustainable future, we must continue to work toward breaking down these silos and accelerating the integration of science into the policymaking agenda.

In order to facilitate this integration, in October 2020, SDSN and Springer Nature hosted a virtual conference, *Science for a Sustainable Future*, bringing together policymakers, government representatives, UN officials, and leading researchers from around the world to discuss the role of science in achieving the SDGs. The conference featured three thematic sessions focused on some of the most timely and pressing issues facing our planet, including health, urbanization, and food systems and land-use.

To confront these complex global challenges, we cannot continue with business as usual. A future without poverty and hunger, with sustainable jobs, and a clean and stable environment, requires transformational change. Deep transformations are needed over the coming decade in how our economies and societies function if we are to achieve the SDGs (Sachs et al., 2019). However, these transformations do not fit neatly into disciplines and cannot be addressed in silos. It is only with greater collaboration across disciplines and among

diverse stakeholders, that breakthroughs in our understanding of the necessary changes needed to achieve sustainable development can be achieved.

Science and technology are powerful agents of change, but realizing their full potential depends on a host of actors, including researchers and engineers in both the public and private sectors, entrepreneurs, financiers, policymakers, educators, as well as the general public (Messerli et al., 2019b). It's crucial that these stakeholders find a common language and modalities for working together to solve pressing problems. We must also recognize the heterogeneity of knowledge systems and work toward raising scientific literacy and awareness of the value of science among citizens, local communities, and policymakers.

The challenge is how to enable inclusive problem solving that brings together researchers and technologists from different disciplines with public policy specialists and the many stakeholder communities, including under-represented groups, and to redouble policy efforts guided by evidence, as real change won't come until the research-policy interface is strengthened (*Nature*, 2020a).

This white paper presents key takeaways and recommendations from the conference for how to foster greater collaboration among these communities. We hope that it will continue to advance the discussion on how to achieve better integration of science, policy, and community to accelerate progress on sustainable development. With an uncertain future and further obstacles ahead, it is only by working together that we can truly achieve the necessary transformative change for our planet.

II. Key recommendations

2.1 Recommendations for policymakers

- **Further develop existing knowledge infrastructures, institutions, and governance that encourage and enable continual, iterative engagement between policymakers, researchers, and the community in diagnosing problems and in decision-making processes.**

- **Expand the use of data and tools in policy processes, including quantitative assessments and modeling, which can be co-developed through collaborative processes that bring diverse actors and knowledge together using a common language.**

- **Facilitate access for researchers to policy dialogue forums to enable them to listen to the challenges that policymakers face first-hand and better design studies that result in practical and actionable findings.**

An important theme that emerged from the conference was the need for a common language and mechanisms to bring policymakers, researchers, and communities together to solve problems. This could include mechanisms that promote engagement of researchers, stakeholders, and decision-makers in generating research priorities and metrics for success; collaborative group processes and policy labs; embedding technical capacities in government; knowledge networks comprising policymakers, government, and civil society; and the use of intermediaries, such as information brokers and boundary organizations, to help translate scientific findings and tailor advice for policymakers and other audiences. The conference sessions also highlighted the value of using empirical examples and case studies that have been effective in achieving these ends. Central to these was the importance of data and tools to bring people together from different disciplines using a common language and to build trust among varied stakeholders to accelerate the policy process.

In particular, the session on food systems and land-use highlighted quantitative assessments and modeling and data-rich tools as effective mechanisms for bringing together siloed stakeholders. Examples of this were explored through the 'bending the curve on biodiversity' modeling research (Leclère et al., 2020), the FABLE Consortium collaboration between modelers and policymakers (The Food and Land Use Coalition, 2020), and the Food Systems Dashboard (Global Alliance for Improved Nutrition (GAIN) and Johns Hopkins University, 2020). The Food Systems Dashboard, for example, brings together data on various aspects of food systems, including drivers of change, supply chains, environment, diets, and nutrition. The system is designed as a

The Food Systems Dashboard brings together data on various aspects of food systems, including drivers of change, supply chains, environment, diets, and nutrition. The system is designed as a public good to help policymakers and citizens better understand their food systems by clearly presenting indicators and metrics and enabling benchmarking across countries. In situations where there is competition around land-use (e.g. agriculture, biodiversity, forestry, urban land), the use of visual maps and datasets with different layers also provides a useful means to build a shared understanding and find solutions.

public good to help policymakers and citizens better understand their food systems by clearly presenting indicators and metrics and enabling benchmarking across countries. In situations where there is competition around land-use (e.g., agriculture, biodiversity, forestry, urban land), the use of visual maps and datasets with different layers also provides a useful means to build a shared understanding and find solutions. These data-driven technologies can build trust between stakeholders, bring together expertise from different disciplines, and accelerate the policy process.

Collaborative tools and data platforms were also explored during the conference in the urban context. Examples included the dynamic three-dimensional Virtual Singapore city model (National Research Foundation Singapore, 2020), which enables users from different sectors to develop sophisticated tools and applications for experimentation and test-bedding concepts and services, as well as accelerate research on new technologies to solve emerging and complex challenges for Singapore. The 3D digital platform is intended for use by the public, private, and research sectors as well as the general public. Another example discussed where data has been leveraged to inform city planning and policy is the *Cómo Vamos* (Cómo Vamos, 2020) network in Colombia, which brings together hard data on technical indicators on cities and data from surveys on public perception. This combination provides knowledge on the effectiveness of city planning and management and insights on how to improve the quality of life for citizens.

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2.2 Recommendations for scientists and researchers

- **Intensify interdisciplinary research in practical areas to gain a clearer understanding of the SDGs, to design transformation pathways in concrete contexts, and to provide evidence on solutions and interventions that work.**
- **Increase the translation of the results of scientific assessments across all scales into practical guidance for policymakers and implementers.**
- **Raise scientific literacy and awareness of the SDGs among citizens and policymakers through greater collaboration, advocacy, and outreach.**
- **Complement conventional science models with other forms of knowledge, such as traditional, cultural, and practical knowledge.**

All sessions emphasized the need for more actionable research in priority areas to gain a clear understanding of the SDGs, design transformation pathways, and provide evidence on feasible solutions. Moreover, the interconnected nature of the SDGs and the transformations needed to achieve them require interdisciplinary research and systems that integrate scientific and practical knowledge and methods in the interest of problem-solving. This can be achieved through more open and hybrid knowledge systems that engage stakeholders and seek a plurality of perspectives in societal agenda setting, collective problem framing, and integrative research processes.

To more effectively design studies that result in practical and actionable findings, researchers need to gain a better understanding of the knowledge gaps and problems faced by policymakers and communities. This requires that researchers listen and learn, as well as undertake greater outreach, collaboration, and advocacy efforts to increase scientific literacy among policymakers and the broader public as well as enhance awareness of important research findings.

The COVID-19 pandemic has further spotlighted this issue. Not only has the pandemic resulted in an improvement in the use of research and evidence in policymaking (Rijs and Fenter, 2020), but it has also provided important insights on how science enters the policy process and the trade-offs that policymakers are weighing in terms of impacts on health and well-being, jobs, and the economy.

As discussed in the health session, countries that have been more successful in addressing the pandemic have a decision-making culture that integrates science. Other examples of effective integration of science into policy and implementation include global responses to malaria, AIDS, and tuberculosis, where scientific evidence and advancements have informed key decision-making, including guidance from the World Health Organization, which has fed through to national and local implementation. Such examples also highlight the importance of ensuring that responses lead to an impact on the ground, including considerations around costs, equity of access, local conditions and culture, and integration with community health services.

Global science-policy processes were also examined, including negotiations on global biodiversity targets under the UN Convention on Biodiversity. Parallels were drawn with the 2 degrees Celsius target under the UN Framework Convention on Climate Change and efforts to develop a shortlist of simple biodiversity metrics or headline indicators that can capture the bigger picture in an easily communicable way. Monitoring of land, water, and biodiversity is complex and expensive, however many opportunities are now available to use satellite imagery, citizen science, drones, and internet-of-things devices to collect and bring data together in new ways. Cloud computing and data science techniques are also readily available to process very large amounts of data and provide meaningful insights. These tools are bringing new evidence to the table and are supporting global policy processes, and translating the results of global scientific findings into practical guidance for policymakers provides another useful mechanism for bridging the science-policy divide (Bazaz et al., 2018). Yet, while global scientific assessments and models are useful starting points, they are insufficient unless they are coupled with finer-scale research to inform local needs and potential solutions (DeFries et al., 2012). The top-down approach of global priority setting evident in the SDGs needs to be supported by bottom-up solutions appropriate for particular contexts.

Lastly, examples of bottom-up collaborations were also highlighted. For instance, the session on food systems and land-use discussed the use of study circles to solve local problems in rural India. These study circles bring

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together local knowledge and experts from local universities, and issues are then reviewed in a decision-making forum based in a village assembly. Other examples reviewed included the Agricultural Science Centre in Southern India, which is jointly-run by government-appointed scientists and local female farmers to ensure the application of diverse knowledge, and the Arctic Biodiversity Assessment, which involves collaboration between the government and indigenous institutions to enhance information and improve decisions taken to sustainably manage the region. Central to these case studies is the radical, deep democratization of governance using a bottom-up approach.

2.3 Recommendations for scientific journals and academic institutions

- **Provide formats and forums that encourage greater breadth and integration of research across disciplines, with a focus on finding solutions to complex challenges.**
- **Adjust the incentive structures and reward systems in academia to promote greater outreach and advocacy from researchers, as well as implementation research focused on evaluating the impact of science on the ground in different settings.**
- **Reorient formal education programs in research institutions to include multiple disciplines and courses related to the SDGs.**
- **Increase mentoring programs for researchers in the Global South to provide opportunities for capacity building, equitable collaboration, and access to resources.**

The conference also examined the role of scientific journals and academic institutions in encouraging interdisciplinarity in research and formal education programs, raising awareness of the SDGs, and incentivizing solutions-focused research. To encourage interdisciplinarity, scientific journals and academic institutions can lead by example by providing formats and forums where disciplinarians, inter-disciplinarians, and non-experts can interact with one another and engage with research findings, for example, Nature Energy Policy Briefs (*Nature Energy*, 2019) or the Science on the Hill event series. This can be further encouraged through the expansion of interdisciplinary courses and content on the SDGs in formal education programs that draw upon open educational resources, such as those developed through the SDG Academy (UNSDSN, 2020).

And while scientific evidence on implementation and the effectiveness of interventions is greatly needed, this type of research often remains undervalued among scientific journals and academic institutions. Further, the traditional pipeline model of publishing research findings in peer-reviewed journals is often insufficient for informing policy and implementation. With increased funding and other incentives, such as credit, scientific journals and

Researchers, scientists, and scientific institutions in the Global North have an obligation to mentor others and provide opportunities for capacity building, collaboration, and access to resources. Mentoring programs are becoming an important mechanism for young researchers in developing countries to become co-investigators and tailor research to the needs of their countries (Major et al., 2019).

academic institutions can support greater uptake of implementation research as well as encourage outreach and advocacy by researchers on their findings. But further discussion and experimentation are needed to determine what kinds of incentives would work here.

There is also a widening gulf between the Global North and South in terms of scientific research institutions and capabilities, funding, scientific literacy, and in attracting people into scientific research. This creates a bias in the formulation of research priorities and solutions that are applicable in different contexts. Researchers, scientists, and scientific institutions in the Global North have an obligation to mentor others and provide opportunities for capacity building, collaboration, and access to resources. Mentoring programs are becoming an important mechanism for young researchers in developing countries to become co-investigators and tailor research to the needs of their countries (Major et al., 2019). A suggestion was made during the conference that such provisions could be instigated as a requirement in research funding programs to expand their use and build networks and partnerships.

III. Why this matters: A deeper dive into the issues

3.1 The emerging role and priorities for science to enable a sustainable future

Science must play a central role in advocating for evidence-based strategies that support SDG achievement, and the focus should be on practical problem-solving in critical areas. The SDGs have generated considerable interest in the scientific and research communities and delivered a rapidly growing catalog of research publications (Nakamura et al., 2019). This includes several reviews of the role of science and research priorities to support the implementation of the SDGs (Stafford-Smith et al., 2018, Messerli et al., 2019a, Schneider et al., 2019). Yet, simply saying that we need to expand the role of science is not enough. Moving forward, practical areas where research can make a valuable contribution include gaining a clear understanding of the goals, designing transformation pathways in concrete contexts, and providing evidence on solutions and interventions that work.

The translation of the Millennium Development Goals (MDGs) into quantitative, time-bound objectives succeeded in mobilizing the research and statistical communities to fill data gaps, particularly on health-related SDGs. The Global Burden of Disease collaboration provides a useful case study on effective partnership between researchers, donors, publishers, governments, and international organizations that has significantly advanced data and metrics for monitoring progress on health-related SDGs (Lim et al., 2016, GBD 2019 Diseases and Injuries Collaborators, 2020).

Despite advances since the MDGs, many SDGs still lack quantitative, time-bound targets, and national and global monitoring of indicators is plagued by data gaps. While we have a clear global climate objective (limit global warming to 1.5 degrees Celsius), for many environmental goals it is less clear what would constitute success by 2030. Science can contribute to filling these knowledge gaps and bring new ambition to agenda-setting by political leaders, including current negotiations underway for a new set of global biodiversity targets and metrics (Leclère et al., 2020). Leveraging big data, citizen science, and advanced data science methods, such as artificial intelligence and machine learning, can also contribute to filling gaps in monitoring. Central to this will be clear communication of complex issues.

Another important role for science relates to elaborating how transformations can be organized (Sachs et al., 2019, Messerli et al., 2019b, Scoones et al., 2018), the scale and pace of change needed (Randers et al., 2019, TWI2050, 2018), and the associated risks, costs, and benefits (O'Brien et al., 2018). Empirical research highlights that policymakers are ever more receptive to

insights from research on sustainable development transitions and how to make them happen (Turnheim et al., 2020). The SDGs include many complex interdependencies as a result of coupling between human, technical, and natural systems (Nilsson et al., 2016, International Council for Science, 2017). Organizing the implementation of the SDGs around a smaller set of key transformations can accelerate understanding of these interdependencies as well as interventions that are necessary to achieve SDG outcomes. This includes transformations in food and land-use systems, cities and urbanization, and health and well-being. Quantitative modeling, including integrated assessment models (IAMs) combined with scenarios and pathways approaches, are well-suited to support transformation research and enable decision-making on the costs and benefits of specific interventions and strategies to achieve the SDGs (van Soest et al., 2019, Allen et al., 2019). Significant advancements have been made in global modeling research, including through the Intergovernmental Panel on Climate Change (IPCC) and Shared Socioeconomic Pathways (O'Neill et al., 2017, Riahi et al., 2017) and The World in 2050 initiative (TWI2050, 2018). There is also a need for national-scale transformation modeling to support decision-making in different country contexts (Allen et al., 2019). Advancing knowledge on SDGs interlinkages and transformations will require greater collaboration across disciplines to support detailed bottom-up modeling at the sectoral levels as well as economy-wide and whole-of-system modeling of interactions across sectors (Allen et al., 2021).

Finally, scientific evidence on the effectiveness of interventions and implementation is also needed. Public health is a field with a long tradition of rigorous intervention-based research that can help to inform less-developed areas, such as education and environmental challenges. Research on implementation is critically needed to better understand the impacts of programs and interventions and increase evidence on what works. While blue sky research remains important and often attracts funding through publications in top-tier journals, implementation research remains undervalued among researchers and publishing institutions. Academic researchers need to strike a balance between pushing theoretical boundaries and generating information for practical use (Weichselgartner and Kasperson, 2010). Promoting research into the impact and effectiveness of interventions and programs implemented to support the achievement of the SDGs remains a key gap.

3.2 Bridging the gap: Interdisciplinary science and hybrid knowledge systems for practical problem solving

Traditional fragmentation of knowledge and research into disciplines tends to favour science addressing small parts of complex problems without due consideration of broader interrelationships and impacts. For example, research might identify an engineering pathway to zero-carbon power without reflection on the social implications or financing modalities. Without considering the bigger picture, including the socio-economic and political context, proposed solutions can be unworkable in practice (Weichselgartner and Kasperson, 2010).

The interconnected nature of the SDGs and the transformations needed to achieve them creates a demand for new knowledge and methods of inquiry that

extend beyond traditional disciplinary research. This requires a move towards greater breadth or integration of research across disciplines, with a focus on finding solutions to complex challenges (van der Hel and Biermann, 2017). The integration of knowledge will be fundamental to achieving the SDGs, and interdisciplinarity is seen as a means to integrate knowledge and methods in the interest of problem-solving (Clark and Wallace, 2015). However, explicit mechanisms for achieving this combination of research depth and breadth are often lacking. Central to this is how scientists and researchers can better organize themselves for such collaboration, integration, and interdisciplinarity.

It is also important to acknowledge some fundamental challenges to expanding science and knowledge in policymaking identified during the *Science for a Sustainable Future* conference. First, policymaking has been perceived as more oriented towards the ease of doing business and economic growth, rather than sustainability of land, biodiversity, or livelihoods. Second, that the hegemony of science and technology has curtailed other forms of knowledge, such as cultural or traditional knowledge systems. Third, that solely expanding the role of formal science in decision-making is insufficient, as it is important to also consider the knowledge of custodians of natural resources and local livelihoods. Expanding science and knowledge in policymaking requires breaking out of the conventional models and integrating other forms of knowledge, such as traditional, cultural, and practical knowledge. Hybrid knowledge systems offer the opportunity for collaborations between formal science, other knowledge systems, and policymakers. Broadening these knowledge systems can be achieved through societal agenda setting, collective problem framing, a plurality of perspectives, integrative research processes, better treatment of uncertainty and diversity of values, effective dialog processes, and stakeholder participation (Cornell et al., 2013).

Scientists and researchers from all disciplines, working from global to local scales in both high-income and low-income countries, need to bring together their scientific knowledge, tools, and approaches to assist society in developing solutions for pressing sustainability challenges (DeFries et al., 2012). To do this, the tensions between depth and breadth and different forms of knowledge will need to be overcome. A positive trend is emerging where the younger generation of scientists see themselves as truly interdisciplinary, and many solutions may flow from this. This has been encouraged through the expansion of interdisciplinary courses and sustainable development programs in education. Further reorientation of formal education programs to include multiple disciplines and courses related to the SDGs should also be encouraged. Scientific journals and institutions have an important role to play by providing formats where disciplinarians and inter-disciplinarians can interact and communicate.

Finding effective solutions for the SDGs extends beyond scientific research to involve a vast multi-stakeholder enterprise, including the science and engineering communities, politicians, business, and civil society. Ultimately, these crucial stakeholders must find a common language to work together to solve problems. Finding effective methods of cross-stakeholder cooperation is a significant challenge, but can be enabled by raising scientific awareness and literacy within the general population and among policymakers. For example, people are more likely to seek positive change if they can understand and appreciate how their behavior and lifestyles impact the environment and other outcomes, and if they are engaged and feel part of the process (Fritz et al.,

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2019). Citizen science represents a win-win opportunity, in terms of engaging the public in science and raising awareness, as well as supporting national and global monitoring efforts and filling important data gaps in the SDGs (Fritz et al., 2019).

3.3 Narrowing the science-policy divide: Integration of science, policy, and community

While gaps in knowledge remain, a considerable volume of research is being done on the SDGs, and many technologies and solutions already exist to address some of the key challenges, such as climate change and rapid urbanization. Research on decision-making at the science-policy interface illustrates the importance of continual engagement between policymakers, researchers, and the community (Ojha et al., 2020, Reid et al., 2009). However, this tripartite engagement is often the exception rather than the norm and a considerable gap remains between scientific research, national policymaking, and local implementation.

Traditionally, science has worked in a trickle-down or pipeline mode, in which scientists set the research agenda, do the research, and then transfer the results to potential users, assuming that they diffuse automatically through the practice community (Weichselgartner and Kasperson, 2010). For many researchers, the focus (at least initially) is on academic journal publications with the expectation that their findings will be disseminated widely, inform policy, and lead to an impact on the ground. Additionally, the practice of bringing research findings into the policy and practice arenas by publishing in peer-reviewed journals is deeply embedded in the science system, including incentive structures that reward publications with scientific impact (Weichselgartner and Kasperson, 2010). In reality, politicians don't often read scientific journals, and access to publications through paywalls can be limiting, particularly in low-income countries. While research findings are often relevant for practitioners, they are rarely presented in a way that they can easily be used and applied by decision-makers. There is a need to be more deliberate and proactive in advocating the use of science and research in policy at the local, national, and global levels. Within academia, while many universities are increasingly encouraging outreach activities, such as working with stakeholders and outside organizations, overall rewards for these kinds of activities remain low (Dilling and Lemos, 2011).

Policymakers operate in complex, rapid, and multi-level environments and often cannot consider all evidence relevant to a policy (Cairney et al., 2016). Academic research and scientific analyses are only one part of a larger realm of economic and political influences on decisions. Policymaking is essentially about managing (or optimizing) trade-offs, which is fundamentally a political governance challenge. Policymakers also face a range of complex problems for which more scientific evidence or advice may be useful, but given the competing demands upon their time and the range of external influences, it's important that scientists and researchers have a clear understanding of these needs and design and tailor research and dissemination efforts to fill knowledge gaps. Often these are not questions about technical aspects, but

rather, relate to implementation (e.g., how can we do this here?; how can we afford this; and what are the implications for other sectors?).

Empirical studies have found that research is more likely to be used by decision-makers if it is considered credible, meaning that it is scientifically robust, legitimate (respectful of stakeholders' divergent values and beliefs), and salient (relevant to the needs of decision-makers) (Cash et al., 2003). Central to this is enabling iterative communication between researchers and policymakers (Cairney et al., 2016, Ojha et al., 2020). For science to be salient, researchers need to understand the questions that policymakers are asking, which requires access to policy dialogue forums where they can listen to the challenges that policymakers face first-hand and better design studies that result in practical and actionable findings. A key limiting factor is that the research community often lacks the adequate agency to effectively engage and communicate research with policy actors, who are confronting diverse decision challenges, but are rarely asking for research (Ojha et al., 2020). The SDG negotiation process took a first step at engaging scientists more proactively in global deliberative processes (Dodds et al., 2016), including through panel discussions in the Open Working Group, but much more can be done to improve the inclusivity of global, regional, and national policymaking.

However, it is not simply a case of bringing science to policymakers. Science also needs to be people-oriented, inclusive, and communicated in a way that builds public understanding of the importance and benefits of science and evidence and ensures that this knowledge reaches the most marginalized populations. Increasing legitimacy requires that researchers listen to and understand the experiences of people in local communities and their diagnoses and recommendations for solving problems. This requires that more voices are included around the decision table, and that durable structures and institutions are built to disseminate and communicate new learnings. Options for generating more usable science include involving stakeholders and decision-makers in generating research priorities and metrics for success, collaborative group processes and policy labs, embedding technical capacities in government, knowledge networks comprising policymakers, government, and civil society, and the use of intermediaries, such as information brokers and boundary organizations to help translate and tailor information for different audiences (Dilling and Lemos, 2011, Cash et al., 2003, Weichselgartner and Kasperson, 2010, Ojha et al., 2020).

Furthermore, integrating science, evidence, and knowledge to support policy is likely to require additional development of existing knowledge infrastructures, institutions, and governance. Importantly, policymakers will also need new skills to deal with a variety of stakeholders, manage and evaluate evidence and experiments (including acknowledging inevitable failures), and monitor progress on multiple dimensions (not just costs) (Turnheim et al., 2020). This represents a major opportunity to develop new indicators and shared data platforms, evaluation procedures, and assessment tools that can help in bringing diverse knowledge together using a common language.

IV. The 'Science for a Sustainable Future' conference

Today's global food system is unsustainable. Agriculture is responsible for 80% of global deforestation, 70% of freshwater use, and close to 30% of global greenhouse gas emissions (Messerli et al., 2019b). More than two billion hectares of land are degraded, while 690 million people are still hungry (United Nations, 2020). The conversion of natural habitats to land for agriculture and forestry is also resulting in a rapid decline in biodiversity (Maxwell et al., 2016, Díaz et al., 2019). However, it is possible to reduce these negative impacts. For example, recent studies describe food systems capable of delivering nutritious food for a global population of 9 to 10 billion with greatly reduced environmental impacts (Leclère et al., 2020, Searchinger et al., 2019). Such transformations of the global food system must ultimately involve multiple stakeholders, from individual consumers to policymakers, experts, and actors along the food value chain, working together toward the shared global goal of healthy and sustainable diets for all (Willett et al., 2019).

Rapid urbanization is resulting in a growing number of people living in slums, inadequate and overburdened infrastructure and services, and worsening air pollution. Cities are responsible for 70% of the global greenhouse gas emissions from burning fossil fuels (Messerli et al., 2019b), around 90% of people living in cities breathe air that fails to meet World Health Organization's (WHO) standards (United Nations, 2019), and over one billion people live in urban slums (United Nations, 2020). By 2050, it is projected that cities will house nearly 70% of the global population (United Nations Population Division, 2018) and produce 85% of economic output (Delgado et al., 2015).

On average, people today are healthier and live longer than previous generations (GBD 2019 Diseases and Injuries Collaborators, 2020). Considerable progress has been made in improving maternal health and reducing child mortality, communicable diseases, and the probability of dying from major non-communicable diseases (United Nations, 2020). However, around half the world's population lacks access to essential health services, and the share of the population paying more than 10% of household budgets on health services is increasing (Messerli et al., 2019b). The COVID-19 pandemic threatens to reverse decades of improvements in health outcomes.

It was against this background that the *Science for a Sustainable Future* conference was organized in October 2020, from which the recommendations outlined in this white paper are drawn.

The virtual conference included three thematic sessions focused on the topics outlined above: health, urbanization, and food systems and land-use. Each moderated session featured a panel of distinguished speakers from around the world, with a focus on the Global South. Discussions centered on the role of

science and knowledge in shaping national and international sustainable development policy, raising the profile of science in policymaking, and how to foster the better use of data and evidence in decision-making.

Key messages from the conference:

Food systems and land-use

- The role of quantitative assessments and modeling to provide a means to bring stakeholders together with a common language in order to facilitate clear communication on complex challenges.
- The need for researchers to design studies that meet the needs of policymakers and provide practical and actionable findings, greater integration of natural and social sciences, as well as traditional and other forms of knowledge.
- Ensuring science-based policy and democratic governance become part of the decision-making culture in countries.
- The implications of COVID-19 for food and land-use systems over the long-term.

Urbanization

- The critical importance of effective governance and institutions.
- Promoting more open governments and engaged citizens in order to generate greater collaboration between scientists and policymakers to create more inclusive and sustainable cities.
- Building capacity to use science and data to improve decisions.
- The need for science to be people-oriented and to incorporate hard data as well as citizen perceptions and viewpoints on urban development.
- The use of data-driven tools to enable sustainable urban planning.

Health

- The need to better engage the public, governments, and stakeholders in designing research projects.
- The critical role of community health services and universal access to basic health care in successful implementation, and the need for greater engagement with communities to increase awareness of the importance and relevance of science and evidence.
- The need for scientists to embrace advocacy and activism.
- The role for research institutions in enabling research on policy implementation and building scientific capabilities in low-income countries.
- The positive effects that COVID-19 has had in terms of the use of science by many policymakers in delivering an evidence-based response, as well as its negative impacts on society and progress towards health-related SDG targets.

V. Participants in the 'Science for a Sustainable Future' conference 8th October 2020

Jeffrey Sachs, President, SDSN
Laura Helmuth, Editor in Chief, *Scientific American*
Magdalena Skipper, Editor in Chief, *Nature*

Food systems and land-use panel
Moderator: Guido Schmidt-Traub, Executive Director, SDSN
Panelists:
Ashish Kothari, Kalpavriksh
Michael Obersteiner, University of Oxford
Jessica Fanzo, John Hopkins University
Jillian Campbell, UN Convention on Biodiversity

Urbanization panel
Moderator: Mark Fischetti, *Scientific American*
Panelists:
Aromar Revi, Indian Institute for Human Settlements
Chan Heng Chee, Singapore University of Technology and Design
Luis Hernán Sáenz, Cómo Vamos
Susan Parnell, University of Bristol

Health panel
Moderator: Amy Maxmen, *Nature*
Panelists:
Chikwe Ihekweazu, Nigeria Centre for Disease Control
Miriam Were, The Champions for an AIDS-Free Generation
John Reeder, World Health Organization
David Heymann, London School of Hygiene and Tropical Medicine

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