Science and Solidarity for a Sustainable Planet

Luca Sabbatucci
Inger Andersen
Dan Larhammar
Giorgio Parisi
and Wolfango Plastino

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Introduction

Luca Sabbatucci

It is now clear that we are in a condition of planetary emergency: the interconnected crises of biodiversity loss, pollution, resource depletion, degradation of ecosystems and climate change – caused to a great extent by unsustainable production and consumption – require immediate global action.

The acceleration and interaction of these phenomena, as indicated by science, is causing irreversible damage, with economic and social consequences and aggravation of poverty and inequalities, since the poor have fewer opportunities and economic resources to cope with and adapt to environmental shocks. However, together with efforts towards sustainable production and consumption patterns, nature-based solutions can deliver multiple benefits across these challenges, and are integral to tackling these issues.

The scientific community has confirmed that the past decade was the hottest ever recorded globally, underlining that there is still time to tackle the threat, if actions are taken swiftly and decisively.

The actions taken collectively in 2021 will very likely shape at least the next decade of climate actions. Since "the next decade" is all that is left to stop the climate crisis and to promote the energy transition, the stakes could not be higher.

I would like to emphasize the importance of science in our shared efforts towards achieving internationally agreed climate and environment targets. It is in effect crucial to raise awareness and understanding through scientific investigation in order to find proper solutions to major economic, social and environmental challenges and to ensure sustainable development. Since no country can reach these goals on its own, international scientific cooperation contributes not only to scientific knowledge but also to create peaceful relations and solidarity.

In this regard, the key role of the Intergovernmental Panel on Climate Change (IPCC) in assessing the science related to climate change comes to mind. As we know, its establishment stemmed from the need to improve the understanding of climate change and related phenomena. Acting as an interface between the scientific world and politics, it provides policy-makers with invaluable

scientific assessments on climate change, as well as its implications, impacts and potential future risks: key elements that help politicians to take accurate decisions at national and international level.

It is thanks to the latest scientific reports that we know for a fact that 2021 will be a key year in the fight against climate change, and Italy, as G20 Presidency and partner of the UK for COP26, intends to work strenuously to ensure the success of the negotiation processes, reaffirming and strengthening its role as a virtuous, ambitious and supportive country. This will be a testing ground for multilateralism, as well as for our country's ability to lead by promoting a recovery based on the ecological transition, conscious of its great potential to generate wealth, well-being and employment.

We believe indeed that recovery offers a unique opportunity for transformative change as a global community: while restoring the health of our economies, we need to invest in the health of our planet and to put people and nature at the heart of our political leadership.

This is why with our G20 agenda, we focus on the enhancement of those public goods – People, Planet, Prosperity, which are a condition for preventing and addressing shocks like the ones we are experiencing.

We have to imagine a new development model, and tackling climate change will be the core of these efforts.

The nexus between climate and energy is crucial to advance towards these three priorities. Building back better requires advancing towards universal clean energy access and centring all our policy actions on people.

This is why we are holding, for the first time ever, a Joint Energy and Climate Ministerial meeting. The Ministerial focuses on series of common priorities, seizing the opportunities offered by innovative technological solutions, the role of sustainable cities and the alignment of global financial flows towards a green, sustainable recovery that will be key in ensuring prosperity and environmental sustainability while eradicating energy poverty.

Moreover, the G20 Environment Ministers Meeting offers the opportunity to tackle issues regarding the protection of biodiversity, ecosystems and oceans and seas.

Specifically, the Environment Ministerial is an important moment to facilitate negotiations and push for ambitious positions for the new post-2020 Biodiversity framework that could be defined at the 15th Biodiversity (CBD) COP in Kunming. The Ministerial has a specific focus on protected areas, oceans and seas, which are fundamental to life on our planet and to our future, as well as being an important source of biodiversity and playing a vital role in the climate system and in carbon and water cycles.

As we know, oceans and seas supply us with oxygen to breathe, they absorb over a quarter of the total carbon dioxide that we produce and they contribute to food security and to the creation of decent jobs and livelihoods. With this in mind, Italy will step up effective actions to expand the Marine Protected Areas by as much as 30%, responding to the challenges arising from climate change and pollution, and supporting a sustainable blue economy. We will also promote commitments aimed at the reduction of emissions deriving from the maritime sector, focusing not only on greenhouse gases, but also on other air-polluting substances, which are harmful to the environment and to our health.

As the leading global voice on the environment, UNEP (United Nations Environment Programme) plays a key role by inspiring, informing, and enabling nations and peoples to improve their quality of life without compromising that of future generations. Its commitment to facilitating the transition to low-carbon societies, improving the understanding of climate science, facilitating the development of renewable energy and raising public awareness is crucial in combating climate change.

As mentioned, this year we have an important role in view of COP26, which the UK chair in partnership with Italy. With COP26, we hope that 2021 will be the year that sees the full and effective implementation of the Paris Agreement, as well as a driver for countries to elaborate and implement ambitious national climate commitments in the short term and the successful transition to climate neutrality in the long term, anchored in concrete instruments for reducing emissions.

As partner for COP26, Italy is hosting a series of significant preparatory events to the Conference, including the Pre-COP in Milan, the preparatory meeting of ministers traditionally held about a month before the COP, with the aim of offering those ministers who represent the main negotiating parties an opportunity to informally discuss key political aspects, thus providing a very relevant step on the path to a successful COP.

Italy is also hosting an event in Milan called *Youth4Climate: Driving Ambition*, which will be linked to the Pre-COP. The event will give young people from around the world the opportunity to draw up concrete proposals, which will be taken into account in the pre-COP and COP26. We have decided to unite the two events, as we deem it crucial to promote the engagement of young generations in order to channel youth mobilization in positive ways.

Furthermore, in October we are hosting a high-level ministerial outreach event in Rome on environmental and climate challenges in Africa, *Incontri con l'Africa*.

In our vision, these events are an opportunity to broaden the perspective of the theme of ambition to all the actors involved in the global climate action: in addition to young people, civil society, the business world, the academy, local authorities and regional institutions.

This holistic approach is indeed a factor behind the recent establishment in Italy of the Ministry of Ecological Transition, which was created in order to promote an integral ecological transition of the Country. Merging the competences for the environment, climate and energy sectors further strengthens the centrality of the energy-climate nexus as a qualifying aspect of Italy's foreign policy, in a pivotal year for Italy at the international level with regards to climate change.

These developments at the national and EU level, with the ongoing work on the Recovery and Resilience Plans, reinforce our resolve at the international level, as G20 Presidency and partner of the UK in the COP26, to make this year a real turning point for all countries towards more sustainable, green and inclusive economies and societies.

Lectio Magistralis

Inger Andersen

More than a year since the emergence of Covid-19, the pandemic continues to devastate lives and economies. There is hope in vaccination programmes, but we have a long way to go. Our sympathies lie with those struggling with physical and mental health, grief and financial problems.

We must overcome this pandemic, for all of our sakes. But as we do so, we must understand that Covid-19 is not something we can fix and forget, so as to return to normal. And by normal, I mean our high-carbon and resource-intensive economic models. Normal helped to cause the pandemic. Normal is warming the planet. Normal is destroying nature and biodiversity, and therefore the foundations of human existence. Normal is polluting the air, land and sea. Normal is a world of inequality in which those least responsible for the three planetary crises – climate change, biodiversity and nature loss, and pollution and waste – are the ones who suffer the most from them.

Normal, my friends, is our and the planet's enemy.

Humanity now faces two paths. The first path leads back to normal and a world in which these crises slowly destroy our future. The other path transforms our economies and societies so that we can live in harmony with nature, on a planet that aspires for peace and prosperity.

Today, obviously, I would like to focus on how we can walk the latter path. I will outline the steps, guided by the principles of science and solidarity, that we must take. And the path that I will describe is outlined in significant detail in UNEP's recent report, entitled *Making Peace with Nature*. We consider this report a blueprint for a sustainable future.

But before I get to the blueprint, and the positive vision it presents, allow me to provide the darkness to counterpoint the light: what science tells us about the scale and threat of the three planetary crises.

Concentrations of all greenhouse gases in the atmosphere are higher than at any time in the past 800,000 years. As a result, the Earth's mean near-surface temperature has risen by over 1°C as

compared to pre-industrial times. 2020 was the second-hottest year on record. The top ten hottest years have all come since 2015.

We are living with the consequences. In 2018, damages from climate-related natural disasters cost about 155 billion US dollars. Two billion currently people live in water stress. Wildfires, floods and droughts are so commonplace they often do not even make the news.

And we are approaching tipping points. Warming oceans are melting ice, which means less reflected sunlight and more heating. Permafrost is disappearing, releasing methane into the atmosphere. Burning forests deprive us of carbon sinks, again sending emissions up. We face a system cascade that will send global temperatures through the roof.

Nature is declining at an unprecedented rate. Around 1 million out of 7.8 million species face extinction. Humans have altered 75 per cent of the terrestrial surface and 66% of marine areas. Only 15% of wetlands remain. Around 10% of forests have been lost since 1990.

As we degrade our ecosystems, we chip away at the foundations of what makes well-being possible – food, water, temperature regulation, economic growth, the roofs over our heads and the clothes we wear, to name only some of nature's services. This loss is a threat to our survival.

Every year, pollution causes about 9 million premature deaths, primarily from dirty air. Marine plastic pollution has increased tenfold since 1980, swirling in ocean currents and in the guts of fish and seabirds. Cities produce 1.3 billion tonnes of solid waste per year and we throw away 50 million tonnes of e-waste every year – roughly equal to the weight of all commercial airliners ever made. And the pandemic is worsening the waste problem, with tens of millions of pieces of disposable protective equipment thrown away every day.

Our current development model was based on the idea that the planet would never stop giving, no matter how we treated it. We grew reliant on fossil fuels. We rushed to convert land for agriculture, infrastructure and urban expansion. We emptied the waters of fish, giving back only plastic and toxic sludge. Since 1970, trade has grown tenfold, the global economy has grown nearly fivefold, extraction of natural resources and energy has tripled, and the world population has grown by a factor of two.

As a result, we are altering the Earth systems that have provided relative climatological stability for the past 3 million years. The systems that enable regular rainfall, seasonal shifts, the hydrological cycle and predictable ocean currents. That predictable world,

where season follows season, where harvest follows harvest, is no longer a given.

Governments and businesses have made promises to deal with these problems: through sustainable development goals, through the Paris Agreement, through international goals on biodiversity and so much more. But the world has not acted strongly enough on the science nor on its own promises. Let us look at climate change as an example.

Nearly six years ago, nations arrived at the Paris Agreement to limit global warming this century to well below 2°C and pursue 1.5°C. Many nations stepped up with pledges. Many are now committing to transition their economies to net-zero emissions by mid-century. But pledges – and the action to back them – must still become stronger. If nothing changes, we will hit a global temperature rise of over 3°C this century. To get back on track for a 2°C world, we have to cut one-third of emissions by 2030. For 1.5°C, we must halve emissions.

The pandemic-linked economic slowdown will not help. The CO2 bathtub was already full, so turning off the tap for a couple of seconds does not mean it is now empty. Worryingly, greenhouse gas emissions have already rebounded to pre-pandemic levels. The light at the end of pandemic tunnel is looking increasingly like a fire.

Just as importantly, we have to catch up on solidarity. Strong financial support for nations that need help to adapt to the impacts of climate change is baked into the Paris Agreement. But we have failed to deliver.

We are in a similar position with biodiversity. In 2010, we agreed on a series of biodiversity targets to be reached by 2020. We met none of them. I could go on to talk about inadequate progress on chemicals, on waste, on sustainable development. But I have talked enough about the problems, about what we have not done. Now I will turn to what we can, and must, do.

As UNEP's *Making Peace with Nature* report lays out, to address the climate crisis, the biodiversity and nature crisis, and the pollution and waste crisis, we need urgent transformations in three areas:

- First, we must tackle the Earth's environmental emergencies and human well-being as one integrated and indivisible challenge.
- Second, we must transform our economic and financial systems to power and enable the shift to sustainability. Easy to say, harder to do, but essential for our long-term survival.

- Third, since we all need food, water and energy, we must transform the systems that provide them to meet growing human needs in an equitable, resilient and environmentally friendly manner.

Let us look at each transformative area in turn. Planetary health and human health are the same thing. The three planetary crises – the climate crisis, the nature and biodiversity crisis and the pollution and waste crisis – are, in essence, one crisis: that of humanity's dysfunctional relationship with the natural world. No one sector on its own is entirely responsible for, or can fix, these crises.

There are many examples to illustrate the interconnectedness of the crises, human health and their solutions.

A cooler climate will protect biodiversity and slow down desertification, conserving nature, while healthier nature will help to store carbon and create natural buffers to the impacts of climate change. Nature-based solutions – such as ecosystem restoration – could provide between 35 and 40% of the effort needed until 2030 to limit warming to 2°C. This buys us time to decarbonize our economies. Quickly reducing greenhouse gas emissions will also make it easier and cheaper for vulnerable countries to adapt to climate change – essential for solidarity.

The sources of climate change and air pollution are often the same, from coal-fired power plants to polluting vehicles, so moving to clean energy will address both crises. Meanwhile, by fully implementing international conventions that touch on chemicals, waste and climate change, we can save millions of lives each year and protect fragile ecosystems.

The destruction of nature and over-exploitation of species is a contributing factor to zoonotic diseases such as Covid-19, so restoring nature will increase human health by reducing pandemic risks, while boosting food security and the services nature provides.

In each of these examples, action in one area impacts another.

This is why it is so essential for nations, this year, to incorporate new net-zero commitments into strengthened pledges at the climate summit, COP26, in Glasgow. In fact, every country, city, financial institution and company should adopt plans for net-zero by 2050 and make them a reality. And this last bit matters: make them a reality, with clear time-bound plans, and start implementing them immediately.

Right now, countries need to take strong action on energy systems, land use, agriculture, forest protection, urban development, infrastructure and lifestyles – all through the lens of resource efficiency and circularity. And right now, we are pouring public finance

into the economy to recover from the pandemic slowdown. We must use these resources wisely – to create a more sustainable and green future, instead of going back to the "old normal". Let us not forget that we are borrowing these monies from the next generation. We do not want to leave them with both a broken planet and an insurmountable debt.

This is why we must pass an ambitious post-2020 biodiversity framework at the next Conference of Parties – COP15 – in Kunming, China. Here, it is vital to target biodiversity-positive agriculture and fisheries, an end to harmful subsidies, promotion of larger and better-managed conservation areas, and movement to patterns of sustainable consumption and production.

This is why we must ensure a strong post-2020 framework for the sound management of chemicals. We require a framework that prevents harmful chemicals from entering the environment and moves nations and businesses towards effective, safe and green alternatives.

This is why we must push hard on the UN Decade on Ecosystem Restoration, which gets underway in June, to restore hundreds of millions of hectares of degraded land.

We need to establish more mechanisms and approaches for cross-sectoral coordination so that solutions addressing all three crises together become the norm. Here, I must draw your attention to the One Health approach. A One Health approach integrates action across sectors and disciplines to protect the health of people, animals and the environment. We must use it.

Integration also applies to science. We have a separate body on climate, in the IPCC. On biodiversity, in IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services). On resources, in the IRP (International Resource Panel). And many more. They are all needed. But if they can work together on joint assessments that demonstrate common solutions, we will have a stronger case to take to the world. This, in fact, is the central tenet of our report, *Making Peace with Nature*.

We must also move outside of the environmental and science bubbles to engage the sectors – public and private – that are essential for human survival, but in their current form undermine long-term sustainability and drive environmental damage. Here I refer to infrastructure. Agriculture. Energy. Transport. Cities. Consumers. There is no point in setting targets for, say, biodiversity loss, unless we engage with and support these key sectors to shift to more nature-positive models.

We need to integrate nature into built infrastructure. Build infrastructure that has a smaller footprint by deploying circular

models in construction. Support and incentivize farmers to use agricultural practices that support and underpin nature. Electrify our transport and invest in public mobility.

And as consumers we have choices too. We can eat a plant-rich diet. Control how we travel and move and what we buy. And when we select who represents us in government, we should demand that they set the policy guardrails for greater sustainability through incentives, through regulations, through laws and through trade rules.

We need trillions of dollars each year to meet the Sustainable Development Goals. To unlock this investment, we need to move entire markets and financial systems. How do we do this? The answers are manifold, but key actions are incorporating accounting for nature into our economic and financial systems, shifting subsidies and investing in the right places.

The starting point is to recognize the true value of nature. Over half of global Gross Domestic Product (GDP) depends on nature – never mind the services nature provides free of charge, such as climate regulation, water filtering and protection against natural disasters.

We are eating into these natural assets faster than they can regenerate because we do not reflect the true value of nature's goods and services in market prices. We have not created wealth if, in the process, we have polluted our waterways, our soil, our oceans or our air. We have not created wealth if we have fished the oceans empty or cut the forests down for timber or agriculture. And yet today, that is our measure of wealth.

When we apply inclusive wealth accounting, as UNEP has done, we can clearly see that our prosperity has come at a price. Produced capital and human capital – such as roads and skills – have increased by 13% since the early 1990s. At the same time, natural capital – the planet's stock of renewable and non-renewable natural resources – has declined nearly 40%. This is not a viable road to follow.

The good news is that there is now a growing understanding that we must replace GDP with an inclusive wealth index that values all forms of capital. This is not in any way to deny the intrinsic value of nature. Nor is it about hanging a price tag on every bee and tree. It is about understanding that intact ecosystems are worth more to humanity than when they are destroyed.

So, the days when environmental impact was treated as an externality must end. We must legislate against and tax the environmental "bads", as opposed to merely targeting labour and goods. Governments, businesses and financial institutions should

mainstream natural capital accounting to help shift behaviour to a more sustainable path.

Even without such measures, we know that backing industries that harm the environment is a bad idea. Many subsidies do just that. I am not suggesting a blanket end to subsidies – particularly those that keep food affordable for many people in difficulty. Nonetheless, trillions of dollars of subsidies go to fossil fuels each year. These could be redirected to underfunded biodiversity and climate goals. Carbon taxes, carbon pricing, markets for carbon trading and payments for ecosystem services are other ways to start moving markets.

Both accounting for nature and shifting subsidies would start investments flowing to where they are needed. But we must invest regardless. Pandemic recovery stimulus packages are a massive opportunity to accelerate action. The UNEP Emissions Gap Report, for example, found that a green recovery could cut 25% off of 2030 emissions.

So, as mentioned, governments must use pandemic stimulus packages to create a more sustainable future. This means putting recovery money into decarbonization, into nature-positive agriculture, into sustainable infrastructure, into climate change adaptation measures that protect vulnerable communities and reduce poverty, and so much more.

The same goes for businesses and investors – for their own bottom lines as well as the planet. Renewables are a great investment. But other figures show that the business opportunities from transforming the food, land and ocean use system could generate 3.6 trillion US dollars of additional revenues or cost savings by 2030, while creating 191 million new jobs.

Investing in sustainability is the smartest move any of us can make.

The world we live in is profoundly inequitable. Almost 700 million people go hungry every day, while we waste almost one billion tonnes of food each year. Hundreds of millions of people struggle with energy poverty, while others leave lights on in every room. Some people leave their taps running without blinking an eye, while others struggle to find water to drink or tend their crops.

If we are serious about solidarity, we need to ensure that everybody has enough to eat. That we provide energy equity and connectivity for all. That water resources are used wisely and shared. We must do all of this while ensuring that the environmental impact of the food, water and energy systems shrinks instead of growing.

On energy, we obviously have to prioritize clean, renewable sources. But this must be accompanied with huge improvements

in the energy efficiency of every appliance, vehicle and building that draws power – including through regulations. We also need incentives and infrastructure for electric vehicles and sustainable bioenergy strategies.

There is a price tag: investments of 0.8-2.9 trillion US dollars are needed per year until 2050 to deliver a low-carbon system consistent with the Paris Agreement. But energy efficiency alone can deliver costs savings of 2.9-3.7 trillion US dollars per year by 2030.

Meanwhile, our food systems need serious reform. The global food system, as a whole, emits 21-37% of greenhouse gases. Then we have the stripping of forests and other ecosystems to meet growing demand for food, feed and fibre. This is why the UN Secretary-General is hosting the Food Systems Summit later this year.

We need to move to food systems that work with nature. Make agriculture, forestry, fisheries and aquaculture biodiversity positive. Integrate sustainable production and management of food and water within terrestrial, freshwater and marine ecosystems. Promote sustainable agricultural intensification, agroecological practices and conservation of genetic resources. Stop overfishing. Empower small-scale farmers, especially women.

I would like to give a special mention here to methane, a greenhouse gas that emanates both from energy and agriculture. Methane is 28 times more powerful at trapping heat than CO2, but it lingers in the atmosphere for far less time. So, efforts such as capturing methane from the oil and gas industry and improving the health of livestock can have rapid effects.

In fact, a new report from UNEP and the Climate and Clean Air Coalition to be released in a few weeks, shows that reducing human-caused methane by 40-45% by 2030 would avoid nearly 0.3°C of global warming by the 2040s. It would also prevent over 250,000 premature deaths and more than 25 million tonnes of crop losses globally each year.

Here, I would like to touch again on the role of personal responsibility. Some 17% of food is wasted at the household, retail and food service level, while meat-heavy diets are big drivers of environmental damage. Relatively minor changes in our diets, cutting waste and reducing meat intake, can make a big difference, including to the methane emissions just mentioned. The same idea of personal responsibility applies in everything from how we travel to the packaging we chose.

Yes, it can be difficult to make choices that are good for the planet. Our societies depend heavily on fossil fuels, monoculture

crops and wasteful packaging. The system must change. Until it does, we must do what we can – within the constraints of our circumstances, and no matter how small – to change our lifestyles.

I have barely scratched the surface of the huge and complex task we face. This task may seem overwhelming. It would be overwhelming, if it were the task of just one person. But it is not. It is the task of over seven billion people. If each of us does our part, we can make rapid progress.

We are seeing this process of change. We have more commitments and solutions than ever. Businesses and investors are stepping up. Renewable energy is more widespread, and cheaper. Public awareness of the issues is at an all-time high. And Covid-19 has shown how quickly we can change, when we have to. Well, we have to change.

We have the science, the knowledge and the tools for transformation. We have the opportunities, in a green pandemic recovery and in the many international processes unfolding over the coming months and years.

We now need to let science lead us, and principles of solidarity guide us, as we get to work making peace with nature, and building a world in which we can all live, peacefully and prosperously, together.

Discussion*

Inger Andersen, Dan Larhammar, Giorgio Parisi,
and Wolfango Plastino

Wolfango Plastino: *How do we bring everyone together to unite the action agendas of the three planetary crises and amplify impact?*

Dan Larhammar: To deal with this on a global scale, as you pointed out, we really need to work together. And I think the only way to accomplish that is through information and education about the situation and what needs to be done, and what ideas we have to do something about it.

Now, these are very beautiful words: information and education. It's easier said than done. But, we should also remember that we have better opportunities than ever before to do this. More people than ever before – a higher proportion, I should say, of the population, than ever before – have reasonably long school educations nowadays. And we have the internet with connections that allow us to convey information to many parts of the world. So I think those tools should be used as much as possible.

The internet is a blessing if we want to transmit information. But it can also be used for opposing purposes; and as you pointed out Dr. Andersen, there are financial interests that go against our efforts to save the planet. There are efforts against vaccination programmes to improve human health, and so on. So we need to be prepared to deal with this anti-science lobbying, the propaganda from certain interest groups, where the financial sector as a whole is probably the largest. And I think it's most important to transmit information about the situation to those with the power to take global decisions. And those are the financial experts, the economists and policy-makers. It's not really the scientists who take those decisive decisions. But the scientists need to provide all the evidence for wise decisions.

* The text below is the full transcript of the Round Table that followed the *Lectio Magistralis* by H.E. Inger Andersen, Under-Secretary-General of the United Nations and Executive Director of the UN Environment Programme.

In fact, I'm presently chairing a working group in the organization of ALLEA (All European Academies), and the title of the report that we will deliver is "Fact or Fake?" We are dealing specifically – as are several other working groups in different combinations – with the problem of false information, disinformation, or even misinformation, deliberately untrue statements. We are looking specifically at how both scientists and science communicators can respond to that, and we are also trying to make policy-makers aware of such interest groups that transmit false information for commercial or ideological purposes. So it's certainly no easy task, but we're striving to increase awareness of those challenges.

Giorgio Parisi: I agree with you that a unifying agenda is crucial. The point is that we very often have a confluence of agreement between states that are devoted to one single crisis, which is addressed separately from the other ones. And there is no widespread awareness that the three crises that you have so clearly spoken about are intertwined, and that you can take measures that are synergic with one another to address the challenges posed by any one of them. All efforts should be done to put the whole problem of the environment at the centre of this line, by emphasizing the advantage of a global vision, so that the problem can be addressed in an effective way.

Now, in the case of climate change, it is clear that the problem is global. But for the other two crises, the problems are seen more by people as local problems that individual governments have to manage, not as global problems. We do not often realize that biodiversity is a huge asset, not only for all of humanity, but for all life on the planet, and it's not the problem of a single country which is losing its biodiversity. Pollution is seen as something which does damage only locally. But for example there has been a recent study that shows that microplastics enter into the global atmospheric cycle, and they are deposited around the world even fifteen years after they've been produced and emitted into the atmosphere. We need to undertake a great work, and I agree with the president about the need to reflect scientifically on this point and to make the public aware. We need to increase scientific conferences and opportunities for debate, such as the one we have had today, but where the three crises we are considering are addressed in a simultaneous way.

Inger Andersen: If I could just comment ever so briefly – as I think that I've done a lot of speaking already – I entirely agree with you: education and awareness is critical, and I also agree with what you said, Professor Parisi, about ensuring that there is

awareness of the integrated nature of these crises. I also very much agree that climate is to some extent seen as global, whereas other things such as pollution and biodiversity might be seen as more local.

I'm so happy that we've heard about the youth summit that Italy will host prior to the COP, because young people actually give me a great amount of hope. Because they get it – in a deeper way, I'm afraid, than my generation does. And so they are also seeing what the situation is for the world that we are leaving them. And they're demanding something in a different way than my generation did when we were young. They get these planetary crises nearly instinctively.

Now, that means that the responsibility that we have is to make their voices heard – not as a "nota bene", not as a small point that we just allow into the "adult" conversation, but we have to begin to give them an equal voice, since it is their future. And I think that here with the transformation that the Green Recovery offers, it would be inconceivable if we were to use these moneys in the wrong way. And that might very well help drive our approach to these crises in a more integrated way.

Wolfango Plastino: *How do we increase international solidarity to ensure fairness and equity for developing nations and vulnerable communities?*

Inger Andersen: I think as things now stand we have vaccine *haves* and vaccine *have-nots*, and even with the vaccine *haves* there is a little bit of jostling at the front line of the queue between a few nations; but I think that we should understand that for the rest of the world, it's a reality of vaccine *have-not*. And we have to ask ourselves if we really believe that that's a viable future – if we really do believe that not driving equity at the global level is going to be good for those who are at the front of the queue, whether it's for vaccines or for anything else.

Surely it can't be. Because if I have Covid, and I'm in a poor country, we all have Covid. And if I have climate change, we all have climate change. It's as simple as that. So if we just want to talk self-interest for a moment, it is in our distinct interest, even if we are at the front of the queue, to think about those at the back.

Now, that is hard for a politician who is elected for four years, and short-termism will drive what they need to supply to the nation and what the nation will demand. But it's also incumbent upon leaders to talk about the fact that if one person has Covid we

all have Covid, so to speak, if one person has climate change we all have climate change. The inequity and the unfairness that we are seeing, and the wealth divide that has grown, is simply not a viable option for long-term stability on this good planet. And we need to look no further than people going into boats and people striving for a better life, etc. to understand that the reason is that the land cannot sustain them, that the rains are not coming, that climate change has hit, that crises are there. There are of course always many aspects to any crisis. It's like peeling an onion. There is politics, and religion, and ethnicity, and many other things – but invariably within that onion, there is a piece called environmental sustainability. And that piece, we have to understand, is more important than we might comprehend. If the land is nutritious and will support people, likelihood of movement is less. If the land is nutritious and the climate is stable, the likelihood of stable society is higher.

So we should understand that investing in solidarity is good from a basic value and ethical point of view, but even if we have to drive it home through self-interest, it's absolutely also in self-interested terms.

Dan Larhammar: That is so excellently said, I cannot possibly add much further. I was also thinking of the example of the Covid-19 pandemic. I think this shows excellently how important global solidarity is, because unless we can reduce the number of infected individuals across the world, there will be new variants popping up, and they will spread. So a pandemic probably shows more than most other things how crucial global solidarity is, because this solidarity will lead to benefits for everyone, or avoid a crisis for everyone.

Now, since conditions differ so much for people across the world, there are different meanings of the word "solidarity". People in highly developed countries, with highly developed economies, do the most damage per capita overall. So they can produce the most changes in the situation. We cannot expect the people who are forced to worry about food and healthcare for themselves and their families for the next few days or weeks to be concerned about consequences for the planet years or decades ahead. And I think we must realize that conditions differ so much, but that should not take away the need for solidarity between regions with different levels of economic and social development.

Giorgio Parisi: I agree with both of you, but there are some distinctions that I would like to make.

I fully agree that fairness and equity for developing nations are a fundamental part of the approach that aim to really solve problems on a global scale. Unfortunately, I am very pessimistic about international solidarity. The vaccine is a very good example. What you have said is fully evident – if other people get Covid, then your chance of getting Covid is much higher. However, there is a programme, the COVAX programme, which is supposed to vaccinate two billion people in countries which are not really rich, and this programme has been financed in a completely inadequate way. They have money to buy 10 or 15% of the needed amounts of vaccines. Of course, there are certain countries in Northern Europe that are helping this action, but aid is certainly not coming from other countries.

This is an example of how the egoistic behaviour of countries – of many countries, not all countries, as I said before – obstructs realizing the clear interests that we all have to vaccinate everybody. The amount of money put toward vaccinating everybody on the whole planet is so ridiculously small compared to the trillions that are spent on the crisis that it's difficult to believe that it's going to happen.

And I think that in the past, too, the rich nations have been able to transfer only marginal amounts of their resources to developing nations. Here we need a much bigger amount. So although I would also like to call it "solidarity", maybe "solidarity" is not the best word to convince politicians. Because if a nation needs economic compensation in order not to destroy its forests – which is a typical situation that happens in developing countries where a nation wants to destroy its forests to improve its economic situation – then compensation should not be regarded as an act of solidarity, but as an action to avoid global disaster. Providing clean energy sources to developing countries should not be considered as a gift, but as something that reduces CO2 impact in the atmosphere, letting us avoid other actions like sequestration of CO2 and so on. Increasing the economic level of developing countries is not an act of simple solidarity, because it leads to a decrease in demographic pressure, and we all know that demographic pressure is one of the sources of all the troubles that we have.

Therefore, my suggestion is that, although we know that this is truly a question of solidarity in some sense, it's important to convince politicians and to convince the public that it's not only solidarity – which is an extremely important thing on the human scale, because we all are humans – but that it is also in the self-interest of everybody to help other countries in this direction.

Wolfango Plastino: *How do we persuade businesses and governments to start including the value of nature in all of their decision-making?*

Giorgio Parisi: Let me say that if business people were obliged to compensate public finance for the damage they do to the environment, the situation would be very different. However, it is of course clear, as the Director also said, that this kind of compensation should be not be taken as a licence to pollute. Strict regulation should be added to enforce the limit, and governments should push for this type of accountability. Accountability is very important. I can remember a famous speech of Robert Kennedy's, which I think was given about fifty-three years ago, in which he was speaking of the gross national product. He was saying that the gross national product contains a lot of information, but not all the things that are important. For example, selling guns increases the gross national product, car crashes that kill people increase the gross national product, and the gross national product does not include many of the things that make life worthwhile.

It is clear that we have to reflect on the gross national product, and if a country is going to destroy its environment, using up its national resources, this must be accounted as a negative factor for the gross national product because the richness of the country is going to decrease. However, in the way that we do the computation, we see that the gross national product is increased if we destroy the country, which is something that does not make sense when we realize that the country's resources are limited. And of course, the important and interesting part is how to persuade the government to start to reach this conclusion.

Now, let me say that if someone asked, two centuries ago, "How do we persuade businesses and governments to start including the value of the well-being of workers in all their decision-making?" – well, we know all the struggles that have occurred over the last two centuries, and we know how things finally worked out. And we also know that this issue is still at the centre of political debates. Adding the value of nature to decision-making may seem simple, but not too simple. As has been said, we need public opinion if we are going to make changes; we need to make convincing arguments. But we have other people who are pushing in the other direction. After the public opinion has been convinced, we need to bring this issue to the centre of the political arena, to the centre of the political agenda. And we should add that it's sometimes possible to find a bipartisan approach to this problem, but this is not easy, nor always possible.

However, we have to do our best to see to it that the people, when they go to vote, have in their minds also the values of the environment, and that they decide in consideration of these things too, which will be crucial for the future.

Inger Andersen: I was enjoying listening to Professor Parisi so much. I just want to say that I think it has to be about setting the regulatory guardrails, as well as driving public understanding and information. But when we began to make new rules – you know, you couldn't smoke in offices, you couldn't smoke in aeroplanes, I'm old enough to remember that – there was a heightened understanding of the public health impact. Some people still choose to smoke, but the number has been reduced, and there is a greater understanding of the impact.

So it is about informing, but also setting regulatory guardrails for what you can and cannot do. Today we have privatized the goods, the profits, and we are externalizing and putting the bads on the public purse. All the environmental clean-up in the oceans, for instance – well, it's *nobody's* business, except *everybody's*. It's yours and mine. So we need to ensure that we use subsidies, and we use regulatory setting, and we use taxation in the right way. As an example, let's put a price on carbon – finish Article Six in the Climate Convention, please, in the Paris Agreement, so that we can get to carbon trading! Let's redirect harmful subsidies, subsidies which up to today have undermined long-term sustainability – not those that support the poor, etc., but those that support over-investments in certain sectors, including obviously the hydro-carbon sector – and support, via smart subsidies, sustainable agriculture, sustainable transport, green transport, public transport, electrification of the motor vehicle fleet.

All of these things don't happen at the speed that we need them to happen, unless we help them through regulatory requirements. So on the one hand it is about GDP, as I mentioned, but it is also about that regulatory setting. And most of the CEOs that I speak to, and most of the financing houses I speak to, are asking for a level playing field. If there is a level playing field, which means at the international level, they don't feel that if they're in one country where the guardrails are set, while in another country they are not, then they have to compete with someone that has a competitive advantage, because of lower regulatory settings. That's why multilateralism has to be part and parcel of the answer.

But I will say, I'm seeing that more and more companies get this. These are especially companies that are reliant on nature

services. And, another big sector is for example the reinsurance industry. They *get* that they have to pay out huge amounts for climate impacts. They are on the front lines, saying, "Can we invest in coral reefs that break the waves, ensuring that they are protected? Can we ensure that sand dunes are there, that mangroves are there?" And so on. Because they understand that these things will buffer high winds. "Can we be sure that we have wetlands, so that the infrastructure won't be flooded – which we then have to pay out?" So I think it is also about increasing awareness.

And finally I would say that this is one of our problems: ensuring there's enough understanding and awareness there amongst the general population that this is not against them, it's in their favour, and ensuring that we put a safety net under those that could potentially be left behind. We have coal miners, who work in mines for coal, and they should not be left high and dry. They should be supported in new opportunities, and it's very important that we understand who are the potential short-term winners and losers, and leave no one behind in that regard.

Dan Larhammar: I totally agree. Encouraging responsibility is something we must strive to achieve, but it is a difficult thing because some people just don't care. But of course, explaining evolution, explaining that nature is precious – that it doesn't regenerate in a few years, that evolution is the result of millions or hundreds of millions of years – will probably make at least some people more aware. And the catch-phrase used recently by David Attenborough and several people before him – "Extinction is forever" – should make everybody think.

Let me add to what you have already said that maybe we can hope a little bit also for consumer power, especially in markets where consumers have a choice. Then they can choose the products, or methods, or whatever else, that show a greater awareness of the situation we're in. It's perhaps difficult in markets where there is no choice, and in less developed areas where people cannot afford to choose, but have to go for the cheapest option all the time.

Then finally, on a very much smaller scale, but nevertheless important for certain ecosystems, tourism can focus on what is sometimes called "luxury tourism" – but it's luxury for nature as well: namely, to restrict the number of individuals that are allowed to visit certain very vulnerable areas. One of the most beautiful examples of that are the limited visitations allowed to the mountain gorillas, and we have also the Serengeti as a whole, where tourism

is restricted, as in many other regions. That's a way to protect some areas of our planet. And this also helps increase awareness.

So we have to work on multiple fronts, here as everywhere else.

Wolfango Plastino: *How do we democratize science so that it becomes more accessible, diverse, understandable and actionable for the general public?*

Dan Larhammar: I think I can be very brief here, because we have already touched upon this to some extent. Again, it's a matter of information and education to make science more accessible and understandable for the general population. And again, the internet is a tool to reach that. But we also need to have help from professional communicators, science writers, who can help explain both the situation that we face, and what possible solutions there are to it, so that this information becomes more comprehensible for the general populations.

Giorgio Parisi: I fully agree with Professor Larhammar, because I think communication, information and education are important. The point is that scientists are very often not good communicators, because they usually speak with other scientists, and other scientists understand their jargon; and very often scientists that I know, when they speak publicly, start to use jargon and say some words which I understand, but which I am sure that no one in the public is going to understand.

Now, all that – communication, information and education – can be done, it should be done. The point is that we scientists have somewhat neglected our duty to communicate to the public, and we should do that in a more serious way. And also, education in school is very important. We have seen during the pandemic that there were simple ideas, like exponential growth, that were very difficult for people to grasp, in part because they could not read, for example, plots on a semi-logarithmic scale. Education should be done in such a way, not only to learn something, but to learn the ability to understand new arguments which one is not familiar with – of course, if it is explained in a reasonable way.

Inger Andersen: Being the non-scientist on the panel, I think I can only endorse what the scientists on the panel are saying. But I'll say that the more we can aggregate, the better. I mean, we understand that science has to be deep; for it to be scientific, it has to be deep. But the more science also aggregates and laterally integrates

across disciplines, the more it will be understood, I think. And the more science is, as you said, explained in language that is accessible, and the more it comes with real-life applied implications, the more it will be understood.

And finally, I think we need to understand that there are things – I'm old enough to have been at earlier COPs, I mean COP2 or 3 or something, for climate – that science has been telling us for a long time. It's just gotten ever more precise for twenty-seven years, plus. But the world hasn't reacted. So we have to ask ourselves, what is it then that science has failed to do? And it is that we need to hit the heart, as well as people's well-being. And unfortunately, we've taken science very purely, and we haven't understood how politicians need to own this in a different way.

I think we're getting there, and lectures such as this, which are open and engaged, are very, very important. I'm deeply honoured to have had the opportunity to participate.